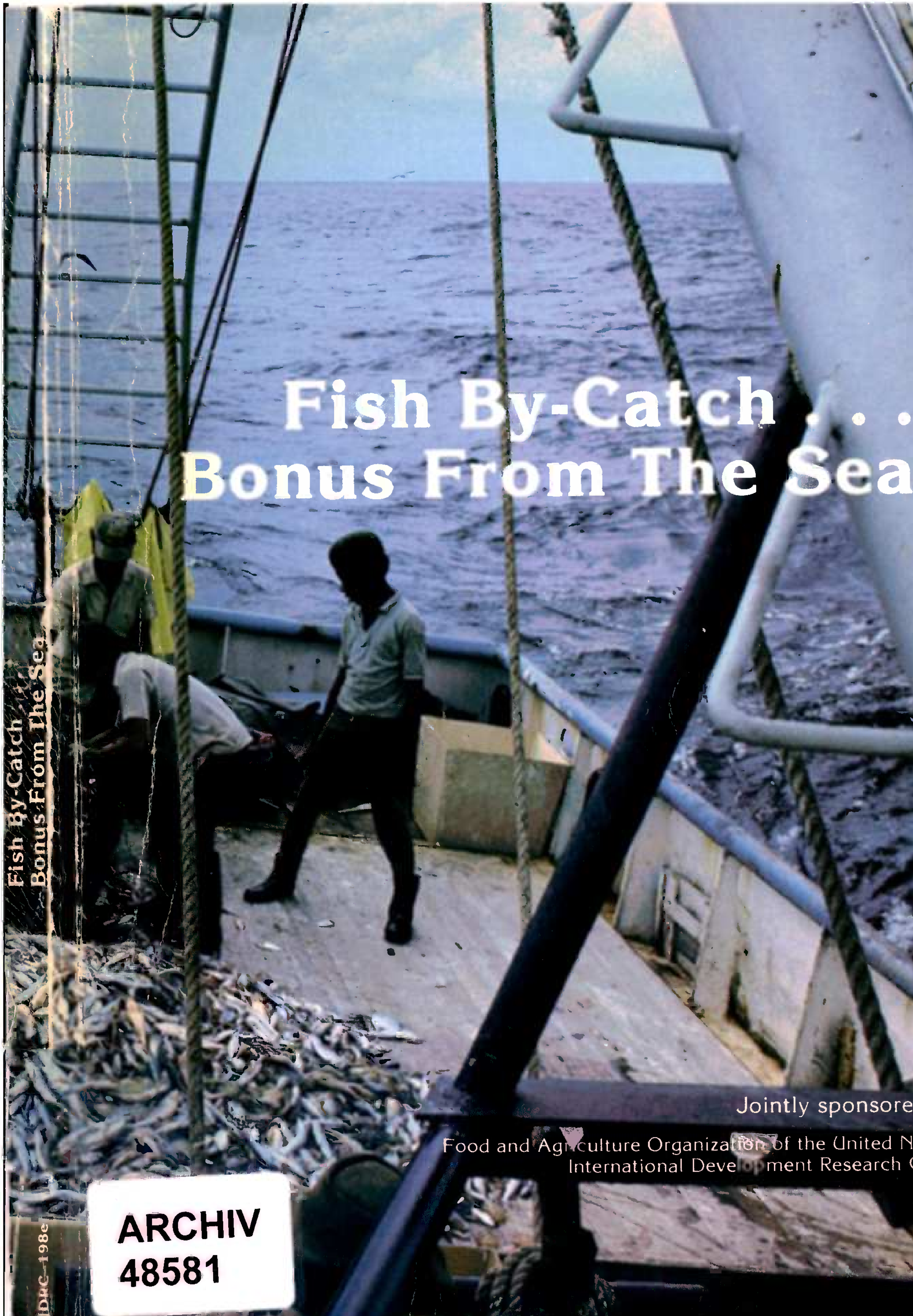

Fish By-Catch . . . Bonus From The Sea

Jointly sponsore

Food and Agriculture Organization of the United Na
International Development Research C

Fish By-Catch . . .
Bonus From The Sea

IDRC-198e

ARCHIV
48581

The International Development Research Centre is a public corporation created by the Parliament of Canada in 1970 to support research designed to adapt science and technology to the needs of developing countries. The Centre's activity is concentrated in five sectors: agriculture, food and nutrition sciences; health sciences; information sciences; social sciences; and communications. IDRC is financed solely by the Parliament of Canada; its policies, however, are set by an international Board of Governors. The Centre's headquarters are in Ottawa, Canada. Regional offices are located in Africa, Asia, Latin America, and the Middle East.

Published by the International Development Research Centre under special arrangement with the Food and Agriculture Organization of the United Nations
©1982 International Development Research Centre
Postal Address: Box 8500, Ottawa, Canada K1G 3H9
Head Office: 60 Queen St., Ottawa

FAO, Rome, IT
IDRC, Ottawa, CA

IDRC-198e

Fish by-catch — bonus from the sea : report of a technical consultation on shrimp by-catch utilization held in Georgetown, Guyana, 27–30 October 1981. Ottawa, Ont., IDRC, 1982. 163 p.

/Deep sea fishing/, /by-products/, /fish utilization/, /fishery product processing/ — /food supply/, /protein rich food/, /fish preservation/, /dried food/, /canned food/, /frozen food/, /fishery development/, /fishery management/, /economic aspects/, /agricultural wastes/, /conference report/, /list of participants/, /IDRC mentioned/.

UDC: 639.281.2 ISBN: 0-88936-336-6

Microfiche edition available

Il existe également une édition française de cette publication. La edición española de esta publicación también se encuentra disponible.

4 85 81

IDRC-198e

Fish By-Catch . . . Bonus from the Sea

Report of a Technical Consultation
on Shrimp By-Catch Utilization held in
Georgetown, Guyana, 27–30 October 1981

LIBRARY - BIBLIOTHÈQUE DU CRDI - IDRC
OTTAWA
27 VII 1982

Jointly sponsored by:
The Food and Agriculture Organization of the United Nations and
International Development Research Centre

ARCHIV
639.281.2
T 4
1981

The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the United Nations or the Food and Agriculture Organization of the United Nations concerning the legal or constitutional status of any country, territory, or sea area, or concerning the delimitation of frontiers.

Contents

Salting of Minced Fish

E.G. Bligh and Roseline Duclos
Technical University of Nova Scotia, Fisheries Research and Technology Laboratory, Halifax, Canada

Cod myosin can be denatured by salt concentrations of about 10%. It should be possible, therefore, to salt minced fish with less than the 25% salt previously recommended. Preliminary results show that less brine is released from lightly salted mince but that the physical and functional properties of the product are related to salt concentration.

Seafood laboratories throughout the world have been investigating the potential of minced fish to increase the supply of edible fish protein and to provide the means for utilizing shrimp by-catch and other non-traditional species of fish. Several international conferences have been held on the subject, and there has been general agreement that one of the major problems with the utilization of minced fish is the development of acceptable and marketable consumer products.

Recent work at Halifax has focused on the salting of minced fish, as Canada has traditionally been a major producer of salted fish and the product currently has a strong international market demand. Results of our earlier work were incorporated in a collaborative project of the government of Guyana and IDRC as the basis for production of salted, minced fish.

Many will recall the original studies done by Del Valle and co-workers. Del Valle and Nickerson (1968) published a quick-salting process for fish that entailed:

- Grinding fish muscle with salt;
- Mixing the salt–fish mixture;
- Pressing the product at 2000 lb/in^2 (~140 kg/cm^2) to remove water and form cakes; and
- Drying the cakes to give a stable product.

In a subsequent paper, Del Valle and Gonzalez-Inigo (1968) applied the process to various species of fish and reported: "... adding amounts of salt lower than the required minimum resulted in gelatinous muscle masses which could not be pressed, while adding amounts of salt higher than the minimum resulted in brittle cakes after pressing." Mendelsohn (1974) of the Gloucester Laboratory in the U.S. proposed another process where skinless fillets were ground and mixed with saturated brine (1 : 1) to which sufficient extra salt (25 g/100 g fish) was added to saturate the tissue. The Halifax process used in the IDRC–Guyana project (Wojtowicz et al. 1977) requires the mixing, at 35°C, of minced fish with sufficient salt (salt/fish, 1 : 3) to saturate the tissue. This denatures the protein and gives maximum water release in a subsequent dewatering step that is followed by drying to about 22% moisture content. The product is stable at ambient temperatures. This process has many desirable features:

- Salting is rapid compared with the 2–3 weeks required for traditional salting;
- Mincing not only increases the rate of salt penetration but also facilitates drying;
- The product resembles traditional salt cod in chemical composition, odour, and taste; and
- The product has excellent shelf life.

The main disadvantages of the process are that the product is heavily salted, the protein lacks functionality, and the fibrous nature of the material is unattractive to some consumers.

The study that we relate here is still in progress and is aimed at resolving some of the disadvantages of the process. In essence, we wanted to produce a lightly salted, minced fish that would retain some of the functional properties of the protein and, accordingly, would be amenable to being formed into a cake or other shape.

The scientific basis for the study was a paper by Duerr and Dyer (1952), which reported: "... study of the denaturation of cod muscle proteins by sodium chloride shows that the myosin fraction is denatured when a critical concentration, about 8 to 10% in the muscle, is reached. Parallelling the rapid denaturation, a sudden increase of salt uptake and of moisture loss occurs." From that observation, we considered it possible to produce lightly salted, minced fish with sufficient functional properties to enable the product to be formed into a cake or portion and therefore more closely resemble traditional salt cod.

Experiment

An experiment was designed to determine the effects of adding different quantities of salt to minced cod. Key factors considered in the study were protein functionality, colour, and water released from the tissue.

A standard test procedure was used wherein a fixed quantity of freshly prepared minced cod was mixed for 5 minutes with five different amounts of sodium chloride (at 5, 10, 15, 20, and 25% of the weight of the mince). The mixtures were then held at 35°C for 30 minutes and were stirred frequently. Released brine was collected through a Buchner funnel with vacuum while the tissue was being pressed to form a cake. The salted cakes were air dried at room temperature in a ventilated fume hood until a moisture content of 30–35% was obtained. Dehydrated cakes were sealed in laminated (polyethylene–aluminum foil) pouches for "curing" and subsequent analyses.

For comparative purposes, the various end-products were subjected to a series of laboratory tests. Protein contents were calculated from Kjeldahl nitrogen values. Sodium chloride levels were determined by conductivity and moisture values from weight losses after oven drying for 24 hours at 95°C. Colour was measured by a Gardner Automatic Color Difference Meter. The dried products were rehydrated by soaking (30-g samples in 10 volumes of water for 4 hours). Subsequent cooking involved boiling each sample in 75 ml of water for 3 minutes.

Results and Discussion

Under the experimental conditions employed, the results indicate that more than 10% salt is required for protein denaturation and the associated loss of water-binding capacity (Fig. 1). Although this level of salt is somewhat higher than that reported by Duerr

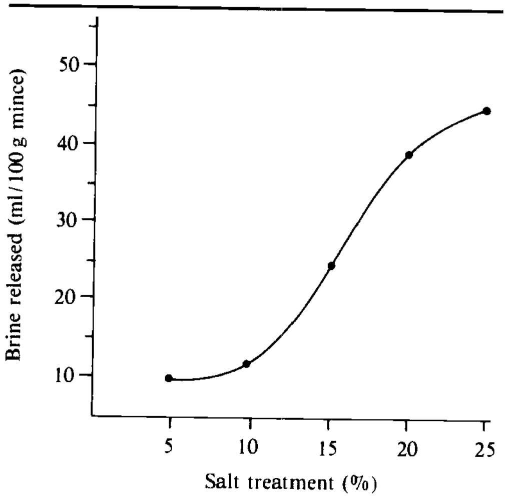

Fig. 1. *Brine released for different salt treatments of minced cod muscle.*

Table 1. Composition, colour, and rehydration values for five salt-treated cod minces.

Parameter	Salt treatment (%)				
	5	10	15	20	25
Composition (%)					
Moisture	30	30	30	30	30
Protein	55	50	48	44	44
Salt	15	20	22	26	26
Colour[a] **(L)**					
Mean	62.9400	65.2857	68.5475	64.0875	67.9675
SD	±1.1914	±1.8396	±1.2768	±0.6581	±0.7467
Water uptake					
Weight before soaking (g)	28.55	32.53	29.83	28.59	20.14
Weight after soaking[b] (g)	46.99	45.22	54.16	43.94	42.76
Uptake (%)	39.24	28.06	44.92	34.94	31.85

[a]Scale 0–100 where 0 is black and 100 is white.
[b]Soaked 4 hours at room temperature in 10 volumes of water.

Table 2. Composition and colour of rehydrated and cooked samples of salted minced cod.

Parameter	Salt treatment (%)				
	5	10	15	20	25
Composition (%)					
Moisture	66	68	72	67	68
Protein	31	30	26	30	31
Salt	3	2	2	3	1
Colour[a] (L)					
Mean	58.935	60.824	65.574	62.446	61.880
SD	±0.0981	±0.8733	±0.0760	±0.9059	±1.1140

[a]Scale 0–100 where 0 is black and 100 is white.

and Dyer (1952), a time–temperature factor may be responsible.

In the composition of the dehydrated, salted, minced fish products (adjusted to 30% moisture content), the protein content is inversely proportional to the amounts of salt present; therefore, the product containing the least amount of salt contains the most protein (Table 1). Additions of salt at 20% and 25% yielded products saturated with salt, whereas 10% and 15% salt additions produced fairly heavily salted products. The results suggest little advantage in processing with more than 20% salt.

After drying to 30–35% moisture, the cakes were solid and could withstand normal handling without breakage. The cakes from the initial treatments with 5% and 10% salt had rough, coarse surfaces unlike the more fibrous appearance from the other treatments. The samples receiving the higher salt treatments were lighter in colour (Table 1) and, therefore, more closely resembled the natural colour of salted cod. On a scale of 0–100 (where 0 is black and 100 is white), the 15% salt treatment yielded a product at least as white as those from the two higher treatments.

After being stored in sealed pouches for approximately 3 weeks at about 20°C, the salted products acquired the traditional odour of salt-cured cod. The intensity of the odour seemed to increase with the amount of salt in the product.

As a first step in examining the functional properties of the salted products, we examined water uptake at rehydration. The results showed that the product treated with 15% salt had the greatest water-binding capacity (Table 1). Furthermore, this property was retained in the cooked product (Table 2). All samples held together and maintained their cake form throughout rehydration and cooking. Initial examination indicated that the 15% salt treatment yielded a lighter coloured product than did the others. This finding was confirmed by the Gardner Color Meter determinations (Table 2).

Preliminary taste-panel tests on the cooked products indicated that the samples had an acceptable flavour, closely resembling that of traditional salt cod, and that the 15% salt treatment sample appeared to have the best texture.

Although this study is continuing, early results have suggested that the addition of about 15% salt to lean, minced-fish tissue is sufficient to yield a product with superior properties.

This study was financed in part by a research grant from the Natural Sciences and Engineering Research Council of Canada.