Fish By-Catch . . .
Bonus From The Sea

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Fish By-Catch...
Bonus from the Sea

Report of a Technical Consultation
on Shrimp By-Catch Utilization held in
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Handling Mixed Catches

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A mechanical fish grader–icer has been developed by the Technological Laboratory of the Ministry of Fisheries in Denmark. The equipment was designed for use on shrimp trawlers; it moves the catch from the deck to the fish stowage in the hold while it grades the fish for either industrial (animal feed) or food use and ices them. At present, the equipment is being tested aboard commercial trawlers in the North Sea.

Danish trawl fisheries in the North Sea vary greatly according to season and locality. Some catches are uniform, containing mainly one species, such as sand eel, but for most of the year, trawl catches contain a variety of species and sizes. Most small fish like sand eel and Norway pout are used in animal feed only, whereas larger species should be handled as food fish.

Fishing takes up many of the working hours of the small crew of Danish trawlers, leaving little time for the handling, chilling, and stowage of the catch. Mechanical equipment for catch handling has so far been very limited or nonexistent. The handling of the large mixed trawl catches has been hindered by the lack of personnel and auxiliary equipment on board.

When industrial fish (small whole fish intended for reduction to meal) are stowed in the hold without effective chilling, the atmosphere within the hold may become dangerous within a few days. The fish undergoing spoilage consume oxygen and emit dangerous gases, such as carbon dioxide and hydrogen sulfide, which accumulate in the lower part of the hold. In 1976, such gases and the lack of oxygen caused the deaths of three Danes working in the holds of North-Sea trawlers loaded with industrial fish.

Chilling of industrial fish is essential not only for security and health reasons but for maintaining the fish quality and yield. Large-scale tests in the North Sea showed that Norway pout, stored in ice for 6 days lost 6% in weight, whereas the weight loss at ambient temperature, 15°C, was 27%. The “blood water” lost at ambient temperature deprived the catch of 74% of its oil and 14% of its original protein content. During storage at ambient temperature, some of the remaining oil hydrolyzes to free fatty acids and some of the remaining protein breaks down to volatile compounds that have no nutritional value and that cause air pollution around the fish harbour and reduction industries.

Large trawl catches coming on deck at a rate of 1–2 t/minute to be stowed in fish holds 3–4 m deep cannot be iced effectively without the use of mechanical equipment specially designed for this purpose.

Another problem in the handling of large mixed trawl catches has been the grading into industrial fish and food fish. Without mechanical-grading equipment, only a fraction of the food fish, mainly the largest fish, can be retrieved. Thus, at times, substantial quantities of smaller food fish remain among the industrial catch.

The Technological Laboratory of the Danish Ministry of Fisheries has participated in the development of improved catch handling. Equipment (Fig. 1) comprises a receiving box on deck equipped with a conveyor continuously feeding a rotating drum. This drum grades the fish into two categories — industrial, which includes fish less than 35 mm thick, and food, which includes thicker species.

The receiving box is equipped to remove the few large fish and other large objects before the catch enters the conveyor and the grader. The box may receive portions of up to 2 t of fish, which are converted to a continuous flow of up to 1200 kg/minute. The food fish pass through the length of the cylinder, and the industrial fish fall through the coil into a trough equipped with a continuous supply of small pieces of ice to chill the fish to 0°C and maintain this temperature until the fish are landed. A conveyor running along the trough takes the mixture of fish and ice to a vertical conveyor that lifts the mixture 2 m above the
Fig. 1. Catch-handling equipment: (1) receiving box covered with a grid of heavy steel bars for protection against the inclusion of large objects; (2) conveyor taking the fish continuously into the grader (3) at a rate of up to 1200 kg/minute; (3) rotating grader separating the small industrial fish from the food fish; (4) trough receiving the small fish and ice, coming from the hold (5) via the conveyor (6); (5) ice store in the hold from which the ice is fed into the horizontal part of the conveyor (6); (6) ice conveyor built into the central gangway of the fish hold (the horizontal part is covered with a safety grid of bars spaced at about 80 mm, which allows the broken ice to fall into the conveyor; the vertical part brings the ice into the mixing trough [4] under the grader [3]; the conveyor speed is adjustable, with a capacity of 0-250 kg/minute); (7) conveyor lifting the mixture of ice and industrial fish 2 m above deck level, discharging it into the funnel (8); (8) funnel and plastic tubes leading the mixture to the scuttle (9) on the deck; (9) one of a number of ice scuttles installed over the hold sections for industrial fish; and (10) discharge of food fish from the rotating grader (3).

The continuous supply of ice to the trough under the grader is taken from a store of bulk ice. In the bottom of the store, a horizontal conveyor feeds the ice onto a vertical conveyor to the trough. The conveyor speed is adjustable so that the supply of ice can be varied. At landing, there should be little or no surplus ice. A fish at 15°C when caught requires about 23% of its weight in ice to be chilled and maintained at 0°C for 4 days.

Food fish passing through the rotating grader are a mixture of many species and sizes, and the total amount varies considerably. Improved equipment and facilities are required if all these fish are to be handled, chilled, and stowed properly for food purposes. The larger fish are gutted by hand, washed, and iced either in bulk or in boxes. Because of the shortage of labour and facilities, bulking of mixed fish species prevails over boxing, but grading into species and boxing are preferred because the quality of the fish suffers in bulk stowage.

At present, trawler owners are planning to place one line of containers in the central gangway. The size of this gangway and of the hatches limits the base of the containers to 1 m². The height of the containers will probably be 2.25 m, and their capacity will be about 1 t of fish each.

The chilling system is that developed by the British White Fish Authority. The containers, which are heat-insulated, are charged with ice in port before being lined up on the floor of the fish hold. Just before the container is filled with fish, seawater is added up to the level of the ice, and the contents are mixed by the introduction of compressed air at the container bottom. This circulation is maintained while the container is being filled and until most of the ice has melted and the fish temperature brought below 0°C. The container is kept closed as long as the fish temperature remains near 0°C. Repeated chilling by brief air circulation may be required during extended storage. The fish are unloaded in the containers, which may serve briefly as raw-material storage for the filleting industries. They are emptied by a tilting device.

Laboratory and pilot-plant studies have shown that it is necessary to discard the belly flaps of fillets cut from whole whiting and haddock. Such fillets should not be sold fresh; they should be preserved — frozen, dried, canned, etc.