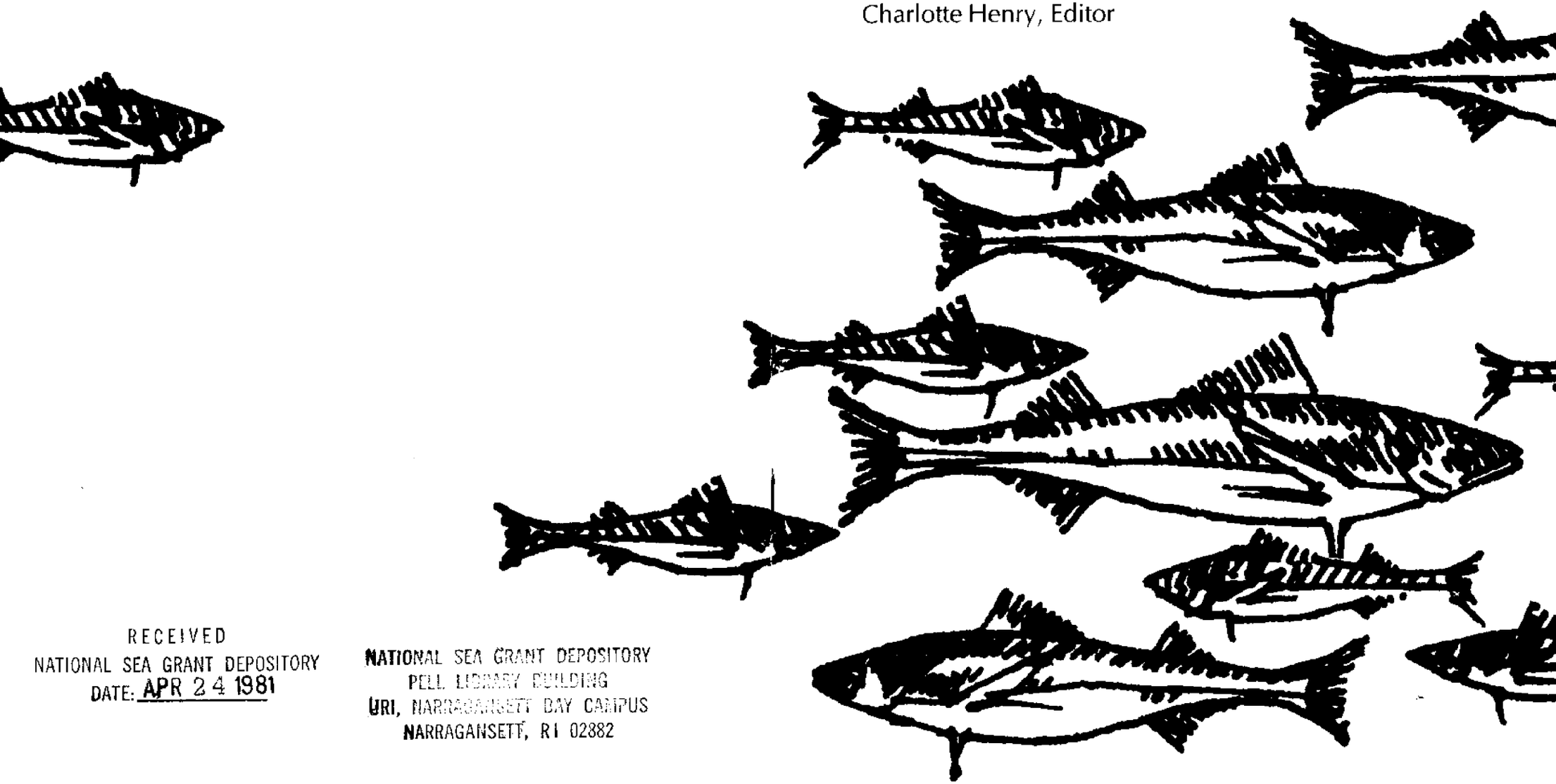
WSG-WO-81-1

$1.50

Black Cod
Boom or Bust?

Proceedings of a seminar
Seattle, Washington
February 27, 1980

Charlotte Henry, Editor



Black Cod
Boom or Bust?

Proceedings of a seminar
Seattle, Washington
February 27, 1980

Charlotte Henry, Editor

A Washington Sea Grant Publication
University of Washington – Seattle

ACKNOWLEDGMENTS

This workshop would not have run smoothly, if at all, without the help of certain people and organizations.

Special thanks go to the National Marine Fisheries Service for organizing and producing this seminar cooperatively with Washington Sea Grant. National Marine Fisheries Service Northwest and Alaska Fisheries Center contributed facilities, audio-visual equipment, and the expertise of many of their specialists. Dick Nelson of the Utilization Research Division, NMFS, provided invaluable assistance in planning, organizing, and presenting the seminar, as well as assisting in the production of these proceedings. Washington Sea Grant Communications prepared seminar flyers, coordinated publicity efforts, and published the proceedings.

Most of all, we wish to thank the participants for providing excellent presentations.

SEMINAR COSPONSORS
Washington Sea Grant Marine Advisory Services
Clover Park Vo-Tech Institute
National Marine Fisheries Service

SEMINAR ORGANIZERS
Scott Harrington, Washington Sea Grant
Dick Nelson, National Marine Fisheries Service

PROCEEDINGS EDITOR
Charlotte Henry, Washington Sea Grant

KEY WORDS 1. Black cod 2. Sablefish 3. Fisheries

Support for this seminar and publication of the Proceedings was provided in part by grant number NA79AA-D-00054 from the National Oceanic and Atmospheric Administration to the Washington Sea Grant Program.

Division of Marine Resources
University of Washington HC-30
Seattle, Washington 98195

WSG-WO 81-1
$1.50.

To receive a list of publications of interest to commercial fishermen, write for Catalog of Marine Publications at the above address.

Contents

Preface

Rising interest in the black cod fishery and escalating prices for black cod in 1979 led many people to inquire about this fishery as an alternative to more traditional fisheries. In response to these inquiries, the National Marine Fisheries Service and Washington Sea Grant sponsored an all day seminar in Seattle on February 27, 1980. Participants included commercial fishermen, seafood processing personnel, naval architects, representatives from government agencies, and others. They were interested in practical information on the status of the sablefish stocks, on the harvesting methods, on quality and preservation of the fish, and on the market for black cod. Pooling the resources of the NMFS specialists and others, this seminar focused on the experience and knowledge of those involved in the black cod fishery.

To provide this information to others interested in the fishery these proceedings were transcribed from a tape recording. The publication is not a verbatim transcription, but it does incorporate the presentations and responses to questions from the audience.

Charlotte Henry
March 1980

Opening Remarks

Dick Nelson
National Marine Fisheries Service

Scott Harrington
Washington Sea Grant

NELSON:

In cooperation with Washington Sea Grant, the National Marine Fisheries Service has arranged this program on black cod because of the many inquiries and questions about the black cod fishery. There seems to be a need for information about where the fish are available, the quantity of fish available, the best techniques for fishing, how to handle the fish, whether to freeze onboard or hold the black cod fresh, how to deal with the problem of texture, and finally--probably most important--what has happened to the market and what direction will it take in the future.

Although we don't have an official program on black cod in the Utilization Research Division of the National Marine Fisheries Service, we have studied the problems of some of the fish being soft and handling on board. Together with Scott Harrington of Washington Sea Grant, we have arranged this program. We don't believe we will answer all the questions by any means, since there are many problems that remain unresolved.

HARRINGTON:

I am the Sea Grant agent in South Puget Sound. When I got back from Alaska last fall, black cod was the hottest topic on the waterfront. Everybody was asking questions about it. Then suddenly the market got soft, and then it got awfully soft. Everybody began to get a little concerned, and the concern is still there. But there is quite a resource out there, and there is no doubt we can harvest that resource. What we hope to find out today is where the market stands and how we can make the most efficient use of the black cod resource. We hope to answer your questions and clear up a lot of misconceptions.

Resource Outlook

Location and Status of Stocks

Loh Lee Low
National Marine Fisheries Service
Resource Ecology and Fisheries Management Division

I will discuss briefly the general history of the black cod fishery, and then discuss the status of the stocks, which will give an idea about the outlook for the condition of the stocks. Finally, I will touch on the management of the fishery in terms of the optimum yield being set by the management council, which will affect the foreign fisheries off the U.S. coast.

Figure 1 shows the general geographic distribution of sablefish or black cod. Sablefish is a North Pacific creature--you will not find many sablefish in other parts of the world. The distribution of sablefish ranges from the Kamchatka coast, along the northeastern coast of Japan, following the edge of the continental shelf in the Bering Sea and along the Aleutian Island chain, and southward along the entire Pacific coast of the United States. By and large the bulk of the distribution—or the center of distribution--is located in the Gulf of Alaska. The shaded portion is the region where you will find most of the sablefish; that region coincides with a rapid drop of ocean depth between the depths of about 400 and 700 meters. There may be concentrations of sablefish at deeper depths.

Figure 2 shows the Japanese catch distribution in the Gulf of Alaska in 1977. This graph is representative of the rather uniform distribution of catches throughout the Gulf. In any single statistical block, no more than 6% of the sablefish is taken. For the resource as a whole, the distribution of sablefish is as follows: 25% in the Bering Sea, 4% in the Aleutians, 47% in the Gulf of Alaska, and 25% off the coast of British Columbia, Washington, Oregon, and California.

From 1915 to 1959 the annual catch (world wide) fluctuated between 5,000 and 7,000 metric tons. In 1960 the foreign fishermen became active in the black cod fishery. Total catches rose until about 1972 when the peak was reached at more than 65,000 metric tons. In the northeast Pacific, from the Gulf of Alaska down the coast through California, 71% of all the black cod was taken by longline gear, and 26% was taken by trawl. Now the catch taken by longline has increased

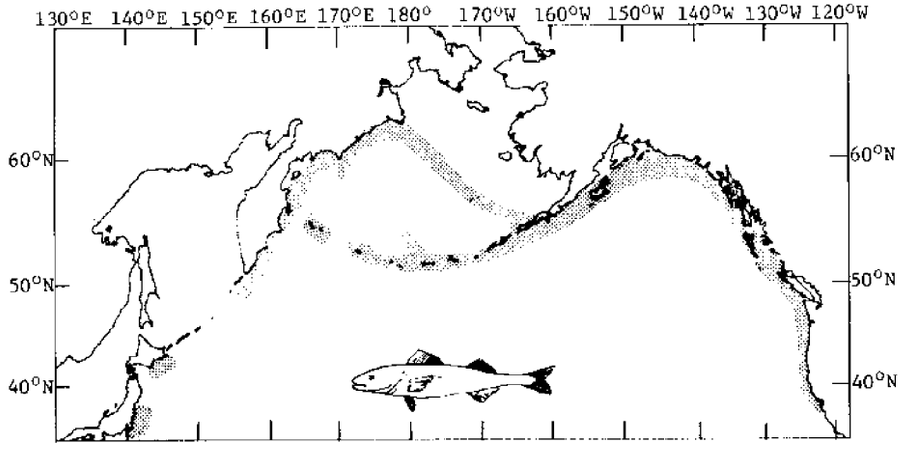


Figure 1. Geographic distribution of adult sablefish.

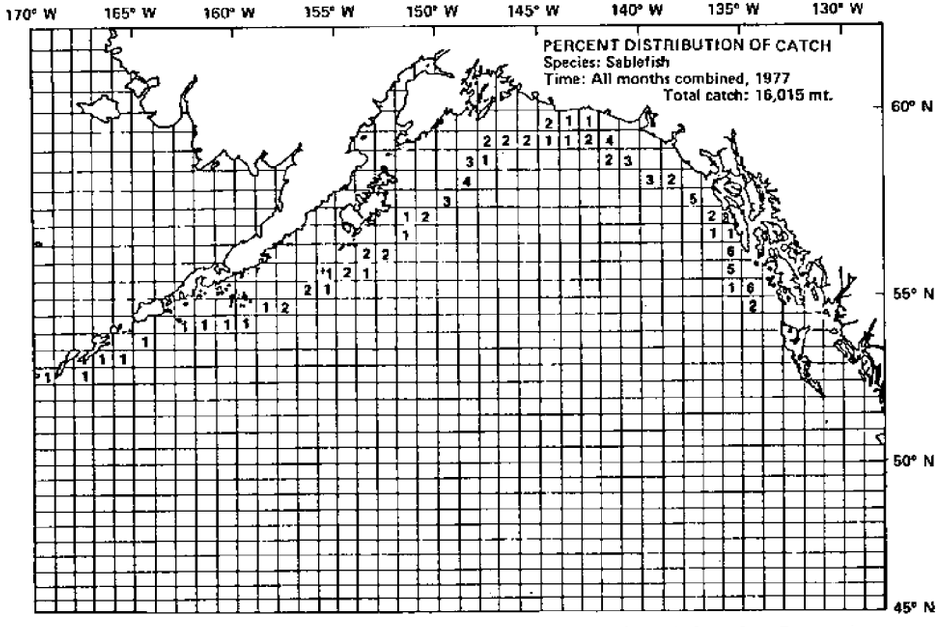


Figure 2. Percentage distribution of sablefish catches by Japan in the Gulf of Alaska, 1977.

to 90%, trawlers being allowed only an incidental catch of black cod. So black cod is more or less a longline fishery. Prior to 1957 sablefish was exclusively a Canadian and U.S. fishery. By 1963 the U.S.S.R. and Japan had become involved, Japan developing into a dominant harvester. By 1968 there were five nations involved--Korea had entered the fishery. In 1975 the Republic of China (Taiwan), Poland, and East Germany had appeared. Although sablefish was not a target species, these countries did catch it on an incidental basis. Since the 200-mile legislation, the U.S. and Canada have restricted quotas of sablefish, offering the Japanese a limited allocation in the Bering Sea and the Gulf of Alaska, and the Soviet Union an allotment on an incidental catch basis.

I will now discuss the status of stock evaluation. We depend heavily on Japanese catch records. By following the catch-per-unit-of-effort (CPUE) trend, we were able to infer what might be happening to the black cod resources. CPUE is just one indicator, but it is our principal indicator of abundance. There are many other methods we use to monitor black cod abundance and although some of the data are not historically complete, they provided us with some indication of what is happening to the abundance of stocks. The point is, by using such crude indicators of abundance, we are able to track the abundance of black cod by region: by four different regions in the Bering Sea, one in the Aleutians, by several regions in the Gulf of Alaska, and so forth. The Japanese fishery historically has not been very active off the coast of Washington, Oregon, and California. In this area we must rely on state fisheries statistics, but since the sablefish fishery has not been that active historically the information has not been very useful.

In the Bering Sea we find that the catch-per-unit-of-effort (CPUE) fluctuated around a fairly high level of abundance before 1964. Since 1965-66 the abundance of black cod stocks has fallen and is presently at a very low but stable level. The main trend is downward. The same is true for the Aleutian region, CPUE has gone down and now is at a very low level of abundance. The stocks of the Gulf of Alaska reached peak abundance in 1972 and have since shown a decline. The decline in the black cod stock abundance first appeared in the Bering Sea, on the outer edge of the black cod distribution--the center of distribution being in the Gulf of Alaska. Then it appeared in the Aleutians and is now apparent in the Gulf region. These declines have since been reflected in the quotas and in the setting of optimum yields for the different regions. In the Gulf of Alaska we tracked the stocks by different regions, the western Gulf, northwestern Gulf, northeastern Gulf, and southeastern Alaska. Again, the general trend is downward. The peak abundance probably occurred in 1972. The information is not as complete for the area off the Washington, Oregon and California coasts; however abundance seems to be stabilizing.

Before the creation of the Pacific Fisheries Management Council (PFMC) there were small regulations restricting gear type, area, and time of the foreign fisheries, which indirectly affected sablefish. However, there were no direct management measures on sablefish. In 1973 Japan made an agreement with the United States to restrict its fishing activities voluntarily off California, Oregon, and Washington to 25,000 metric tons, but it was the only country whose catch of black cod was limited until 1976. That was the only regulation that directly affected sablefish before the 200-mile legislation. All the other nations were not allowed to target on sablefish but were not limited in their incidental catches.

In closing, I would like to say that we have prepared a couple of

reports on sablefish studies which are entitled: "Sablefish of the Northeastern Pacific and Bering Sea" and "Preliminary Report on the Bio-Economic Considerations of Harvesting Sablefish by Longline and Trawl Gear in the Gulf of Alaska." These are available from the Northwest and Alaska Fisheries Center at 2725 Montlake Boulevard East, Seattle, 98112.

Harvest Methods

NMFS Experience with Longline and Pot Fishing

Steve Hughes
National Marine Fisheries Service
Resource Assessment and Conservation Engineering Division

In July 1978 the Japanese fisheries were restricted to areas west of 140° W longitude. They no longer dominated the black cod fishery off the coast of Alaska. In 1979 the total U.S. black cod landings were three times that of the Japanese, Japanese totals being 6,500-6,900 metric tons contrasting with American landings of 21,000-22,000 metric tons. However, the tide has turned in the three or four years since the North Pacific Fisheries Management Council's plan on black cod has been in effect. Since the Pacific Coast management plan on black cod is not in effect and will not be until at least November of 1981, fishermen off the Washington, Oregon, and California coasts have one more year to fish outside the control of any management plan.

The changes which have occurred in the black cod fishery are described below. In 1976 all Japanese and Korean activity off the coasts of Washington, Oregon, and California was halted as a result of bilateral and trilateral negotiations. In 1976 and 1977 a series of actions were taken in southeastern Alaska to limit the Japanese longliners in several areas. This occurred for two reasons. First, the American effort was increasing. Second, under the 200-mile limit legislation, the United States claimed priority over the resources available for harvest. As soon as the United States is able to build up its fishing effort to harvest the optimum yield of black cod, foreign fishermen will not be allowed to harvest these fish. Although this takes time, foreign fishing effort is being eliminated gradually. For example, between 1976 and 1979 the Japanese fishery for black cod in southeastern Alaska was eliminated. The Japanese may no longer fish south or east of Yakutat (140° W longitude).

As a result of the good prices, many people got into the black cod fishery during the last two years. As U.S. landings increased, the North Pacific Fishery Management Council initially reduced and finally removed the Japanese fishing effort from southeastern Alaskan waters.

For a number of years, Japanese landings of black cod exceeded 40,000 metric tons. As the Japanese quotas were cut back to 6,500 metric tons, the price of black cod on the world market soared. This made it possible for U.S. fishermen to enter the fishery.

The American black cod fishery began in California and moved north. Presently, the fishery is concentrated in Washington, southeastern Alaska, and the eastern central Gulf region. The American fleet presently harvests or exceeds the maximum sustainable yield in California and Oregon.

There is a shortage of black cod on the world market as a result of the cutback in Japanese landings, and the Japanese control the price of black cod on the world market. As the landings of the Japanese have been cut back, the price has increased as a result of decreased supply and increased demand. In recent months the North Pacific Fisheries Management Council has taken steps to move the abstention line for the Japanese further west of 140° in the hope that the entire eastern Gulf of Alaska can be opened to U.S. fishermen. The deterrent is not a lack of U.S. fishing effort but a lack of U.S. markets.

Black cod are a deep-water species; however, the depth distribution changes seasonally. During the winter black cod are at the deepest range of their distribution—that is from 400 fathoms to more than 1,200 fathoms. Unfortunately, very limited information is available about maximum depth distribution of black cod. Because of this lack of information, the biomass estimates and potential yield are probably underestimated in many areas. This fact is particularly evident in the California fishery where there is considerable fishing effort out to 1,000 fathoms.

The U.S. fishery got off to a good start, primarily as a result of U.S. rectangular pots and Korean-type pots, which have been used extensively in the last few years. From California, the fishery moved into Oregon, and then into Washington. At the same time it was developing at a slower but steady rate in southeastern Alaska. Presently there is little U.S. effort in the black cod fishery west of Kodiak.

The amount of black cod caught by foreign trawlers is insignificant. Black cod generally are found at depths beyond where most dragging takes place. At the present time there is no foreign trawling off the coasts of Washington, Oregon, or California except for the hake fishery. In southeastern Alaska there is minimal dragging and probably fewer than 100 metric tons of black cod are taken by all draggers in that area. The Bering Sea trawl fishery and the western Gulf trawl fishery take of black cod is an ongoing quota, but it is essentially insignificant. In most cases it is less than 2% of the total catch.

In 1979, a total of 17,000 metric tons of black cod were harvested off the California, Oregon, and Washington coasts. According to figures of the North Pacific Fisheries Management Council, there were approximately 4,000 tons of excess harvest relative to the optimum sustainable yield. The fishery off the California coast is presently saturated, and by its own doing has leveled off. The percentage of landings coastwide does not indicate the levels of abundance. Black cod is not more abundant in California and Oregon than in Washington; the fishery developed sooner in those areas and presently is saturated. It is my guess that in 1980 the major growth in the fishery will be in the Washington and Alaska areas.

The wholesale prices in Tokyo for longline caught, Japanese-dressed black cod are the key to world prices on black cod. In 1977 the prices

Table 1. Total domestic black cod landings, 1976-79

Location	1976	1977	1978	1979
		---Metric tons---		
Washington	641	1100	1800	2600
Oregon	641		1600	7600
California	600	6000	7100	7100
Southeast Alaska		1500	3200	

began a rapid climb from a low of about 50 cents per pound to a high of $1.40 per pound. The Japanese market is complex. There are about five or six different sizes and the price varies with each size. The two above figures were derived by taking an average of the prices for each size.

The reasons for the decline in the price of black cod are complex. The major foothold in the black cod fishery left to the Japanese off our coast is the market. The only hope for continued Japanese allocations of black cod in U.S. waters is to manipulate market prices. By manipulating the market and keeping prices low, the Japanese hope to discourage U.S. fishermen from entering the fishery, hence retaining a larger allocation for themselves. Whether this ploy will work for long is questionable, but that's what is presently happening.

The other major factor affecting the market is a tremendous surplus of salmon from the 1979 Bristol Bay run as well as from the Hokkaido run in Japan. The black cod holdings for 1979 in Japan do not exceed the 1977 or 1978 holdings tremendously; however, the Japanese blame the slump in price on the oversupply of black cod. A more probable factor affecting the price of black cod is the tremendous decrease in salmon prices, both of Bristol Bay and Hokkaido caught salmon. Since the Japanese consumer can buy salmon at a price lower than the 1979 summer price of black cod, there is more salmon than black cod moving through Japanese markets. The only solution to this problem—and what many people in the industry have been doing in the past year—is to develop markets in Europe and domestically. But this takes time.

There are essentially two kinds of black cod gear: pots and longlines. Pots are used primarily off the California and Oregon coasts where the substrate is mostly clay and gravel. From the central coast of Washington off Point Granville the bottom changes into a rock stratum which continues up through southeastern Alaska and into the Gulf of Alaska. It is in these rocky areas where longline gear tends to be superior in catching power. The catch rates from NMFS research in southeastern Alaska would by no means support a commercial pot fishery. However, out of Kodiak and on toward the Aleutians the bottom type changes once again to a softer substratum where pot fishing might be financially feasible.

The price for longline-caught fish is consistently higher than pot-caught fish due to better quality. The price for pot-caught black cod in Oregon and California has ranged from 15 to 45 cents while Alaska longline-caught fish have brought between 35 and 55 cents. The Japanese are starting to appreciate the difference in the quality of longline-caught cod which is firmer than those caught in pots.

National Marine Fisheries Services has conducted a number of studies on black cod over the last 10 or 12 years. One of the studies involved the tagging of 40,000 fish off the California, Oregon, Washington and Alaska coasts. About 80% of the black cod that are recaptured after being tagged are caught within 50 miles of where they

were initially tagged. This return indicated that black cod are a fairly residential fish. While there distribution is tremendous, the majority of the fish occupy a rather small area during their life span. On the other hand, there were a few cases where fish tagged in Puget Sound were recaptured in the Bering Sea.

If anyone catches tagged black cod, the National Marine Fisheries Service appreciates getting the tags back. Tags provide information on the migration and the growth of this fish. The tagging has been a cooperative effort among federal and state agencies, and Japan and Russia.

We are presently involved in a number of biochemical genetic studies to study black cod stock distribution. Some preliminary results suggest that black cod stocks in the Gulf of Alaska are genetically different from stocks off the Washington, Oregon, and California coasts. These differences must be considered in designing management plans. A comparison of the quality and general characteristics of black cod found off the extreme southern California coast and off Mexico and those found off the northern California coast suggests two stocks of black cod. Although NMFS has not done any biochemical genetic studies in the Bering Sea, it looks as though the stocks off the coasts of California, Oregon, and Washington may be separate from the stocks in the Gulf of Alaska.

There are two types of pot gear: Korean (conical) pots and larger rectangular pots. The conical pots weigh about 40-50 pounds and cost about $60-$70. They are a very effective type of gear. The problem with conical pots, particularly in the California and Oregon area, is that they seem to take a very high percentage of small fish, which has created a marketing problem. From an operational standpoint, the conical pots are nice to handle. A good-sized vessel can fish anywhere from 300 to 600 of these in a day. On the boat we fished last summer, we hauled 50 pots, rebaited them, set them out again and iced the fish in two hours. The catch rate from these pots varies tremendously. The conical pots can average 35 to 50 pounds of black cod per trap. With the rectangular pots, you can't fish as much gear in a day, but the average catch per pot is somewhat higher. The most I've seen in a rectangular pot is about 400 pounds; however, the average is probably closer to 70 or 80 pounds.

The pots are set on a longline system with buoys and flagpoles at both ends of the line. Attached to the groundline with snap-on gangions, there can be between 20 and 100 pots to a skate depending on the size of the boat and where you are fishing. The most common distance between pots is about 30 fathoms. The vessel normally runs about 4-5 knots while setting gear.

A big hangup with this fishery is the thousands of fathoms of line the fisherman must coil. The best way to handle line, if the space is available, is not to coil it, but rather to put it directly into the fishhold. The line and gangions are piled directly into the fishhold and come out in the same manner. With this method, you can haul at full power block speed, dropping the line and gangions into the hold and stopping only when the pots break the water in order to unsnap the gangion from the pot bridle and lift the pot aboard. As soon as the pots have been unsnapped, the block directs the line into the hold. This method works well. It increases the amount of gear you can haul in a day and reduces the number of crewmen needed. It is not, however, a viable option on vessels where space is limited.

We use 30-50-pound Danforth anchors at the ends of the groundline. Depending on how swift the current is, anchors sometimes aren't necessary. If the anchor gangion is a different color from the other

gangions, you can tell when you've reached the end of the groundline and should attach the anchor. The buoy line is next with a buoy and a flagpole at the end. In hauling gear on the research boat, we didn't have a hold to put the line in, so we used fiberglass tubs. On a smaller boat this beats coiling on the deck.

Incidentally, we spent about four days around seamounts in the Gulf of Alaska where we found a tremendous amount of black cod. There are 10 to 12 big seamounts in the Gulf of Alaska which are about 200 miles offshore and rise from depths of about 2,000 fathoms to within about 200 to 400 fathoms of the surface. Surveyor Seamount is the largest: it has about 70 square miles of flat-top surface. Right on top, large quantities of black cod can be found. Since seamounts seem to harbor large quantities of black cod, a vessel with freezing capabilities might do very well fishing around them.

As for bait, pots fish well with herring. An alternative which is cheaper and just as efficient as herring is California squid. Recently squid could be purchased in ten-pound bags for about 22 cents per pound. Squid has a very high oil content and works well as black cod bait.

As previously indicated, longline gear is preferred off the Washington and Alaska coasts. There are essentially two longline systems available for smaller boats. One is the Huff system, which is a semi-automated system that has gained a lot of acceptance by the industry. George Johnson, owner of the F-V Ocean Storm, indicated his crew was attaining consistently 12,000-15,000 hooks of effort per day with Huff's automated longline system.* The MARCO system, a competitive product, is more expensive. This system can fish only a fixed number of hooks because of the way the system is set up. The company advertises about 9,000 hooks of effort a day; however, the fishermen I've talked with are getting around 8,000 hooks a day. It's a good system for vessels under 80 feet long; however, in making a cost analysis on the fishery—that is determining the number of hooks you can set a day—the catch rate is about .5 pound of dressed black cod per hook. So if you are able to set out 10,000 hooks every day, you could average about 5,000 pounds of dressed black cod a day. These figures come from the southeastern Alaska area for 1978-9, but hold true in British Columbia and Washington as well. If you are thinking of entering this fishery, you can look at whether it appears to be financially feasible by figuring out the daily income and weighing that against expenses.

The other system presently available is the Mustad system--a fully automated and very expensive system designed for vessels larger than 80 feet. It costs from $90,000 to $120,000 and requires a fully sheltered deck or van. A crew of six people can fish approximately 25,000 hooks a day. A crew of ten can, in addition, dress and freeze the fish. Most vessels that are getting the Mustad, and a number that already have the system, are larger vessels that operate the western Gulf of Alaska and dress and freeze their fish at sea. For a vessel of that size, where the operating costs are considerably higher, a system such as this offers the increased efficiency and effort needed to make it worthwhile.

With stricter controls on quality, these larger vessels may have an advantage over the smaller ones. The southeast Alaskan longline fishery is mainly made up of small boats that ice their catch. The

* Mention of commercial products does not constitute endorsement by the National Marine Fisheries Service or the Washington Sea Grant Program.

smaller vessels must run back and forth unloading their catch, while the larger vessels come in when they are loaded. When the weather blows, the larger vessels are able to lay out a storm, whereas the smaller ones must retreat.

Black cod spawn over a six-month period in deep water, approximately 350 fathoms out. While the fish are spawning, they tend to be more concentrated than during the summer when they are in their feeding cycle. Fishermen using pots do extremely well on these spawning concentrations, when the fish are in schools. Fish in deeper water tend to be smaller and softer and are subject to bruising in pots. They are generally of poorer quality than longline-caught fish, which usually are caught in shallower water during the feeding cycle. These fish have recovered from spawning. By and large, with Korean pots the catch will be about 60-70% small fish and 20-30% large fish. Longline gear produces just about the opposite, around 60-80% large fish and 20-30% small. The tremendous amount of small fish taken by Korean pots off the California and Oregon coast is hurting the market.

A lot of people believe no automated system can replace hand baiting. The Mustad system doesn't have a snag bait system, it has a positive bait system by which the hooks are double baited. In other words, the hook goes through both skins, and comes out in a chunk of bait. It's as good as hand baiting. For example, as I watched 5,000 hooks being baited there was only one hook that was not baited. It's said that 95% of hooks are baited with this system. The MARCO and Huff systems use a snag bait system which does not positively fix the bait on hooks in all cases. The snag system baits fewer hooks effectively. On the one hand there is an increase in the number of hooks per day in both the snag bait system and the positive bait system over hand baiting. However, the snag bait system is not as efficient as the positive bait system.

The market for Pacific cod is beginning to look good. Any longline gear is directly compatible with Pacific cod. I think this is going to be the next big domestic fishery to open up. With any of the longline gear, you can switch from black cod to Pacific cod. Pots, on the other hand, are not an effective way to catch Pacific cod, even though you may find a few in the pots.

Harvest Methods

Observations of One Fisherman

Warren Huff
F-V *Urania*
Warren Huff, Inc.

First, I make no claim to being a highliner or any kind of expert. I'm a longliner for halibut and black cod, and build and sell automated black cod systems.

As for longlining for black cod, it's quite simple. If you put the right bait on the right gear, put it in the right place and run enough hooks, you're going to catch fish. Once you've caught the fish, if you process and refrigerate them properly, sell them for the right price, and keep your expenses down, you'll make money.

If you have not longlined before, you need to know that it's very hard work—probably harder than any other fishery. I know of one larger troller who rigged up last May, fished four days, made $10,000, quit and went back to trolling. He said he had to work too hard black-codding.

On their longliners in the eastern Pacific, the Japanese have pretty well established that squid is the most productive bait. American fishermen have found that squid baits better than herring in automatic baiters. In Oregon and Washington squid is plentiful and cheaper than herring in most ports, but in the past this hasn't been true in Alaska. I've heard that bait herring in Alaska will cost more than $.40/lb. this year whereas last year small Japanese squid was approximately $.53/lb. in Pelican, Alaska, while it was $.20-.26/lb. in Newport, Oregon. So if you fish Alaska, securing reasonably priced squid could be a problem. San Diego squid fishermen only receive about $.05/lb., so here is a case where the catcher and the end user should get together. Daily bait usage in black-codding will run 70 lbs. plus per 1,000 hooks. That figures out to a boat running 10,000 hooks per day for six days to 4,200 lbs. or more per trip. At the end of any kind of season that's a lot of bait, so it is worth some effort to obtain quality bait as cheaply as possible.

As to gear, if you talk to ten different fishermen you're apt to get ten totally different gear recommendations. Hook sizes range from #6/0 to #10/0, spacing from 30" to 84". I personally believe spacing

of 32" to 42" has proven itself on the better U.S. producers. Groundline may be anything from 1/4" floating poly to 3/8" tarred nylon. Although it appears that light-floating poly with intermittent weights may be more productive off Oregon and Washington, in my opinion leaded poly or such sinking gear is superior off Alaska.

The right place off Alaska isn't quite so hard to find because there is a steep, narrow edge and the cod will be somewhere among the nooks and crannies along that edge; whereas down in this country the edge may be a gentle slope 20 to 40 miles wide with fish roving around in tight schools. Finding productive quantities will require luck, prior ground knowledge and a very good recorder.

I would also like to suggest that everyone use tall flagpoles with radar reflectors on his gear. This would help other boats avoid "setting you down" and also avoid obvious gear conflicts. Besides, it makes it much easier to locate your own gear.

If we are going to get top prices for our fish, top quality is a prerequisite. In this regard, black cod are no different from large red king salmon. They must be protected against the sun--slime fish will sunburn quite easily with noticeable quality deterioration--proper cleaning and scraping is very important. I've found it takes twice as long to thoroughly scrape a fish as to head and butcher it. If the entrails are not scraped well, the fish will sour in a very short time. Proper icing and refrigeration for anything over a 3-day trip is a must. If we're to compete in any market, domestic or worldwide, the oldtimers and newcomers alike must do whatever is necessary to insure top quality.

As to the right price, if we're to have a decent, stable price, then we must get out from under market domination by Japan and Korea.

I have a few more opinions not specific to longlining but pertaining to black cod in general.

The first is regarding the inordinately high percentage of small and medium size fish taken by pots. I've been told the average take off Oregon of large fish by pots is approximately 25%--the balance being mostly small or medium. This, when considered with the millions of pounds taken by pots, is in my opinion, totally unacceptable. I have no wish to see pot fishermen put out of business or even severely restricted, but there must be some way of reducing the taking of undersize and immature fish such as larger mesh size, escape rings or as a last resort, releasing the live small fish when the pots are hauled.

Now here I may differ with some biologists, but it has been said by one biologist from Newport that these undersize fish are different fish from those caught by longliners whose percentage of large fish is 75-85%. These small fish supposedly are all males which will never grow to the larger size. In my opinion this is pure nonsense. I've butchered thousands of pounds of sablefish with the percentage of large fish 75% and over and a very large percentage of those were males. It is also difficult to believe that among all these undersized fish there isn't a proportionate percentage of females. I'm not attempting any shots at biologists, but when authoritative statements justify obviously poor conservation or harvesting practices, then they should be challenged. In any case, something should be done about the taking of undersized fish as this practice can only have a long-term adverse effect on the industry.

Another problem developing in the industry is that some areas such as Monterey and Sitka are approaching overcrowding with longlines and pots. One other area is also overcrowded and that is all of Alaska west of Cape Fairweather. The only difference is that this area is

overcrowded with Japanese, Korean, Russian, Polish, and now even Mexican vessels. Our fleet is expanding so rapidly that we must have this area for our own fishery, and according to my understanding of our 200-mile limit law, we are entitled to it and can evict foreign fishermen when we develop a fishery to its maximum potential. We have proven in just one year we can rise to this challenge.

I'd like to hit on one last item and that's our marketing. At this time Japan controls almost all the west coast market for sablefish, and with the exception of a limited number of pounds to the east coast smokers, they are about the only game in town.

It bothers me that Japan dictates the price we will be paid for our fish and Japan also owns most of the black cod fleet west of Fairweather. If our fleet expands and Japan is displaced, in all probability Japan will have to scrap the bulk of its black cod fleet or find a new fishery. However, if Japan keeps the price paid for U.S. black cod down, that country may get a few more years for its vessels in western Alaska since our fleet can't expand on poor fish prices.

The way I see it we must do two things: one is to get the foreign black codders out of all Alaska now. This relieves Japan of the problem of our prices versus their fleet. The second thing that must be given immediate attention is the development of other markets, such as Europe, China, a domestic market, etc. For example, smoked sablefish is excellent and would be well received locally, yet I've never seen it in any of the supermarkets in this area. If our governmental agencies want to assist our fishery, then let them help find and develop new markets.

Right now it's anybody's guess what kind of price we're going to receive for our fish this season. But there is no question that our expenses will be up--such as fuel by more than 50%, gear costs by more than 25%, bait, groceries, insurance, and the list goes on and on. The world wants food, but we must be able to make a living producing it. Otherwise, at today's high interest rates and tight money, we won't be able to borrow the money to tide us over a poor year!

(Editor's note: These are the original notes prepared for Mr. Huff's speech and may vary slightly from the speech given at the seminar.)

Preservation and Quality

Methods of On-board Handling

Dick Nelson
National Marine Fisheries Service
Utilization Research Division

We will begin this afternoon's program by discussing the on-board aspects of black cod quality and learn something about the problems that should be avoided. (Please bear in mind that we have not studied the problems peculiar to black cod.)

When a fish is brought on board, it should be headed and gutted as soon as possible. Cutting the fish allows it to bleed, which improves the appearance of the end product and slows down undesirable changes affecting the fish during frozen storage. Gutting decreases or eliminates spoilage due to the autolytic action. It is difficult to specify the length of time before spoilage occurs. Some fish will bellyburn in a very short time, while others will not. The rate of spoilage depends on gut content in the fish and temperature. As a rule of thumb, if you plan to deliver fish several days after they are caught, the kidneys should be scraped and the gut should be washed. There are factors to consider in the care of fish: rigor mortis, slime formation, and bleeding. Before freezing, fish should go through rigor, stop producing slime, and be bled. Making sure a fish is cleaned well is a problem when the belly isn't cut because it is difficult to insert your hand in the fish and do an adequate job of scraping. However, if that is what the market demands, you must accommodate the market but still do an adequate job of cleaning. It is very important to wash the entrails and blood from the gut cavity. Black cod seem to be very susceptible to sunburning and other changes that occur from drying out in the sun, particularly the onset of oxidation. These fish go through what is called an "induction period" before oxidation begins. It is important to keep the fish covered. Use something porous, such as burlap, so that the fish can be kept wet, rather than a dark-colored, plastic tarp that absorbs the heat.

I have received many questions about the benefits of icing as opposed to storing the catch in refrigerated seawater (RSW), and fresh versus frozen storage.

I will begin by comparing icing and refrigerated seawater. Both

refrigerated seawater and slush ice provide adequate conditions for a short trip; however, beyond several days ice is preferable. I question the benefit of RSW for even a short trip for several reasons. There is a noticeable increase in the salt content of fish kept in RSW which causes a different spoilage pattern. A different microorganism grows in RSW that does not grow in iced fish. After about a week, the quality of fish held in RSW is significantly poorer than in fish held on ice. The changes occurring in frozen storage, such as the development of rancidity, are accelerated in RSW-held fish. As far as icing fish is concerned, an experienced fisherman knows that as long as black cod are thoroughly cleaned and well iced, they will be of relatively good quality for about 10 days. I believe RSW held fish should be held no more than 5-7 days, especially if they are gutted. Longer holding results in excessive salt in the flesh.

There has been considerable interest in slush ice and in particular in the so-called "champagne" system. The champagne system differs from the regular slush ice system in that air is bubbled from pipes located in the bottom of the wells. The air bubbles break up any icebergs in the well and cause some circulation to even out temperatures. A problem with both systems is that an iceberg in the well may cause damage as the vessel rolls and pitches. Therefore neither system should be used if the wells are large. Although both regular slush ice and the champagne system will provide rapid cooling, neither can be used for more than a few days unless ice is added or mechanical refrigeration is used in the combination to maintain proper temperature.

There are several factors to consider with regard to fresh holding on board as opposed to freezing. If fish are fresh, buyers can inspect the quality of the product. They can't look into a frozen fish and see just how well the gut is cleaned. This is a major objection of buyers to frozen fish. By freezing on board, there is the major advantage that you can stay out longer and fill the hold. Another advantage is that you have the opportunity to freeze fish when it is absolutely fresh and at peak quality. Buyer confidence in the fisherman's ability and reliability for consistently delivering top quality can overcome the objection regarding need to inspect the fish.

With regard to freezing methods, you have a choice of brine or blast freezers, shelf freezers, vertical-plate freezers, or a combination. As far as I know, no one on the West Coast is using a vertical-plate freezer.

Earlier there was a question about propylene glycol freezing. We examined several samples of black cod frozen in a system using propylene glycol as a freezing medium. Initially we noticed that the quality of the fish itself was excellent. The outside of the fish, however, had an unusual appearance. It probably would be more difficult to put a good glaze on this fish. Most important, the layer next to the skin and belly cavity had a flavor definitely due to propylene glycol. Although we did not analyze for propylene glycol in the fish, there was no question it did contain some. We concluded that it might be detected by the buyer even though the interior of the fish was in excellent shape as the tissue near the skin left a bitter aftertaste. The propylene glycol content of the fish raises the question whether the Food and Drug Administration would allow its usage. Although we have not contacted the FDA in this regard, I personally doubt whether they would put their blessing on it. I understand the Japanese use a propylene glycol system for freezing tuna. This would probably work quite well, since tuna is handled in a completely different way: it is soaked in water and precooked, which

would aid in eliminating any residual propylene glycol. I certainly would not advise trying it with salmon.

A sodium chloride brine has been used in many applications and will be used for many years to come. It has certain advantages, in that it is relatively easy to use. However, there are disadvantages as well. Sodium chloride brines are difficult to work with below 5°F, which in my estimation is too high a temperature for satisfactory freezing of black cod. Black cod has an oil content which ranges up to 25%, which makes it rather soft at those temperatures. It doesn't actually completely freeze above zero, due to the high oil content. Furthermore, when you freeze fish in sodium chloride brine, there is a significant intake of salt noticeable in the product. The higher salt content makes it more difficult to apply a glaze to the fish and can induce more rapid development of oxidative rancidity in the frozen product. It is also more difficult to control the shape of the fish in freezing.

That leads us to a more conventional style of freezing, the blast freezer. The evaporator coils can either be overhead or in a separate area in the hold. If nothing else, have a rubberized canvas or a neoprene curtain to section off a part of the hold so you can blow the air past to do a satisfactory job of freezing. My recommendation is combination of moving air and shelf freezing, from a standpoint of quality and convenience. Freezing temperature should be in the vicinity of -20°F or lower. Most black cod boats should have a freezing capacity of 5,000 to 8,000 pounds every 24 hours.

The vertical-plate freezer is another alternative. The Europeans, particularly the British, have used this method for freezing at sea for a number of years and seem to get along pretty well without it. I question its advantage in the black cod fishery due to its size. The end product is a 100- to 200-pound square block of fish. Although the vertical-plate freezer utilizes space much more efficiently, when the fish have thawed you can tell they have been frozen in a vertical-plate freezer because of odd shape due to squeezing the fish together.

In regard to freezing time, it is important to know that time required for freezing is increased by the square of the thickness of the product. In other words, if a one-inch thick portion of fish takes one hour to freeze, a two-inch thick portion takes four hours, and a three-inch thick portion takes nine hours. These are examples, not actual freezing times. I am just calling your attention to the fact that freezing time increases with the square of the thickness of the product. This assumes you are freezing from both sides simultaneously. If you have a through-put in your freezing system of two to three loads per day, you will be in good shape. Shelf space can be designed accordingly.

Preservation and Quality

Ice and Modified Atmosphere Storage

Harold Barnett
National Marine Fisheries Service/Utilization Research Division

First, I will summarize some work we did in September of 1979 with black cod off the coast of Washington. We did well over 300 pounds of black cod when we returned to Seattle. The fish were caught in pots set at 90 to 450 fathoms. The fish ranged in length from twenty inches on up, so we had a random sampling of small, medium, and large fish in this test. The objective of this experiment was to compare the relative merits of storing whole and butchered (headed and gutted) black cod in ice and also butchered black cod in a modified atmosphere.

At the laboratory, the fish were weighed out and iced in totes. Some of the butchered fish were placed in a special container designed to hold a specific gas: in this case, we used 90% carbon dioxide and 10% nitrogen. The results from the fish held in this modified atmosphere will be discussed later. The iced fish were stored in a 35°F cool room for a total of 17 days from the time they were caught.

We periodically examined the iced fish microbiologically, chemically, and organoleptically. The organoleptic testing was confined to evaluating the fish by smell, visual observation, and cooking. These were the results. The TBA (Thiobarbituric acid) is a method of evaluating the rancidity in fish. Someone asked us what really happens to iced fish. Well, if gutted and exposed to air, there is a potential problem of rancidity. The results indicate that the fish held in the round were slightly less rancid, but a 0.25 TBA value is not very high for these fish. As a result of these analyses, I can say that these fish were not rancid. This was corroborated by our sensory work. No significant changes were observed in the pH of the fish to indicate spoilage. I'm a little surprised that we didn't get an increase (more alkaline) in the pH level of the fish held in the round.

The total bacterial count is the interesting aspect of our research. There was not a large increase in the bacteria count for those fish headed and gutted immediately after landing, nor was there a large increase of bacteria in the fish held in the round, but there was

a substantial difference in the two. Each time the fish were examined, we took them out and re-iced them. These were obviously ideal conditions, but we wanted to see how long the fish could be held and still have an acceptable product. We used a total plate count of a million to indicate bacterial spoilage. The results indicated that these fish hold up quite well even when held in the round.

The fish held in the modified atmosphere were examined after 17 days in storage. At this time, the bacterial counts showed no significant increase in numbers of bacteria during storage, indicating the product was, from a bacterial count point of view, a high quality product.

Sensory examinations of the cod held in the modified atmosphere showed that the fish were quite acceptable with only a small change in normal flavor and odor. Sensory evaluation for rancidity indicated that no problems, related to oxidative rancidity, were apparent.

Because additional research is needed to assure the safety of using modified atmospheres for preserving fish, we are not recommending the use of modified atmospheres to commercial fishermen.

Preservation and Quality

The Soft Fish Problem

Max Patashnik
National Marine Fisheries Service
Utilization Research Division

In the early 1970s a high percentage of the sablefish in the newly developed fishery were rejected by some of our processors for being overly soft. In response to the early industry interest, our laboratory carried out some initial studies during February 1971 to explore the causes of soft sablefish. Recently our laboratory has received numerous inquiries from the industry concerning the softness of sablefish, and some Japanese buyers have rejected our black cod for being overly soft. Thus to both retest our earlier findings on soft sablefish and to answer the more recent inquiries, we carried out a second limited study in September 1979.

Sablefish samples from the 1971 and 1979 tests were caught by NOAA Research Vessel, JOHN M. COBB, off Cape Flattery on the Washington coast after a one day soak in the pots. The pots of the 1971 study were set at depths of 250 fathoms and 350 fathoms while the pots of the 1979 study were set at 320 fathoms and 450 fathoms. The main spawning process of sablefish is believed to occur between February and July. The 1971 study was conducted during the spawning process in February, while the 1979 samples were taken well after the completion of spawning.

The data obtained in our preliminary test suggested increased water content and decreased protein content as a likely explanation for the soft condition, similar to that found in deep-water Dover sole or American plaice. The possibility of a similar proteolytic involvement with the myxosporidian parasite that causes soft texture in Pacific whiting was considered but rejected at that time.

We compared the chemical composition of the firm 250-fathom fish and the soft 350-fathom fish of our 1971 study. The 250-fathom fish manifested a lower moisture content than the 350-fathom fish; 74.2% as opposed to 78%. The firm fish contained more protein (12%) than the soft fish (8.7%). The water:protein ratio was therefore lower in the firm fish taken at 250 fathoms than in the softer fish caught at 350 fathoms: 6.35 and 9.03 respectively.

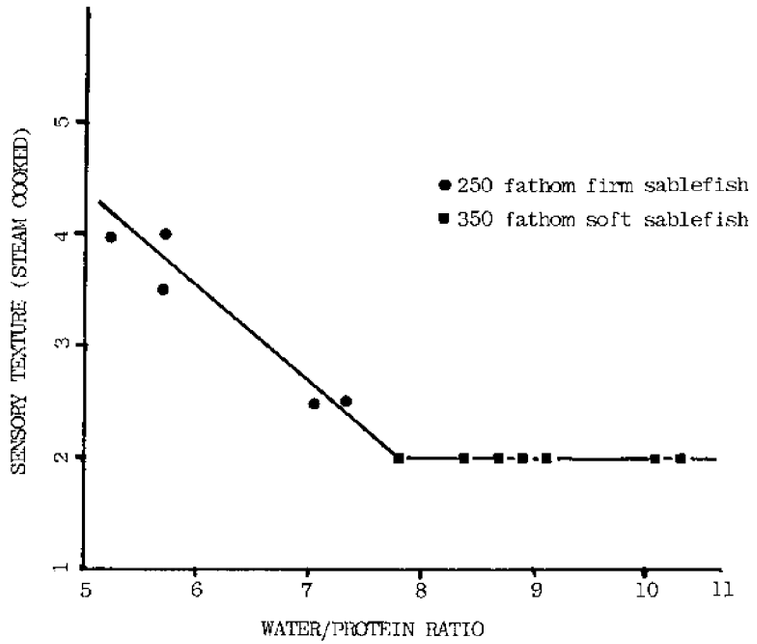


Figure 1. Variation in sensory texture with water/protein ratio of firm and soft pot-caught winter sablefish (anoplopoma fimbria) caught off the northwest coast of Washington at 250 and 350 fathoms(John N. Cobb, 2/13/71).

Figure 1 shows the sensory texture of steam-cooked sablefish plotted against the water:protein ratio. Sensory texture is figured on a five-point scale; 5 is very good quality, 2 is borderline, and 1 corresponds to poor quality fish. We then compared free drip, cooked drip, and smoked fish yield. The soft 350-fathom fish displayed a significantly higher free drip yield (9.1% versus 2.7%); a higher drip yield (37.6% versus 28.6%); and a lower smoked fish yield (65.7% versus 70.8%) than that of the firm 250-fathom fish. The poor water holding capacity of the soft sablefish is largely caused by its lower protein and higher water contents. The lower yield of smoked fish represents a greater economic loss in the smoked fish process.

Investigating the potential of parasite-induced softness of the 1971 samples revealed one severely parasitized mushy fish out of fifty-three, or 1.7%.

In order to obtain more contrast in the samples, the 1979 sablefish were taken from deeper depths, 320 fathoms and 450 fathoms. Once again, in this study we compared the chemical composition of the two samples, rated the sensory texture and examined the parasite induced softness of the fish.

Table 1 shows the comparative chemical composition of firm 320-fathom and soft 450-fathom pot-caught sablefish. The firmer 320-fathom fish again showed a significantly lower water content (71.0%

versus 81.8%); a higher protein content (11.5% versus 8.7%); and a lower water:protein ratio (6.2% versus 9.4%) than that of the softer 320-fathom fish. We also noted that the fat content of the 320-fathom fish was about twice that of the 450-fathom fish; 16.4% compared to 8.6%. Further tests with fall and winter-caught sablefish will be needed before we can assess the relevance of this large difference.

The sensory texture of the steam-cooked sablefish for the relatively firm 320-fathom samples was significantly higher than for the relatively soft 450-fathom sablefish. The average texture was 3.5 compared to 2.0 and the texture range was 5 to 2 for the 320-fathom samples and 3 to 1 for the 450-fathom samples.

Fish caught in the fall of 1979 show a similar decrease of sensory texture with increasing water:protein ratio as was found in the earlier 1971 winter-caught sablefish. This confirmation of a similar trend in fall- and winter-caught sablefish further strengthens the relationship of soft texture with higher water:protein ratios found in deep-water sablefish compared with those coming from shallower waters. Inasmuch as protein content decreases and water content increases only at the

Table 1. Comparison of the proximate composition[1] and the water: protein ratio of firm and soft pot-caught fall sablefish (Anaplopoma fimbria) caught off the northwest coast of Washington at 320 and 450 fathoms (John N. Cobb, 9/24-26/79).

Depth	%Water	%Fat	%Ash	%Protein	Water: protein ratio
320	69.5	18.6	1.0	10.9	6.4
fathom	77.0	11.3	1.1	10.6	7.3
(firm)	73.7	14.4	0.8	11.0	6.7
	64.4	22.9	1.1	11.6	5.5
	74.8	11.4	1.2	12.7	5.9
	66.8	19.8	1.1	12.4	5.4
Average	71.0	16.4	1.0	11.5	6.2
Range	64.4-77.0	11.4-22.9	0.8-1.2	10.6-12.7	5.4-7.3
450	79.8	9.8	0.9	9.5	8.4
fathom	81.8	8.6	0.8	8.8	9.3
(soft)	78.2	10.9	1.0	9.9	7.9
	87.5	4.4	1.0	7.1	12.3
	83.0	8.1	0.9	8.0	10.4
	80.1	9.9	0.9	9.1	8.8
Average	81.8	8.6	0.9	8.7	9.4
Range	78.2-87.5	4.4-10.9	0.8-1.0	7.1-9.5	7.9-12.3

[1] Water, fat, ash, and protein was determined by standard AOAC procedure.

extremity of starvation or to meet spawning demands, it therefore would be logical to assume that seasonal spawning factors are involved. Further studies will be required to assess the feasibility of partially limiting this quality defect in commercially landed pot-caught sablefish.

Out of 110 sablefish examined from the 1979 delivery, we found one severely parasitized fish, about 0.9% of the delivery compared to 1.9% of the 1971 delivery.

On the basis of our 1971 and 1979 studies, we conclude that softness in sablefish primarily involves an alteration in the chemical composition of the flesh, a higher than normal water content, and a lower than normal protein content somewhat similar to that found in deep-water Dover sole or American plaice. Secondarily, softness found in sablefish due to myxosporidian involvement was found to be only a minor factor, about 1-2%.

Marketing

Outlook for Foreign and Domestic Markets

Bob Alverson
Vessel Owners Association

Starting with the production records of 1975 the landings were predominantly Japanese, Korean, and Taiwanese in the Bering Sea, Gulf of Alaska, off British Columbia, and on southward off the coasts of Washington, Oregon, and California. Through 1975 and 1976 about 100 million pounds of black cod were landed by foreign nations and the United States in the northeast Pacific. Underlogging by foreign vessels may increase that estimate.

By 1977 some of the management plans of the North Pacific Fisheries Management Council and the Pacific Fisheries Management Council were beginning to go into effect after the passage of the 200-mile legislation. The permanent management of the plan of the North Pacific Council for the Gulf of Alaska caused a reduction in the harvestable amount of black cod available to foreign nations. The permanent management plan for Washington, Oregon and California eliminated foreign harvesting of black cod completely. By 1977 we estimate the all nation production rate dropped from about 100 million pounds to about 57 million pounds. The Canadians were beginning to phase out the Japanese longliners off of British Columbia, and in 1980 they are being phased out totally. The Gulf of Alaska management plan reduced the optimum yield for that area from 22,000 metric tons to 13,400 metric tons. We saw almost 40 million pounds taken off the international market, a large part of that market being the Asian market.

In 1978 the catch rate of foreign interest had not kept up with their rate of consumption. The total catch in 1978 was about 53 million pounds. This is when the price began to move upward. Between June 1978 and August 1979 the price continually went up. There were a number of factors affecting the market at the time—supply was not the only one. Between 1976 and 1979 we saw the value of the dollar against the yen decline almost 35%. The 200-mile legislation initiated a Japanese buying spree into American companies to secure the product. Consequently the ex-vessel price of black cod peaked in August 1979 at $1.15/lb., up from .55/lb in 1975. This was for the large five-pound

plus, gutted, headed, longline product. Those prices probably could be reduced from $.10 to $.20 to arrive at the southeast Alaska price.

From the middle of August 1979 to the present (February 1980) there has been a decline in the ex-vessel price of black cod in Seattle to $.70/pound and $.50/pound and in Southeast Alaska to $.60/pound and $.40/pound, the two figures indicating the price for headed and gutted fish weighing five pounds and over, and under five pounds respectively. Between 1978 and 1979 the U.S. black cod catch increased by about 20 million pounds which also contributed to the downward turn in the price by adding additional product to the market.

Some of the other factors affecting the price are as follows. The high prime rate has caused buyers problems. If processors are paying 16% plus 2% or 3% to hold fish, fishermen will lose something like 1.2% of the value of that fish every month that fish is held in cold storage, since the storage cost has to be paid by someone.

There is also a quality problem with pot-caught black cod harvested in the round off the coasts of Oregon and California. The problem with the fish, according to the Japanese trading companies, is that they are blood-spotted and have rather large bruises. Japanese longliners indicated that in the early 1970s they experimented with potfishing. They believe that these fish fight each other, bite each other, and bruise themselves in the pot. Also, if a pot is left for any duration of time, it is the opinion of the Japanese longliners that chemical changes occur or some acid is excreted by the fish later on in filleting or in smoking the fish. Some of the domestic processors who have bought the pot-caught fish have complained that it almost melts like wax at times when used for smoking. There is still a question as to what causes this effect, but the Japanese believe it is a problem associated with potfishing, and they have consequently gone back strictly to longline harvesting.

There is also a major problem because of a terrific run of chum salmon in the Hokkaido area off northern Japan. The Japanese, American, and European markets for salmon are plugged. The Japanese consumer visualized black cod to be on the same quality level and price level as chum salmon. This is due to advertising by the Japanese industry. When chum salmon went on sale for $1.00/pound in Hokkaido this competed directly with the black cod price. It has brought down the price significantly, not just for black cod, but for other seafoods that compete in the market as well.

I am rather optimistic about the outlook of the black cod industry after this season. Neither the processor nor the fisherman has been able to control the market factors surrounding black cod, primarily because the majority of its market is in Japan. I am confident that there will be general stability in the black cod market and increasing prices, at least for quality black cod after August. The processors will put more emphasis on quality control when buying black cod at the dock in the coming years. This past year has been a learning period for many people, especially those who have just gotten into the fishery. There will be more emphasis on heading, gutting, and bleeding. I still believe there is good movement of the product in the smoked fish market in New York, in Japan, in Hawaii, and in Los Angeles, which are some of the key areas where black cod is consumed domestically.

Appendix

California Sablefish Survey

(The following was taken from California Sea Grant Marine Advisory Programs Newsletter, February 1981)

NMFS SABLEFISH SURVEY OFF CALIFORNIA

On November 23, 1980, the NOAA research vessel Chapman completed the 40-day sablefish (Anoplopoma fimbria) study off of California that was mentioned in our December 1980 Newsletter. The major objectives of the cruise were to study the relative abundance and biological condition of the sablefish resource at two locations and to test the effectiveness of escape rings in reducing catches of small sablefish. The study took place at the Patton Escarpment west of San Diego and off of Bodega Head in northern California.

Rectangular and conical sablefish traps, with and without escape rings, were fished at six depths between 225 and 700 fathoms. Five sets of 10 traps were completed at each depth.

Approximately 3100 sablefish were captured. The overall catch rate was about the same in both Patton Escarpment and Bodega areas, although the most productive depth in both areas was 300 fathoms.

Escape rings were only partially successful in reducing the numbers of smaller fish taken; fish averaged less than one inch larger in the traps with escape rings. Catch rates in conical traps with escape rings were less than half of the catch rate in traps without rings. Catch rates were very close in both the rectangular traps with and without the escape rings. The catch rate for rectangular traps was over three times as great as for conical.

More detailed result information (Cruise Report No. CH-80-2) is available from NMFS, Northwest and Alaska Center, Div. of Resource Assessment, 2725 Montlake Boulevard East, Seattle, WA 98112
(Source: NMFS Cruise Report No. CH-80-2 12/8/80)