



## TRAVEL NOTES

The Chinese Fisheries mission arrived in Ottawa on October 2, 1986 and left Vancouver for Shanghai on October 21, 1986. The mission leader was Mr. Qian Zhilin, Deputy Director, Bureau of Aquatic Products, Ministry of Agriculture, Animal Husbandry and Fisheries (MAAF) of the People's Republic of China in Beijing, and the two other members were Mr. Chen Jiabin, Deputy Director of the Yellow Sea Fisheries Research Institute (YSFRI) in Quindao and Mr. Yu Hongwei, Interpreter and Aquaculturist on the same institute. The Bureau of Aquatic Products (BAP) is a large organization with more than 10,000 scientific staff. In addition to 15 administrative division, the BAP includes seven fisheries colleges, societies and corporations including the Chinese Academy of Fisheries Sciences which consists of 11 specialized institutes including the YSFRI located at Quindao.

Mr. He Zegao, First Secretary and Science Advisor at the Chinese Embassy in Ottawa, travelled with the mission at his own expenses. The Chinese delegation visited 5 provinces, 10 major cities and 20 universities and research institutions, and a few private enterprises including a mussle farm in Nova Scotia, a salmon farm and a fish food mill in British Columbia. The mission met approximately 100 Canadian scientists and several Chinese students and Chinese visiting scientists who came to Canada under various programs.

At each institution visited, there was normally a general meeting with people working in fisheries research or marine science. Since information about the proposed mariculture project had been sent in advance to each institution, the mission was asked to make only a brief presentation of China fisheries. The people in attendance would then brief the mission about their research activities pertaining to the specific interest of the delegation. The purpose of the

mission was for the Chinese members to establish contacts and to get acquainted with the Canadian institutions and scientists with whom they could cooperate for joint research or for exchange and training of staff. The meeting was usually followed by a visit of the research facilities and further discussions were held with the people who showed particular interest in collaborating with the Chinese. About half a day was spent at each institution, and a few field trips were organized when time permitted. Most of the institutions visited hosted a lunch for the visitors and the Chinese took this opportunity to thank their host for the cordial reception and invited them to visit China. The mission members distributed packages of Chinese tea and gave Chinese pins to most people that they met.

In general, the mission members were very impressed with what they saw and with the warm reception they have received everywhere they went. The last reception on the eve of their departure was given by the President of Simon Fraser University who is a sinologist who could speak to them in their own language. The next day at the airport, CP Air upgraded their ticket to first class for their return trip to Shanghai. The weather was good throughout the trip from coast to coast and the Chinese had the opportunity to see the best fall sceneries of the country. They were thrilled by Canada and its people.

### Ottawa

The film "Choices" and the IDRC "Briefing" film which are available in Mandarin were shown to the Chinese delegation. A meeting was also organized with Gerry Bourrier, Neil McKee and Michael Graham to discuss the training and communication components of the project. The mission was informed that Pedro Flores and Michael Graham would most likely make a visit to China in early 1987 to discuss the proposal.

A visit was made to the headquarters of the Fisheries Research Branch of the Department of Fisheries and Oceans. During a meeting chaired by Dr. Ian Pritchard, the mission was briefed on Canadian fisheries and the Canadian Hydrographic Service. Several publications on Canadian fisheries statistics and the Canadian Hydrographic Service including a map of all fisheries research stations in Canada were given to the mission. Unfortunately, it was not possible for Dr. L.S. Parsons, Assistant Deputy Minister, to meet the group because of other commitments. However, Dr. Richard Beamish, Director of the Pacific Biological Station at Nanaimo, B.C., attended the meeting and briefed the mission on the activities of DFO on the west coast. He is organizing a symposium on fisheries in the north Pacific that will be held in Canada in 1987 and he asked Mr. Qian to provide names of four participants from China to be invited to the symposium. Mr. Qian promised to send the names of competent fisheries experts to attend the symposium. The intention in the long-term is to set up an international fisheries research organization for the north Pacific with membership from Canada, the United States, Japan, Russia and China.

### Halifax

The first meeting at Dalhousie University was with Dr. Roger Doyle of the Department of Biology. Dr. Doyle, who has a long experience in working in developing countries and with IDRC, made an excellent briefing of the two programs on bivalve culture and fish genetics respectively which are supported by IDRC and other donors. He explained the objectives of the fish genetics program and of the aquaculture genetics network supported by IDRC with projects in Indonesia, Philippines, China and India. He explained the difference between the cooperative and regular programs of IDRC which was very useful to the mission members. He explained the training component of the Asian project and the time he spent in the field advising the project staff.

Mr. Chen asked Dr. Doyle if he would take a student to do research on the genetics of prawn (Penaeus orientalis), particularly with regard to studying the sex change of large prawns. Dr. Doyle explained that they were applying advanced traditional techniques at Dalhousie for breeding fish and that they were not equipped to do research on prawns. However, Dr. Doyle has some experience in working with shrimps in Thailand, and he said that a trainee could take some courses on genetics at Dalhousie and could go to another institution for practical research on prawns. For training on prawns, the Chinese candidate would have to go to Texas University or Hawaii in the United States, Japan, Philippines, or Thailand where research work on genetic improvement is being done.

A special meeting with Dr. Doyle was arranged in the evening to discuss further possible future collaboration between Dalhousie and YSFRI. Dr. Doyle envisaged the possibility of collaborating with a third institution, Shanghai Fisheries University, which is already participating in the freshwater aquaculture genetics network. Dr. Doyle feels that someone from Dalhousie will have to visit the YSFRI in Quindao to identify people who could become good research colleagues. Doyle or Newkirk are planning to travel to Shanghai in April/May 1987, and a visit to Quindao could be made at that time. Doyle is confident that Dalhousie could assist YSFRI in building the stock improvement for aquaculture. If a visit is made in April 1987, a Chinese trainee could come to Dalhousie in July with a specific research topic.

During the visit to the Sandy Cove Research Station of the Atlantic Research Laboratory (ARL), Dr. Gary Newkirk briefed the mission members on his research work on oysters and about his participation in the IDRC-sponsored projects in Jamaica and Asia. At the station, Dr. Catherine Enright of ARL explained the work she did on oysters (Ostrea idulis) and Mr. Peter Shacklock, the station

technician briefed the group on the research being carried on Irish moss (Chondrus crispus). Mr. Chen took samples of various seaweeds to bring back to China for cultivation, but they were all dead by the time we reached Vancouver.

At the ARL of NRC, Dr. Foxall, Director, informed the delegation about the long history of collaboration that his institute had with Chinese institutions. Dr. K.C. Tseng, Director of the Institute of Oceanology, Academia Sinica of Quindao spent a year at ARL in Halifax several years ago and several other visiting scientists have come later. Dr. Foxall is particularly interested in problems of water quality in aquaculture and he would like to develop collaborative research in molecular biology where he feels both sides are equally ignorant. He is planning to visit China in 1987 and he hopes to develop other cooperative projects in China during this visit.

Dr. Van der Meer, a seaweed geneticist at ARL briefed the group on the research programs being carried out in marine bioscience. This includes the taxonomy, genetics, tissue and cell culture, plant physiology, molecular genetics, bioactives, cytology and electron microscopy. A tour of the research laboratories was made and the group was briefed on the research being carried out in each of the fields mentioned above. The Chinese delegation were impressed by the sophisticated equipment, and particularly by the scanning electron microscope and the mass spectrometer. They expressed an interest in sending trainees to learn to operate scientific equipment.

Dr. R.G.S. Bidwell, Executive Director of the Atlantic Institute of Biotechnology briefed the group on the activities of his institute which is mainly carrying out research contracts for the industries of the Atlantic provinces. The institute has the equipment to do rapid analysis of growth rate of seaweeds and Dr. Bidwell would be happy to collaborate to select species or optimum conditions for growth

of seaweeds. It is a small organization with about 12 employees and an annual budget of about \$1 million.

Dr. Doyle made arrangements for the delegation to meet with Dr. Anthony Charles of the Department of Finance and Management Sciences of Saint. Mary's University. Dr. Charles is giving a course at Dalhousie on fisheries economics and he has a graduate Chinese student doing some work in fisheries economics. He indicated his interest in a cooperative project in the field of fisheries economics in China. Dr. Charles showed me copies of letters he exchanged with Chris MacCormac with regard to possible future cooperation in fisheries projects in southeast Asia.

A full day was spent with the research staff of the Fisheries Research Branch of the Department of Fisheries and Oceans of the Scotia-Fundy Region in Halifax. In the morning, Dr. David Scarratt, Division Coordinator for Fisheries and Environmental Sciences chaired a meeting which was attended by 10 research scientists. The research scientists briefed the delegation on their research projects pertaining to fish and invertebrate nutrition research, fish and shellfish virology, fish immunology, crustacean and fish disease research, fish health diagnostic, fish culture research and salmon genetics research program. A written summary of research projects and activities of the Fisheries Research Branch in the Scotia-Fundy Region was given to the delegation, and a tour was made of the research facilities. After lunch, a visit was made to the mussel farm of Mr. Paul Budreski which is located at Ship Harbour about 50 miles north of Halifax. It is a large farm of about 1 km<sup>2</sup> where mussels are cultivated in collectors attached to ropes and suspended strategically from buoys in seawater. A description of this growing industry in Nova Scotia is given in a reprint of Atlantic Business entitled "Farming The Seas". It is one of the largest mussel farm in Nova Scotia and the Chinese delegation were extremely pleased with this visit.

On the advice of Dr. Gary Vernon, President of the International Centre for Ocean Development (ICOD), a brief visit was made to the headquarters of ICOD in Halifax. The group was welcomed by Mr. Garry Comber, Secretary-Treasurer who briefed the delegation on the mandate of ICOD. Mr. Jeff Watson, Director, Information Division, explained the activities of his division. Mr. Laurence Edelstein, Program Officer, explained the program activities of the technical assistance division and Dr. Carol Amaratunga and Ms. Carol Stanish described the training and scholarship programs of the training division. Mr. Qian will send some information to ICOD on China fisheries and he hopes that his bureau will exchange information with ICOD on a regular basis in the future. ICOD does not plan to support specific projects in the YSFRI in the near future.

The delegation paid a visit to the Canadian Institute of Fisheries Technology (CIFT) of the Technical University of Nova Scotia where discussions were held with Drs. John Merritt, Richard Ablett and Tom Gill. Professor Merritt explained the research work done with the support of IDRC in the fish deboner cooperative project with Thailand. He expressed great interest in collaborating with YSFRI in the field of fish processing. A tour was made of the research laboratories and some brochures and reports explaining the activities of CIFT in aquaculture technology, fish process engineering, marine oil, process technology, and protein and fish post-mortem biochemistry, were given to the delegation. The institute lives mainly on contract research with industries and it is unlikely that YSFRI will make use of their services.

The delegation was given the opportunity to visit the Trace Analysis Research Centre of Dalhousie University which has a Slowpoke Reactor in operation since July 1976. The SLOWPOKE (an acronym standing for Safe Low Power Critical Experiment) is a low-cost, pool-type nuclear research reactor using enriched <sup>235</sup>-Uranium fuel with a light-water moderator and beryllium reflector. The

Slowpoke Reactor is used for research and teaching purposes. Its research applications center mainly around Neutron Activation Analysis and radioisotope production. A report is available for anyone interested in this research facility.

References:

- 1) Summary of Projects and Activities for Discussion with Visiting Chinese Scientists, Fisheries Research Branch, Department of Fisheries and Oceans, Scotia-Fundy Region, October 8, 1986, 20 pages.
- 2) Annual Report 1984-85, Canadian Institute of Fisheries Technology, Technical University of Nova Scotia, Halifax.
- 3) Annual Report 1984/86, Trace Analysis Research Centre, Dalhousie University, Slowpoke Reactor.
- 4) The Oceans: New Opportunities and Responsibilities, brochure by the International Centre for Ocean Development, Halifax.
- 5) World Fisheries, World Map prepared by ICOD showing for each country a total volume of catch in metric tonnes, value of import and export, percent of population employed in fishing and per capita supply of fish in kg-year.
- 6) Farming The Seas. Article published in the Atlantic Business on the mussel farm of Paul Budreski.
- 7) Papers on mussel culture prepared by the Department of Fisheries and Oceans, Halifax.

St. John's, Newfoundland

We visited the Marine Science Research Laboratory of Memorial University which is located near the sea at Logy Bay. The laboratory provides facilities to encourage faculty staff at Memorial University to carry out basic research on aquatic organisms. There is a permanent staff of seven research scientists supported by a number of research assistants and technical personnel. The visit started with a tour of the facilities which includes a seawater system, heated seawater and freshwater systems, and a fair amount of analytical equipment including a mass spectrometer, atomic absorption analyzers, and spectro-photometers. It was followed by a general meeting where research scientists briefed the delegation on their research projects.

Several staff members are engaged in research on hormones which regulate growth, sexual maturation, spawning and salt balance in fish. Other field of interest include the role of antifreeze proteins in protecting fish against low temperatures, the control of growth in kelp (seaweed), the physiological ecology of marine invertebrates, and the aquaculture of salmonids and bivalves. Some research is done on contracts with government agencies. Research is also being carried out by faculty staff possessing joint appointments with the Marine Sciences Research Laboratory and by faculty in other departments. Dr. Larry Crim explained his research being carried out in the IDRC-supported cooperative on fish gametes for the milk fish project in the Philippines. A Chilean trainee Universidad Austral in Valdivia is doing a Ph.D. degree with Dr. Ray Ferguson with support from FAD.

Dr. David Idler, the Director of the Laboratory is President of the organizing committee for the Third International Symposium on Reproductive Physiology of Fish which will be held in St. John's in August 1987. He asked if IDRC could provide support for fisheries research scientists from developing countries to attend the symposium. He gave me some application forms which I will send to the fisheries program staff. The speakers on the program include Nancy Sherwood, Laurence Crim and Clarissa L. Marte from the Philippines who are involved in IDRC-supported projects.

In the afternoon, we visited the Newfoundland and Labrador Institute of Fisheries and Marine Technology which was previously known as the College of Fisheries. It is a technical training institution offering three-year diploma programs and a two-year certificate programs in mechanical engineering technology, fisheries technology, food technology, naval architecture and ship building, and nautical science. There is no research being carried at present, but the intention is to provide a course in aquaculture.

The delegation also had the opportunity to visit the NRC Institute for Marine Dynamics. It is a huge facility used by NRC to conduct research related to the design of ships and off-shore structures needed for operations in Canada's frozen arctic seas and in open water worldwide. It contains an ice tank measuring 90 m in length by 12 m wide, a seakeeping tank measuring 75 m by 32 m, a towing tank measuring 200 m by 12 m, and a wave generator. There is no such facility in China, and Mr. Qian thought that collaboration could possibly be established with Chinese marine experts to make use of this impressive research institute for marine dynamics.

#### References:

- 1) Visitors' Guide, Marine Research Laboratory, Memorial University of Newfoundland, St. John's, Newfoundland.
- 2) Activities at the Marine Science Research Laboratory for the Period September 1984 to September 1986.
- 3) Scientific Accomplishments at the Marine Science Laboratory, September 1984 to August 1985.
- 4) Experience the Marine Institute, brochure explaining the technical programs of the Newfoundland and Labrador Institute of Fisheries and Marine Technology.
- 5) Brochure on the Institute for Marine Dynamics, National Research Council, Canada.
- 6) Facilities and Programs, Institute for Marine Dynamics, National Research Council.

#### Guelph

The morning was spent in the Department of Nutritional Science of the University of Guelph with Dr. John W. Hilton who explained his work in fish nutrition research. The various topics covered included nutrient requirements studies, least-cost diet formulation, feed processing, alternative fish studies, brood-stock nutrition, post-larval fish feeding and nutrition, and nutrition environmental toxicant studies. Following this general introduction, four graduate students made presentations on their research topics. At present, all

the research is done in the laboratory, but next year the department will have access to a trout farm located at the Alma Research Station which is about 35 miles from Guelph. Dr. Hilton is apparently a world leader in fish nutrition research.

The afternoon was spent in the Department of Pathology with Dr. Hugh Ferguson and Dr. Brad Hicks who are involved in fish disease research. The Fish Pathology Laboratory is part of the Department of Pathology of the Ontario Veterinary College, University of Guelph. Aquaculture, environmental health, disease of tropical and aquarial fish, nutrition and toxicology are major areas of studies. The laboratory performs contract research for various universities, governmental and industrial agencies requiring specific pathological services. Dr. Ferguson will receive financial support from the Ontario government to build a fish pathology laboratory at the Alma Research Station. Dr. Ferguson expressed an interest in collaborating with YSFRI in fish disease and in training of Chinese students in his laboratory. It is a small unit which cannot take more than three or four graduate students per year. The degrees offered include the M.Sc. which takes a minimum of two years, the Ph.D. which requires two to three years more, and the doctorate in Veterinary Science (DVSC) which is a more flexible program that requires three years of study.

Dr. Ferguson feels that it would be necessary for a Chinese scholar to spend two to three months at Guelph to understand the system in order to supervise the research work of the trainees later in China. This supervisor would select the student for the type of environment that they would face at Guelph. The major courses in fish disease are given between January and May of each year for non-veterinarians with no veterinary background. Dr. Ferguson individual training programs to suit the particular type of training that is required at

YSFRI. Mr. Chen said that he had a person in mind to train in fish disease who has a B.Sc. from the Quindao College of Oceanography.

Reference:

Introducing FBL: Fish Specialists in the Fish Pathology Laboratory, Ontario Veterinary College, University of Guelph.

Edmonton

The first meeting at the University of Alberta was with Dr. Fu-Shiang Chia, Professor of Zoology and Dean of the Faculty of Graduate Studies and Research. Dr. Chia was born in China and he is familiar with the Fisheries Research Institutes at Quindao. He made a trip to China a few months ago where he met the staff of several research institutes and selected a student that has now come to U of A for a Ph.D. degree on invertebrates which is the field of study of Dr. Chia. He feels that a cooperative research project could be carried out at the Bamfield Research Station on the Vancouver Island which is operated by five western universities (UBC, Victoria, Simon Fraser, Alberta and Calgary). The former director, Dr. Ron Foreman, took another position at the Arts Science and Technology Centre in Vancouver, and the acting director is now Professor John McInerney, Chairman of the Department of Biology at the University of Victoria. Dr. Chia told the delegation that China had much practical know-how in aquaculture, but that they needed top scientists, not technologists, to carry out basic research to solve complex problems that they will face in polyculture systems.

The next meeting was a briefing session with the staff of the Department of Zoology and of the Department of Microbiology that were interested in collaborative research contacts with the YSFRI. I explained the background of the proposed mariculture project and each staff member briefed the delegation on

their specific research interest. The meeting was attended by Chinese graduate students including one person from the induced spawning project with Zhongshan University in Guangzhou and Dr. Vandercrack, a post-doctoral fellow who spent a few weeks with Dr. Lin in Guangzhou.

The lunch at the Faculty Club was hosted by Dr. Brian Evans, Associate Vice-President for International Affairs who spent some time as counsellor in the Canadian Embassy in Beijing. In the afternoon, further discussions were held with the academic staff of the Department of Zoology and of the Department of Microbiology with visits of their research laboratories. The following professors described their field of interest:

Dr. D. Westlake: environment microbiology (aerosols, sewage; aquatic and terrestrial), industrial microbiology;

Dr. Tats Yamamoto: infectuous pancreatic necrosis of salmonids and skin tumors of fishes.

Research projects involve cell culture, virus purification, biophysical characterization of viruses including electron microscopy; the preparation of specific viral antiserum and their application to rapid diagnostic test; immunoelectron microscopy of virus infection.

Dr. Yamamoto informed me that he had been involved in the IDRC-supported project on wildlife disease in Kenya. He is planning to spend one year at the Hatfield Marine Science Centre at Oregon State University to study diseases of salmon.

Dr. Richard E. Peter: neuroendocrine regulation of reproductive activity, growth hormone secretion, and secretion of other pituitary hormones in fishes.

Dr. A.N. Spencer: the neurobiology of lower invertebrates, particularly the coelenterates and molluscs; the physiology of electrically excitable non-nervous cells; neuropeptides as synaptic modulators.

Dr. W.C. McKay: physiology ecology of fish energetics, particularly the effects of biotic and abiotic factors on feeding, growth, metabolism and reproduction. Director of Lac Ste Anne Biological Station and Co-Director of Meanook Research Station. .

Dr. N.E. Stacey: physiology of reproductive behavior and ovulation in fish; role of prostaglandins and the endocrine systems in spawning behavior, pheromones and male sexual behavior, periovulatory endocrine events in domestic and wild species.

Dr. E.E. Prepas: limnology, nutrient cycling in lakes and streams, nutrient and water budgets for prairie-parkland lakes, zooplankton and phytoplankton population dynamics, macrophyte growth and standing crops, predictive ecological models.

Dr. Prepas said that she would be interested to accept a Chinese graduate student. Her area is freshwater, but there is a possibility of working in salt water at the Bamfield Research Station.

The delegation had a good discussion with Dr. Peter about possible cooperative projects with the University of Alberta. Dr. Peter is involved in a cooperative project with China on induced spawning and he is familiar with the IDRC cooperative program. He feels strongly that it will be necessary for a Chinese scientist to spend some time at the University of Alberta before being in a position to develop a truly cooperative project. In the short term, a Chinese

research scholar could come to Alberta for one year to work in the laboratory and to establish a relationship with a Canadian research scientist to develop a joint research proposal. There is no specific procedure for visiting scholars at the University of Alberta. The long-range plan is to identify good students to come to Alberta for training in basic sciences. This will take an average of three years for an M.Sc. degree, and five to six years for a Ph.D. degree.

Another possibility would be for a group of Canadian scientists to go to China to conduct workshops on practical research methods with equipment to explain the techniques. This would permit to reach a larger number of Chinese scientists. Mr. Chen said that YSFRI could send two scholars to Canada in the field of ecology and fish nutrition respectively. There are 11 specialized institutes under the Chinese Academy of Fisheries Science which could provide up to 20 scholars for exchange visits. Mr. Chen said that eight students could be sent for training in Canada within the next three years.

#### References:

- 1) List of staff from the Department of Zoology, University of Alberta.
- 2) Research Activities, Department of Microbiology, 1985-86, University of Alberta.
- 3) University Guide, University of Alberta.
- 4) Information for applications in programs leading to M.Sc. and Ph.D. in zoology, Department of Zoology, University of Alberta.
- 5) Publications of Academic Staff 1981-1985, Department of Zoology, University of Alberta.
- 6) Folder containing information on the Boreal Institute for Northern Studies, University of Alberta.

#### Vancouver

The delegation paid a courtesy visit to Dr. Peter Larkin, Vice-President for Research at UBC. Dr. Larkin travelled to Beijing and Quindao in September 1986

where he had met Mr. Qian and Mr. Chen. Dr. Larkin introduced the delegation to Mr. Morley W. Chang, Vice-President Finance of British Columbia Packers Limited. Mr. Chang explained that a delegation from Quindao had visited Vancouver recently and that he was planning to travel to Quindao in November to explore the possibility of purchasing shrimps and scallops for B.C. Packers. Mr. Qian informed Mr. Chiang that his bureau was not involved in the export of shrimps and that it would be necessary to discuss this issue with other agencies in China. Mr. John Kilpatrick of the same company confirmed later that B.C. Packers was no more interested in a joint venture in mariculture in China, and the intention of the company now was to try to buy shrimps and scallops for sale in North America.

Dr. Larkin guided the delegation to the Woodward Library to look at a tapestry of Dr. Norman Bethune which was given to the University by Mr. MacMillan. He also introduced the members of the mission to Professor Robert Blair, Head of the Department of Animal Science. Dr. Blair informed the group that the department would soon offer a graduate program in aquaculture. It seems that the interest in aquaculture is growing in British Columbia, and aquaculture facilities are to be built at the University of Victoria. Simon Fraser University has also a proposal for a graduate program in aquaculture.

A visit to the West Vancouver Laboratory of the Fisheries Research Branch of the Department of Fisheries and Oceans was made on Monday morning, October 20, 1986. We were received by Dr. Edward Donaldson and Dr. David Higgs who conducted a tour of the research facilities and made slide presentations on their research projects. Dr. Higgs is involved in fish nutrition for mariculture. The goal is to improve the cost-effectiveness of mariculture operations and he has carried out research on various sources of food for fish, particularly for the pink and coho salmon. Food represents about 40% of the mariculture operating cost. He is looking at vegetable sources of proteins including rapeseed meals, cottonseed

and soybeans. He found that canola meal was an excellent protein supplement in juvenile coho salmon diets. He provided the delegation with a reprint of an article on feeding fish efficiently which has been reproduced from the Canadian Aquaculture Journal.

Dr. Edward Donaldson explained his work in fish culture, particularly on induced maturation and ovulation of fish. He said that the West Vancouver Laboratory had been designated by the Minister of Fisheries and Oceans as a centre of excellence for research on biotechnology. Both Dr. Higgs and Donaldson are prepared to supervise the research work of graduate students who are registered in the Universities of British Columbia or Alberta.

On Monday afternoon, the delegation visited the Department of Biological Science at Simon Fraser University in Burnaby. A briefing meeting was held with eight academic staff from Biological Science, Natural Resource Management and the Institute of Fisheries Analysis. I explained the background of the mission and each faculty staff introduced himself and informed the delegation about his field of interest. This was followed by a smaller meeting with four biologists of the Department of Biological Science whose chairman is Dr. L.M. Srivastava. These biologists include Dr. Larry Albright who is involved in the development of fish vaccines, Dr. L.D. Druehl who is employing recombinant DNA techniques to identify population and races of seaweeds; Dr. Brian McKeown, who is involved in growth, nutrition, reproduction and genetics of fish; and Dr. Srivastava who is doing research on the growth physiology and chemistry of seaweeds. A visit was made of the laboratory research facilities. Marine research is conducted at the Bamfield Research Station on Vancouver Island.

At the end of the afternoon, a reception for the delegation was hosted by the President of the University, Dr. W.G. Saywell who is a sinologist, fluent in

Mandarin. The reception was attended by Dr. T. Calvert, Vice-President, Research and Information Systems, Dr. J. Geen, Dean of Science and several Chinese graduate students. The Chinese delegation was visibly impressed by the hospitality being given to them.

References:

- 1) UBC: University-Industry Liaison Program for Collaborative Research with Industry.
- 2) UBC: Thirty-Eight Great Ways to Use UBC.
- 3) Bamfield Research Station: User's Guide.
- 4) Booklet on Bamfield Marine Station
- 5) Report on the University of British Columbia: Engine of Recovery.
- 6) West Vancouver Laboratory, Fisheries Research Branch, DFO.
- 7) Natural Resources Management Program, Simon Fraser University.

Nanaimo

We arrived at the Pacific Biological Station of the Department of Fisheries and Oceans in mid-afternoon and the acting Director, Dr. L. Margolis, chaired a general meeting which was attended by seven research scientists. I introduced the Chinese visitors to the group and explained briefly the purpose of their mission. Each research scientist made a presentation of 10-15 minutes on his research projects.

Dr. J. McFarlane explained his work on the sablefish or "black cod" which is sold as smoke fish (smoke Alaska cod) and which is of considerable economic importance for British Columbia. To date, he has been successful in raising juvenile fish, but it will take another two years before the technology can be transferred to industries to raise this deep sea species in fish farms.

Dr. Evelyn is in charge of the fish health and parasitology section and is doing research on disease of finfish (salmonids and marine invertebrates). He is developing techniques to immunize the fish to prevent disease rather than curing the disease later. He is looking at the effects of nutrition on disease resistance.

Dr. Craig Clark is involved in salmon culture and works closely with Dr. Edward Donaldson at the West Vancouver Laboratory. He is working mainly with chinook and coho salmon, but he has also done some research on the Atlantic salmon and the rainbow trout.

Dr. N. Bourne has conducted research for many years on molluscs, mainly oysters, mussels and clams, and he is now conducting research on scallops. The problem with mussels is mortality before they reach commercial size. The problem with clams is to obtain seed and they must be produced in captivity. There are 13 species of scallops on the West Coast and he feels that several species could be raised in scallop farms. He has developed hatchery methods and raised algae for food. Again, the major problem is high mortality.

The next morning we made a tour of the research laboratories where we saw the various species of fish and shellfish used for research. We went to a small island facing the laboratory where Dr. Greg Clark is conducting research on salmon in pens. Later in the morning, we visited a fish feed plant (White Crest Mills) which is owned by a fisherman's cooperative association from Prince Rupert. The manager, Dr. Fred W. Ming, explained the process to produce fish pellets from fish meal and plant waste. The fish pellets are sold at 9000\$ per tonne. Mr. Chen tried unsuccessfully to obtain a detailed list of ingredients in the feed.

At Duncan, we visited the Sea Spring Salmon Farm. At the time of the visit the employees were stripping eggs from females and milt from male salmon and the eggs were placed in plastic bags for fertilization before being transferred to trays and placed into an incubator with running water. The raising of salmon in captivity is well developed in British Columbia where there are about 75 salmon farms at the present time. Most of the salmon raised in farms are sold on the market during the off-fishing season from October to May.

References:

- 1) National Policy Goals for Canadian Aquaculture, DFO.
- 2) Developing Aquaculture in Canada - A Discussion Paper, DFO.
- 3) Private-Sector Aquaculture Production and Value in Canada: An Overview, DFO.
- 4) Fish Habitat and Mining, DFO.  
Fish Habitat and Dredging, DFO.  
Fish Habitat and Forestry, DFO.
- 5) Underwater World (Series of leaflets) on Lingcod, Sea Cucumber, Red Sea Urchin, Shrimps of B.C., Dungeness Crab, Rockfish.
- 6) The Incredible Salmonids, DFO.
- 7) Get Hooked on Salmonids, DFO.
- 8) Pacific Biological Station (Booklet), DFO.
- 9) List of Staff of the Fisheries Research Branch, Pacific and Yukon Region.
- 10) Publications by Members of the Fish Culture Research Section, Fisheries Research Branch, DFO.
- 11) West Vancouver Laboratory and Pacific Biological Station.
- 12) Effects of LHRH and Des-Gly LHRH-Ethylamide on Plasma Gonadotropin Levels and Oocyte Maturation in Adult Female Coho Salmon by Edward Donaldson et al.

Victoria

At the University of Victoria, the delegation was met by Dr. Nancy Sherwood and Dr. Brian Harvey who have been involved for many years in the fish gametes project and who are both recognized as visiting scientists in the Department of

Biology. We were informed that Dr. W.W. Kay, Chairman of the Department of Biochemistry and Microbiology was interested to meet the mission. Dr. Kay explained that his department had been involved in fish disease and that they had the capability to develop vaccines for fish. He explained that the department was providing first class graduate programs and that many research projects had practical applications. He said that the students learn to develop diagnostic methods for detecting fish disease. There are three vaccines that have been developed by the department and tested in the field in British Columbia. He expressed interest in a cooperative project on fish disease. There is now a Chinese student in the department, and they expect to have four more in the near future. Finally, he said that he was very open to any suggestions of cooperation.

Dr. Nancy Sherwood took the visitors around for a visit of the research laboratories. Mr. Chen took note of a protein sequencer costing about \$400,000 to identify the structure of proteins. I told him that IDRC could not provide this type of equipment. We visited the laboratory of Brian Harvey and in subsequent discussions he presented a number of ideas to the delegation. He mentioned low temperature storage of gametes and embryo of fish and mollusc which would provide the advantage of taking the embryo off the shelf when needed. The visitors reacted by saying that they would like to exchange information and receive papers on Brian Harvey's work on low temperature storage.

We also had a meeting with Dr. G.L. Littlepage who has done work on aquaculture for many years and who is a consultant to a CIDA project in Brasil. He is now involved in a geothermal aquaculture farm in Idaho near Boise for raising tilapia and catfish. This is sold as fishsticks and gourmet fish in USA. He has practical experience in working with shrimps in Brasil and he has done a lot of work on artemia.

Dr. Harvey advised the group to visit the Vancouver Aquarium in Stanley Park in Vancouver. We went to the Aquarium on Sunday where the delegation saw a large collection of marine, freshwater, tropical and temperate species including several primitive and rare fishes. I also took the group to the Salmon Hatchery along the Capilano River in West Vancouver. The delegation greatly appreciated these visits.

Reference:

- 1) Brochure on Biology Department, University of Victoria.
- 2) Brochure on Biology Co-Operative Education, University of Victoria.
- 3) Brochure on Biochemistry and Microbiology Department, University of Victoria.