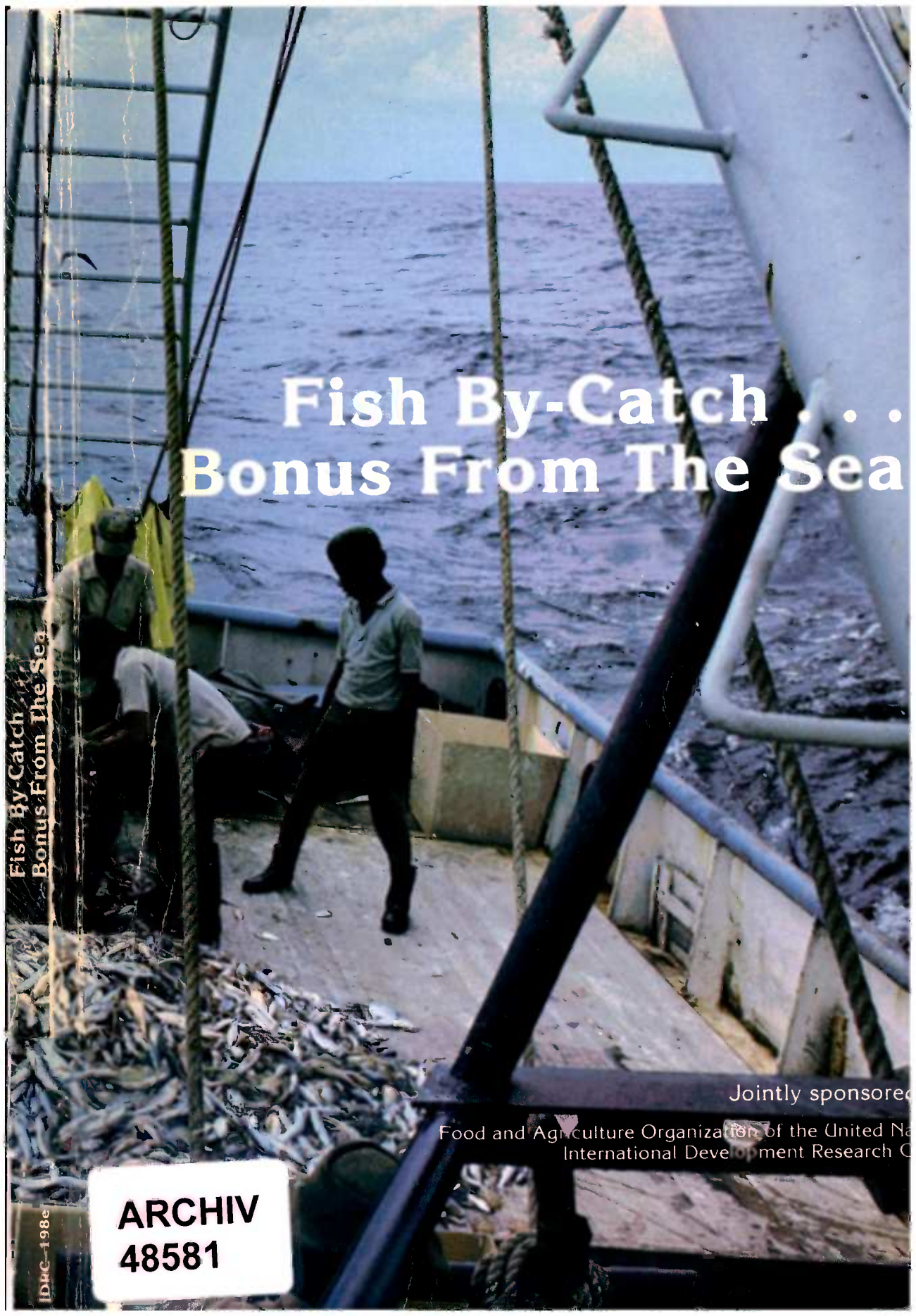

Fish By-Catch
Bonus From The Sea

IDRC-198e

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Report of a Technical Consultation
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Georgetown, Guyana, 27–30 October 1981

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Contents

Effects of Acetic-Acid Aided Evisceration on Deboned Minces from By-Catch Fish

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We studied gutting and cleaning methods that might be conducted efficiently and rapidly at a minimum cost. Five fish species that are frequently found in the by-catch were used. They were cleaned semiautomatically with 4% aqueous acetic acid as the active agent (AE — acetic-acid aided evisceration). We deboned the material, using a Paoli deboner and then analyzed the minces, comparing the findings with those for deboned minces prepared from manually gutted and cleaned fish (ME). We were able to process larger quantities of by-catch fish in shorter intervals with the AE method than with the ME method, and recoveries of deboned minces were similar (60%). The proximate composition of deboned minces was generally unaffected by the method of gutting and cleaning, although the extractability of nitrogen and the water-holding capacity tended to decrease in minces prepared from AE fish. Besides the colour of minces, few differences existed between the individual fish species. The use of the AE method with by-catch fish may radically improve the economic potential of this underutilized resource, without adversely affecting the quality of the deboned minces.

By-catch from the Gulf of California is a complex mixture of marine organisms, and the finfish portion comprises many small demersal fish species. Although it has been shown that it is possible to prepare by-catch fish manually on a factory scale in Mexico, labour requirements are extensive. Further, even though deboned minces from whole fish have successfully been used in dried, salted fish cakes (Young 1978b), the minces obtained are generally poor quality. The disruption of fish tissues and the intimate mixing that occurs during deboning can allow undesirable chemical changes to proceed more rapidly (Lee and Toledo 1977; Raccach and Baker 1978). These changes are further promoted if the deboned material contains the viscera of fish, and they result in dark minces that can have a high bacterial load. These factors may severely limit the utilization of minces prepared from whole fish.

Prototype machines capable of efficiently gutting small fish have been proposed for commercial processing, but they are designed for regularly shaped fish that are at least 20 cm long (Mendelsohn and Callan 1981). Thus, we studied a method of gutting and cleaning by-catch fish species in an attempt to reduce labour costs and time. The method consists of cutting the fish and soaking them in an acid medium.

Materials and Methods

By-catch fish were obtained fresh from commercial trawlers in the Gulf of California during the latter half of the 1980–81 season. The five species groups, which are frequently found in the by-catch (Young and Romero 1979), were mojarras (*Eucinostomus* spp.), orangemouth corvina (*Cynoscion xanthulus*), Gulf croaker (*Micropogon altipinnis*), bronzestriped grunt (*Orthopristis reddingi*), and cabaicuchos (*Diplectrum* spp.). Their average length is 12–17 cm and their weight 38–57 g. Analar grade acetic acid was used in the study.

Quantities of the fresh by-catch (60 kg/species) were divided into two equal lots, one to be cleaned by hand (ME) and the other to be cleaned with acetic acid solution (AE). The manual process involved cutting the fish heads off and slitting open the belly cavity so that the viscera could be removed. The carcasses were then cleaned, the black peritoneum and kidney tissues being removed when scrubbed by hand in ice-cooled water. Fish to be cleaned with acetic-acid solution were knobbed with a sharp knife. Carcasses were then chopped laterally into

Table 1. Basic analytical data for deboned minces (Gulf croaker, bronzestriped grunt, orangemouth corvina, cabaicuchos, and mojarras[a]), eviscerated manually (ME) and with the aid of acetic acid (AE).

	Gulf croaker		Bronzestriped grunt		Orangemouth corvina		Cabaicuchos		Mojarras
	ME	AE	ME	AE	ME	AE	ME	AE	AE
Gutted, cleaned fish (as % of whole fish)	58.4	51.9	53.3	57.7	68.0	64.7	63.8	54.4	60.7
Deboned mince (as % of whole fish)	36.0	33.6	33.5	43.3	45.8	41.9	32.1	26.8	37.8
Deboned mince (as % of gutted fish)	61.6	64.5	63.1	75.0	67.4	64.8	51.1	49.3	62.1
Total crude protein (N × 6.25) (%)	16.30	15.69	17.06	17.41	17.81	17.43	17.93	15.77	16.37
Moisture (%)	80.63	81.46	78.77	78.78	77.96	79.22	78.30	79.82	79.31
Lipid (%)	1.50	1.85	2.75	2.95	2.72	1.34	2.75	1.24	2.35
Ash (%)	0.93	0.73	1.19	0.81	0.99	0.78	1.25	0.80	0.90
pH	6.5	5.4	6.4	5.5	6.5	5.3	6.8	6.6	5.0
Total nitrogen (%)	2.61	2.51	2.73	2.79	2.85	2.79	2.87	2.52	2.62
N extracted by water (%)	30.30	25.24	27.73	22.62	24.89	22.83	31.73	27.60	21.31
N extracted by 5% NaCl (%)	58.15	37.02	40.78	39.88	43.86	45.85	36.45	41.27	28.99
N extracted by 10% TCA (%)	4.60	5.20	5.11	4.99	3.87	4.90	4.36	2.55	4.75
Drip (% — v/w — liquid lost on thawing)	0.1	9.2	0.8	4.0	0.1	9.8	0.1	0.2	2.0
TEF[b] (% — v/w — liquid lost on centrifugation)	29.8	48.0	43.4	39.8	28.8	45.4	28.8	37.6	39.2
Total weight, bones and scales (% dry-weight basis)	0.38	0.24	1.14	0.63	0.37	0.00	0.50	0.56	0.07

[a]Mojarras were not prepared manually because of their small size: average weight 38 g; average length 12 cm.
[b]TEF is total expressible fluid.

roughly 3-cm pieces and added to a 4% (v/v) aqueous solution of acetic acid (fish/solution, 1 : 1) in a plastic container. The mixture was stirred continuously for about 1 hour at ambient temperature (27°–33°C), strained and rinsed in two separate volumes of ice-cooled water. Both manually and acid-cleaned fish were then minced coarsely (Paoli mincer, model 863) and deboned by a Paoli deboning system (model 19-529). Deboned minces were frozen after being packed in polyethylene bags and stored at -20°C prior to analysis.

The deboned minces were analyzed for total crude protein (N × 6.25), lipid, moisture, and ash contents. All analyses were carried out in duplicate. Nitrogen extracted from deboned fish minces in water and in 5% sodium chloride was also determined. The solutions contained sodium bicarbonate (0.02 M) to maintain the pH at 6.5–7.0 during the homogenization. Samples were homogenized and then centrifuged (3500 g, 30 minutes) and the supernatants analyzed for their nitrogen content. The non-protein nitrogen (NPN) content of minces was determined in a similar manner, although ice-cold 10% trichloroacetic acid was used as the extractant and the bicarbonate was omitted.

We measured the pH of 2 g of mince homogenized in 10 ml of neutralized sodium iodoacetate solution (0.005 M) and determined water-holding capacity (WHC) of the minces following the method described by Tableros and Young (1981), giving values for free liquid lost from frozen minces after 3 hours of thawing and total liquid lost from thawed minces after centrifugation.

Bone and scale contents of minces were also determined, 10 g of fresh mince being dried to constant weight and then ground in a mortar. The mince disintegrated to a fine powder, and the residue consisted of the more durable bones and scales. These were counted and weighed and their combined weights expressed as a percentage of the dried weights of the minces.

Results

The use of an acetic-acid solution greatly reduced (more than 50%) the time required for gutting and cleaning. During the period that the chopped fish pieces were in the acid baths, the viscera of the fish disintegrated and dissolved to a large extent. The black peritoneum lining the body cavity became detached and the skin and scales could be rubbed off easily. This cleaning action may be caused by increased activity of the proteolytic enzymes endogenously present in the alimentary tract and on the skin.

Recoveries on gutting, cleaning, and deboning varied considerably for the fish species studied, regardless of the method of preparation (Table 1). This variation was ± 30% of the species mean calculated for deboned minces from whole fish and ± 20% for deboned minces from gutted and cleaned fish. The means obtained for deboned minces from fish prepared manually or by the use of acetic acid were similar.

The total crude-protein values of manually prepared fish were slightly higher than those of fish prepared with acetic acid, whereas the moisture values were a little lower (Table 1). The lipid contents of the deboned minces from the five fish species were all less than 3%. The ash contents of the minces were consistently reduced (20–30%) by the use of the AE method, and, as was expected, the pH levels of AE-deboned minces were lower than those of fish prepared manually (pH 5.4 and 6.5, respectively).

Larger amounts of nitrogen were extracted with 5% NaCl solution than with water (Table 1). There was no significant trend in the individual values obtained for ME and AE fish, although the mean values tended to be lower for AE-prepared minces. Similarly, there was no consistent trend for the nitrogen extracted by 10% TCA.

The water-holding capacity of minces when thawed was considerably reduced in those minces that had been prepared by the AE method, as indicated by the higher values for liquid lost during both thawing and centrifugation. The AE-prepared minces tended to have a lower bone/scale content because of a reduction in the number of scales (Table 1).

The colour of the deboned minces was subjectively determined and varied greatly between species: bronzestriped grunt and mojarra minces were extremely gray, whereas the other minces were white to cream. The AE method produced lighter-coloured minces from bronzestriped grunt than did manual evisceration, but no differences in inherently light-coloured minces were discernible.

Conclusions

The quality of deboned minces from fish gutted and cleaned either manually or with the aid of acetic acid was similar, although there were interspecies differences, especially with regard to their colour. The acid-aided method of evisceration considerably reduced the time and effort required and had the added advantage of lightening the dark minces. The water-holding capacity of the minces was reduced by the AE method, and this may affect their potential uses in the unprocessed form.

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