U.S. Albacore Landings Seen Highest in 3 Years

The U.S. albacore fishery was significantly better in 1981 than during the previous two seasons. As of mid-October U.S. landings (including those from Midway) were estimated to be about 14,000 metric tons (t) and there was a possibility that the landings for 1981 would exceed 15,000 t. The total U.S. landings (including those from Midway) for 1980 were about 9,000 t and for 1979 about 7,300 t.

By mid-October, most of the pole-and-line boats were still reported to be fishing in an area off San Francisco to Fort Bragg, Calif. Pole-and-line fishermen were targeting on a large body of large albacore, ranging between 20 and 60 pounds (9.1 and 27.3 kg). There was considerable natural food in the area and the fish were often difficult to catch. Poor weather conditions also tended to hamper the fishing effort. Nevertheless, fishermen continued to operate on the body of fish with modest success and with hope that the fish would "go wide-open on the bite." During the second week and part of the third week of October, some of the pole-and-line boats worked 8-30 miles off Fort Bragg. While information on the number of fish caught was scarce, it was reported the fish were averaging 30-35 pounds (13.6-18.9 kg).

Jigboats operated mainly between Monterey, Calif., and Cape Mendocino during the first half of October. Vessels were scattered between 150-200 miles off the coast and worked with limited success when birds and albacore were sighted; otherwise catches were poor. The average jigboat scores were 10-30 fish/day/boat with top catches of generally <150 fish per day. The size of the fish ranged from 6 to 50 pounds (2.7 to 22.7 kg) and averaged about 12-16 pounds (5.5-7.3 kg). Jigboats had been generally unsuccessful at getting fish to bite in the area off Fort Bragg to San Francisco where the baitboats were operating. Because of small catches and increasing frequency of rough seas, many of the jigboats had returned to their home ports and tied up for the season.

Phosphate Treatment and Freezing of Pacific Cod

During August 1981, scientists from the Utilization Research Division of the NMFS Northwest and Alaska Fisheries Center processed Pacific cod samples aboard the RV *Chapman* operating near Kodiak, Alaska. The purpose of the experiments initiated aboard the vessel is to study the effects of various treatments, including pre- and post-rigor freezing, on quality and quality changes in frozen cod.

Laboratory evaluation of one group of samples treated with phosphates has begun. Pre-rigor and post-rigor, skin-on fillets dipped 30 seconds in a solution of 4 percent sodium tripolyphosphate, 2 percent sodium hexametaphosphate, and 2 percent sodium chloride prior to freezing are being compared to untreated fillets. At the laboratory, the fish is thawed, skinned, trimmed, and refrozen. Prior to freezing, the representative samples were evaluated for physical and sensory changes.

In general, the samples were found to be of good quality. However, it was observed that both the treated and untreated pre-rigor cod samples were considerably discolored (moderate to severe) because of the presence of blood in the muscle tissue. This phenomenon was not observed in the flesh of the post-rigor cod samples which possessed white flesh normally associated with quality cod products. Slight to moderate gaping was observed in both the pre- and post-rigor processed fillets. After deglazing the fillets, free thaw drip analysis was made. Results showed that both pre- and post-rigor treated cod fillets averaged 26 percent less weight loss (as free thaw drip) than their corresponding controls. However, the treated post-rigor fillets lost 40 percent less free drip than the pre-rigor treated cod fillets. Free thaw drip for the pre-rigor, chemically treated cod samples averaged 5.9 percent and 8.4 percent for the controls. Free thaw drip loss for the treated, post-rigor samples averaged 3.5 percent and 6.1 percent for the untreated control.

Fillet yield (as a result of skinning and trimming) from the deglazed, post-rigor fillet samples that were chemically treated averaged 78 percent, whereas their corresponding controls yielded 69.5 percent. The post-rigor fillets yielded 74 percent edible product for the treated cod fillets and 66.7 percent for the untreated control samples. Similar studies are being made on headed and gutted cod blocks.

Measuring Phenol Content of Smoked Whitefish

One of the oldest methods of food preservation has been smoking of food (primarily meat or fish) by hanging it over a fire or in a room where the fire was maintained. In recent years, liquid smoke preparations manufactured from certain varieties of wood pyrolysates have been successfully used as a substitute for the traditional smoking in a kiln. Liquid smoke has the advantage of ease of application, speed, and uniformity of product, and it may be applied in a variety of ways, such as injection, spraying, or dipping.

Microbiological studies by Mel Eklund's group at the Northwest and Alaska Fisheries Center's Utilization Research Division have shown that liquid smoke plays a very important role in the inhibition of growth and toxin production by *Clostridium botulinum* types A and E in hot-processed whitefish steaks. The degree of inhibition and storage life of the smoked product depends upon factors such as the concentration of smoke and salt and the storage temperature. A method to determine the con-

centration of smoke in the finished product was considered necessary.

The chemical composition of the liquid smoke is known to be very complex, consisting mainly of acids, terpenes, phenols, carbonyls, and polynuclear aromatic hydrocarbons. The phenols (over 40 compounds have been identified so far) have been found to contribute significantly to the desirable odors and flavors of the smoked foods. They seemed like a good choice for quantitation, even though a review of the literature showed that difficulties still exist in obtaining quantitative recoveries of phenols from smoked foods, and methods of isolating the phenolic fractions from foods are either very time-consuming or have poor recoveries.

Studies are currently in progress to develop a rapid and reproducible method for extracting and measuring phenols from smoked fish. In extracting the phenols from the fish muscle, acetronitrile was passed over a sample of homogenized tissue that was packed in a liquid chromatography column. An aliquot of the extract was then used for analysis of the phenols by a colorimetric method.

The above method was used to measure the phenol content of smoked whitefish. Two lots (1 and 2) were brined for 2 days in 3.2 percent salt solution prior to dipping in a smoke solution for 2 and 60 seconds. Another lot (3) was similarly held 2 days in a brine solution that also contained 3 ounces of smoke per gallon of brine. All 3 lots were then held an additional day at 38°F for equilibration. Results of the analyses showed phenol concentrations of 5.40, 5.67, and 8.58 mg/100 g of fish for lots 1, 2, and 3, respectively. The analyses were in duplicate and agreement among the replicates was excellent. The data indicate that a variation of about 1 minute in dip time had only a very slight effect upon the amount of phenol found in the fish tissue. An extended exposure of the fish flesh to a dilute smoke solution (3 ounces of smoked solution/gallon) in conjunction with salt resulted in higher phenol levels. Although the overall procedure still needs to be carefully tested on a series of samples before final acceptance, the outlook is very promising.

Fuad M. Teeny

Improving the Keeping Quality of Frozen Pollock Surimi

The technical and economic feasibility of a domestic fishery for the walleye (Alaska) pollock, *Theragra chalcogramma,* depends greatly on two major factors: 1) Utilizing the harvest for food as frozen fillets, blocks, and minced fish products including surimi; and 2) assurance of good quality and acceptability of the frozen products during a market period of 1 year. Current utilization research in Seattle and Kodiak laboratories of the National Marine Fisheries Service includes studies of seasonal and quality variations in the landed pollock, keeping quality of iced or refrigerated fresh fish, and methods of processing for freezing and storage in various intermediate forms.

Surimi is an important frozen minced fish product developed by the Japanese for use in kamaboko and a variety of prepared products. Japanese import regulations specify that surimi is prepared from suitable fresh fish (such as pollock) with washing (water leaching) of the minced flesh and addition of sugar, sorbitol, sodium tripolyphosphate, and emulsifying agent followed by blending, packaging, freezing, and storage.

In this study, high quality frozen whole pollock were prepared at Akutan, Alaska, in February 1980 and thawed at the Seattle laboratory 2 months later for the surimi preparation. Fresh pollock of comparable quality were not available for use as a control lot. The study variables included the effect of washing the minced flesh, the use of the additives (sugar, salt, and tripolyphosphate), and the effect of storage at 0°F (−18°C) and −20°F (−29°C).

The study was initiated by visiting scientist Javier Borderias in 1980, and the sample analyses were completed by George Kudo of the Northwest and Alaska Fisheries Center's Utilization Research Division following Javier's return in September 1980 to the Institute of Refrigeration, University of Madrid, Spain. Detailed evaluation of the physical/chemical examination and analysis of the samples from the 1-year study has not been completed; however, the following preliminary observations are apparent from the quality and chemical changes of the 12-month samples.

1) Effect of not washing. Frozen unwashed minced pollock with no additives and stored at 0°F (−18°C) was judged unacceptable in quality after 12 months of storage. Samples had high shear values, low elasticity, and high dimethylamine values.

2) Effect of washing. Minced pollock that was given a single or double wash, then dewatered, frozen, and stored at −20°F had acceptable quality and texture after 12 months of storage. Samples stored at 0°F were of borderline acceptability and showed poorer texture and elasticity values than those stored at −20°F.

3) Effect of additives—sugar, tripolyphosphate, and salt. Addition of sugar and tripolyphosphate did not improve the quality of frozen unwashed minced pollock (see item 1) after 12 months of storage at 0°F. Addition of sugar and tripolyphosphate improved the acceptability and texture of frozen washed minced pollock (see item 2) after 12 months of storage at either 0°F or −20°F. Addition of salt to the additives accelerated the adverse texture changes in pollock surimi and, after 12 months at 0°F, the samples showed poor texture and were nonelastic.

4) Effect of storage temperature 0°F (−18°C) and −20°F (−29°C). Pollock surimi (frozen washed minced flesh with the additives sugar and tripolyphosphate) was of acceptable quality and texture after 12 months of storage at −20°F. Similar samples stored at 0°F had inferior texture but were otherwise acceptable after 12 months of storage. Frozen unwashed minced pollock stored at −20°F for 12 months had poor quality and texture (nonelastic) but was still significantly superior to samples stored at 0°F.

The results of the study after further evaluation will be prepared for publication; preliminary recommendations will be prepared for industry application and further study.

John Dassow