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Proceedings of the First International
Workshop on

The Management and Culture of Marine Species Used in Traditional Medicines

*July 4-9, 1998
Cebu City, Philippines*

Edited by
Marie-Annick Moreau
Heather J. Hall
and Amanda C. J. Vincent

Project  Seahorse

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Conservation Note

Project Seahorse is a team of biologists and social workers committed to conserving and managing seahorses, their relatives and their habitats while respecting human needs. These remarkable animals are threatened by overfishing and by damage to their inshore habitats. Project Seahorse works with partners to undertake fundamental biological research, empower local communities, establish marine protected areas, manage subsistence fisheries, restructure international trade, advance environmental education, promote integrated policy, and redress habitat loss. We have professional teams based in Canada, Hong Kong, Philippines, UK, USA, and Vietnam and are active in many more nations. Our vision is a world in which populations of seahorses and their relatives are secure in well-managed marine ecosystems.

The designation of geographical entities in this document does not imply the expression of any opinion whatsoever on the part of Project Seahorse or other participating individuals and organisations concerning the legal status of any country, territory, or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries. The views expressed in this publication do not necessarily reflect those of Project Seahorse, the International Development Research Centre, or other participating individuals and organisations.

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A Chinese version of these proceedings is available from Project Seahorse

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Part I. Background

Sponsor's Note

Introduction

Executive Summary

Description of Project Seahorse

Description of Workshop Series

Workshop Agenda

Field Trip Agenda

List of Participants



Sponsor's Note

International Development Research Centre



The International Development Research Centre (IDRC), as part of its program on the Sustainable Use of Biodiversity, is pleased to have funded this workshop on the sustainable use and conservation of marine medicinals. Seahorses are being used as test species because they offer an important case study for questions of the sustainability of marine medicinal species and their marine ecosystems.

IDRC supports research to develop incentives, methods and policy options that facilitate community participation in the design and implementation of plans for sustainable biodiversity use. The program supports projects covering a variety of plants and animals (including fish and other aquatic organisms), in recognition of their contribution to the food security of marginalised communities. In addition, the program encourages the conservation of the genetic variation within these natural resources, as these will continue to play a critical role in terms of the intermediate and long term interests of dependent people. Emphasis is also given to cross-cutting issues such as the fair use of indigenous and local knowledge, gender analysis, and informing policy based on local perspectives.

This workshop, and the larger project of which it is a part, provides one example of the IDRC emphasis on integrated, multisectoral approaches. This more holistic thinking has followed from the discussions surrounding the development of Agenda 21. Interestingly, this workshop also draws in other important components, addressing the relationship of biodiversity to human health, particularly in terms of traditional medicines.

We begin with seahorses as our model at this workshop, with the hope that this will lead to a larger study of other marine medicinals. Marine medicinals are relatively under-studied, yet are of importance to local economies all over the world. This is particularly true in Asia due to their use in the Chinese pharmacopoeia and tonic food tradition. The present workshop, which brought together wholesalers of traditional Chinese medicine with conservationists, aquaculturists, and (through a visit to a community-based seahorse conservation project) men, women and children of Filipino fishing communities, is the first step in the promotion of non-confrontational collaborative linkages between stakeholders in the marine medicinal trade. These linkages can serve to develop methods to manage marine medicinals in a sustainable fashion. We wish to compliment the organisers of this workshop for successfully undertaking this endeavour, recognising that it is a very promising start to this important initiative.

Bertha Mo and Brian Davy
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Introduction

These proceedings report on an open, vigorous and sympathetic workshop that delighted us from beginning to end. Thirty-five participants from 17 countries, speaking 9 languages, met in the central Philippines for five days. Their – and our – mission was to talk about the management and culture of marine species used in traditional medicine. Our wish, as organisers, was to address conservation concerns about the potential overconsumption of such marine life while there was still time for creative management, in order to avoid facing extinction crises in the long run.

Hundreds of marine species are used in traditional medicines around the world. Perhaps eighty percent of the world's people depend at least partly on traditional medicine, according to the World Health Organisation. Demand is increasing as human populations grow and economic change enhances purchasing power for medicines. The United Nations Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) noted in 1997 that uncontrolled trade of wild animals and plants for traditional medicine could pose conservation worries. The main case study of marine species in trade, on seahorses, found that wild populations were indeed declining in the face of growing demand for medicinal use (and probably also because of habitat damage and bycatch). This fact was recognised by both producers and consumers, and led to concern for other marine medicinal species.

This workshop arose directly from requests by a wide range of stakeholders associated with the trade in marine medicinals. Many fishers, traders, and traditional medicine practitioners had been asking for help to balance dwindling supplies with growing demand for marine species of medicinal value. Nearly all these producers and consumers suggested that aquaculture could help meet needs. The aquaculturists, meanwhile, were acutely conscious of the difficulties in culturing many marine species. They also wanted advice on which individuals and which species were most marketable. Fisheries managers and conservationists were becoming increasingly concerned about overconsumption of marine species for traditional medicine, and wary of aquaculture ventures that might do more environmental damage than good. It seemed time to talk, and find common ground for future initiatives in managing marine medicinal species.

We were delighted that people from a wide range of disciplines accepted our invitation to come together in Cebu. Our main goal was to open communication to the extent that people with very different backgrounds realised they had more common concerns than differences. We then hoped that a network of committed individuals would emerge, each bringing his or her own experiences and expertise to a collective vision of how marine medicinal species might be better managed. This indeed happened.

Workshop participants repeatedly commented on the positive and productive atmosphere of this workshop, noting that the lack of confrontation among groups with potentially conflicting interests encouraged them to engage thoroughly in the process. From this engagement came a strong set of messages and energetic suggestions for action. Two of the most noteworthy, in the conciliatory spirit of this meeting, were the plans to set up a touring exhibit of live marine medicinal species for traditional medicine communities in Asia and a reciprocal touring exhibit on traditional medicine for Western visitors to public aquaria. In a similar vein, a man in the traditional medicine trade offered to write to his constituency telling them that there were conservationists with whom one could work, and we planned to send the same message about the traditional medicine community to our conservation colleagues.

Cultural rapport was enhanced when Westerners commented that they now realised that traditional medicine and conservation had similar goals: the long-term availability of marine resources. It was further advanced when ethnic Chinese and Korean participants suggested that the sale of pregnant

male seahorses cease, so as to reduce pressure on wild populations. Three more delightful cross-cultural memories stand out in our minds: the participants' sheer joy at meeting a real live seahorse, most for the first time; their dawning recognition during the field trip that dependent villagers' socio-economic needs had to be considered in managing marine medicinals; and the completely crazy dancing and singing during the karaoke evening that convinced dubious Westerners that Asians were on to a good thing.

We hope that the very positive and proactive nature of this meeting shines through in the proceedings, and we invite you all to join us in seeking common responses to the problem of balancing the needs of humans with those of wild marine animals and plants. This large problem becomes tractable if tackled with good will.

Amanda Vincent and Heather Hall
Project Seahorse

Executive Summary

International Workshop on the Management and Culture of Marine Species used in Traditional Medicines

Cebu City, Philippines, 4-9 July 1998

Background: Overconsumption of wild plants and animals used in traditional medicine (TM) poses a threat to their populations and also to the people who depend upon them for their livelihood or health. Seahorses provide the only case study of the effects of exploiting a marine species for use as medicine, but initial surveys suggest that global dependency on marine medicinals could present a threat to other species as well. Co-operation between TM communities and subsistence fishing communities is necessary to balance marine medicinal supply and demand and ensure trade sustainability.

Objective: To initiate development of a co-ordinated international plan of action to ensure the sustainability of trade in marine species used in medicines. Seahorses were used as the example from which general paradigms were sought.

Preparation: Briefing materials on the workshop subject areas were prepared by Project Seahorse and circulated to participants for comment. These were: "Global Survey of Marine Medicinals", "Aquaculture and the Conservation of Marine Medicinal Species" and "A Review of the Current State of Seahorse Aquaculture".

Participants: Thirty-five participants from 17 countries and territories attended the workshop. They included traders and researchers in TM, aquaculturists and aquarium representatives, fisheries managers and fish biologists, conservationists and social anthropologists.

Format: Six presentation sessions laid the foundation for the workshop, outlining key issues and ensuring common understanding: (1) Setting the scene (2) Trade in exporter countries (3) Trade in importer countries (4) TM and conservation (5) Aquaculture and (6) Global issues. Breakout groups discussed (1) Problems and limitations (2) Options and possibilities and (3) Plans and proposals for achieving trade sustainability. A field trip to a community-based conservation project guided by Project Seahorse increased participants' awareness of the workshop issues.

Discussions: Participants repeatedly noted misconceptions about use of wildlife in TM, and emphasised the importance of understanding both the content (what) and context (how) of marine species use in TM. Consumption of marine medicinals appears to be increasing, although patterns of TM consumption vary by geographic area and over time. Participants suggested that culturing marine species for TM offers some potential for reducing imbalances between supply and demand, but identified both technical and cultural (e.g. the TM perception that "wild is better") obstacles to its success.

Outputs: Proposed actions included:

- developing a formal network to facilitate communication among the TM, trade, conservation and aquaculture communities, to include English and Chinese newsletters;
- publishing bilingual proceedings and holding a second workshop on the same theme in China;
- producing a glossary of terms used in TM to reduce sources of confusion and misunderstanding;
- drawing up guidelines explaining the types of animals and plants most sought after by TM users, in order to reduce waste created when fishers collect inappropriate individuals;

- creating a priority list of species that should (and could ?) be produced by aquaculture, with input from both the TM and aquaculture communities;
- developing an educational exhibit of live seahorses, to tour areas with high concentrations of TM use in order to promote interest in conservation, with a reciprocal exhibit on the use of marine species in TM, to take to Western zoos and aquaria;
- promoting research into seahorse biology, ecology and behaviour, and the marine medicinals trade.

Significance: Participants viewed the meeting as a success, as it provided an opportunity to develop proactive rather than reactive discussion between TM and conservation communities. They felt that the workshop launched a process that avoided conflict while identifying problems with the TM trade in marine medicinals, and possible solutions.

This meeting was developed and organised by Project Seahorse, with funding provided by the International Development Research Centre (IDRC), Ottawa, Canada.

Project Seahorse

Project Seahorse is a team of biologists and social workers committed to conserving and managing seahorses, their relatives and their habitats while respecting human needs. These remarkable animals are threatened by overfishing and by damage to their inshore habitats. Project Seahorse works with partners to undertake fundamental biological research, empower local communities, establish marine protected areas, manage subsistence fisheries, restructure international trade, advance environmental education, promote integrated policy, and redress habitat loss. We have professional teams based in Canada, Hong Kong, Philippines, UK, USA, and Vietnam and are active in many more nations.

Our vision is a world in which populations of seahorses and their relatives are secure in well-managed marine ecosystems.

The Project Seahorse program included the following conservation-related activities in 1998:

Managing fisheries and adjusting supply

- running community-based conservation in Philippines fishing villages, including the establishment of marine sanctuaries, fisheries modifications and management, enforcement of legislation, education programs, and the development of alternative livelihoods for seahorse fishers;
- leading a broad coastal resource management program on a key double barrier reef in the Philippines, developing regional alliances for conservation;
- undertaking trade and fisheries research, small-scale aquaculture trials, and community education in Vietnam;

Monitoring and adjusting consumption

- initiating marine medicinals conservation with the traditional Chinese medicine community in Hong Kong, to promote self-monitoring and self-regulation;
- monitoring seahorse fisheries and trades in Asia, the Americas, Africa and Europe.
- co-ordinating seahorse aquarium husbandry world-wide;
- establishing a valid husbandry protocol for seahorses;
- compiling a global directory of marine species used for traditional medicines.

Policy development

- hosting national and international workshops on the conservation and management of seahorses and other marine species, especially those used in traditional medicine;
- informing and encouraging national and international policies that monitor and control trade in seahorses and their relatives;

Biological Research

- studying the biology of seahorses in the wild and in the laboratory;
- documenting population dynamics in exploited populations;
- conducting genetic research to clarify the relationships among species and among populations;
- carrying out morphometric research to clarify seahorse taxonomy;
- quantifying the relationship between seahorse population viability, habitat quality and exploitation;

Education and Dissemination of Information

- training marine conservation apprentices through high school scholarships in the Philippines;
- disseminating information to colleagues, the public and the media;
- producing educational materials and information on seahorses.

We work in formal partnership with the Haribon Foundation for the Conservation of Natural Resources (Philippines), Institute of Oceanography (Vietnam), World Wide Fund for Nature Hong Kong, TRAFFIC East Asia, and the John G. Shedd Aquarium (USA). To find out more about Project Seahorse, and how you can help, contact us directly (e-mail: projectseahorse@hotmail.com) or visit our web site (<http://www.projectseahorse.org>). All support and donations are greatly appreciated.

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Description of Workshop Series

Seahorse Management and Conservation Workshops 1998

Project Seahorse and its partners organised a series of three workshops in 1998, addressing related issues of seahorse management and conservation. The outputs produced at each meeting will inform an international conservation action plan for seahorses, and contribute to many related marine conservation initiatives. The summary reports of the three workshops in the series are included in these proceedings (see Part V. Workshop Context).

National Conference-Workshop on the Conservation and Management of Seahorses in the Philippines, 21-22 May 1998

This national, multi-stakeholder meeting represented the first collective attempt to resolve the problem of seahorse over-exploitation in the Philippines. To consolidate the country's seahorse conservation and management initiatives, Project Seahorse and the Haribon Foundation invited a wide range of stakeholders (fishers, traders, users, researchers, policymakers, law implementors, and NGO workers) to share their experiences and capabilities at this national meeting. Participants made a strong call for action and took initial steps toward an integrated plan for managing these valuable and poorly understood fish species. This workshop laid down the template for action at the international level.

International Workshop on the Management and Culture of Marine Species used in Traditional Medicines, 4-9 July, 1998

Stakeholders in the collection, trade and culture of marine species for use in traditional medicine (TM) met with fisheries and conservation biologists to develop a co-ordinated international plan of action to improve the sustainability of the trade. The meeting was notable in prompting proactive (rather than reactive) discussion between representatives of TM and conservation communities. Participants began the process of identifying problems with the trade in marine medicinals for TM as well as possible solutions, in an atmosphere free of cultural conflict.

International Aquarium Workshop on Seahorse Husbandry, Management and Conservation, 6-9 December 1998

This workshop may be the first example of a global, integrated approach to conservation action by the world's aquaria on behalf of a group of threatened marine bony fishes; its nearest equivalents would be joint plans for sharks and cichlids. At the meeting, public aquaria acknowledged their direct connection to, and shared responsibility for, wild populations of seahorses in particular, and marine conservation in general. Participants began developing a long-term program for resolving technical problems associated with seahorse husbandry, and recognised that this collaborative approach could also serve as a model for similar endeavours on behalf of other marine wildlife.

*Proceedings from these workshops are available from Project Seahorse: Dept. of Biology, McGill University, 1205 Ave Dr. Penfield, Montréal, Québec H3A 1B1, Canada Fax: 1(514)398-5069
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Workshop Agenda

Management and culture of marine species used in traditional medicines

Cebu City, Philippines, 4-9 July, 1998

Day 0 - Saturday 4 July

18h00 - 20h00	Welcome gathering
19h00	Informal introductions
20h00	Supper & Reception

Day 1 - Sunday 5 July

OPENING REMARKS

08h00-08h15	Organisers	Introduction
08h15-08h30	Co-ordinator	Logistics briefing
08h30-08h45	Facilitator	Guiding remarks

SESSION 1: SETTING THE SCENE

08h45-09h30	Amanda Vincent	Setting the scene for marine medicinal species
09h30-10h00	Allison Perry	Global survey of marine medicinals
10h00-10h30	Marivic Pajaro	The importance of trade in marine medicinals to local communities
10h30-11h00	<i>Break/Snack</i>	

SESSION 2: TRADE IN EXPORTER COUNTRIES

11h00-11h30	Plenary	Open forum
11h30-12h00	Salome Quijano	Role of women in the production, trade and use of marine species as medicine
12h00-12h30	Aaron Lipton	Fishery for marine medicinal species in India: problems and responses
12h30-14h00	<i>Lunch</i>	
14h00-14h30	Rene Ledesma	Government administration of TM issues

SESSION 3: TRADE IN IMPORTER COUNTRIES

14h30-15h00	Jokkeng Lee	Traditional Chinese medicine (TCM) use of marine medicinals: content and context
15h00-15h30	Endi Zhang	Preliminary report on seahorse trade in Shanghai and Tianjin
15h30-16h00	<i>Break/Snack</i>	

SESSION 4: TM AND CONSERVATION

16h00-16h30	Samuel Kwokhung Lee	How conservation can work with TM communities
16h30-17h00	Hanchen Zheng	Marine species in TCM
17h00-17h30	Young-Jong Lee	The state of seahorses as herbs in Korean Oriental Medicine
17h30-18h30	Plenary	Open forum
18h30-20h00	<i>Supper</i>	
20h00 -	Films	Screening of participants' videos

Day 2 - Monday 6 July**SESSION 5: AQUACULTURE**

08h00-08h30	Philippe Dhert	Tools for the production of marine medicinal species in backyard hatcheries
08h30-09h00	Do Huu Hoang	Culturing seahorses in Vietnam
09h00-09h30	Jacqueline Lockyear	South African seahorses: consumption, threats and research problems
09h30-10h00	<i>Break/Snack</i>	

SESSION 6: GLOBAL ISSUES

10h00-10h30	Jong-Geel Je	Marine conservation in Korea
10h30-11h00	Peter McGlone	Australian concerns for marine medicinal use of Syngnathids
11h00-11h30	Douglas Warmolts	Marine medicinal species in the aquarium trade
11h30-12h00	<i>Travel to DENR</i>	
12h00-13h30	<i>Lunch</i>	<i>DENR Campo Forestal</i>

SESSION 7: SUMMARISING AND REVIEWING

13h30-14h15	Rosalinda Paredes & Allison Perry	Synthesis of marine medicinals and aquaculture wall charts
14h15-15h00	Heather Hall	Summary of presentations
15h00-16h00	Plenary	Responses to all presentations (A)
16h00-16h30	<i>Break/Snack</i>	
16h30-17h30	Plenary	Responses to all presentations (B)
17h30-18h00	Amanda Vincent	Achieving sustainable use of marine medicinals: a survey of our options
18h00-18h30	<i>Travel to hotel</i>	
19h00-20h30	<i>Supper</i>	
21h00-	Karaoke at hotel	

Day 3 - Tuesday 7 July**BREAKOUT GROUP DISCUSSION I: PROBLEMS AND LIMITATIONS**

08h00-10h00	Four breakout groups	Problems and limitations A
10h00-10h30	<i>Break/Snack</i>	
10h30-11h30	Four breakout groups	Problems and limitations B
11h30-12h30	Plenary	Problems and limitations overview
12h30-13h00	<i>Walk to Fort San Pedro</i>	<i>Via cathedral and Magellan's Cross</i>
13h00-14h00	<i>Lunch</i>	<i>Fort San Pedro</i>

BREAKOUT GROUP DISCUSSION II: OPTIONS AND POSSIBILITIES

14h00-16h00	Four breakout groups	Options and possibilities A
16h00-16h30	<i>Break/Snack</i>	
16h30-17h30	Four breakout groups	Options and possibilities B
17h30-18h30	Plenary	Options and possibilities overview
18h30-19h00	Field trip briefing	

Day 4 - Wednesday 8 July**FIELD TRIP TO DANAJON BANK**

06h00-23h00	See separate detailed briefing
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Day 5 - Thursday 9 July

BREAKOUT GROUP DISCUSSION III: PLANS AND PROPOSALS

08h00-10h00	Four breakout groups	Plans and proposals A
10h00-10h30	<i>Break/Snack</i>	
10h30-12h30	TM representatives	Traditional medicine presentations
12h30-14h00	<i>Lunch</i>	<i>Casa Gorordo</i>
14h00-16h00	Plenary	Plans and proposals B & overview
16h00-16h30	<i>Break/Snack</i>	

CLOSING DISCUSSIONS

16h30-17h30	Plenary	Networks & Plans: the way forward
17h30-18h30		Final discussions, analyses and formalities
19h30-21h00	<i>Banquet</i>	
21h00 -	<i>Disco at hotel</i>	

Friday 10 July

12h00	Workshop secretariat closes
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Field Trip Briefing

Danajon Bank – Day 4

This field trip will allow us to introduce Danajon Bank. One of only about six double barrier reefs in the Indo-Pacific, it runs 145 km along the northwest coast of Bohol and comprises hundreds of coral atolls, shoals and reefs. Formerly one of the richest fishing areas in the central Philippines, overfishing and destructive techniques have so degraded the resource that many local fishers now find it difficult to feed their families. Human populations continue to grow rapidly in this Roman Catholic country. Subsistence fishers are forced to take whatever resources they can find, including seahorses.

The Project Seahorse/Haribon Foundation team began working in Handumon village (*barangay*) in Getafe municipality on Danajon Bank in late 1994. Project Seahorse is now assisting the Haribon Foundation to implement US-AID's Coastal Resource Management Program for most of Danajon Bank. This has led to the establishment of new project sites in the villages of Jagoliao (Getafe municipality) and Batasan (Tubigon municipality), together with the appointing of a community relations officer to link the sites together. We emphasise improved resource management, biological and socio-economic research, capacity building, environmental education, development of alternative livelihoods, establishment of marine protected areas, enforcement of existing fisheries and habitat protection laws, promotion of new regulations, and alliance building.

We ask you to behave with decorum throughout the visit to Danajon Bank, and to respect the people and the natural environment of the region. This will be a long but, we hope, interesting day. The following schedule is inevitably tentative and will change according to weather, mechanical breakdowns and a host of other possible disruptions. Water is very scarce so please do not use more than necessary.

Program

- 05h30** **Wake up calls**
- 06h00** **Depart hotel and walk to the pier in Carbon market**
Please wear rough clothes and footwear that can get very dirty and wet. Bring sunhat, sunglasses, sunblock, mosquito repellent, and a change of clothing. You may also wish for your camera and binoculars.
- 06h15** **Board boat for Danajon Bank**
breakfast on board
discussions about Danajon Bank and other coral reefs
- 08h45** **Arrive Banacon Island**
transfer to three smaller outrigger boats (*bancas*)
- 09h00** **Depart for boat tour through mangrove plantation**
discussions of mangroves and seagrasses
introduction to Jagoliao field site of Project Seahorse/ Haribon Foundation
snack en route
- 11h30** **Arrive Handumon village, Jandayan Island**
Your base will be the Project Seahorse staffhouse, where we live and work.

- 12h00 Lunch**
welcome by Mayor of Getafe municipality
message of support from Governor of Bohol province
- 13h00 Guided walk through Handumon**
This walk will give you an opportunity to observe village life and to see craftspeople at work. You will be accompanied by village councillors (*kagawads*) and members of KANAGMALUHAN (new people's organisation).
- 14h45 Rest at guesthouse**
opportunity to buy local crafts made by KANAGMALUHAN
snack
- 15h15 Brief presentations by team members and villagers**
1. Marivic Pajaro, Project Seahorse/ Haribon Foundation Philippines team leader
 2. Gregorio Botero, Handumon village captain (*translation by Rosemarie Apurado, Project Seahorse/Haribon Foundation community organiser in Handumon*)
 3. Nestor Botero, Handumon fisher and former seahorse buyer (*translation by Isidore Ancog, Haribon Foundation/Project Seahorse community organiser in Batasan*)
 4. Camilo Socias, Handumon fisher, current president of local youth association, *Sanguniang Kabataan*, and former Project Seahorse/ Haribon Foundation scholar (*translation by Jonathan Anticamara, Haribon Foundation/Project Seahorse biologist in Jagoliao*)
 5. Estelita Tacatane, treasurer of KANAGMALUHAN and craftsperson (*translation by Flordeliza Alcaria, Haribon Foundation/Project Seahorse community organiser in Jagoliao*)
 6. Elvira Bohol, secretary of KANAGMALUHAN, craftsperson and Project Seahorse scholar (*translation by Marivic Pajaro, Project Seahorse/Haribon Foundation Philippines team leader*)
 7. Amanda Vincent, Project Seahorse international leader
- 16h00 Mangrove planting**
We hope you will each agree to plant 100 propagules to help restore Handumon's mangroves. You will be led by village councillors and KANAGMALUHAN members.
- 16h45 Swim in marine sanctuary (optional)**
Handumon's marine sanctuary was established in 1995 in a devastated area of corals, and is recovering very well. *We ask you to respect it fully. Do NOT stand on corals or swim too close together. The reef crest runs parallel the shore. Move about 10m inshore to the flat if you wish to stand.*
- 17h30 Return to staffhouse and relax**
- 18h00 Supper, with music by villagers**
- 19h30 Entertainment**
1. Primary school teachers of Getafe, performing *tinikling*, the national dance of the Philippines.
 2. Isidore Ancog and Celestina Torreta with a Visayan folk dance.
 3. Renaldo Paden, reciting his *balak* poem on seahorses. It won this year's World Environment Day contest in Handumon. *Balak* is a traditional form of declamatory poetry in Bohol.

4. Project Seahorse/ Haribon Foundation team singing a medley of Bohol songs, with original introduction.
5. (Impromptu dance by Glenn and Debra, Australian workshop participant and guest).

22h00 Departure for Cebu

List of Participants

Person	Country	Field
Ir. Ali Hafiz al Qodri	Indonesia	Aquaculture
Mr. Jonathan Anticamara	Philippines	Conservation
Mr. Rudi Bijmens	Vietnam	Aquaculture
Dr. Jeffrey Boehm	USA	Public Aquaria
Mr. Suraphol Chalarkid	Thailand	Aquaculture
Mr. Vincent Chen	Taiwan	Conservation & TM
Dr. Philippe Dhert	Belgium	Aquaculture
Ms. Dolores Ariadne D. Diamante-Fabunan	Philippines	Conservation
Mr. Do Huu Hoang	Vietnam	Aquaculture & Conservation
Dr. Heather Hall	UK	Public Aquaria
Ms. Grace V. Hilomen-Garcia	Philippines	Aquaculture
Dr. Jong-Geel Je	Korea	Conservation
Mr. Boris Saiping Kwan	Hong Kong	Conservation & TM
Mr. Rene Geraldo Guerrero Ledesma	Philippines	Government & Fisheries
Mr. Jokkeng Lee	Malaysia	TM & Trade
Mr. Samuel Kwokhung Lee	Hong Kong	Conservation & TM
Dr. Young-Jong Lee	Korea	TM Research
Dr. Aaron P. Lipton	India	Fisheries & Trade
Ms. Jacqueline Lockyear	South Africa	Aquaculture & Biological Research
Mr. Zhenqiu Mai	China	TM Research
Mr. Peter McGlone	Australia	Conservation
Dr. Bertha Mo	Canada	Medical Anthropology & Gender Issues
Mr. Glenn Moore	Australia	Biological Research
Dr. Vorathep Muthuwan	Thailand	Aquaculture
Ms. Marivic Pajaro	Philippines	Conservation
Ms. Allison Perry	Canada	Conservation & TM
Ms. Salome Quijano	Philippines	Gender Issues & TM
Dr. Truong Si Ky	Vietnam	Aquaculture & Conservation
Dr. Amanda Vincent	Canada	Conservation
Mr. Douglas Warmolts	USA	Public Aquaria
Mr. Mark Wilson	UK	Aquaculture
Mr. Chris Woods	New Zealand	Aquaculture
Dr. Chunguang Zhang	China	Conservation
Dr. Endi Zhang	China	Conservation & TM
Prof. Hanchen Zheng	China	TM Research

Part II. Workshop Preparation

Explanation of Workshop Preparation Process

Workshop Outline

Summary of Briefing Paper A:

Global Survey of Marine Medicinals



Explanation of Preparation Process

The distribution of preparation materials to participants in the months leading up to the meeting served to engage participants in the workshop process even before their arrival in the Philippines. An early introduction to the workshop goals and themes was particularly important given the varied background and expertise of invited participants. For many, this meeting would be their first introduction to such fields as traditional medicine, community-based conservation, or aquaculture.

The workshop outline sent to participants upon their invitation described the objectives and rationale for the meeting, and set out the main workshop subject areas. In addition, the following draft briefing materials on the principal workshop themes were prepared by Project Seahorse and circulated to participants for comment:

- Paper A: “Global Survey of Marine Medicinals” presented the preliminary results of a study to determine the taxonomic and geographic distribution of use of marine medicinal species.
- Paper B: “Aquaculture and the Conservation of Marine Medicinal Species” provided a brief introduction to the ecological, social and economic components of conservation-driven aquaculture.
- Paper C: “A Review of the Current State of Seahorse Aquaculture” addressed the technical problems of seahorse aquaculture. Only participants with an interest in aquaculture were asked to read this paper.

The comments received for all three papers were informative and important: participants raised new issues, and also provided additional information on marine species used in traditional medicines. Only Paper C was significantly revised, and a second version distributed to participants before the workshop.

Paper A and Paper C are currently under revision by Project Seahorse researchers, and will be widely available upon their eventual publication. A brief summary of Paper A is included in these proceedings.

Apart from these three papers, participants were also sent a short questionnaire on the use of marine species in TM, together with their country’s section of the 1996 TRAFFIC report on the international trade in seahorses¹. A complete schedule of the pre-workshop mailings is found below:

Preparation Materials Mailing Schedule:

1. April 1998 Mailing: Briefing Documents
 - Introduction to the Briefing Documents
 - Paper A: Global Survey of Marine Medicinals
 - Paper B: Aquaculture and the Conservation of Marine Medicinal Species
 - Paper C: A Review of the Current State of Seahorse Aquaculture
2. May 1998 Mailing
 - Guidance on Workshop Preparations
 - Philippines Travel Information
 - Marine Medicinals Questionnaire

¹ Vincent, A.C.J. 1996. The international trade in seahorses. TRAFFIC International, Cambridge, UK. vii + 163pp.

3. June 1998 Mailing
 - Thoughts in Preparation for the Workshop Sessions
 - Comments on the IDRC Briefing Documents (Papers A & B)
 - Revised Paper C: A Review of the Current State of Seahorse Aquaculture
 - Glossary of Terms

4. June 20 1998 Mailing
 - Summary Report of the National Conference-Workshop on the Conservation and Management of Seahorses in the Philippines.

Workshop Outline

The following document accompanied participants' invitation to attend the workshop. It served to introduce the rationale and goals of the meeting, and to stimulate thinking on issues of marine medicinal conservation and management.

Objectives

Overall objective

To develop a co-ordinated international plan of action to improve the sustainability of trade in marine species used in medicines. Decisions will be based on the consensus of stakeholders, conservationists and biologists. Seahorses are the only marine medicinal that has been studied in detail, so will be used as the example from which general paradigms can be sought.

Specific objectives

- Hold a discussion workshop where stakeholders in fishing, trade, and culture of marine medicinal species can work with fisheries and conservation biologists to assess the current situation and develop new collaborations.
- Compile directories of marine species used in medicine, consumption levels and histories, perceived conservation concerns, and livelihood possibilities.
- Generate action plans and design protocols that will improve the management of seahorses and other marine medicinals in order to provide livelihood options for those who are dependent on this trade.
- Consult with traders and consumers on their projected needs for marine species, and how to meet them.
- Discuss improvement of aquaculture of marine medicinal species in order to provide new livelihood options for fishers and aquaculturists, while simultaneously reducing pressure on overexploited wild populations.
- Use seahorses as a model group of species to focus on the technical and social problems of marine aquaculture in developing countries.
- Establish a network of stakeholders for future consultation and collaboration.
- Develop general paradigms for how newly recognised trades in marine medicinals should be managed for conservation, for socio-economic gain, and for medicinal use.

Background

Traditional medicines

Unsustainable consumption of plants and animals for traditional medicine poses conservation concerns, and damages the future prospects of people who depend on these resources for income or medicines. Consequently, in June 1997, Parties to the Convention on the International Trade in Endangered Species (CITES) agreed by consensus to call for action on the overexploitation of medicinal plants and animals. Ensuring long-term persistence of species targeted for medicine will not be easy. It is now vital to identify use, assess trade volumes and values, evaluate the long-term viability of such consumption, and promote wise management of populations, species and ecosystems.

Traditional medicine systems are trusted by a large proportion of the world's people, and are recognised by the World Health Organisation as providing a valid form of health care. They typically have a long history of use, with apparent validation of medical efficacy coming from their perceived record of successes. Such medical systems rely heavily on compounds of plants, animals and minerals, often tailored to the individual patient.

Traditional Chinese medicine (TCM) plays a dominant role in wildlife trade, because of its huge number of adherents globally and its dependency on a wide range of medicinal substances. Most conservation attention has focused on the use of charismatic large mammals, such as rhinoceros, tigers and bears, even though at least 11,000 species of plants and animals are involved in TCM. The use of at least 211 marine species (including algae, corals, echinoderms, fishes, and reptiles) in TCM

has been comprehensively ignored in conservation assessments. A recent report highlighting the trade in seahorses was the first case study of the TCM trade in a marine species. Brief studies on the use of pipefishes and pegasid fishes in TCM make it clear that other marine species are also coming under pressure.

Other cultures also trust their health to marine species. Traditional Japanese and Korean medicines (*kanpo* and *hanyak* respectively) are derived from TCM and rely on many of the same practices and ingredients. Diverse Indian pharmacopoeia also include marine species: for example, sturgeon swim bladders can be used to treat diarrhea or as plasters for wounds, and pearls from certain mussels are powdered to treat low fevers, coughs and epilepsy. The global importance of marine species may be considerable: folk medicine in the central Philippines employs sea lettuce to eliminate worms, giant clams to treat malaria, and stingray tail to alleviate chest pains; oil derived from leatherback turtles is used to relieve respiratory ailments in the British Virgin Islands; traditional South African medicine has now expanded to embrace deep sea fishes and black corals, and employs chitons to treat venereal disease.

A directory of marine animals and plants used in traditional medicine is now being compiled at McGill University. This will indicate the scale of global dependency on marine medicines, provide an introduction to the taxonomic and geographic distribution of such use, and begin identifying possible conservation concerns. The pilot compendium will be available by April 1998 but trade surveys and detailed analyses will take many more years, during which consumption of marine species will undoubtedly increase.

This workshop is intended to bring members of traditional medicine communities into direct contact with other stakeholders, so that they may influence natural resource extraction and aquaculture planning. The mutual goal should be to ensure long-term persistence of the marine species involved and hence long-term availability of the medicinal ingredient.

Seahorses

Management of seahorses, as the only case study available, must inevitably serve as a role model for all marine medicinal species. These fishes are heavily exploited for traditional medicines, tonic foods, aquarium fishes and curiosities. The trade is large (involving over 20 million seahorses every year), global (involving 40 countries) and seemingly unsustainable, with widespread reports of serious declines in wild populations throughout Asia. Traditional East Asian medicines are the largest consumers of seahorses, with China, Hong Kong, Taiwan, Singapore, Korea, and Japan acting as the primary markets. Importers report that seahorse sales are growing at a rate of about 10% per year in response to China's economic development, and that demand far exceeds supply. Certainly the numbers of wild seahorses in exploited populations has declined markedly.

The complex problem of seahorse conservation will require creative responses. Co-operation with traditional medicine communities offers one possibility for balancing seahorse supply and demand. Sadly, however, previous interactions between conservation campaigns and traditional medicine communities have often been highly confrontational, with sociological and cultural differences hampering progress on conservation issues. Seahorses provide a new opportunity for measured dialogue, as these fishes are not yet on the verge of extinction, nor have they been the target of hostile conservation campaigns.

Fishing communities offer particularly good scope for innovative measures to manage wild seahorse populations. Seahorses, and many other marine medicinal species, are caught by small-scale subsistence fishers, often providing the main source of income to feed families. Meeting the economic needs of such marginalised communities while conserving the resource base on which they depend requires a delicate balance. Yet the fishers themselves are very aware of the need to seek both sustainability and long term viability.

The world's first seahorse conservation project was established in early 1995 in the fishing village of Handumon, in the central Philippines. Local fishers had observed a dramatic decline in seahorse catch, in the region of 70% in the 10 years from 1985. The community-based project initiated by Dr. Amanda Vincent and the indigenous Haribon Foundation is proving effective at encouraging

fishers to manage their own marine resources, including seahorses. The fishers are highly motivated because nearly half of them earn a substantial proportion of their household incomes from targeting seahorses. Fishers cannot contemplate a future without seahorses because there are so few other resources in this degraded and depleted marine environment.

Handumon's use of the seahorse project as a catalyst for change demonstrates that fishing communities will grasp the opportunity to empower themselves: the village rapidly implemented a no-take marine sanctuary for all species and patrols it effectively; rather than selling newly-caught pregnant male seahorses immediately, fishers now place them in sea cages until they have given birth, from where the young escape to replenish the depleted reef (and the fishers can then sell the male); fishers and other villagers survey marine ecosystems, record fisheries data (which the project team analyses and feeds back to them) and plant mangroves; a core resource management group has been formed and is addressing education, natural resource management and livelihood options. The project team has now grown to assume responsibility for coastal zone management in an area of six municipalities (about 150,000 people) on Bohol, and is relying on Handumon and its fishers to promote and facilitate action throughout the region.

Culturing

Alternative livelihoods are needed in Handumon and other fishing communities that depend on marine medicinals, but these must be appropriate, ecologically sustainable and economically viable. The development of small-scale, low-technology aquaculture could provide new income-earning opportunities for fishers and reduce pressures on wild populations. At present, however, there are few examples of successful marine aquaculture for finfish, with most projects only at an experimental stage. None of the many attempts at seahorse culturing (e.g. South Africa, Philippines, China, Indonesia, Thailand and New Zealand) has yet proven economically or ecologically viable.

Farming seahorses has proven technically difficult because of problems with diet and disease: seahorses are strict carnivores that succumb rapidly to parasitic, fungal and bacterial ailments, for which there are currently no effective treatments. 'Successful' seahorse culturing has most commonly referred to a wild-caught pregnant male giving birth in captivity, or to seahorses mating in captivity and giving birth. The seahorse life cycle has rarely been closed (i.e. captive born young producing captive born young), and even then with very low survival rates (e.g. 10% surviving to breed).

The prognosis for small-scale culturing of seahorses is improving, through the combined efforts of researchers in academia, industry and the aquarium trade. In particular, a second field program was established by Dr. Vincent in 1995 in Vietnam (another major seahorse exporting nation) to focus on the development of small-scale and low-technology seahorse aquaculture. The Vietnamese team has made significant progress in resolving disease and dietary problems; more careful hygiene and improved production of necessary live food organisms has increased seahorse survival to commercial size and maturity.

Small-scale culturing will really only be viable when both biological and socio-economic factors are incorporated into the planning, in order to understand the state of the fishery and the potential for alternative livelihood development. In Vietnam, the team is documenting the national fishery and the trade by going to sea with the fishers, encouraging fishers to keep catch calendars, recording catch data on landing, tracking market supplies, and traveling the country to obtain information on volumes and prices. Field monitoring of wild seahorses is also underway. Education and training are vital and the Vietnamese team conducts regular sessions on marine conservation and ecology with local schools and universities, and leads community discussions on declining fisheries and future options.

Socio-economic analysis

Communities using traditional medicine play a large role in determining the exploitation and consumption of marine species, including seahorses. Economic changes in consumer spending and social changes in values and attitudes are of vital importance in influencing the conservation status of marine animals, plants and algae. In turn, the success of fisheries management and culturing directly affect medicinal prices and availability. It is essential that the suppliers and the consumers have a mutual awareness of their needs and resources, and plan towards a common management approach.

The workshop will include the analysis of the socio-economic benefits of introducing small-scale aquaculture to subsistence fishing communities. A key objective of the workshop is to identify the appropriate way to develop aquaculture for species exploited by the marine medicinal trade. The exchange of information at the workshop will enable the development of low-technology protocols for culture of species such as seahorses. These protocols would be used to develop small scale aquaculture in fishing villages in developing countries as an alternative to wild capture fisheries. This approach will result in a significant improvement in lifestyle for fishers (many fishing methods are very labour intensive), potentially improve their incomes and reduce the fishing pressure on a wide range of marine species and habitats.

Co-ordination

Problems in the development of innovative aquaculture practices, including those with seahorses, are exacerbated by lack of information exchange internationally. Aquaculture ventures commonly work totally independently. Recent technical advances from different parts of the world indicate that seahorse culturing problems are solvable, so it now seems appropriate to facilitate co-ordinated action by the diverse groups of stakeholders.

Public aquaria recognise the need to reduce the relatively low, though significant, demand for wild seahorses in the aquarium trade, and also to facilitate the survival and recovery of wild seahorse populations. Hence an international effort is now underway to collate a database of husbandry information which will be made accessible. Dr. Heather Hall is co-ordinating the collection of this information from zoos and aquaria who keep and breed seahorses, as well as from the published literature. A student at McGill University is working with Dr. Hall to produce an initial protocol for aquarium husbandry of seahorses by April 1998. A group of aquaria will help develop simple methods for seahorse keeping that can be applied in developing countries.

This international workshop to assess the use and management of marine fauna and flora in traditional medicine will be very timely. Culturing the many species in demand for marine medicine would offer the hope of alternative livelihoods to the many fishers who face dwindling marine resources, while reducing pressure on wild populations. The challenging case study of seahorses can provide a focus for the workshop discussions, and should motivate a search for protocols and paradigms of general applicability. An opportunity for dialogue and collaboration between people of many nationalities who are actively involved in the fishing, trade and use, and culturing of marine species will lay the template for future co-operation. This can only improve the conservation prospects and enhance the socio-economic value of marine medicinals.

The International Development Research Centre (IDRC) and Project Seahorse

This workshop will be financially supported by the International Development Research Centre (IDRC), which is based in Ottawa, Canada. A public corporation created by the Canadian government, its principle mandate is to help researchers and communities in the developing world find solutions to social, economic, and environmental problems through research. This workshop fits into at least three of IDRC's six program initiatives: Community-based Natural Resource Management, Sustainable Use of Biodiversity, and Medicinal Plants. The IDRC is also funding much of our Vietnamese seahorse culture work for 1998 and a gender study on the "The role of women in the use and management of marine medicinal species" (see below).

Project Seahorse (led by Dr. Vincent and Dr. Hall) is a global, integrated program for seahorse conservation, incorporating field conservation programs, trade surveys, fundamental research, and ex-situ management. Field conservation initiatives aim to increase the sustainability of the seahorse trade and identify alternative livelihoods for those who currently depend on the fishery. The IDRC workshop will complement these objectives by identifying protocols for alternative livelihoods and

increase dialogue with traditional medicine communities. The lack of biological information on seahorses and the current problems with captive breeding mean that a workshop to resolve these issues is a priority. Associated work within Project Seahorse has investigated other species used as medicinals, such as pipefishes and pegasids, so a workshop addressing the wide range of marine species used in traditional medicines is complementary and timely.

Preparation

Groundwork

The groundwork for this workshop is as follows:

- A. Marine medicinal research. A Canadian student is currently carrying out the first known investigation into the global use of marine species in medicines, as a project with Dr. Vincent. Her initial overview and synthesis will comprise an important part of the research leading into the proposed IDRC workshop, and will also provide the template for further developments in knowledge arising from the workshop.
- B. Seahorse husbandry protocol. Another Canadian student is working with Dr. Hall to collate a best-available-knowledge husbandry protocol for seahorses from aquarists and public aquaria. This process is itself unusual and represents a real involvement of aquarists in helping to address a field conservation concern. The outcome of that process will be distributed to participants, and help guide their technical and marketing decisions at the IDRC workshop.
- C. Published material on marine medicinals and seahorses. All participants will be provided with syntheses of known material on marine medicinals, their trade and conservation status, and on seahorse culturing.
- D. A national action plan for exploited seahorses in the Philippines. A meeting to formulate this plan will be held in the Philippines in May 1998, organised by the Philippine Project Seahorse team. This meeting will thus involve all stakeholders in discussions of seahorse conservation and management in the Philippines, and allow local issues to be discussed in depth in a less intimidating forum than an international workshop. A proceedings and action plan will be produced and incorporated in the briefing materials for the IDRC workshop.
- E. A study of the role of women in the use, management and consumption of marine species in medicine is underway in the Philippines and Hong Kong, under the supervision of the Haribon Foundation (Philippines) and funded by IDRC. The Filipina social worker carrying out the study will present preliminary reports at the workshop, for discussion and feedback.

Timing

- March 15: Briefing documents A, B, and C (see above) will be sent to participants
- April 15: Participants return briefing documents A, B, and C with suggestions and modifications. Participants provide background information on their specific areas of expertise for inclusion in briefing materials.
- May 28-30: Philippines national meeting on the conservation and management of exploited seahorses.
- June 15: Revised briefing documents A, B, and C will be sent to participants, along with a 5 page report on the Philippines national workshop (D).
- July 4: Participants arrive
- July 5-9: Workshop
- July 10: Participants leave.
- August 1: Workshop proceedings sent to participants for comment and input.
- September 15: Participants return comments on workshop proceedings.
- December 31: Action plans and papers finalised.

Workshop plan

The IDRC workshop will include (a) core sessions involving all participants and (b) working groups to address specific issues: [*Eds.*: The workshop plan described below was altered for the actual meeting, in response to discussions with the facilitator and participants].

	Action	Task	Objective
4 July	Participants arrive		
5 July	Introductory talks	Plenary sessions to identify specific issues in the following themes: 1. Unusual fisheries 2. Marine medicinals: use, trade, conservation status 3. Culturing potential and difficulties 4. The case of seahorses Discussions	To introduce participants and present their interest and involvement in the marine medicinal trade. To develop the context for and objectives of the workshop.
6 July	General analysis and integration	Analysis of key technical (e.g. feeding, disease) and socio-economic issues (e.g. infrastructure, marketing and trade, education and training)	To evaluate past experience To identify key technical and socio-economic issues, and their interconnectedness.
7 July	Field trip to Project Seahorse, Handumon village.	Tour to see seahorse fishing village, visit field program and meet key members of the community	To examine a community-based field conservation program, involving fisheries management and alternative livelihood options.
8 July	Working groups	Breakaway groups, each discussing a problem in its socio-economic context (e.g. overfishing, aquaculture difficulties, trade priorities, medicinal alternatives)	To synthesise problems and possible solutions To agree approaches and formalise action plans. To ensure socio-economic feasibility of new initiatives.
9 July	General discussion	Working group presentations, proposing future action. Integration of workshop outcomes into global context. Analysis of paradigms derived from workshop: how to apply the methodology, protocols and networking developed here for marine medicinals in general. Development of outputs.	To present the action plans of each working group for discussion. To develop formal networking, to establish timetable for progress. To agree on a monitoring system for other marine medicinals, and determine protocols for maintaining databases on seahorses and other marine medicinals.
10 July	Participants leave		

Follow-up

1. Workshop on seahorse fisheries and trade (provisional). This meeting would be held in August in Australia, and would involve stakeholders from developed and developing countries in the region. Apart from considering Australia's involvement in the seahorse trade, it would seek to assess the ecological, social and economic implications of developed world involvement in developing country fisheries issues and trade in traditional medicine [*Eds.*: This meeting was not held].

2. Workshop on seahorse husbandry, management and conservation. This meeting will be hosted by the John G. Shedd Aquarium in Chicago USA in December 1998, in conjunction with their special exhibition of seahorses and their relatives (May 1998 to December 1999). It will develop an international co-ordinated program of research and action, to involve aquaria as full partners in ensuring the survival of healthy populations of wild seahorses. Proceedings and action plans from the IDRC workshop will be incorporated into briefing materials for the Shedd workshop.
3. Project on "Seeking sustainability in Hong Kong's marine medicinals trade". This will be launched in the middle of 1998 (in conjunction with WWF Hong Kong and TRAFFIC East Asia), and will seek collaboration with the Hong Kong traditional medicine community on the assessment and management of marine species consumption.

Outputs

1. Workshop proceedings to provide an overview of the IDRC workshop, including:
 - a) Background information of the marine medicinal trade from the perspective of traditional medicine practitioners, aquaculturists, fishers, conservationists and fisheries managers.
 - b) Key points of discussion held by the working groups with summarised actions.
2. Protocols. The following protocols will be developed as a result of this workshop:
 - a) Seahorse culturing handbook. This will provide technical information on seahorse culture, incorporating (i) the synthesis of seahorse culturing prepared as background briefing for the workshop (ii) data previously collected by the Project Seahorse team on seahorse husbandry and (iii) results of discussions that take place during the workshop.
 - b) Seahorse culturing in developing countries. This protocol will provide information on low-technology culture of seahorses where resources are few. It will include material from current programs in the Philippines and Vietnam as well as the results of the discussions held during the workshop. We will illustrate this in a manner that can guide and assist fishers in the practicalities of establishing such an initiative.
3. Action plans. Each technical working group will develop an action plan during the IDRC workshop. At the end of this meeting, the action plans will be formalised, time tabling targets and identifying people who will take responsibility for monitoring progress. Possible action plans might be:
 - a) Monitoring system for the trade in seahorses and other marine medicinals, with the traditional medicine community.
 - b) Development and maintenance of a database on use of seahorses and marine medicinals.
 - c) Recommendations for socio-economic development in culturing of marine medicinal species.
 - d) Technical development for culturing seahorses and other marine medicinal species.
 - e) Identification and development plans for other livelihood options.
 - f) Development of communication and collaboration among workshop participants.
 - g) Facilitation of trade along agreed conservation guidelines between suppliers and traditional medicine communities.
4. Dissemination of results. The findings of this workshop will be made widely accessible to communities and organisations involved in conservation, development, fishing, traditional medicines, and aquarium display. The public will be made aware of workshop outputs through media activity. In addition, Project Seahorse can incorporate workshop outputs in its schools education packages and seahorse adoption packs and through its Web site. A model example of the inter-dependence of socio-economic and biological factors in the development of a sustainable marine medicinal trade would be a valuable message to millions of people world-wide.

Summary of Briefing Paper A: Global Survey of Marine Medicinals

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The following is a shortened version of the briefing document sent to participants in order to introduce the workshop theme of global marine medicinal use. The original document included an appendix listing the scientific and common names of marine medicinals used in different regions of the world. Although efforts have been made to retain the key points of the text, certain sections have been edited for length. An expanded version of Paper A will be prepared by the author for eventual journal publication.

Introduction

Traditional systems of medicine have extensive histories of use in many countries. In China, the first *materia medica*, the Shennong bencao jing (Divine Peasant's Classic of the Materia Medica), was compiled in the first to second century AD (Otsuka 1976), and schools of Chinese medicine had been established as early as 200 BC (Kwan et al. 1996). Indian Ayurvedic medicine is believed to have originated not later than 600 BC, and some place its beginnings as early as 4000 BC (Sharma 1976). It has been suggested that aspects of both Greek and Arabic medicine were derived from Ayurveda (Otsuka 1976), while TCM (traditional Chinese medicine) influenced medical practice in nations including Korea (*hanyak*), Japan (*kanpo*), and Indonesia (*jamu*).

Traditional medicinal use continues to be vitally important in many areas. For example, TCM is practiced in China, Hong Kong, Taiwan, Singapore, and in ethnic Chinese communities around the world, Ayurvedic medicine in India and Sri Lanka, Unani healing in Pakistan and India, and *Jamu* in Indonesia. According to the World Health Organisation (WHO), the majority of cultures in developing countries depend upon traditional medicine to satisfy primary health needs, either for economic or cultural reasons (WHO 1996). Traditional healing methods are used as well in many developed countries, where there is growing interest in "alternative" (non-Western) systems of medicine.

In many societies, traditional systems exist alongside Western medicine, and healing methods may be chosen on the basis of ailment. Traditional medicines may be preferred for the treatment of chronic illnesses, or those seen as culturally-specific, and Western treatments chosen for acute ailments (Whistler 1992; Koo 1984). Proximity to urban centers may also dictate healing preferences.

While traditional healing practices are highly varied, remedies in many cultures involve the use of plant and/or animal species for medicinal purposes. These treatments are labeled as "herbal" medicines. (Because of this, it is often mistakenly assumed that the term refers only to plants). Many types of traditional medicine therefore depend upon the sustainable harvesting of wild species (CITES 1997a).

Given the global magnitude of the use of traditional medicines, and more specifically, the use of traditional herbal medicines, the possibility of over-exploitation of medicinal species must be considered. TRAFFIC, the joint wildlife trade monitoring program of WWF and the IUCN, states in relation to trade in medicinal wildlife that "increased demand and increasing human populations are leading to increased and unsustainable rates of exploitation" (1997). Overharvesting of wild species for medicinal purposes may pose a threat to their survival, as well as to the economic and medical needs of those people who depend upon them. In 1997, the Parties to the Convention on the International Trade in Endangered Species (CITES) agreed upon the importance of addressing these issues, while also recognising that the WHO has acknowledged the global importance of traditional medicines (CITES 1997a).

The case of large, terrestrial mammals threatened by trade for traditional medicine, especially for TCM, is fairly well-known, but the use of marine species in traditional medicine has effectively not

been studied. Accounts usually outline uses of marine medicinals in a single culture (Aliño et al. 1990), and even then may not be complete. Other studies are conducted to promote bioprospecting, and papers thus tend to emphasise promising chemical compositions or pharmacological actions (Carté 1996; Scheuer 1988), rather than the breadth of flora and fauna which could potentially be threatened by overharvesting. Even printed *materia medica* may not necessarily provide comprehensive listings — traditional systems of medicine are not static, and current practices can involve species which were not historically used (Vincent 1997).

To date, only one group of fishes has been studied in detail as a marine medicinal. An examination of the use of seahorses for traditional medicines revealed an extensive international market, rising demand, and declining seahorse populations (Vincent 1996). Whether similar situations of exploitation for trade exist for other marine medicinal species has not been extensively studied. A key step in the identification of potential threats to marine medicinals is the determination of the global scale of dependency upon these species.

This summary document presents the preliminary results of an ongoing study that aims primarily to provide an introduction to the taxonomic and geographic distribution of the use of marine medicinals. The long-term goal of this research is the identification of potential conservation concerns which may result from such use, and the suggestion of ways in which these concerns might be resolved.

Methods

Information was gathered from May 1997 to March 1998. A project summary and one-page questionnaire were sent to all WWF and TRAFFIC offices world-wide, as well as to experts, institutions, and organisations in the fields of conservation, marine biology, anthropology, and fisheries, who often forwarded the questionnaire to their own contacts. Seventy-two people responded to the questionnaire. [Eds.: The original marine medicinal questionnaire is included in these proceedings. See Part V. Workshop Context].

The use of literature was limited to only those sources that appeared immediately useful, such as *materia medica* of Ayurvedic, Unani, and TCM, the journals TRAFFIC Bulletin and Oryx, and anthropological work describing traditional marine resource uses or healing practices. Data were also collected through Internet searches.

Applicability of data was judged using a broad definition of the term “marine” which encompassed organisms living in oceans, estuaries, mangroves, and salt marshes. “Traditional medicine” was defined as those methods of maintaining and restoring health which are not part of the institution of Western medicine, and which do not typically involve highly technological processing. Tonic foods were considered to be a form of traditional medicine, because in some cultures, no significant distinction is made between tonic foods and other medicines.

Information was sought for the following variables:

- 1 type of organism (including broad classification, e.g. invertebrate, scientific, local and common names)
- 2 geographic region of use (as specifically as possible)
- 3 condition(s) treated
- 4 history of use
- 5 method of preparation
- 6 frequency of use
- 7 portion of organism used
- 8 quantity used per treatment
- 9 source of supply
- 10 habitat of organism
- 11 harvest method
- 12 time of harvest

1 3 time of reproduction

1 4 within-species preferences (e.g. size, colour, or stage of development)

Statistics were not employed in data analysis given the nature of the data set. Data were analyzed instead with respect to broad patterns and trends, with the goal of raising future questions for study.

Results and Discussion

Data were highly variable in level of detail, because information was obtained from many different types of sources.

Overview of Findings

In conducting this research, I came across a broad range of accounts of marine medicinal species and their uses. The following are various aspects of marine medicinal use which appeared particularly interesting or unusual:

- conditions treated with marine medicinals include poisoning, cancer, bone fractures, chest pains, painful childbirth, poor circulation, blood clots, colds, fevers, digestive ailments, deafness, insanity, depression, night blindness, cataracts, rabies, leprosy, inflammations, uterine conditions, swollen glands, liver disease, muscle strains, nosebleeds, strokes, convulsions, kidney disease, tuberculosis, asthma, rheumatism, back pain, impotence, sexual exhaustion, skin diseases, sunburn, venereal disease, wounds..... and many others
- the rationale of use for most marine medicinals is not readily apparent, although in some cultures, organisms are used on the basis of appearance or behaviour. Flatfish are used in Southern Africa to treat strokes on the basis of their purported resemblance to paralysed stroke victims.
- most marine medicinal use involve specific parts of organisms, and within one culture, different parts of a particular organism are generally used for different purposes
- parts used vary widely, and include skin, flesh, fat, shells, excreta, swim bladders, eyes, cartilage, bones, blood, tentacles, claws, tails, beaks, and feathers
- most accounts of marine medicinal use which indicate source of supply seem to pinpoint local sources, with the exception of Western nations which imported medicinals such as shark cartilage
- nearly all marine medicinal species reported thus far are coastal or shallow water species
- the range of substances used to treat groups of conditions is usually highly varied. Aphrodisiacs, for example, include sea cucumbers, eel blood, seagrasses, duck flesh, bivalve shells, crocodile fat, seahorses, shrimp, crabs, and the liquid from dugong eyeballs, among many others
- consumption of marine medicinals as tonic food is widespread
- distinctive marine medicinal derivatives are found in multiple systems of traditional medicine. Ambergris, a secretion from sperm whale intestines, is used to treat many conditions in Unani medicine and TCM.
- methods of preparation and treatment vary widely. Marine medicinal ingredients are cooked and eaten, taken alone or in combination with other herbal ingredients, eaten raw, carefully aged, or dried, ground, and applied externally.

Taxonomic Distribution of Use

A broad diversity of marine organisms was found to be used medicinally, representing 11 phyla, and a minimum of 394 species (Table 1, Fig. 1). This figure is almost certainly an extreme underestimate, as several geographical regions are entirely absent from the data set, and the accuracy of numeric estimates within regions included in the study is likely to vary in relation to quality of data used.

One difficulty encountered was analysing data in situations where organism type was not defined beyond a broad taxonomic label. For example, five accounts described the use of "whale", and four mentioned "shark". Numerous others referred simply to "sea shells." It is highly unlikely that all such accounts refer to a single species, or to the same species. When considering how many species are used, therefore, it is important to note that these represent only the minimum numbers of marine medicinal species, and that relative trends among regions or among taxonomic groups within a region

are therefore probably distorted. It is nevertheless possible to note trends in the data collected to date, while realising that these may not hold true as more data are added.

A comparison of species numbers within broad taxonomic categories (Fig. 2) reveals that most marine medicinal species are macrofaunal. This trend would not be surprising if the use of marine species for medicines were related to visually-perceived diversity; animal forms generally vary more than do plants or algae. The relative dominance of macrofauna, however, may also reflect an imbalance in data sources.

Nearly half of reported marine medicinal species are invertebrates. Fishes are the next most numerous; fish species represent approximately one quarter of all marine medicinals, and in nearly all regions, there is a greater emphasis on the use of bony fishes (Osteichthyes) than on cartilaginous fishes (Chondrichthyes) (Table 1). Plants and macroalgae comprise approximately 15 % (59 species) of total species.

The relative dominance of invertebrates may be related to the high proportional abundance of invertebrates in nature (Pechenik 1991) but is also likely to be tied to other factors. Several texts that highlighted invertebrates contributed a substantially greater proportion of the data, and therefore had a greater effect on the overall data set than information regarding other regions. Whether these general patterns of distribution across broad taxonomic categories is indicative of global trends is open to speculation. Clarification will depend upon further data collection.

Geographic Distribution of Use

Marine medicinal use was noted for 46 geopolitical regions world-wide (Table 2). For comparative purposes, these regions were grouped into 10 broader geographical zones, on the basis of location and assumed cultural similarities. Although categorisation may have had the effect of obscuring trends in marine medicinal use, these zones nevertheless seemed the most sensible based on the available data.

One apparent trend concerns the proximity of regions using marine medicinals to the marine environment — of those regions identified, all but 2 (Swaziland and Zimbabwe) have marine coastlines. This trend is hardly surprising, but may also reflect a tendency to seek information regarding coastal regions. This bias would have been compounded by the tendency for respondents in landlocked countries to assume that no marine medicinals were used simply because the country was landlocked, without considering the possibility of marine species entering local medicinal practice through trade. Trade in marine species is known to occur in landlocked regions. For example, seahorses are traded in Mali, a landlocked country. (E. Fleming, TRAFFIC Europe, *in litt.*, 28 January 1997).

As discussed earlier, data may not be representative geographically. In addition, for nearly every region for which *materia medica* or medicinal wildlife literature were obtained, marine medicinal use was found. It therefore seems likely that many other regions may also use marine medicinals.

Regional Trends in Taxonomic Distribution

Taxonomic patterns of use appear to vary among zones (Table 1). Sub-Saharan Africa, for example, does not appear to embrace as many marine species within its *materia medica* (n = 59) as does Eastern Asia (n = 286), but nevertheless uses an extremely broad range of organisms. Fish species used medicinally within the Kwa-Zulu Natal region of South Africa range are highly diverse, and includes the species *Halieutaea stellata* (Cunningham and Zondi 1991), also used for TCM (Tang 1987). The use of these fishes is unusual in comparison to other marine medicinal species noted to date, because they are found only in deep water and may therefore represent a more recent addition to the *materia medica* of China and South Africa. If this is the case, then such use in turn points toward the changing nature of some systems of traditional medicine.

Conclusion

As the result of this preliminary examination, a minimum of nearly four hundred marine species have been found to be used for traditional medicines. The difficulties and biases within the data have, if anything, resulted in an underestimate of the number of marine medicinal species, rather than an exaggeration. Comparisons across regions and groups of organisms are also complicated by the uneven data set, but suggestive trends have emerged. Clearly the use of marine medicinals is widespread. Further study is necessary to determine the potential implications for the conservation of those species used, and for the lives of those who depend upon them.

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Table 1. Minimum number of marine medicinal species grouped by zone and broad taxonomic category. Total number of species recorded for each taxonomic category are also indicated. Totals do not represent sums of columns, as use of some marine medicinal species overlaps among zones.

Zone	plants and macroalgae	invertebrates	cartilaginous fish	bony fish	reptiles	mammals	birds	TOTAL
Caribbean	-	-	-	-	1	1	-	2
Central America	-	-	-	-	5	-	-	5
Eastern Asia	48	126	11	61	17	8	15	286
Europe	-	-	1	1	2	-	-	4
North America	1	-	1	2	-	1	-	5
Oceania and Australia	2	4	2	8	-	1	-	19
South America	-	5	1	3	-	-	-	9
Southeast Asia	9	19	1	4	4	2	-	39
Southern Asia	-	13	1	5	1	2	3	25
Sub-Saharan Africa	1	30	4	9	5	7	3	59
Total Number of Species Recorded	59	185	15	84	19	11	21	394

Table 2. Countries/regions in which marine species are used for traditional medicines. Countries are grouped into larger geographic zones, and the number of information sources for each zone are indicated in parentheses below the zone names. Country names in square parentheses indicate strong possibility of marine medicinal use.

Zone	Countries/Regions Included
Caribbean (2)	"West Indies" British Virgin Islands
Central America (3)	Costa Rica Guatemala Mexico [Belize] [Honduras] [Nicaragua]
Eastern Asia (12)	China Japan North Korea Singapore South Korea Taiwan Vietnam
Europe (3)	"Europe" Norway Turkey United Kingdom
North America (5)	Canada USA
Oceania and Australia (12)	Australia Caroline Islands (Federated States of Micronesia) Cook Islands Gilbert Islands (Kiribati) Hawaiian Islands (USA) Northern Mariana Islands (USA commonwealth) Belau Papua New Guinea "South Pacific" Tahiti (French Polynesia) Tuvalu
South America (3)	Brazil Colombia Venezuela [Ecuador]
Southeast Asia (9)	Cambodia Indonesia Malaysia Myanmar Philippines
Southern Asia (2)	India [Sri Lanka] Pakistan
Subsaharan Africa (8)	Comoros Cote d'Ivoire Kenya Madagascar Mozambique South Africa

Figure 1. Relative minimum number of species by geographical zone. Numbers likely reflect data sources more than relative patterns of use. (Total number of species = 394).

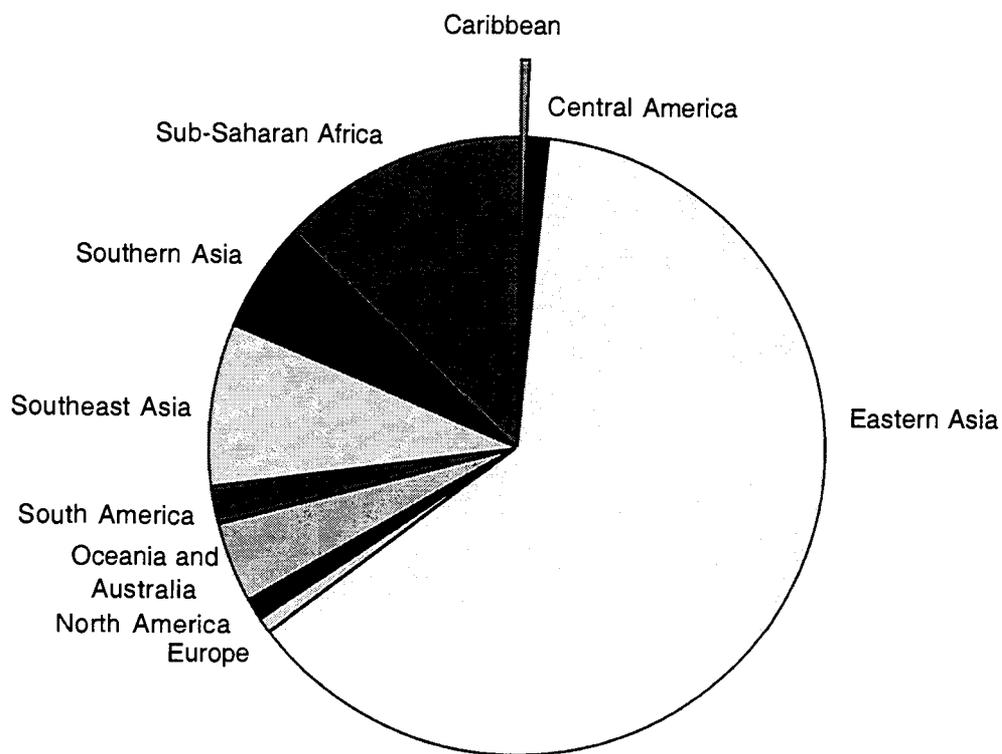
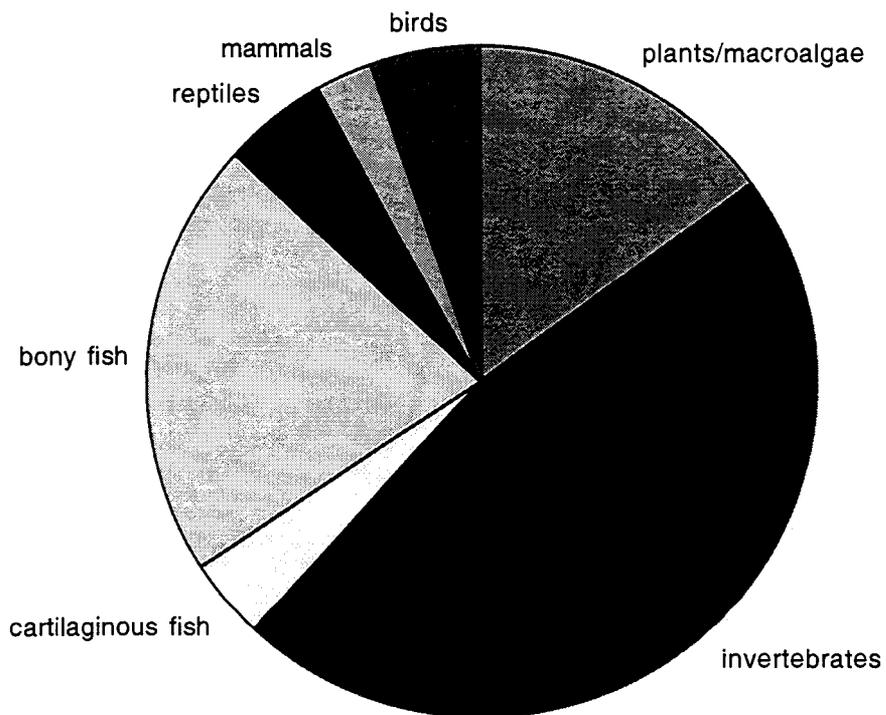


Figure 2. Minimum number of marine medicinal species, grouped by broad taxonomic category. Relative proportions may reflect non-random sampling of data more than patterns of medicinal use. (Total number of species = 394).



Part III. Workshop Report

Editors' Introduction
Abstracts of Presentations
Presentation Summaries
Review Session
Breakout Group Discussions
Field Trip Reports



Editors' Introduction

The workshop report is divided into three main sections: Presentations (Abstracts and Presentation Summaries), Review Session and Breakout Group Discussions. Presentations took place in the first day and a half of the workshop. On the afternoon of Day 2 at Campo Forestal (an open-air meeting facility), the group reviewed its progress to date and began to think ahead to options for marine medicinal management. Breakout groups met on Days 3 and 5. Also included in the workshop report are selected participants' accounts of the group's field trip to Handumon, the site of workshop organisers' community-based seahorse conservation project. The field trip took place on Day 4 of the workshop.

Days 1 and 2: Presentations

A representative cross-section of workshop participants were asked to give formal presentations at the workshop. Organisers' suggested general topics to invited speakers based on their work and their country's role in the marine medicinal trade.

Participants did not submit written versions of their talks. The versions presented here are summaries of speakers' presentations, as drawn from rapporteurs' notes and transcripts of audio tapes. The talks are edited for length, although an effort was made to include all pertinent information. All speakers have approved the synopsis of their presentation as appears in the proceedings.

Presentations were organised under six broad themes that laid the foundation for the workshop by outlining key issues and ensuring a common understanding of the different subject areas:

Session 1: Setting the scene

The use of marine species in TM and their economic importance to local communities.

Session 2: Trade in exporter countries

Its importance, the role of women and India as a case study.

Session 3: Trade in importer countries

Patterns of TM consumption and administration.

Session 4: TM and conservation

How they work together and TM research into marine medicinal species.

Session 5 : Aquaculture

The potential for small-scale aquaculture and case studies of culturing marine medicinals in Vietnam and South Africa.

Session 6: Global issues

Marine conservation, legislation and the aquarium trade.

Time was allotted at the end of each session for questions to the speakers. In this report, the format has been slightly rearranged so that relevant discussion points appear immediately following each presentation.

All participants were invited to bring posters to the workshop, illustrating their work. The poster format was completely flexible, and left for participants to decide. Unusual and engaging posters included Ali Hafiz Al Qodri's cartoons of seahorses in culture, and Aaron Lipton's poster on Indian marine medicinals, including dried samples. The posters served as a good introduction to peoples' interests, and sparked much conversation during the session breaks.

Day 2: Review Session

The afternoon of Day 2 was spent examining key themes from the presentations and brainstorming for options and actions to promote sustainable use of marine medicinals. Each participant has verified the text of their comments for this session.

Days 3 and 5: Breakout Group Discussions

Breakout groups discussed the sustainable use of marine species in TM by considering, in separate workshop sessions:

<i>Session I</i>	Problems and limitations
<i>Session II</i>	Options and possibilities
<i>Session III</i>	Plans and proposals

An informal discussion of the technical aspects of seahorse aquaculture took place on the evening of Day 3 between interested participants. No official notes were taken.

On Day 5, participants representing the TM community hosted an additional session in order to elaborate on their perspectives of the relationship between TM and conservation. A summary of these discussions appears in the section entitled *Traditional medicine presentations*. The participants in this session reviewed the summary prior to publication.

General Notes

The workshop was chaired by Amanda Vincent and Heather Hall, and facilitated by Rosalinda Paredes. Virginia Cruz and Daniel Ocampo acted as workshop rapporteurs. The agenda was flexible, in response to participants' wishes and needs.

Throughout the proceedings, the following approach was taken to Chinese names: first names were written without hyphens and, as in Western practice, the surname was placed after the first name. When participants used both Western and Chinese names, the Chinese first name and surname were placed after the Western first name.

NB. Opinions expressed in the proceedings are those of the participants. Any questions or comments should be addressed to them. The editors did not attempt to verify/ validate comments, but have occasionally inserted editorial notes for clarification.

Abstracts of Presentations

Session 1: Setting the scene

Setting the scene for marine medicinal species

Dr. Amanda Vincent

Department of Biology, McGill University, Montreal, Canada

The overexploitation of many fish populations around the world is forcing fishers to turn to new resources, many of which are unsuitable for heavy fishing. Traditional medicine (TM) consumes many such aquatic species, but seahorses are some of the few for which trade data have been collected and the conservation impact assessed. Current evaluations indicate that wild seahorse populations are declining and that such declines must be reversed quickly.

Seahorses serve as a model for other unusual fisheries, raising questions about how to balance supply and demand in order to ensure population persistence, while simultaneously respecting the needs of dependent peoples. The socio-economic barriers to conservation include disenfranchised fishing communities, limited understanding of trade, and lack of economic extinction. It can also be difficult to motivate conservation action internationally because of a perception that fishes cannot go extinct, because we know so little about a species' life history, because conservationists have a history of conflict with TM consumers, and because of narrow responses to complex issues. Small-scale aquaculture is one weapon in the arsenal of management options but must be undertaken with great care.

This workshop can address ecological, political, economic and social issues in marine medicinal species conservation, partly by opening communication among different stakeholder groups.

Global survey of marine medicinals

Ms. Allison Perry

Department of Biology, McGill University, Montreal, Canada

Traditional medicine (TM) is recognised by the World Health Organisation as an important form of health care. Many traditional healing practices involve the use of plant and animal species, and increased demand may lead to overharvesting. The situation of large, terrestrial mammals threatened by poorly-managed trade for TM is fairly well-known, but the use of marine species for TMs has not previously been studied on a global scale. A preliminary examination of marine medicinal use, conducted through correspondence and literature reviews, suggests that marine medicinal use is extensive. Marine medicinals are used in a minimum of 46 geopolitical regions, and a minimum of 394 marine species are used medicinally. Most species noted are invertebrates, followed by fishes, plants and macroalgae, reptiles, and mammals. Further study is necessary to identify additional marine species used for TMs and levels of consumption, in order to assess potential conservation implications. Of the marine medicinal species noted, 27 are listed on the updated 1996 IUCN Red List, and 23 on CITES Appendix I or II. The harvest of these species for TMs must be considered in the context of their threatened status, and the relative significance of medicinal use be determined. The study of other marine medicinals is no less important; the conservation status of these species may be unknown, or may have been assessed without consideration of harvest for TMs.

The importance of trade in marine medicinals to local communities

Ms. Marivic Pajaro

Haribon Foundation, Manila, Philippines

Marine medicinals continue to play a significant role, particularly to many fishers in some coastal villages in the Philippines. For instance, in a village called Handumon (central Philippines), 40% of the fishers target seahorses and earn from these approximately 40% of annual household income and up to 100% of seasonal income. These fishers are at the base of the market level as they pass on their catch to a primary buyer from the village who in turns sells them to an exporter in Cebu. This primary buyer can become a secondary buyer when a primary buyer from another island sells to her. Dynamics in the trade of marine medicinals, such as fishers having a “*suki*” (or patron) relationship with the buyer, or price margins between secondary or primary buyer and exporters, have to be considered when exploring options to sustainably manage marine resources used in medicine. Local communities are the most accessible and the most dependent on these resources, so that their innate abilities and potentials to wisely manage them should be recognised and developed.

Session 2: Trade in exporter countries

Role of women in the production, trade and use of marine species as medicine

Ms. Salome B. Quijano

Haribon Foundation, Manila, Philippines

This paper is based from on-going research under Project Seahorse, funded by the International Research and Development Centre. This is a case study which looked into the role of women in seahorse fishing, although other species are also mentioned, especially those that are being used as medicine by the local women of Handumon. The study’s main objective is to investigate women’s access, control and decision-making in the harvest, marketing, preparation and consumption of marine species used in medicine and their overt and subtle role in marine fisheries, in general, and seahorse trade, in particular. This study also aims to obtain women’s views on marine conservation concerns and fisheries management options, to learn more about the importance of marine species, and to define the cultural, economic and medical importance of these marine species for women. In addition, the study looks at the relationship between women’s situation in the seahorse trade and their status in the community and within their families and to identify and develop alternative income earning opportunities for men and women in their communities, and proposal for community self-organisation.

Women’s knowledge of fishing and marine resources was revealed by their responses to survey and interview questions on the different types of species that can be sourced from the sea, the different types of fishing methods practised in their community, volume of fish production, beliefs and practices associated with fishing and knowledge of other medicinal marine species.

Women assume three roles in production: women as fisher, women as co-fisher and women as helper of the fisher husband. The woman fisher actually goes out to the sea to fish; the woman co-fisher accompany and fish with her husband but is only given tasks to assist the man who is the main fisher; and the woman helper takes care of preparing the provisions of the husband and all implements used in the fishing activity.

Fishery for marine medicinal species in India: problems and responses

Dr. Aaron P. Lipton

Central Marine Fisheries Institute (CMFRI), Vizhinjam, India

Ayurveda/Unani, Siddha and the 'home remedy' practices in traditional Indian medicine utilise a variety of marine organisms for their formulations. Medicinal plant/animal species are used either individually or as combinations with other ingredients, including plant extracts, to suit the patient's condition and the ailment, as drug or tonic food. Among the seaweeds which are target collected for food/industrial purposes, fourteen species are used as home remedies. Considering ecological problems, the CMFRI has suggested a harvest time-table. Medicinal uses of corals, sponges and gorgonids and the need for judicious exploitation are indicated. The sacred conch (gastropod), *Xancus pyrum*, four species of cephalopods and five species of bivalves are documented as medicinals in addition to crabs and turtles. Out of the several species of fish used as medicinals, export demand for seahorse (*Hippocampus* sp.) for TCM resulted in large scale specific exploitation along the Tamil Nadu coast from 1992. The catch rate, present trade trend including recent catch reductions due to trawling impact, low price in the national and international avenues, and consequent economic impact on the dependent seahorse fishers, together with research needs, are enumerated. Increased pipefish landings (about 1.4t dry wt./year) and the trade trends are presented.

Government administration of traditional medicine issues: meeting the challenge of aquatic resource bioprospecting

Mr. Rene Geraldo G. Ledesma

Bureau of Fisheries and Aquatic Resources, Manila, Philippines

The 1992 Rio Summit encouraged the Philippine government to incorporate the concept of sustainable development relative to the conservation and management of its natural resources. Provisions of the Summit affecting trade of organisms used in Traditional Medicine are Articles 15, 17 and 26. These articles embodied objectives incorporated in four Laws: Executive Order 247: Philippine Bioprospecting Law, Republic Act 8371: Indigenous People's Rights Act, Republic Act 8423: Traditional and Alternative Medicine Act and Republic Act 8550: Philippine Fisheries Code. At present there is no category for traditional medicine (TM) in Philippine fisheries statistics. Regarding the issue of aquatic resource bioprospecting in traditional or modern medicine, the Bureau of Fisheries and Aquatic Resources classifies aquatic organisms as food, decorative/handicraft or live items. However, it is recognised that TM is both a wildlife resource and an intellectual property. These laws recognise that indigenous peoples or traditional fishers have the right to decide on the management, use and disposition of their wildlife resources. The requisites of obtaining prior informed consent, public consultation and provision of benefits to these peoples for obtaining biological material for medicinal purposes should therefore be respected by any entity that intends to develop these resources for commercial purposes.

Session 3: Trade in importer countries**TCM use of marine medicinals: content and context****Mr. Jokkeng Lee**

Eu Yan Sang International Holdings, Kuala Lumpur, Malaysia

Summary statement

In order to understand the TCM use of marine medicinals, one needs to understand not only the content, i.e. the types of marine species used, but also how they are used in the proper context, especially from the TCM medical and cultural perspective.

Summary points

1. In the practice of TCM, marine medicinals are used in herbal prescriptions, patented herbal medicine and as medicinal foods. Seahorse, specifically, is used mainly in patent medicine, and is not frequently used in herbal prescriptions or medicinal foods.
2. Other marine medicinals, especially the four seafood delicacies, are rarely sold in Chinese medicine halls but are mainly sold in stores that specialise in dried delicacies (pervasive in Hong Kong). They then distribute them to gourmet restaurants and those that specialise in exotic foods.
3. The functions of many TCM marine medicinals are more than just boosting of sexual drive and improving virility (boosting the Yang). The primary functions are extensive, including: settling the mind, nourishing the Yin, boosting the Yang, tonifying the Qi and blood, preventing the leakage of various fluids, promoting the downward flow of energy, dissipating nodules, softening hardness, neutralising excess heat and reducing phlegm.
4. Consumption of marine medicinals for medical purposes and therapeutic food is a deeply etched lifestyle in many cultures, especially East Asian. Changes in collective awareness will take time. What will not work is to tell people to stop eating these foods, to tell people what they believe is superstitious and that there is an alternative to what they are eating, for example, "Don't take sea cucumber, tofu is equally good".
5. Finally, species endangerment is a multi-dimensional issue. The TCM community is not the sole contributor to this predicament. Media bias exists, and perhaps the TCM community has/will continue to become a scapegoat in this issue.

Preliminary report on seahorse trade in Shanghai and Tianjin**Dr. Endi Zhang**

Wildlife Conservation Society, Shanghai, PRC

The availability of seahorses in the traditional Chinese medicine pharmacies in Shanghai and Tianjin was investigated between March 1997 and April 1998. It was found that 55.2% pharmacies offered seahorse for sale in 1997 and the number dropped to 42% in 1998. Most pharmacies were selling large and/or medium-sized seahorse (70.6%). About one third (29.4%) pharmacies were selling small-sized seahorse. The retail price in Shanghai ranged from US\$302 to \$846 per kilogram in 1997 and US\$343 to \$600 per kilogram in 1998. Retail price in Tianjin ranged from US\$339 to \$472 per kilogram. Information obtained from elsewhere showed that the price for seahorse remained stable in major domestic TCM markets in the past few months. Historical data in Shanghai, however, showed that wholesale price had increased three fold from 1989 to 1995. It was also noted that most of the fish were imported from Southeast Asia and Africa.

We conclude that current use of seahorse does not seem to be ecologically sustainable for the following reasons:

1. the seahorses were imported from abroad and caught from wild and the demand is not likely to be sustainable;
2. some patent seahorse based medicines use up seahorses in large quantity, which were mostly young seahorse;
3. sorting method does not follow species criteria, and thus poses potential threats to vulnerable species;
4. the advantages in price favours demands for buying younger seahorses ,thus increasing the catch of younger seahorses.

In order to improve the conservation of seahorses, we recommend conducting a nation-wide survey on trade of seahorse and enforcing legislation for protecting wild seahorse by monitoring the manufacture of seahorse-based medicines. We must also educate the consumer to improve awareness about the threat to the survival of seahorses.

Session 4: TM and conservation

How conservationists can work with traditional medicine communities

Mr. Samuel Kwokhung Lee and Ms. Judy Mills

TRAFFIC East Asia, Hong Kong

Traditional medicine (TM) communities often have been criticised for using derivatives of endangered wildlife as medicines. Whilst consumption of endangered wildlife can be reduced to a certain extent by laws and trade controls, voluntary adherence to these regulations by TM communities is far more effective and constructive than law enforcement alone. Misinformed media coverage on the use of wildlife in TM often portrays an undesirable image of TM. This has offended some members of TM communities, and communication between conservationists and TM communities has suffered as a result.

In order to enlist the support from TM communities in reducing the consumption of endangered wildlife, ongoing respectful communication is a prerequisite. When creating and implementing a co-operative approach to sustainable use of wildlife with TM communities, the following points may be worthy of note:

- Understanding TM
- Understanding the target audience
- Language and communication
- Cultural differences
- Beware of biases

Success in combining the interest of TM and wildlife conservation requires a great deal of common sense. Showing respect and communicating in a language understood by all sides are not profound concepts. However, they demand time, money and good-will –precious resources that conservationists and TM specialists never thought they would have to spend on one another. But investing the time, money, and the good-will is the only way forward for TM and the world's wildlife.

Marine species in traditional Chinese medicines

Prof. Hanchen Zheng

College of Pharmacy, Second Military Medical University, Shanghai, PRC

This year, 1998, is called the International Year of the Ocean. Today, the “International Workshop on the Management and Cultures of Marine Species Used in Traditional Medicines” is being held in this beautiful island country– the Philippines. It is very appropriate. China is not only a continental country, but also an oceanic country. The length of its coastline is up to 18000km. It possesses

many islands. It has more than 1500 fish species and is abundant in marine algae.

As early as more than 2000 years ago, some marine species had been used in medicine and recorded in books by ancient Chinese people. For example, in a book called “*Shen Nong’s Herbal Classic*”, which was regarded as the most ancient monograph of Pharmacy, ten marine species were recorded. In “*Compendium of Materia Medica*”, the most comprehensive work of ancient Chinese herbal books (written by Li Shizheng, who lived in the 16th century), 101 medicinal marine medicines or species were recorded.

In *Chinese Medicinal Fauna* published in 1979, 263 species of marine animals were recorded. According to my incomplete figures, there are about 400 marine species or medicines that have been used in traditional Chinese medicine. But up to now, only a few of medicinal marine species or medicines are being used. In *Chinese Pharmacopoeia* (1995 edition), only 11 marine medicines were recorded: ark shell (Wanglengzi); abalone shell (Shijueming); oyster shell (Muli); kelp (Kunbu); pearl (Zhenzhu); mother-of-pearl (Zhenzhumu); seahorse (Haima); pipefish (Hailong); cuttlebone (Haipiaoxiao); seaweed (Haizao) and shell (Geqiao). These are derived from 29 marine species, and make up only 2.1% of the total medicines in the Chinese Pharmacopoeia.

China attaches much importance to the conservation and sustainable utilisation of marine species, and some marine species such as seahorse, oyster and kelp have been widely cultured in China. We desire to learn the advanced experiences and methods of the management and culture of marine species from overseas, and desire to co-operate and exchange information and ideas with international colleagues in this field.

The state of seahorses as herbs in Korean oriental medicine

Dr. Young-Jong Lee

Department of Herbology, Kyung Won University, Korea

Fishes belonging to the Family Syngnathidae which are distributed on the Korean coast are the following: *Hippocampus aterrimus* Jordan et Seale [eds.: species name has been revised to *H. kuda*], *H. coronatus* Temminck et Schlegel, *H. histrix* Kaup, *H. japonicus* Kaup, *H. kuda* Bleeker, *Syngnathus schlegeli* Kaup, *Trachyrhampus serratus* Temminck et Schlegel, *Urocampus rikuzenius* Jordan et Snyder. Some of these fishes, for example those in the *Hippocampus* genus (seahorse, *Hae-ma*), *Syngnathus schlegeli* and *Trachyrhampus serratus* (Pipefish, *Sea Dragon*, *Hae-Ryong*), are adopted as oriental medicinal materials. Most seahorses and pipefish circulated inside the oriental medicinal material markets of Korea have been imported from foreign countries.

Dried seahorses may be powdered in order to be used as oriental medicinal material. Another processing technique for seahorses is to roast them clean and brown with talcum powder over medium-hot fire. Dried seahorses may be kept in a dry and cool area in order to be protected from vermin. In the past when there were no refrigerators, they were preserved from bugs inside bowls with another oriental medicinal material called *Zanthoxyli fructus*. Dried seahorses are classified according to their colour, size, and condition in Korea.

Seahorse has been applied to oriental medical clinics in Korea. Since it promotes sexual desire and strengthens sexual functionality, it has been used for the elderly and weak to cure their impotence or incontinence. It is helpful to strengthen weakened minds and to stop dry coughs. Its active circulation of Gi (or, Qi) and blood can also cure masses in the abdomen, lymphadenitis and lymphatic tubercle that are caused by wrong circulation of Gi and blood.

Clinical application of pipefishes (including capturing, processing, preserving and clinical efficacy) are the same as for seahorses. Other marine herbs imported to Korea include cuttlebone, sea cucumber, pearl and oyster shell.

Session 5: Aquaculture

Tools for the production of marine medicinal species in backyard hatcheries

Dr. Philippe Dhert and Dr. Patrick Sorgeloos

Laboratory of Aquaculture & *Artemia* Reference Center, University of Gent, Belgium

In analogy to commercial species that are cultured today, it is expected that a wide range of species that might be cultivated for medicinal purposes will be planktonic during at least part of their life cycle (e.g. shrimp and molluscs). For practical reasons, marine fish and shellfish species raised in hatcheries are/will no longer be fed on their natural diet consisting of phytoplankton and zooplankton but will be offered more practical diets (rotifers, brine shrimp, copepods). Over the last decades various techniques have been developed to deliver nutrients to these zooplanktonic organisms either through artificial diets or by manipulating the composition of their live prey. Live micro-algae can be replaced partially or completely in the diet of filter-feeders such as rotifers, *Artemia*, shrimp larvae and bivalves, by various types of preserved algae, micro-encapsulated diets and yeast-based diets, whereas lipid emulsions may be utilised to supplement specific lipid- and water-soluble nutrients. Live prey organisms, in particular rotifers and *Artemia*, can be bio-encapsulated with a variety of enrichment diets to manipulate their content of certain nutrients, including fatty acids, vitamins or other growth or health stimulating products.

Culturing seahorses (*Hippocampus kuda*) in Vietnam

Mr. Do Huu Hoang

Institute of Oceanography, Nha Trang, Vietnam

Seahorse aquaculture is very new in Vietnam, and still very difficult. Many people are interested in culturing seahorses to obtain income, while a few people try to keep seahorses in their aquarium at home. Most knowledge of seahorse keeping is very poor, and seahorses commonly die after a few days in captivity.

Our work shows that adults seahorses in the wild eat Amphipods, Palaemonidae and mysids. Wild seahorse juveniles eat many kinds of zooplankton, but mainly copepods. The maximum daily food ration of adults *H. kuda* is 26% of their body weight.

Seahorses sometimes become infected by white spot disease caused by a kind of oval or spherical Protozoa, *Ichthyophthirius multifiliis*. Newborn seahorses can get a protozoan disease, which holds in the tail of the young and grows very fast after 3-5 days.

The key to success in seahorse aquaculture is their food. Our first attempts at *Artemia* culture have been successful in Nha Trang. One pond with an area of 300 m² provided 2-3kg of wet *Artemia* every 4-5 days for about 3 months. Such a set up looks promising as a means to transfer seahorse culturing to fishing communities in the future. By the time our cultured seahorses have reached a commercial size of 110 -120 mm they are 6 months old. In one recent trial, more than 70% of one *H. kuda* brood survived to 6 months old.

South African seahorses: consumption, threats and research problems

Ms. Jacqueline Lockyear

Department of Ichthyology and Fisheries Science, Rhodes University, Grahamstown, South Africa

Six seahorse species have been recorded in South Africa (SA). Five of these have been recorded along the East coast and include *Hippocampus camelopardalis*, *H. histrix*, *H. whitei*, *H. trimaculatus* and *H. kuda*. [Eds.: Some species names have changed as a result of a recent taxonomic revision of the genus]. The distribution of these five species has been based on isolated sightings or collections.

The sixth seahorse species occurring on the southern tip of South Africa is the estuarine Knysna seahorse, *Hippocampus capensis*. This species is endemic to SA and due to its limited distribution has been listed as Vulnerable in the 1996 IUCN Book of Threatened Animals as well as the SA Red Data Book for fish.

The consumption of seahorses for traditional medicines in South Africa is low. They are not targeted for their medicinal use probably due to their limited availability.

The major threats to the Knysna seahorse population lies within its narrow distribution range and the vulnerability of the estuary. A natural disturbance such as flooding occurring in the estuary could wipe out the existing population. In addition, a growing industrial area and tourism ventures surrounding the estuary may cause a decline in the water quality of the estuary.

No ecological work has been conducted on the Knysna seahorse so comparisons to natural populations cannot be made. The problems of feeding seahorses with a varied nutritionally balanced diet should never be underestimated and live food issues should be solved before embarking on seahorse culture even on an experimental level. Disease and health issues arise from an inadequate diet, for example Mycobacteriosis (fish tuberculosis). The reproductive cycles of the species has not been closed on a sustainable basis.

Session 6: Global issues

Marine conservation in Korea

Dr. Jong-Geel Je

Korea Ocean Research and Development Institute, Seoul, Korea

Conservation of the marine environment in Korea was first considered during the 1980s by groups of marine biologists, fishery officers, underwater photographers and others concerned about the problems of habitat loss mainly due to shallow water land-reclamation projects and water pollution. Their efforts have been concentrated in establishing MPAs on a tidal flat and the rocky islets around Cheju Island and building marine environmental education capacity.

The tidal flat near the estuary of Han River system has been well known as one of the feeding and resting places for migratory birds and for its spectacular benthic communities. Cheju Island, which is located in the very south of Korea has several rocky islets at its southern end. A warm current originating in the tropical ocean passes by the island in the south. The current transports tropical and sub-tropical elements to the ambient water of the island. Although these areas have long been recognised as special places with a unique range of marine life, the areas have also been exposed to heavy development pressures during the last 20 years. Under the Nature Environment Conservation Act of 1991, the Ministry of Environment designated Nature Ecosystem Conservation Areas, a kind of protected area, at the flat and the islets in 1992 and 1994 respectively.

The efforts to build environmental marine education capacity have been aimed at the public, to expand their awareness and appreciation of the marine ecosystems that support us. The number of educational activities, especially in tidal flats, which are conducted by NGOs is rapidly increasing. In order to construct programs to encourage student learning through discovery and personal experience, several teacher's workshops on marine education have been held in last two years.

Australian concerns for marine medicinal use of syngnathids

Mr. Peter McGlone

World Wide Fund for Nature Australia, Hobart, Australia

Australia has a great responsibility for the conservation of syngnathid species, with about half of all syngnathid species, including the only two seadragon species and 11 of the 35 seahorse species,

occurring in its waters. On 1 January this year, after much lobbying by conservationists, the Commonwealth Government introduced export controls on all syngnathid species, arguably the strongest such legislation in the world. Controls over fishing of syngnathids in Australia's states and territories is still very patchy. Only Tasmania has protected all syngnathid species but it is understood that Victoria is about to do likewise.

Since introduction of export controls, export permits have been issued by the Commonwealth Government for several companies. The two Victorian and Tasmanian aquaculture companies among these have had limited success in completing the life cycle of their species and have not commenced exporting.

The Tasmanian operation has attracted a great deal of public attention and community concerns. Proponents of the company have not considered the potential impact their operation may have on subsistence fishers or aquaculturists in Asian countries, nor have they addressed environmental issues. For these reasons, the Tasmanian Conservation Trust have appealed against the issuing of an export permit to this company.

Those concerned with achieving a sustainable trade in traditional medicines need to consider the possibility of a large scale project such as the proposed Tasmanian venture dominating the world market for seahorses. It is important to note that the Australian legislation that controls export of wildlife does not provide for the assessment of impacts in other countries, either socio-economic impacts or conservation impacts.

Marine medicinals in the aquarium trade

Mr. Douglas I. Warmolts

Columbus Zoological Park Association, Powell, Ohio, USA

Marine ornamental fishes and invertebrates are held in zoos, public aquariums, and private collections world-wide for display purposes. Over 800 species of fish and an unknown number of invertebrates are estimated to be in the aquarium trade of which 98% are collected from the wild. The United States (U.S.) imports more than 60% of the marine fish and invertebrates in the international aquarium trade of which 99 % are purchased by individual home hobbyists and 1% by public aquariums. In the U.S., one in ten homes keep fish as pets (11 million households) and 40% of these homes have two or more aquariums. Wholesale value of trade in aquarium fish and equipment in U.S. is estimated at US\$400 million. Global retail value of trade in aquarium fish and equipment estimated at US\$7 billion. World-wide market for marine ornamentals alone, is estimated at more than US\$100 million.

Zoos and public aquariums have become an increasingly popular recreational and educational destination for the general public. In 1997, 185 American Zoo & Aquarium Association institutions had a collective attendance of over 122 million visitors. The Global Zoo Directory estimated a world-wide attendance of over 468 million visitors. Drawing upon their popularity, zoos and public aquariums are uniquely situated to present current educational information on the conservation of world wildlife, raise funds to support field conservation work, and actively participate in areas of research relevant to marine ornamentals including reproduction, culture and maintenance, nutrition (particularly larval), pathology and diseases, and aquarium science.

Presentation Summaries

Days 1 and 2

The workshop began with a series of presentations on Day 1 and the afternoon of Day 2. The versions of the talks presented here are edited synopses, rather than direct transcripts of the workshop presentation sessions. Speakers have approved the text of their presentations as appears here.

Opening Remarks

Heather Hall opened the workshop by welcoming participants and thanking the International Development Research Centre of Canada for sponsoring the meeting. Amanda Vincent explained that the meeting arose directly from the requests of developing country fishers, marine medicinal traders, aquaculturists, government line agency personnel and non-governmental organisations with whom she had been in contact since her 1993 seahorse trade surveys in South-East Asia. Stakeholders in the marine medicinal trade are eager for support and facilitation to address issues relating to the conservation and management of marine medicinals. To ensure that every concerned sector had a voice in the workshop discussions, a wide spectrum of participants were invited to the meeting.

After a brief introduction to the goals and work of Project Seahorse, A. Vincent reviewed the workshop's objectives. She noted that for both herself and H. Hall, the most important and eagerly anticipated achievement of the meeting would be the establishment of communication links that would, in the longer term, produce a co-ordinated international action plan for marine medicinal species.

Overall Objective:

- * To develop a co-ordinated international plan of action to improve the sustainability of trade in marine species used in medicines.

Specific Objectives:

- * To hold a discussion workshop where stakeholders in fishing, trade and culture of marine medicinal species can assess the current situation and develop new collaborations.
- * To compile directories of marine species used in medicine, consumption levels and histories, perceived conservation concerns, and livelihood possibilities.
- * To generate action plans and design protocols that will improve the management of seahorses and other marine medicinals in order to provide livelihood options for those who are dependent on this trade.
- * To improve aquaculture of marine medicinal species in order to provide new livelihood options for poor fishers and aquaculturists, while simultaneously reducing pressure on overexploited wild populations.
- * To use seahorses as a model group of species to focus on the technical and social problems of marine aquaculture in developing countries.
- * To establish a network of stakeholders for future consultation and collaboration.
- * To develop general paradigms for how newly recognised trades in marine medicinals should be managed for conservation, for socio-economic gain, and for medicinal use.

Facilitator's Remarks

The workshop facilitator, Rosalinda Paredes, explained the overall structure of the workshop, as outlined below:

Day 1	Presentations
Day 2	Presentations and Plenary
Day 3	Workshop I: Problems and Limitations Workshop II: Options and Possibilities
Day 4	Field Trip to Handumon
Day 5	Workshop III: Plans and Proposals

R. Paredes then presented a set of guidelines, or “foundation values”, for participants to keep in mind throughout the workshop. These were:

- participation
- co-operation
- teamwork
- consensus-building
- action

Session 1: Setting the scene

Setting the scene for marine medicinal species

Dr. Amanda Vincent

Department of Biology, McGill University, Montreal, Canada

Amanda Vincent introduces the principal themes of the meeting in this opening presentation, together with the fishes that will serve as a case study in the workshop process: the seahorses.

This workshop will attempt to advance wise management of marine medicinals. Little is known about what marine species are used in traditional medicine (TM), how they are used, or the impact of this use. This workshop is somewhat pre-emptive, as preliminary information on the trade of marine species for TM suggests looming conservation concerns. This workshop will address the questions of how to recognise and how to resolve these impending problems.

The issues under discussions at this meeting are of relevance not only to the TM trade in marine species, but to larger issues of the state of our oceans, and of our planet. As we attempt to balance the conflicting demands placed on marine medicinal species, we will be learning valuable lessons for managing our natural heritage for millennia to come.

The workshop addresses even larger issues than the TM trade in marine species. It is about how to use wisely 70% of our planet. The oceans have been largely ignored and overlooked in our obsession with terrestrial matters. This workshop is about how to balance conflicting demands as we seek to manage our natural heritage for many millennia to come.

Key Concerns

It is critical to have a background understanding of some of the key concerns that bear on our discussions at this meeting. The following points should be kept in mind throughout this week of presentations and working group discussions:

Fisheries Collapse

The world's fisheries are collapsing. The United Nations Food & Agriculture Organisation (FAO) reports that 70% of the fisheries it monitors are fully or over-exploited. The FAO does not systematically monitor small-scale and subsistence fisheries, such as inshore fisheries, even though these may be particularly threatened. Inshore species are very vulnerable to habitat loss, are heavily fished by growing human populations in developing countries, often have low rates of reproduction, structured social and spatial patterns, and do not recover quickly from heavy fishing pressure.

Poor Management

The state of fisheries management is deeply worrying at the moment. In Vietnam, for example, virtually all fisheries within the 50m depth contour are overexploited. Fisheries managers continue to rely on ill-judged methods and models in their work, including the discredited concept of Maximum Sustainable Yield. The impact of certain fisheries practices, such as trawling, are little understood. In trawl fisheries, up to 33kg of catch can be discarded for every kg kept, and the effect of habitat damage, trawl-induced and otherwise, on marine resources is still unknown. Management models are entirely lacking for multispecies tropical fisheries, the very fisheries from which many marine medicinal species come.

Irrational Economics

Fisheries are not governed by any recognisable economic principles. FAO estimates that the world's fisheries lose approximately US\$54 billion per year. Fishing can continue only because government subsidies cover the deficit. The International Center for Living Aquatic Resources Management (ICLARM) notes that even small-scale fisheries are subsidised in many areas of the world by women and children earning income in order to support men's fishing.

Overfishing

Manifestations of overfishing are loosely defined here in increasing order of severity:

Growth overfishing:

Catching too many fish

Recruitment overfishing:

Catching fish before they are able to reproduce

Ecological overfishing:

Fishing that leads to disruption of local community structure

Malthusian overfishing:

Fishing with gear and methods that destroy the resource base

Malthusian overfishing occurs when fishers become desperate and willing to destroy the very resources upon which they depend in their efforts to catch all fish remaining in depleted marine environments. Trawl fishing might be considered one such technique, as it mows the bottom flat. Subsistence fishers dynamite coral reefs and poison them with cyanide, use fine mesh nets to catch fry and juveniles in seagrass beds, and cut down the mangroves which serve as nursery grounds for many species. Once the habitat understructure is destroyed, what then is left for the future?

Aquaculture

FAO has stated that in order to feed the world's growing population we will need 50% more fish by the year 2010 than will be provided by capture fisheries. Aquaculture is not the magic solution to this impending crisis. It is but one approach to tackling complicated management concerns and, unfortunately, commonly causes as many problems as it resolves.

Aquaculture:

- is technically challenging for many species;
- often destroys habitats
(e.g. about 25% of the world's mangroves have been removed as coastal areas are converted to fish and shrimp ponds);
- usually displaces/disenfranchises fishers;
- exploits wild populations for broodstock or food. Aquaculture attempts commonly rely on wild food for cultured fish, and might use 3kg of food derived from wild, mature individuals to produce 1kg of cultured fish;
- often fails for monocultures
(e.g. due to disease);
- is ecologically problematic, releasing eggs, disease, chemicals and organic waste into the environment, and allowing cultured organisms to escape. These are often non-native species or genetically modified individuals that can disrupt local populations.

Extraordinary Fisheries

Most of the world's fisheries are directed towards dead table food, but as fishers become more desperate, they may switch to harvesting unusual and novel resources destined for other purposes. These 'extraordinary fisheries' include fisheries for medicinals and tonic foods, live table food, aquarium and pond display, mariculture seed, fish parts, education and research, curiosities, souvenirs and decoration, bait, chemicals and food for cultured species. We know very little about these fisheries, their volume and value, or their impact. We do know that they are increasing in size, and that demand for their products is growing. Many of these fisheries target species which have never been harvested before, for the very reason that they could not sustain heavy exploitation.

My colleagues and I are currently trying to understand the emerging problem of extraordinary fisheries, using seahorses as a key case study.

Seahorses: An Extraordinary Fisheries Case Study

Seahorses are used in traditional Chinese medicine (TCM), in Indonesia's *jamu* medicine, and in the TM systems of Korea, Japan, the central Philippines and some parts of India. The seahorse trade is not exclusively an Asian problem, however. Seahorses are also sold as aquarium fishes and as curios in North America and Europe.

Seahorses are commonly collected as bycatch, but are also targeted by subsistence fishers in the Philippines and many other parts of the world. Individual fishers usually catch small volumes of seahorses, but their combined impact on seahorse populations is considerable.

The Global Seahorse Trade

Over 47 nations are involved in the seahorse trade, with more than 20 million animals sold dead every year, and more than one million sold live to the aquarium trade. In fact, the figures for the dead trade may be severe underestimates. If only 2% of mainland Chinese used only one seahorse per year, the consumption figure would already surpass 20 million.

The world's leading dried seahorse exporters are India, the Philippines, Thailand and Vietnam. The leading importers are Hong Kong, Taiwan and mainland China. Seahorses can be worth more than silver by weight at Hong Kong retailers, and trade in seahorses can account for 80-100% of subsistence fishers' seasonal income.

Vulnerable Fishes

Wild seahorse populations are not able to cope with current heavy fishing pressure because of their particular biological characteristics. Seahorses have a lengthy and vital parental care period, low fecundity, mate fidelity and low natural adult mortality. They are sparsely distributed, are site faithful, and have low mobility.

The result is that fishers are catching fewer and smaller seahorses, which is a concern to both users and conservationists. Juveniles are now being caught at a great rate, which poses an important threat to the future survival of these populations. We need to take action to ensure the long term persistence of syngnathid populations. Seahorse aquaculture has not been successful to date.

Socio-political and Economic Issues

Many seahorses are sourced from disempowered or disenfranchised people who are commonly indebted to patron buyers, whom they cannot afford to anger. Women and children in subsistence communities, together with men, are affected by declining seahorse populations. We need to know who is dependent on the trade, who captures and trades these fishes, and who makes the decisions shaping the trade. We cannot avoid addressing these socio-economic issues without condemning fishing communities, and reducing our effectiveness as conservationists. People will ignore rules which they cannot obey.

Seahorse exploitation and trade is poorly controlled. Management approaches are little thought-through, or non-existent. Existing legal measures are often not implemented or enforced, in part because of corruption, but also because of a lack of resources, of faith in the effectiveness of the controls, and of enforcement capacity. International trade controls are often badly planned or misunderstood by those affected.

The seahorse trade is not necessarily governed by the usual economic principles. For example, the Chinese purchase many medicinals as conspicuous gifts, so that rising costs as populations decline can lead to increased demand. Further, economic extinction will commonly not precede biological extinction. In source communities, fishers must catch fish for their families, and collect seahorses at the same time to sell to buy the rice. They will continue collecting seahorses as long as they must continue to catch fish.

Conservation of Marine Species

Seahorses are not the only syngnathids traded in TM. A number of species of pipefish are used in TCM, and the related pegasids (or sea moths) are also in demand as a substitute for seahorses. We still know rather little about trade dynamics of seahorses, and very little about pipefish and pegasids. Even less is known about the trade in several hundred other marine species used in TM, which is why we are here.

As research into the marine medicinals trade continues, we are bound to discover resource use conflicts between conservation and overconsumption. To decide what our response will be to these conflicts, we must consider a range of complex issues.

Asians often do not realise that the Western conservation community does not speak with one voice on marine conservation issues. Many conservationists have entered into conflict with TM resource users, but we would prefer to see more compromises emerge in order to resolve management issues. Seahorses are not as acutely endangered as rhinoceroses, tigers and bears, for example, and have never been the focus of hostile conservation campaigns. They present an ideal starting point from which to develop creative conservation solutions to the problems facing medicinal wildlife, in partnership with resource users.

Managing Marine Medicinals

How can we begin to manage marine medicinals, and reconcile ecological, political, economic and social issues? We must define and anticipate the problems, open communication channels, lay groundwork, set up monitoring and develop understanding. We must seek pre-emptive solutions before it is too late, and we need to involve the concerned communities in management plans. Possible options for managing marine medicinals include:

- Managing supply
 - restrict fishing season, location, sex, age, size; reproductive status;
 - improve culturing;
 - educate fishers;
 - develop alternative livelihoods.
- Adjusting demand
 - seek alternatives in partnership with TM consumer communities;
 - encourage selective choice with respect to source, sex, age, size, morph.
- Protecting habitats
 - plant mangroves;
 - establish marine protected areas (MPAs);
 - rehabilitate damaged habitats.
- Tracking trade
 - develop policy and increase research into trade;
 - address the problem of species recognition;
 - monitor sales and become aware of the issues;
 - establish appropriate controls and legislation.
- Conducting biological research
 - pursue biological studies to understand ecology and behaviour of species;
 - resolve taxonomy.

Conclusion

What will this meeting accomplish? It will assess problems, identify solutions, and prepare options and plans. We will build a network here to undertake ongoing work, and develop the potential for stakeholder management. Our challenge is first, to remember the fishers and the communities that depend on these resources in all our discussions and thinking and second, to remember the other communities that also use these resources, for medicine or for public education (i.e. public aquaria).

Our important mandate is to ensure that we have options available to us in the future. We will only have choices available to us if we still have resources left in the sea.

DISCUSSION

Description of IDRC

Peter McGlone What is the IDRC?

Bertha Mo IDRC is a crown corporation, as opposed to being a government department. We receive funding from Parliament, but are not tied to international aid—we are apolitical. This means we can fund research in countries with which Canada does not have an official relationship. For example, we were one of the few countries in the world who continued to fund small research projects in South Africa even during apartheid.

IDRC is 28 years old, and its model is empowerment through knowledge. It funds researchers to do applied research in the developing world—we provide funds, with the participation of Canadian researchers. As aid is decreasing, we're increasingly looking at multi-donor initiatives, partnering with other organisations. We only entertain proposals that are originally from developing world scientists.

One of the things IDRC likes to do is to promote multi-disciplinary, multi-sectoral collaboration. This is probably one of the most multi-disciplinary, multi-sectoral meetings I have ever been to.

Global survey of marine medicinals

Ms. Allison Perry

Department of Biology, McGill University, Montreal, Canada

Allison Perry's work represents a first step towards identifying unrecognised marine species used in traditional medicine world-wide, determining the extent of their use, and ultimately, the implications for their conservation.

The analysis of the use of seahorses for TCM revealed an extensive international market, rising demand, and declining wild populations. Seahorses, however, provide the only detailed case study of a marine medicinal species, and there is very little known of others. Considering what was found for seahorses [eds.: see A. Vincent's presentation for a discussion of the seahorse medicinal trade], it is extremely important to identify other unrecognised species used in TM world-wide.

Traditional Medicines

TM has an extensive history of use in a number of countries. The first *materia medica* in China was compiled in the first to second century AD, and schools of Chinese medicine had been established as early as 200 BC. Indian Ayurvedic medicine is believed to have originated not later than 600 BC, and possibly as early as 4000 BC. It has been suggested that aspects of both Greek and Arabic medicine derive from Ayurveda, while TCM influenced medical practices in nations including Korea, Japan, and Indonesia.

TM continues to be vitally important in many areas today. According to the World Health Organisation, the majority of cultures in developing countries depend on TM to satisfy their primary health needs, either for economic or for cultural reasons. There is also growing interest in alternative (i.e. non-Western) remedies in the West: one third of Americans are estimated to have used alternative treatments such as herbal remedies or acupuncture.

The term 'traditional medicine' generally refers to methods of maintaining and restoring health which do not necessarily involve highly industrialised processing or packaging. There are two types of TM: codified, large-scale systems such as TCM and Ayurveda, and folk medicine, for which there may be no written code. Also included within TM are tonic foods, which are eaten to invigorate, revitalise or retain balance in one's body. In some cultures, no significant distinction is made between tonic foods and other medicines.

Within any one culture, there can be different levels of dependency upon TM. In many societies, TM is used alongside Western medicine, and healing methods may be chosen on the basis of ailment. TMs may be preferred for the treatment of chronic illnesses, or those seen as culturally-specific, and Western treatments chosen for acute ailments. Proximity to urban centres may also dictate healing preferences.

While traditional healing practices vary widely, remedies in many cultures often involve the use of plant and/or animal species. As a result, many types of TM depend upon the sustainable harvesting of wild species. Given the global magnitude of the use of TM, the possibility of overexploitation of medicinal species must be considered. TRAFFIC, the joint wildlife trade monitoring program of WWF and the IUCN, states in relation to trade in medicinal wildlife that: "increased demand and increasing human populations are leading to increased and often unsustainable rates of exploitation".

Marine Species in TM

The situation of large, terrestrial mammals threatened by poorly-managed trade for TM is well-known. The use of marine species for TM, however, has effectively not been studied. Printed literature on the topic is rare, tends to focus on single cultures, is not necessarily complete, and is rarely up to date.

I will now share with you a few examples of what I discovered through my study:

- Marine medicinal use was noted in 46 geo-political regions world-wide. Most of these regions were defined as countries, with the exception of island groups in the South Pacific.
- There is a broad diversity of marine organisms used in TM, involving 11 phyla and a minimum of 394 species. This figure is almost certainly an extreme underestimate, because more than 46 regions are likely to use marine medicinals; because general terms such as 'shark' or 'whale' were taken to represent only one species; and because traditional systems of medicine are not static, so that printed texts may not list more recently added species.
- Most marine medicinals recorded to date are large, visible animals or plants. Nearly half of reported marine medicinal species are invertebrates. Bony fishes are the next most numerous group, followed by plants and macroalgae, reptiles, cartilaginous fishes and mammals.
- Many different parts of organisms are used in TM, including skin, flesh, fat, shell, excreta, swim bladders, eyes, cartilage, bones, blood, tentacles, claws, tails, beaks and feathers.
- Conditions treated with marine medicinals are highly varied and include cancer, bone fractures, painful childbirth, fevers, deafness, and depression. Seaweeds are used in the Philippines to prevent and treat goitre, presumably because of their high iodine content. Islands in the Torres Strait, Micronesia and the Philippines treat wounds caused by venomous fish spines in similar ways by applying the liver or gall bladder of the fish directly on the wound.
- The rationale for use of most marine medicinals is usually not readily apparent, although in some cultures organisms are used on the basis of appearance or behaviour. Flatfish are used in southern Africa to treat strokes, on the basis of their purported resemblance to paralysed stroke victims.
- Methods of preparation and treatment vary widely. The marine medicinal ingredients can be cooked and eaten, taken alone or in combination with other ingredients, or dried and used externally.

TM and Conservation

I would now like to turn to how TM and conservation interact:

Of the marine medicinal species identified thus far, a minimum of 27 are found on the updated 1996 IUCN Red List of Threatened Species. The harvest of these species for TM should be considered in the context of their threatened status, and the relative importance of their medicinal use be determined. Such investigations must be undertaken now, while it might still be possible for stakeholders to work towards co-operative management solutions.

In addition to those species found on the Red List, a minimum of 23 marine medicinal species are listed on CITES Appendix I or II. CITES only addresses international trade, however, and as most trade in marine medicinal species appears to be local, is not the most useful tool for monitoring the trade.

One striking pattern concerns the widespread medicinal use of sea turtles. Six of the seven existing species of sea turtles are known thus far to be used in TM world-wide, and all six of these species are listed as Endangered or Critically Endangered on the Red List. Global harvesting of sea turtles for marine medicinals may contribute to the many known threats to these animals, and should be factored into policy and management decisions.

In contrast to many other marine medicinals, sea turtles are large and charismatic species which have been relatively well studied by biologists. The abundance and life histories of other species used in TM, such as cuttlefish, corals, cowries and stingrays, are not as well known. This lack of basic biological information hinders conservation assessments.

Conclusion

The use of marine medicinals is clearly widespread. As a result of this preliminary study, a minimum of 394 marine species have been found to be used for TM. Further research is necessary to determine the potential implications of this work for marine medicinal conservation, and for the people who depend upon these species. Questions remaining to be answered relate to such factors as conditions treated, parts of medicinal organisms used, quantity and frequency of use. All of these details will be important to our understanding of the global scale of dependency on marine medicinals.

In continuing with this research, however, there are also more general factors which must be considered:

1. Given that detailed field studies are very time-consuming and costly, are there other ways to effectively identify marine medicinal species in cases where there are no, or incomplete, written records?
2. How can we identify medicinal species in cultures where the ingredients of TM are often considered secret?
3. How do we ensure that our data are current, given the continual changes which occur in some systems of TM?
4. How do we build awareness that marine medicinal use will depend upon sustainable harvesting practices, without creating hostility among communities dependent upon them?

DISCUSSION

No discussion points were raised for this presentation.

The importance of trade in marine medicinals to local communities

Ms. Marivic Pajaro

Haribon Foundation, Manila, Philippines

In her role as Project Seahorse-Philippines team leader, Marivic Pajaro works closely with the community of Handumon, a small subsistence fishing village in Bohol. Her presentation sets the scene for discussions of marine medicinal trade sustainability on a local, rather than a global, level.

The fishers of Handumon live below the poverty line, and fishers say that the sea is poor as well. They report that while they could catch 50 to 150 seahorses per night in the early 1970s, it is now common for them to return from a night of fishing with only one seahorse.

Trade Dynamics

Trade Routes

Handumon fishers paddle out to the fishing area between midnight and 2am, and dive for seahorses until dawn. While searching for seahorses among the corals, fishers also spear fish, collect sea cucumbers and take anything else that can be sold or eaten. In the morning, the fishers or their wives bring the night's seahorse catch to the village buyer, a local storekeeper and fishpond owner. The storekeeper also purchases seahorses from another buyer on a different island (Mahanay), where fishers dive for seahorses using hookah compressors. Seahorse brought to the village buyer will either be sold into the aquarium trade, or into the dried trade.

When the buyer in Handumon has amassed a sufficient volume of dried seahorses (usually over several weeks), these are taken to the secondary buyer/exporter in Cebu City, and exported to Taiwan and Hong Kong. (In the southern Philippines, seahorse exporters might choose instead to send their products to Malaysia). The secondary buyer in Cebu also exports other marine medicinal and food species, such as sea cucumbers, pipefish and sharks (fins only).

From the importer in the country of destination, Handumon's seahorses are sold to retailers and, finally, to the end consumer.

Seahorse Prices

Primary buyers on-site in Handumon will pay fishers PP9 (US\$0.23) per seahorse for the dried trade. Compressor divers in Mahanay will earn PP5-7 (US\$0.13-0.18) per seahorse, and their primary buyer will sell these for PP12 to the buyers in Handumon.

Capital & Risks

The capital required for seahorse fishing is labour. Fishers run great health risks in order to feed their families. They dive for extended periods of time in cold water with no or inadequate equipment, and go to sea even in dangerous weather.

Buyers require money as capital to enter the trade. They use this money to buy seahorses from fishers for eventual re-sale to the Cebu exporter. Buyers risk losing on their investment if large seahorses destined for the dried trade are damaged by ants, or if smaller seahorses earmarked for the aquarium trade die in holding. Although buyers can dry dead aquarium fish and sell these into the dried trade, smaller seahorses are worth more alive than dead.

Importance of Trade To the Lives of Stakeholders

Income & Benefits

The sale of dried seahorses makes up 10-50% of the average monthly income of Handumon's seahorse fishers, while the remainder (50-90%) comes from other catch such as fish (e.g. grouper), sea cucumbers and abalone. If both the live and dead seahorse trades are taken into account, seahorse sales can represent from 10-70% of fishers' monthly income. On occasion, 100% of a

fisher's daily income will derive from seahorses. In contrast, seahorse sales probably account for only 10% of the village buyer's total income.

With the income earned from seahorse fishing, fishers can buy household necessities, fishing implements, boat fuel and lanterns. Income might also be spent on children's education and on entertainment (gambling and alcohol). Fishers sometimes keep seahorses for domestic use, boiling the fish to use as medicine in the treatment of stomach pains and asthma.

Patronage

Seahorse fishers usually sell exclusively to one buyer (their patron, or *suki*). The *suki* might allow his clients to buy items on credit (including rice), or to pay for their boats and fishing gear on an instalment basis.

The relationship between the village buyer and the Cebu exporter is not based on patronage, but only on capital. The exporter will sometimes lend money to the buyer for seahorse purchases, but that is the extent of their relationship.

Community-Based Seahorse Management

Fishers are Project Seahorse's partners in all of the team's marine conservation, education, monitoring and research initiatives in the Philippines. The fishers are the people most closely connected to the seahorses. They have made a commitment to the project, and are very willing to take action.

Villagers were directly involved in the planning and implementation of Handumon's marine sanctuary, and are responsible for its patrolling. Fishers contribute to efforts to monitor the seahorse population by bringing their nightly catch to the team for measurement, and by sharing trade information. They are indispensable to education work, as they can communicate more effectively with other fishers than can the project team.

Conclusion

To have effective conservation in the long-term, we must consider the lives of stakeholders. The fishers believe that the sea is vast, and that it will never run dry. They do not believe that the seahorses could ever finally disappear. Fishers' minds, hearts and stomachs are connected to the sea, but they cannot save the fishery on their own. We must remember this over the next few days, as we work together towards the goal of achieving sustainable use of marine medicinals. Seahorses are only one example for us as we strive towards a brighter future.

DISCUSSION

Nocturnal seahorses

Philippe Dhert Why do fishermen fish at night?

Amanda Vincent Seahorses are usually active in the day, but in the central Philippines they are active only at night. Fishers used to catch them during the day as well as at night. Perhaps the fishers have selected against any diurnal seahorses.

Trade decisions: live vs. dead

Doug Warmolts In Handumon, who makes the decision which seahorses go to aquarium trade and which go to the marine medicinals trade?

Marivic Pajaro Usually the fishers decide, on the basis of size. Seahorses smaller than 120mm are worth PP5 (US\$0.13) if sold live, and only PP4 (US\$0.10) if sold dry. If it is a larger seahorse, they will sell it to the dried trade. There is a cut-off size.

DISCUSSION (continued)

- Marivic Pajaro (continued) Because there is only one kind of seahorse in Handumon [*eds.*: there are in fact more than one species in the area, but *H. comes* dominates], buyers don't take any other characteristic of the animal into account when deciding on a price, besides its size.
- Amanda Vincent Around the world, the live trade pays for seahorses either as one unit (i.e. will pay the same price for any sized seahorse), or divides them into two size classes at most. For the marine medicinals trade, the seahorses are dried and bought by weight. For conservation purposes it makes no difference whether the seahorse is traded dead or alive: it is removed from the wild in either case.

Session 2: Trade in exporter countries

Role of women in the production, trade and use of marine species as medicine

Ms. Salome B. Quijano

Haribon Foundation, Manila, Philippines

Salome Quijano's work represents the first gender study of the marine medicinals trade. She here discusses issues of women's involvement in fishing in general, and also addresses aspects of marine medicinal harvest and use by the women of Handumon.

Understanding the role of women in the marine medicinals trade, their opportunities, constraints and ambitions, is vital to the development of conservation initiatives in communities faced with declining resources. This gender study is the first of its kind, and has the following objectives:

- to investigate the role of women, their access, control and decision-making in the harvest, marketing, preparation and consumption of marine species used in medicine;
- to define the cultural, economic and medical importance of these marine species for women;
- to identify and develop alternative income earning opportunities for men and women, and proposals for community self-organisation;
- to obtain women's views on marine conservation concerns and fisheries management options;
- to examine the relationship between women's situation in the seahorse trade and their status in the community and within their families.

Methods

Communities known to be involved in the marine medicinals trade were chosen as study sites in the three major island groups of the Philippines (Luzon, Visayas and Mindanao). Data were obtained from semi-structured and informal interviews with women, and through surveys, group discussions and direct observation of the study communities. [*Eds.*: Research was still ongoing in July 1998].

The village of Handumon will serve as a case study for the purposes of this talk. Handumon is one of three *barangays* (villages) on Jandayan island, in the north-west of the island province of Bohol. Most of the women interviewed in Handumon had completed grade 4 - level schooling, were between 25 and 46 years old, and had an average of 5.6 children. Their average monthly income was PP782 (US\$20), and their occupations included raising pigs, gathering and selling firewood, weaving mats, storekeeping, preparing food, leading prayers, farming and fishing.

Women's Roles in Fishing

Women assume three roles in fisheries production: fisher, co-fisher, or helper. Women fishers go to sea alone and fish independently from men. Women co-fishers accompany their husbands to sea but only perform tasks which assist the man, who is the main fisher. These tasks might include sorting the catch, organising the gear in the boat or watching over the lantern. Helpers organise the fishing gear and provisions, and prepare their husband for his outing to sea.

Regardless of their primary role in production, all women can be considered helpers, as each must make sure that their husband is fed before going to sea, pack his meal for the night, and ensure that everything needed for fishing is ready. Women may also be responsible for sorting the catch (keeping some for household use), and might take charge of selling it.

While some women said that their husbands placed no restrictions on their livelihood activities, others were either not allowed to fish, or were themselves not interested in fishing, perceiving it to be a male activity.

Fishery Access and Control

Implements of Production

The fishing equipment used by women includes boats, fishing gear (nets, spears, traps), containers (pails, buckets) and accessories (masks, goggles, lamps). Women found some implements, such as boats, spears and lamps, to be more difficult to use than others. All fishing gear, apart from containers, are owned by the husband, and cannot be used by the wife or loaned to others without his permission.

Ownership of Produce

Most women consider that produce is owned only by the husband, even if the two of them fished together. The two women who fished independently from their husbands, however, considered the catch to be jointly owned.

All proceeds from the sale of the catch are entrusted to the wife, who is responsible for household budgeting. The men are allotted a certain amount to spend on entertainment, with the remainder divided between the purchase of food, household necessities and fishing implements, and women's gambling.

Decision-making

The husband decides when to fish and what type of fishing method to use. The couple decide together whether to sell the catch, when to sell, and to whom.

Seahorse Trade

Seahorses caught in Handumon accumulate at the local buyers' shop. In this particular village the main buyers are women, though seahorse buying is, in fact, a family business.

The buyers weigh the seahorses, decide on their price, and pay the fishers. Buyers dry the seahorses and protect them from ants; sort and package the seahorses according to size; and prepare them for sale to traders and exporters in Cebu City. It is the men who bring the seahorses to exporters in the city, and the women do not seem to be interested in this aspect of the business.

Knowledge of Marine Resources

Women in Handumon were able to identify seven types of marine resources: fish, crab, shells, seahorses, seaweed, squid and sea cucumber. They enumerated seven fishing methods, identifying four as illegal. According to the women, when it rains, or during the new moon or low tide, and when it's not too windy, catch is plentiful. They also claimed to know the time of year when seahorses were in season and ready for collection. The women mentioned a number of beliefs and rituals associated with fishing.

Two kinds of seaweed and three types of shells are used locally as marine medicinals for the treatment of stomach aches, asthma, goitre and worms. The medicinals can be eaten raw, cooked or toasted, or pulverised and mixed with water. Women administer these medicines in their role as the household care-giver.

Seahorses are sold outside of the community for medicine, and are the village's main source of cash income. They are fished and sold in medium to large quantities, while other locally-available medicinals are gathered or sourced only when the need arises. While seahorses are harvested only by male fishers (called *manunugay*), seaweed species are gathered by both sexes. Shell species are collected primarily by women and children.

DISCUSSION*Status of Handumon*

- Jeff Boehm Is Handumon a typical community, or are there constraints not present in other communities in Bohol?
- Marivic Pajaro Handumon is a typical fishing village. Its advantage is that during the dry season villagers can stop fishing and sell water. They also have access to land and the opportunity to plant cassava and other crops. Other islands don't have land to farm on.
- Bertha Mo What is the population size of the community, and the number of people in each household?
- Marivic Pajaro There are 143 households in Handumon, and approximately 800 people. The households are of 5 to 6 people, and if the son marries and stays with the family, an additional 4.

Women fishers

- Bertha Mo What are the characteristics that differentiate women fishers from other women?
- Salome Quijano One of the women fishers is a widow, and the other is involved in the seahorse conservation project's core group. [*Eds.*: A people's organisation active in the conservation, management and livelihood development initiatives facilitated by Project Seahorse in Handumon].

New approaches

- Jokkeng Lee It is traditional that money goes to the wife in East Asia, including in Korea, India, China and Malaysia. Males are the primary breadwinners, but they give cash to the female as a lump sum to manage. This is not an issue which is unique to the Philippines.
- I'd like to compliment the organisers for including this topic of gender roles. It's introducing another angle to deal with a problem. Like losing a key in a dark room, you have two approaches: either look for the key, or look for the light switch. Examining the issue of women and marine medicinals is like trying to look for the switch.

Fishery for marine medicinal species in India: problems and responses

Dr. Aaron P. Lipton

Central Marine Fisheries Institute, Vizhinjam, India

India's marine medicinals trade is expanding, according to Aaron Lipton. In this presentation he briefly surveys the historical use of marine species in Indian traditional medicine and describes a number of the country's new and/or growing marine medicinal fisheries.

Overview of Indian Marine Medicinals

Indian TM is comprised of three separate practices: Siddha, Ayurveda/Unani and home remedies. Few records exist of either Siddha or Ayurveda TM. Researchers at the Siddha Medical College and the Ayurveda Medical College, both in Tamil Nadu, India, have translated and published a portion of the remaining ancient texts. The information presented in the table below is drawn from these publications, and the organisms listed are still used in Indian TM today.

Table 1. Marine organisms used in Indian TM

Marine Medicinal	Use	Preparation
Seaweeds (14 species)	Intestinal disorders, vermicide.	Salad, extract, or porridge.
Sponges	To treat goitres.	Ashes mixed with vegetable oil
Gorgonids	For painless childbirth.	Water extract.
Corals	Cough, nervous disorders, tuberculosis.	Variable, depending on ailment.
Bivalve molluscs (e.g. oysters, brown-green mussels)	Antacid, loss of appetite, liver and spleen disorders, skin disorders.	Oyster pearls are taken as a powder, with cow's milk, hot water and honey. The oyster shell is also used in TM preparations.
Gastropods	A wide range of applications.	Shell powder with other ingredients.
Cephalopods (squid and cuttlefishes)	–	Taken in a variety of ways, including eating the meat and using the shell.
	Wound treatment.	In combination with parrot or pigeon egg yolk
Crabs	Very important, particularly to treat asthma.	Meat
Sea Turtles ¹	Digestive disorders, scrofula, anaemia, pulmonary infections and whooping cough in children.	Almost every part of the turtle is used, including the meat, shell, bones, blood, fat, eggs, etc.
Fishes (a wide variety of species)	Anaemia	Mainly use the flesh and the liver. Also a high demand for swimbladders (use unknown). ²
Marine eels	Rheumatism, skin irritations and to treat piles.	Use the meat, mucous and blood.
Silver bellies (<i>Leiognathus</i> spp.)	To improve lactation.	Prepared as a soup, with coconut milk. ³

¹ While it is illegal to harvest sea turtles in India, they are still obtained as bycatch.

² Systematic data on the swimbladder fishery in India have not yet been collected.

³ A common practice along the coast, and also inland.

A New Seahorse Fishery

In 1992, in response to a significant increase in demand from foreign countries, a target fishery for seahorses opened on the East coast of India, in the Gulf of Mannar. Seahorses harvested from the gulf are sent to three traders operating out of a major collection centre in Tamil Nadu. Researchers from the Central Marine Fisheries Research Institute (CMFRI) have been monitoring this fishery since it began, recording catch data and investigating opportunities for aquaculture.

In 1992, the sizes of harvested seahorses ranged from 60 to 120mm, with an average size of 80-84mm. In 1998, the mean size of caught seahorses had decreased to 74mm. Fishers also reported a decline in seahorse numbers to CMFRI in 1997 and 1998, which researchers attributed to trawls operating in shallow coastal areas (5-10m depth). Together with the decreasing supply, the low price for seahorses on the national market (1200-3800 rupees/kg dry weight, or US\$40-88/kg dry wt.) has reduced the economic viability of the seahorse fishery.

CMFRI researchers have proposed a number of actions to address the problem of declining seahorse fisheries throughout India:

1. conduct biological and ecological studies of local seahorse populations;
2. carry out stock assessments to monitor production and exploitation levels (already underway);
3. control indiscriminate fishing of undersized and breeding individuals;
4. control access to the fishing area during the breeding season;
5. encourage hand-collection of seahorses to avoid damaging the natural ecosystem (e.g. seagrasses).

In order for these management proposals to succeed, researchers must have the co-operation and input of fishers. Making fishers aware of the importance of seahorse conservation and management will be essential for obtaining their participation in these initiatives.

Marine Medicinal Fisheries in India

Seahorses are not alone in facing increased exploitation for India's marine medicinals trade. Other harvested marine medicinal species include:

Pipefishes Pipefishes are being harvested in a new, uncontrolled and rapidly expanding trawl and shore seine bycatch fishery along the Tamil Nadu coast, concentrated in Palk Bay. The pipefish are shipped to collection centres in Madras, and from there are exported to South-East Asian countries. Data show that 1.4t of pipefish are exported from the centres each year, and that the fish are worth approximately US\$3.70/kg.

Seaweed Seaweeds are subject to an uncontrolled target fishery, affecting both seaweed populations and their associated fauna. CMFRI researchers have proposed a seasonal harvesting schedule as the best means of improving sustainability.

Molluscs Shell collectors are indiscriminate in their exploitation, as are the bottom trawlers. Harvested molluscs are sold to both domestic and foreign markets. *Murex* and *babylonia* shells are two targets of fishers in Tamil Nadu. (To catch *babylonia* shells, fishers use a ring type net held at the sea bottom and baited with oligochaete or polychaete worms). CMFRI has now begun a conservation project for the sea chank, first rearing the gastropod in nurseries and then moving them to sea-ranches.

While trawlers specifically target shrimp and edible fishes, there is an increased demand for all marine products, especially mollusc and gastropod shells. The modified nets used by bottom trawlers can pick up everything found in the mud. Nets used for shellfish collecting (*chanku madi*) have a larger mesh size and sinkers, and are towed at half the speed of fish trawls (2.5km/hr rather than 5km/hr). Of the trawls studied by CMFRI, 11.9 to 34.1% discarded all living substrate, as well as major and minor invertebrates.

Other Species Holothurians, gorgonids, sponges and seahorses are now being harvested by specimen collectors who previously targeted only sea chank. For example, in response to high demand, fishers harvested tonnes of gorgonids before authorities became aware of the fishery and CMFRI closed the area.

DISCUSSION

An expanding marine medicinals trade

Amanda Vincent Do you think the marine medicinals trade is expanding in India?

Aaron Lipton Certainly the trade is expanding, where previously there was little. Pipefish and swimbladders are being collected in large numbers. Skins of skates and rays are also exported, though we do not know for what purpose. There is a very valuable trade for gastropod operculums (each selling for 1200-1300 rupees/kg (US\$50-80)), which are exported to several countries, possibly for incense.

Amanda Vincent What is India doing to regulate the trade?

Aaron Lipton There are no clear trade controls in India, but limiting the allowable size range might be an option for holothurians.

Government administration of traditional medicine issues: meeting the challenge of aquatic resource bioprospecting.

Mr. Rene Geraldo G. Ledesma

Bureau of Fisheries and Aquatic Resources, Manila, Philippines

As modern pharmaceutical companies increasingly turn to the developing world in search of new compounds, there is a need to protect the practices and pharmaceutical resources of indigenous TM systems from unethical or unsustainable exploitation. Mr. Ledesma here discusses the actions the Philippine government is taking to address issues of marine medicinal management, both for TM and modern medicine (i.e. bioprospecting).

I was a participant in a national workshop held here in Cebu [*eds.*: The National Conference-Workshop on the Conservation and management of seahorses in the Philippines, May 21-22 1998] and recall an interesting discussion held then on the concept of TM. The Philippine government defines TM as the knowledge, skills and practices not necessarily explicable by Western science but recognised by the people to help maintain and improve their health. TM is thus both tangible (wildlife resources as medicinal ingredients) and intangible (knowledge, or intellectual property).

With its strong TM tradition (as evidenced by the presence of many Quiapo and Chinese medicine shops and the popularity of *Albularios*, Filipino medicine men) and high biodiversity, the Philippines is a likely target for bioprospectors. The Philippines' ratification of Agenda 21 at the 1992 UN Conference on the Environment and Development has prompted the government to develop legislation to ensure that any future commercialisation of TM:

1. meet sustainable development standards
2. protect the intellectual property rights (IPR) of source communities and
3. respect the rights of indigenous peoples and local government units (LGUs) as regards decisions involving the disposition of fisheries resources within their jurisdiction, such as resources used in TM.

Legislation

Certain chapters of Agenda 21 were of particular relevance in guiding government policy decisions affecting the trade in marine species for TM.

Table 2. Philippine legislation corresponding to Agenda 21

Agenda 21	Corresponding Philippine Legislation
<u>Chapter 15:</u> Conservation of Biological Diversity, sections 15.4 (c), (g) and (j).	(1) <u>Executive Order 247</u> , or the Philippine Bioprospecting Law
<u>Chapter 26:</u> Recognising and strengthening the role of indigenous peoples and their communities, section 26.3.	(2) <u>Republic Act 8371</u> , or the Indigenous Peoples' Rights (IPRA) Act (3) <u>Republic Act 8243</u> , or the Traditional and Alternative Medicine (TAMA) Act
<u>Chapter 17:</u> Protection of the Oceans, section 17.5 (e).	(4) <u>Republic Act 8550</u> , or the Philippine Fisheries Code of 1998

The full text of Agenda 21 is available at <http://www.infohabitat.org/agenda21>

1. Executive Order 247, or the Philippine Bioprospecting Law: Prescribing Guidelines in establishing a regulatory framework for the prospecting of biological and genetic resources, their by-products and derivatives, for scientific and commercial purposes.

Before conducting research on any Philippine genetic and biological resource, researchers must undergo a prior informed consent process, consulting with local communities and reaching an agreement with the Philippine government. Any benefits derived from the research must be shared with source communities and the government. The first such research agreement (between the University of Utah, the University of the Philippines and the national government's Department of Agriculture) has already been approved.

TMs will only be covered by the Bioprospecting Law if they are scientifically proven to be medically efficient. [Eds.: The issue of how such an assessment might be made was not addressed].

2. Republic Act 8371, or the Indigenous Peoples' Rights Act: To recognise, protect and promote the rights of indigenous cultural communities or indigenous people, creating a National Commission on Indigenous Peoples, establishing implementing methods, appropriate funds, and for other purposes.

The IPRA Act recognises the right of indigenous peoples to develop their own sciences and technologies, and their cultural manifestations, including their knowledge of TM. Access to biological and genetic resources and any use of indigenous knowledge will only be allowed within the ancestral lands of these communities with their prior and informed consent.

3. Republic Act No. 8243, or the Traditional and Alternative Medicine Act: The Act creating the Philippine Institute of Traditional and Alternative Healthcare: to accelerate the development of traditional and alternative healthcare in the Philippines, providing a fund for the development of these etc.

The purpose of the TAMA Act is to improve the quality and delivery of health care services to the Filipino people, by developing traditional and alternative medicine and incorporating these into the national healthcare delivery system. The TAMA Act also seeks to develop a legally workable basis from which indigenous peoples would own and profit from their knowledge of TM.

4. Republic Act 8550, or the Philippine Fisheries Code of 1998: An Act providing for the development, management and conservation of fisheries and aquatic resources, integrating all laws pertinent there to and for other purposes.

One of the basic policies of the Philippines Fisheries Code is to ensure the rational and sustainable development as well as the management and conservation of the fishery and aquatic resources found in Philippine waters, including the Exclusive Economic Zone and adjacent high seas. The Code:

- limits access to the fishery and aquatic resources of the Philippines for the exclusive use and enjoyment of Philippine citizens;
- recognises the primordial right of municipal fishers to fishery resources;
- punishes the unauthorised collection of any aquatic organism for TM by an individual not from the area;
- sets regulations on the harvest size and quantity of organisms caught in the wild.

Although the Code was signed 25 February 1998, its implementing rules were signed only in April 1998. [Eds.: As of July 28 1999 the necessary Fisheries Administrative Order had not yet been established].

Classification of Marine Medicinals

There is no category in Philippine fishery statistics for TM products. All aquatic resources are classified only as (1) food (2) decorative, handicraft/curio items or (3) live items (tropical aquarium fish or pets). Due to this inappropriate classification system, the number of marine products being exported for medicinal use is unknown, and their market value may be severely underestimated.

Agency Jurisdictions

A number of government agencies work together to administer government legislation of relevance to marine medicinal resources. All of these laws recognise that indigenous peoples or traditional fisherfolk have the right to decide on the management, use and disposition of their wildlife resources.

Under the Integrated Protected Area System of the Philippines, LGUs have the right to accept or reject any collection of aquatic organisms in protected areas falling under their jurisdiction. (Municipal (or LGU) waters in the Philippines extend to 15km offshore). The harvest of marine medicinals may thus be subject to fees, permits and licenses issued by the LGUs. The LGUs also have the exclusive authority to grant auxiliary invoices for the transport of aquatic organisms away from the source area. Establishing a standardised record-keeping system for TM products on these invoices could greatly aid in trade monitoring.

At the national level, the Bureau of Fisheries and Aquatic Resources (BFAR) is the mandated agency for the conservation and management of Philippine aquatic resources. Export of marine medicinals from the Philippines does not require a permit, although BFAR will issue commodity clearances for live organisms (such as seahorses destined for the aquarium trade) if requested by the importer.

Other government agencies have been invited to join committees addressing the issues of: bioprospecting; IPR protection for indigenous peoples; the development of potential medicines through traditional knowledge; and the promotion of sustainable development for organisms used in TM. While these inter-agency committees were meant to remedy jurisdictional overlap among agencies, they have instead increased the amount of red tape in the government bureaucracy. Rules presently exist, but are difficult to apply.

Conservation would benefit from a better understanding of the TM trade. This could be achieved through proper accreditation and documentation of TM products, the TM trade, and the people that use, manufacture or sell TM.

DISCUSSION

No discussion points were raised for this presentation.

Session 3: Trade in importer countries

TCM use of marine medicinals: content and context

Mr. Jokkeng Lee

Eu Yan Sang International Holdings, Kuala Lumpur, Malaysia

In order to understand marine medicinal use in TCM, Jokkeng Lee explained, one needs to understand both the content (or type of marine species used) and how the content is used in its proper context. In his presentation, Mr. Lee provides this context by examining the use of marine medicinals from a TCM medical and cultural perspective.

In the practice of TCM, marine medicinals are used in herbal prescriptions, patented herbal medicines and as medicinal foods. The following list describes a number of the marine medicinals carried in 1996-97 by the Malaysian branch of Eu Yan Sang (EYS), the oldest and largest wholesaler of TCM products outside of China:

- Scallops represented the largest marine product order (by weight) for the year. Scallops are held to be the least 'toxic' of all seafood, and can be used in babies' diets.
- Sea cucumbers, abalone, shark's fin and fish maw (swimbladder) followed, in decreasing order size. These marine products are considered to be the four major seafood delicacies, or 'The Four Kings of the Sea'. Abalone is the most expensive of the four, shark's fin the most difficult to prepare, and fish maw the most easily digested.
- Pearls were ordered in large quantities, although order size by weight appears quite small. This is because pearls are ground into powder, with a single medicinal dose weighing only 0.4g (1 fen).
- Pipefish were ordered in very small amounts, and no seahorses were ordered by the store in 1996-97. The highest-quality seahorses are worth RMI 1500/kg (US\$395/kg) at cost.

Seahorse Orders

In 1996-97, EYS-Hong Kong ordered 6kg of seahorses, while EYS-Malaysia still had quite a number in stock, left over from a 3kg order received in July 1995. How can we explain this difference in seahorse orders between the Hong Kong and Malaysian stores?

In Malaysia, seahorses are not used extensively, and are therefore not a major selling item. Oyster shells, sea turtle shells, kelp (*Laminaria*), and sargassum are the most commonly sold marine medicinals. This is representative of the majority of Chinese herbal prescriptions dispensed in the modern practice of TCM. In terms of EYS herbal patent medicines, none of the more than 100 herbal products we sell utilise seahorses, although some use oyster shells and pearl powder. If the figures of large consumption of seahorses are accurate in the context of TCM use, then perhaps the explanation lies with the manufacture of herbal patent medicines in China.

Patent Medicines

Seahorses are mainly used in patent medicine, and are relatively less used in herbal prescriptions or eaten as medicinal foods throughout TCM-practising countries.

Seahorse-containing patent medicines are usually taken as tonics and strengtheners. 'Pipefish and Seahorse Major Tonic Pills', 'Seahorse Kidney Tonifying Pills' and 'Ginseng and Deer Antlers Pills' are a few of the representative and long-standing herbal patent medicines produced in China that include seahorses as an ingredient. These are the classics, but the complete and updated list of Chinese patent medicines is extensive, and may include more than ten different seahorse-based products. In these three particular medicines, seahorses represent 8-10% of ingredients.

Exotic Seafood

If we consider the use of marine medicinals by TCM to be a threat to species survival, we should also examine the role of exotic seafood restaurants in marine species exploitation. Major marine delicacies include shark fins, swim bladders, abalone and sea cucumber, and their medicinal properties are well known. (Seahorses are not considered to be a marine delicacy). The four seafood delicacies are rarely sold in Chinese medicine halls, but are carried instead by stores specialising in dried delicacies. These shops are pervasive in Hong Kong, and they distribute their products to gourmet restaurants and those that specialise in exotic food. Although marine delicacies are not a part of the everyday diet of ethnic Chinese, the trade could still be having an impact on marine species.

I have localised two areas we should examine more closely in our investigation of the medicinal trade: patent medicines and seafood restaurants. To try to look at the TCM community as a whole is too broad.

Function of Marine Medicinals

Due to biased media reports, it appears to the general public that TCM practitioners do little but concoct aphrodisiacs. The primary functions of many TCM marine medicinals are in fact very wide-ranging, and while they do include boosting sexual drive and improving virility (increasing the Yang), marine medicinals can also: settle the mind; nourish the Yin; tonify the Qi and blood; prevent the leakage of various fluids (e.g. frequent urination); promote downward flow of energy (e.g. a cough or belch is an upward flow of energy); dissipate skin nodules; soften hardness; neutralise excess heat; and reduce phlegm.

Seahorses boost the Yang (or, promote activated processes, including sexual function), dissipate skin nodules by softening hardness, treat tenacious pimples, reduce swelling by promoting blood circulation, and strengthen the bones and tendons.

In general, in their cultural context, marine delicacies principally nourish the Yin (produce nutritive fluids) and promote circulation of blood and Qi. Therefore, according to TCM, marine delicacies have the ability to slow the ageing process (i.e. reduce wrinkles) by preventing dryness. Slowing the ageing process (or in other words, reducing the threat of mortality) is a deeply rooted desire in all cultures. Telling people that a marine medicinal is ineffective for this purpose, or that pharmaceutical alternatives will suffice, will not be enough to convince them to abandon a particular marine medicinal.

The principal reason for the popularity of marine medicinals among East Asians is that, if well-cooked, marine products are easily digestible and nutritious. This is therapeutically quite valuable, as a major problem with herbal tonics is that they tend to cause stagnation in the body if the digestive tract is weak or the formula is not well crafted.

TCM and Conservation

Although aquaculture may appear to be a practical approach to species conservation, the strong belief among TCM practitioners that wild is better must be overcome for culturing to succeed. If wild is better, wild species will continue to be harvested for medicine, and will be even more precious and in demand as supply decreases. We can still work towards developing aquaculture, but must remember this factor. Trade restrictions are another proposed conservation measure, but can lead to the creation of a black market.

Species conservation is a multi-dimensional issue and the TCM community is not solely responsible for biodiversity loss. Infrastructure developers, animal researchers, the pet trade, bioprospectors and exotic food consumers are only a few of the other resource users also threatening marine species. As long as media bias exists, the TCM community will continue to be used as a scapegoat. I hope that through more frequent gatherings such as these, we can develop a better understanding of the problems facing marine species.

DISCUSSION

See discussion following Endi Zhang's presentation.

Preliminary report on seahorse trade in Shanghai and Tianjin

Dr. Endi Zhang

Wildlife Conservation Society, Shanghai, PRC

Dr. Endi Zhang here presents the results of his study on the availability of seahorses in Tianjin and Shanghai's TCM pharmacies, conducted between March 1997 and April 1998. This is the first seahorse trade survey in the area and is the beginning of a long-term monitoring program.

China has a long tradition of using seahorses as medicine. Tao Hongjing, in his book 'The Collective Notes to the Canon of *Materia Medica*' (approximately 502-557AD) described seahorses as

“the water-horse [living] in the sea, belonging to shrimp or fish, but resembling a horse.”

Historically, medicinal use of seahorses in China was restricted to the following five species: *Hippocampus kelloggi*, *H. japonicus*, *H. histrix*, *H. kuda* and *H. trimaculatus*.

Due to taxonomic confusion, these five names likely represent more than five seahorse species. *H. kelloggi* is the only seahorse species protected under China's Wildlife Protection Law (Category II). A permit is required for its harvest.

Today, any and all available seahorse species are used in TCM. Improved living standards have made TCM more accessible to the public, and demand has increased rapidly both for prescription and for mass-produced patent medicines. Seahorses are the major ingredient in a number of patent medicines, the most popular of which is probably *Nan Bao* (Man's Treasure), a product sold even in North America and Europe.

Survey Results

It is difficult to collect data on seahorses in China, as so few people have studied them. Before 1985, the Chinese system was such that harvested wildlife could only be sold to government-owned companies, or kept for personal use. These companies kept records of the wildlife trade, but since 1985, people can sell wildlife on the free market, making monitoring more difficult.

Chinese researchers sponsored by the Wildlife Conservation Society visited 121 local pharmacies in Shanghai and 8 pharmacies in Tianjin, asking shop employees whether they sold seahorses, and for what price.

Researchers found that:

- more than 50% of the pharmacies visited in both Shanghai and Tianjin acknowledged selling seahorses.
- The retail price ranged from US\$302 to \$846 per kg in 1997, and US\$343 to \$600 per kg in 1998.
- Retail price differences could be accounted for by seahorse size category, and not by weight. Seahorses over 6cm high were considered to be large; seahorses between 4 and 5cm, medium-size; and seahorses less than 4cm in length, small.

Data were also collected from published weekly price lists for 12 large domestic TCM markets located throughout the country. All 12 markets sold seahorses, and when questioned, traders reported no difficulties in obtaining these fish from suppliers. International seahorse trade has greatly increased in recent years, and there is evidence that most seahorses sold in China are imported. This international trade has kept prices stable and low.

Table 3. Wholesale price (US\$/kg) for medium sized seahorses in major TCM markets

	Jun 97	Jul 97	Aug 97	Oct 97	Nov 97	Dec 97	Jan 98	Mar 98
Average	179	174	166	164	168	164	157	145
Range	169-181	133-200	145-181	97-218	121-218	145-181	133-181	120-145

Data for August 1997 and February 1998 were not available

Although current price of seahorses in major domestic markets shown are stable, historical data in Shanghai show that the wholesale price has increased almost three fold from 1989 to 1995.

Table 4. Wholesale price (US\$/kg) of seahorses in Shanghai between 1989 and 1995

	1989	1990	1991	1992	1993	1994	1995
Large-sized	88	101	127	127	162	184	237
Medium-sized	75	89	112	112	142	162	208
Small-sized	68	81	102	102	130	149	131
Cultivated	68	89	112	103	131	149	191

Aquaculture

There is a perception among Chinese TCM users that cultured seahorses are not as medically effective as wild-caught ones. Seahorse farming was first attempted in China in the early 1960s, and in 1972, the Ministries of Agriculture, Forestry, and Commerce issued a notice encouraging people to produce more seahorses (or 'southern medicines'). Many seahorse farms were subsequently established in coastal areas. A few continued to be poorly maintained up until 1996, such as Lufeng in Guangdong and Guilin Seahorse Farm in Guangxi, but it appears that all Chinese seahorse farms are now out of operation.

Problems & Recommendations

Seahorse conservation in China faces a number of problems:

- Most seahorses sold in China are imported. For example, one Guangdong drug company imported 80% of its seahorses in 1995.
- Seahorse consumption is high, though incompletely understood. The number of pharmacies in China, together with the results of this study, is enough to suggest consumption is enormous. Apart from their use in herbal prescriptions, seahorses are also used in large quantities in patent medicines.
- Current sorting methods used by TCM practitioners and traders do not use species criteria, and thus pose a potential threat to vulnerable species. [*Eds.*: Species-based conservation initiatives would fail in the TCM context, and decreases in certain species' availability go unrecognised by traders].
- The difference in price due to body size has generated an increase in the demand for smaller, cheaper seahorses in prescriptions, increasing pressure on juveniles. Chinese patent medicine companies also choose to use smaller seahorses in their medicines.
- People are now eating seahorse soup as a delicacy, and seahorses are popular in spirits as well. One pharmacist reported that seahorses were not very useful in the past, but now are seen as more interesting by the public.

The study makes the following recommendations in response to the above problems:

1. Conduct a nation-wide survey on both the domestic and international seahorse trade;
2. Control the manufacture of seahorse-based medicines;
3. Enforce wildlife protection legislation;
4. Educate consumers about the threats to the survival of seahorses;
5. Conduct research into seahorse biology.

DISCUSSION*Apparent increases in availability*

Amanda Vincent When traders say that a product is easily obtainable, this can be misleading. If traders accept a wider and wider range of species and sizes, there is an apparent increase in availability because of a reduction in selectivity. We heard that seahorses larger than 6cm are now considered 'large' in China: these would still be juveniles for virtually all species that are traded. What may easily be happening is that the trade is switching more and more to juveniles.

Herbal vs. patent medicines

Jokkeng Lee In the course of researching patent medicines, it is important to bear in mind whether the medicine is made from extracts, or is 100% herbal. If it is an extract, it will use greater quantities of the ingredients. [*Eds.*: Seahorses are 100% herbal].

Economic growth and medical choices

Rudi Bijmens Do you think that when these countries are more developed, and more educated, that they will switch to Western medicines, as happened in Europe decades ago?

Endi Zhang A potential danger is that when people have money, they don't necessarily have a developed conservation awareness. Demand is now increasing for wildlife products. What we will probably see is people moving on to more expensive wildlife products. [*Eds.*: See presentation by A. Vincent].

Manufacturers are heavily promoting patent TM, and there is a potential danger with Western companies trying to enter the Chinese market as well. The government is encouraging the use of extracted biomedical substances from all kinds of marine species, and held a conference to encourage such research, both in the TM and modern medicine fields.

Consumer control

Marivic Pajaro How can a user tell if a seahorse has been cultured or caught from the wild?

Endi Zhang The company would know where they had sourced it, and would keep records. The user would not know. The company won't mark seahorses as cultivated even if they are, because no one will buy it.

Bertha Mo As a consumer, if I buy a patent medicine, I will not be able to tell if the seahorses it contains were small or large.

Jokkeng Lee There is absolutely no consumer control.

Session 4: TM and conservation

How conservationists can work with traditional medicine communities

Mr. Samuel Kwokhung Lee (and Ms. Judy Mills)

TRAFFIC East Asia, Hong Kong

Samuel Kwokhung Lee is a conservationist whose work with TRAFFIC, the joint wildlife trade monitoring group of the IUCN and WWF, brings him in close contact with East Asian traditional medicine (TM) communities. In this talk, Mr. Lee shares a few of the guidelines developed by TRAFFIC's programme officers in their efforts to establish co-operative relationships with TM users.

TM communities often have been criticised for using derivatives of endangered wildlife as medicine. Whereas consumption of endangered wildlife can be reduced to a certain extent by laws and trade controls, it is TRAFFIC's view that voluntary adherence to these regulations by TM communities is much more positive and constructive than law enforcement alone. Misinformed media coverage often portrays an undesirable image of TM, offending some members of the TM community and making relations with conservationists more difficult. In order to enlist the support of the TM community and develop a co-operative approach towards achieving sustainable wildlife use, ongoing respectful communication is a prerequisite. The following points may be of importance in these efforts:

Understanding Traditional Chinese Medicine

According to the World Health Organisation, 80% of the world's population has its health care needs met by TM. Nevertheless, TM systems are sometimes considered inferior to Western, or 'modern' medicine, and may even be perceived as superstition.

The core concept of TCM, the concept of Yin and Yang, is often misinterpreted by Western conservationists. 'Tonifying the Yin' or 'Enhancing the Yang' to achieve balance is misperceived as increasing sexual capacity. Recent media coverage comparing Viagra to the use of rhino horn is a typical example of this misunderstanding. Unlike Viagra, rhino horn is not used as an aphrodisiac, but rather as a treatment for serious and sometimes life-threatening illness. TM communities are humiliated by the widespread perception that they mostly deal with aphrodisiacs.

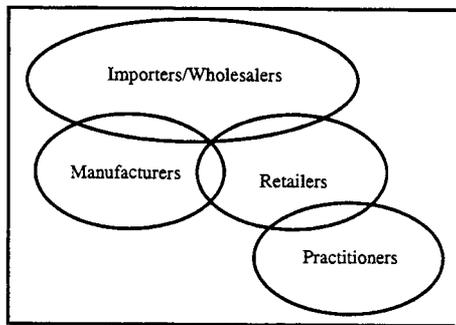
Western medical science does not have the tools with which to evaluate TM. As an analogy, picture the nutritional label often found on bottled mineral water sold in North America. The label lists the carbohydrate, protein, fat and calorie content of the water, with the measure for each being, of course, zero. It is not that the water is without qualities, but rather that the wrong parameters have been chosen to measure its characteristics. Proper respect and understanding of TM systems is essential for medicinal wildlife conservation.

Understanding the Target Audience

The practice of TM in Hong Kong has never been adequately regulated. The TM community feels victimised by the lack of professional recognition afforded them by the Hong Kong government. Raids on TM stores by the government's wildlife conservation department contribute further to this unease. Conservationists in Hong Kong such as myself must try to communicate with the TM community within a very difficult, mistrustful context. I make it very clear to my contacts that I am not a government official, and will not pass any information on to the authorities. Within Hong Kong's TM community, besides the formal academic institutions, there are currently more than 30 organisations representing groups of practitioners, retailers, manufacturers and importers (see Figure 1).

These organisations and their memberships overlap, people may belong to several, or none, and certain groups may not speak to others.

Figure 1. Overlap between Hong Kong TCM associations.



In contrast, Korea has only two associations representing the TM community. To be effective, conservationists in Hong Kong need to know the key players in the community, as working with the wrong group not only wastes time, money and effort, but also risks offending a more influential organisation.

Communication Channels

TRAFFIC East Asia has found that it is important to begin communicating wildlife conservation issues to the TM community long before these lead to increased controls and restrictions. This allows the TM community to become involved in the process, to plan in advance for restrictions on supply and uses, and even, if informed early enough, to perhaps eliminate the need for legislation through voluntary reduction in consumption. The methods of communicating with the community must be well crafted, otherwise a new trade control can be misperceived by the TM community as a trade ban, ending all hope of gaining their voluntary co-operation.

Languages

TRAFFIC relies heavily on newsletters to reach the widest possible audience. TRAFFIC's Korean newsletter (funded by the Association for Korean Oriental Medicine), and Chinese newsletter (with English copies also available) cover similar topics, but are written to meet the particular needs of regional contacts. Previously, information on issues of TM and wildlife conservation often were published only in English, and the TM community was caught by surprise when controls or bans took effect. The newsletters have thus been enthusiastically welcomed by the TM community. They allow readers to understand more about the issues that will impact their livelihood and health, and to understand how their own actions can impact wildlife conservation.

Cultural Differences

Most Asian cultures view animals and plants as objects existing to serve human needs. Prohibiting the use of natural resources simply does not make sense to many Asians, and conservation can be an alien concept. Conservationists should take care to avoid measures that may be seen as ideological or cultural imperialism. It is important to accept different views on the value of wildlife, while at the same time explaining the necessity of conservation measures to the TM community.

Beware of Biases

There are two obvious biases in the portrayal of TM's use of wildlife. The first is that the focus is often solely on TCM, ignoring all other forms of TM that also use wild plants and animals. Examples from India include: the use of tiger bone in Unani and Ayurvedic medicines; the folk remedy for asthma that recommends regular intake of dry seahorse powder with honey; and the practice of applying a mixture of dried and burned seahorse and coconut oil to wounds. [*Eds.:* See also A. Lipton's talk for further examples of Indian TM]. A second bias is that TM is represented as the only threat to the survival of the world's wildlife. This is rarely the case. Tigers are threatened by TM, but also by habitat destruction, game hunting and conflicts with farmers. Stopping the use of tiger bone in TCM is only a part of helping to save the tiger from extinction. Conservationists cannot

hope to obtain the desperately needed co-operation of the TM community if they continue to incorrectly assign blame to them.

Conclusion

Success in combining the interests of TM and wildlife conservation requires a great deal of common sense. Showing respect and communicating in a language understood by all will be key tools in achieving mutual trust and co-operation. As important will be investing time, effort, money and goodwill—precious resources that conservationists and TM specialists never thought they would have to spend on one another. But investing the time, effort, money, and goodwill is the only way forward for TM and the world's wildlife.

DISCUSSION

See discussion following Young-Jong Lee's presentation.

Marine species in traditional Chinese medicines

Prof. Hanchen Zheng

College of Pharmacy, Second Military Medical University, Shanghai, PRC

(In Mandarin, assisted by an interpreter)

In the two months preceding the workshop, Hanchen Zheng conducted a literature survey to determine the past and present use of marine species in traditional Chinese medicine (TCM). The result was a list of 415 historically-used TCM marine medicinals. Prof. Zheng distributed this list to participants, restricting his presentation to a discussion of marine medicinals in current TCM use.

China is an oceanic country, with 18 000km of coastline, and more than 20 000 marine species occurring in its waters. Marine species have been used in TCM for at least 2000 years. The most ancient monograph of Chinese Pharmacy, the 'Shen Nong's Herbal Classic', lists ten species of marine medicinals, while the 'Compendium of Materia Medica', the most comprehensive work of ancient Chinese TM, records 101 marine medicinal species. The more recent 'Chinese Medicinal Fauna', published in 1979, lists 263 species of medicinal marine animals. My own research revealed 415 marine species mentioned in past and present TCM literature.

Current Use of Marine Medicinals

Relatively few marine medicinals are currently in use in China according to the 1995 edition of the Chinese Pharmacopoeia, compiled by the Pharmacopoeia Commission of the Ministry of Public Health. The work lists 11 marine medicinals included in the modern TCM pharmacopoeia, derived from 29 marine species. The use of unlisted species is not recommended by the Commission. Unlisted species used medicinally fall into the 'folk medicine' category, rather than TCM. [Eds.: It is nevertheless probable that a large number of unlisted medicinal species are used in China. For example, the Commission lists only 5 seahorse species used as marine medicinals, but it is known that nearly all of the recognised 32 seahorse species are in demand in China as TM].

*A discussion of the marine medicinals included in the modern Chinese Pharmacopoeia formed the remainder of Dr. Zheng's presentation, as summarised in Table 5. The names of the 11 marine medicinals appear in the shaded rows. The species names from which the medicinal is derived follow. For example, the Ark Shell marine medicinal is derived from the species *Arca subcrenata*, *A. granosa* and *A. inflata*. Species names and medical indications have not been verified by the editors. Prof. Zheng closed by saying:*

Marine resources should continue to be used in the future, but with care. If resources are not used, the opportunity for discovering their medicinal value is lost, and the resource is wasted.

DISCUSSION

See discussion following Young-Jong Lee's presentation.

Table 5. Marine medicinals currently in use in P.R. China

Scientific Name	Part Used	Indications
I. (Wa leng zi) Ark Shell		
<i>Arca subcrenata</i> <i>A. granosa</i> <i>A. inflata</i>	Shell	Goitre, scrofula, masses in the abdomen. Gastric pain with acid regurgitation.
II. (Shi jue ming) Abalone Shell		
<i>Haliotis diverdiversicolor</i> <i>H. discus</i> <i>H. ovina</i> <i>H. ruber</i> <i>H. asinina</i> <i>H. laevigata</i>	Shell	Headaches and dizziness, blurred vision due to nebula, optic atrophy and night blindness.
III. (Mu li) Oyster Shell		
<i>Ostrea gigas</i> <i>O. talienwhanensis</i> <i>O. rivularis</i>	Shell	Palpitation, insomnia, dizziness and tinnitus, scrofula, malformation in the abdomen. Sweating, seminal emission, abnormal uterine bleeding, excessive leukorrhea, epigastric pain with acid regurgitation.
IV. (Kun bu) Kelp		
<i>Laminaria japonica</i> <i>Ecklonia kurome</i>	Dried thalline	Goiter, scrofula, swelling and pain of the testis, edema.
V. (Zhen zhu) Pearl		
<i>Pteria martensii</i>	Pearl	Palpitation and insomnia, convulsions, epilepsy, nebula, skin ulcerations which are difficult to heal.
VI. (Zhen zhu mu) Mother of Pearl		
<i>Pteria martensii</i>	Shell	Headache, dizziness, fidgetiness and insomnia, inflammation of the eye due to heat in the liver, blurred vision, deficiency conditions of the liver.
VII. (Hai ma) Seahorse		
<i>Hippocampus kelloggi</i> <i>H. histrix</i> <i>H. kuda</i> <i>H. trimaculatus</i> <i>H. japonicus</i>	Dried body	Impotence, enuresis, dyspnea in deficiency syndrome in the kidney, mass in the abdomen, traumatic injuries, external use for carbuncles and boils.
VIII. (Hai long) Pipefish		
<i>Syngnathus acus</i> <i>Syngnathoides biaculeatus</i> <i>Solegnathus hardwickii</i>	Dried body	Impotence and seminal emission, mass in the abdomen, scrofula, traumatic injuries, external use for carbuncles and boils
IX. (Hai piao xiao) Cuttlebone		
<i>Sepiella maindroni</i> <i>Sepia esculenta</i>	Dried internal shell	Peptic ulcer with hyperacidity, spitting of blood, epistaxis, abnormal uterine bleeding, hematochezia, seminal emission, spermatorrhea, morbid leukorrhea, gastric pain with acid regurgitation, external use for traumatic bleeding and wounds with purulent discharge.
X. (Hai zao) Seaweed		
<i>Sargassum pallidum</i> <i>S. fusiform</i>	Dried alga	Goiter, scrofula, swelling and pain of the testis, edema.
XI. (Ge qiao) Clam Shell		
<i>Meretrix meretrix</i> <i>Cyclina sinensis</i>	Shell	Cough, chest pain and bloody sputum caused by heat in the lung, scrofula, goiter, epigastric pain associated with acid regurgitation, external use for eczema and scaldes.

Table taken from Prof. Zheng's notes, based on: The Pharmacopoeia Commission of the Ministry of Public Health, P.R. China. 1995. Pharmacopoeia of the P.R. China, Vol. 1. Guangdong Science & Technology Press. 342pp.

The state of seahorses as herbs in Korean oriental medicine

Dr. Young-Jong Lee

Department of Herbology, Kyung Won University

(in Korean, assisted by an interpreter)

Korean traditional medicine (TM) is derived from traditional Chinese medicine (TCM), but consumption patterns of marine medicinals between Korea and P. R. China vary. Dr. Young-Jong Lee here discusses the use of seahorses in Korean TM, and aspects of their trade.

Korean TM consists of two major systems: *hanyak* and acupuncture. Of the 5000 species of animals and plants found in Korea, 450 are included on the standard *hanyak* ingredients list. Ingredients on the list are government approved, and the list provides information on clinical applications of ingredients. Only twenty of these are marine species.

Although seahorses are little used in modern Korean TM, they have been historically valued as good medicine items because of their strong pair bond. It is said that sailors always collected seahorses in pairs to ensure that their medicine would be effective.

Seahorse Imports

There are six kinds of seahorses used in Korean TM, the most common being *Hippocampus japonicus*. [Eds.: Species name has been revised to *Hippocampus mohnikei*]. Even though several seahorse species occur naturally in Korean waters, native species are not harvested for medicine. Instead, seahorses are imported from abroad, often from China or Hong Kong.

Table 6. Seahorse and pipefish imports to Korea, 1995-97.

Year	Seahorses		Pipefish	
	Amount (kg)	Total Cost (US\$)	Amount (kg)	Total Cost (US\$)
1995	391	86 797	-	-
1996	355	76 248	52	848
1997	378	83 820	-	-

Source: Korea Pharmaceutical Traders Association
[Eds.: Table may include only partial data].

Clinical Applications

Korean TM distinguishes three grades of dried seahorses, and uses them in herbal prescriptions. First class seahorses (very bright yellow colouring, 16-30cm height) are very expensive, and as such are rarely used. Only second class (bright yellow, 8-15cm high) and third class (bright yellow or dark brown, <8cm high) seahorses are used commonly for medicinal purposes. Fishers could benefit from taking this classification scheme into account when harvesting and drying their seahorses.

The clinical applications of seahorses are similar to those explained by the other speakers [eds: see J. Lee and H. Zheng's presentations], and I will not repeat them here. It is important to note that while seahorses may work very well for one person, other patients may not benefit from the same medicine due to differences between individuals. Seahorses are not appropriate for every person. They should only be used by those in need, and in consultation with a doctor.

Apart from seahorses, cuttlebone, sea cucumber, pearl and oyster shells are the major marine species used in Korean TM.

Table 7. Marine medicinal imports to Korea, 1995-96

Marine Medicinal	1995		1996	
	Amount Imported (kg)	Total Cost (US\$)	Amount Imported (kg)	Total Cost (US\$)
Cuttlebone	18 747	13 996	23 384	16 649
Sea cucumber	-	-	500	6 350
Pearl	-	-	10	110
Oyster Shell	500	100	300	30

Source: Korea Pharmaceutical Traders Association

DISCUSSION*Korean seahorse imports*

Glenn Moore Why are Korean seahorses not used in Korea?

Young-Jong Lee The seahorse fishery is not considered economically viable, therefore it is more profitable to import seahorses than to catch them in Korean waters.

Efficacy of seahorses

Salome Quijano I would like to know if there are studies and data that prove that seahorse medicines work.

Samuel Kwokhung Lee TM systems develop on the basis of trial and error, and accumulated evidence of what works and in what combination. There is no equivalent to what is known as Western scientific proof.

Vincent Chen I think the different systems are equal, but different, and you cannot use modern techniques to prove the efficacy of the Eastern system. If eventually the West learns about the Eastern philosophical system, they will learn a lot. Both can communicate, to the good of all humans.

Mark Wilson Has anybody here been cured by seahorses, or witnessed it?

Young-Jong Lee Yes, there are many cases, but not because of the use of a single seahorse.

Aaron Lipton In India, in general, more people are interested in TM because they do not trust antibiotics.

Hanchen Zheng When we talk about TCM we talk about the whole biological body, composed of many chemicals. To research efficacy is very difficult, as there are many compounds involved. TM is a comprehensive effect—you can't really say which single factor is having a certain effect. Because the medicinals have been tested for so many years, we don't know exactly why they work. Just as when we eat food, we don't know which food is good for muscles, or for putting on weight—it is a comprehensive effect. One thing is for sure—since some TMs have a long history, they have proven to be effective. There have been no studies on seahorse efficacy as detailed as for ginseng.

Taiwan trade statistics

Vincent Chen Prices for seahorses have declined by nearly US\$100/kg since 1984. In 1990, the yearly import of seahorses to Taiwan doubled as a result of

DISCUSSION (continued)

- Vincent Chen
(continued) rapid economic development, and has stayed at that level ever since. Thailand supplied from 51-90% of Taiwan's imported seahorses. A similar pattern exists for sea cucumbers: imports have doubled since 1990.
- Vorathep Muthuwan I don't know about the South, but in the East of Thailand, there are only 7 trawlers harvesting seahorses. How can you report such high volumes of imports from Thailand?
- Amanda Vincent Many of those seahorses were probably caught by Thai vessels fishing in other regions, or they will have been transhipped through Thailand. We would need to see the Thai export figures before we would trust the Taiwan import figures.
- As for the finding of declining seahorse prices in Taiwan, there are taxes on imports, so traders may understate prices to avoid taxes. Also, the seahorses are getting smaller, and less desirable, and so are cheaper.
- 'Seadragons'*
- Amanda Vincent The term 'seadragon' means different things to different people here. In TCM, 'seadragon' refers to pipefish species, and not to the fishes known as weedy and leafy seadragons in Australia. Australian seadragons are not used in TM.

Session 5: Aquaculture

Tools for the production of marine medicinal species in backyard hatcheries

Dr. Philippe Dhert (and Dr. Patrick Sorgeloos)

Laboratory of Aquaculture & *Artemia* Reference Center, University of Gent, Belgium

To serve a conservation purpose, marine medicinal aquaculture must provide jobs to fishers currently targeting these species in the wild. Philippe Dhert here proposes a simple and easily transferable model for marine medicinal aquaculture (the backyard hatchery) and discusses the importance of developing live diets for cultured organisms.

Since 1975, the proportion of global fish production contributed by aquaculture has been increasing yearly. The major aquaculture producers are: China (the largest, mainly due to the culture of freshwater carp), Japan, India, Korea, the Philippines, Indonesia, the former USSR, USA, Thailand, France, Spain and Bangladesh. If we consider only marine aquaculture production, Japan is the leader, followed by the countries already mentioned. The European countries, particularly those located near the Mediterranean, are also involved in aquaculture.

Freshwater finfish account for the largest portion of world aquaculture production, followed by marine finfish, seaweeds, molluscs, crustaceans and others. Very sophisticated aquaculture methods exist for finfish species (e.g. bass, bream and salmon). The production of crustaceans, and especially of penaeid shrimp, however, is completely different, and more relevant to our discussion of marine medicinal culturing.

Backyard Hatcheries

Many shrimp culturing facilities are dependent on wild-caught juveniles, as in the Philippines and Ecuador. The juvenile shrimp are brought to nurseries and grown to adult size. In South East Asia, many juvenile shrimp are also produced in backyard hatcheries. These hatcheries are usually owned and controlled by a single family, and located very close to the seashore. It is these simple, rather than sophisticated, hatchery systems which would best be suited to the culture of marine medicinals.

Marine medicinals are new species to aquaculture. They will be difficult to rear as little will be known at first of their biology or their nutritional requirements. Until artificial diets can be developed, cultured marine medicinal species will need to be fed natural foods. Natural food has the advantages of being both abundant and composed of a maximal diversity of organisms, improving culturists' chances of meeting the nutritional requirements of cultured species. It can be very difficult to maintain cultures of natural prey items and often the only option is to harvest these from the wild. The solution is to develop live diets, easily produced within hatcheries, for the maintenance of marine medicinal cultures.

Live Diets

We distinguish three different live feeds, fed in progression to cultured species as they grow:

1. Microalgae (single cell algae)
2. Rotifers (*Brachionus plicatilis*, approximately 70-220µm)
3. Brine shrimp (*Artemia*, 430µm-1 cm)

Cultured species can only be given artificial diets once they have grown past these feeding stages.

To begin the live diet, a starter culture (or inoculum) of microalgae is upscaled, drained into tanks at backyard hatcheries, and grown to feed to shrimp, for example. Rotifers can be used for the second stage of feeding, but are a more difficult food source than algae as they must be continuously produced: culturists cannot simply seed the tank, as with microalgae. Rotifers are rarely used in

South East Asian aquaculture, and are more commonly used in cultures of marine finfish. *Artemia* are an easier food source for backyard hatcheries to produce, as their eggs can be bought from companies, hatch within 24 hours of being placed in seawater, and can grow on waste products from agriculture.

Both rotifers and *Artemia* are very nutritious (composed of 50-60% protein), and have adequate carbohydrate and mineral content. However, they entirely lack some essential amino acids and vitamins, or possess these in insufficient quantities to maintain certain aquaculture species. Rotifers and *Artemia* also have a low lipid content. To overcome these problems, *Artemia* and rotifers can be fed enrichments containing missing nutritional requirements. Enriched emulsion oils added to *Artemia* and rotifer cultures are absorbed by the organisms.

Bio-encapsulation of *Artemia*

Rudi Bijmens

Shrimp and *Artemia* Research & Development Institute, Can Tho University, Vietnam

At Philippe Dhert's invitation, Rudi Bijmens here discusses the technique of bio-encapsulation for enriching Artemia shrimp, and the effects of this enriched diet on the growth and reproduction of cultured seahorses.

The Shrimp and *Artemia* Research & Development Center at Can Tho University is currently producing an excess of both adult and cyst *Artemia*. A portion of the surplus is being used in seahorse breeding experiments.

In our experiments, zooplankton (consisting mainly of mysids) were the first live food items given to captive *Hippocampus kuda* seahorses. The diet produced good results, with seahorses courting, mating and giving birth.

Upon comparing the nutritional profiles of mysids and *Artemia*, we found that mysids had a relatively higher amount of essential fatty acids than *Artemia*, as well as higher levels of DHA (Docosahexaenoic acid 22:6N-3), EPA (Eicosapentaenoic acid 20:5N-3) and HUFA (Highly Unsaturated Fatty Acids). We therefore incorporated these missing elements into *Artemia*, using commercially available emulsion products. In a one-month experimental trial, *Hippocampus kuda* broodstock fed on unenriched, pond-grown *Artemia* had no courtships, matings or births. Among those broodstock fed with HUFA-enriched *Artemia*, however, three males spawned, though with very small brood sizes (an average of 53 young).

We noted in our nutritional analysis that mysids have a relatively high amount of phospholipids. We therefore decided to develop our own emulsion containing both HUFA and phospholipids. Although still not perfected, this second emulsion has produced much higher seahorse brood sizes than the first. The standard length of the young did not change between the two treatments.

I hope this short presentation has given you an idea of the technique of bio-encapsulation, and its potential impact on seahorse aquaculture.

DISCUSSION

Inland hatcheries

- | | |
|-------------------|---|
| Vorathep Muthuwan | In Thailand, most backyard hatcheries are located far from the sea, and use water from salt pans transported to the farms by trucks. Even coastal farms use this high salinity water, and dilute it for their purposes. |
| Philippe Dhert | It is absolutely true, although I did not mention it, that in both Thailand and China there are backyard hatcheries far inland. Some of these hatcheries specialise in producing <i>Artemia</i> and selling to other farms. |

Culturing seahorses (*Hippocampus kuda*) in Vietnam

Mr. Do Huu Hoang

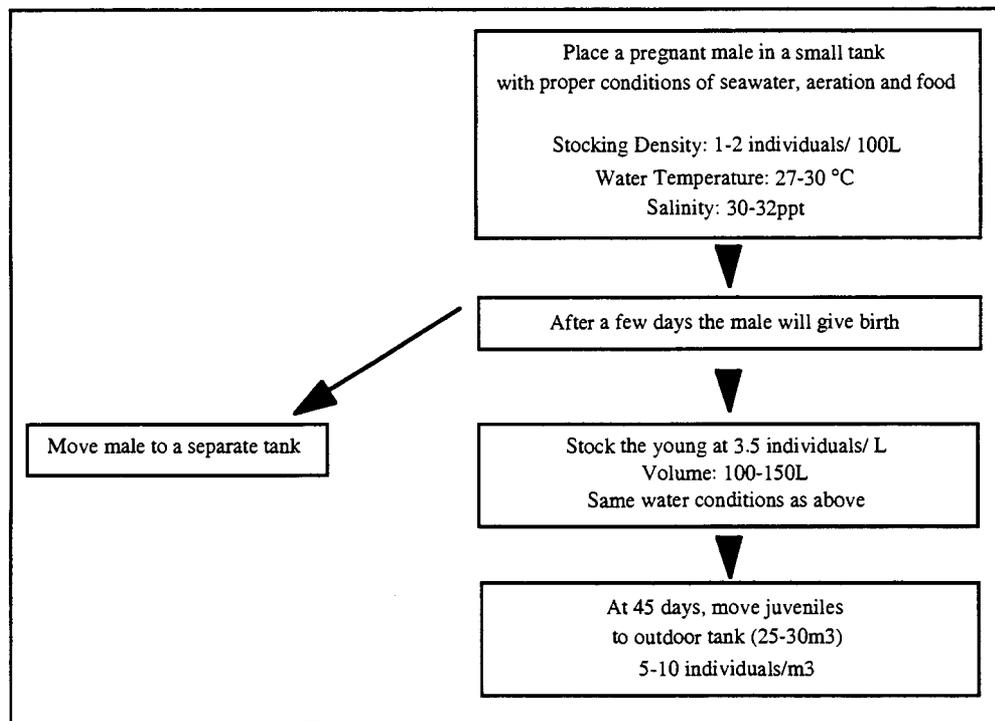
Institute of Oceanography, Nha Trang, Vietnam

The Project Seahorse-Vietnam team is working towards developing sustainable seahorse aquaculture for eventual transfer to fishing communities. The culturing project is unusual in being explicitly small scale, low technology and conservation-oriented. Do Huu Hoang here discusses the technical obstacles to successful seahorse culture, and notes a few encouraging results obtained by the team.

Many species are used as marine medicinals in Vietnam, including oysters, cuttlefish, abalone, seahorses, pearls, sea turtles and seaweed. Vietnam is a major seahorse exporter, but fishers are reporting numerical declines in local populations. For this reason, and to earn better incomes, fishers are interested in developing alternative livelihoods. Seahorse aquaculture is still quite new to Vietnam, and very difficult, but our team is trying to develop aquaculture techniques that could be easily transferred to the community. We hope that small-scale aquaculture will reduce pressure on wild seahorse populations, provide income to fishers, and perhaps meet market demand for seahorses.

Our general aquaculture scheme, from caring for pregnant males through to raising the juveniles in outdoor ponds, is presented in the following diagram:

Figure 2. Simple seahorse aquaculture protocol



Young seahorses can begin eating immediately after birth. From days 0 to 10, the young are fed copepods. At 10 days the juvenile seahorses can begin eating *Artemia* nauplii. After 45 days they are able to eat adult *Artemia* and mysids, and can be moved to the larger outdoor tanks.

Obstacles to Seahorse Culturing

There are many problems in seahorse culturing. At present, the majority of wild-caught broodstock seahorses we collect die after only a few days in captivity.

The greatest obstacle to seahorse culture is providing appropriate food. Seahorses will only accept live, moving prey. Work by the team has shown that captive adult *H. trimaculatus* and *H. spinosissimus* individuals fed with food collected from the wild selectively ate amphipods, palaemonids, and mysids. While these prey species are available from natural sources, supply is unpredictable. The team is presently working to develop *Artemia* cultures as a more reliable alternative to wild food harvesting. The *Artemia* are raised in salt ponds a short distance from the Institute. Over three months of operation, the ponds were able to produce 2-3kg wet weight of *Artemia* every four to five days.

A second problem in seahorse culture is disease. 'White-spot disease' is common in adults, and manifests itself as many white spots on the individual's tail. The cause of white-spot disease in seahorses is unknown. The disease can be treated with malachite green, by bathing seahorses in a 0.15-0.20ppm solution for two to three hours a day, on alternate days. We have a success rate of 70-80% if treatment begins early enough.

The young are prone to protozoan infestations, which first appear as white threads covering their tails, but spread over the entire body within a few days. The infestation hinders seahorses' movements, and individuals will usually die within a few days of contracting the parasite. Formalin is a possible treatment, and succeeds in some cases.

Adult male seahorses can suffer from air becoming trapped in their brood pouch. Air entrapment may be the result of males rising to the surface during courtship. If so, the problem might be avoided by keeping breeding adults in tanks deeper than 80cm.

While seahorse aquaculture provides one possible means of reducing pressure on wild populations, the Vietnamese team is also involved in:

- community education;
- seahorse biological research; and
- fisheries training, to encourage fishers to modify their fishing practices.

DISCUSSION

White-spot disease

Vorathep Muthuwan The disease that causes white-spot in freshwater fishes is known as 'ich', but in salt water is caused by another species. If you collect mixed species of copepods from the wild, you may have introduced a parasitic copepod species into your seahorse culture. We suspect that this is what happened in one of our experiments in which all our young seahorses died.

Aaron Lipton As a general point, there have been several mentions of disease in captive seahorses. Shrimps often escape from the hatcheries, and carry diseases with them to wild populations.

South African seahorses: consumption, threats and research problems

Ms. Jacqueline Lockyear

Department of Ichthyology and Fisheries Science, Rhodes University, Grahamstown, South Africa

The Knysna seahorse (Hippocampus capensis) is listed as Vulnerable on the 1996 Red List of Threatened Animals. Jacqueline Lockyear describes the threats facing this species, and her conservation-minded research into seahorse culturing techniques.

Six seahorse species have been recorded from South Africa. The East coast of the country has warmer water temperatures than the West coast, which could explain the occurrence in the area of the following five species:

Table 8. Seahorse species occurring on South Africa's East coast

Species	Location
<i>Hippocampus camelopardalis</i>	near Durban
<i>H. histrix</i>	near Durban
<i>H. whitei</i>	in northern Natal
<i>H. trimaculatus</i>	in Mossel Bay
<i>H. kuda</i>	in Mossel Bay

[Eds.: Some species names have changed as a result of the recent taxonomic revision of the genus].

The distribution of these five species has been based on isolated sightings and collections only, and the animals are generally not abundant. Many of the divers who have spent time in East coast waters have very rarely seen live seahorses on the local reefs. The East coast of South Africa may represent the distribution limits of these species. Seahorses might be washed down the East coast in the summer, with the warm currents, and then die out the following winter. This is known to occur for juveniles of other tropical fish species.

The sixth seahorse species found in the country is the endemic Knysna seahorse, *Hippocampus capensis*. *H. capensis* is a temperate, estuarine species, found primarily in the Knysna estuary. The species has also been recorded from surrounding estuaries (in particular the Swartvlei estuary), although their abundance in these areas is largely unknown. The Knysna estuary provides sheltered conditions to *H. capensis*, abundant *Zostera* seagrass beds, and water temperatures influenced by cold ocean currents.

Due to its limited distribution *H. capensis* has been listed as Vulnerable in the IUCN Red Book of Threatened Animals, and is also listed in South Africa's Red Data Book of Fishes. [Note added June 1999: A recent proposal was submitted to the IUCN requesting that the status of *H. capensis* be changed from Vulnerable to Endangered due to its exceptionally low distribution, vulnerability to floods and looming pollution effects].

Seahorse Consumption in South Africa

While there are numerous anecdotal reports of seahorses being used in TM in South Africa, the consumption level is considered very low. This is probably related to the limited availability of seahorses, but also to the beliefs of various ethnic groups which rely on TM. For example, the Xhosa people believe that anything washed up onto the shore or available in the intertidal zone may be collected as a gift from the gods, and used in TM. Seahorses used in Xhosa TM are therefore most probably collected dead and washed up on the shore after heavy storms.

There are also reports that marine organisms, possibly including seahorses, are collected as bycatch in Mozambique and traded within South Africa. These marine species are first transported to Swaziland, an independent state within the country, and from there distributed along the East coast of South Africa, particularly to the Kwazulu-Natal area.

Potential Threats to South African Seahorses

While TM does not appear to be a threat to South African seahorses, the growing domestic aquarium trade may become one in the future, especially for the easily-collected Knysna seahorse. Various South African laws and legislation do exist to protect seahorses and marine aquarium fish in general. For example, there are many MPAs established along the East coast of South Africa where the collection of marine organisms is prohibited. Where fish can be removed, collectors must have a permit, and are not allowed to take more than three individuals per year of any aquarium fish species. It is also illegal to remove a Knysna seahorse from the Knysna or Swartvlei estuaries, and this appears to be well-policed both by the local authorities and by the community.

At present, the major threats to the Knysna seahorse population include their narrow distribution and the vulnerability of their estuary habitat. Natural disturbances such as flooding could wipe out the existing population. In addition, there is growing concern over the development of industrial and tourism ventures around the estuary that could potentially cause a decline in water quality.

Aquaculture

The aquaculture of seahorses in South Africa is still at the experimental stage, focused on the Knysna seahorse, and far from moving to a commercial level. Reasons for working with the Knysna seahorse include the need to gather information on seahorse species in general, to meet the growing aquarium trade demand, and to prepare for any eventual re-stocking programs for the estuaries.

My own culturing work is at the experimental stage. I have 24 broodstock tanks, each with a pair of seahorses, in a closed, recirculating system of 3000L. The outflow from each tank moves through a settlement tank, and then a series of five biological filtration boxes containing filter mediums such as oyster shell, shredded plastic and downing. The water is then pumped into a sump, and then back into the tanks, with a percentage of the water constantly being diverted by a series of trickle towers. Each tank also has its own undergravel filtration unit.

The rearing experiments are conducted in smaller tanks which are linked to the same recirculating system.

Problems with Seahorse Culturing

Seahorse aquaculture presents a number of significant problems:

1. Maintaining constant supplies of live food with good nutritional value must never be underestimated. My broodstock were maintained on *Artemia* grown in outside porter pools or collected from the salt pans. In my experience food collection and production can be both time-consuming and unreliable. Food issues should be solved before embarking on seahorse culture, even on an experimental level. Otherwise, more time is spent on trying to feed the animals than on carrying out research.
2. Disease and health issues arise from an inadequate diet. My broodstock have been infected with tuberculosis (*Mycobacterium*), a progressive, systemic, currently untreatable disease common in captive fish. Symptoms vary, and include body ulcerations, nodules on internal organs and swollen swimbladders.
3. Seahorse researchers themselves may pose a problem by down-playing culturing difficulties in order to more easily obtain funding.

State of Knysna Seahorse Research

Based on experiments and personal observations, I consider the following to be the current reality and limitations of the aquaculture of *H. capensis*:

- The Knysna seahorse breeds readily in captivity throughout the year, provided correct temperature and light intensities are maintained. The physiological stress of maintaining animals in breeding conditions for extensive periods is unknown, however, and may have contributed to the development of tuberculosis.
- Young can be reared on *Artemia* at least up to 4 months of age with 50-80% survival (no data have been collected past this age).
- Growth rate of captive seahorses appears slow, but the natural rate is unknown. In captivity, the first generation can reach sexual maturity and do on occasion breed, although they do so at half the size of normal (i.e. wild) adults. Second generation captive offspring are smaller in both height and weight than first generation offspring, and survival is low. [Note added June 1999: Good growth and survival rates have been obtained recently for second generation seahorses, probably due to a change in diet from *Artemia* to euphorsids].
- The reproductive cycle of the Knysna seahorse has not been closed on a sustainable basis, most probably as a result of inadequate nutrition. [Note added June 1999: Progress has been made and the reproductive cycle has been closed, however more research is needed to determine how sustainable this is].

DISCUSSION

Growth

Zhenqiu Mai Do you know why the second generation is smaller than the first generation bred in captivity?

Jackie Lockyear I can only assume that it is because of inadequate nutrition.

Disease

Mark Wilson Is the tuberculosis present in the juveniles or the broodstock?

Jackie Lockyear Tuberculosis has only been confirmed in the broodstock, and not yet in the juveniles.

Mark Wilson Is it then a wise policy to consider releasing them into the wild?

Jackie Lockyear No one is allowed to release captive seahorses in the estuaries, although there is talk of restocking these areas. Nature conservation officials want to carry out more research first. At the very least, we need abundance studies.

Jeff Boehm Has anyone done any studies of diseases in wild populations, to compare with the captive situation?

Jackie Lockyear No. The tuberculosis is a recent discovery, but the disease has been isolated in other wild fish populations. I would be very interested to know whether the disease is present in wild *H. capensis* populations and has simply progressed faster because of captivity stress.

Survival rates

Grace Hilomen-Garcia How many broods are included in your figure of 50-80% survival?

Jackie Lockyear The figure was based on seven or eight trials and personal observations of the juveniles.

Session 6: Global issues

Marine conservation in Korea**Dr. Jong-Geel Je**

Korean Ocean Research and Development Institute, Seoul, Korea

Dr. Jong-Geel Je provides an Asian-based perspective on marine conservation, discussing the current state of marine environmental protection and education in Korea.

Korea's coastline encompasses a range of ecosystems due to its varied coastal profile and the presence of warm tropical currents. Algal forests are found along the East coast, huge tidal flats on the West coast, and unique soft coral communities off Cheju Island.

The most serious marine environmental problem in Korea today is the reclamation [*eds.*: i.e. sea-filling] of shallow water areas. Housing developments are being built on tidal flats, and coastal development in general is increasing. Pollution from industrial complexes located in coastal areas and habitat destruction through recreational activities are also important concerns. For example, tourist submersibles have destroyed soft coral communities near Cheju Island.

Marine Protected Areas (MPAs)

Marine conservation awareness began in Korea in the 1980s, largely among marine biologists, fisheries officials and underwater photographers. Presently, Korea's marine conservation activities focus on two areas:

1. The Tidal Flat of Kanghwa Island
(Very close to Seoul, located at the mouth of the Han river system).
This huge tidal flat encompasses a number of different types of salt marshes, and is a nesting and feeding ground for over 20 species of migratory birds travelling between Australia and Western Siberia. Fourteen of Korea's 24 tidal flat crab species are found here.
2. The Islets of Cheju Island
These islets are biologically distinct due to the presence of a warm tropical current. Marine biologists believe that the current brings many tropical and subtropical organisms to the area.

In Korea, several types of so-called Marine and Coastal Protected Areas (called National or Provincial Sea Parks) have been implemented. These are in fact land-based parks, with no focus on coastal or marine ecosystems. My colleagues and I have carried out a number of underwater surveys with the goal of establishing true MPAs in the country. Areas surveyed between 1991 and 1993 include:

- South Kanghwa Island (both the mudflat and the intertidal wetland)
- Ullung Island, in the Sea of Japan (rocky shore, intertidal and sublittoral zones)
- The Munsom area of Cheju Island
- Sohuksan Island in the Yellow Sea, the westernmost island of Korea.

Education

After receiving educational training in Australia, I returned home in 1995 and collaborated with groups such as Green Korea and other non-governmental organisations (NGOs) to develop marine environmental education programs. In its first year, less than 1000 people participated in these programs. Three years later, in 1998, 20 000 people were involved in the NGOs' educational activities. Green Korea is now one of the largest NGOs in the country. One of Green Korea's main

educational activities is organising beach clean-ups, which usually end in beach-trash sculpture contests whenever primary schoolchildren are involved.

I lecture to university classes occasionally in an effort to promote conservation and raise awareness of human impacts on the marine environment. I have also organised two workshops at the Korean Ocean Research and Development Institute on marine conservation themes. The first meeting involved an exchange between Australian and Korean researchers, while the second brought together Korean science teachers and NGOs in order to develop marine conservation educational programs for the country's primary and secondary schools.

DISCUSSION

Fisheries in Korea

- Marivic Pajaro I would like to ask if there are problems in Korea due to the use of fine-meshed nets, trawling, or other destructive forms of fishing?
- Jong-Geel Je Many fishers overfish, and trawling with small sized nets to catch juveniles is one of our big problems in Korean marine conservation. Fishers are hard to control because they catch fish for their livelihood.
- Jokkeng Lee Is TM a problem for marine conservation in Korea?
- Jong-Geel Je As was said yesterday, we use marine TM species in very few places in Korea. I think only abalone and cuttlebone are collected from Korean waters for use in TM. Other things are imported from other countries, but we have no data about that. We have no problem from TM in Korea for marine conservation.

Australian concerns for marine medicinal use of syngnathids

Mr. Peter McGlone

World Wide Fund for Nature Australia, Hobart, Australia

Nearly half of the world's 220 syngnathid species, including the only two seadragon species in the world, occur in Australian waters. This gives the country a unique responsibility towards syngnathids, says Peter McGlone. His discussion of Australian legislation relating to syngnathid conservation, and the country's growing interest in aquaculture, point to ways in which the developed world can have an impact on subsistence marine medicinal fisheries.

Australian Syngnathid Conservation Efforts

In 1994, conservation groups in Australia began making approaches to state and federal governments to introduce controls on the collection of seadragons. Officials scoffed at the idea of protecting fish, which they perceived not as wildlife, but as food. However, the media attention generated by the publication of Amanda Vincent's trade report¹ generated ongoing concern and interest for syngnathid conservation in Australia. Without intending to, this publicity has probably created a somewhat negative view of TM among the general Australian public, an impression conservation groups have been trying to overcome in recent years. As no one in Australia depends on syngnathid species for their livelihood, conservationists allow themselves to be belligerent in demanding strong controls over them.

At the state level, marine species in Australia are generally not protected by legislation, with syngnathids being one exception.

- In Tasmania, all syngnathid species are protected.
- There is a proposal in Victoria to protect all syngnathid species. [Note added June 1999: The proposal passed into law in August 1998].
- The weedy seadragon is protected in New South Wales.
- Western and South Australia protect the leafy seadragon.
- Northern Territory and Queensland have no regulations to control the collection of syngnathids.

On January 1 1998, all syngnathids became subject to national export control legislation in Australia. This made syngnathids the first marine fishes to be moved onto Australia's Wildlife Protection Act (WPA). The decision allows for the regulation and monitoring of the export (but not import) of live and dead syngnathids through the issuing of permits. These federal controls are potentially very strong, but could just as easily be very weak depending on the level of enforcement by the authorities.

Syngnathid Exporters

A number of companies in Australia deal in syngnathid products. In Western Australia, there are 17 licensed syngnathid collectors who are allowed to export all species but the leafy seadragon. Eight companies in Queensland sell pipefish caught as bycatch to the overseas TM trade, some of which are caught in the Great Barrier Reef National Park. Five Australian companies are attempting commercial seahorse aquaculture.

Australian Aquaculture

Australian aquaculture projects are of growing concern to conservationists. Large-scale, profit-driven aquaculture may disrupt or halt the development of sustainable aquaculture in countries where seahorses are the target of subsistence fisheries. At the moment, the Australian example shows that conservationists do not have control as to how and why seahorse aquaculture is developing.

¹ A. C. J. Vincent. The international trade in seahorses. TRAFFIC International. vii + 163pp.

One Tasmanian company in particular well demonstrates the potential problems with seahorse aquaculture in the developed world. The company promises to supply the international TCM market with millions of pot-bellied seahorses (*Hippocampus abdominalis*), but has yet to produce convincing evidence that they have the technical skills to do so. Nonetheless, the company has won export approval from the Commonwealth agency responsible for administering the controls of the WPA. The Tasmania Conservation Trust (a non-governmental organisation), is currently appealing the export permit on the basis of environmental concerns. These include:

- the removal of 600 broodstock from the wild, where there is no knowledge of how this may impact wild populations of *H. abdominalis*;
- the near complete lack of documented scientific research supporting their proposal, suggesting the project will fail;
- the increase in interest for syngnathid products in Australia as a result of the company's claims of millions of dollars of potential income and huge publicity, possibly encouraging other similar ventures;
- the difficulty of distinguishing cultured seahorses from wild ones, rendering it difficult to enforce protective legislation.

Apart from questions of ecological sustainability, I have two additional problems with the seahorse aquaculture plans of Australian companies:

1. Companies have not taken into consideration the impact of their aquaculture ventures on people who currently fish these species. Companies claim that they will save seahorses, without even talking to those communities concerned. (To be fair, the export legislation does not require companies to address these types of socio-economic concerns).
2. Companies assume that producing large numbers of seahorses and selling these in the international market will be automatically beneficial to wild animals. If it's true that markets cannot be completely supplied [*eds.*: see A. Vincent's presentation for a discussion of the seahorse trade], a proposal such as that of the Tasmanian company may just top up what is currently taken from the wild.

Conclusion

Even though the Tasmanian proposal is highly questionable, we need to consider what would happen if a large-scale, profit-driven aquaculture company ever did succeed in producing significant numbers of seahorses:

1. What would be the impact on wild animals, the seahorse market and small scale aquaculture?
2. How appropriate is it to call on governments to limit such aquaculture proposals, to involve governments in the development of aquaculture protocols, and in the development of action plans for the management of seahorses and other marine medicinals?

A difficulty for conservationists in Australia is that neither the government nor the media want to address the negative aspects of seahorse aquaculture, and they certainly do not want to hear how a big Australian company is going to affect the livelihood of other Asian people. I need your help to raise awareness of these concerns in Australia.

A detailed paper on legislative protection of syngnathids in Australia is available from the author.

DISCUSSION*Market concerns*

- Heather Hall In the export permit applications submitted by the seahorse aquaculture companies, did they indicate the markets they were targeting, and secondly, do they know whether *H. abdominalis* is in demand for TCM?
- Amanda Vincent The companies did indicate that they expect most of their product to go to Hong Kong.
- Jokkeng Lee TCM traders don't purchase items according to species, but in terms of size and structural recognition. Larger seahorses are more valuable, as are seahorses with rounder bellies, those that are nice and clean, and that are structurally intact. We do pick and choose, but not based on Latin zoological terminology.
- Amanda Vincent I've never seen this big-bellied seahorse species [*eds.: H. abdominalis*] in use in TCM anywhere in the world. Aquaculture might create a demand for a species not currently exploited for TCM, and with slow reproduction, which is a concern.
- Marivic Pajaro Does 'round-bellied' mean pregnant males?
- Jokkeng Lee I don't know that detail. I don't make the purchases, and also it's important to realise that from the harvest in the wild to the retailers, there are several other people involved. The traders are wholesalers. By the time the product reaches us, the retailers, we don't have much control except to say "Yes we want that" or "No, we don't".
- Zhenqiu Mai According to TCM, the bigger the better, no matter what kind of seahorse. We consider the big-bellied seahorse to be pregnant males. The best quality seahorses are yellowish. *H. trimaculatus* is the most commonly used seahorse in China.

Marine medicinals in the aquarium trade

Mr. Douglas I. Warmolts

Columbus Zoological Park Association, Powell, Ohio, USA

Wild seahorse populations are threatened not only by traditional medicine (TM), but also by the aquarium trade. The same could be true for a number of other marine medicinals as well. Douglas Warmolts examines the growing trade in aquarium organisms, particularly in North America, and the ways in which public aquaria can contribute to the conservation of marine resources.

The international aquarium trade supplies both individual home hobbyists and large public aquaria with marine fishes (primarily tropical ornamentals), live coral and invertebrates. Although this trade is relatively small in comparison to the trade in live food fish and other fishery products, it is high profile and growing very rapidly.

- Global retail value of the trade in aquarium organisms and equipment is estimated at US\$7 billion.
- The market for marine ornamental fish and invertebrates, world-wide, is estimated at US\$100 million.
- Over 800 fish species and an unknown number of invertebrates are involved in the trade.
- It is estimated that 99% of the marine species in the aquarium trade are wild-caught, with only very few species captive bred.
- The United States imports more than 60% of the marine fish and invertebrates in the international aquarium trade. Of these, 99% are purchased by individual home hobbyists and 1% by public aquaria.

The North American Aquarium Hobby

In the United States, one out of every ten homes keeps fish as pets, with 40% of these homes having more than two tanks. Tanks are used almost as decorative furniture pieces in the home, and can also be found in offices and restaurants. Virtually all fish and invertebrates in hobbyist tanks are purchased from pet and aquarium stores.

Over the last decade, advances in filtration systems have meant that hobbyists can now purchase whole marine aquarium systems, often without having had previous experience with easier, freshwater systems. As an aquarium curator I receive many inquiries from people who do not know how to take care of their animals or their tank system.

A 150 gallon (40L) mini-reef system is typical of a North American home aquarium. The tank itself, including the lights and the filtration, can cost from US\$2000-5000, and even upwards of US\$10 000. With the purchase of live rock (much of it wild-harvested), corals, fish and other invertebrates, the home hobbyist can easily spend this amount over again. Smaller systems can of course be bought for much less (around US\$750).

Hobbyists commonly keep inappropriate species in small home aquaria, such as sharks. When these fish become too large to keep, their owners ask public aquaria to accept them. Other organisms kept by hobbyists include angelfish and tridacnid clams. Cultured tridacnid clams are sold in North America, but there seems to be a feeling among hobbyists that these are not as attractive as wild-caught ones, as their zooxanthellae are reportedly less vibrant.

Over the last decade, the proportion of fish to invertebrates in the aquarium trade has shifted. Where previously fish would make up 90% of a store's inventory and invertebrates only 10%, today the proportions are roughly equal, with no decrease in the number of fish carried by the store.

Public Aquaria's Role in Conservation

In the past ten years, the number of public aquaria built or expanded has risen dramatically world-wide, partly as a result of the public's growing fascination with the ocean. In 1997, the 185 North

American institutions belonging to the American Zoo and Aquarium Association (AZA) reported a combined attendance of over 122 million people.

As a result of their popularity, zoos and public aquaria are uniquely situated to present current educational information on environmental conservation through their exhibits and graphics.

Education

Zoos and aquaria can be involved in public education programs through community outreach programs, teacher workshops, publications, special exhibits and public information campaigns. For example, the Columbus Zoo has developed a marine conservation education kit, which local teachers can borrow to use in their schools. I brought one with me to donate to the Handumon seahorse conservation project. These kits are very simple to make, and are one way public aquaria can help the conservation movement.

Certain aquaria use eco-labelling to educate home hobbyists visiting their facilities. Signs in the aquarium exhibit tell potential consumers whether the fish on display is a 'good' fish or a 'bad' fish to keep at home. Many public aquaria also offer workshops and education opportunities for hobbyists to learn how to keep their animals appropriately.

Fundraising and Research

Zoos and aquaria can raise funds for, and be involved in, field conservation and research through collaborations with universities and conservation organisations. Dr. Heather Hall and Dr. Gordon Reid, for example, are involved in a collaborative effort by United Kingdom and Mexican institutions to protect endangered livebearers in Mexico. Zoos and aquaria can also serve as fora for discussions on environmental issues, aid in the captive propagation of target species (e.g. Lake Victoria cichlids), and develop new technologies, especially those related to aquarium science.

Conclusion

The aquarium trade acquires almost all of its marine organisms from the wild, and is arguably responsible for any resulting habitat degradation. The trade is in direct competition with the medicinal and live food fish trades for marine organisms, and so contributes to the pressure on wild populations. The current state of tropical ornamental species' aquaculture cannot meet the aquarium trade's demand. It is thus in the best interest of the aquarium trade to help seek solutions for the wise management of marine resources. Zoos and public aquaria can contribute to this effort through:

- public education and outreach;
- fundraising to support field conservation and research; and
- research in areas relevant to marine ornamentals (including reproduction, culture and maintenance, nutrition, pathogenesis and disease, and aquarium science).

DISCUSSION

Eco-labelling

Rene Ledesma Regarding the eco-labelling for fishes, is it a private initiative of your aquarium or a US-government effort?

Douglas Warmolts Within Europe and North America, most of the zoos and aquaria belong to associations, through which we meet and collaborate on efforts. We have formed what we refer to as Taxon Advisory Groups (TAGs), to collectively design conservation initiatives. The Marine Fishes TAG developed the idea of eco-labelling. It has met with mixed success, and is something we should continue to look at.

A separate North American organisation, primarily driven by the pet industry, the Marine Fish Aquarium Council (MFAC) is developing a

DISCUSSION (continued)

Doug Warmolts
(continued)

certification process for retail stores. The certification means that a store's owner and employees have received a certain level of training in how to keep animals and train consumers. The public aquaria are peripherally involved, and offering to help where we can.

[Eds.: MFAC is now known simply as MAC, the Marine Aquarium Fish Council. It is a non-profit organisation composed of representatives of the aquarium industry, hobbyists, conservation organisations, government agencies and public aquariums, with the goal of ensuring a sustainable future for the marine aquarium industry, organisms and habitat through market incentives that encourage and support sustainable practices].

Review Session

Day 2

On the afternoon of Day 2, participants travelled to an open-air meeting facility in the hills of Cebu City, run by the Philippines' Department of Environment and Natural Resources. The change of location also signalled a change in the emphasis of the workshop process: from active listening to active discussion.

Chart Summaries

On the first morning of the workshop, participants were briefed on an information-gathering project designed by workshop organisers. Two charts covered an entire wall of the main workshop room. These were essentially spreadsheets on the topics of (1) Marine Medicinals and (2) Seahorse Aquaculture, displaying data gathered by Project Seahorse in the months leading up to the meeting. Participants were asked to add any information they could to the charts during workshop breaks. After a brief introduction by the facilitator, Allison Perry opened the session at Campo Forestal by reviewing the new information contributed by participants to the databases.

A. Perry began by thanking everyone for their contributions to the marine medicinals and seahorse aquaculture charts. In particular, she thanked Hanchen Zheng for his months of research towards compiling a list of 415 marine species used historically in TCM. Other major contributions came from Aaron Lipton (a detailed list of marine medicinals and their uses, as recorded in Ayurvedic, Unani and Siddha TM texts, along with samples) and Jackie Lockyear (the translation and distribution of A. Perry's original marine medicinal questionnaire to South African tribal groups). Do Huu Hoang, Truong Si Ky, Young-Jong Lee and Salome Quijano each provided information on the use of marine medicinals in use in their respective countries.

Ali Hafiz al Qodri, Suraphol Chalarkid, Glenn Moore and Chris Woods filled in details of seahorse survival, growth and reproduction on the seahorse aquaculture chart, for which they were thanked.

A. Perry closed by highlighting some of the more interesting new examples of marine medicinal use given by participants, and thanked each again for the time they devoted to their workshop preparations.

Summary of Workshop Presentations

Reviewing and looking ahead

Dr. Heather J. Hall

Zoological Society of London, London, UK.

Heather Hall here summarises and integrates the information gathered from participants' talks over the previous day and a half, in order to direct subsequent workshop discussions.

This workshop provided the mechanism for communication among the different stakeholders involved with the use of marine species in TM. The 35 participants from 17 countries and territories at this meeting represent the fields of TM practice, trade and supply, of conservation, biology, aquaculture and public aquaria. These are communities that would never normally have the opportunity or forum to meet and discuss a common interest and its associated issues. The purpose of this paper is to summarise the main themes, distil the key points from the participants' presentations and focus everyone's thoughts for the workshop discussion sessions that follow.

The Workshop Process

This workshop process has been designed to be proactive rather than reactive, to enable discussion before conflict arises, and to develop solutions before any one species is in imminent danger of extinction. This meeting provides the opportunity to combine the ideas and thoughts of those who have identified the problem with those who have the key to the solution. As Jokkeng Lee stated, we have lost the key in a dark room and, rather than groping for the key, we are looking for the room's light switch. Participants arrived at the workshop having done a considerable amount of preparatory work, from reading the extensive briefing documents to collecting regional information and data. Wide-ranging options for management and improved sustainability in our use of marine resources in TM have been outlined in a number of the presentations, from managing supply, adjusting demand, managing the resource, conserving the habitat, and providing appropriate education at all levels.

In the workshop's opening presentation, Amanda Vincent cited seahorses extensively as a model for many marine conservation issues, and as one of the few marine species for which we have some data on their trade and use in TM. Allison Perry, Amanda Vincent and others repeatedly highlighted the fact that we know relatively little about the use of many marine species in TM, and therefore have to use the seahorse as our example, extrapolating these data where appropriate.

Misconceptions Surrounding TM

Many of the issues raised by participants related to the perception of TM by outsiders and, in particular, the way TM is portrayed by the media. Although TM is often blamed for declines in medicinal species, TM is in fact just one type of resource demand. If we are addressing the problems of overconsumption of wild marine species, the food fishery should be considered as a far greater problem. Time and again we heard examples of some of the misconceptions: Jokkeng Lee, Endi Zhang and Samuel Lee described the common, but incorrect, belief that TM is primarily used as an aphrodisiac, and is a 'hocus pocus' medicine that is somehow inferior to Western treatments. In practice, 80% of the world's population uses TM, and, as Allison Perry explained, one third of the population of the USA uses some kind of alternative medicinal treatment. The problem of marine medicinal over-exploitation is not exclusively a Chinese or Asian issue.

TM is often used as a scapegoat even though Western countries do not even understand the basic principles of this approach to medicine. Many of the Western participants at the workshop, including Mark Wilson, Glenn Moore, Jeff Boehm and myself, have looked for the medical properties to be based on a single recognisable ingredient from a single identifiable species. Hanchen Zheng explained that TCM is actually based on the whole animal or plant and its qualities, and complex testing of the medicinal's value is based on tens, hundreds, or thousands of years of careful practice.

Clear Communication

Obviously, cultural differences exist among participants. Many of the cultures represented here consider that plants and animals are for human use, so the concept of wildlife conservation as promoted by other cultures can be difficult to accept. These differences can be further complicated by confused terminology. Allison Perry reported that the term 'herbs' is used to describe both plants and animals used in TM, while in the West the term refers to plants that are primarily used to season foods. Similarly, the word 'seadragon' in Australia is applied to two endemic species of syngnathid, while in TM this word is used to describe several species of pipefish.

Samuel Lee highlighted the importance of accurate communication channels: TM communities are often the last to know about legislation affecting their health and livelihood needs. Legislation is usually developed without prior consultation or warning and published in English, leaving no opportunity for TM practitioners to comment, respond and voluntarily adjust their practices.

Information Exchange

To change the perception of TM (and to specifically target the misconceptions), the stakeholders represented at this workshop need to speak in a united voice to dispel myths and encourage the

exchange of information between the conservation and TM communities. We need to identify the best way to ensure accurate and up-to-date information is exchanged between ourselves and then disseminated to a wider audience. This means recognising the current gaps in communication channels and identifying ways they can be overcome.

Use of Marine Species in TM

Jokkeng Lee outlined the importance of understanding both the content (what marine species are being used) and context (how they are being used in each culture) of marine species use in TM. A number of other participants (Zhenqiu Mai, Jackie Lockyear, Young-Jong Lee) described some of the different uses of these species for TM, indicating the wide range of demands for marine medicinals and the variety of controls that may be required to improve the sustainability of their use. In Korea, (as explained by Young-Jong Lee) only a small number of marine species are in common use, and their application depends on the individual. As each person is different, a product that is good for one person is not necessarily good for another. Zhenqiu Mai suggested that for ingredients in TCM prescriptions, big is often better (referring to seahorses in particular), whereas Bertha Mo noted that for patent medicines the size of the animal is irrelevant. Controls required in each case therefore will have to be different. In South Africa, Jackie Lockyear explained, cultural beliefs may actually help marine species conservation, as only intertidal species or those washed ashore can be used in local TM.

Trade in Marine Species

As well as understanding the method of use of marine species in different types of TM, data on the level of consumption and an understanding of the trade routes are also critical. Aaron Lipton reported that the marine species trade is expanding in India, both in species and numbers, especially for high value species and parts such as pipefishes, seahorses and swimbladders. Jokkeng Lee confirmed that there were clear regional differences in the demand for different species: Of the eight marine medicinal species carried by the Malaysian branch of Eu Yan Sang, only a few of these are traded in the Hong Kong store. Endi Zhang gave evidence that there is an increased demand for small seahorse species and/or individuals for use in patent medicines in China. Most of these seahorses are imported to the country. In Korea, Young-Jong Lee said that the economics of the fishery and current market forces mean that it is not viable to use local seahorse species in TM. Vincent Chen reported a decrease in the price of seahorses imported to Taiwan over time. Amanda Vincent added some words of caution in interpreting some of these trends, as the facts may be misleading. For example, importers may declare lower prices in order to avoid taxes, and stores that have been holding unsold stock on their shelves for a long time may appear to carry and trade large numbers of a particular species.

Up-to-date and accurate information is essential, as species that we may be worried about now may actually no be used in the trade. Hanchen Zheng conducted extensive research and supplied information on 415 marine species used in the TCM trade and confirmed the need to keep updated information. Participants agreed that trade restrictions may help, though this depended on an accurate understanding of the trade. The workshop participants need to develop the mechanisms to continue the exchange and updating of trade information. Amanda Vincent's TRAFFIC report provides a good example of the impact of trade data, and the potential utility of the workshop discussions and outputs must also be considered.

Community Involvement

As Allison Perry summarised, the use of marine species in TM is widespread and, thanks to the information provided by participants, we are beginning to build a picture of what types of marine plants and animals are being utilised. These trade and consumption data need to consider both the resources and the local communities who rely on them if the trade is to be sustained. Marivic Pajaro clearly explained that when considering the source of TM species (i.e. the animal in the ocean) we must also consider how that species is being caught and by whom, and the implications of any proposed actions on those dependent communities. Both Marivic Pajaro and Salome Quijano focused their talks on the dependence of poor, subsistence fishing communities in the Philippines on

the seahorse fishery. This local example can be applied to many other traditional fisheries around the world, such as those described by Aaron Lipton in India. In developing any management options, we can not ignore this fundamental link in the chain and must always draw on local knowledge. We can learn from examples of work in local communities involving education, monitoring and habitat initiatives, and the planning and implementation of MPAs.

Aquaculture

One key initiative discussed by participants was to use aquaculture as a practical approach to deal with some of the problems of overexploitation. 'Wild is better' was one important reservation, held by both the TCM users (as explained by Zhenqiu Mai) and in some cases the aquarium trade, with examples (such as giant clams) given by Doug Warmolts. Aquaculture is certainly not straightforward, as Endi Zhang illustrated with his example of the complete collapse of all seahorse farms in China. From a Western perspective, Peter McGlone expressed reservations about the unrealistic expectations and hence potential problems that might be experienced by a new large-scale seahorse farming initiative in Australia. Philippe Dhert explained that the global increase in aquaculture was a general response to the decrease in wild stocks. He encouraged the 'backyard hatchery' approach, but highlighted the importance of information exchange on research and development (e.g. into topics of diet and disease) among initiatives. Rudi Bijmens, Jackie Lockyear and Do Huu Hoang added that the obstacles to achieving sustainable aquaculture may not be culturing the animal itself, but resolving the problem of providing appropriate food and controlling diseases. Another concern expressed by both Jackie Lockyear and Peter McGlone was that the pressure and competition for funds to develop aquaculture resulted in people overstating their successes.

This workshop needs to consider the more general issues surrounding the development of aquaculture in response to the needs of TM communities for marine species: Is large-scale or small-scale culturing more appropriate? What are the needs and demands of the TM community? Is the proposed aquaculture venture aiming primarily for commercial or conservation success? Does aquaculture provide a real alternative to the exploitation of wild resources and what are the implications of the associated economic issues? Whatever the questions and issues, they must be discussed within some forum that enables and encourages information exchange. The exchange of accurate information on aquaculture will allow us to maximise technical advances and develop appropriate community-level initiatives.

Legislation

Legislation is one route that must inevitably be discussed and considered, from trade to aquaculture controls. Peter McGlone gave the example of wildlife legislation protecting syngnathids introduced in Australia without concern about affecting people's livelihoods. He recognised that extending or copying this example to other parts of the world where communities do depend on syngnathids could not necessarily be done without considering the human element of wildlife conservation. Rene Ledesma supported this conclusion and explained that Philippines legislation relating to the sustainable use of national resources respects the rights and knowledge of local people. Where there is a potentially valuable product identified, appropriate benefits must return to local communities.

Legislative anomalies occur in the Philippines for seahorses used in TM, as they can be classified under three different categories (food, souvenirs or live). An understanding of the trade routes is also varied. Jokkeng Lee believed that documenting trade routes and developing appropriate restrictions would be one practical legislative approach. Young-Jong Lee suggested that we should look at placing controls on the middle men who are responsible for implementing the huge price differences between the primary supplier and the end user. Jackie Lockyear added that some species are theoretically well protected by legislation, but that pressure should be applied to ensure that the legislation is utilised and enforced.

Conclusion: Looking for Solutions

To summarise, workshop participants have presented information to show that TM is just one use of

marine species and is rarely, if ever, solely responsible for species endangerment. There are many other issues that may have a much greater impact, such as the habitat destruction described by Jong-Geel Je in Korea, or the pressure of increasing human populations, as outlined by Salome Quijano in relation to the large family sizes in Philippine fishing communities. We need to look at possible solutions: Greater education can be achieved through public education initiatives in vulnerable habitats (Jong-Geel Je), by encouraging interactions between fishing communities (Marivic Pajaro), by community initiatives such as those in Vietnam (Do Huu Hoang) and by reaching the millions of people who visit public aquaria every year (Doug Warmolts). Habitat protection will be essential if species are to be conserved and in some cases, it may be habitat loss rather than overexploitation that is the primary cause of a species' decline (e.g. the Knysna seahorse in South Africa, as described by Jackie Lockyear). Options for habitat protection and recovery were given by examples from Korea (Jong-Geel Je) and the Philippines (Marivic Pajaro).

Our objective for the rest of the workshop must be to utilise the enormous diversity of expertise, backgrounds and cultures represented by participants to develop ways in which we can work towards a common goal of the sustainable use of marine species in TM. A variety of creative initiatives will be required, but we have the opportunity to work within this forum of constructive dialogue and information exchange to generate a positive response to the issues concerning the use of marine species in TM.

Question Period

Amanda Vincent led the discussion period following H. Hall's presentation, asking questions to specific participants in order for the group to gain a better understanding of their differing opinions and experiences.

Question 1	Asked to: Aquaculturists
What are the survival and growth rates of your captive-born seahorses, and the reproductive rate of your broodstock?	

Participant & Species	Survival Rate	Reproductive Rate	Growth Rate	Notes
Chris Woods Reported at Workshop <i>H. abdominalis</i>	<ul style="list-style-type: none"> • 20% at 90d • 15% at 180d • 15% at 270d 	<ul style="list-style-type: none"> • not yet sexually mature at 11cm • 270 young/ brood 		Survival rate 80% at 30d for F2, compared with 32.5% at 30d for F1
Reported June 1999 <i>H. abdominalis</i>	<ul style="list-style-type: none"> • 15% at 90d • 11.2% at 180d • 10.8% at 270d • 10.6% at 365d 	<ul style="list-style-type: none"> • adults 11-13cm: 40 young/ brood (F2) • adults >20cm: 270 young/ brood (F1) 	<ul style="list-style-type: none"> • sexually mature at 11cm (3.4g) • 4.8cm, 0.36g at 90d • 7.9cm, 1.02g at 180d • 9.3cm, 1.96g at 270d • 11cm, 3.4g at 365d 	
Glenn Moore Reported at Workshop <i>H. angustus</i>	<ul style="list-style-type: none"> • 0% at 5d • Tried varied diets and filtration systems 	<ul style="list-style-type: none"> • 200-500 young/ brood 		
Jackie Lockyear Reported at Workshop <i>H. capensis</i>	<ul style="list-style-type: none"> • 60-90% at 35d • 50-80% at 120d 	<ul style="list-style-type: none"> • young/ brood average: 50 • range: 7-125 • breed year-round, 6 broods/ year at 8-10cm length 	<ul style="list-style-type: none"> • sexually mature at 6-8 months (5-6cm length) 	
Reported June 1999 <i>H. capensis</i>		<ul style="list-style-type: none"> • young/ brood average: 40 • range: 7-125 	<ul style="list-style-type: none"> • sexually mature between 5-6 months • 6.5cm, 0.95g at 10 weeks 	
Ali Hafiz al Qodri Reported at Workshop <i>H. kuda</i>	<ul style="list-style-type: none"> • 30% at 30d • 10% at 90d 	<ul style="list-style-type: none"> • ~ 400 young/ brood • 5 broods/ year 		

Question 1 (continued)

Participant & Species	Survival Rate	Reproductive Rate	Growth Rate	Notes
Rudi Bijens Reported at Workshop <i>H. kuda</i>	<ul style="list-style-type: none"> • 0% In week 1, young could not digest <i>Artemia</i> instar I nauplii.			Work on seahorses has stopped, as project priorities have changed
Reported June 1999 <i>H. kuda</i>	<ul style="list-style-type: none"> • 0% at 14d • (100% survival at 1.5 years for wild-caught broodstock) 			
Truong Si Ky Reported at Workshop <i>H. kuda</i>	<ul style="list-style-type: none"> • 80% at 120d 	<ul style="list-style-type: none"> • 1200 young/ brood • 6 broods in 4 months 	<ul style="list-style-type: none"> • sexual maturity at 6 months (12cm, 8g) 	Results reported at workshop and those for June 1999 cannot be compared, as seahorses were kept under different conditions.
Reported June 1999 <i>H. kuda</i>	<ul style="list-style-type: none"> • 71% at 210d (n=1500, from 1 brood) 		<ul style="list-style-type: none"> • sexual maturity at 7 months: 8.82cm +/- 0.76 2.88g +/- 0.78 	
Grace Hilomen-Garcia Reported at Workshop <i>H. barbouri</i>	<ul style="list-style-type: none"> • 51% at 10d • 20% at 30d (n=42) See Notes	<ul style="list-style-type: none"> • 3-300 young/ brood 	<ul style="list-style-type: none"> • sexually mature at 4 months 	Survival is expressed as the % of batches showing greater than 70% survival at 10d and at 30d
<i>H. kuda</i>	<ul style="list-style-type: none"> • 10% at 10d • 4% at 30d (n=43) See Notes	<ul style="list-style-type: none"> • 1500 young/ brood 		
Reported June 1999 <i>H. barbouri</i>	<ul style="list-style-type: none"> • mean: 60% at 10d • range: 0-100% (n=46) • mean: 33% at 30d • range: 0-100% (n=36) 			

Question 1 (continued)

Participant & Species	Survival Rate	Reproductive Rate	Growth Rate	Notes
Grace Hilomen-Garcia Reported June 1999 <i>H. kuda</i>	<ul style="list-style-type: none"> • mean: 13.8% at 10d range: 0-91.7% (n=42) mean: 7.3% at 30d range: 0-84.4% (n=42) 		<ul style="list-style-type: none"> • sexually mature at 8 months 	
Vorathep Muthuwan Reported at Workshop <i>H. kuda</i>	<ul style="list-style-type: none"> • 40% at 90d 90% at 90d Rate: 90% at 90d if intensive care is taken. 	<ul style="list-style-type: none"> • 250-500 young/ brood 	<ul style="list-style-type: none"> • sexually mature at 8 months 	Fed frozen mysid shrimp once a day, or live adult <i>Artemia</i> when mysids unavailable.
Reported June 1999 <i>H. kuda</i>		<ul style="list-style-type: none"> • breed all year round but peak in cool season • 150-600 young/ brood • gestation: 12-14d, water T° not given • males have broods 1 month apart 		
Mark Wilson Reported at Workshop <i>H. fuscus</i>	<ul style="list-style-type: none"> • 100% at 106d (n=33) 			Careful hygiene & feeding technique (<i>Artemia</i> and copepods). Also kept <i>H. kuda</i> and <i>H. comes</i>
<i>H. histrix</i>	<ul style="list-style-type: none"> • 100% at 106d (n=33) 			
<i>H. reidi</i>	<ul style="list-style-type: none"> • 100% at 106d (n=33) 			

Question 2	Asked to: TM traders and ethnic Chinese participants
Have you had any previous experience with conservation groups?	

Vincent Chen: I have had a different experience from the one at this workshop, and not a very good one. The TCM community feels that conservation groups pushed the government to prohibit the use of tiger balm, bear gall bladders, and other medicinals. This legislation has had a big impact on the Taiwanese TCM community. They cannot change the law, and neither can they say that conservation is wrong. The result is that the TCM community feels reluctant to share their opinions on conservation, impeding communication between the two sides.

–Taiwan, Programme Officer, TRAFFIC-East Asia, Taipei

Young-Jong Lee: TM is not a threat to conservation communities. In Korea's case there are many kinds of products used in TM that are cultivated. A few animal products, such as musk and deer antlers, are under strict government regulations. In the case of seahorses, they are not listed on CITES. We should consider management options, and the outcomes from this workshop could contribute to developing legislation.

–Korea, Professor, Department of Herbology,
Kyung Won University

Jokkeng Lee: This is the second workshop between the TCM community and conservationists that I have attended. I attended a workshop before on tiger bone and musk. The flavour of the two workshops is different. The other one had a lot of pointing fingers and pressure, and was a bit nervous, while here the atmosphere is relaxed and co-operative. Maybe it's because we're in the Philippines.

I really don't like the sound of 'TRAFFIC'. It puts up barriers. If you enter a TCM shop and say that you work for TRAFFIC, the name is very official-sounding, as if you were a traffic police officer approaching the shopkeeper for a serious offence. People will not believe that the information they give you will be kept confidential, and will refuse to help you.

On this subject matter, I would note that seahorses are just threatened species, unlike tigers which are not allowed to be used.

–Malaysia, Education and Development Executive,
Eu Yan Sang

Jeff Boehm [to Jokkeng Lee]: What do you think makes the mood different at this workshop? Is it the composition of the group or the subject matter?

–USA, Director of Research and Veterinary Services,
John G. Shedd Aquarium

Jokkeng Lee: Both. We can still talk about seahorses as they are not near extinction. At the other workshop, tiger bone had been out of trade for 10 years, and we were very surprised by the meeting. Or maybe it's just a geographic reason. The other conference was in Hong Kong, and this one is in the Philippines.

Endi Zhang: In mainland China there are 400 universities that teach TCM and a huge amount of graduates each year. After graduation, they are licensed TCM practitioners. Others don't even have any formal training, but learn from TCM practitioners. In our surveys of folk medicine use in Shanghai we interviewed students of TCM, practitioners and others. Most people were aware of the necessity of not using endangered species. Among the students surveyed, less than 70% believed that TCM actually works. This is due to the fact that in earlier subjects, they took up science (e.g. anatomy, biology) which conflicts with the study of "chi". TCM is changing. People do not choose to use animal-based animals anymore, unless these are prescribed to them. Practitioners are the key to conservation.

–P. R. China, Director, Asian Conservation Communication Program,
Wildlife Conservation Society

Hanchen Zheng: Both of us [*eds.*: referring to Endi Zhang] studied TCM. Most of us have studied biology, and everyone knows that we are losing biodiversity. My personal view is that the main reasons for biodiversity loss are pollution, industrialisation and habitat destruction. Although TCM use contributes to the loss of biodiversity, it does so a lot less than these other causes.

I conduct pharmaceutical research in TCM by looking for possible medicinal resources from nature. Like the topic of this workshop, I am pro conservation. I am a standing member of the Chinese Pharmacopoeia Commission, appointed by the Ministry of Public Health. All species used in TCM are listed in the pharmacopoeia. [*Eds.*: The use of unlisted species constitutes misuse of TCM, and is considered to be folk medicine]. Among these are some species that should not be included on the list. There are a lot of differences in the cultures and backgrounds of TCM users. We cannot force all people to meet the same standards.

A few months ago, Amanda's video [*eds.*: the BBC documentary, 'Kingdom of the Seahorse'] was shown in translation in China and was very well received. We conservationists and TCM users can reach an agreement. People in Shanghai are more aware now of conservation issues.

–P. R. China, Professor, College of Pharmacy,
Second Military Medicine University

Chunguang Zhang: I study fish conservation in China, particularly of freshwater fishes. I tried to collect some information on the seahorse trade in Beijing, but could not find complete information. I did not find any contradiction between seahorse conservation and TCM use, but need to do more research.

People should devote more time to seahorse aquaculture research. Based on the latest report in China, there has been a decline in Chinese fisheries due to the gradual development of the coastal areas. Over-population and development causes pollution of the coastal environment, where most seahorse populations are found. Developing seahorse aquaculture for TCM use is a must.

–P. R. China, Professor, Institute of Zoology,
Chinese Academy of Sciences

Zhenqiu Mai: Is there a conflict between TCM and environmental conservation? There are some conflicts since TCM uses animals and animal parts. However, if we can integrate the principles of harvest and conservation, these conflicts can be resolved. As a party to CITES, China pays great attention to the conservation of endangered species. For example, we have a regulation on the "Protection and management of Chinese medicinal resources in the wild". TCM has always valued wildlife and recognised the need for conservation. There are unwritten rules for the collection of wild medicinal resources such as 'take the adult and leave the juvenile', or 'take six specimens and leave four'.

Both Chinese and Western medicine require raw material, but the difference between these two systems is not our concern here. Let us say that some humans need to use Chinese medicines, and others don't, so inevitably there is conflict. Some believe that seahorses are threatened simply due to their use in TCM. There are other uses for seahorses, in aquariums, tonic foods and as souvenirs.

If TCM use is done correctly, with proper management, there will be no conflict. We have to strike a balance between the protection of humans and the survival of wildlife. We must take several steps for protecting species, including the development of aquaculture.

–P. R. China, Senior TCM pharmacist

Samuel Kwokhung Lee: TCM and wildlife conservation can co-exist, although historically, there have been some very bad experiences. When there was suddenly a ban on tiger bone and rhinoceros horn, TCM practitioners were caught unaware. Most of them received the information only three months before the ban took effect. The trade ban caused many economic losses, as practitioners were left with lots of stock. The ban also hurt their dignity, and therefore caused cultural tension. They now perceive wildlife conservation as trade bans. It's that simple. We want to look at trade control

and monitoring, but the TCM community thinks that these will just lead to more trade bans. We are losing many opportunities for data gathering because of this perception.

–Hong Kong, Programme Officer, TRAFFIC-East Asia

Question 3

How do you feel about the balance of legislation in considering humans and animals?

Rene Ledesma: The Philippines makes it a point to find a balance since the livelihood of people and communities is affected by wildlife legislation. BFAR is involved in many evaluations and consultations with local government units. BFAR takes a stand to make careful investigations before implementing trade restrictions or trade bans. We are now seriously considering the issue of requiring permits for the trade in tropical aquarium fish. We are bound to include the respect of indigenous peoples' rights to their traditional resources in our efforts. Fisheries administration cannot issue bans and restrictions without consulting with local communities.

–Philippines, Bureau of Fisheries and Aquatic Resources (BFAR)

Peter McGlone: It seems that Australia has generally forgotten Agenda 21, which was formulated during the Earth Summit in Rio de Janeiro. The summit developed international agreements for conservation of biodiversity, and the integration of development and trade.

–Australia, Representative, World Wide Fund for Nature

Jong-Geel Je: In 1984, the Ministry of Environment established the Natural Environment Conservation Act, which restricts the collection of animals and plants. The law also promotes the establishment of MPAs. The Ministries of Environment and of Marine Affairs and Fisheries have also conducted a meeting to establish legislation for the conservation of wetlands.

–Korea, Principal Research Scientist,
Korean Ocean Research & Development Institute

Endi Zhang: In China, marine species have their own government bureau, but if they are used for TM purposes, they fall under the TCM administration bureau. The TCM administration bureau works to ensure sustainable use, but people come first.

–P. R. China, Director, Asian Conservation Communication Program,
Wildlife Conservation Society

Vincent Chen: Conservation does not equal trade bans, not even banning TCM. When we talk of conservation, we talk about sustainable use and not of absolutely prohibiting the use of anything. In Taiwan there is one law that relates to marine medicinals. Marine mammals are protected under the Wildlife Conservation Law. The legislation is too rigid and carries strict penalties for using prohibited animals. As a result, the legislation is not reasonable, and is itself 'unsustainable'. Reasonable management can be an important tool for reaching a solution.

–Taiwan, Programme Officer, TRAFFIC-East Asia, Taipei

Aaron Lipton: In India there are restrictions on a number of species. The use of sea turtles and marine mammals (such as dugongs and dolphins) is punishable by law. Pearl and chank fishing is administered by the State Bureau, and is generally prohibited, although you can obtain a three month fishing license. These licenses are given only to specialists and to local people. The State Bureau considers that local people are dependent on these resources, which is why they will provide them with licenses if needed.

–India, Researcher, Central Marine Fisheries Research Institute

Question 4	Asked to: Field conservationists & researchers
How do TM traders and practitioners affect the people and animals in the areas in which you work?	

Marivic Pajaro: I would say that people in the area depend on marine resources for their livelihood. These people have very few options or none at all. These resources are the only thing they can hold on to. However, it should be recognised that they can make informed decisions as well when given access to information (e.g. on trade dynamics). The need to strike a balance should be considered. Traders and practitioners can provide information to communities (for example, on how the marine products are used), with the exchange to be facilitated by non-governmental organisation workers.

*–Philippines, Biologist and Team Leader,
Haribon Foundation/Project Seahorse*

Jonathan Anticamara: I work with seahorse fishing in the Philippines context. I would tell the TM community that the Philippines is a poor country, and that seahorses are targeted because of their economic value, to subsistence fishers. I would tell traders and practitioners that the fishers feel very sad at the unfair trade for two main reasons: 1) the sales they earn from their daily catch are not enough for their daily needs of healthy/decent living, and 2) they feel victimised by the unfair nature of the trade, where middle buyers and exporters gain more by always controlling prices without consideration of fishers' needs. I also would want them to know that the extremely low buying price at the fishers' level will only drive seahorse fishers to be unselective in their fishing practices, catching pregnant males and juveniles which has not reproduced yet in order to meet their daily needs. Finally, I should say that changing the trading system in such a way that maximum benefits go to fishers (possibly through fishers' organisations) will help fishers have more options to sustainably manage their resources.

–Philippines, Biologist, Haribon Foundation/Project Seahorse

Salome Quijano: Based on the study I'm undertaking, the three stakeholders are very closely linked: fishers, traders and conservationists. We know that fishers' livelihood is catching seahorses, or in Palawan, sharks. The NGOs working with fishers need to educate the communities they work with. The traders need to be educated. The fishermen do not know where their catch goes to. The traders should inform the consumers or other traders of where they are getting these resources from.

–Philippines, Researcher, Haribon Foundation

Aaron Lipton: It is very difficult to convince traders– it is even difficult to go into their shops. Fishers themselves regulate the fishery because they depend on it. They see the importance of using the fishery sustainably.

–India, Researcher, Central Marine Fisheries Research Institute

Glenn Moore: The West is riding on a wave of environmental concerns, and also a lot of emotion. When you think about seahorses, think also about the people who depend on them. There are implications down the line, from traders to fishers. Seahorse populations must be monitored, and self-regulation is needed.

–Australia, Researcher, University of Western Australia

Question 5	Asked to: Western participants
What perceptions, insights or changes in attitude have you had since arriving at the workshop two days ago?	

Jeff Boehm: That's a very difficult question. The first thing that comes to mind is the bias. I am a fairly open-minded person, and I came here with no experience of TCM, but this did not keep me from having biased opinions. I've learned that I don't know most of the things there is to know about TCM. It's good to be exposed to these things and know how much there is to understand, and how interesting it is. It's like what Samuel said about the water bottle labels with the wrong

parameters written on them [*eds.*: see presentation by S. Lee]. I have to look at this discipline with new filters, and evaluate different subject matters in different ways.

–USA, Director of Research and Veterinary Services,
John G. Shedd Aquarium

Philippe Dhert: It's a very difficult question. What strikes me is the complexity of this issue. We also have a symbolic issue: a fish that behaves in a specific way, and how it is used for medicinal purposes. As a researcher, we need figures and facts. I understand that this is not available for TCM, but I want more openness in their industry. There is a need to study the efficacy of TCM, as well as obtain trade information.

–Belgium, Researcher, Laboratory for Aquaculture &
Artemia Reference Center

Mark Wilson: I'd like to draw an analogy between Western and Asian medicine and the predicament with which they are faced. For many types of illnesses in the West we are heavily dependent on the use of antibiotics as treatment. A resource with dwindling efficiency due to mismanagement and over-exploitation. Asia's dependency on seahorse medicine has also succumbed to the same social failings. I do not understand how medical resources will be able to continue to satiate the needs of an ever increasing population.

–UK, Hatchery Manager, Tropical Marine Center

Chris Woods: Up until now it's been hard to rely on Western perceptions of TCM. It's good to be exposed to new perspectives in this conference, and to know why people use TCM and its potential impacts on people. We also need to know what is being used in TCM.

–New Zealand, Researcher, National Institute of Water and
Atmospheric Research

Glenn Moore: I am very interested in indigenous communities and I've followed the life of the Aborigines in Australia. I understand that taking away the trade would have detrimental effects on communities. I did not really have a knowledge that taking the trade away would also have an effect down to the lowest level (villagers/fishers), or that their need was so great. There is a need to strike a balance.

–Australia, Researcher, University of Western Australia

Doug Warmolts: The workshop has clarified issues in my mind. The Columbus Zoo Conservation Committee supports conservation projects around the world. We debated whether or not it was ethical to fund seahorse aquaculture development in Vietnam, where the animals might be used to supply the TM trade. While some of my colleagues see conservation as a black and white issue, I am still realising and coming to terms with the biases in how conservation projects are run.

–USA, Assistant Director of Living Collections,
Columbus Zoo

Peter McGlone: I think one thing that struck me is how the practitioners of TCM show high sensitivity to Western perceptions of TCM and its impact on wildlife. I thought they would be tough and wouldn't care. There would seem to be a large percentage of the TM-practising populace that does not like the idea that millions of seahorses are being killed. Maybe people in Australia can be convinced of the validity of TCM if they see that it really cures, and also that it is being used sustainably.

–Australia, Representative, World Wide Fund for Nature

Bertha Mo: Endi and I were talking about the success of panda habitat conservation in China. No Chinese would consider destroying the habitat. We should look at success stories and see how these occurred instead of focusing on difficulties. This is how we can learn.

–Canada, Senior Program Specialist-Health,
International Development Research Centre

Brainstorming: Available Options for Managing Marine Medicinals

From the wide-ranging discussions in the first part of the afternoon's plenary, participants moved to a brainstorming session in which they were asked to identify any and all available options for managing marine medicinals. No limits were recognised, or practical problems discussed. The list of ideas generated here is not conclusive, but served as a very useful starting point from which workshop breakout groups could select and develop realistic options for inclusion in the final action plan (see Workshop Session II).

At the start of the exercise, A. Vincent reminded participants that developing conservation initiatives was a multi-step process, and that management options were important at every level. She gave the group the following guidelines for the design of management and conservation initiatives for marine species:

1. Develop an awareness of the problem through research.
2. Consider what options are available to address the problem.
3. Do not limit yourself to a single choice. There are many different approaches for resolving a problem.
4. Monitor the effect of your initiatives, to keep aware of your progress and mistakes.
5. Ensure the long-term health of the resources you are protecting.

The results of the brainstorming session are presented in Table 9. Options are grouped by theme, rather than by the temporal order in which they were proposed by participants. All participants engaged fully in the exercise, and were eager to begin sharing the ideas suggested to them by the workshop's presentations, and by their own experience with resource management issues.

Table 9. Brainstorming: Available options for managing marine medicinals

Habitats and Ecosystems	
<ul style="list-style-type: none"> • establish MPAs • involve local community in MPA management • implement resource use zonation • develop ecotourism 	<ul style="list-style-type: none"> • be aware of habitat diversity • be aware of all impacts on habitats • restore habitats • provide artificial habitats or non-damaging enhancement of natural habitats
Trade	
<ul style="list-style-type: none"> • record trade at municipal level (i.e. source communities) • understand trade routes • create direct import/export opportunities (to avoid middlemen) • establish regulatory mechanisms for export and trade • involve governments, etc. in developing legislation • enforce current legislation • develop bioprospecting laws well-conceived to control volumes 	<ul style="list-style-type: none"> • apply appropriate fines and penalties for poaching /illegal fishing • make airlines, etc. aware of restrictions and welfare issues with animal trade • emphasise that controlling trade does not necessarily mean banning trade • encourage self-regulation at all levels • encourage demand-side to invest in supply-side of trade • restrict advertising for products derived from threatened species

Supply	
<ul style="list-style-type: none"> • encourage the use of the entire animal where possible • practice selective harvest (as to size, reproductive status, sex, age, behaviour) • control quality to avoid harvesting individuals not required by trade • develop legislation for harvest • enforce seasonal closures of fishery • develop a licensing system with accreditation 	<ul style="list-style-type: none"> • implement quotas • implement gear restrictions • restock depleted areas • establish MPAs • establish resource use zones with buffer areas • develop alternative livelihood options • encourage ecotourism (i.e. seahorse watching, rather than catching) • develop aquaculture
Demand	
<ul style="list-style-type: none"> • develop substitutes and synthesised products • have practitioners encourage wise use of species to clients • recognise species for which efficacy has not been proven 	<ul style="list-style-type: none"> • implement tariffs and taxes • help hobbyists to recognise species that are difficult to keep in aquaria • consider other consumers of species in management plans
Communication and Education	
<ul style="list-style-type: none"> • develop an Information Education and Communication (IEC) campaign on habitat-related issues • incorporate and involve communities in conservation • consult stakeholders and provide them with feedback • educate children and train young people • include conservation and wildlife concerns in TM training • develop eco-labelling to recognise sustainable practices • define the role of public aquaria in education and raising awareness • discourage the curio/souvenir trade • develop consumer awareness at the national and international level 	<ul style="list-style-type: none"> • communicate at all stages of the management process • maintain good communication • provide information, liaison and links between different sectors (national, international) • formalise network from this workshop • publish bulletins and newsletters in local languages • publish information on species biology • publish across specialist literature to aid in information exchange • improve and increase well-balanced media treatments of TM
Research	
<ul style="list-style-type: none"> • monitor wholesalers • avoid waste (e.g. improve processing) • conduct ecological research • monitor stocks • monitor pressures on ecosystem • conduct biological studies of species used in TM • integrate and analyse different views (i.e. western and TM) • verify efficacy of TM products 	<ul style="list-style-type: none"> • research seahorse disease • develop new aquaculture methods • open dialogue with bioprospecting companies • anticipate new demands • document patent medicines • study consumer behaviour • understand socio-economics, gender roles • develop links between supply and demand

Breakout Group Discussions

Days 3 and 5

Explanation of Discussion Structure

Participants were divided into four breakout groups by subject area: Culturing, Consumption, Conservation and Cross-Cutting, the latter being a mix of each of the other three subject areas to provide an overall perspective. Participants were assigned to breakout groups according to their field of interest by the workshop organisers.

Conservation	Culturing
Marivic Pajaro (Leader) Dolores Diamante-Fabunan Do Huu Hoang Jong-Geel Je Rene Ledesma Jackie Lockyear Peter McGlone Glenn Moore Chunguang Zhang [+ interpreter]	Heather Hall (Leader) Ali Hafiz Al Qodri [+ interpreter] Rudi Bijmens Suraphol Chalarkid [+ interpreter] Grace Hilomen-Garcia Truong Si Ky Douglas Warmolts Mark Wilson Chris Woods
Consumers	Cross-Cutting
Samuel Kwokhung Lee (Leader) Boris Saiping Kwan Young-Jong Lee [+ interpreter] Zhenqiu Mai [+ interpreter] Bertha Mo Allison Perry Salome Quijano Hanchen Zheng	Amanda Vincent (Leader) Jonathan Anticamara Jeff Boehm Vincent Chen Philippe Dhert Jokkeng Lee Aaron Lipton Vorathep Muthuwan Endi Zhang

The breakout groups discussed the sustainable use of marine species in TM by considering, in separate sessions:

- I. Problems and Limitations
- II. Options and Possibilities
- III. Plans and Proposals

In each session, groups were given a series of guideline questions to help them address the issue under discussion. Representatives from each group then presented key points in plenary for further debate. The process was lively and energetic, and consensus was the rule. Outcomes were all embracing, without much attempt to set priorities. This was in part due to the limited time available.

Session I: Problems and limitations

Session I. Guidelines

1. How does your group define sustainable use of marine species for TM?
2. What does your group consider to be the major obstacles to achieving this goal? Brainstorm for ideas then sort them as indicated.

	Local (Loc)	National (Nat)	International (Int)
Minor (1)			
Medium (2)			
Major (3)			

3. Please rank the top 10 obstacles in terms of severity of how they hamper sustainable use.
4. Put an asterisk beside the 10 problems and limitations that can be most easily overcome.
5. Indicate which problems will also apply to fishing communities, and how.

NB: Focus on problems and limitations. Avoid beginning work on options and possibilities during this session.

Session I. Outputs

Definitions of Sustainable Use

Conservation Group

Sustainable development is the use, based on scientific data, that would help ensure healthy biodiversity and availability/equitable distribution of benefits from these resources for all stakeholders for generations to come.

Culturing Group

Manage stocks to supply demand and ensure long-term survival of the exploited stock, without damaging the environment.

Consumer Group

To use (human and natural) resources endlessly, without depleting these resources, whilst meeting existing needs, including livelihood.

Cross-Cutting Group

Sustainable use means managing resources efficiently to balance supply and demand in such a way as to ensure socio-economic stability and biological and cultural integrity and diversity for at least another millennium.

Obstacles to Achieving Sustainable Use of Marine Medicinals

Table 10 summarises the minor, medium and major obstacles identified by breakout groups to achieving marine medicinals trade sustainability, on a local, national and international scale. The time spent on this exercise prevented most groups from completing steps 3 to 5 of the session guidelines.

Obstacles which were mentioned by more than one group are underlined in the table. A code in brackets indicates how the obstacle was classified by the other group. (For example, 'habitat degradation' was considered to be a National, Minor obstacle (Nat 1) by one group, but an International, Major problem (Int 3) by another).

Session I. Synthesis

Most obstacles to sustainable marine medicinal management were considered to be major, whether on the local, national or international scale. Problems that needed to be addressed on the international scale were the most numerous. Obstacles that were mentioned by several groups included lack of biological knowledge, poverty and lack of alternative livelihoods in dependent communities, habitat degradation, negative environmental effects of aquaculture, and lack of research funding. Potential problems with developing sustainable aquaculture seemed to be of great concern to participants. They listed as concerns (among others): the introduction of disease, exotic animals and polluted water by culturing; the escape of cultured fish; reliance on wild food and seed; and potential conflict with dependent communities. The imbalance between supply and demand for marine medicinals was recognised as an important obstacle to trade sustainability. Lack of controls, monitoring or enforcement of trade and environmental legislation were also mentioned in several contexts.

Table 10. Session I: Obstacles to achieving sustainable use of marine medicinals

	Local (Loc)	National (Nat)
Minor (1)	<ul style="list-style-type: none"> • competing interests (e.g. pearl farmers) • wasted catch 	<ul style="list-style-type: none"> • <u>habitat degradation</u> (Int 3) • impacts of natural event
Medium (2)	<ul style="list-style-type: none"> • <u>lack of knowledge</u> (Int 3) among users, fishers and communities (perception of the sea as endless) • disruption of ecological balance by aquaculture 	<ul style="list-style-type: none"> • <u>lack of funding</u> (Loc 3) • <u>lack of vision</u> in government • bycatch • introduction of exotic animals by aquaculture
Major (3)	<ul style="list-style-type: none"> • <u>introduction of disease and contaminated effluent to the environment by aquaculture</u> (Int 2) • <u>no alternative livelihoods for fishers (poverty)</u> (Int 3) • <u>no appropriate funding</u> (Nat 2) • poor water quality available for culturing • social impacts and conflicts of aquaculture 	<ul style="list-style-type: none"> • biased monitoring systems for wild and captive stocks • no enforcement of MPAs, of size and catch limits • contributing environmental pressures • identifying appropriate aquaculture technology • lack of access to information • lack of culturing expertise and training • inappropriate legislation and zoning relating to aquaculture facilities

Table 10. Session I: Obstacles to achieving sustainable use of marine medicinals (continued)

	International (Int)
Minor (1)	<ul style="list-style-type: none"> • lack of appropriate trade controls • identifying appropriate scale of aquaculture
Medium (2)	<ul style="list-style-type: none"> • <u>introduction of diseases and polluted water into the wild by aquaculture</u> (Loc 3) • lack of gender and social studies • government emphasis on the economy over human needs • aquaculture escapes • devaluation of wild stocks due to aquaculture
Major (3)	<ul style="list-style-type: none"> • <u>lack of biological knowledge</u>, leading to poor management (Loc 2) • <u>lack of knowledge</u> (Loc 2) of natural resources among traders, producers, government officials, consumers • <u>lack of biological and baseline</u> population data of cultured species (Loc 2) • <u>limited livelihood opportunities</u> (Loc 3) • <u>poverty</u> (Loc 3) and socio-economic inequality • <u>habitat destruction</u> (Nat 1) for aquaculture (e.g. fish ponds) • uncontrolled development of aquaculture (loss of livelihood, or economically non-viable) • lack of appropriate (sustainable) aquaculture technology • lack of financial support for aquaculture • conflicts between commercial and conservation interests in aquaculture • dependence of aquaculture on wild seed and food • demand exceeds supply for both wild and cultured species • unnecessary consumer demands (often misinformed by advertisements, leading to misuse of TM). • no communication between producers, consumers, traders, professionals, academia and decision-makers • lack of co-operation between nations • population growth • human greed • snapshot view of the world which ignores different value systems, neglects history and has few frames of reference • poor implementation of fisheries and environmental legislation

Session II: Options and possibilities

Session II. Guidelines

1. Assess the current situation and discuss the general context in which we now find ourselves. This can be free-form.
2. Please consider yesterday's (Day 2, afternoon session) options for management. Then look at the problems you identified this morning (Day 3, Workshop I). Consider how well they match.
3. Identify possible solutions to your problems. Note gaps where yesterday's options would not resolve problems. Try to develop more ideas to fill those gaps.

Session II. Outputs

Breakout groups reviewed the problems identified in the morning's workshop, and selected options for marine medicinal management from the list generated at the Review session (Day 2) which addressed these concerns. In some cases, problems had been proposed that had not been recognised at the Review Session (e.g. population growth), and new solutions had to be devised. Proposed options were meant to be as broad ranging as possible, to ensure that all possibilities would be considered in the development of the final plans arising from the workshop.

The first rapporteur to present was asked to share their group's list of problems and corresponding options for management. The remaining three groups added any problems and/or options which had not yet been mentioned. The results of this exercise are presented in Table 11.

NB. The problems and options shown in Table 11 do not represent the views of all participants. There was no debate among the larger workshop group as to the validity of proposed problems and solutions. Although participants may have agreed with the measures discussed and put forward by their own breakout group, they had no opportunity to accept or reject those suggested by other groups.

Session II. Synthesis

Participants viewed the key problems facing marine medicinal management to be related to trade imbalances, limited knowledge and research capacity, poverty, unsustainable aquaculture and government indifference. For most of these problems (with the exception of population growth and governments' prioritisation of economic over environmental concerns), options had already been proposed at the Campo Forestal brainstorming session. Habitat and ecosystem degradation were not specifically recognised as problems in this exercise, but a number of options proposed at Campo Forestal with respect to these concerns reappeared as solutions to problems of supply (establishing MPAs) and poverty alleviation (developing ecotourism).

Many solutions were proposed for addressing the imbalance between marine medicinal supply and demand, including developing alternatives and only allowing prescription use of TM. Ways to increase funding and communication between researchers and stakeholders were thought to be important for furthering aquaculture and also expanding our knowledge of marine medicinals and their trade. A number of identified options involved dependent communities, such as the establishment of fisher co-operatives and small-scale aquaculture farms in source communities, and the education of TM practitioners and users to promote reduced consumption of marine medicinals.

Table 11. Session II: Options for managing marine medicinals

<p>Problem:</p> <p>Imbalance between supply and demand</p>	<p>Options:</p> <ul style="list-style-type: none"> • Develop substitutes/alternatives • Encourage reduced consumption through education • Impose taxes • Allow only prescription use of TM • Enforce appropriate legislation to protect certain species • Focus efforts on TCM practitioners and students by providing them with scientific data • Document the efficacy of marine medicinals (by either TM or western methods) • Restrict advertising to stop “created demand” • Improve culturing efficiency • Establish MPAs to improve the supply
<p>Problem:</p> <p>Lack of funding</p>	<p>Options:</p> <ul style="list-style-type: none"> • Obtain funds from taxation, environmental rent, the sale of licenses • Develop tourism • Sell research results • Approach international funding bodies and NGOs, public aquaria and government
<p>Problem:</p> <p>Research gaps (biological, trade, socio-economic, environmental)</p>	<p>Options:</p> <ul style="list-style-type: none"> • Increase research (involving NGOs and academia) • Improve communication • Integrate research across fields • Obtain funding • Develop technical skills of researchers • Develop confidence building in stakeholder groups • Investigate the efficacy of TM by experimentation
<p>Problem:</p> <p>Poverty & lack of alternative livelihoods</p>	<p>Options:</p> <ul style="list-style-type: none"> • Develop appropriate aquaculture • Diversify so as not to be dependent on one species • Increase opportunities in the service and trade industries • Develop tourism • Add value to fisheries products before sale by the fisher • Involve aid agencies • Make creative partnership choices to develop alternative livelihoods • Establish fisher co-operatives (to by-pass middlemen)
<p>Problem:</p> <p>No links among stakeholders</p>	<p>Options:</p> <ul style="list-style-type: none"> • Create publications about marine TM aimed at consumers and the general public • Write newsletters and newspaper articles • Network with people involved in TM (e.g. e-mail list server)
<p>Problem:</p> <p>Governments care primarily about economics</p>	<p>Options:</p> <ul style="list-style-type: none"> • Lobby on important issues

Table 11. Session II: Options for managing marine medicinals (continued)

Problem: Population growth	Options: <ul style="list-style-type: none"> • Provide education and services • Provide family & health planning • Empower women
Problem: Unsustainable aquaculture	Options: <ul style="list-style-type: none"> • Encourage scientists to take responsibility for developing sustainable aquaculture • Develop small-scale backyard aquaculture farms • Improve dialogue between aquaculturists and conservationists • Create an inter-Asian website for aquaculture issues • Develop and enforce appropriate legislation • Create an eco-labelling system for fish cultured sustainably • Provide incentives for sustainable aquaculture • Treat effluent to protect habitat • Carefully choose culturing facility site • Protect mangroves
Problem: Lack of environmentally-sensitive aquaculture technology	Options: <ul style="list-style-type: none"> • Promote research • Encourage information exchange among researchers • Transfer technology as it becomes available

Traditional Medicine Presentations

There was concern at the workshop that due to language difficulties and uneven interpreters the TM representatives may not have been completely heard and understood by the rest of the group. On the morning of Day 5, Young-Jong Lee, Zhenqiu Mai, Chunguang Zhang and Hanchen Zheng asked for the opportunity to share their perspectives on marine medicinal use, management and conservation with participants through a series of short presentations and subsequent discussions. Jockeng Lee summarised TM representatives' talks, expanding on key concepts and adding his own views.

Clear and accurate communication was essential in the presentation of complex issues to a group representing many nationalities and cultures. Endi Zhang and Samuel Kwokhung Lee facilitated the session, and also acted as interpreters, with assistance from Boris Saiping Kwan.

Dr. Young-Jong Lee

Department of Herbology, Kyung Won University, Korea

assisted by an interpreter (Yeon-hee Park)

Above all, I would like to express thanks to everyone. Through this workshop I have learned many things from all of you, and I am very glad to express more of my opinions this morning. I feel that through this workshop I have been able to clarify the relationship between traditional oriental medicine and conservation.

Some people think that TM has a negative impact on conservation, but I do not agree fully with this opinion. TM has contributed to the good health of people for many hundreds of years. We have to be aware of the importance of maintaining biodiversity, but also recognise that TM is not the main cause of biodiversity loss. To harmonise between TM and conservation, we should remember that there should be a balance between supply and demand of natural resources, and that the responsibility for achieving this balance is on the people.

In Korea, we distinguish between the use of a resource as food and as medicine. For example, we use the platycodon root as a food [*eds.*: translated as 'pumpkin'], but also as a medicine. Because it is very difficult to find wild in Korea, we have had cultivate these roots instead. We should find a similar balance between supply and demand with seahorses.

We must try to cultivate seahorses for use in TM. In Korea there are about 540 species of plants and animals being used in TM, and most are cultivated. However, the use of tiger bones and rhino horns is strictly prohibited in Korea. To maintain the balance between TM and conservation, we try to differentiate which resources should be used as medicine, and which should not. For example, tiger bones cannot be cultivated, and so we should avoid using this material. We can try to culture other resources, like plants or seahorses.

DISCUSSION

Culturing medicinals

Amanda Vincent

I am very interested in your suggestion that most of the plants and animals used in *hanyak* are cultivated and also find it interesting that you would encourage culturing so actively. I understood that in many forms of traditional Asian medicine, cultivated specimens were commonly considered less efficacious as medicines. Is this a difference between *hanyak* and TCM, or do you feel that this represents a forced shift of *hanyak* in response to resource limitations?

DISCUSSION (continued)

Young-Jong Lee

In TM, any plants or animals used as medicine must be easily obtainable. If it is very difficult for people to get materials, they will not use them as medicine. In TM, there is a very deep relationship between the medicinal materials being used and human behaviour— all share the same environment. The basic principle of *hanyak* is achieving harmony between humans and nature. It is therefore obvious that the most effective medicine will be medicine produced in the area where people are living. If a Korean gets sick, we tend to choose Korean medicine to treat them. TCM and Korean *hanyak* each has its own characteristics, but the principles are very similar.

As for efficacy, wild ginseng grows in Korea, and is very effective. Many people believe that cultivated material are less effective. It is very difficult to say if this is true, as there is little scientific research. This point should be explored through biological experiments.

Mr. Zhenqiu Mai

Senior TCM pharmacist, P. R. China

 assisted by Samuel Kwokhung Lee

After a few days of discussion, I feel that the theme of this workshop is very apparent and our objective is very clear. The workshop has been conducted in an active way, with many exchanges. Friendship has been enhanced, and we also understand each other more. Subsequently, we have a consensus on the conservation of marine life and the issue of the sustainability of the marine life trade. This event is timely, important and successful, and we will surely achieve our goal. First of all, I would like to express my heartfelt thanks to Dr. Vincent and her colleagues for all their hard work. Their efforts in saving lives and biodiversity earn them the title of 'gods of seahorses'. I would also like to thank you for your understanding and support of the TM community.

In order to explore the critical issue, we need to understand the following: in my opinion, the main reasons for marine species being threatened are marine pollution and global warming, followed by over-exploitation and insufficient management. These are all worrying issues.

In TCM, 12 772 species of animals and plants have been used as medicine at one time or another. Of these species, 87% are plants and 12% are animals, with perhaps only 1% being marine life. Many of these are the by-products (e.g. mollusc shells) or the pathological products (e.g. ambergris, an expensive medicine obtained from the digestive tract of the sperm whale, *Physeter catodon*) of marine organisms. The use of marine organisms is essential to TCM, to cure diseases and strengthen the body.

Appropriate decisions should be made. When a species is becoming endangered, do not ban the trade immediately. This will bring more disadvantages than advantages. Instead, we should carry out sophisticated studies on the geographical distribution and biology of the species, and on the threats they are facing. We must arouse people's interest in conserving these species. Organising timely discussions on endangered species is very wise. What we are doing here, at this event, is taking effective action before the situation gets worse.

The approach to protect marine medicinal species should not be simple, but rather should establish a symbiotic relationship between humans and nature. On this basis, we should promote the establishment of seahorse aquaculture. Through cultivation, human development will be able to co-exist with producing medicinal supplies. TCM values the environment and the importance of being

in harmony with nature. Conservation and sustainable trade will provide the society with livelihood and economic gains.

We should wisely use marine species, including encouraging TCM practitioners to use substitutes. We should also ban the use of juveniles and pregnant males, and other forms of over-exploitation, to consequently reduce consumption. Management should be strengthened by establishing MPAs and implementing fisheries policy and monitoring. We should strengthen exchange, communication and co-operation at the international level. We must exploit useful species reasonably under the integrated principles of use and conservation.

The Chinese are comfortable with the use of domesticated species in TCM. Medicinal species were cultured in China as early as the beginning of the Tang Dynasty (618-906 AD). Most TCM products currently in use are cultivated. While some people still perceive wild medicines to be better than cultured, the quality of a medicine actually depends on its composition. Cultivation and collection from the wild are both ways to obtain medicinals.

Seahorse aquaculture has been studied for many years, although the technology is still not appropriate. In my opinion, there are two areas of weakness in the development of culturing: cultivation technology and research are insufficient, and there is a lack of financial support.

We believe optimistically that full co-operation between us here can help marine conservation and trade, to allow the trade to proceed sustainably. This will enhance the survival of humans.

Prof. Hanchen Zheng

Department of Pharmacognosy, College of Pharmacy,
Second Military Medical University, P. R. China

Assisted by Endi Zhang

I would like to say that I have learnt a lot in these last few days, especially as this was my first time seeing a live seahorse. This was a great experience, and the animals are so cute! I will go back to China, and will give a few presentations. I will tell people what I have seen and learnt here, and I will try to persuade them not to use seahorses, if possible, or to use alternatives.

My own personal opinion, as well as what I have gathered from other participants, is that we need to bring more people together. This is especially necessary to convince people of the validity of TCM because TCM has such a long history, and many of its components and concepts have proven to be effective. It is difficult for people who have never used TCM to understand why TCM uses animal medicinals. I think both sides have their own reasons to doubt the other.

I think that the main problems for the conservation of marine species are first, a lack of communication, and second, a lack of financial support.

In China, the relationship between TCM and conservation is emphasised, as can be seen from the many TV programs, videos and books on the subject. Most Chinese of the younger generation (university students and intellectuals) spend a lot of time studying English, and have access to literature on conservation issues published in English. But because of the language barrier, most western scholars do not have the opportunity to look at the literature produced in Chinese, in China.

In China, the problem is not that the concept of the relationship between TCM and conservation is unfamiliar, but that money and equipment for research are not available. Although China has been developing very quickly in recent years, it is still a developing country. We would very much welcome the support from developed countries' institutions and funding bodies. We could have a workshop like this in China, and have participants come to our country. It would be good to have the support of IDRC and others to support similar workshop in China to bring together more Chinese.

I would like to thank the organisers and the staff for their hard work, and the success of this workshop.

Dr. Chunguang Zhang
Center of Animal Systematics,
Chinese Academy of Sciences, P. R. China

Assisted by Endi Zhang

Most of my points have already been discussed. My own view on the workshop is that the organisers are working hard to make people understand the situation. The trip to Handumon especially did a lot for developing countries, conservation and consistency of good-will.

China is a major consumer of seahorses, along with Hong Kong and Taiwan, but imports are mainly restricted to the southern provinces. The demand for seahorses seems to be mainly limited to the south, and they are not commonly used in other areas. Also, the demand for seahorses, compared to the potential demand that would exist for tiger bone and antelope horn if these were not illegal medicines, is very low.

TCM needs wildlife, but has some negative impacts on the conservation of wildlife species. TCM has made great contributions to people's lives in East and South-East Asia. In mainland China, the cost of imported western medicines is extremely high. China is a developing country, and most people cannot afford these expensive western medicines, especially in the far countryside. TCM is relatively cheap (and especially effective for many unusual diseases) in comparison, which is why people like to use it. In China, people in general prefer western medicines to treat common diseases, but feel that TCM is more effective for the treatment of unknown and chronic diseases (e.g. cancer and a few others). TCM is probably more effective in these areas than classical western medicine.

My suggestions are to conduct more research on wild seahorses, to develop seahorse aquaculture and to strengthen international exchange and co-operation. Although China began seahorse farming in the early 1950s, it has so far not proven very successful. Exchanging cultivation technology and methods would be useful.

Workshop organisers invited Jokkeng Lee, Education Development Executive for Eu Yan Sang (the largest Chinese herbal company outside of P. R. China) to lead the discussion following from the presentations of the TM delegates. He began with a brief summary of their talks, drawing out the ideas of especial relevance to workshop themes.

I would like to thank the Chinese delegates for coming to this workshop and sharing their ideas. I would also like to take this opportunity to recap and highlight certain important points from their presentations.

Dr. Lee pointed out that one of the most important things in conservation is the balance between supply and demand, and that to achieve this balance we must rely upon the people of the country. He also said that in Korea there is a clear distinction made between food and medicine. In the Oriental pharmacopoeia in general there is this clear distinction, and seahorses should be seen in this context. To expand on the example used by Dr. Lee, pumpkin, if eaten occasionally, is viewed as a food. However, if pumpkin is eaten frequently, it can be considered as a medicine for the treatment of frequent constipation.

If a particular ailment really calls for seahorses, then by all means, use seahorses. But if it is not an exact need, then perhaps one does not need to use seahorses. In other words, the use of seahorses as food should not be encouraged, but they can be used as medicine. If this rule is widely practised, there will be no wastage. This is a most important points brought up by Dr. Lee.

Mr. Mai has been involved in TCM, in one way or another, for 49 years. He is currently a trader and pharmaceutical technical consultant. Mr. Mai pointed out that in the entire Chinese materia medica, 87% of ingredients are plant based, 12% animal and 1% marine medicinal. Not all of these 12 000 ingredients are actively used. A very established apothecary might stock 600-700 raw ingredients.

The average medicinal hall, in Taiwan and Malaysia (and perhaps other parts of South-East Asia as well) will stock 300 products, most of which are plant-based.

Mr. Mai asked that we not be hasty in encouraging trade bans. He felt that it was more important to enhance the human-nature relationship, i.e. the ecological balance. In Chinese philosophy, which is embedded in TCM, the balance of human and animal societies is emphasised.

Culturing of medicinal products is not new to China and has been very successful, even for products considered very difficult to culture. For example, through research, the Chinese have been able to produce a good quality culture of a form of caterpillar fungus found only in high elevation areas of China. The efficacy of cultured specimens versus wild is not known however, and the perception that wild is better is still deeply etched among TCM practitioners.

Professor Zheng is responsible for pharmacological research. This workshop has given us a good opportunity to see the many different areas of TCM practice, with a pharmacological researcher, a zoological researcher, practitioners and traders. It is therefore not surprising if we notice some contradictory and seemingly conflicting viewpoints, because each of the TCM participants have certain ideas from their point of view.

Professor Zheng identified two obstacles: communication and financial support. It is quite easy for modern Chinese students to have access to western information. However it is more challenging, due to the nature of the Chinese language, for westerners to have access to information in China. Not only does the difficulty stem from language, but also from the ability to retrieve information. For example, there is not much Chinese information on the Internet, and there are still certain universities that hesitate to give out information to researchers they do not know.

Financial support is lacking, and yet we hear that China is doing extensive research on medicinal products. How do we come to terms with this? I think that what Dr. Zheng meant to say is that to receive financial support, the research has to be perceived by the government as something practical for the people, and also as being economically advantageous. If seahorses are perceived as economically impractical, then the government will decide not to fund seahorse research.

And finally **Professor Zhang**, a zoology professor, acknowledged that China is a major importer of seahorses, but he helped us to localise the demand, which I think is very important. He pointed out that the demand is high only in southern China. (Seahorses are called southern medicine, while Ginseng is northern). He also acknowledged that the use of wildlife is necessary in the practice of TCM. However, because the TCM community, which is a large community, acknowledges their use of wildlife, they also see the importance of conservation. Conservation and the practice of TCM in China see eye to eye, and don't have any clashes. This is what is claimed by a few of the Chinese delegates.

The relative demand for seahorse as compared to other products is low. This is also true in clinical practice. If you take a look at the therapeutic effects of seahorses, you will find that these are not as wide-ranging as tiger bone. Tiger bone is used to treat rheumatism, considered to be the world's primary chronic health problem. Seahorse, to be exact, is used to treat coughs originating from a problem of a weak lower back. In Chinese medicine we say that the kidney energy does not have the ability to anchor the lung energy. The kidney meridian is the root of all organs, and when the kidneys cannot anchor floating energy from the lungs, you need to use seahorses. This does not happen in all kinds of coughs, but mainly in the elderly with chronic coughs. If I see this pattern in my practice, the first ingredient I think of is seahorses. However I do not see this pattern a lot. The majority of coughs are from infections, and I don't have to use seahorses. There are many other cough medicinals that can be used. This is only for seahorses in the context of treatments for coughs. There are other uses of seahorses as I mentioned in my own talk.

Perhaps one of the reasons the use of seahorses is not that prevalent in South-East Asia is because of the warm climate. Seahorses are considered a warming herb, and are not so practical for a tropical country. Therefore, the question of relative demand is important.

Jokkeng Lee then asked the TM delegates the following question:

Jokkeng Lee: We have heard that the demand for seahorses in Malaysia is quite low. Eu Yan Sang ordered 3kg in 1995, and did not re-order any the next year. And yet there is clearly a lot of demand for dried seahorses, judging from trade data. Seahorses are not a crucial ingredient in the TCM pharmacopoeia, and yet tonnes are imported to P. R. China. How would you explain this dichotomy?

Hanchen Zheng: Our information is not complete. Demand and consumption is still under research in China. There are many companies dealing in seahorses, and trade routes are very complicated.

Chunguang Zhang: There is high demand versus limited use. It is difficult to collect data and we can only estimate trade volumes. Seahorses are not commonly used— neither I nor any of my friends have ever used seahorses, but we have in the past used medicines containing tiger bone, antelope horn and musk. The explanation may be the increased use of tonic foods.

Hanchen Zheng: Medicines that are self-prescribed are not TCM. If you purchase medicines in a TCM pharmacy, these are prescribed to you. Most people buy medicines without a prescription. The high consumption may be due to the purchase of unprescribed tonic foods and patent medicines. People also buy seahorses as gifts for the elderly. This alone represents a huge consumption.

Zhenqiu Mai: Seahorse is not a crucial ingredient in the TCM pharmacopoeia, but it is still valued. Seahorses have been used for more than 1500 years, and can be used in the medical treatment of impotence, haemorrhage, kidney disorders, cancer and to increase and maintain normal sexual function. 'Boosting the Yang' is often misinterpreted as treating impotence, but the meaning is much wider than that. Seahorses can reduce swelling and dissipate nodules all over the body, for example.

In addition, use of medicine varies geographically according to the physical environment, life-style, culture, history and even the different health care means, thus the demand for seahorses will vary regionally. There is no formal census of the consumption of seahorses, and furthermore, all seahorse consumption is not necessarily related to TCM.

Samuel Kwokhung Lee: In China, the southern provinces use more marine species than the northern areas due to geographic location. I would assume that both shop (Eu Yan Sang) and trade figures are true. It may be true that seahorses are stocked as a marginal item in individual shops. They may not be very popular items, but if you add up all the seahorses in all the shops in China, the consumption number will be very high.

Session III: Plans and proposals

Session III. Guidelines

1. What are the main messages that you would like this workshop to take home from your group?
2. Considering past discussions, particularly the break-out groups on options and possibilities (Workshop II), what realistic plans can you suggest that might help achieve sustainable use? Divide them into small and large, short- and long-term. Please choose goals that have a good chance of success.

	Short-term (by July 99)	Long-term (by 2003)
Small		
Large		

3. How would you suggest we implement each of these ideas? Be specific.

Session III. Outputs

Main Messages

Breakout groups reviewed the week's discussions, and summarised the main messages that could be taken away from the meeting. These messages encompass the principal findings, ideas and advances arising from the workshop. They are organised by theme, and presented on the following page.

Workshop Plans

Workshop participants identified a number of short- and long-term activities for achieving trade sustainability, on both small- and large-scales. These activities are compiled in the list appearing on p.127, organised by theme. The codes following each proposed action indicate how it was classified by participants.

A= Short-term (by July 1999)
 B= Long-term (by 2003)
 1= Small-scale
 2=Large-scale

Once a list of actions had been agreed upon by the workshop group, participants volunteered to take responsibility for moving these forward. Actions were allocated either to individuals with particular interest or experience in the area, or assigned to the 'network'. Participants envisioned themselves as the core of this network, but that their numbers would grow, and include people from different fields than those represented at the meeting (e.g. government and media). The same actions as appear in Workshop Plan list reappear in Table 12, together with the names of the people responsible for carrying out these initiatives.

Session III. Synthesis

This final session served to clearly identify the key priorities of workshop participants, as they took the first steps towards the development of an international action plan for the sustainable use of marine medicinals. In the five years to come, it will be necessary to build networks and open communication channels, begin to redress imbalances between supply and demand, develop

sustainable aquaculture methods and gather much more information on all aspects of the trade. Responsibility for furthering these goals was equally distributed among participants, with a number of activities being assigned to the workshop network.

Main Messages

Network Building & Communication

- * TM and conservation have the same goal: to maintain a long-term, harmonious relationship between people and nature.
- * Conservationists do not form a single, unified group. Individuals hold many different opinions, and the majority are very positive and open towards discussion.
- * There is a need and desire to improve communication between conservationists and TM communities. It is important to address imbalances in accessible information— an understanding of conservation among TM users is often more developed than an understanding of TM among conservationists.
- * This workshop involved a real dialogue. Information and opinions were exchanged among many different sectors and stakeholders. There is a need and desire to continue and strengthen communication among us, and to explore who else can become involved in this collaborative effort.

Supply & Demand

- * It is very important to balance supply and demand for all marine medicinal species. This can be accomplished through the following actions:
 - a) reduce use of marine species through co-operation with TM practitioners in order to lead to voluntary self-control (e.g. regulation of species, life history stages, and reproductive states used, and more discriminatory prescription);
 - b) recognise other significant threats to marine medicinal species rather than placing the whole responsibility on TM communities;
 - c) educating consumers on the judicious use of marine medicinal species. Paper advertisement may play a significant role in this important task;
 - d) educate new generations of TM practitioners on the judicious use of marine medicinal species;
 - e) regulate the manufacture of packaged patent medicines;
 - f) use modern technology to re-examine the efficacy of marine medicinal species;
 - g) increase the volumes of marine medicinal species produced by aquaculture.
- * The economic and health needs of source communities, and particularly of women and children, are very important and must be considered in all resource management decisions.

Aquaculture

- * Aquaculture can have a positive impact on the sustainable use of marine species used in traditional medicine, but we need to clearly define its role and develop appropriate technology, legislation and funding guidelines.

Information Gathering

- * There is a major lack of information on all aspects of the marine medicinal trade. It is necessary to unravel the complex unknowns of the trade and consumption of marine medicinals, and to investigate the biology of exploited species.
- * It is necessary to maintain a broad perspective, and to consider the collective impact of many systems of TM upon marine species. Any one system or geographic region may not have a large impact upon marine medicinal species populations, but together, the resulting pressure is significant. Therefore, all people involved in the trade must play a role in creating solutions.

Workshop Plans

Network Building & Communication

- * Develop a more formal network between workshop participants that encompasses the TM, trade, conservation and aquaculture communities. This will be carried out in the form of a regular newsletter in English and Chinese, distributed primarily by e-mail. (A1)
- * Publish the proceedings of the workshop in English and Chinese and disseminate using the Internet. (A1)
- * Produce short briefing document for fishers, aquaculturists, TM communities and conservationists in both English and Chinese for international dissemination. (A1)
- * Develop a workshop series addressing issues of marine medicinals trade. (A2)
- * Produce a travelling educational exhibit containing displays of live seahorses to visit traditional medicine centres and a travelling educational exhibit on the use of marine species in TM to visit zoos and aquaria. Both aim to inform, educate, present accurate information and dispel current attitudes and misconceptions about the TM and conservation community. (A2)
- * Conduct a second workshop on the 'Management and Culture of Marine Species in Traditional Medicine' in China. (B1)
- * Produce a glossary of terms used in TM that may cause some confusion between different stakeholder groups (e.g. the term 'seadragon' refers to a type of pipefish in TCM, but elsewhere refers to two distinct Australian species, the weedy and leafy seadragons. (B1)
- * Organise exposure trips (e.g. of TM traders to coastal fishing communities). (B2)
- * Write regular progress reports to keep network members aware of developments. (B2)

Supply

- * Produce guidelines for fishers, with input from biologists and the TM community, to reduce destructive fishing practices and to minimise wasted catch by establishing which species and types are most useful for TM. (A1)
- * Initiate the application of the "Handumon" model of coastal fisheries conservation to other communities world-wide. (A2)
- * Promote alternative livelihood or enterprise development for fishers. (B1)

Demand

- * Encourage voluntary reduction of marine medicinal consumption. (B2)
- * Educate all stakeholders (particularly students of TCM) as to existing threats to marine species, and their exact therapeutic uses. (B2)
- * Publish a free, bilingual (English and Chinese) magazine to publicise the issue of marine medicinal management. (B2)
- * Regulate the manufacture of pre-packaged TM. (B2)

Workshop Plans (continued)

Aquaculture

- * Develop a newsletter on the subject of the culture of marine species for use in TM. (A1 & B1)
- * Identify a list of marine species that could be produced by aquaculture for use in TM, with input from both the TM and aquaculture communities, and create a priority listing of these species for developing culture technologies. (A2)
- * Identify a country co-ordinator for each country and an international overseeing body to guide the development of marine medicinal aquaculture. (A2)
- * Develop neutrally funded, co-ordinated, international culture facilities to benefit local communities through the supply of high quality seed. (B2)
- * Establish a fund for resuming seahorse aquaculture studies in China. (B2)
- * Determine how aquaculture could satisfy the TM community's perception that "wild is better". (B2)

Information Gathering

- * Promote research on heavily-demanded species. (A1)
- * Write funding applications, collaboratively and individually. (A1)
- * Collect and collate existing trade data. (A2)
- * Assess the trade in live seahorses for use in the marine ornamental trade. (A2)
- * Adapt research findings to small-scale communities. (B1)
- * Promote wise management of national resource needs. Each country should rely on its own resources, and use these well. (B2)
- * Develop a program of research into seahorse biology, ecology and behaviour. Exchange results and information through the network. (B2)
- * Develop a program of research into the trade of marine species used in TM, identifying numbers traded and trade routes. Exchange results and information through the network. (B2)
- * Obtain government compliance on data release (e.g. of import/export figures). (B2)
- * Integrate biological research findings and trade data to evaluate impacts of trade on wild populations. (B2)

Table 12. Session III: Workshop plans

A1. Short-term, Small Activities		
Small (1)	Short-term (A)	
	Activity	Person(s) Responsible
	Develop a newsletter for aquaculture species used in TM.	Heather Hall & Doug Warmolts
	Develop communication and establish a strong network of stakeholders.	NETWORK
	Develop a Web posting of the messages, agreements and actions arising from the workshop proceedings. (In English and Chinese).	Marie-Annick Moreau co-ordinating with Chinese participants
	Translate briefings on the Handumon project and on Project Seahorse into Chinese.	Amanda Vincent & Boris Kwan
	Prepare briefing document on trade discrepancies (i.e. how to evaluate trade information).	Allison Perry
	Prepare briefings for fishers/aquaculture/TCM/conservationists.	Marivic Pajaro, Philippe Dhert, Jockeng Lee & Amanda Vincent
	Promote research on heavily-demanded species.	Amanda Vincent
	Write funding applications.	NETWORK
	Initiate biological and aquaculture research.	To be determined
	Write protocol for small-scale conservation fishing methods, based on basic seahorse biology.	Amanda Vincent & Glenn Moore
	Quality control: promote the use of appropriate fishing, handling and management methods to avoid wasting organisms.	Marivic Pajaro (& Hanchen Zheng)

Table 12. Session III: Workshop plans (continued)

A2. Short-term, Large Activities		
Large (2)	Short-term (A)	
	Activity	Person(s) Responsible
	Identify a country aquaculture co-ordinator for each country and an overseeing body.	Aquaculture group: Truong Si Ky, Heather Hall, Aaron Lipton, Jackie Lockyear, Rudi Bijmens, Mark Wilson, Grace Hilomen-Garcia, Philippe Dhert
	Develop a program of national workshops.	Aquaculture group
	Identify species required for TM that have high aquaculture potential.	Mark Wilson, Boris Kwan, Heather Hall & Chunguang Zhang
	Collect and collate data on trade.	Allison Perry, Boris Kwan, Vincent Chen, Samuel Lee & Endi Zhang
	Analyse Hong Kong Customs data on seahorse/ pipefish collected since Jan 1 1998.	Boris Kwan
	Assess the ornamental use of live seahorses.	Heather Hall, Jeff Boehm, Doug Warmolts, Amanda Vincent & Mark Wilson
	Develop small live seahorse exhibits for TM users/traders (link this with aquarium seahorse workshops world-wide) & promote TM exhibits in Western zoos/aquaria.	Heather Hall, Doug Warmolts, Endi Zhang, Jong-Geel Je, Boris Kwan, Vincent Chen, Chunguang Zhang, Hanchen Zheng
	Consolidate available research (starting at this workshop).	NETWORK
	Initiate the application of the "Handumon" model globally, where needed (re: fishing practice).	Marivic Pajaro, Amanda Vincent & NETWORK

Table 12. Session III: Workshop plans (continued)

B1. Long-term, Small Activities		
Small (1)	Long-term (B)	
	Activity	Person(s) Responsible
	Develop a newsletter for <i>all</i> TM aquaculture species.	Heather Hall & Doug Warmolts
	Promote wise management of national resource needs. Each country should use its own resources, and manage these wisely.	NETWORK
	Hold a marine medicinal workshop in China.	Jokkeng Lee (Eu Yan Sang co-sponsor), Hanchen Zheng, Endi Zhang, Samuel Lee, Heather Hall Amanda Vincent
	Clarify TM terms and concepts for consumers and conservation groups.	Allison Perry to help co-ordinate, Endi Zhang, Hanchen Zheng, NETWORK
	Encourage alternative livelihood and/or enterprise development for fishers.	NETWORK
	Adapt research findings to small scale fishing communities.	To be determined

Table 12. Session III: Workshop plans (continued)

B2. Long-term, Large Activities		
Large (2)	Long-term (B)	
	Activity	Person(s) Responsible
	Create a fund for resuming seahorse studies in China.	Chinese participants to develop a research priority list, Endi Zhang to help co-ordinate
	Publish a magazine to publicise the issue of marine medicinal management (bilingual and free).	Merge with Aquaculture Group Zhenqiu Mai will contribute
	Develop neutrally funded, co-ordinated, international aquaculture facilities to benefit local communities through the supply of high quality seed.	Aquaculture group
	Encourage voluntary reduction of consumption.	Boris Kwan, Samuel Lee, TM community
	Regulate pre-packaged TM.	NETWORK
	Educate all stakeholders, and especially TCM students, on threats to marine species and therapeutic use of species.	NETWORK
	Resolve how aquaculture can possibly satisfy the "wild is better" perception in the TM community.	Aquaculture Group
	Organise exposure trips (e.g. for TM practitioners/traders to see fishing communities).	NETWORK
	Prompt government compliance on data release (e.g. import, export).	NETWORK
	Promote research into trade dynamics.	NETWORK
	Promote biological research on marine species (behaviour, ecology).	NETWORK
	Integrate biological research results with trade data to evaluate impacts and issues of trade on wild populations.	NETWORK
	Continue aquaculture development.	Aquaculture group
	Write regular progress reports.	NETWORK

Closing Remarks

Heather Hall reviewed the list of specific objectives that had been set at the beginning of the meeting in order to determine to what extent each had been addressed. Organisers were pleased to note that there had been discussion on each of the workshop objectives, despite the complexity of the issues under consideration and the limited time available.

The goal of compiling directories of marine species used in TM, consumption levels and histories, perceived conservation concerns, and livelihood possibilities was underway, thanks to the efforts of participants to bring new information to the meeting, and to propose methods and set objectives for further data gathering. Participants identified a mechanism for building on workshop contacts to establish a strong network, and created an exceptional atmosphere in which to work in while in Cebu. Developing action plans, protocols and general paradigms to improve marine medicinal management will require much further work, but through the newly established workshop network, continued research and a number of the actions proposed here, participants identified a route forward towards meeting these objectives. Finally, although more discussion on marine medicinal aquaculture techniques will be necessary, the meeting did confirm that aquaculture was an important and viable option, a view that was not obvious to all at the start of this process. H. Hall ended by thanking everyone for their contributions to meeting workshop objectives so successfully.

Amanda Vincent shared her and H. Hall's excitement with the success of the workshop, and particularly with the enthusiasm and hard work of participants, from their preparations for the workshop to their efforts at communicating with and understanding the different perspectives of their colleagues at this meeting. She noted that clear communication had been one of the biggest difficulties of the workshop, with inadequate support for non-English speaking participants despite the best efforts of the interpreters.

She reminded the group that this workshop was only the beginning of a long building process, but that strong foundations had been laid.

A. Vincent thanked a number of people for their contributions to the workshop: the people of Handumon, the staff of the Centrepoint Hotel, the interpreters, rapporteurs, members of the workshop secretariat and Rosalinda Paredes, for her creative and effective facilitation of the meeting. The institutions that had allowed their representatives time to attend the meeting, and in many cases also provided travel funds, were also thanked.

The important role played by the workshop sponsors, IDRC, was acknowledged. A. Vincent remarked that the process undertaken here well represented the organisation's work: developing research and management options to address resource problems while respecting the environment and people around the world. Bertha Mo was active in initiating the project, and continued to provide her support throughout, for which organisers were grateful.

Finally, A. Vincent thanked each participant for devoting one week of the year to coming to this meeting and joining in the organisers' dream of a conciliatory workshop where there could be a real sharing of visions for sustainable marine medicinal use.

Danajon Bank Field Trip

Participants' Reports

The field trip to Danajon Bank and to Handumon village's seahorse conservation project was an opportunity for participants to see one community's attempt to manage their marine medicinal fishery. Mark Wilson, Aaron P. Lipton and Hanchen Zheng here share their thoughts and impressions on the visit:

Extracts from Wilson's Diary, Wednesday 8 July 1998
Mr. Mark Wilson (Tropical Marine Centre, Chorleywood, UK)

Following a very intense three days of lively discussion and constructive debate, day four of the IDRC workshop found its participants embarking on a unique field trip. The destination was Jandayan Island situated north west of Bohol in the Indo-Pacific Ocean. Here we were to meet the villagers of Handumon fishing village, an experience that would not only introduce us to the culture and beauty of the Philippines but also to the environmental and social problems associated with life on a tropical island. For me this was a significant part of the workshop. Meeting face to face with individuals whose lives were directly influenced by their own almost exhausted natural resources brought me closer to understanding the difficulties that faced them and would put the previous 3 days' discussions into context. Here I present a few smoothed out extracts from my diary, hopefully purveying the atmosphere, mood and objectives of the day.

6am

The day started early with the group promptly assembling in the foyer of the hotel. After a short briefing we made our way through the waking streets of Cebu City towards Carbon market, and finally on to the pier, where our two boats were waiting to set sail. Once boarded and clear of the busy shipping lanes we were underway and speeding over the ocean towards Danajon bank and the mangroves beyond. Remarkably the sea was calm, only occasionally would a wave created by the wake of passing merchant ships send a shudder through our boat. Croissant and rice cakes made for a simple breakfast. We ate in silence, all staring towards the horizon in anticipation of our preconceived expectations. The pensive mood only to be broken with a shout from one of the crew drawing our attention to a shoal of flying fish airborne at the bow of our boat.

Banacon Island

On arrival at Banacon Island we rendezvoused with three smaller outrigger boats called bancas. These were to take us for our tour through the mangrove plantation and the Project Seahorse Jagoliao field site. Young children gathered on the jetty obviously amused at the mixed assortment of faces and watched curiously as we transferred to the smaller *bancas*, some jumping into the water, overwhelmed with excitement. Boarding the small *bancas* went surprisingly smoothly with no one falling overboard.

9:30am The Mangrove Plantation & Field Site.

The mangrove plantation was everything I had imagined it to be; rich green foliage set against a backdrop of clear blue sky. The only sound was that of our *bancas* cruising through the narrow channels and the occasional singing of resident birds perched within the dense foliage. Our tour of the area was complemented by a discussion of the mangroves and seagrass environments. Small houses occupied every piece of exposed land enough for perhaps one, maybe two families. As we sailed past I could hear the distinct but faint sound of a radio program coming from one of the houses. When I asked what the people were listening to I was amused by my disappointment. A soap opera!

We continued on through the mangroves for about an hour until almost without warning we emerged, facing the open sea once again and the seemingly endless seagrass beds of the Jagoliao field site. In the distance we could see the sharp poles of the seahorse pens protruding awkwardly from the water.

As we drew closer I realised that there was also a tiny boat floating near to the pen. Sitting in the middle of the ocean were two young boys, one in the water. These were the fishers? Exposed to the intense sun and with no coast guard to watch for them. I stood up in my comparatively sturdy boat and looked around. Not even an ear to listen for them. Our *bancas* drew closer to the pen. The two young fishers manoeuvred alongside and in a way that suggested its contents held the world, the boy in the water presented us with a blue plastic bucket. This was their catch and their meal ticket.

We each in turn inspected the seahorses in the bucket, three females and one pregnant male, then promptly handed them back to the fisher in the water. The pregnant male was for re-release into the pen where it would be allowed to give birth, and then sold for traditional medicine. The less fortunate females were to be dried immediately and sold. I was staggered. How vulnerable were these young people? How vulnerable were the seahorses? Whilst I was dwelling on this, the boat had turned around and was heading for Jandayan Island. The sun was at its hottest, even the pilot complained about the heat. Everyone was sitting motionless trying not to exert any effort. With a yell, the group leader jumped up and began pointing at the Island ahead. We had finally arrived at Handumon.

Handumon Village, Jandayan Island

The *bancas* were moored and everyone crudely disembarked, stepping off the boats into the warm shallow water. As I walked along the beach towards the village, the realisation of isolation overwhelmed me. No electricity, no telephones, no hospital, water only from wells. After a brief lunch and welcoming introduction by the mayor of Getafe municipality a guided walk through the village introduced the workshop to village life and the remarkable skills of the craftspeople. Everything, from houses to baskets, was beautifully constructed from natural materials, the fabrication cleverly integrating aesthetics with practicality. As we continued our tour, the villagers, knowing we were unaccustomed to the intense heat, generously offered water at every opportunity. This simple offering, one we in the west would take for granted, was a great act of kindness as water here was in extremely short supply. Once re-assembled at the village guesthouse a short presentation by villagers and team members was given. This was followed by a craft sale. No one could resist purchasing such unusual beautifully crafted items.

4pm Planting Mangroves

To contribute to the restoration of Handumon's mangroves, part of our agenda required each member of the workshop to plant a bundle of one hundred propagules. This became rather a messy affair with even the most careful unavoidably becoming lathered in thick black sediment. As some had been more careful than others a swim in the marine sanctuary was made all the more appealing. It was now getting dark and for me a dilemma, for a walk along the shore, at the interface between mangrove and reef, was equally enticing. This time I favoured a slow thoughtful walk back to the village.

Entertainment

Back at the village tables had been set and supper prepared. Those who had swam in the sanctuary washed in makeshift showers, and seated themselves ready for an evening of hospitality and entertainment. First the teachers of Getafe energetically performed *tinikling*, the national dance of the Philippines. This was followed by folk dancers performing the *Kuradang* at each table as supper was being served. A warm humid evening and clear star filled sky created the perfect atmosphere for 'Balak' traditional poetry to be read. A relaxing and thought provoking part of the evening. The villagers politely remained behind their seated guests throughout the evening, creating a defined barrier of etiquette, yet still skilfully remained very much a part of the whole evening. By 8pm it was time to leave.

Journey Back to Cebu

Most people slept during the trip back to Cebu. For me there was still too much activity to sleep. Lightning constantly illuminated the sky while bioluminescent plankton occasionally flickered in the sea. Speeding through the dark in open water was not without its dangers, the pilot paying constant vigil to our onward journey. Risk of collision with night fishers in tiny barely visible boats was a serious possibility. The journey back was a good time for me to reflect upon the day's events and experiences. There were many problems to be resolved. Some had already been given attention, but the issue of the seahorses was a constant reminder of the delicate balance between human existence

and the inherently destructive nature of human activities upon the natural resources that sustain them.

Report on the Field Trip to Project Seahorse, Handumon
Dr. Aaron P. Lipton (Central Marine Fisheries Research Institute, India)

As a part of the IDRC Workshop on marine medicinals, a field trip to 'Project Seahorse', Handumon village, was arranged by the organisers. All the 35 participants from 17 countries visited the village. The following report highlights the field trip:

Boat Journey along the Danajon Bank:

On July 8 (Wednesday), 1998 at about 6 AM, departed from the Centrepoint Hotel, Cebu where we stayed and walked to the pier in Carbon market. We wore rough clothes as instructed and boarded the boat bound for Danajon Bank. After breakfast onboard, we discussed about the coral reefs around Danajon Bank. We understood that the Calituban reef is one of the double barrier reef, and its 145km length stretch comprises coral atolls, shoals and reefs. It was informed that the barrier reef once abundant with fish fauna became almost barren due to overexploitation. This in turn led to severe economic crisis for the fishers who were dependent on the reef fishery resources and induced them to exploit the remaining meagre living resources, including seahorses.

Dr. Amanda Vincent informed that the 'Project Seahorse' at Handumon village was initiated with the objective of improving resource management through informal environmental education, capacity building and developing alternative livelihoods.

Visit through Mangrove Plantations and Jagoliao Field Station

After arriving near the Banacon island, we boarded three small outrigger boats (*bancas*), led by Amanda, Heather and Marivic respectively. The boat journey was through dense mangrove plantations. Mr. Ledesma informed us that the mangroves were planted about four/five years back in an effort to reforest the denuded mangrove areas. During most of the journey period, the engine of the boat was switched off and with slow drift we could observe the seagrass rich seabed. We reached the Jagoliao field site of the Project Seahorse and Mr. Jonathan Anticamara explained about the field station. Cages (knotless type) were kept near the field station for maintaining the freshly caught seahorse brood specimens, allowing them to release the babies. The fishers were educated/advised to keep the brood males in these cages for releasing young ones. The co-operation of the adjoining villagers after some initial reluctance was also highlighted by Jonathan. Two seahorses (*Hippocampus comes*) were removed from the cages by the fishers and all the participants got the rare chance of playing with them.

Arrival at Handumon Village

We arrived at Handumon village at around 12 noon. Due to the high tide condition, we got down very near to the shore. Upon arrival, we went to the staffhouse of Project Seahorse. The house was built with split bamboo on a raised platform. The staffhouse accommodates communication systems including computer with e-mail access which operate on solar power. Lunch was hosted by the villagers after an address by the mayor of Bohol province.

Glimpses of Handumon

Subsequent to lunch, a guided tour through Handumon village was organised. The participants were divided into seven groups. My group leader, Amanda, explained about the water scarcity problems [*eds.*: in outlying islands, not on Jandayan]. Boys were seen carrying water in carboys of about 30L capacity which were transported from the main island by boat. In the entire village, one well was giving good quality water [*eds.*: there are many other wells, but these are becoming saline]. The boys carrying water get very low wages. In the island, en route, we saw seaweed (*Gracilaria* sp.) being dried for commercial purposes. Mango trees bearing mangoes were photographed by Korean and Chinese delegates. Drumstick trees were common. Mango is called '*munga*' in the island. Amanda took us to shops where dried seahorses are collected from fishers for further trading. Each shop formed an annex to the respective owner's residence. A Catholic church, adjacent market place and primary school (new) were seen.

Developing Alternative Skills/Livelihoods

As a part of the Project Seahorse program, alternative income generating ways have been taught/guided to the fishers by Amanda and associates. These included 1. net making; 2. mat weaving; 3. basket making; 4. weaving of *banyans*; 5. baking bread, cakes and other pastry items; 6. carpentry and carving works (especially carving miniature boats). [*Eds.*: only activities 3 and 6 were newly introduced to Handumon by Project Seahorse]. We talked to a former fisher, with amputated legs, who mastered the techniques of carving models of outrigger boats. The hand-carved miniature outriggers are exported to the US and sold as souvenirs. We saw a mini-boat was being built by another member, for which Amanda was helpful in mobilising materials from the mainland.

In general, the economic status of the people living in Handumon is poor. Most of the houses are of 'make shift' type. Goat rearing and piggery apart from fish drying are some other vocations in addition to rice paddy cultivation.

Mangrove Planting and Coral Reef Observations

After resting in the guesthouse of Project Seahorse, we participated in a reception by the villagers. Home-made rice pastry items and tender coconut juice were given to us. Handicraft items made by the villagers were displayed. Water proof camera, masks, snorkels etc. were given and we were guided to the Bay through the mangrove areas. Each participant planted about 100 propagules in the barren mangrove area, near the Bay. The 'mud slinging' item after the planting made the day, as the most memorable one of the workshop. Due to the low tide condition, we could observe the exposed corals, and other reef associated organisms. Excluding a few, others swam through the reef. After the swimming program we assembled in the Project Seahorse staffhouse.

Finale

During and after the supper, good music was provided by the villagers. Programs such as '*tinikling*', '*kuradang*' and recitals of '*balak*' were given by different groups, comprising teachers, students and fishers of Handumon. Songs by the team members of the Project Seahorse added the grandeur. A world map with signed photograph of all the participants was presented to the local school of Handumon. As the low tide condition continued till 10 PM, our departure was delayed and we reached the hotel at midnight.

A Good Impression of the Danajon Bank Trip in the Philippines
Prof. Hanchen Zheng (College of Pharmacognosy, Second Military Medicine University, Shanghai, P. R. China)

On the fine summer morning of July 8th, 1998, we all 35 persons attending the IDRC Workshop on the Management and Culture of Marine Species Used in Traditional Medicines coming from 18 countries and areas, left Cebu, the second largest city in the Philippines, and went by boat to Handumon Village in Getafe municipality on Danajon Bank, guided by the members of Project Seahorse under the leadership of Dr. Amanda Vincent. In the village, we made an investigation into the seahorse culture, mangroves, coral reefs and the work and life of local fishermen. This field trip, though sweltering and hard, was very exciting and memorable. It has benefited me a great deal and given me a good impression:

1. I deeply esteemed Chairwoman Dr. Amanda Vincent and her colleagues for their inflexible seeking of profession, from which it is worth learning. It was very difficult and painstaking to deal with the conservation of marine species and work with local fishermen. They left their hometown and comfortable work and went abroad to the poor island and have developed the resource management, biological and socio-economic research and culture of seahorse for many years. They have achieved greatly.
2. At its initial stage, Project Seahorse was not understood by local fishermen, but up to now it has been enjoying warm and wide support from them. All of these should owe to their care for local people in livelihood, education and help in the development of economy during their scientific research work. It was showed that it's very important for scientists to merge with local people while they pay attention to their own research work. A scientist especially a biologist should also have a good knowledge of social science and folklore because he often makes contact with different people.
3. It has enriched my experience greatly. Though the small island is remote, directed by Chairperson, we have investigated the specific tropical landscape such as mangrove plantation and colourful coral reefs in shallow seashore, enjoyed delicious food with distinctive national features and watched the national dance of the Philippines. We also planted mangrove trees on the seashore, which was not only helpful for us to recognise this tropical seaside plant and its magical seed but also a good deed for local people, meanwhile it was the best memento for all of us in this Workshop. It was a good idea!
4. It's very difficult to prohibit seahorse from being used in TM for some historical and social reasons. After having seen the lovely oceanic fish seahorse and known the difficulty of its mass aquaculture with my own eyes, I have a strong desire that we should use this animal as less as possible and should find a good way for its living and sustainable utilisation.
5. We were all satisfactorily arranged by the host during the field trip. The organisation was very good. Here I should express my heartfelt thanks to all the members of Project Seahorse, IDRC of Canada, Haribon Foundation of the Philippines, London Zoo and all the people who supported and helped the Workshop. I wish greater achievement for Project Seahorse under the leadership of Dr. Amanda Vincent!

Part IV. Workshop Participants

Participants' Contact Details
Summary of Work



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I am a Marine Fish Biologist currently working on the Seahorse Conservation Project and Coastal Resource Management Project in Jagoliao, Jetafe, Bohol, Philippines. My work essentially includes research to establish baseline data for preparing proper management options and plans for seahorse and other fisheries conservation in Jagoliao and on many other islands around Northwest Bohol.
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I am the research co-ordinator in a Belgium co-operation project working on the topics of shrimp larviculture and mud crab research. We are also trying to close the life cycle of seahorses using a diet of *Artemia*.

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I am a government employee of BFAR. My current work group memberships are the following: member of the technical secretariat for the Inter-Agency Committee on Biological and Genetic Resources; member of the Subcommittee on Biodiversity representing BFAR; member of the BFAR-CITES Committee which handles aquatic organisms; chairman of the BFAR-FRRD Environment Unit. I graduated B.S. Zoology from the University of Santo Tomas (1985) and obtained my M.S. Biology degree from the Gregorio Araneta University Foundation (1991).

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I finished an undergraduate course on social research and environmental policy analysis in Melbourne in 1993. I then returned to Hong Kong and joined WWF-HK in early 1994 and later TRAFFIC East Asia in 1996. I have recently finished an attitudinal research on Hong Kong Chinese towards wildlife conservation and the use of wildlife as medicine and food. Apart from being the editor of a newsletter on issues concerning wildlife conservation and TCM, I also carry out liaison work with TCM communities in Hong Kong, Macau and Southern China. I am currently researching the trade in medicinal plants in East Asia.

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I have worked on threatened species conservation in Tasmania, Australia for 8 years and have worked for WWF for 3 years. I, among a number of Australians, have for the last 4 years publicised the plight of seahorses and their relatives in Australia and internationally. We have successfully lobbied for legal protection at State and Commonwealth levels.

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I have recently completed a BSc degree in Biology at McGill University, Montreal, Canada. As an honours research project towards my degree, I studied marine species used for traditional medicines, in order to begin identifying potential conservation implications of their use. I am currently preparing to begin trade research on seahorses and their relatives, and to continue studying other marine medicinals. (Project Seahorse)

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Dr. Amanda VINCENT*Conservation*

I did some of the first work on seahorse biology, trade and conservation and continue to work on these quirky fishes, their relatives and their habitats. I teach aquatic conservation and sit on the Steering Committee of the IUCN Species Survival Commission, with special responsibility for coastal species. (Project Seahorse)

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I am employed by the Columbus Zoological Gardens as the Assistant Director of Living Collections. My responsibilities include the daily supervision of a 65 person husbandry staff and their care of a 6,000+ specimen animal collection, establishment of husbandry protocols, new exhibit design and construction, and animal/plant collection acquisitions and dispositions. I am also responsible for the development and implementation of related conservation and research programs. I serve on or as chair of several American Zoo & Aquarium Association aquatic conservation committees. I am an aquatic biologist by training.

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I am involved in all aspects of marine fish and crustacea aquaculture, particularly coral reef species, with emphasis on developing techniques in larval rearing. I also design and build filtration units for commercial aquaculture projects.

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Mr. Chris WOODS*Aquaculture*

NIWA has been conducting a preliminary investigation into the aquaculture of *Hippocampus abdominalis*. This has included breeding captive broodstock and rearing the juveniles produced from this broodstock.

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Dr. Chunguang ZHANG*Conservation*

Associate professor and vice director of the Centre of Animal Systematics, Institute of Zoology, the Chinese Academy of Sciences, Beijing, China. I have been researching systematics and conservation of fishes mainly distributed in China. I am engaged in compiling Chinese Red Data Book of Fish and Fauna of China (Pisces: Exocoetidae, Syngnathidae, Anguilliformes, etc).

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Dr. Endi ZHANG*Conservation & TM*

I have been involved in conservation since 1983. My main research interests are behavioral ecology of mammals and wildlife conservation. I joined the Wildlife Conservation Society in 1996 and work on its Asian Conservation Communication Program that is based in Shanghai, China.

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Prof. Hanchen ZHENG*TM Research*

I have been working on the study and teaching of Pharmacognosy and Natural Medicinal Resources. Now I am a member of the Chinese Pharmacopeia Commission, and board member of the Natural Resource Association of China as well as the Shanghai Pharmacy Association. I have published more than 80 academic papers and more than 30 books (in collaboration).

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Summary of Work

The diversity of participants at the workshop, in knowledge, experience and opinion, matched the complexity of the issues under discussion. Without this diversity, developing a balanced and accurate view of the state of marine medicinals would have been impossible. To introduce you to the range of perspectives participants brought to the meeting, we asked each to prepare a summary of his or her work, and to explain how it relates to the workshop themes. Most chose to focus on a limited portion of their activities that bear directly on the workshop.

These contributions are as written by the participants, with slight editing for flow.

Aquaculture

Ali Hafiz Al Qodri, A. Pi.

Culture of seahorses in Indonesia

Seafarming Development Center (SDC), PO Box 74, Teluk Betung, Lampung 35401, Indonesia

Background

Indonesia is a maritime country. Two thirds of its area consists of water, and the country has great potential as a supplier of ornamental fish. Presently, most of these fish are wild caught with simple tools and technology. If fishermen want to catch many fish quickly, they tend to use financially and ecologically unsustainable methods, such as anaesthetisation.

Of the different sorts of commercially valuable ornamental fish, the seahorse (*Hippocampus* spp.) is easily cultured. [Eds.: See Part V. Position Statement on Seahorse Aquaculture]. In addition to being an ornamental fish, the seahorse is also used for medicine. Nowadays, it is considered to be endangered [eds.: most seahorse species are in fact listed as Vulnerable by the IUCN]. In Indonesia, decreasing catches over the last few years suggest that the population of seahorses is gradually decreasing, although exact numbers are not known. This situation is made worse by damage to seahorse habitat, either by nature or by human activities, such as the reclamation of beaches to be used for recreation, houses or shrimp ponds.

Since 1990, seahorse trade, especially from Lampung waters, has decreased. Collectors send no more than 10 seahorses per week, on average, to exporters in Jakarta. Even the breeding experiments done by Seafarming Development Center (SDC) lack broodstock— the more seahorses we want to produce, the more broodstock we need. If the number of seahorses decreases, the prices will be higher, whether they are alive or dry. Yellow seahorses are more expensive than the black ones. An average sized black seahorse costs 4000-5000 rupiah (US\$0.28-0.35), while a yellow one costs 7000-10 000 rupiah (US\$0.49-0.70). Buyers will pay 100 000 rupiah (US\$6.95) for a white seahorse.

Current Activities

National Seafarming Development Center (SDC), as one of the technical organiser units (UPT) of the Fishery General Directorate, has the mandate of developing sea fishery culturing technology in Indonesia. Since 1992, SDC has experimented with seahorse breeding. Besides mass producing seahorse young, SDC also cultures juveniles to enlargement. The young produced are sold to collectors and neighbouring fishermen, who keep them until they are big. We hope that seahorse culturing technology can be distributed to the farmers, fishermen and stakeholders interested in seahorse culture.

Traders from either Jakarta or Singapore ordered dried seahorses in great numbers from Lampung, but unfortunately, because its seahorse culturing is still on a small-scale, SDC could not meet this order. To date, the highest survival rate achieved in culture is around 30% at 30 days. In addition to culturing on land, sea-ranching has also been done. The young seahorses are spread out in the waters surrounding SDC. Other activities of SDC include producing young seafish such as groupers,

seabass, molluscs and various ornamental fish and holding training and education sessions for the fisheries industry, and for fishers.

Connection to Workshop Themes

Seahorse aquaculture and other supporting activities is the appropriate answer to avoid the overharvesting of wild populations. We must learn to use available resources optimally.

Projected Action

Seahorse culturing information is made widely available by SDC through the publication of a culturing guidance book, and through training sessions for farmers/fishermen. SDC's goal is to develop economical and appropriate technology for culturing, and also to contribute to seahorse conservation. The technology, once mastered, should be transferred to fishermen as an alternative livelihood option.

	Conservation
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Jonathan Albuo Anticamara

Marine and Coastal Resource Management in Bohol, Philippines
(Project Seahorse/ Haribon Foundation)
Jagoliao Island, Getafe, Bohol, Philippines

Background

The Coastal Resource Management Project (CRMP) which is implemented by Haribon Foundation in Northwest Bohol, Philippines, is a national project operating throughout the Philippines and funded by the United States Agency for International Development (US-AID). The project in Bohol operates in six municipalities and one expansion municipality. The project started last July 1997, and is targeted to operate for three years. As a coastal resource management project, it uses seahorses as flagship species while generally addressing issues which concern the entire marine and coastal environment. The project in Northwest Bohol has adopted a Community-based Resource Management strategy, which means we are involving local villagers in all our activities, and training them to be able to manage their resources on their own while linking to other agencies.

Current Activities

As a biologist of the CRMP, assigned in the municipality of Jetafe, Bohol, I am mostly involved in the resource management aspect of the project, which entails research, education and linking. The project which I am working on at the moment has just finished its first year, and so far, we have facilitated the implementation of a marine sanctuary in Jagoliao island in Jetafe, Bohol. We have also recently finished the Participatory Coastal Profiling of one island village in Jetafe. This participatory research process aimed to involve local villagers in all aspects of resource inventorying and research, in order to help them improve their understanding of the status of their resources and identify management opportunities and options. This kind of research work will be propagated in other coastal villages in the whole learning area of CRMP-Northwest Bohol to come up with a learning area profile to be use for management planning.

Connection to Workshop Themes

The CRMP which I am involved in at the moment is, fundamentally, a seahorse conservation project, though it is not limited to seahorses alone. Seahorse conservation includes a vast range of other coastal resource management issues, which seahorses beautifully represent. These issues include habitat destruction, overfishing, and indiscriminate exploitation. In this sense, my job closely relates to the theme of the workshop which is 'Marine Medicinals Use, Culture and Conservation', though my focus is mainly on conservation at the source level, or the fishing community.

Projected Action

Two years more is the remaining time frame of the CRMP and basically our aim is to cover as wide an area as possible (that is, many fishing villages), and to facilitate their learning of how to manage their own resources—seahorses specifically, and the entire coastal resources in general. Targets are:

establishing more sanctuaries; establishing more people's organisations to implement resource management strategies; gathering baseline data with regards to seahorse abundance and population and also monitoring any changes in seahorse population once the proper management schemes are implemented. We also plan to go beyond monitoring of animal populations to try to monitor any changes in the conditions of human populations dependent on coastal resources such as seahorses.

Aquaculture

Rudi Bijns

Nutritional aspects of seahorse breeding: bio-encapsulation of essential nutrients in *Artemia* sp.
Shrimp *Artemia* Aquaculture & Development Institute (SARDI), 3rd of February St.,
Can Tho University, Can Tho, Vietnam

Background

In the past, the Shrimp *Artemia* Aquaculture & Development Institute (SARDI) focused their research activities on the development of *Artemia* pond culture and shrimp culture in the Mekong delta. However, shrimp culture has declined strongly since 1995 due to the presence of diseases. With the support of the Belgian universities, a new project started in 1996 to diversify aquaculture activities in this area. Besides research on post-larvae quality, the possibilities of mud crab (*Scylla serata*), molluscs and cockles, and seahorse breeding are being investigated. Research on seahorse breeding is investigating the value of *Artemia* as a food to raise *Hippocampus kuda*, and specifically, the effect of essential fatty acids on broodstock and juvenile performance.

Artemia culture in the Mekong delta is currently focused only on cyst production. Moreover, *Artemia* biomass cannot be marketed due to the lack of proper processing equipment and the distance to the nearest possible market. Therefore, *Artemia* biomass can only be used locally, as in our seahorse breeding project.

Current Activities

1. Maturation Diet:

It is generally assumed that for marine fishes, there is an effect of broodstock diet on egg and larvae quality: e.g. Watanabe *et al.* (1994), Mourente and Odriozola (1990 a, b) and Harel *et al.* (1994) demonstrated such effects of phospholipids and essential fatty acids on bream species. Mangor-Jensen *et al.* (1991) reported similar effects of vitamin C on cod. Therefore a study was undertaken to investigate the effect of broodstock diet on the frequency of mating, brood size and quality of newborns of *H. kuda*.

In a first phase, broodstock animals, *H. kuda* 'Nha Trang strain', were fed *ad libitum* with *Artemia* biomass enriched with a range of commercial products. A few pairs were fed with wild zooplankton (mainly mysid larvae) as a positive control, while others were fed with non-enriched *Artemia*. Although the results were far from satisfactory, it was clear that there exists an effect of essential fatty acids on broodstock behaviour and quality. While the animals fed with zooplankton were reproducing, the seahorses fed with *Artemia* biomass were not. However enrichment of *Artemia* resulted in some small batches of newborns.

The second step was the development of a self-made enrichment emulsion to give a more suitable fatty acid profile. Bio-encapsulation of this emulsion in *Artemia* biomass resulted in a constant and regular supply of newborn juveniles. Moreover, juveniles reached maturity in less than 4 months. For the three following months, brood size of these animals varied between 160 and 540 juveniles. Spawning is continuing.

2. Juvenile culture:

Specific problems were encountered during the first trials, most probably related to our *Artemia* strain. Different feeding regimens and prey animals were compared. Although the rotifer *Brachionis plicatilis* was hunted strongly by the newborns, rotifers seem not to be suitable as a first

food because of their small size. Rotifers were found in the mouth, throat and digestive tract of seahorses, but energy supply seems to be unbalanced.

Different *Artemia* strains and stages were compared with each other. Using the proper molting stage of *Artemia* nauplii seems to have a clear effect on survival. Moreover, high survival rates of newborns during the first week seems to be related to feeding them the proper *Artemia* strain. Results need to be verified and processed.

Projected Action

The need for essential fatty acids and phospholipids in a broodstock diet will be further defined. The Belgian project is a research and education project. Therefore larviculture techniques will be optimised for the local circumstances using the seahorses as a study model. Further experiments will hopefully give us more necessary data to establish small seahorse cultures in co-operation with the *Artemia* farmers.

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Public Aquaria

Jeffrey R. Boehm, DVM

The role of public aquaria in issues relating to trade in marine medicinals

John G. Shedd Aquarium, 1200 South Lake Shore Drive, Chicago, Illinois, 60605, USA

Background

The exhibition of animals in zoos and aquariums has long held a fascination for the visiting public. Over the past couple of decades, however, these facilities have been challenged to develop beyond their historic roles as educational facilities into more comprehensive learning, research and conservation institutions.

The Shedd Aquarium opened in 1930 with a global collection of aquatic animals exhibited in a manner that for its time was quite progressive. In the intervening years the style of animal display changed to accommodate an interest in more comprehensive exhibitry: exhibiting the animals in the context of the other animals with which they share habitat and exhibiting the habitat itself. Beyond the physical changes, philosophic shifts have occurred as well. Aquariums and zoos now manage their collections co-operatively, seeking to advance mutual goals beyond public education to include research and conservation.

Current Activities

In my role as the vice president of research and veterinary services at the Shedd Aquarium, I oversee the aquarium's preventative veterinary medical program, the water chemistry laboratory and the aquarium's research and conservation programs. In the latter capacity, I have had an opportunity to be a part of the creation of several interesting and productive initiatives—several recently, that are linked to the discussions topics of this workshop.

Research programs are supported by the aquarium when they match the institution's mission of conservation of aquatic resources, complement the resources of the aquarium and link, in a relevant manner, to field conservation or research programs. A standing research committee reviews

submitted scientific protocols and seeks to establish partnerships with investigators whose work best matches our programs and directions.

Connection to Workshop Themes

In 1996, the aquarium began support of Project Seahorse, specifically program elements of the community-based project in the village of Handumon, in the province of Bohol, in the Philippines. The following year, the aquarium continued to work closely with the Project's co-ordinators to develop an exhibit on syngnathids. The exhibit, opened this past May, includes a large collection of these incredible animals and a strong, well-developed message regarding effective conservation. The aquarium continues to support the work of Project Seahorse and is currently sponsoring an array of activities in the village of Handumon.

Projected Action

Our collaboration with Project Seahorse has led to the co-hosting of a workshop to occur late this fall (December, 1998). Building on a series of workshops, the December meeting will convene aquatic husbandry experts from the zoo and aquarium community internationally to discuss the state of husbandry with syngnathids, to develop a prioritised list of research objectives focused on their care and husbandry and to develop a process for assuring that the research agenda is advanced and that information is disseminated effectively.

With these collaborative efforts the aquarium has invested in a significant conservation effort. Beyond being a part of specific advances in seahorse conservation, the collaboration is remarkable in a broader way, as well. Collaborations such as this have become models for the ways in which public aquariums can make optimal use of limited resources to achieve their missions. The audience that a public aquarium can reach (~1.8 million visitors per year for the Shedd Aquarium) is a key contribution that the aquarium community can bring to these collaborations. Coupling the resources of aquariums with those of other conservation-related organisations is an exciting direction for these facilities as they redefine their goals and position themselves anew within the conservation community.

	Aquaculture
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Suraphol Chalarkid

Seahorse culture

Bangsaen Institute of Marine Science (BIMS), Burapha University, Bangsaen, Chonburi 20131, Thailand

Background

Culture of seahorse (*Hippocampus kuda*) in the laboratory. Investigating the effect of feed types and salinity on the growth of young seahorses. Nursing young seahorses with *Artemia* nauplii, enriched from various different food sources.

Current Activities

Culturing seahorses in a recirculating system.

Connection to Workshop Themes

Working on seahorse culture.

Projected Action

To prevent the extirpation of seahorses from Thai waters, and to increase wild population numbers by releasing captive bred seahorses. [Eds.: See Part V. Position Statement on Releasing Captive Seahorses].

Vincent Chen
TRAFFIC and its work
Program Officer

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Background

An Introduction to TRAFFIC:

The TRAFFIC Network is the wildlife trade monitoring program of the IUCN and WWF. TRAFFIC was established in the mid-1970s to work with CITES, a UN treaty which in 1998 had more than 140 member countries and territories. The TRAFFIC Network has offices or representatives in 20 of these member countries and territories. TRAFFIC East Asia has a regional office in Hong Kong and representative offices in Tokyo and Taipei.

The TRAFFIC Network's primary focus is the commercial consumptive use of wildlife and whether or not levels of use constitute a threat to the survival of the species in the wild. TRAFFIC's mission is to "...help ensure that wildlife trade is at sustainable levels and in accordance with domestic and international laws and agreements". TRAFFIC achieves this through the investigation, monitoring and reporting of wildlife trade. The Network analyzes the impact of trade, develops recommendations, and communicates the results of its work to the appropriate audiences.

Seahorse trade in Taiwan:

Seahorse and pipefish (*hai ma* and *hai lung*, respectively) products are imported in dried form for TCM use in Taiwan. According to Custom records, Taiwan imported an average of 5t of dried seahorse annually from 1983 to 1989. After Taiwan's economy rapidly developed during the late 1980s, the dried seahorse imports doubled to average 12t per year from 1990 to 1997. However the average price of dried seahorses decreased from 124.50US\$/kg in 1984 to a low of 32US\$/kg in 1996. Thailand has consistently been the largest source of dried seahorse products for Taiwan.

Current Activities

TRAFFIC has chosen to adopt four program priorities to organise its work on wildlife trade. They are:

- trade in CITES-listed and other protected species;
- fishery products in trade;
- trade in timber and other wood products; and
- medicinal wildlife trade

All of these sectors are important to the economies of East Asia and Southeast Asia and, with the exception of timber, all are relevant to the current workshop. Taiwan is an important market for medicinal wildlife and is also home to a major distant-water fisheries fleet, making these two program priorities especially important to TRAFFIC Taipei.

Connection to Workshop Themes

To date, TRAFFIC Taipei has undertaken the following activities:

- Medicinal wildlife trade: surveys of the medicinal use of rhinos, tigers, saiga antelope and bears.
- Fisheries: surveys of Taiwan's fisheries and markets for shark species (including whale shark), reef fish (including aquaculture products) and sea cucumbers.

Work done on Taiwan's market for turtles and tortoises, as well as supporting Dr. A. Vincent's work on seahorses, bridges both medicinals and fisheries.

In addition to survey work, TRAFFIC Taipei has also reviewed Taiwan's existing legislation and regulations related to harvest and trade in wildlife species and has provided recommendations to the government where required. Targeted outreach activities to both the TM community and the fisheries industry have been identified as priority activities for the office. The aim of this outreach has been to inform stakeholders of existing domestic and international trade controls, concerns over sustainability of harvest levels, and likely future developments which could affect resource access. This has been done through media, workshops and seminars, publications, and a Chinese language web-site.

Projected Actions

As trade in medicinal wildlife and fishery products are identified as Network-wide priorities, TRAFFIC Taipei will continue to work in these areas. Follow-up work on the species mentioned above will continue, with increased emphasis on research into the trade in medicinal plants.

Aquaculture

Philippe Dhert, Ph.D.

General information: Laboratory of Aquaculture & *Artemia* Reference Center
University of Gent, Laboratory of Aquaculture & *Artemia* Reference Center, Rozier 44, B-900, Belgium

Background

Research on the brine shrimp *Artemia* and its use in aquaculture started at the Gent State University in 1970 in the Laboratory of Ecology (Director Prof. Dr. em. J. Hublè) and further expanded as of 1972 in the Laboratory of Mariculture (Director Prof. Dr. G. Persoone). The *Artemia* Reference Center (ARC), set up as a section of the Laboratory of Mariculture in 1978 and co-ordinated by Dr. P. Sorgeloos, became an independent Research Center of the Faculty of Agricultural Sciences in 1985 with the Faculty Dean Prof. Dr. ir. F. Pauwels as its Administrative Director. In view of an expansion of research and training activities the name "Laboratory of Aquaculture & *Artemia* Reference Center (ARC)" was adopted in 1989. In 1990, Prof. Dr. P. Sorgeloos was officially appointed as laboratory director.

The ARC occupies over 1000 m² of lab space, including analytical laboratories with modern instrumentation and culture rooms with different set-ups for small-scale and pilot scale culture testing of algae, the rotifer *Brachionus*, brine shrimp *Artemia*, larviculture of marine shrimp *Penaeus* spp., freshwater prawn *Macrobrachium*, marine fish spp. and bivalve mollusc species (*Tapes* spp.).

Current Activities

The ARC continues the study of various fundamental aspects related to *Artemia* biology and its mass-production, e.g. cyst biology and diapause regulation, strain characterisation, filter-feeding kinetics and intensive production techniques for cyst and biomass. Since several years the ARC is involved in the following fish and crustacean larviculture Research & Development themes through interdisciplinary co-operation programs with other labs in Belgium and abroad:

1. broodstock and larviculture nutrition (feed formulation, feeding strategies, etc.) in marine fish (turbot, seabass, seabream)
2. effect of broodstock nutrition in shrimp and prawn on maturation, egg and larval quality, and larval dietary requirements
3. qualitative and quantitative lipid requirements of fish and crustacean larvae (DHA/EPA, phospholipids): use of enrichment diets (experimental ICES standard emulsions) for *Brachionus* and *Artemia*; use of formulated feeds (ICES standard diet)
4. vitamin C and E nutritional requirements and supplementary effects (disease and stress resistance) in fish and crustacean larvae
5. use of *Artemia* and *Brachionus* for biomedication and vaccination in larviculture of fish and crustaceans
6. manipulation of the microflora in live food production and larviculture of fish and crustaceans

7. use of algal substitutes and/or supplements in mollusc larviculture
8. use of immunostimulants in fish and shrimp larval diets

Testing with target species is done at small-scale at the laboratory in Gent with larvae of fish, shrimp, and molluscs that are obtained from hatcheries abroad. Through co-operation programs with research and commercial production centers in Europe, Asia and Latin America, further verification work is performed with other fish and shellfish species (e.g. different *Penaeus* spp.; different European marine fish spp. such as bass, turbot, bream, halibut, cod, Dentex; Asian seabass, milkfish, grouper and mahimahi, different clam spp.).

Since 1978 the ARC has organised eight editions of the "International *Artemia* Training Course" in Belgium. Furthermore, at least once a year the ARC participates in the organisation of regional *Artemia* training courses. So far over 300 students from more than 30 different countries have received training in *Artemia* biology, production techniques, interaction with salt production and use of *Artemia* products in aquaculture at the occasion of courses organised in Belgium, Brazil, PR China, Panama, Dominican Republic, Ecuador, Egypt, India, Mexico, and the Philippines. Initially the training focused on the reproduction and use of *Artemia*, later, other aspects of aquaculture gained importance so that the scope of the training course was broadened to larviculture in general. Since October 1991 the Laboratory of Aquaculture & *Artemia* Reference Center has offered a two-year inter-university MSc Course in Aquaculture, sponsored by the Belgian Administration for Development Cooperation. The MSc in Aquaculture is a two year program offered by the Faculty of Agricultural and Applied Biological Sciences, University of Gent, on the most important aspects of aquaculture for both marine and freshwater organisms. The program is characterised by an increased inter-university approach resulting from a policy to intensify co-operation with other specialised Laboratories both in Belgium and abroad.

The ARC is the (co-)editor, publisher and/or author of over 100 scientific contributions on brine shrimp *Artemia* and larviculture nutrition in: international journals and books; three bibliographies on *Artemia*; a FAO manual for the culture and use of the brine shrimp *Artemia* in aquaculture; three volumes of proceedings of the first international *Artemia* symposium (1980); three volumes of proceedings of the second international *Artemia* symposium (1987); CRC Handbook of *Artemia* Biology (1991); one volume of proceedings "Progress in Larviculture of Marine Fish, Shrimp and Prawns (Special Session at the World Aquaculture '90 meeting in Halifax, Canada); two volumes with the Short Communications and Abstracts of Larvi '91 and Larvi '95; two volumes of proceedings of the Fish & Crustacean Larviculture Symposium LARVI '91 (Gent, Belgium); and since 1986 thirty-five issues of the "*Artemia* Newsletter" (recently renamed "Larviculture & *Artemia* Newsletter").

Other activities of the laboratory entail: the maintenance of an *Artemia* cyst bank containing over 150 samples from different sources on the five continents; the delivery of quality certificates for commercial cyst batches (characteristics of hatching, biometrics and nutritional value); short and long term world-wide consultation for different (inter)national organisations and private companies; (co)-organiser of symposia; distant education and extension.

Connection to Workshop Themes

Through co-operation programs with research and commercial production centers in South-East Asia, the Lab of Aquaculture & *Artemia* Reference Center got involved in the larval rearing of ornamental fish. Seahorse culture is being performed on a very small experimental scale in Vietnam where an excess of *Artemia* biomass is being produced which can not be sold or valorised due to economic and logistic problems. In order to increase the income of the local farmers a small project was set up in which the excess of *Artemia* biomass could be fed to seahorses. After one year of basic research on seahorse breeding and larval rearing, a better knowledge on the nutritional requirements of the seahorses has been obtained.

Dolores Ariadne D. Diamante-Fabunan
Integrated Coastal Management in the Philippines

Coastal Resource Management Project, 5/F CIFIC Towers, Humabon cor. J. Luna Sts., North Reclamation Area, Cebu City, Philippines

Background

The Philippines is a maritime country and has always relied so much on its marine and coastal resources. These past several years however, the Philippine coastal resources have been declining and/or are being degraded due to several factors such as pollution, increasing human population, overexploitation, unequal trade and many more. To address this problem(s)/issue(s), several coastal management efforts—initiated by the government, non-government organisations, people's organisations and other projects—have been made in the past 20 years or so. One of the most recent of such activities is the Coastal Resource Management Project (CRMP), a technical assistance project funded by the United States Agency for International Development, implemented by the Philippines' Department of Environment and Natural Resources (DENR) and managed by Tetra Tech EM, Inc.

Current Activities

In contrast to earlier programs, the CRMP aims to promote integrated coastal management by strengthening leadership in the government, private and community sectors. The project does not usually fund livelihood endeavors, for instance, although it would be quite willing to help provide the necessary training as well as to facilitate in addressing marketing or trade issues. The CRMP is also very serious in its information, education and communication (IEC) programs. CRMP would like to believe that it has learned from past Coastal Resource Management (CRM) projects, hence, its present thrusts and programs.

As the CRM Specialist of the project, I am tasked to provide technical assistance to our Learning Area Co-ordinators in planning and management; help in our training courses; guide our learning area teams in developing the area profiles and help in our IEC efforts.

Connection to Workshop Themes

Anything that would affect or have any tremendous impact on coastal communities and/or areas would greatly interest any decent CRM practitioner. Overexploitation of marine or coastal resources, for various reasons, has been one of the greatest problems that coastal communities, our country, and even the world, have encountered. Loss of biodiversity is not an issue that is solely the interest of biologists or conservationists. Trade is not an exclusive domain of economists, nor medicine of doctors. CRM is about the environment, living or otherwise, its use, people and how they all relate together towards the common good for generations to come.

Many, many species have been disappearing in the world, some of them we never really knew about but could only guess. And it is not only this richness that the world is losing. Each kind of life has an important role to play and who knows what irreparable damage the world will experience with the loss of said species. In the end, if only true integrated management can be implemented, then there is no need to suffer such losses. Biodiversity is maintained, resources are basically extracted only in response to real needs and all sectors of society are generally satisfied.

Projected Action

To date, the CRMP is working with the Haribon Foundation in Bohol. Officially, we, with I as a CRMP staff, are in support of Haribon's CRM-related efforts. Also, as I have mentioned in the workshop, anybody who can and will contribute to "*Tambuli*", the CRMP's newsletter, is welcome. "*Tambuli*" may serve as a venue for making known issues and measures about marine medicinals.

Personally, although I am no doctor, trader or user (as far as I know!) of marine medicinals, I have always been supportive, in one way or the other, of any CRM-related effort. If I needed to do things for this in my spare time, I do not hesitate to do so as long as they are, indeed, humanly possible and within my means and/or sphere of influence. For example, as soon as I learned about this program, I immediately informed my MSc Marine Biodiversity students about the possibility of their taking this on for their theses. I also saw this as an opportunity or as an entry point to gain due recognition and appreciation for the much ignored, if not maligned ecosystem, the seagrass beds; and so, promptly applied it in my subsequent training courses.

I never tire to teach the children about the many miracles in the sea, seagrass, seahorses and marine medicinals included. I do not intend to stop. But I do hope to gain a better opportunity, to find the right venue, soon, to be able to do something—and perhaps, with the right people, with their hearts and minds in the right places—with a greater impact.

Aquaculture & Conservation

Do Huu Hoang and Truong Si Ky, Ph.D.

Attempts to conserve seahorses in Vietnam

(Project Seahorse/ Nha Trang Institute of Oceanography)

Department of Aquaculture Biotechnology, Institute of Oceanography, Cau Da, Nha Trang, Vietnam

Background

Seahorses are heavily exploited in Vietnam, for export to China and Hong Kong, where there is heavy demand for these fishes in TCM. About 5t of seahorses were exported in 1995. Fishers and buyers report that the number and size of seahorses (and other marine fishes) are decreasing and it appears that many seahorse populations are now at risk. At least seven species of seahorses are found in Vietnam: four are listed in Vietnam's Red Data Book, although with poor supporting evidence.

A project of seahorse conservation and management was launched in Vietnam in May 1995, with initial funding from the United Kingdom Department of the Environment's *Darwin Initiative*. This work is based at the Institute of Oceanography in Nha Trang and involves five Vietnamese biologists.

We first concentrated on trade assessment and fisheries monitoring. Most of the seahorses traded in Vietnam are incidental by-catch of trawlers who are targeting other species. A vast increase in the number of trawlers on Vietnam's coasts over the past decade has greatly exacerbated the pressure on target and non-target species alike, and probably explains declining seahorse yields. In addition, many more seahorses are target caught by hand and sold alive. High demand for seahorses is promoting more seahorse catches.

Current Activities

We now undertake a wide range of activities:

1. Aquaculture:

Our main work focuses on small-scale and low-technology seahorse aquaculture, in order to help protect seahorse populations in the wild. Our pilot projects on captive rearing have shown early success with two species, *Hippocampus kuda* and *H. trimaculatus*. We have succeeded in closing the life cycle of the former, and rearing a third generation of *H. kuda*, but we have not yet determined how to do this reliably.

H. kuda is often found in estuaries. They can tolerate a very large range in salinity. This is an advantage for aquaculture. In captivity, by the time they are six months old, *H. kuda* have reached a commercial size of 110mm - 120mm. Our trials are improving. In one trial, more than 70% of one brood survived to six months.

Feeding presents the major difficulty with culturing. Seahorses will only accept mobile and living prey and a size small enough to fit in their snout (usually <15mm). Wild seahorses eat mysids, amphipods and palaemonids, but they are difficult foods to produce *ex situ*. Instead, the captive seahorses are fed cultured *Artemia* and wild-caught mysids, collected from the shrimp ponds. Such wild sources of food are far from ideal because of their unreliability, so we are now trying to culture large volumes of *Artemia* in disused salt ponds, with good yields from the first two batches.

We are now working with fishers and farmers to develop more reliable seahorse aquaculture, and to introduce this potential source of income to villages. Our goals are to reduce catches of wild seahorses, to provide income for fishers, and to satisfy market demand for seahorses as medicines. We have held four workshops with a total of forty participants, explaining what we do know and enrolling them in helping to learn the rest. The main problem with village seahorse culturing lies in the need for large volumes of food so we hope that pond culture techniques for *Artemia* can be transferred to villagers, once adequately field-tested.

2. Fisheries, trade, and biological research:

A. Seahorse fishery and demography

- We record and measure incidental catches of seahorses by trawl boats, in order to determine seasonal and annual changes.
- Fishers complete catch calendars in order to give us longitudinal records of seahorse catch by eight focal trawl boats.
- Trawl boats take us to sea four nights each month so that we can get a detailed understanding of seahorse distribution with respect to habitat, depth and other species.

B. Seahorse trade

- We travel around Vietnam, interviewing fishers and traders and visiting markets and dealers in order to determine trade volumes, prices and routes.

C. Seahorse biology

- We study seahorse behavior and physiology, through laboratory observations and experiments to understand growth rate, feeding and reproduction.

In addition, thousands of baby seahorses have been released into the sea. [Eds.: See Part V. Position Statement on Releasing Captive Seahorses].

3. Community education

The survival of organisms depends greatly on a healthy environment, which in turn depends directly on a wide range of human activities. In order to protect animals, we have a responsibility to increase awareness about environmental issues in the larger community.

- We lead the school's education program once a week, making students aware of conservation and environmental issues.
- Several informal village visits per month allow us to discuss environmental issues with fishers and their neighbours, examining with them the causes of declining fishing yields and making them aware of their own power to improve management practices.
- Judicious use of mass media allows us to disseminate information about seahorse aquaculture and conservation, and other project activities, to newspapers, magazines, radio and television.
- We also produce posters and T-shirts about seahorse conservation in order to spread the message further.

Projected Action

Our main goal is to ensure the long-term health of wild seahorse populations. One way to achieve this objective (although by no means the only way) will be to improve seahorse culturing techniques (increasing growth and survival rates) so that this activity becomes both ecologically and economically viable, reducing pressure on wild populations even while enhancing incomes of poor

fishers. We continue to try to enhance aquaculture yields while maintaining our other conservation related activities.

Acknowledgments

We would like to thank Dr. Amanda Vincent for her great assistance. We are also very grateful to Ho Thi Hoa, Ho Van Trung Thu for helping with seahorse aquaculture, seahorse biology and community education, and Nguyen Van Long for his work in community education and the seahorses trade. The work has received financial support from the United Kingdom Darwin Initiative for the Survival of Species, Canada Fund for Local Initiative (CIDA), International Development Research Centre (Canada) and Tropical Marine Centre (UK).

Public Aquaria

Heather Hall, Ph.D.

Issues surrounding the aquarium trade in seahorses
(Project Seahorse/ Zoological Society of London)

London Zoo, Zoological Society of London, Regent's Park, London, NW1 4RY, UK

Background & Current Activities

I carried out my first degree in Marine and Fish Biology at the University of Plymouth, UK, then went on to complete a Ph.D. in Genetics at the University of Swansea and University College London. My project focused on using genetic techniques as fisheries management tools for studying salmonid populations in England and Wales. This research continued as a two year postdoctoral position at the Institute of Zoology (Zoological Society of London), where I investigated issues of stock management and recovery of depleted trout populations by determining the population structure of migratory fishes between and within river systems. During this period, I also conducted other conservation genetics projects on Lake Victoria cichlids, European lizards, barbs from Lake Tana, Ethiopia, and also met Dr. Amanda Vincent (then at Oxford University). With a fellow postdoctoral researcher, Dr. Helen Stanley, we developed a collaborative project with Dr. Vincent to clarify the confused seahorse taxonomy using a combined morphometric and genetic approach (carried out by a research assistant and Ph.D. student).

Since 1995, I have been the Curator of Lower Vertebrates at London Zoo. This role encompasses the daily responsibilities for the staff and animals in the Aquarium and Reptile House, as well as the development and management of conservation breeding programs and research projects on fish, reptiles and amphibians. The Zoo receives over one million visitors every year so provides a significant opportunity for educating people about aquatic conservation issues. I co-chair the FAITAG (Fish and Aquatic Invertebrate Taxon Advisory Group), and chair the Reptile TAG, which are the groups that co-ordinate conservation breeding programs among British and Irish zoos, aquaria and museums.

Connection to Workshop Themes

In 1996, Dr. Amanda Vincent and I developed Project Seahorse as an umbrella for the different initiatives we are involved with to conserve seahorses and their relatives. My primary involvement is through the issues surrounding the aquarium trade in seahorses, the role of aquaria in the husbandry and management of seahorses, the application of aquarium technologies to aquaculture, and the potential for education of zoo and aquarium visitors about aquatic conservation. I maintain an active involvement in seahorse genetic research and work closely with Dr. Vincent on all aspects of the evolution and development of Project Seahorse.

Projected Action

I plan to communicate the outcome of the workshop to the other zoos and aquaria in Europe, in conjunction with similar initiatives by my North American colleagues attending the workshop. Specific actions will be discussed and developed, where appropriate, within the zoo and aquarium community to support the sustainable use of marine species in traditional medicine.

Grace V. Hilomen-Garcia

Seahorse breeding and seed production research at SEAFDEC/AQD

Southeast Asian Fisheries Development Center Aquaculture Department (SEAFDEC/AQD), 5021 Tigbauan, Iloilo, Philippines

Background

Seahorses are threatened by heavy exploitation, mainly for use in TCM. Being exotic, they are also in demand as aquarium fishes and curios. Their low mobility in small home ranges, small brood size, and low adult mortality rate, however, make seahorses very vulnerable to fishing pressure and degradation of their habitat. To reduce the impact on wild seahorse populations, research on artificial propagation techniques for seahorses are being undertaken at SEAFDEC/AQD since 1996.

Current Activities

Current studies focus on two species of seahorses, the relatively smaller thorny seahorse (tentatively identified as *Hippocampus histrix*, 3-9 g body weight) and the lined seahorse (the adults look very much like *H. erectus* but the sub-adults resemble *H. kuda*, 10-22 g body weight). [Eds.: Genetic and morphometric work by Project Seahorse has shown that the species referred to in this text as *H. histrix* is actually *H. barbouri*, and the lined seahorse is in fact the species *H. kuda*- S. Casey, pers. comm.]

Stress related to capture, transport, and handling may induce premature birth as indicated by small, weak, and lightly pigmented juveniles born within nine days after transport of pregnant males. These juveniles die within four days. Re-maturation and breeding of wild seahorses in captivity may resume three months after transport.

From three pairs of wild breeders and 11 hatchery bred broodstock of the thorny seahorse, breeding and seed production trials in the laboratory have produced about 300 hatchery reared broodstock and some 400 second generation offspring, while three pairs of wild lined seahorse breeders have produced around 1000 first generation offspring including about 60 potential broodstock.

In the hatchery, sexual dimorphism, indicated when the males develop a pouch, occurs as early as three months old in the thorny seahorse and seven months old in the lined seahorse. First parturition may then follow as early as one month after sexual dimorphism but brood size may be as low as three juveniles for the thorny seahorse and twelve juveniles for the lined seahorse. Gestation period ranges from 12 to 14 days. Established breeding pairs can mate and breed every two weeks with intermittent gaps year round.

Seahorses may be fed rotifers, copepods, various sizes of HUFA-enriched *Artemia* nauplii and biomass, tilapia fry, mosquito larvae, and mysid shrimps. Seahorse breeders can consume about 30% of their body weight of *Artemia* adults, 10% of their body weight of tilapia fry, or 13% of their body weight of mysid shrimps. Frequency of births and brood size in the lined seahorse may be doubled if breeders are fed a combination of HUFA-enriched *Artemia* adults and mysid shrimps rather than a single diet of HUFA-enriched *Artemia* adults.

Although brood size is smaller (up to about 300 juveniles) in the thorny seahorse than in the lined seahorse (more than 1500 juveniles), the new-born thorny seahorses (stretched height (sH), 12-14mm) are bigger and hardier than the lined seahorses (sH, 7-9mm). The present number of batches having greater than 70% survival rate at day 10 was 51% for the thorny seahorse (n=43) and only 10% for the lined seahorse (n=48); while at day 30, 26% and 4%, respectively. Peculiarities between these two seahorse species suggest that rearing requirements will vary depending on the species being cultured.

Good water quality may be maintained by daily siphoning of fecal materials and excess food off the tank bottom and by 75-100% water change. Regular cleaning, removal of fouling organisms, and

disinfection of rearing tanks may be employed to prevent occurrence of diseases. Secondary infection, mostly parasitic infestation, may be triggered by poor water quality, handling stress, and poor nutrition.

Projected Action

To increase production of viable broods, further investigations on alternative food organisms, a suitable feeding scheme, improved water management, and efficient rearing systems for both species will continue. Research on inter-family mating and increasing the number of founder stock from the wild will also continue to prevent in-breeding. A low cost sea cage rearing technique will be developed for seahorses. Finally, integration of seahorse seed production and culture in existing milkfish and other established aquaculture production facilities will be explored.

Conservation

Jong-Geel Je, Ph.D.

Marine and coastal conservation in Korea

Biological Oceanography Division, Korean Ocean Research & Development Institute (KORDI), Ansan PO Box 29, Seoul
425-600, South Korea

Background

I am a marine biologist, having served as a principal research scientist at the Biological Oceanography Division of Korea Ocean Research & Development Institute (KORDI), where I have been doing research into benthic ecology and taxonomy of molluscs for the past 12 years. I received my Ph.D. in biological oceanography from Seoul National University. In 1995 I visited Deakin University, Australia to study environmental science, and in 1996 visited West Vancouver Laboratory, Canada to work on coastal habitat restoration. My research interests currently focus on environmental monitoring and marine conservation studies such as impact assessment, marine protected areas, marine biodiversity, ecotourism and environmental education.

Current Activities

I have conducted five conservation-related research projects. These were on the conservation of tidal flats, environmental monitoring of mariculture farms, marine biodiversity, ocean ranching programs and coastal habitat restoration. As a chairman of the marine ecology committee in Green Korea, one of the largest NGOs in the country, I have also arranged the editing of a book on marine environmental education and managed a training course for marine education teachers. Now I am chair man of a working group on coastal habitat restoration. I have tried to establish marine protected areas in three areas: a tidal flat on the west coast of Korea, some islets of Chejudo south and Tok Island in the East Sea of Korea. I give marine conservation lectures for the general public more than ten times per year.

Connection to Workshop Themes

I am also a malacologist, and so have studied marine molluscs and collected seashells. Some mollusc species such as abalone, sea hare, shell of cuttlefish, etc. have been used in some kinds of oriental medicines. While taking underwater photographs, I often encounter marine medicinal species, including seahorses. I hope to know the marine species, especially molluscs, that have used traditionally used as medicines in the world.

Projected Action

I would like to contribute to any work related to marine conservation, especially ecotourism and molluscs.

Boris Saiping Kwan**What do we need to do in Hong Kong?
(Project Seahorse/ WWF Hong Kong)**

c/o WWF Hong Kong, GPO Box 12721, No.1 Tramway Path, Central, Hong Kong

Background

According to *The international trade in seahorses* (Vincent, 1996)¹, Hong Kong is a major entrepôt for seahorse trading. A minimum estimate is that Hong Kong consumes 7t of dried seahorses annually, although in excess of 10t is more probable, while many tonnes of seahorses are re-exported to China and Taiwan, among others. This estimation coincides with the custom information of import, export, and re-export of seahorses. In only the first half of 1998, 6216kg of dried seahorses and 9680kg of dried pipefishes were imported to Hong Kong². Even though the volume of trade is so large, trade studies of seahorses and other marine medicinals are scarce.

Current Activities & Projected Action

I have joined Project Seahorse since September 1 1998 and work in Hong Kong. Part of my work is communicating with the TCM communities. There are a number of aims, including (1) to encourage monitoring of consumption of marine medicinals by TCM communities; (2) to encourage TCM communities to carry out voluntary measures such as rejecting immature animals or endangered species; (3) to involve TCM community members in small-scale culturing to meet the gaps of supply.

In addition, I will be doing some library research (in Chinese and English) and interviews with specialists in order to figure out which marine medicinals are endangered, threatened, or likely to be affected by TCM. I will also be identifying the species with culture potential, identifying alternative treatments and developing TCM species identification keys (if possible) for TCM. Hong Kong has started to record the import, export, and re-export data of seahorses. I would collect and analyse this data to see if they could be correlated to my study.

Education is also a part of my work. I would not only educate TCM communities about the concept of conservation and sustainable use of marine medicinals but, I would also educate Western conservationists about TCM. It is a two-way process and it is targeted to promote mutual understanding between TCM communities and Westerners.

Last but not least, translation and bilingual publications are needed for both parties. People from the TCM communities usually do not speak English, while not many conservationists speak Chinese. My job is to promote the exchange of ideas between TCM communities and conservationists and it is important to facilitate this communication.

In conclusion, Hong Kong has an important role in international trade of seahorses, however, little work has been done. The effort of the TCM community is obviously critical, but friendly and constructive communication between TCM communities and conservationists is not enough. The work to be done in Hong Kong is to promote dialogue and encourage collaboration to strengthen the network for achieving sustainable use of marine medicinals.

References

¹ Vincent, A. C. J. (1996) *The international trade in seahorses*. TRAFFIC International.

² Census and Statistics Department of Hong Kong.

Rene Geraldo G. Ledesma

Government administration of traditional medicine issues: meeting the challenge of aquatic resource bioprospecting

Bureau of Fisheries and Aquatic Resources (BFAR), 860 Quezon Ave., Quezon City, Metro Manila, 3008 Philippines

Background

The Philippine government was among the countries that ratified AGENDA 21 in 1992. The Rio Conference encouraged the Philippines to incorporate the concept of sustainable development relative to the conservation and management of its natural resources. It also initiated a stream of thought among government planners recognising the traditional knowledge of indigenous peoples as resources that need to be protected from intellectual piracy.

The issue regarding Philippine traditional medicine (TM) revolves around its being both a wildlife resource and an intellectual property. The situation on aquatic resource bioprospecting for use in traditional or modern medicine shall serve as the example for discussion purposes in this paper.

Current State of Legislation and Management of Philippine Aquatic Organisms Used in TM.

1. Classification of Philippine Aquatic Organisms Used in TM

At present, Philippine aquatic organisms used in TM are generally classified under three categories: as food, decorative/handicrafts or live items. At present there is no category for TM in Philippine fisheries statistics.

2. Philippine Government Requirements Re. Export of Aquatic Organisms Used in TM

Export of these items does not require an export permit from the national government. In certain instances, as in the case of live seahorses for the aquarium trade, the Philippine government, through BFAR, may issue a commodity clearance if this is required by the receiving country. The harvest of aquatic organisms used in TM may likewise be subjected to certain fees, permits and licenses issued by the Local Government Units.

3. Legislation

After ratifying AGENDA 21 the Philippine government took steps to implement the objectives embodied in Articles 15, 17 and 26 of this Summit. These objectives, addressing the issue of aquatic organisms used in TM, are reflected in four (4) Philippine laws enacted after the 1992 Rio Summit:

- *Executive Order no. 247: The Philippine Bioprospecting Law*
This law covers activities aimed at discovering, exploring or using Philippine resources for pharmaceutical development, agriculture and commercial applications.
- *Republic Act no. 8371: The IPRA Act*
Under this law, access to biological and genetic resources and any utilisation of indigenous knowledge related to the conservation, utilisation and enhancement of these resources (e.g. TM) shall be allowed within ancestral lands and domains of the ICCs/IPs (Indigenous Cultural Communities/Indigenous Peoples) only with a free and prior consent of such communities.
- *Republic Act no. 8423: The TAMA Act*
The basic policy of the TAMA Act is to improve the quality and delivery of health care services to the Filipino people through the development of traditional and alternative health care and their integration into the national health care delivery system; and to seek a legally workable basis by which indigenous societies would own their knowledge of TM.

- **Republic Act no 8550: The Philippine Fisheries Code of 1998**
Under this code one of the basic policies is to ensure the rational and sustainable development, management and conservation of the fishery and aquatic resources in Philippine waters, including the exclusive economic zone (EEZ) and adjacent high seas, consistent with the primordial objective of maintaining a sound ecological balance, and protecting and enhancing the quality of the environment.

Connection to Workshop Themes

These four laws recognise that indigenous peoples or traditional inhabitants of fishing grounds have the right to decide on the management, use and disposition of their wildlife resources. The requisites of obtaining prior informed consent, consultation and provision of benefits to the indigenous peoples for obtaining biological material are likewise respected.

Projected Action

Although jurisdictional overlaps have been created in an attempt to regulate aquatic resource bioprospecting in the Philippines, the lead agency for aquatic resource conservation and management remains under BFAR. Inter-Agency Committees have also been created to promote development of TM. What is badly needed is proper accreditation and documentation of persons or entities that utilise, sell or manufacture TM. Such activities would be useful toward managing the potential commercial aspect of TM in the near future.

	TM & Trade
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Jokkeng Lee

TCM education and issues

Education & Development Executive, Eu Yan Sang (1959) Sdn Bhd., 9-11 Jalan Petaling, 50000 Kuala Lumpur, Malaysia

Background

I am an educational development executive for Eu Yan Sang (EYS). EYS is the largest retailer of Chinese natural medicinals outside China, therefore we retail marine medicinals as well.

Current Activities

My primary activities are educating the public and staff on TCM products and herbal formulas. I do this through giving presentations, group discussions and answering calls throughout Asia. Marine medicinals are not the focus of my presentations.

Connection to Workshop Themes

I provide TCM technical assistance, putting issues discussed at the workshop in the right context and perspective. Having lived in the West for more than a decade and at the same time being steeped in Asian culture, I can act as an important bridge to the understanding of East-West ideas and issues.

Projected Action

I uphold that biodiversity conservation is critical for TCM communities. In fact, biological sustainability is important for TCM to continue its practice in the right spirit. I will support and assist in efforts towards this end if both parties illustrate wholesome, harmonious and intelligent exchange of perspectives.

Samuel Kwokhung Lee

Research and monitoring of the trade in wildlife

TRAFFIC East Asia, Room 2001, Double Building, 22 Stanley Street, Central,
Hong Kong**Background**

TRAFFIC East Asia is part of the world-wide TRAFFIC Network. TRAFFIC, Trade Records Analysis of Flora and Fauna in Commerce, which is a joint program of WWF and the IUCN was established in 1976 to monitor trade in wild plants and animals to ensure that that trade does not become unsustainable. The TRAFFIC Network is also working closely with the Secretariat of the CITES. Currently TRAFFIC has 19 offices around the world. TRAFFIC East Asia has offices in Hong Kong, Taipei and Tokyo. Below are some works of the TRAFFIC East Asia in the region:

- **Market Survey:** Documenting species of concern in trade, the volume, prices and, if possible, the place of origin. Species include products and derivatives of tiger, rhino, bear, shark. The office's report *The Bear Facts: the East Asian Market for Gall Bladder* documents how the bear is a walking drugstore, with virtually every part in demand for TCM.
- **Legislation:** Assist governments in the region in identifying and implementing adequate controls on wildlife trade. In both Japan and Taiwan, staff gave technical expertise to the respective governments during the strengthening of national wildlife legislation. Once laws take effect, enforcement becomes critical. Therefore, TRAFFIC East Asia continues to monitor implementation of these new regulations to determine their effectiveness.
- **CITES Implementation:** As part of preparations for the tenth meeting of the Conference of the Parties to CITES, TRAFFIC East Asia produced *Still in Business: The Ivory Trade in Asia, seven years after the CITES ban*, a report which provides a review of the current ivory trade in the region and documents that serious weaknesses persist in the domestic ivory trade controls of several Asian countries and territories, including Japan. Similarly, inadequacies have been highlighted with respect to the regulation of whale meat trade in East Asia and are reported in *Whale Meat Trade in East Asia: A review of the markets in 1997*.
- **Liaison With Wildlife User Groups:** Staff in TRAFFIC East Asia work directly with TCM communities throughout the region, seeking to enlist their support or wildlife conservation measures. Bi-annual Chinese- and Korean-language newsletters are published by TRAFFIC East Asia, with a total circulation of 11 500 and the TRAFFIC office in Taipei is assisting Chinese academics with production of an identification manual for wildlife derivatives used in TCM. As a result of efforts to improve trust, co-operation and communication with the TCM communities, they are increasingly seeking advice from TRAFFIC, where necessary.
- **Traditional Medicine And Wildlife Conservation:** TRAFFIC East Asia organised an unprecedented event, *International Symposium on TCM and Wildlife Conservation*, with the Hong Kong Government in October 1995. That forum brought together those who wish to utilise wild animals and plants as medicines and those who wish to conserve those species in the wild, allowing conservationist and TCM community to understand each other better. Another remarkable event, *The First International Symposium on Endangered Species Used in Traditional East Asian Medicine: Substitute for Tiger Bone and Musk*, took place in 7-8 December 1997. Recent researches on the substitute for Tiger bone and musk and relevant socio-economic issues were presented, among others.

Current Activities

An attitudinal research on Hong Kong Chinese towards wildlife conservation and the use of wildlife as medicine and food has been recently finished. The results will be published in the near future.

I am the editor of a bi-annual Chinese language newsletter on issues concerning wildlife conservation and TCM. I also carry out liaison work with TM communities in Hong Kong, China and Macau, and am engaged in a three-year study on the trade in medicinal plants in East Asia.

Connection to Workshop Themes

TM communities have often been criticised for using derivatives of endangered wildlife as medicines. However, the involvement of TM communities in conservation efforts are generally neglected by the conservation community. With its experience and expertise on the issue of the use of wildlife as TMs in the East Asian region, TRAFFIC East Asia wishes to further strengthen the communication between wildlife conservationists and TM communities.

TRAFFIC is the world's largest network specialising in wildlife trade investigation and monitoring. Expertise at TRAFFIC could contribute to the monitoring of the trade in those identified marine wildlife species that are used in TMs.

Projected Action

To assist the Marine Medicinal Conservation Officer of Project Seahorse to carry out trade monitoring work and to facilitate the liaison work with TM communities in the region.

To publicise the issue of consumption of marine wildlife as medicine in two newsletters on wildlife conservation and TM which are written in Asian languages.

To maintain input to the network established at the Cebu Workshop.

Web sites: (English): <http://www.traffic.org> (Japanese): <http://www.twics.com/~trafficj>
(Chinese): <http://www.wow.org.tw> (Russian): <http://www.deol.ru/nature/protect>

TM Research

Young-Jong Lee, OMD Ph.D.

The state of seahorses as herbs in Korean Oriental Medicine
Professor, Dept. of Herbology, Kyung Won University
President, The Korea Association of Herbology
Pokjong-dong, Sujong-gu, Songnam-shi, Kyonggi-do, Korea

Background

I am a doctor of oriental medicine and a graduate of Kyunghee University, the most prestigious Korean university in the field of Oriental medicine. Korean herbs known for their miraculous efficacy have long been used by our ancestors. Marine herbs, however, are not common as general herbs due to their rarity in Korea. Although the percentage of marine herbs count for little in the consumer market, seahorse, pearl, cuttlebone, sea cucumber, oyster shell and seal testes and penis have been used for a long time.

Seahorses inhabit the Korean coast, especially near Cheju Island. All seahorses in Korean markets are imported from foreign countries. Between the years of 1995, 1996 and 1997 Korea imported 391kg, 355kg and 378kg of seahorses, which are equivalent to US\$86 797, US\$76 248 and US\$83 820, respectively. Generally speaking, in Korea, these amounts are indeed large figures. It is forecast that the demand for seahorses will increase because of consumers' faith in its efficacy.

Current Activities

I research and teach oriental medicine at Kyung Won University. My main field of research is in systematisation of standardised medicinal herbs. This research looks into the timing of harvesting and the processing of medicinal herbs in order to maximise their medicinal effects. Herbs come in various kinds and as such their efficacy is complicated. Even the same kind of herbs show different

efficacy according to the region, time or season of harvest, and processing methods. I have identified quality of herbs and I am also working on their clinical applications.

Connection to Workshop Themes

In my opinion, it is most desirable to discuss the aquaculture and the conservation of seahorses from the consumer country's point of view. I look forward to broad discussions of marine medicinals along with seahorses during the workshop.

Projected Action

As far as marine medicinals research is concerned, I am greatly interested in the clinical applications of seahorses and sea cucumbers. As stated in the Korean Oriental Medicine Book, seahorses effectively facilitate blood circulation. I hope to develop a blood circulation-enhancing product using seahorses after I clinically prove its effectiveness.

	Fisheries & Trade
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A. P. Lipton, Ph.D.

Fishery for marine medicinals in India: problems and responses
Central Marine Fisheries Research Institute (CMFRI), Vizhinjam Research Centre
Vizhinjam - 695 521, Thiruvananthapuram, Kerala, India

Background

In June 1992, the seahorse exploitation along Ramnad Coast in India became a target fishery. The traditional marine divers, who dive for collection of sea cucumber and sacred chank (*Xancus pyrum*) diverted their efforts to the specific exploitation of seahorses. Reasons attributed for the sudden spurt in seahorse exploitation being: 1) dwindling catches of sea cucumber and chank due to bottom trawling by mechanised boats, and 2) increased demand for seahorse for TCM in the export avenue.

Apart from export potentials, seahorse is being used as a home remedy to control the whooping cough in children in the coastal districts of Tamil Nadu. In addition, it is also used for treating certain forms of allergic conditions, including asthma. The heavy exploitation prompted us to undertake observations on the seahorse fishery, its trade and traditional medical values and practices.

Studies from 1992 to 1997 indicate that the divers select grounds in the sea with luxuriant growth of seagrasses, seaweeds and/or sponges, and then dive to depths ranging from 4 to 8m. On average, 10 to 30 seahorses are collected with catch per unit effort of 7 to 10 seahorses per hour per diving day. The fishing trend continued until mid 1997. However, recently (as of June, 1998) the seahorse fishery became a by-catch fishery due to decreased price structure. Traditional divers desisted from target fishing. The by-catch from shore seines is estimated to be 120g/day/boat.

Putative *Hippocampus kuda* complex was represented in the catch. Immediately upon arrival to the shore they are sold to vendors. From 1992 to 1997 each seahorse specimen could be sold at the landing centre for Rs. 5 to 15 (US\$ 0.16-0.50) per piece, depending on individual size. The present rate is about Rs. 1 to 3 (US\$ 0.03-0.10) per seahorse. The dominant length group in the catch was 60 to 120mm with a mean length of 86.38 ± 14.15 mm (4.2g). Dried seahorse is subsequently sent to a major collection centre (Kilakkarai) for further trading. The dried seahorse samples were found to retain about 53% of the body weight.

Current Activities

Considering their potential medicinal properties/applications, concerted effort is underway to study the bioactive compounds from seahorse. Methanol extract preparations using them as whole, ground tissue (in Soxhlet) are being evaluated for bioactivity under the CMFRI's on-going Research Project.

Preliminary studies on captive rearing indicates that the seahorses can be maintained under wet laboratory conditions. Captive breeding and releasing of young ones in marine aquaria at Mandapam Regional Centre of CMFRI on two occasions led to a gain of confidence in attempting further research.

In the first batch, spawning occurred on May 15, 1995. A total of 204 juveniles were released by an adult measuring 118mm (8.0g). The juveniles measured 7.0 to 9.0mm and were fed with shrimp (*Penaeus semisulcatus*) nauplii (stages 1 and 2). The average temperature, salinity and pH were 28.0°C, 34.5ppt and 8.5 respectively. They survived for 7 days and slowly succumbed. In the second instance breeding was observed on December 8 1995. About 200 young ones were released and they were fed with *Brachionus* sp. The water temperature ranged from 24.6 to 26.8°C. The dissolved oxygen (DO) was 6.5ppm while the salinity and pH were 34 and 8.2 respectively. The young ones survived for 4 days.

Connection to Workshop Themes

The on-going research program in the CMFRI attempts to monitor resource characteristics and aquaculture aspects of seahorse. Research is progressing on extraction and isolation of bioactive/pharmaceutical substances from seahorse and other marine medicinal organisms. Studies indicated that marine algae (12 species), sponges and corals (a few species), bivalves (3 species), gastropods, cephalopods (cuttlefish/squids), crabs, turtles and fishes (many) are used in Indian TM such as Siddha, Ayurveda and Unani. These aspects are directly related to the workshop themes.

Projected Action

Research projects are being proposed to different national funding agencies for financial support to study marine medicinals, including the seahorse. The future goals concerning seahorse are:

1. studying the distribution pattern of species of seahorse in chosen areas of east and west coast of India;
2. recording the reproductive behaviour of wild seahorse under laboratory conditions;
3. developing suitable larval and juvenile seahorse rearing strategies;
4. developing and maintaining domesticated broodstocks for spawning and sea ranching periodically.

These goals will be pursued by:

1. Collecting data on the landings of seahorse along the Palk Bay/Gulf of Mannar in the east and Karwar in the west coast of India. The size range, species composition, sex ratio, seasonal abundance and fishing methods will be studied.
2. Establishing culture facilities to maintain large number of different size groups and species of seahorse to study their captive behaviour.
3. Maintaining broodstock (including impregnated males) to study mating behaviour and breeding under controlled conditions.
4. Studying the physiology of seahorse to determine the optimum conditions required for culture.
5. Establishing suitable live feed facilities for rearing seahorses
6. Regular health monitoring programs.
7. Developing artificial feed and experiments on the acceptability and efficacy of artificial feed on juvenile and adult seahorse.

8. Sea ranching of hatchery produced seahorses in chosen seabed after tagging to study their recruitment to fishery and natural growth rates.

Aquaculture & Biological Research

Jacqueline Lockyear

Aspects on the captive culture of the Knysna seahorse, *Hippocampus capensis*.
Department of Ichthyology & Fisheries Science, PO Box 94, Rhodes University, Grahamstown, South Africa

Background

Research is being conducted on the culture of the Knysna seahorse, *Hippocampus capensis*. This species is an estuarine seahorse endemic to isolated estuaries within South Africa. It is listed as Vulnerable in the IUCN Book of Threatened Animals and in the South African Red Data Book of fishes. The Knysna seahorse population is threatened by the vulnerable nature of the estuaries, which is compounded by an increase in human settlement and industrial development surrounding the estuaries. The objectives for culturing the Knysna seahorse in captivity are numerous. Firstly, there is a paucity of information on the Knysna seahorse. No ecology studies have ever been conducted. Secondly, conservation authorities request that a captive population be maintained so that if re-stocking of the estuary is necessary, this information will be available and beneficial. Thirdly, there is a growing demand for seahorses among aquarists in South Africa which could be met through aquaculture. Lastly, information gained from the research will hopefully be of value to be added to the growing knowledge of seahorses in general.

Current Activities

The scale of culture is at an experimental level, employing intensive, recirculating system methods. The seahorses are fed with adult *Artemia* enriched with Selco products (INVE). Research has concentrated on the following areas:

1. Manipulation of photoperiod, temperature and light intensity to maintain year-round breeding in *H. capensis*.
2. Manipulation of prey densities, prey size and juvenile stocking densities to determine the optimum conditions for growth.
3. Manipulation of light intensity, light spectra and tank background colour to improve feeding efficiency and consequently growth of juveniles.
4. The effects of DHA/EPA ratios and vitamin C boosting of broodstock diets on reproductive outputs.
5. The effects of DHA/EPA ratios and vitamin C boosting of rearing diets on survival, growth and fitness of the young.
6. Isolation of diseases from the broodstock and juvenile seahorses.

Results so far indicate that the Knysna seahorse breeds readily in captivity throughout the year, provided correct temperature and light intensities are maintained. The physiological stress placed on the animal if maintained under breeding conditions for extended periods is unknown.

The young can be reared on *Artemia* at least up to four months of age with approximately 50-80% survival. Survival is mentioned up to four months as after this period animals are moved into a holding facility and no further data is collected from them.

The growth rate of the young appears slow (approximately 4cm after four months), but cannot be compared to natural conditions, as no research has been conducted on the wild populations. The young of the broodstock can be reared to sexual maturity and do on occasion breed, although they

appear half the size of a normal adult. Due to the lack of ecological studies on the wild populations, no comparisons can be made regarding size at sexual maturity.

The offspring of the second generation are considerably smaller if compared to the lengths and weights of the first generation. The survival of the second generation young is poor.

In summary, the reproductive cycles of the Knysna seahorse have not been closed on a sustainable basis, probably as a result of inadequate nutrition.

Connection to Workshop Themes

This research contributes to aquaculture of seahorses and highlights problem areas in seahorse aquaculture. For example, providing a constant supply of live prey of good nutritional quality should be solved before embarking on seahorse aquaculture even on an experimental level. Seahorse disease also occurs as a result of inadequate nutrition, for example Mycobacteriosis (fish tuberculosis).

Projected Action

Future goals of research are to improve the broodstock and rearing diets so that reproductive outputs can be increased, as well as the growth and survival of the offspring. This research contributes to seahorse culture in general, which may in the future improve the sustainability of trade in seahorses used for TM.

TM Research

Mr. Zhenqiu Mai TCM research and trade

401, 22 Building, North Lane of Bohua, South St. of Wengchang, Guangzhou, PR China, 510140

Background & Current Activities

I have been engaged in TCM research for 49 years. I received my qualifications from the School of TCM of Henan, Guangzhou, and the Department of Chinese, University of Sun Yeshan. Now, I am a senior pharmacist of TCM. I have studied mainly by myself and have practiced TCM for long time. I am very familiar with production, supply, sales, management and use as well as education of TCM in China. I have researched mainly merchandise, economics, distinction, pharmacology and paleography of TCM, I am also interested in studies of aquatic plants and plants of Orchidaceae used in TCM, Western ginseng, seahorses, and the relationship between health and TCM. I collaborated with professor Luo Xian-rei, (South China Institute of Plants, Chinese Academy of Sciences) to publish the book "*Original Color Book of Frequently Used TCM*", and have myself published many other articles on TCM.

Connection to Workshop Themes

Since retirement, I have not been directly involved in TCM trade, though I continue to keep an eye on it. I now work as a consultant on TCM techniques. I am in charge of advising people who want to, for example, develop a new, pre-packaged TCM product. I provide information about the source, ecology and efficacy of medicinals. In this role I can recommend people not to use endangered species as medicine.

Projected Action

I plan to emphasise promotional and educational work. I believe in the "mutualism" of human and marine resources, and would like to educate the TCM community to promote the concept of sustainable use of marine medicinals. I would also like to reduce the demand for endangered species by reducing my own use and by persuading other TCM members to do so as well. The use of alternatives should be promoted. Abalone shells or cuttlebones are good alternatives. The source animals are eaten as food, and the shells and bones would be wasted if not used in medicine.

Peter McGlone**Syngnathid conservation in Australia**

World Wide Fund for Nature Australia c/o 102 Bathurst St., Hobart 7000, Tasmania, Australia

Background

My work has focused on generating media publicity and facilitating other organisations to take action to protect syngnathid species (seahorses, seadragons and pipefishes) in Australia. My interest in syngnathids started five years ago with publicising in the media the apparent decline in weedy seadragon populations in Tasmania. This led to the realisation that marine fishes were generally not legally protected throughout Australia. In 1994, I made the first approaches to state and Commonwealth governments seeking legal protection of syngnathids. The rationale was that they should be protected before they became threatened or heavily exploited. We aimed to get controls over fishing or taking at a state level, and control over exports at a Commonwealth level. Interest soon spread to other states, particularly South Australia, and conservation groups started working towards legal protection in their respective states.

The advertisements which appeared in Australian fisheries magazines at that time, requesting "Seahorses Dead or Alive" gave substance to our concern that syngnathids were being exploited and warranted protection. This, and Amanda Vincent's trade report released in 1995, triggered much media interest in the enormous international demand for these species. We didn't want Australian species to be open to exploitation in the same way. Without intending to, this publicity gave a negative view of TM use, something we have tried to correct since.

The Tasmanian Government protected all syngnathid species in 1995 and the Commonwealth Government introduced export controls on 1 January, 1998.

Current Activities

My current work has involved publicising the lack of state legal protection of syngnathids outside of Tasmania, and working with other conservation groups and government officials to ensure that the Commonwealth export controls are wisely administered for the benefit of syngnathids in Australia and internationally. I am particularly concerned about a Tasmanian company's seahorse export proposal. They have claimed in media statements that they want to provide the entire world demand for seahorses for TM.

I am currently organising a tour of Australia by Amanda Vincent for August 1998 to focus media and government attention on Australia's role in international trade in syngnathids.

Connection to Workshop Themes

The overall goal of this workshop is to commence development of an action plan for sustainable trade in marine species for TM.

In relation to seahorses and pipefishes, my prime concern is that without an integrated international conservation strategy, large-scale, profit-driven aquaculture industries may disrupt or halt the development of sustainable aquaculture in countries where seahorses are being over-exploited.

Protocols for aquaculture alone will not be sufficient. Aquaculture has the potential to be a key strategy to conserving syngnathids in the wild by providing an alternative for those who currently fish them, but we don't currently have control of how the industry is developing. I believe there is a vital need to control and direct the developing aquaculture industry, particularly in Australia, towards sustainability, both environmentally and socio-economically.

I am particularly concerned about the Tasmanian company proposing to culture seahorses for export to the Asian TM market. Here are some statements the company have made:

“By steadily increasing our production we believe we can lower the world market price and make poaching less attractive” — The company director, quoted in The Examiner (Hobart, Tasmania) newspaper on June 3 1997

“The operation will eventually produce 20 million seahorses a year”—Comment attributed to the company, The Examiner, April 27 1998

I have three prime concerns:

1. that the proposal may not be environmentally sustainable, i.e. will have local impacts;
2. even if it proves sustainable in the future, large-scale exports of seahorses from Australia will not necessarily have a beneficial impact on the international market, i.e. by reducing the pressure on wild populations; and
3. little concern has yet been shown, by the proponent or governments, of the potential impact a large-scale operation may have on fishers who currently depend on selling wild seahorses.

While the Tasmanian company’s proposal is highly questionable and may not achieve its bold goals, we need to consider the repercussions if one company succeeded in dominating the market.

- Is this a realistic scenario?
- What would be the impacts on wild animals, markets and aquaculture in other countries?
- Would we call on governments to limit and guide the development of such aquaculture proposals?
- Do we involve governments in developing the action plan and seahorse protocols?

Projected Action

My key interests for the future are:

- Getting the Commonwealth Government focused on the interaction between the Australian and Asian seahorse industries. Australian aquaculture operations should be treated as scientific experiments. As discussed with Amanda Vincent, this could be an important topic for a future workshop in Australia.
- The Dragon Search Program (a community based seadragon survey program) working in all states and territories and succeeding to identify key habitat areas.
- Strong and uniform State and Territory controls on fishing or taking of syngnathids.
- Commonwealth controls over imports of syngnathids.

	Medical Anthropology & Gender Issues
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Bertha Mo, Ph.D. MPH Sustainable use of marine medicinals

International Development Research Centre (IDRC), P.O. Box 8500, 250 Albert St., Ottawa, Ontario, Canada K1G 3H9

Background

At the International Development Research Centre (IDRC), I co-manage the sustainable use of marine medicinals project with McGill University and the Haribon Foundation. I am particularly interested in gender analysis in communities which depend on marine medicinals for their livelihoods, in order to ensure that changes to promote sustainable use do not adversely impact on the health of the most vulnerable, including women and children. A secondary interest is of ensuring that safety and efficacy be considered within the rubric of sustainable use.

Current Activities

I am currently working with Haribon on the gender analysis portion of this seahorse project. Of particular interest here are the differential human health needs of men and women on the island. One hypothesis is that better management of the ecosystem, including seahorses, will also result in improved human health. Apart from fertility management, which was not discussed in the early stages of the project but surfaced at the July meeting, it is not clear what these human health needs are.

Projected Action

My future goals are to assist in the publication of a paper on gender and marine medicinals in a referred journal and to assist the McGill/Haribon team to submit a proposal jointly to two IDRC program initiatives: Sustainable Use of Biodiversity and Ecosystem Approaches to Human Health.

Biological Research**Glenn Moore**

Reproductive biology of the Western Australian seahorse
Hippocampus angustus.

Department of Zoology, University of Western Australia, Perth, W.A. 6907

Background

Until recently, seahorses have been poorly studied. Several studies have now documented the life history and reproductive biology of some species. Many more remain relatively unknown. The present study is examining the biology of the Western Australian seahorse *Hippocampus angustus*.

Current Activities

H. angustus is restricted to the west coast of Australia. It is most abundant in muddy habitats and typically estuarine conditions. Permanent artificial structures such as jetties and moorings appear to be more important than natural habitats such as seagrass meadows. They occur in depths between 1 and 20m. Diet consists mostly of crustaceans. Sex ratios vary, but do not differ significantly from a 1:1 ratio of males to females. Although work is continuing, home range size does not appear to differ between the sexes. Movements tend to be within less than 10m². *H. angustus* grows to some 22cm, although most are in the range 10-15cm. On average, they weigh around 12g alive (~4g dry). Colour is generally brown but quite variable, including yellow, red, white and even purple.

Differences between the sexes can give an indication of the direction of sexual competition. With some exceptions, there is little size difference between the sexes in *H. angustus*. Males tend to have longer tails, while females exhibit a coronet that is larger than that of the males. The longer tail could simply be an evolutionary consequence of possessing a pouch. Since males use their coronet as a jousting weapon, it is thought that the smaller coronet of males is a result of mechanical erosion from fighting. This is currently under review.

The breeding season of *H. angustus* falls during summer (October to March), but varies with environmental conditions. Courtship occurs at various times throughout the day, and is generally initiated by the male. Both sexes undergo a stereotyped ritual of colour changes and displays concluding in one or more brief copulations. Gestation is around three weeks, and individuals will mate several times throughout the season. Males have an average of 370 young (range 15-639) of which an average of 91% are born alive. Young are born at around 10mm and growth rates are largely unknown, although unconfirmed reports suggest 2-5mm per week. There does not appear to be any correlation with male or female size and number of young, nor the weight of the clutch.

Pregnant males were collected from a natural population and returned to the laboratory until birth of their progeny. Fifty progeny sampled randomly from each brood were frozen for microsatellite DNA analysis, as were the known fathers and the adult females also collected. Four polymorphic microsatellite loci were used to assess biological parentage of 453 offspring from fifteen males.

Microsatellite DNA genotypes in the progeny arrays were consistent with a monogamous mating system in which both males and females had a single mate during a male brooding period. Multi-locus genotypes implicated four females in the adult population sample as contributors of eggs to the broods of collected males, but there was no evidence for multiple mating by females.

Current work is examining monogamy over consecutive broods. Preliminary results indicate that more than 40 % of sampled males are actually polygamous over two reproductive events. So while a single brood is mothered by a single female, males are not necessarily faithful between broods.

Connection to Workshop Themes

H. angustus is not yet subject to large-scale harvesting for medicinal use. It is, however, collected for the local aquarium market. Since few species of seahorse have been studied intensively, detailed studies on the basic biology of this species will assist in conservation efforts of the group as a whole. Information on reproductive ecology not only augments an understanding of the basic biology, but also serves as a tool for aquaculture and management.

Projected Action

A biological understanding of seahorses and the interactions between them are often cited as crucial components to any management decisions. It is anticipated that the effect of removing individuals will be better understood with an understanding of population structure, dynamics and reproduction.

	Aquaculture
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Vorathep Muthuwan, Ph.D.

Development of mass culture techniques for marine ornamental fishes and invertebrates

Bangsaen Institute of Marine Science (BIMS), Burapha University, Bangsaen, Chonburi 20131, Thailand

Background

Bangsaen Institute of Marine Science (BIMS) is a research institute and a part of Burapha University. BIMS is divided into six sections, with the Marine Aquarium and Marine Science Museum open to the public. The main objective of the BIMS is to conduct research in marine science and other related fields. Cha-am Research Substation, located in the south of Thailand, is another research facility which provides facilities for scientists to conduct research on a larger scale. Most of the research running at the Cha-am Research Station is in the aquaculture field. A project on development of mass culture techniques for marine ornamental fishes and invertebrates is a corporate research project between the Marine Aquarium and the research station. The project aims to reduce pressure on harvested wild stocks and to enhance declining wild stocks with captive bred animals. [Eds.: See Part V. Position Statement on Releasing Captive Seahorses].

Current Activities

The project started in May 1998 and is in its initial stages. It was divided into 6 phases. In the first phase, potential marine ornamental fishes, including seahorses and invertebrates, were identified and brought in. These animals were cultured with special care at BIMS and at the research station for use as broodstock in the future.

Connection to Workshop Themes

Seahorses were one of the candidates selected for developing mass culturing techniques. The cultured seahorses will be used for aquarium trade, TCM and to enhance declining wild populations due to overharvesting and degradation of the environment.

Projected Action

The ultimate goal of the project is clear from the title of this summary: to develop techniques for mass culture of marine ornamental fishes and invertebrates. The techniques developed will be used to produce marine ornamental fishes and invertebrates either for the aquarium trade or for replenishing wild populations.

Marivic Pajaro**Initiatives on seahorse conservation in the Philippines
(Project Seahorse/ Haribon Foundation)**

Barangay Handumon, Jandayan Island, Getafe, Bohol, Philippines

Background

The Philippines continues to be a major exporter of seahorses, now traded globally by over 40 nations (Vincent 1996 pers. comm.). Their popular use as traditional Chinese medicines, charms, curios and ornamental fish by Asian, European and North American importing countries have created a large demand for seahorses. Supply from the Philippines is now inadequate and uncertain. A combination of habitat damage and overfishing makes it necessary to conduct appropriate conservation measures to ensure that seahorse populations are healthy.

Forty per cent of fishers in a village called Handumon in Getafe, Bohol (central Philippines) earn incomes from catching seahorses, but seahorse numbers are declining rapidly. In October 1994, a project on community-based seahorse conservation and management was implemented in this village by Project Seahorse and the Haribon Foundation for the Conservation of Natural Resources.

In July 1997, we expanded into other sites in Bohol to implement a coastal resource management project (CRMP). We now work at the municipal level in four other municipalities (Tubigon, Clarin, Inabanga and Buenavista) and have additional village projects on two islands (Batasan and Jagoliao). The Handumon project remains independent of CRMP and provides the model for many of our endeavours. Seahorses continue to serve as the focus for our efforts and to link all our initiatives.

Current Activities

The first underwater study of Indo-Pacific seahorses in the wild is being conducted in Handumon. Like other seahorses studied to date, they were found to be vulnerable to over harvesting because of low reproductive rates, site adherence, mate fidelity, small home ranges and low mobility. Catch data were collected and analyzed to obtain growth performance indices and exploitation rates. In 1997, the exploitation rate is estimated to be 72% per year, far in excess of sustainable harvests.

Efforts to stabilise the seahorse populations include initiatives such as allowing newly-caught pregnant males to give birth in the wild before they are sold, community education, facilitating the enforcement of regulations in a 33 hectare marine sanctuary, and community organising. A core group of villagers has been developed and is gradually assuming leadership responsibilities in the community. An experimental grow-out corral for young seahorses was set up with fishers as a supplemental income option.

In May, a national workshop on seahorse conservation and management was conducted by the project and succeeded in bringing together participants from many different sectors, and uniting them in the goal of protecting the Philippines seahorse fishery.

Connection to Workshop Themes

Our work included investigation of trade in key areas in the Philippines such as Zamboanga, Palawan and Cebu. The initiatives on setting up grow-out corrals for young seahorses is seen as a first step towards development of appropriate seahorse aquaculture techniques for fishers.

Projected Action

Our major goals for the future include evaluating coastal resources, establishing marine reserves, educating communities, facilitating enforcement and formulation of laws, and developing alternative

livelihoods. We will continue to encourage support from the local government and will also provide technical assistance and build local capabilities for conservation and management of marine resources.

We were designated to partner the Bureau of Fisheries and Aquatic Resources (BFAR) as lead agencies in establishing the national network of seahorse stakeholders. Thus, we will also be having more initiatives on the national level, particularly in the establishment of a one-stop information center and in sustaining the links between institutions and individuals involved in seahorses through collaborative research, workshops and newsletters.

Conservation & TM

Allison Perry

Global directory of marine medicinals
(Project Seahorse/ McGill University)

Department of Biology, McGill University, 1205 Dr. Penfield Ave., Montréal, Québec, Canada H3A 1B1

Background

Traditional medicine systems have extensive histories of use, are relied upon by as much as 80% of the world's population, and are recognised by WHO as important forms of healthcare. Traditional healing practices are highly varied, but many cultures use treatments involving plant and/or animal species and therefore depend upon the sustainable harvesting of wild species.

TRAFFIC, the joint wildlife trade monitoring program of WWF and the IUCN, states in relation to trade in medicinal wildlife that "increased demand and increasing human populations are leading to increased and unsustainable rates of exploitation." Overharvesting of wild species for medicinal purposes may pose a threat to their survival, as well as to the economic and medical needs of those people who depend upon them. In 1997, Parties to the Convention on the International Trade in Endangered Species (CITES) agreed upon the importance of addressing these issues, while also recognising that the WHO has acknowledged the global importance of traditional medicines (TM).

Conservation attention has focused on large, terrestrial mammals threatened by poorly-managed trade for TM, especially traditional Chinese medicine (TCM), but the use of marine species has effectively not been studied. Accounts usually outline uses of marine medicinals in a single culture, and even then may not be complete. Even printed *materia medica* may not necessarily provide complete listings—traditional systems of medicine are not static, and current practices can involve species which were not used historically.

TRAFFIC cites the fact that "in most cases little is known regarding harvest and trade volumes and conservation impact" of medicinal wildlife trade, and highlights the need for broad reviews of defined areas of medicinal wildlife use, in order to identify potential threats to medicinal species. To date, seahorses provide the only detailed case study of marine medicinal species. Analysis of their use revealed an extensive international market, rising demand, and declining seahorse populations. Whether similar situations of exploitation for trade exist for other marine medicinal species has not been extensively studied. We urgently need to identify other marine species used in all forms of TM, the extent of their use, and how this use affects their conservation prospects.

Current Activities

I have spent the past year compiling and analysing a global directory of marine medicinal species used world-wide. This study aimed to provide an introduction to the taxonomic and geographic distribution of marine medicinal use. The long-term goal of this ongoing research is to identify potential conservation concerns, and to suggest ways of resolving these concerns.

To date, I have noted marine medicinal use in 46 geopolitical regions world-wide. I have found thus far that a broad diversity of marine organisms is used medicinally, representing 11 phyla and a

minimum of 394 species. Of these, a minimum of 27 species are found on the updated 1996 IUCN Red List of Threatened Animals, and a minimum of 23 species are listed on CITES Appendix I or II. This preliminary examination has shown that marine medicinal use is widespread. Further study is necessary to identify additional marine medicinal species, and to determine potential implications for the conservation of marine medicinals and for those people who depend upon them.

Connection to Workshop Themes

My work represents the only global study to date of marine medicinals. Such initial research is an essential step before the trade in marine medicinals can be investigated further, or the need for conservation action can be identified.

Projected Action

I am currently preparing to begin field research on the trade in marine medicinals. This work will be focused mainly on seahorses and their relatives, due to their threatened status, and because there are already baseline surveys upon which to build. Analysis of their trade was last carried out between 1993 and 1995, and needs to be updated, so as to determine current levels of consumption. This, in turn, allows for decisions to be made regarding necessary conservation initiatives. For seahorses, this reevaluation of the trade is especially important because the last investigation revealed increasing demand and declining populations in the wild.

In addition to studying the trade in seahorses and their relatives, I will continue to research other marine medicinals. This work will involve identifying additional species used for TM, determining historic and current patterns of consumption, noting trade routes, and assessing conservation implications. Findings will be added to the global directory of marine medicinals that I compiled this year, and will be used to prompt conservation responses where necessary.

Gender Issues & TM

Salome B. Quijano

Potential role of women in the conservation of marine species used as/in medicine: a case study
(Project Seahorse/Haribon Foundation)
c/o 80A Malakas St., Barangay Pinyahan, Quezon City, 1100 Philippines

Background

Marine species have been widely used for medicinal purposes. The Chinese were noted in this area and traditional Chinese medicine (TCM) has made popular the use of a variety of marine species for this end. However, the uncontrolled collection, trading and use of marine life have contributed to the depletion of these already scarce resources.

The seahorse is a form of marine life whose medicinal value is already recognised and believed to cure cough, asthma, anemia, and weight loss. In an island in Samar, Philippines, residents use shark's fin for measles and the tail of sting rays as a cure for stomach aches. It is possible that there are a number of other Philippine marine species used in the country for their medicinal potential, like the pearl which is believed to enhance human skin complexion, although there is no systematic documentation identifying these and their potential uses.

The Haribon Foundation's Bohol team became well known for Project Seahorse. The team was able to study the biology, behavior and trade and marketing of seahorses. Recently, they thought of looking into the role of women in the production, trade and use of seahorses as traditional marine medicines, which resulted in this on-going study.

Current Activities

The main objective of the study is to investigate the role of women, their access, control and decision-making, in the harvest, marketing, preparation and consumption of marine species used in medicine, and their overt and subtle role in marine fisheries in general, and seahorse trade in particular.

Women's knowledge of fishing and marine resources was revealed by their responses to questions on the different types of species that can be sourced from the sea, the different types of fishing methods practiced in their communities, volume of fish production, beliefs and practices associated with fishing, and knowledge of other medicinal marine species.

The study looked into women's access and control of their economic activity related to fishing and collection of marine species, means or implements of production, ownership of produce and decision-making in their livelihood. Women's access and control of species used as medicine is also looked into.

The study also documented the role of women in the production, trade and use of marine medicinals, especially seahorses. The study also looked into women's view of organising towards the protection of the sea and conservation of marine species used as medicine.

Three methods were employed in primary data-gathering: surveys, key informant interviews and informal interviews and observations. Three areas are covered by the study: Bohol, Palawan and Tawi-tawi. These areas represent the women of the three major island groups in the country, namely Luzon, Visayas and Mindanao, and from three ethno-linguistic groups: Tagalog, Bol-anon and Badjao (and/or Tausug). A comparison will be made on the differences, if there are any, of the role women assume in the production, trade and use of marine medicinals and their perception and knowledge on the conservation of species used as or in medicine.

Connection to Workshop Themes

Women are part of a large community network involved in the fishing and trade of seahorse. However, none of the studies done in the past ever talked about women and their role in this growing industry. It would be worthwhile if women could also take part in the effort to conserve marine life by starting with a documentation on the medicinal uses of marine species and the role of women in this endeavor and how they can help. It is a belief that women have the natural instinct to nurture and not to destroy, and because of this there is the recognition of their potential contribution to the effort to conserve endangered marine species.

Projected Action

At present, substantial, while incomplete, data have already been gathered from field work in these areas. Additional data will be gathered in the following weeks in the last two areas for the completion of data needed for the study. Seahorse traders from the two areas have already been interviewed, except for Palawan where those interviewed were dried seahorse vendors.

	Conservation
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Amanda C. J. Vincent, Ph.D.

Marine conservation with a focus on seahorses
(Project Seahorse)

McGill University, Department of Biology, 1205 Dr. Penfield Avenue, Montréal, Québec, H3A 1B1 Canada

Background

Marine fishes are commonly regarded as food rather than wildlife. Such attitudes deter conservation action for all fishes and presume that captured fishes will be eaten. In fact, however, conservation is sorely needed for many marine fishes, including for those that are not caught for food. Seahorses are among those at risk from trades for traditional medicine, aquarium fishes and curiosities.

I co-founded Project Seahorse in 1996, as an international collective of biologists and social workers that would lead conservation and management initiatives for seahorses, their relatives and their habitats. We already have teams in Canada, the Philippines, UK and Vietnam, and will shortly be adding people in Hong Kong and the USA.

Current Research/Work

In the context of my post as a university professor, I study and teach marine conservation, with a special focus on seahorses. I have a particular interest in the reproductive ecology of marine organisms and in the maintenance of healthy populations of marine fishes in well-managed ecosystems.

Seahorses are my passion but also allow me to be involved in many pressing marine conservation issues: the development of marine protected areas; the plight of subsistence fishers faced with growing populations and dwindling resources; the actively growing trade in extraordinary (non-food) fisheries; the unacceptable toll of marine life in fishing by-catch; and the degradation and damage of seagrasses, mangroves, coral reefs and estuaries.

My group is active in fundamental research on seahorse biology, management of seahorse fisheries, adjustment of seahorse consumption, policy formulation at local and international levels, and information dissemination about issues relating to the threats to seahorses. We seek to marry basic and applied science with advocacy and development work. In-country teams of professionals and local people are critical to our success.

The flagship venture in our program is community-based marine conservation project in the central Philippines, which I direct. Our local team's work in the core village of Handumon (and now in other villages) has attracted considerable interest because of its integrated approach and its respect for local socio-economic considerations. [Eds.: See M. Pajaro and J. Anticamara's summaries in this section].

Connection to Workshop Themes

Our work largely reflects the themes of this workshop: we focus attention on marine species that are being used for non-food fisheries; we develop responses that include local people; we seek partnerships for marine management; we promote alternative livelihoods for fishers. This workshop derives from wishes and interests expressed by a range of contacts during my 1993 and 1995 surveys of the seahorse trade in Asia. It should help support my teams' work in the region.

Projected Action

Project Seahorse will draw on the outcomes of this workshop to advance our work with traditional medicine and aquaculture communities. We need to enlist more and more stakeholders in wise marine management for conservation and sustainable use. Partnerships with subsistence fishers, traders, practitioners and consumers are necessary prerequisites for progress towards ensuring long-term persistence of healthy populations of marine medicinal species. Only broad-based support and international alliances can really hope to stem the overexploitation of marine resources.

Public Aquaria

Douglas I. Warmolts

North American public aquarium collections

Columbus Zoological Park Association, P.O. Box 400, Powell, Ohio 43065-0400 , USA

Background

I am employed as the Assistant Director of Living Collections at the Columbus Zoo and co-manage the entire animal division, including husbandry, animal acquisition, conservation programs, research, record keeping, and personnel management. The Columbus Zoo is an accredited member of the American Zoo & Aquarium Association (AZA). As a professional member of the AZA, I currently serve on several national conservation committees including as Vice Chairman of the AZA Marine Fishes Taxon Advisory Group (MFTAG). The AZA MFTAG represents over 185 accredited zoos and aquariums in North America who share a collective goal of promoting and supporting wildlife conservation

Current Activities and Connection to Workshop Themes

The AZA Marine Fishes Taxon Advisory Group (MFTAG) has identified three broad directives:

1. To promote AZA involvement with and support of marine life sanctuary conservation and research (Marine Protected Areas).
2. Develop a MFTAG Seahorse Strategy to advance husbandry technology, identify research priorities, support in-situ conservation efforts, and solidify conservation alliances with effective field projects such as Project Seahorse.
3. Having completed the AZA teleost propagation survey, conduct a similar survey of elasmobranchs and explore collaborative partnerships (e.g. IUCN Shark Specialist Group & American Elasmobranch Society). Promote the development of larval marine organism rearing technology and reduce dependence on wild populations to supply institutional collection needs.

At this workshop, I represent the AZA MFTAG, will report on our activities, and help disseminate the results of this meeting to the American Zoo & Aquarium Association.

Projected Action

To report results of this meeting to the AZA MFTAG membership during its annual working meeting this September and promote the continuing development of relevant technologies that will assist sustainable management of wild caught marine organisms for the aquarium trade. To assist Dr. Jeff Boehm (Shedd Aquarium) and Dr. Heather Hall (London Zoo) present results of the workshop during the annual meetings of the American Zoo & Aquarium Association and European Union of Aquarium Curators, respectively. Continue support of Project Seahorse initiatives through the Columbus Zoo's Conservation and Collection Management Committee. Encourage similar support amongst other AZA institutions.

	Aquaculture
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Mark J. Wilson**Tropical marine ornamental aquaculture**

Tropical Marine Centre Ltd (TMC), Solesbridge Lane, Chorleywood, Hertfordshire,
WD3 5SX, UK.

Background

During the early seventies the first tropical marine ornamental hatchery was launched in the U.S. This event paved the way for the development of today's mass production of fish and invertebrates sold into the marine ornamental aquatic industry. Since this time a number of hatcheries specialising in marine ornamentals have become established around the world, with some making significant advances in this relatively new field of aquaculture. Commercial numbers of animals that had previously been considered difficult to culture are slowly beginning to appear on the world market. More recent progress has been made due to the techniques passed over from food producing operations and advances made in more specific areas of aquatic research such as bacteriology, virology, immunology, nutrition and recirculation technology, all of which share a vital role in the future development of tropical marine aquaculture. In 1994, Tropical Marine Centre (TMC) opened a commercial hatchery facility producing several marine fish species for the ornamental trade.

Current Activities

As Research & Development and Hatchery Manager at TMC, it is my role to not only ensure continuous production of our existing cultured species, but also to adopt applicable technology from other specialised disciplines and, along with findings from our own research, develop new and novel techniques for rearing marine species of high commercial and environmental value.

Our own research covers a wide variety of projects including the design, manufacture and application of commercial filtration units, diet formulation, vaccination techniques, larval rearing environments and culture protocols. The increasing awareness of overexploited and vulnerable marine animals has focused our attention on developing culture protocols for species that have a

value in both the marine medicinal trade as well as the ornamental trade.

Connection to Workshop Themes

During June 1995, TMC conducted a study into the feasibility of commercially producing seahorses for sale into the aquatic trade. Three species of seahorse were selected: putative *Hippocampus kuda*, putative *H. histrix* and putative *H. fuscus*. Batches of juveniles were raised from males that had given birth in captivity but had become pregnant in the wild. The results from this study were very encouraging and although temporarily shelved, work has now begun once again with the intention of continuous production from permanently housed and conditioned broodstock. For this breeding attempt, two pairs of putative *H. reidi* have been selected as our broodstock.

Projected Action

We are hoping that over the coming months a small but continuous production of seahorses can be achieved and maintained. At this time we feel the benefit of a small-scale project will be to allow greater control over environmental conditions and allow us to thoroughly monitor events. If successful, the opportunity to attempt other species of seahorse may arise.

Exchanging reports of success and failure with other workers may hopefully speed up the development of culture techniques. Regular reports of our seahorse activities published on our web page will potentially reach a far wider audience, increasing public awareness.

	Aquaculture
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Chris Woods

A preliminary investigation into the aquaculture of the large-bellied seahorse *Hippocampus abdominalis* Lesson, 1827 in New Zealand.

National Institute of Water and Atmospheric Research (NIWA), PO Box 14-901, Kilbirnie, Wellington, New Zealand

Background

Due to the increased awareness of the trade in seahorses destined for the Asian pharmaceutical market—and the related negative effects this trade has on wild stocks—there has been considerable interest in New Zealand regarding the potential of seahorse farming. In New Zealand, only one species of seahorse occurs, the large-bellied seahorse *Hippocampus abdominalis*.

H. abdominalis is a large species which is not currently fished in New Zealand on either a commercial or traditional basis. It is not a listed species in our Quota Management System, which is the regulatory mechanism through which we attempt to maintain sustainable fisheries. However, *H. abdominalis* can be caught as by-catch and sold to licensed fish receivers who may then export them.

In a preliminary investigation, NIWA bred and raised *H. abdominalis* in a land based aquaculture facility in Wellington, New Zealand from August 1997 to June 1998. The wild broodstock had been collected from Wellington Harbour and held in the facility for six months prior to breeding.

From a broodstock of 7 females and 5 males, a total of 12 broods were produced at ambient seawater temperature (10.6-19.5°C). Adult broodstock were maintained in a flow-through 500l tank with a 15L:9D photoperiod. These adults were fed a mixture of adult brine shrimp, sand amphipods, glass shrimp, and mosquito larvae.

Following release, young juveniles were kept in 75l flow-through tanks and fed freshly hatched brine shrimp nauplii. As juveniles grew in size, they were transferred to 500l flow-through tanks and fed on progressively larger brine shrimp and small sand amphipods.

The average number of juveniles produced per brood was 269.33 ± 55.52 (range 53-721). The average time in days for each male to brood was 34 ± 3.42 (range 24-69d). The average total length of juveniles at first release was 15.65 ± 0.44 mm. On a diet of micro-algae enriched brine shrimp,

juveniles grew 1-5mm in length per week. The oldest juveniles (8 months) are now approximately 105mm in total length, and 1.5g in weight.

Mortality was greatest from birth to around 8 weeks. From this point onwards the survival of juveniles was relatively consistent, with 15-20% survival from 2 to 8 months.

Current Activities

Due to a lack of research funding, our investigation is currently not continuing. However, the wild broodstock and the surviving juveniles that they produced are still being maintained in our facility. Funding is being sought from various industry and private groups to continue our investigation.

Connection to Workshop Themes

Our work seeks to investigate the feasibility and successful techniques for culturing *H. abdominalis*, so that economical and efficient aquaculture ventures are possible. It is hoped that if this is the case, then not only can our wild stocks of *H. abdominalis* be protected from possible overexploitation, but that a demand (the Asian pharmaceutical market) may have an increased supply. It is also hoped that results gained in investigating aquaculture techniques for *H. abdominalis* will be of use in culturing other seahorse species.

Projected Action

The immediate goal is to obtain funding so that we can experimentally determine the optimal culture conditions for *H. abdominalis*, using the juveniles that were initially produced as broodstock. Our investigation highlighted certain areas, such as juvenile survival, juvenile growth rates, and the maintenance of year-round breeding, which require more research.

Conservation & TM

Endi Zhang, Ph.D.

Survey on trade in Shanghai and Tianjin

Wildlife Conservation Society (WCS), Asian Conservation Communication Program, c/o East China Normal University, Shanghai 200062, PR China

Background

My main involvement is running the Wildlife Conservation Society's (WCS) Asian Conservation Communication Program. This program is a China-based conservation program that WCS established in September 1996. It aims to improve public awareness among the Asian community on their role in the consumption of wildlife products. The program includes, but is not limited to, identifying and working with traditional Chinese medicine (TCM) practitioners and pharmacies, giving talks to community and school groups and working with government officials on these efforts. The program aims to strengthen the existing collaboration between WCS and various levels of the government and scientific institutions in China in our efforts to promote public conservation education. The program is the first wildlife consumer-oriented program ever based in China by any international conservation organisation.

Seahorse has been used for several thousands of years. But the current utilisation is probably ecologically unsustainable. Therefore to study its trade pattern will help us to understand the demand for seahorses. I hope our study could find out the problems existing in the seahorse trade that threatens wild populations, and find solutions for a better management and conservation of medicinal wildlife.

Current Activities

We conduct public awareness campaigns on the use of endangered species for medicine and food. Current work is focused on tiger-based products. The work includes changing attitudes and practices of students of TCM; educating present and future TCM consumers; raising broad-based public awareness through television, zoo exhibits and leaflets; and building support for wildlife conservation among Chinese government officials and other influential decision makers. We are also involved in

capacity development of the first Chinese wildlife forensics lab, Shanghai Wildlife Forensics Laboratory, in monitoring wildlife trade both legally and illegally. I am also interested in behavioural ecology of the Chinese water deer.

Connection to Workshop Themes

As a part of our ongoing project on the status and trade of endangered wildlife used in TCM, we have started to examine wildlife trade. Seahorses are one of the species that we are monitoring. The Wildlife Forensics Laboratory is an official center for species identification. Samples include many marine species sent to us for identification before they can be issued permits for import and export. This lab has helped us to have a better knowledge of what is in trade in Shanghai and adjacent provinces.

Projected Action

1. To raise public awareness and influence patterns of use of endangered wildlife-based products among Asian population as a way to reduce pressures on wild populations.
2. To strengthen existing collaborations between WCS and various levels of government and scientific institutions in China to promote public conservation education.

	Conservation
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Chunguang Zhang, Ph.D.

Systematics and conservation of some of China's fish fauna

Division of Fish, Center of Zoological Systematics, Institute of Zoology, Chinese Academy of Sciences, Beijing, 100080
PR China

Background

I graduated from the Department of Biology, Beijing Normal University in 1979 and then went to the Institute of Hydrobiology, Chinese Academy of Sciences for graduate study. I obtained my master's degree from the institute in 1983 and came then to my present institute for a permanent position in the same year.

I am an ichthyologist. I have visited the Institute of Zoology (Russian Academy of Sciences) and the National Museum of Natural History (Smithsonian Institution, Washington D.C.), among others. I was at the Australian Museum for six months for further research.

Current Activities

My research interests are mainly in the systematics and conservation biology of fish. I have published more than 30 scientific articles and books by myself or with other colleagues up to date. I am engaged in the following projects at present:

1. Compiling the fish fauna of China (the sections on Exocoetidae, Synodontidae, etc.);
2. Conservation Biology of the Catosomidae of China;
3. Investigation of fish fauna of Shiwan Dashan Mountains of Guangxi, China;
4. Systematics of Syngnathidae and seahorse conservation in China.

Connection to Workshop Themes

The seahorses have been one of the most important groups of fishes in TCM, in China. The stocks of Chinese seahorses have been declining in the past several decades. I have been very interested in the research on the systematics and conservation biology of this fish.

Projected Action

I am applying for a project to conduct further research on the systematics and conservation biology of the seahorses of China.

Prof. Hanchen Zheng

Traditional Chinese medicine research

Vice President, Shanghai Botanical Society/ Vice President, Society of Natural Medicinal Material Resources/ Board member, China Society of Natural Resources (CSNR)/ Commissioner, Seventh Chinese Pharmacopoeia Commission/ Board member, Shanghai Pharmaceutical Association/ President, Military Society of TCM

Department of Pharmacognosy, College of Pharmacy, Second Military Medicine University, 325 Guohe Rd., Shanghai 200433, PR China

Background

I was born March 14, 1939 in Wuxi, Jiangsu province, China. I have been working in the Department of Pharmacognosy, College of Pharmacy, Second Military Medical University in Shanghai since I graduated from the Department of Biology, East-China Normal University in July 1962.

Current Activities

I have been studying and teaching Pharmacognosy and Natural Medicinal Resources for 36 years. In 1978, I was a lecturer in the College of Pharmacy, Second Military Medical University. In 1987, I was an associate professor, and in 1990, I became a professor.

I have done research into *Acanthopanax senticosus* Maxim, *Phytolacca* spp., *Aralia* spp., *Torreya* spp., *Cuscuta* spp., *Glycyrrhiza* spp., *Perilla* spp., *Matricaria chamomilla* L., *Murreya* spp., *Hydropotes inermis* Swinhoe (Chinese water deer) and so on, amounting to 60 species of medicinal plants and animals. I have inspected these species in the field and herborised throughout about 30 provinces, autonomous regions and municipalities directly under the Central Government. I have taken about 10 000 colour photographs of medicinal plants and animals. During this time, I have discovered three new species and one new plant resource of Taxol (which I have patented). I have published 85 academic papers and 36 books (collaborative, in Chinese). These books mainly are:

- A Pictorial Encyclopedia of Chinese Medicinal Herbs (Vol.1-12);
- Medicinal Botany;
- A Color Atlas of the Chinese Materia Medica Specified in Pharmacopoeia of the People's Republic of China;
- Resource Science of Chinese Medicinal Materials;
- Summary of Information on Chinese Traditional Medicine(Vol. 2-5) and
- Color Pictorial Handbook of Toxic Chinese Herbs.

Connection to Workshop Themes

In fact, I have done less research work dealing with the trade and use of marine medicinals. What I have presented at this Workshop was collected from published papers and books. But from now on, I will pay more attention to the research and conservation of the medicinal marine species.

Projected Action

I plan to discover more new resources of medicinal plants and animals by research into the co-sanguinity among biological species, and I hope to co-operate and exchange with international colleagues in screening valuable biological resource for new drugs. As to marine species, I suggest that we should use them in TM as less as possible. We should attach more importance to the aquaculture of marine species such as seahorse and the protection of the marine species ecosystem. We should investigate the allowable amount of exploitation so that we can keep the sustainable use of marine species.

Part V. Workshop Context

Seahorse Workshop Series Summary Reports:

Philippines National Workshop

IDRC Workshop on Marine Medicinals

Shedd Aquarium Workshop

Project Seahorse Position Statements:

Seahorse Aquaculture

Releasing Captive Seahorses

Marine Medicinals Questionnaire



Summary Report

National Conference-Workshop on the Conservation and Management of Seahorses in the Philippines

DENR Training Center, Campo Forestal, Capitol Site, Opra, Cebu City, Philippines
21-22 May 1998

A recent meeting on seahorse conservation and management in the Philippines represented the first attempt to resolve the problem of seahorse overconsumption. Participants made a strong call for action and took initial steps toward an integrated plan for managing these valuable and poorly understood fish species. This workshop laid down the template for action at the international level.

Background & Objectives

The global trade in seahorses for use in traditional Chinese medicine (TCM), the aquarium trade and as curios involves over 40 nations, and consumes at least 20 million animals a year.¹ The Philippines is one of the world's leading exporters of seahorses, although recent reports from fishers and traders indicate that supplies cannot keep up with international demand. Fishers from the province of Bohol, an important seahorse supplying region, report that catches plummeted 70% in the ten years from 1985.

In late 1994, a community-based project on seahorse conservation was initiated and implemented in Bohol through a partnership of Dr. Amanda Vincent and the Haribon Foundation, the Philippines' oldest environmental non-governmental organisation (NGO). The project is flourishing and the team has now taken on management of coastal resources throughout the region.

As part of their ongoing initiatives, project leaders recently invited a wide range of stakeholders to participate in a workshop directed at consolidating conservation and management of seahorses throughout the country. Fishers, traders, users, researchers, policymakers, law implementors and catalysts came together to share their experiences and capabilities at this national meeting. Their primary objective was to assess the state of the country's little-managed seahorse fishery in order to develop a national action plan for the long-term persistence of Philippine seahorse populations. Specific objectives were to:

1. Draw out issues and concerns related to the Philippines' seahorse trade and fisheries management.
2. Develop and consolidate action plans from stakeholders and government, non-government and research institution representatives.
3. Recommend appropriate implementation strategies and schemes to carry out action determined at the workshop.

Arrangements

The national conference-workshop was organised by the Bohol team of the Project Seahorse/Haribon Foundation partnership, in collaboration with the Department of Environment and Natural Resources, Region VII (DENR VII). It lasted two days and was held at the DENR's Training Facility at Campo Forestal, in Cebu City. Financial and logistic support came from the Foundation for a Sustainable Society Inc., the Foundation for the Philippine Environment and DENR.

The 27 invited participants included representatives from:

- stakeholder groups (3 fishers, 2 middle buyers and 2 exporters, one of them a former fisher and now a member of the Federation of Aquarium Fish Gatherers)

¹ Vincent, A.C.J. 1996. The international trade in seahorses. TRAFFIC International. vii+163pp

- government: municipal representatives (LGUs) (3), DENR regional office (3), DENR's Parks and Wildlife Bureau (DENR-PAWB) (1) and Department of Agriculture's Bureau of Fisheries and Aquatic Resources (DA-BFAR) (1)
- non-governmental organisations (NGOs) (2)
- research institutions (3 seahorse aquaculture scientists)

Six people from the Bohol seahorse conservation team and DENR provided workshop support, helping with documentation, facilitation and logistic arrangements. Dr. Amanda Vincent, from McGill University, Canada, was invited to provide expert advice and an international perspective on seahorse issues, and to give the opening message of support.

Participants were chosen for the workshop on the basis of their relevant experience and potential to help develop and implement a national seahorse action plan. Most came from the Palawan and Visayas region, which are among the most active seahorse trading centers. Future workshops will also involve the other Philippine seahorse trading regions, such as Mindanao.

The workshop consisted of two series of presentations, with interspersed open fora for questions and discussions, and two workshops with breakout groups and feedback plenary sessions. Most workshop proceedings were in Tagalog or English, with only limited use of Cebuano (the primary language of the Visayas and Mindanao). All participants expressed themselves comfortably in breakout sessions but the plenary sessions proved somewhat more daunting for those with less workshop experience, or speaking only Cebuano. Future workshops will gain strength from greater efforts to integrate participants fully, perhaps through regular debriefing sessions, or interpretation.

Format & Presentations

Presentations gave participants an awareness of the issues and concerns surrounding the seahorse fishery. Topics were as follows:

- introduction to the international context of the Philippines seahorse trade
- overview of seahorse biology, emphasising the biological characteristics that make this fish especially vulnerable to exploitation
- recent numerical decline in those seahorse populations that have been studied, and the situation of subsistence seahorse fishers
- nature of the national seahorse trade
- use of seahorses in traditional medicine, and the user's perspective on management
- current conservation and management initiatives
- aquaculture potential of the fish, and the current state of the research in the Philippines.
- introduction to existing Philippine bioprospecting guidelines and regulations (described in Executive Order 247 and Administrative Order 96-20)
- overview of current fisheries regulations of relevance to seahorses, including certain sections of the newly signed Fisheries Code (RA 8550).

Discussions

Workshop sessions and open forum periods were wide ranging, with particular attention on the following key issues:

Current state of knowledge

Most participants felt that the lack of information on seahorses as to their status, biology, aquaculture, trade and especially taxonomy was a major obstacle to successful management.

Scientific Justification: Researchers stressed that any management initiatives must be based on sound scientific data, and insisted that proposals such as minimum size limits for seahorse catches must derive from reliable research.

Taxonomy: Seahorse taxonomy is in chaos, and participants welcomed the upcoming publication (by Project Seahorse) of a field guide that could greatly facilitate research, trade monitoring and other initiatives.

Aquaculture: It was agreed that biologists should severely limit the number of animals used in pilot studies, and should establish reliable basic husbandry techniques before embarking on complex experiments.

Trade

Monitoring There was a call for Philippines Customs to return to documenting the trade in seahorses (suspended since 1987), as a significant initiative at the national level.

Prices: Traders and fishers reported that the prices for dead seahorses were declining, even though supplies were low, while prices for live seahorses remained steady. The price decline may not reflect the situation throughout the market, however, since only two trade routes were represented at the workshop.

Aquarium trade: According to one fisher, the western province of Palawan has banned the collection of aquarium fishes, but not seahorses, and these may well become the next target of collectors. Apparently most aquarium fish exporters insist that shipments of seahorses also include other marine fishes.

National legislation

Permits: The DENR Parks and Wildlife Bureau's bioprospecting regulations require that scientists collecting any species (including seahorses) for use in experiments must obtain permits from local government units.

Fishery Code RA 8550: This national legislation was signed in February 1998 and has potentially important consequences for seahorse conservation and management. DA-BFAR is currently preparing the Implementing Rules and Regulations that will determine the interpretation of this policy. Sections of the code of potential relevance to seahorse conservation and management include:

- an intention to ban the export of all live fishes
- greater enforcement of laws against the use of certain destructive types of fishing gear
- encouragement to restore certain fishponds to mangroves
- creation of Fisheries and Aquatic Resource Management Councils (FARMCs), local organisations of fishers who will be responsible for the implementation of coastal resource management, fisheries laws and regulations at the *barangay* (village) level.
- establishment of more marine protected areas
- a ban on the trade in all species listed in CITES Appendix I and II (see below)

International controls

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) lists species for which international trade is banned or controlled. The Humane Society (US) recently proposed that the USA CITES Scientific Authority should nominate all seahorse species for listing on Appendix II of CITES. This is now under consideration for the CITES Conference of the Parties in late 1999.

Workshop participants spent considerable time and energy discussing this proposal. A CITES Appendix II listing normally serves to regulate trade by requiring traders to obtain export permits. Under the new Philippines Fishery Code, however, any such Appendix II listing would result in the ban in all trade of these species (see above). It is far from clear that such a ban would result in conservation gains, especially as the ban might well drive the seahorse trade underground, making it much more difficult to monitor and control.

Most participants were against an Appendix II listing at this time, and supported alternative regulatory actions. Among the national government agency participants and academic researchers, however, a majority tended towards accepting a CITES Appendix II listing, at least temporarily, because of significant seahorse population declines and the current lack of regulations. Participants representing both views accepted that further thought and consultation was necessary.

Workshop Outputs**Workshop I. Issues & Concerns**

Participants were divided sectorally into smaller working groups for workshop I:

- A- Stakeholders (Fishers, traders and consumers) & municipal representatives
- B - NGO representatives and aquaculture researchers
- C - Regional and National line agency representatives (DENR and DA)

Each group was given specific questions to draw out the issues and concerns related to the Philippines seahorse fishery. The consolidated output of the three groups follows, with issues marked with a star (*) being used as the basis for the development of action plans in Workshop II:

- | | |
|---|--|
| <ul style="list-style-type: none"> *1 A clear decline in seahorse numbers *2 Habitat destruction *3 Trade concerns <ul style="list-style-type: none"> • Lower price for seahorses • Low demand, irregular supply, difficulty of keeping in captivity, high freight cost and difficulty of obtaining necessary permits for seahorse export 4 Poverty of fishers *5 Information Dissemination <ul style="list-style-type: none"> • Lack of awareness as to the status of seahorses among the general public • Limited access to seahorse research and culturing information 6 Management Initiatives: <ul style="list-style-type: none"> • Lack of management initiatives for seahorses | <ul style="list-style-type: none"> • Uncertainty about nature and validity of existing fisheries management concepts, such as Maximum Sustainable Yield (MSY) • Lack of policy implementation, and of co-ordination among implementors *7 Research Gaps: <ul style="list-style-type: none"> • Lack of knowledge of basic seahorse biology • Lack of research funding • Lack of baseline data on wild seahorse populations, trade and socio-economic factors 8 Aquaculture: <ul style="list-style-type: none"> • Non-viable seahorse aquaculture techniques |
|---|--|

Workshop II. Guideline Presentation & Action Planning

Participants were divided according to geographic origins and asked to develop action plans based on the issues raised in Workshop I:

- A- Visayas
- B- Luzon and Mindanao
- C- National government agencies and research institutions (mainly Manila-based)

Each group was specifically asked to consider its attitude to a CITES Appendix II listing for seahorses. The proposed action plans are presented in Appendix I.

Geography as well as group composition influenced the nature of the recommendations made. The Visayas participants, from a region where seahorse conservation is already underway, focused on continued conservation initiatives, such as establishing marine sanctuaries, promoting the caging of pregnant males (the male is sold only after he has released his offspring) and enforcing a minimum size-limit for seahorse harvest. Participants from Luzon & Mindanao, regions currently without seahorse management, placed more emphasis on start-up activities, including information gathering (baseline data collection), dissemination (One Stop Information Shop) and community education.

The national agencies and research institutions concentrated on legislation and research initiatives. This group tended to plan on a wider scale than the other two, emphasising inter-agency co-ordination for example, but also recommended many community-level actions, such as sanctuary establishment and community organisation.

The ideas proposed at the workshop will be consolidated into one national seahorse action plan, and implemented by two designated groups: the Project Seahorse/Haribon Foundation team, represented by Marivic Pajaro, and the DA-BFAR, represented by Rene Ledesma. These two representatives will

liaise closely on the action plan and on a response to the proposal for a CITES Appendix II listing. Participants felt that initial implementation of workshop suggestions should begin within the year.

Significance of the Meeting

Participants viewed the workshop as a success, and were eager to share the experience gained therein with their community and/or agency, and to move forward with the development of the world's first national seahorse action plan.

National

The issues tackled during the workshop will also arise for other non-traditional fisheries resources. Developing a seahorse action plan will help to prepare the Philippines for future resource management challenges. The workshop succeeded in bringing together participants from many different sectors, and uniting them in the goal of protecting the Philippines seahorse fishery. The recommendations for increased inter-agency co-ordination and further workshops indicates the willingness of groups to work together on the issue. The decision to establish a national repository of all internationally available information on seahorses ("One Stop Seahorse Information Shop") at the Fisheries Resource Research Division of BFAR, in Manila, will promote co-operation between BFAR and all concerned groups.

International

The national conference-workshop on the seahorse fishery was the first of its kind to be held anywhere in the world. It also launched a series of workshops planned until the end of 1999, all focusing on issues relevant to seahorse management and conservation. In July 1998, international participants will meet in Cebu to discuss the sustainability of trade in marine species used in traditional medicines. Live trade issues will be addressed by workshops in Europe and the U.S.A later in the year, with one objective being to involve aquaria in seahorse research and conservation. Tentatively planned for 1999 are an Australasian workshop to assess the ecological, social and economic implications of developed world involvement in developing country fisheries issues and a meeting on seahorse and pipefish biology.

The outputs produced at each workshop will help inform the next, to facilitate the final goal of an international seahorse action plan.

– Summary Report written in June 1998

Workshop II: Action Plans

PROBLEM	ACTION	GROUP*
Decline in seahorse populations	Collect baseline data Establish sanctuaries Stop illegal fishing practices Rehabilitate seahorse habitats Popularise the practice of caging pregnant male seahorses until they release their young Strengthen and establish FARMCs, Co-operatives and NGOs Establish a quota system for wild caught seahorses Establish a minimum size limit for harvest	V V, LM, NR LM LM V NR NR V, NR
Habitat destruction	Establish and enforce sanctuaries Rehabilitate seahorse habitats Increase research Information, education, communication (IEC) Organise communities	V, LM, NR V NR NR NR
Trade problems	Dept. of Trade and Industry to train traders Form a co-operative or federation to negotiate prices with exporters	V LM
Lack of awareness of seahorse issues throughout the Philippines	IEC activities: form focus groups, co-ordinate with villages for this activity, information caravan Assess stocks of exploited seahorses: actual inventory and also co-ordinate with other agencies for secondary data on seahorse habitats Involve media for IEC	LM LM NR
Limited access to information	Establish a One-Stop Information Shop linking national and international agencies to share information on seahorse culture and research	LM
Research gaps	Make seahorse research a priority Co-ordinate with other research agencies & funding institutions to fill research gaps Carry out trade research Hold a meeting of all stakeholders to discuss policies for seahorse conservation and management	NR LM, NR NR NR
* Actions proposed by the following workshop breakout groups: V=Visayas, LM= Luzon and Mindanao, NR= National Line Agencies and Research Institutions		

Summary Report

1st International Workshop on the Management and Culture of Marine Species used in Traditional Medicines

Cebu City, Philippines, 4-9 July 1998

Background

Overconsumption of the wild plants and animals used in traditional medicine (TM) poses a threat both to their populations and to the people who depend upon them for their livelihood or health. According to the World Health Organisation (WHO), the majority of cultures in developing countries rely on TM to satisfy their primary health needs. The World Conservation Union (IUCN) and TRAFFIC² state that "increased demand [for medicinals derived from wildlife] and increasing human populations are leading to increased and unsustainable rates of exploitation" (1997). In 1997, the Parties to CITES³ agreed upon the importance of addressing these issues, while also recognising the global significance of TM. Traditional Chinese medicine (TCM) is by far the largest of the many TM systems and exploits a wide range of natural ingredients, and so has a particular responsibility to ensure consumption is sustainable.

In 1997, TRAFFIC noted that in most cases little is known of the medicinal wildlife trade, and highlighted the need for broad reviews of defined areas of medicinal wildlife use, in order to identify potential threats to medicinal species. One such defined area was the use of marine species in TM, and a key step in identifying potential threats was determining the global scale of dependency upon these species.

Conservation efforts with respect to TM have focused on the consumption of large terrestrial mammals, effectively ignoring the trade in marine species. Seahorses provide the only case study of a marine species exploited for use as medicinals. An examination of the seahorse TM trade revealed an extensive international market, rising demand, and declining seahorse populations (Vincent 1996). Seahorses are commonly caught by small-scale subsistence fishers, and can provide their main source of income. Seahorse fishers in the village of Handumon in the central Philippines are well aware of the need to seek sustainability in their resource management. Declines in their seahorse catches - about 70% in the 10 years from 1985 - have prompted fishers to co-operate on a number of conservation initiatives.

Meeting the economic needs of marginalised communities while conserving the resource base on which they depend requires a delicate balance. The development of small-scale, low-technology aquaculture could provide new income-earning opportunities for fishers while reducing pressures on wild populations. At present, however, none of the many attempts at seahorse culturing have proven to be economically or ecologically viable, though there appears to be scope to improve this situation through the combined efforts of researchers, aquaculturists and aquarium communities. Such collaborative efforts may also prove valuable for the development of aquaculture programs for other marine medicinal species.

Co-operation with TM communities will be a vitally important step in balancing marine medicinal supply and demand. Previous interactions between conservation campaigns and TM communities have often been highly confrontational. Seahorses provide a new opportunity for measured dialogue, as these fishes are not thought to be on the verge of extinction and have not been the target of hostile conservation concerns.

² The joint wildlife trade monitoring group of the IUCN and WWF.

³ The United Nations Convention on the International Trade in Endangered Species of Wild Fauna and Flora

Objective

To initiate the development of a co-ordinated international plan of action to improve the sustainability of trade in marine species used in medicines.

Specific objectives

- Hold a discussion workshop where stakeholders in fishing, trade and culture of marine medicinal species work with fisheries and conservation biologists to assess the current situation and develop new collaborations.
- Compile directories of marine species used in medicine, consumption levels and histories, perceived conservation concerns and livelihood possibilities.
- Generate action plans and design protocols to improve the management of seahorses and other marine medicinals in order to provide livelihood options for those who depend on this trade.
- Consult with traders and consumers on their projected needs for marine species and how to meet these demands.
- Discuss improvement of aquaculture of marine medicinal species in order to provide new livelihood options for fishers and aquaculturists, while simultaneously reducing pressure on overexploited wild populations.
- Use seahorses as a model group of species to focus on the technical and social problems of marine aquaculture in developing countries.
- Establish a network of stakeholders for future consultation and collaboration.
- Develop general paradigms for how newly recognised trades in marine medicinals should be managed for conservation, for socio-economic gain and for medicinal use.

Briefing materials

Draft briefing materials on the workshop subject areas were prepared by Project Seahorse and circulated to participants for comment. The revised documents were then submitted to participants at the meeting.

- *Global Survey of Marine Medicinals* presented the preliminary results of a study to determine the taxonomic and geographic distribution of use of marine medicinal species.
- *Aquaculture and the Conservation of Marine Medicinal Species* provided a brief introduction to the ecological, social and economic components of conservation-driven aquaculture.
- *A Review of the Current State of Seahorse Aquaculture* addressed the technical problems of seahorse aquaculture.

Arrangements

The meeting took place over five days, based at the Centrepoint Hotel, Cebu City, Philippines. It was funded by the International Development Research Centre (IDRC), a public corporation created by the Canadian government with the principal mandate of helping researchers and communities in the developing world find solutions to social, economic and environmental problems through research.

The workshop was developed and organised by Project Seahorse, a collective of biologists and community organisers working for the conservation and management of seahorses, their relatives and their habitats. Project Seahorse is led by Dr. Amanda Vincent (McGill University) and Dr. Heather Hall (Zoological Society of London) with teams in Canada, UK, Philippines, Vietnam, Hong Kong and USA.

Thirty-five participants from 17 countries and territories attended the workshop. They included:

- traders and researchers in TM (China, Korea, Malaysia);
- aquaculturists and aquarium representatives (Belgium, Indonesia, New Zealand, Philippines, South Africa, Thailand, UK, USA, Vietnam);
- fisheries managers and fish biologists (Australia, China, India, Philippines);

- conservationists and social anthropologists (Australia, Canada, South Korea, Hong Kong, Philippines, Taiwan)

The meeting was held in English with translators assisting participants where necessary. The official translators were of uneven quality but generous support from other participants helped to ensure full involvement of all present.

The workshop was facilitated by Rosalinda Paredes and two rapporteurs from the Haribon Foundation for the Conservation of Natural Resources, Project Seahorse's partner in the Philippines. Marie-Annick Moreau co-ordinated workshop logistics, with direct and central involvement of the Project Seahorse team in the Philippines.

Format

Presentations during the first day and a half laid the foundation for the workshop, by outlining key issues and ensuring common understanding of issues:

- 1 Setting the scene: the use of marine species in TM and their economic importance to local communities;
- 2 Trade in exporter countries: its importance, the role of women, and India as a case study;
- 3 Trade in importer countries: patterns of TCM consumption and administration;
- 4 TM and conservation: how they work together and TCM research into marine medicinal species;
- 5 Aquaculture: the potential for small-scale aquaculture and case studies of culturing marine medicinals in Vietnam and South Africa;
- 6 Global issues: marine conservation, legislation and the aquarium trade.

The afternoon of day two was spent examining key themes from the presentations and brainstorming for options and actions to promote sustainable use.

Breakout groups during days three and five were divided into four subject areas: Aquaculture, Consumption, Conservation and Cross-cutting, the latter being a mix of each of the other three subject areas to provide an overall perspective. These groups discussed the sustainable use of marine species in TM by considering, in separate sessions: (1) Problems and limitations (2) Options and possibilities and (3) Plans and proposals.

Representatives from each group presented key points in plenary for further discussion. An informal session on seahorse aquaculture was organised in the evening of Day three to allow for interested participants to discuss methods and technology. On day five, participants representing the TM community hosted an additional session to elaborate on their perspectives of the relationship between TM and conservation.

A **field trip** on day four brought participants to a community-based conservation project guided by Project Seahorse, based in the village of Handumon, Bohol. After crossing by boat to Bohol and exploring mangrove and seagrass habitats by outrigger boats, participants were welcomed to Handumon by provincial, municipal and village dignitaries. In the afternoon, participants toured the village to observe local livelihood activities and heard from community members of their local involvement in resource conservation and management. An evening banquet, prepared by the community, closed the day.

The field trip clearly achieved its objective of increasing participants' awareness of the complexities of managing natural resources in very poor communities with limited options. Many participants had not previously seen a live seahorse and felt that such an experience provided a new perspective on the TM trade in these animals.

Discussions

Four interdependent and intersecting themes emerged from the discussion, each provoking preliminary recommendations on possible action towards ensuring sustainability:

1. Perceptions and principles in traditional medicine

Participants repeatedly and insistently cited misconceptions on the use of animals and plants in TM. Members of the TM community at the workshop argued that TM is often attacked because Western countries do not understand its underlying principles, and contended that an understanding of conservation issues is often more developed among TM users than is an understanding of TM among conservationists.

Participants recognised the need to understand both the content (what) and context (how) of marine species use in TM. For example, while TM patients traditionally relied on prescribed medicines tailored to their individual needs, the increasing availability of pre-packaged TM is altering consumption patterns. Consumer preference for large, smooth seahorses does not apply to patent medicines, which include seahorses once considered unsuitable for TM. Individual choice is not exercised, with consequences for the demand for medicinal species, and available options for managing demand.

Preliminary recommendations:

- Exchange of information and opinion among TM and conservation communities (in appropriate languages) is vital in order to improve mutual understanding.
- Those with focal interests in TM, conservation and aquaculture will need to develop a common voice if sustainable use of medicinal plants and animals is to be achieved.

2. Consumption and trade of traditional medicine

Participants were asked to collect information on TM use of marine medicinal species, providing new insight into TM consumption in their countries. One participant's survey showed that at least 410 marine species have been used historically in TCM, although current levels of use remain unclear. The TM contributors noted the difficulty of documenting trade levels, because of a lack of appropriate record keeping or centralised information. It does appear that TCM trade (at least) is expanding markedly, with, for example, increases in the number of species and of individuals landed in India for TCM export. Demand for - and mode of - consumption of TM ingredients varies by geographic area, and changes with time.

Preliminary recommendations:

Balancing supply and demand for marine medicinal species in decline will require:

- Documentation of the level and nature of consumption of TM species;
- Information on changing trade dynamics and accurate interpretation of trade data;
- Open exchange of information among stakeholders;
- Education for TM consumers and practitioners about wise and judicious use;
- Reduction of use by encouraging TM practitioners to exercise voluntary self-control on their prescriptions (e.g. discriminating by species, life history stages, or reproductive states and advising in favour of species of least conservation concern where possible);
- Examination and verification of efficacy, using rigorous methodology;
- Regulation of use in the manufacture of packaged patent medicines;

The nature and level of any proposed trade restrictions must be carefully considered to ensure maximum conservation gain with minimum human cost.

3. Management approaches

Conservation and management require an understanding of the fishery for TM species and the socio-economic and political context in which it operates. Economic dependency on fisheries for TM appears to be increasing. Possible remedial actions must thus be analysed in terms of their implications for local communities.

A wide range of examples of legislative initiatives for managing the TM trade were discussed. In the Philippines (as a case study), natural resource legislation protects the knowledge of local people where a potentially valuable product is concerned (Intellectual Property Rights). It was noted that while conservation legislation in Australia is introduced without specifically examining its socio-economic impact, such an omission would, in many parts of the world, largely preclude real progress on the conservation issue.

Preliminary recommendations

- Examples of community initiatives should be widely publicised and promoted.
- Communication and consultation must be cultivated prior to legal decisions. TM communities often perceive themselves as victims rather than as partners in legislative development.

4. Aquaculture

Aquaculture has often been promoted as a practical approach to dealing with problems of overexploitation in the wild, but is commonly neither ecologically nor economically sustainable. Most participants at the workshop recognised that culturing marine species for TM offered some potential for reducing imbalances between supply and demand, but also registered caveats. Technical difficulties with diet and disease control need to be resolved methodically on a small-scale before seahorse aquaculture initiatives are promoted. The scale of culturing also needs to be carefully considered to ensure that culturing reduces pressure on wild populations, provides alternative livelihoods for dependent communities, and meets TM quality concerns. An important obstacle to captive supply is the TM perception that "wild is better".

Preliminary recommendations:

- The expected role of aquaculture in conservation must be clearly defined, and rigorous small-scale research must precede aquaculture ventures.
- The TM community should be consulted to identify priority species for culture, and be encouraged to accept captive-bred animals and plants.
- Information should be freely exchanged.
- Developed countries should invest in the establishment of marine medicinal aquaculture in developing countries.

Workshop Outputs

The final discussion sessions concentrated on setting short-term and long-term goals, on both a small and large scale. These included:

- developing a formal network as a first step to facilitating communication among the TM, trade, conservation and aquaculture communities. Activities and progress will be reported in a bilingual newsletter (English and Chinese);
- publishing bilingual (English and Chinese) proceedings and disseminating widely;
- holding a second workshop on the same theme, to be hosted by the Chinese participants;
- producing a glossary of terms used in TM to reduce sources of confusion and misunderstanding;
- engaging the TM community to help prepare guidelines on the animals and plants that are most useful for TM, in order to reduce waste when fishers catch sub-optimal individuals.
- creating a priority list of species that could and should be produced by aquaculture, with input from both the TM and aquaculture communities;
- developing an educational exhibit of live seahorses, to tour areas with high concentrations of TM use to promote interest in conservation;
- developing a reciprocal educational exhibit on the use of marine species in TM, to take to zoos and aquaria, primarily in the West, to promote understanding of TM;
- encouraging the TM and conservation communities to undertake joint research into the marine medicinal trade;
- promoting research into seahorse biology, ecology and behaviour.

Main messages: In the final analysis, the workshop participants appeared comfortable with a number of general observations:

1. The use of marine medicinals is widespread.
2. Wide-ranging options for management could include managing supply, adjusting demand, managing the resource and its habitats, and providing education at all levels (from children to fishers to public aquaria).
3. Seahorses were accepted as flagships for marine medicinal issues, especially as we know so little about many of the other marine species used in TM.
4. TM is just one use of species in the marine environment and is rarely, if ever, solely responsible for a species becoming endangered. Other types of fisheries, habitat loss, and human population pressures are major factors contributing to marine species decline.
5. Habitat protection initiatives are vital and may be particularly important in species with restricted ranges.

Significance of the Meeting

Participants viewed the meeting as a success, as it was seen to provide the opportunity for the development of proactive rather than reactive discussion between TM and conservation communities. They felt that the workshop launched a process that avoided conflict while identifying both the problems with the trade in marine medicinals for TM, and possible solutions. TM contributors noted that the obvious presence of the aquaculturists at the workshop had helped to avoid the polarisation that can ensue from isolating only two parties to a problem.

Participants noted that it would be important to promote solutions before the focal species were at the point of extinction, and to avoid confrontational campaigns about conservation interests. All were agreed that TM and conservation communities in fact share the same goal: to maintain a long-term harmonious relationship between people and nature

– Summary Report written in August 1998

Summary Report

International Aquarium Workshop on Seahorse Husbandry, Management and Conservation

John G. Shedd Aquarium, Chicago, USA, 6-9 December 1998

Background

The success of public aquaria as visitor attractions and education centers helps these institutions to play an important role in the conservation of the aquatic species they exhibit. Co-ordinated management and conservation programs among aquaria are still relatively new ventures, but have great potential to make a difference. Seahorses, as popular and attractive aquarium fishes, provide an ideal case study for the establishment of such programs, particularly because the fate of seahorses represents a convergence of key marine conservation issues: overexploitation of target fisheries; waste of resources in trawl by-catch; destruction of coral reef, mangrove and seagrass habitats; and the need for marine protected areas.

Seahorses are the target of large, global and unsustainable fisheries. Primarily sold for traditional Chinese medicine (TCM), significant numbers are also exploited for the aquarium trade, with widespread reports of serious declines in wild seahorse populations. The disappearance of seahorses from already depleted and degraded fishing grounds would devastate the many subsistence fishing communities dependent on these fish as an important source of income.

Virtually all captive seahorses are obtained from the wild. These fishes are notoriously difficult to keep, and those that die are frequently replaced, resulting in increased pressure on wild seahorse populations. The current lack of information on the basic biology of these animals limits the development of successful husbandry and captive breeding techniques. Seahorses are prone to stress and associated diseases, disease treatment is difficult, diets are poorly understood and the requirements of different species are unclear.

In addressing the role aquaria can play in seahorse conservation, institutions will need to consider a number of inter-related issues: subsistence fisheries and trade sustainability for marine ornamentals, management of fish breeding programs, and the need for research and communication among aquaria and with the public. Seahorses are striking fishes and can serve as a flagship species for highlighting the plight of many marine fishes and their ocean habitats. Seahorses are also at risk in their own right, and so will certainly benefit from the strategic support of the world's aquaria.

Objective

To develop an international, co-ordinated program for seahorse management and conservation in aquaria, to link this with field conservation programs and fundamental research, and to use seahorses as a model for wider issues relating to the trade in marine ornamental fishes.

Specific Objectives

- To hold a discussion workshop on seahorse husbandry, conservation and management with involvement and participation of representatives from international aquaria and the aquarium trade, field conservation workers and associated scientists.
- To co-ordinate efforts in the ex-situ care of seahorses in aquaria.
- To identify and establish research objectives that address the problems in seahorse husbandry and management.
- To develop a network of aquaria that exchange well-researched information.
- To enhance links with field conservation initiatives.

- To address wider issues in the marine ornamental trade and the role of aquaria in conservation programs.

Preparation

Preparation for the workshop began more than 18 months in advance when Dr. Heather Hall and Kristin Lunn, both of Project Seahorse (see Arrangements, below), distributed seahorse husbandry questionnaires to public aquaria, hobbyists and researchers world-wide. The data obtained from the 94 completed questionnaires were incorporated into a review of the current state of knowledge of seahorse husbandry. Analysis revealed gaps in the original questionnaire, prompting organisers to survey workshop participants more closely on the topics of disease diagnosis, seahorse acquisition, live food culture and established collaborations with outside projects. In the two months leading up to the workshop, informal e-mail discussion groups were organised, allowing participants to identify the concerns and interests requiring further discussion at the workshop. The groups covered four broad subject areas affecting seahorses: (1) Disease (2) Diet (3) Physical Parameters and (4) Acquisition, Disposal & Transport.

Before the workshop, participants were mailed briefing materials which included the results of the husbandry survey analysis (“Breeding and Management of Seahorses in Aquaria”), a summary of current legislation protecting seahorses and potentially affecting aquaria, and a number of documents relevant to the management and co-ordination of conservation breeding programs in zoos and aquaria. At the workshop, participants received summaries of the e-mail group discussions and the additional surveys, samples of pathology/necropsy reports from various aquaria, and summary reports from two previous workshops addressing issues of seahorse conservation (see Significance, below).

Arrangements

The workshop was developed by the John G. Shedd Aquarium (Chicago, USA) and Project Seahorse, as part of their partnership on a number of seahorse-focused marine conservation issues. Shedd is a non-profit, public institution which promotes the enjoyment, appreciation and conservation of aquatic life and its environments through education, exhibits and research. Project Seahorse is a global, integrated program of conservation and management initiatives, working to ensure the long term persistence of wild populations of seahorses, their relatives and their habitats. The problems associated with ex-situ maintenance of seahorses have been an important concern of the project from its inception in 1996. Project Seahorse is led by Dr. Amanda Vincent (McGill University, Montreal, Canada) and Dr. Heather Hall (Zoological Society of London, UK) with teams based in Canada, the UK, the Philippines, Vietnam and Hong Kong.

The workshop lasted three days, and was held at the Shedd Aquarium. Financial support for the workshop was provided by the American Zoo and Aquarium Association through its Conservation Endowment Fund/Walt Disney World Company and the Osprey Foundation. The National Aquarium in Baltimore contributed to participants’ travel costs. Dr. Vincent and Dr. Hall, together with Dr. Jeff Boehm, Vice-President of Research & Veterinary Services at the Shedd, acted as workshop organisers, with the active participation of Kristin Lunn. Logistic support was co-ordinated by Cindy Salopek of Shedd’s Conservation Department, and involved many of the aquarium’s staff.

Thirty-five participants from nine countries and 29 organisations attended the workshop, and included:

- Professional aquarists, exhibit co-ordinators, curators and directors of public aquaria;
- Veterinarians and an animal nutritionist;
- Researchers familiar with seahorse husbandry;
- Field conservation workers.

Tim Sullivan, Chair of Conservation Biology at the Brookfield Zoo, Illinois, USA, helped plan and then facilitated the meeting. Two aquarists involved with Shedd’s ‘Seahorse Symphony’ special exhibit, Jeff Mitchell and Kurt Stephenson, acted as rapporteurs.

Format

A welcome reception at the aquarium on the evening of 6 December opened with a presentation by Dr. Vincent introducing the broad themes of the workshop and its focal animals.

Day 1 of the workshop began with a plenary session in which organisers and participants shared their goals for the meeting. Participants were then assigned to one of four facilitated breakout groups to discuss the **problems and options** of seahorse husbandry. Each group explored the same three topics of Diet/Nutrition, Disease and Physical Parameters. Participants were asked to assess (1) Problems and Limitations and (2) Possibilities and Options. Imaginative and unconstrained thinking was encouraged.

Every group chose one rapporteur for each of the three topics (Diet/Nutrition, Disease and Physical Parameters). Rapporteurs were asked to meet with their counterparts from other groups to prepare a synthesis of the day's discussions on their topic. Each synthesis then became the focus of its own one-hour panel discussion on the morning of Day 2. A fourth panel discussion dealt with the problems and options of seahorse acquisition and disposal. In the afternoon of Day 2, participants were re-assigned to breakout groups based on the four panel discussion topics, and asked to identify specific - and perhaps more realistic - **actions and goals** for overcoming identified problems. An evening session on conservation issues, with presentations from three field workers (Galapagos, Philippines, South Africa), generated enough discussion to be continued on the morning of Day 3.

Day 3 was spent entirely in plenary, creating imaginative **protocols** for improved seahorse husbandry, conservation and management, based on the previous day's proposed actions and goals. Protocols were grouped under the following themes, and discussed in turn: (1) Communication, Centralised Programs & Data Collection (2) Research (3) Guidelines & Policy and (4) Education & Training. A presentation on the Captive Breeding Program for Lake Victoria Cichlids by Douglas Warmolts of the Columbus Zoo (USA) indicated the connection between issues bearing on conservation of seahorses and on other aquarium species.

Discussions

Certain key topics aroused particularly marked interest, as outlined below:

Justification for Seahorse Focus

Public aquaria are limited by financial, staff and space resources. Faced with these limitations, participants wanted to be sure that seahorses warranted special attention.

- Are seahorses threatened? Surveys of stakeholders throughout Asia indicate that observed populations have declined 15-50% in the last decade. Such population declines must be addressed, regardless of whether or not extirpations have occurred.
- Are seahorses important? Seahorses are important in ecological, evolutionary, economic, and perhaps medical terms: they play an important role in structuring seagrass communities; their male pregnancy raises interesting issues about the evolution of sex differences; they supply important income for subsistence fishers; they are reputed to cure illnesses. In addition, they are a charismatic fish, able to motivate action on a number of conservation issues affecting thousands of other marine species.

Lack of Knowledge

All participants agreed that the significant lack of information on seahorses was by far the most serious obstacle to their successful management in aquaria, and that collaborative research among aquaria and academic institutions could address these knowledge gaps.

- Seahorse taxonomy, biology, behaviour, ecology, anatomy, histology, physiology, disease, nutritional requirements and metabolism were noted as topics of considerable research interest, to be studied concurrently in both wild and captive populations. The importance of differences among species and life history stages was recognised. The need for research into live food culture was also emphasised.

- Accurate, informative and standardised record keeping was considered crucial for improving the current state of seahorse knowledge. The information gathered from record sheets would need to be universally compatible, with clear guidelines of use and access. Information sharing at all levels was recommended, though there was concern about preliminary data being made too freely available, in case they encouraged misguided efforts at seahorse keeping by inexperienced people.

Acquisition: Source Communities

There was much discussion among participants as to public aquaria's responsibility towards the people who depend on the aquarium trade for their livelihood. It was acknowledged that any solution to the problems of overexploitation must include subsistence fishing communities.

- Fair trade mechanisms were discussed, with suggestions that public aquaria buy only from reputable dealers, lobby for fair trade practices, or eliminate the use of middlemen entirely by helping to establish fishers' co-operatives.
- Participants agreed that they would in principle be willing to pay more for fishes caught sustainably from known sources. They noted that having information on the animal and its collection site (e.g. water temperature and salinity) would benefit husbandry. The uncertain supplies, level of commitment required, complex logistics, and risk of upsetting present trade relationships with importers were identified as the major concerns associated with investing in co-operatives.
- It was noted that the Marine Aquarium Council (MAC)⁴ is developing a certification system for aquarium fish, to ensure trade sustainability. Participants wished to avoid duplicating this effort, but felt that seahorses would prove a key case study for the MAC, particularly as they are not caught with cyanide; focusing on seahorses would thus force awareness of the larger issue of overexploitation.

Disposal: Releases and Re-introductions

Releases are sometimes proposed as a purported conservation measure. The workshop heard that IUCN guidelines strongly discourage casual releases of surplus animals because of risk of disease, genetic mixing, and behavioural disruption of wild populations (along with poor survivorship of released animals). The general consensus was that lack of knowledge on seahorse populations currently prevents serious consideration of re-introductions programs. Even when more information becomes available, participants suggested that re-introductions might only be appropriate for certain species.

Outputs

To guide discussions of seahorse husbandry, management and conservation protocols, participants developed the following visionary goals for ultimate achievement:

- Develop diets that promote health, meet nutritional requirements, address specific needs (e.g. breeding vs. maintaining seahorses) and are as practical as possible.
- Ensure the health of captive seahorses through research, prevention, diagnostics, treatments and exemplary husbandry.
- Identify and understand the physical requirements for seahorse species and design the systems required for these parameters.
- Establish acquisition and disposal guidelines and/or policies in consultation with all stakeholders to ensure long-term survival of wild and captive seahorse populations, without compromising local communities.

Participants made a commitment to (a) invite collegiate institutions to join a communication network and (b) develop and implement agreed plans.

⁴ MAC is a non-profit organization composed of representatives of the aquarium industry, hobbyists, conservation organizations, government agencies and public aquariums, with the goal of ensuring a sustainable future for the marine aquarium industry, organisms and habitat through market incentives that encourage and support sustainable practices.

Proposed actions included:

- constructing a communication network, to include newsletters and mailer lists;
- creating working groups to co-ordinate efforts on specific issues;
- developing complementary and compatible record keeping, research approaches and standards across aquaria as they pertain to the management of seahorses;
- establishing a formulary to describe current disease treatment protocols;
- designing a research agenda by priority, with particular emphasis on diet, nutrition, disease and physical parameters, in both wild and captive seahorse populations;
- agreeing on guidelines on acquisition, disposal of seahorses, quarantine and necropsy procedures;
- launching educational programs (including training for aquarists, veterinarians, hobbyists, individuals involved in the trade, and the general public) on such topics as seahorse biology, taxonomy, pathology, and trade.
- contributing to both ex-situ and in-situ research by securing funding, sponsoring postgraduate students in developing countries, recruiting volunteers, and developing research programs for local seahorse populations.

It was fully recognised that different institutions will have different capacities to contribute to specific initiatives, but that every commitment is meaningful. As aquaria are, however, already involved with co-ordinated conservation programs through the Taxon Advisory Groups (TAGs), these will provide a valuable mechanism for the implementation of a number of these initiatives. Seahorse TAG groups already exist in North America (part of the AZA Marine Fish TAG) and Britain and Ireland (part of the Fish and Aquatic Invertebrate TAG), the latter soon to be expanded to a European level. Project Seahorse and the John G. Shedd Aquarium will continue to promote co-ordinated seahorse conservation activities among public aquaria through the work of an Aquarium Research Co-ordinator, to be appointed in June. This person's primary responsibility will be to advance the recommendations of this workshop for improved seahorse husbandry, management and conservation.

Significance

This workshop appears to be the first example of a global, integrated approach to conservation action by the world's aquaria on behalf of a group of threatened marine bony fishes; its nearest equivalents would be joint plans for sharks and cichlids. Public aquaria acknowledged their direct connection to (and shared responsibility for) wild populations of seahorses in particular, and marine conservation in general. Participants developed a long-term program for resolving the technical problems associated with seahorse husbandry, and recognised that this collaborative approach can also serve as a model for similar endeavours on behalf of other marine wildlife.

This workshop was the third in a series organised by Project Seahorse, each addressing issues of seahorse conservation and management. A national, multi-sectoral workshop on the state of the Philippines seahorse populations launched the series in May 1998, and initiated a national action plan for fishery management. It was followed in July 1998 by an international meeting on the management and culture of marine species, such as seahorses, used in traditional medicines. A workshop on the biology of seahorses and their relatives (family Syngnathidae) is anticipated in late 1999. The outputs from each workshop will inform an international conservation action plan for seahorses, while helping to resolve many other related marine conservation issues as well.

– Summary Report written in January 1999

Seahorse Aquaculture

a position statement from Project Seahorse

Seahorse aquaculture has the potential to help reduce pressure on wild seahorse populations while providing alternative livelihoods for seahorse fishers. Yet seahorse culturing can also be highly problematic in conservation terms, with costs to wild seahorses that far exceed the benefits. Aquaculture proposals must be thoroughly examined and the issues addressed with good science before any work begins.

Demand for seahorses is so high that it will be virtually impossible to flood the market with cultured seahorses, especially given the general preference for wild-caught animals in the medicine trades. Moreover, seahorse fishers are commonly so poor that they cannot stop catching seahorses unless they earn money in other ways. Thus, seahorse aquaculture that does not involve seahorse fishers is unlikely to have many conservation benefits.

Indeed, seahorse aquaculture has the potential to be very costly to wild populations. Technical difficulties in rearing seahorses mean that none of the many attempts at seahorse culturing - including those in Australia, China, Indonesia, New Zealand, Philippines, South Africa, Thailand and Vietnam - has yet proven biologically and economically successful. Most cultures (a) rely heavily on repeated removal of wild seahorses to replenish the captive population, and/or (b) need wild-caught food to supplement cultured foods, and/or (c) release waste, chemicals and treated water into the surrounding area, often occupied by wild seahorses. Economic viability is usually limited by low yields: most - perhaps all - of China's seahorse farms closed in the aftermath of economic reforms in the 1980s, unable to make sufficient profit despite their years of culturing experience.

Farming seahorses has proven technically challenging because of problems with diet and disease. Seahorses are strict predators that will essentially only eat live, moving prey. This means that the seahorse farmer must culture algae to feed the zooplankton to feed the seahorses. Moreover, cultures must be adapted to meet different food needs as the seahorse grows. In addition, scrupulous hygiene is required to prevent these fishes from succumbing to a wide array of parasitic, fungal and bacterial ailments.

Any claims of successful seahorse culturing need to be examined carefully, to ensure that the life cycle has been closed repeatedly and reliably: to be called successful, captive-bred seahorses must themselves have produced normal-sized broods of healthy young for several generations. To date, the term "seahorse culturing" has most commonly referred only to wild-caught pregnant males giving birth in captivity or to seahorses mating in captivity, with subsequent births. Both are relatively easy. The difficulty comes in rearing large portions of the young to maturity, which usually takes many months to a year. Moreover, seahorses born in captivity themselves generally produce few and small young that fail to flourish. To serve conservation goals, findings on seahorse culturing should be published in international refereed journals, where they are subject to peer scrutiny.

Seahorse culturing on any large scale (more than a few seahorses) should not proceed until quantitative evidence shows that :

1. the reproductive biology of the particular species has been thoroughly investigated;
2. the source populations are sufficiently well-understood that the initial broodstock can be removed without damaging them;
3. the culturing operation will not be dependent on repeated removal of wild broodstock;
4. the life cycle has been closed (i.e. breeding adult to juvenile to breeding adult) repeatedly and reliably;
5. the operation can rear high percentages of young to market size and maturity;

6. the captive-bred animals are as viable as the wild-bred animals (e.g. number, size and quality);
7. any capture of wild food for the seahorses is sustainable;
8. discharges from the facility (e.g. waste, chemicals, heated water) will not be detrimental to the local environment (including wild seahorse populations);
9. the captive-bred seahorses will not escape to cause disease and genetic problems in local populations;
10. the culturing operation will not promote new trade - or increase existing trade - in wild seahorses, either locally or globally.
11. the international impact of this culturing on subsistence fishers has been addressed.
12. the cultured seahorses will be acceptable in trade.

The success of seahorse culturing in achieving conservation goals will partly depend on its effects on subsistence fishing communities in developing countries. The United Nations Convention on Biological Diversity includes three elements: conservation of biodiversity, sustainable use of its components (biological resources), and fair and equal sharing of the benefits (between North and South). Raising seahorses in developed countries will affect fishers in developing countries, which will in turn affect their use of seahorses and other marine resources. One outcome of seahorse culturing in developed countries might be reduced prices for seahorses in developing countries, which would either (a) force fishers to catch more seahorses in order to meet their economic needs or (b) move them from one diminished resource to another, creating new conservation problems.

Lax or thoughtless attempts at seahorse culturing could further endanger the world's seahorses, while potentially penalising the fishers who have come to depend on seahorses in the face of collapsing marine resources. Aquaculture expertise should be used to resolve problems with small-scale and low-technology culturing in developing countries, such that seahorse fishers can become seahorse farmers, thereby reducing pressure on wild seahorse populations. Large-scale industrialised seahorse culturing in other countries should not be attempted or approved until clear evidence is provided that biological, economic and conservation concerns have been addressed.

Releasing Captive Seahorses: a position statement from Project Seahorse

Releasing animals to the wild commonly creates more conservation costs than benefits. The Re-introduction Specialist Group (RSG) of the World Conservation Union (IUCN) strongly discourages casual releases. Yet the prospect of release is often used as justification for holding animals in captive populations, a public relations gesture to attract support for an enterprise, or a hook to obtain permission for ventures that may be costly in conservation terms. The RSG is also quite explicit that releases must never be used as a way of disposing of surplus animals. Yet many individuals and institutions treat releases as a viable means of disposing of unwanted or surplus stock.

Releasing animals where wild populations still exist (even if these are small) is termed **supplementation** and not re-introduction. Such releases can threaten wild populations. The captive-reared animals may bring disease and/or disrupt the genetic and behavioural patterns of existing populations in the wild. The first of these is most immediately serious, with widespread recognition that epidemics often result from release of captive individuals. The other factors may act synergistically to weaken further an already vulnerable wild population, perhaps compromising its viability. Ironically, the newly released animals may themselves not thrive in the short term or survive in the long term. The same concerns arise when wild animals are moved from one site to another site (**translocation**) where conditions may be rather different. Seahorses are often mentioned as candidates for supplementation, but such approaches must be very critically assessed.

Releasing animals where there has never been a population constitutes the **introduction** of an exotic species and carries the risk of greatly disturbing local biota, often without producing a viable population of the target species in the release area. Seahorses should never be released outside the normal geographic range of the species concerned.

Releasing animals where the local population has been extirpated (gone extinct locally) is **re-introduction**. The RSG notes that well-organised formal re-introductions (with associated preparatory and follow-up activities) are always very lengthy, complex and expensive processes; they should not be attempted without committing long-term financial and political support. No seahorse populations are currently known to have been extirpated but many are declining rapidly and the need to consider re-introductions may well arise in the future.

The RSG states that releases must NOT occur simply because captive stocks exist, and should only be considered if preconditions have been met, including the following:

- the species is extinct or extirpated in the wild;
- the species is being re-introduced into its former range and in suitable habitat;
- the factors that led to the species extinction have been removed;
- re-introduction is part of a recognised multidisciplinary long-term international management plan;
- detailed biological and socio-economic studies have been conducted;
- and local people understand and support the release.

Project Seahorse supports the clear guidelines of the RSG and will exercise great caution in releasing any captive-bred or captive-reared animals. We also strongly discourage other individuals and organisations from premature or casual releases, whether to supplement existing wild populations or to re-establish extirpated populations. If conservation is the goal, it will usually be preferable to maintain a species in the wild than to bring animals into captivity for rearing and release. Breeding programs and aquaculture ventures should manage their populations carefully, and should avoid releasing surplus animals. *The full IUCN RSG guidelines on releases are available at:*
<http://www.iucn.org/themes/ssc/pubs/policy/reint-english.htm>

Marine Medicinals Questionnaire

Allison Perry, a researcher with Project Seahorse, is compiling a global directory of the use of marine species in traditional medicine. Because an analysis such as this has not previously been attempted, it is essential that information be gathered from as broad a base as possible. Obtaining any information that people can provide, based on their own knowledge and experience, is central to the success of this project. If you have any knowledge of the use of marine medicinals in your area, or elsewhere, we would be very grateful to receive a completed questionnaire from you. As well, please feel free to photocopy this questionnaire and distribute copies to any of your interested contacts.

According to the World Health Organisation, an estimated eighty percent of people use traditional medicines, for either economic or cultural reasons. While traditional healing practices are highly varied, many involve the use of plant and/or animal species for medicinal purposes. Overexploitation of species for traditional medicines may pose a threat to their survival.

While the case of large, terrestrial mammals threatened by trade for traditional medicine, especially traditional Chinese medicine, is well-known, the use of marine species has not been equally studied; accounts tend to outline uses by only one culture, and even then are not necessarily complete. Moreover, present-day uses often involve species which were not historically part of traditional *materia medica*; the use of technologies such as deep sea trawling has presented traditional medicine with marine resources which were previously unattainable or unknown. Likewise, people are turning to alternative species as the availability of those which have been over-exploited declines.

Marine medicinals represent a potentially enormous and economically important activity with serious implications for conservation. An analysis of the use of seahorses and pipefish for traditional Chinese medicine revealed an extensive international market, rising demand, and declining seahorse populations. Similarly misjudged overconsumption may threaten other marine species. Unfortunately, as the extent and range of marine medicinal use has not been determined, the conservation status of marine species cannot be properly assessed, and thus management strategies cannot be undertaken.

As a Project Seahorse team member, I am conducting a study of the global use of marine species for traditional medicines and tonic foods. The main focus is to determine the taxonomic distribution of use. However, information is being collected on all of the following variables: (i) which species are used and by whom, (ii) history of use, (iii) which parts are used in what quantities, (iv) which conditions and/or illnesses are treated with marine medicinals, (v) rationale for use (i.e. therapeutic value, folklore, etc.), (vi) within-species preferences (i.e. colour, size, gender, stage of development, etc.), and (vii) sources of supply. In addition, I am gathering information regarding the basic biological characteristics of species which are used, such as population range, habitat requirements, and reproduction. Any additional anecdotal information regarding such factors as market value, harvesting techniques, and trade dynamics is also valuable; these may prove useful for future investigations.

Ideally, this study will allow for the prediction of trends within the marine medicinal market, with respect to future demand, and those potential sources of supply which are likely to be exploited. This information could eventually be used to help determine the need for marine conservation initiatives for species used for traditional medicine.

INFORMATION ON TRADITIONAL MEDICINE AND TONIC FOOD SOURCES FROM SEAS AND OCEANS

Please fill in any information possible, even if it is only the name of a species used.

NAME: _____ DATE: _____

CONTACT ADDRESS: _____

1. TYPE OF ORGANISM: [e.g. algae / plant / mammal / fish / bird / reptile / crustacean / mollusk / other invertebrate / other (please specify)] _____

2. SPECIES: local name (if known) _____ scientific name (if known) _____
Western name (if known) _____

Any photographs or drawings would be very appreciated.

3. GEOGRAPHICAL REGION OF USE: Name the area as specifically as you can (e.g. country, province or region, etc.) _____

4. TYPICAL USE: What conditions or illness is it typically used to treat? _____

Are these conditions or illnesses acute or chronic? _____

5. HISTORY OF USE: For how many years has this method of treatment been practiced? (e.g. within the past 10 years, within the past 10-100 years, longer than 100 years, etc.) _____

6. FREQUENCY OF USE: How often would the average individual use this treatment (e.g. how many times per day, per week, or per year) _____

7. PREPARATION OF TREATMENT: How is the treatment prepared? (e.g. dried, ground, etc.) _____

Is the whole organism used, or only part? (be as specific as possible) _____

What quantity is needed for one treatment? (e.g. #, mass, length) _____

8. RATIONALE FOR USE: Why is this treatment used? (e.g. therapeutic value, folkloric belief) _____

9. SOURCE OF SUPPLY: Where is the organism caught, purchased, or traded? [e.g. locally, other (please specify)] _____

10. NATURAL HABITAT: Where does the organism live in the wild? (e.g. open ocean, rocky bottom, sandy bottom, coral reef, etc.) _____

11. HARVEST: How is the organism captured or harvested? _____

At what time of year is the organism caught or harvested? _____

12. SPECIES REPRODUCTION: At what time(s) of year does the organism reproduce? _____

13. PREFERRED CHARACTERISTICS: Are there any preferences with respect to stage of development, sex, colour, size, etc.? (Please be as specific as possible) _____

14. ADDITIONAL INFORMATION

I would be very grateful for any other information regarding the use of marine species for traditional medicines or tonic foods.

THANK YOU FOR YOUR TIME AND SHARING THIS VALUABLE INFORMATION

Please return questionnaire and any other information to:
Allison Perry, c/o Dr. Amanda Vincent, Department of Biology, McGill University,
1205 Ave. Dr. Penfield, Montréal H3A 1B1, Québec, Canada
Tel: 1 (514) 398 5112 Fax: 1 (514) 398 5069
E-mail: projectseahorse@hotmail.com

List of Acronyms
Workshop Secretariat and Staff
Acknowledgements



List of Acronyms

Acronym	Full Name
AKOM	Association for Korean Oriental Medicine
AZA	American Zoo and Aquarium Association
BFAR	Bureau of Fisheries and Aquatic Resources (Philippines)
CITES	Convention on the International Trade in Endangered Species of Wild Fauna and Flora
CMFRI	Central Marine Fisheries Research Institute (India)
EYS	Eu Yan Sang
FAO	Food and Agriculture Organisation of the United Nations
ICLARM	International Center for Living Aquatic Resources Management
IEC	Information, Education and Communication campaign
IPR	Intellectual Property Rights
IUCN	World Conservation Union
KORDI	Korean Ocean Research and Development Institute
LGU(s)	Local Government Unit(s) (Philippines)
MAC	Marine Aquarium Council
MAFC	Marine Aquarium Fish Council (now known as MAC)
MPA(s)	Marine Protected Area(s)
NGO(s)	Non-Governmental Organisation(s)
NIWA	National Institute of Water and Atmospheric Research (New Zealand)
PP	Philippine Peso
RMI	Malaysian dollar (Ringgit)
SEAFDEC/ AQD	South East Asian Fisheries Development Center/ Aquaculture Department
TAG(s)	Taxon Advisory Group(s)
TCM	Traditional Chinese Medicine
TM(s)	Traditional Medicine(s)
TRAFFIC	Trade Records Analysis of Flora and Fauna in Commerce
US-AID	United States Agency for International Development
WHO	World Health Organisation
WPA	Wildlife Protection Act (Australia)
WWF	World Wide Fund for Nature (or World Wildlife Fund)

Workshop Secretariat and Staff

Project Seahorse

Many members of Project Seahorse were involved in the organisation of the Marine Medicinals Workshop:

Person	Role	Description
Dr. Amanda Vincent (Canada)	Workshop Organiser	All aspects of the workshop design and implementation
Dr. Heather Hall (UK)	Workshop Organiser	All aspects of the workshop design and implementation
Marie-Annick Moreau (Canada)	Workshop Co-ordinator	Co-ordinated all logistics
Marivic Pajaro (Philippines)	In-country Co-ordinator (Leader of Project Seahorse Philippines Team)	Pre- and post-workshop arrangements in the Philippines, and workshop design
Rosemarie Apurado (Philippines)	Assistant to Workshop Co-ordinator (Community Organiser)	Full logistic support in the Philippines
Jonathan Anticamara (Philippines)	Workshop Secretariat (Biologist)	Logistic support in Cebu and helped organise and run field trip to Handumon
Isidore Ancog (Philippines)	Workshop Secretariat (Community Organiser)	Logistic support in Cebu and helped organise and run field trip to Handumon
Flordeliza Alcaria (Philippines)	Workshop Secretariat (Community Organiser)	Logistic support in Cebu and helped organise and run field trip to Handumon
Paulette Apurado (Philippines)	Workshop Secretariat	Logistic support in Cebu
Nick Graham (UK)	Workshop Secretariat (Volunteer in Philippines)	In charge of audio-visual equipment at workshop, and helped to run the field trip to Handumon
Allison Perry (Canada)	Workshop Preparations (Research Assistant)	Involved in pre- and on-site workshop preparations
Elinor Low (UK)	Workshop Preparations (Volunteer in Canada)	Involved in pre-workshop preparations
Kristin Lunn (Canada)	Workshop Preparations (Research Assistant)	Involved in pre-workshop preparations

Workshop Staff

The dedicated staff of the workshop played a large part in its success:

Person	Role
Rosalinda Paredes (Philippines)	Workshop Facilitator
Virginia Cruz (Philippines)	Workshop Rapporteur (Haribon Foundation)
Daniel Macanaya Ocampo (Philippines)	Workshop Rapporteur (Haribon Foundation)
Josephine Co (Philippines)	Interpreter (Mandarin)
Yeon-Hee Park (Korea, studying in Philippines)	Interpreter (Korean)
Gabriel Silalahi (Indonesia, studying in Philippines)	Interpreter (Indonesian)
Chulamaas Suwanabool (Thailand, studying in Philippines)	Interpreter (Thai)
Michael Wong (Philippines)	Interpreter (Cantonese)

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We are indebted to many people world-wide for their help in preparing this meeting. We apologise to anyone we may have omitted here, and remain grateful for your assistance.

At the Workshop

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Workshop Proceedings

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