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Silver Smelt: A Valued Non-Quota Fish?

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Tighter fish quotas have given rise to increased interest in non-quota species throughout the EC. In encouraging this interest, the EC Commission undertook to fund (in part) a 2-year cooperative project on catching/handling, quality evaluation, processing and suitability for products of the Silver Smelt *(Argentinus silus)*.

This project has been recently completed by staff at The National Food Centre (NFC), An Bord Iascaigh Mhara, The Department of the Marine, and at IFREMER (in France). The NFC component of the project, as presented here, dealt with the quality, composition and properties of the fish, and with its suitability for products and analogues.

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The Silver Smelt is a non-quota, deep water (300-500 metres) fish species, which is caught off the west coast of Ireland at the edge of the continental shelf in the period April-June. Landings have varied considerably, with significant tonnage in some seasons and virtually none in others. This is because only a small number of Irish trawlers are capable of catching this fish due to equipment requirements for deep water fishing, and because currently it is more economical and easier to catch other species such as mackerel.

The Silver Smelt is a relatively small fish, with an average weight of about 0.5 kg, and ranging from 0.2 to 1.2 kg. It has easily detachable hard scales and very eyes. Careful machine filleting and bone separation are essential in order to remove small bones and skin. Commercial fillet yield is 40-43% with skin on, and about 30% for mince, as percentages of round fish weight.

Judging and testing

The quality of whole fresh fish (on ice) from different catches was assessed over a 6-day period post-catching, by a panel of judges using a four point scale, with 3 (top) and 0 (bottom). Marks were awarded for the appearance of the skin, eye, gills and flesh, the odour of the gills and skin, and the overall flesh condition. The results were favourable with 23 judges out of 54 giving scores of 3, and only 11 out of 54 scores below 2. There were no scores below 1. Parallel tests on steamed fish indicated that flavour and odour scores remained high throughout the period of iced storage, indicative of a good shelf life on ice. A paired comparison test with 12 tasters, showed that steamed Silver Smelt was preferred by 9 to 3 to steamed cod. The consensus was that the Silver Smelt had a pleasant bland flavour, white flesh and good texture. However, small bones were sometimes a problem. In a concurrent series of objective laboratory tests on fresh, iced Silver Smelt, the results generally supported the sensory testing by the judging panel.

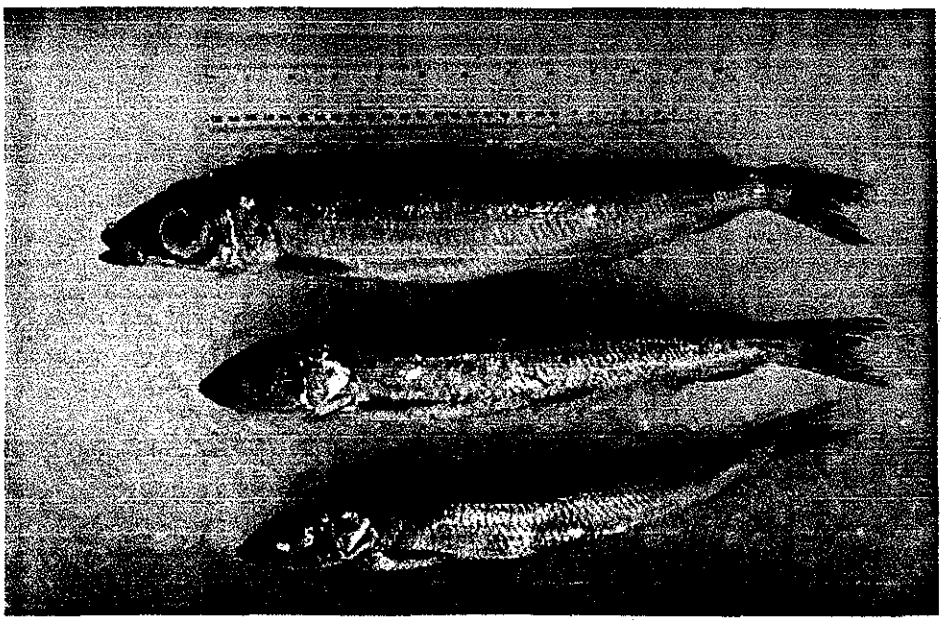
Mean moisture, protein and fat contents of fresh Silver Smelt were 80, 17.9 and 0.5%, respectively, with corresponding ranges of 78.2-81.3%, 17.3-19.1%, and 0.3-0.8%. Total volatile nitrogen (TVN) values ranged from around 16 mg/100 g for fish which was 1-3 days on ice, to about 30 mg/ 100 g by day 6, indicating that, by then, the fish were close to the end of their 'fresh' shelf life.

Water binding

The ability of fish tissue to bind and hold water is of major significance in the production of fish products. Tests were carried out, therefore, on the water loss from pieces of fish tissue. Lower values for water loss indicate higher levels of water binding capacity.

The water binding capacity of fresh fillets of the Silver Smelt was similar to that of cod but lower than pollock and ling. The values for frozen fish were similar for the four fish types (Table 1). The results show clearly that both mincing and freezing had an adverse effect on water binding capacity. These findings were confirmed (Table 2) in further tests where the ability of Silver Smelt mince to hold added water was assessed. It is clear that, where possible, fresh fish should be used in the preparation or manufacture of fish products.

These data were largely mirrored in tests where fish flesh was used to produce gels with and without added water. Gels were made by mixing Silver Smelt mince with salt and added water (used only for 'added water' gels) in a food blender for 3 minutes at full speed. The mixture was transferred to sausage casings and cooked for 40 min. at 90°C. This produced long cylinders of gels which were sliced and tested. In the



The Silver Smelt is a relatively small fish, averaging 0.5 kg.

TABLE 1: Water loss (%) from fish pieces and mince on centrifugation at 500G for 10 minutes

Sample		Water loss %
Silver Smelt	– fresh fillet	12.1
	– frozen fillet	20.7
	– fresh mince	17.2
	– frozen mince	38.0
Cod	– fresh fillet	11.3
	– frozen fillet	24.6
Ling	– fresh fillet	6.5
	– frozen fillet	19.8
Pollock	– fresh fillet	8.2
	– frozen fillet	19.0

TABLE 2: Weight of added water[1] held by 100g of Silver Smelt mince on centrifugation at 500G for 10 minutes

Mince from	Water (g) held per 100g mince
Fresh fish	147
Frozen fillets	28
Frozen block (mince)	12

[1]200 g of water added to 100 g of fish mince.

tests, Silver Smelt produced strong gels, but gel strength and pliability decreased when frozen fish (minced), or pre-frozen mince was used.

Freezing and frozen storage

In evaluating the effect of freezing and frozen storage on the quality of Silver Smelt stored as fillets or mince, it was clear that the flesh became less white over a 374 day storage period at —28°C. The texture of fillets from frozen whole fish, and of block-frozen fillets, remained relatively constant during storage, but frozen mince texture toughened, with shear values of 0.38 after 150 days, 0.43 after 235 days, and 0.54 kN after 374 days. It should be stressed that fish with the least white colour and highest shear values were still acceptable for use in products. However, fresh fish or frozen fish should be used in preference to frozen mince for this purpose. There is a quality advantage in using mince which is freshly prepared from frozen fish, rather than using pre-frozen mince. However, it is possible that some of these difficulties could be overcome by using cryoprotectants.

Consumer products

The potential of Silver Smelt for manufacturing consumer products as enrobed nuggets/fingers, fish cakes and enrobed prawn analogues was investigated.

The enrobed nuggets and fingers were prepared from block-frozen mince and were compared with commercial cod nuggets and breaded cod steaks, respectively. In nuggets, the Silver Smelt product was preferred by 13 to 2 in a 15-member panel, while the opposite held in the case of fingers where there was a 16 to 8 preference ratio for the cod product. These contrasting results could be due to a difference in quality between the two commercial products (not obvious), or because the frozen blocks used to prepare the nuggets and fingers were from different catches at sea. A number of panellists commented that the Silver Smelt product was too tough. This was probably due to the use of block-frozen mince, and better results would be likely with block-frozen fillets.

Fishcakes made from Silver Smelt were preferred in a panel with 12 tasters, to those made from pollock, ling or cod and also to a commercial fishcake. The formulation was fish mince (50%), water (33%), potato flake (16.2%) and seasoning (0.8%). The ingredients were blended, hand-extruded, blast-frozen, enrobed/flash-fried and blast frozen again for storage. The product was finish-fried in oil at time of consumption.

A number of tests were also done on producing an enrobed prawn analogue from Silver Smelt frozen mince block (Table 3). The process involved thawing, comminution, forming, freezing, enrobing and flash-frying, freezing/storage and finally finish-frying and evaluation. Taste panel results indicated that this product compared favourably with large enrobed Dublin Bay prawns.

TABLE 3: Formulation for an enrobed prawn analogue from Silver Smelt

	Batch weight (g)
Fish mince	500
Starch	22
Sucrose	5.4
Salt	5.4
Flavour (Japanese, ZA: 2334)	4.3
Glycine	2.7
Monosodium glutamate	2.7
Cochineal	54 microlitres

Summary

- Careful machine filleting and bone separation are essential in order to obtain a commercial yield and to remove small bones and skin.
- Silver Smelt is low in fat, has white flesh and a bland flavour, making it suitable for consumer fish products.
- Silver Smelt has good water-binding and gel-forming properties, with fresh and frozen fillets best in this regard and frozen mince the worst.
- Freezing and long-term frozen storage result in a decline in flesh whiteness and an increase in toughness in frozen mince which are carried through into products.
- It is best to make products from fresh or frozen whole fish/fillets rather than from frozen mince.
- Highly acceptable fishcakes and enrobed prawn analogues were made from Silver Smelt, but enrobed nuggets and fingers made from block frozen mince were on the tough side.

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