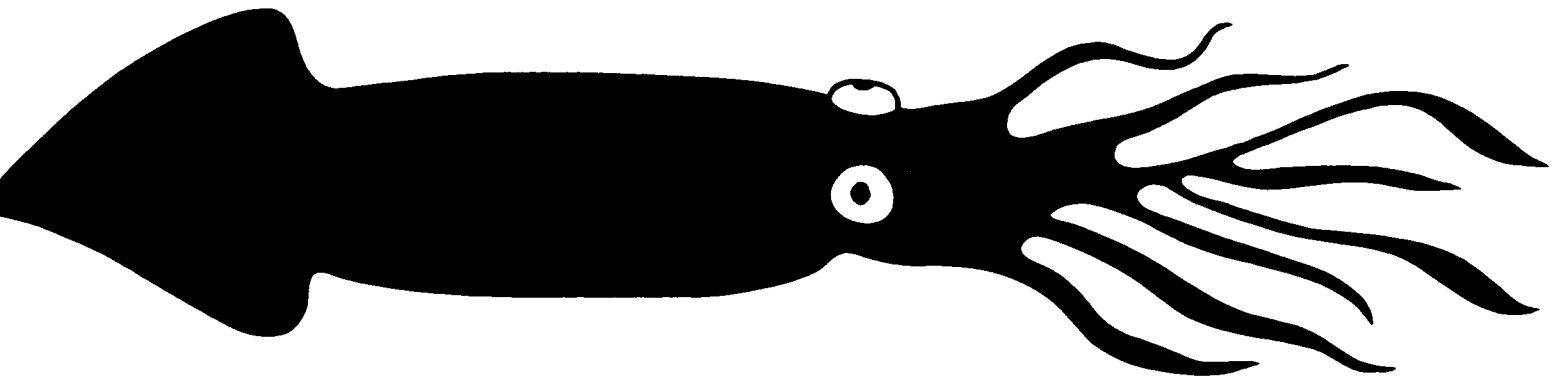


FILE
**PROCEEDINGS
OF THE
WEST COAST
SQUID
SYMPOSIUM**

FEBRUARY, 1983
NEWPORT,
OREGON



PREPARED BY
THE WEST COAST
FISHERIES DEVELOPMENT
FOUNDATION
AND
OREGON STATE
UNIVERSITY EXTENSION
SEA GRANT
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WEST COAST SQUID SYMPOSIUM

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Prepared by:

The West Coast Fisheries Development Foundation

and

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PREFACE AND ACKNOWLEDGEMENTS

Whether by sheer luck or by what we at the Fisheries Development Foundation feel was some calculation on our part, certain things began happening right after this symposium with respect to development of a squid fishery off Oregon and Washington. A processing firm in Newport geared up for squid production in May and June and, in fact, landed a considerable quantity of Oregon squid. Prospecting for squid off Coos Bay, Eureka, and other ports began in earnest and continues at the present time. A processor in Port Angeles is landing and processing squid at the moment. Sea Galley Restaurants, a large seafood chain on the West Coast, has made a commitment to feature squid as a specialty item on a regular basis--this after considerable prodding on our part.

Things are happening in a exciting fashion, "El Nino" and its effects on traditional California fisheries notwithstanding.

Originally this symposium was conceived to be very informal, to the point, in fact, of not even publishing a proceedings. As you can see, that idea was dropped. However, not until the symposium actually had taken place was I fully convinced the format would fit into a formal publication. At that time we realized that such a wealth of information had come out of the conference that we must make an effort to publish it. Our recording of the proceedings was not made under the best of circumstances. A tremendous amount of work has gone into deciphering and interpreting a wide variety of communication styles. Chief credit for that work goes to Julie McKenney and Pat Shanahan of WCFDF staff. We regret that due to technical difficulties one particular speaker's talk does not appear herein--that of Pierre Mercurio. His presentation on lampara fishing in Monterey was extremely informative. We regret very much the omission.

I wish to thank the OSU Marine Advisory staff for all their work. Bob Jacobson, in particular, deserves most of the credit for putting the program and logistics together. The Fishermen's Wives of Newport put on a fabulous spread of squid dishes on Monday night that put everything into perspective and many thanks go to them.

Pete Granger
August 1983

The following editorial by A.D. Chandler appeared in the April 1983 issue of National Fisherman.

SQUID CONFERENCE IS EYE-OPENER

Can conferences help the fishing industry develop? Most of us sneer at the thought. However, a recent gathering in coastal Oregon may have changed some people's attitudes about the effectiveness of fishery development conferences.

With strict size limits on black cod, trip limits on widow rock, a dearth of shrimp, and quality concerns over deep-water Dover sole, Oregon draggermen (and the processors who serve them) would dearly like to develop a new fishery or two.

Traditionally, fisheries have been developed by individuals--usually during lean times. That's because when fishing is skimpy, a skipper has incentive to investigate what opportunities might be available elsewhere. While most fishermen limit their search to established fisheries, a few adventurous souls will always look for something new.

Doing that takes guts. New grounds must be found, gear has to be worked in a different way or changed altogether, and markets have to be located. All this takes considerable time and money.

Nonetheless, a handful of Oregon vessel owners have been trying their luck with squid, box crab and shark. None has found the going easy; but, then, they didn't expect to. Last summer, hoping to save time and money, a couple of these pioneers approached local extension agent Bob Jacobson.

What they hadn't known when they went to Jacobson was that a processor or two had been asking Pete Granger at the West Coast Fisheries Development Foundation what information he had on Loligo squid. When Bob and Pete got together, the natural result was a "fishery development" conference.

Now, under most circumstances, a squid conference would be a low-key affair. As matters developed, however, by registration time, the squid had all but vanished from Southern California, forcing prices to soar, brokers to reach for their field glasses and local processors to recast their indifferent attitudes. So, in the end, not only did the pioneers get a well-rounded conference with fishermen, they got a standing-room-only event attended by processors, brokers, distributors, bureaucrats and the press.

For a day and a half, information flowed. Fishermen talked to brokers; processors met with folks from food service; everyone talked to each other. By the time the final panelist had answered the last question, the audience was approaching overload but had still not lost interest.

The event succeeded as a true fishery-development conference, a conference in which one sector of the industry is forced to develop a better understanding of the needs and difficulties facing all the others. Without conferences like these, future development could be delayed interminably.

CONTENTS

Preface and Acknowledgments	iii
Squid Conference is Eye-Opener A. D. Chandler	iv
Welcoming Remarks Pete Granger	1
Squid Distribution, Biology and Life History Kathy Jefferts	3
East Coast Squid Fisheries Warren Rathjen	11
An Overview of California Squid Fisheries and the California Light Fishery Sus Kato	23
Squid Trawling Gear and Techniques Duncan Amos	28
Squid Jigging Gear and Techniques Duncan Amos	37
Panel Discussion: Overview of Japanese Squid Fisheries Bill Court Sus Kato Frank Cary Warren Rathjen	43
Panel Discussion: Insuring Orderly Development of the Oregon Squid Fishery Richard Thompson Terry Thompson Bob Loeffel Joe Easley	62
Squid Handling and Processing for Export Markets Anthony Klos	87

Squid Handling and Processing in California Pat Flanagan	97
Automation in the Squid Processing Industry Dave Hartzell	113
Panel Discussion: Recent Developments in Squid Marketing Anthony Klos Bill Court Thomas Steiner Pat Flanagan Steve Hofer Terry Elwell	122
Appendix Selected Squid Landing Statistics	141



West Coast Squid Symposium attendees listen to a panel discussion on the development of an Oregon squid fishery.

WELCOMING REMARKS

BY

PETER GRANGER*

My name is Pete Granger, and I am the director of the West Coast Fisheries Development Foundation. We are located in Portland. On behalf of the Foundation and the OSU Sea Grant Advisory Program, I would like to welcome you all. I know that there are individuals from all sectors of the industry here today, including fishing industry press such as Seafood Leader, National Fisherman, Fishermen's News, among others. At some point if any of you want to query some of those folks, I am sure you will be able to see by their name tags who they are.

I think that you can characterize this conference today as an inquiry. There is too little known about the squid resource off the Oregon Coast. Perhaps we should call it "calamari" as our compatriots farther south do. You will notice in your packet a brochure on Pacific Squid. This is a point-of-purchase piece that the Foundation recently generated to add to our portfolio in our work with the retail sector. We agonized over whether to put the name "calamari" on the front of this thing or "squid." A lot of people in the industry said "calamari." Nobody eats squid. They are afraid of the word "squid." But this, as you will notice, is a guide for someone who wants to take squid home whole and clean it at home. We figured, if they are not squeamish about taking it home and cleaning it, then they certainly won't be averse to the word "squid." So that is why you see "Pacific Squid" on the brochure.

There are a number of questions being asked about this resource and about a potential fishery. We know that there are a lot of squid out there but where are they, and how many are there? What particular gear would be most effective if a market were available? Because the resource in

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San Pedro is thin this year, there is a demand for squid. We all know what happened with scallops two years ago, and I know you don't want that to happen again should an Oregon fishery get started helter-skelter. I feel we are in a much different situation here. If squid is landed who will process it? And in what product form will it be processed? We are a fledgling in the domestic market which we in the Foundation are trying to develop and promote. In attempting a sure development of a squid fishery, we would like to see production absorbed rather than seeing it exported. We'll not answer all these questions or even most of them today and tomorrow, but we hope to provide you with information to use in making rational decisions. The free market enterprise undoubtedly will determine the destiny of this fishery.

We have a number of people here to share knowledge with you. They come from the East Coast and Southern California, where, as you all know, there are more established squid fisheries. We are going to be very informal in our session. We have a number of people who just met each other as speakers, and they will from time to time overlap, but all these folks know a great deal, and as we get into questioning I'm sure we will be able to bring out as much information as possible.

Now, before I get started I want to thank Bob Jacobson from OSU Marine Advisory Program here in Newport. He is the fellow who put all this on today.

Today we are going to start out by talking about the biology of this resource, something we know very little about. We have with us Kathy Jefferts, who has completed her Ph.D. work on squid at OSU. Kathy received an undergraduate degree from Stanford in 1974 and a masters at OSU in oceanography in 1977. Her current work is concentrating on squid in the sub-arctic Pacific, so she has a broad range of knowledge to share with us today. I would like to welcome Kathy.

SQUID DISTRIBUTION, BIOLOGY, AND LIFE HISTORY

BY

KATHY JEFFERTS*

There are several species of squid off the Pacific Coast of the United States that present potential fisheries. The one I am going to be concentrating on today is Loligo opalescens. I am just going to say a couple of words about the others and then I'll restrict my comments to Loligo. There exist a number of the genus Gonatus. They are usually small squid in the California current. There are larger forms occurring in the sub-arctic on the Gulf of Alaska which are currently the subject of minor fisheries. These species may present fishery possibilities at a later time. There is also a squid known as Dosidicus gigas, or the Jumbo Squid, which occurs off Central America and occasionally is found off Southern California in large quantities. It's not present often enough to likely represent a potential fishery.

Loligo opalescens is also known as the California Market Squid, the Market Squid or the Opal Squid. It is a mollusk, which means it is distantly related to clams, oysters, snails, and more closely related to octopuses and cuttlefish. It has a muscular mantle that comprises the main portion of the body, and is a very fast swimmer. Swimming is accomplished through jet propulsion. Water is drawn in by the sides of the head inside the mantle. Then the mantle contracts around the head and water is forcibly expelled through the funnel. The direction of swimming is controlled by the funnel and the fins. It has eight arms each with two rows of suckers. The suckers have chitinous rings that form a supporting structure inside the sucker. This feature distinguishes all squid from octopus, which don't have chitinous rings in the suckers. It also has two long appendages known as clubs. The tentacles are used in food capture.

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The eye of the squid is very complex. It is equivalent in function to a vertebrate eye. They form images. They are sight feeders. This squid is distinguished from all others in the area by having a corneal covering over the eye. The eye is not in direct contact with sea water, and that is one way to tell this squid apart from other species in the field.

Loligo has an internal chitinous pen which represents a shell remnant. It is situated on the dorsal surface of the interior of the mantle and it is usually removed in cleaning. This squid has a hard chitinous beak, much like that of a parrot, that is used to tear food into small pieces before it is ingested.

The overall color is whitish, but it has large chromatophors that rapidly change color to red and brown. Loligo reaches a maximum size of about 200 millimeters, dorsal mantle length. It reaches a maximum length of about 350 millimeters overall.

This species is endemic to the California current system and British Columbia. I have heard recent rumors that there are squid in southeastern Alaska but there is no published information on this. At various stages of development this species is found from the surface to the bottom at all depths over the continental shelf and even beyond. I have taken it in hauls as deep as 460 meters. It usually occurs only in high-salinity waters, meaning it is generally absent in estuaries and it is usually not found around the mouth of the Columbia River. It is found in some inland waters, such as Puget Sound and the Strait of Georgia. The overall distribution ranges from Dixon Entrance at 55° north to Punta Eugenia in central Baja California, although the larvae have been taken as far south as the southern tip of Baja. Bill Pearcy did some work off the Oregon coast in 1981 and found concentrations as high as about 2000 squid per 100,000 meters cubed off Siletz.

This animal generally moves inshore to spawn. It spawns in waters of five to 40 meters depth, with a maximum spawning activity at about 15 meters depth. It usually chooses a somewhat sheltered bay with a sand

and mud bottom. These spawning aggregations are often found in the vicinity of submarine escarpments or submarine canyons especially in California. Spawning aggregations have been noted in the Strait of Georgia, in Queen Charlotte Strait, near Victoria on the west coast of Vancouver Island, in Puget Sound, in Monterey Bay, and off the Channel Islands of Southern California.

Where it has been studied, reproduction in the species is generally found to occur year round. In addition, during the year there seem to exist peak times for reproduction. The spawning periods in the south of California are usually between December and March, sometimes with a small peak in July. In Monterey it is somewhat later in the year, lasting from May to June with an occasional small spawning peak in November. In Oregon, eggs have been noted between April and July. Bill Pearcy found the highest concentrations of squid in May and June. In Washington the spawning period has been from mid- to late summer and this is probably true for British Columbia. So you see a northward progression in spawning times.

The spawning animal shows sexual dimorphism. The male has much longer tentacles, a slightly larger head and thicker arms than the female. It is also somewhat larger. The males probably feed slightly more than the females when they are on the spawning grounds. The females seem to essentially cease feeding. The sex ratio is probably about equal, although not necessarily so in one school. In spawning individuals, males are usually between 13 and 19 centimeters in length and females between 12 and 18 centimeters in length. Spawning usually occurs at night. The male grasps the female from behind and below and transfers sperm packets to the female with a modified left ventral arm called a hectocotylus (a term used to describe a modified arm). The male places the spermatophore near the female's oviduct (the place where the eggs are extruded). The sperm sacs are discharged from the spermatophore and adhere to the mantle and the viscera of the female. The eggs aren't fertilized until the female extrudes them. She extrudes them through the oviduct and then through the funnel. They then pass through the arms.

They are contained in an egg capsule which is attached to the bottom by filament. The egg capsule ranges in length from five to 20 centimeters and has a filament at the end with which it is attached, either to other egg capsules or a hard substrate on the bottom. The female can extrude 20-30 egg capsules in a spawning session. Each one has from 200 to 300 eggs. These egg capsules are laid in large clusters that have been reported to be 12 meters across.

The adults die following spawning, and this is quite important to management considerations. The eggs are quite small, and at about 2 X 1-1/2 millimeters in diameter they undergo direct development. The hatching time is very dependent on temperature. At a temperature of 7-8° C. it takes nearly three months for the eggs to hatch. At 10° C. it takes somewhat less time. At 13° C. it takes about a month, and at 16° C. it takes 12 to 23 days for the eggs to hatch.

Very few things eat the eggs while they are in the egg capsules on the bottom. Various predators include a few species of starfish, one Lytechinus urchin, and a parasitic or commensal worm which is found in the egg capsules, called Capitella ovincola. It is thought that the worm feeds on the eggs. The young squid hatch at a size of 2-1/2 to three millimeters in length. They can live up to several days on their yolk sacs that are attached. They then begin to stalk and attack small planktonic crustaceans. Off both California and Baja California the larvae have been found to be most abundant from Point Conception to Punta Eugenia.

Work in British Columbia has shown that young squid aggregate in cohort schools, i.e. in schools of similarly sized squid. They remain in these schools until they reach a size of about 50 millimeters. Both experiments in the lab have shown that the squid can grow at a rate of up to about seven millimeters a month for three months after hatching. Field experiments show a slightly different number, reaching about 10 millimeters total length in two months. The juvenile squid are found in the middle of the water column and they appear to move toward the surface as they grow. Schooling behavior declines once they reach a size of about

50 millimeters. The individuals at that point are largely scattered and usually found near the bottom. Schooling behavior begins again at a size of about 70 to 80 millimeters. The research done in British Columbia shows that they school in mixed size schools. This hasn't been found as commonly in California.

They are fully sexually mature at a size of about 100 millimeters. Gonad maturation begins at a size of about 50 millimeters. Occasional precocious males are found as small as 80 millimeters. The squid on the spawning grounds are usually 100-145 millimeters in length. Growth is dependent on both temperature and food availability. Data come from several sources such as a study of the statoliths, which are the functional equivalent of an otolith, or ear bone, in fish and are contained in the balance organ. They form rings that are thought to grow daily, and studies show that they can reach a maximum age of two years. The animals that derive from winter spawning grow and reproduce in their second summer, about 13-14 months after they are hatched. The individuals that come from summer spawning probably reproduce in their second winter at an age of about 18 months. These animals are much larger than the animals spawning in the summertime and can be up to 200 millimeters in length.

It is still unknown whether the Loligo stocks off this coast are represented by more than one population. Studies have been done on morphological characteristics, on like-relationships and so on, and studies have also been done on protein characteristics. But neither one has answered the questions. All of the studies have been essentially equivocal. In rearing experiments these squid have been raised to a size of about 17 millimeters or a maximum age of about 100 days. Problems with rearing in the lab include providing appropriate food and physical damage to the squid, apparently from running into the sides of the tanks.

These squid are sight feeders. They do most of their feeding during the daytime, primarily during a three-hour period during the morning and for an hour just before sunset. In addition, the males will feed during a

full moon. In British Columbia, most feeding has been noted at depths in water of 20 to 50 meters. They have been observed feeding at the surface, especially on euphausiids. They form feeding schools which are much less dense than the spawning schools and which are very sensitive to fishing activity. The squid larvae feed on small planktonic crustaceans and things like crab larvae and copepods. The older animals feed primarily on two species of euphausiids, Euphausia pacifica and Thysanoessa spinifera, sometimes known as "krill" and closely related to the Antarctic krill. They also feed to a lesser extent on fish and other cephalopods including their own species, gastropods and polychaete worms. The diet varies by location. Deep water living individuals concentrate on euphausiids, but fish, cephalopods and other crustaceans are also important in their diet.

On the spawning ground, feeding is much reduced. That which does occur concentrates on crab larvae, polychaete worms and juvenile gastropods, or juvenile snails. There is a male/female difference in feeding on the spawning grounds. The males eat more prey items per meal and they eat more cephalopod fragments. They often find tips, arm tips from other squid and pieces of skin in the male stomachs. This is thought not to be a true feeding behavior, but a result of crowding. Digestion in the squid is very rapid. It takes five to seven hours to go to completion, and they eat about 14% of their body weight per day.

This squid is a major prey item for fish, birds, and marine mammals. It has been found in the stomachs of at least 22 species of bony fish and elasmobranchs (fish with cartilaginous skeletons), such things as tuna, salmon, midshipman, croaker, rockfish, various flatfishes, lingcod, sablefish, hake and several species of shark. At least 13 species of birds feed on Loligo: the loon, cormorant, the fulmar, various species of gulls, the kittiwake, the rhinoceros auklet, murre, and three shearwater species, especially the sooty shearwater, for which Loligo may form the primary diet item for much of the year. Most pinnipeds (seals) or eared seals and small cetaceans (whales) throughout the range feed on Loligo including the sea otter, the elephant seal, the harbor seal, the Northern

fur seal, the California sea lion, the pygmy sperm whale, the pilot whale and several porpoises and dolphins. Scavenging invertebrates such as crabs may feed on spawned out or dead squid which are found on the bottom on the spawning grounds.

Only two parasite groups have been found in Loligo. One is the dicyemid. The octopods off California are famous for their dicyemid species. There is only one species that has been recorded from Loligo. They occur in the eye, the stomach, the digestive caeca, in the mantle cavity and in the mesenteries, and a study in 1969 found an infection rate of 77%.

We still have several questions that need to be answered about this squid. Such things as the location of the individuals from their hatching to their spawning grounds. Essentially nothing is known about where these squid are found and what they are doing, from the time they hatch as very small larvae to the time they come back to spawn. Another question we need to answer is whether this stock is represented by more than one population. It is vital to management. And a third question is how abundant squid are off the British Columbia, Washington, Oregon, and Northern California coasts. There are at least estimates that the resource off California amounts to about 300,000 tons, but for the rest of the Pacific Coast no estimate has even been made.

QUESTION: Do squid continually keep swimming in the water or will they stand still in the water column? Can they adjust their bouyancy to be more positive or negative to move up and down vertically?

JEFFERTS: They don't have a gas bladder like fish do, so they don't have the bouyancy problem that some fish do. They generally swim at all times. They must swim or maintain mantle movements in order to exchange oxygen, so they have to keep in motion most of the time.

QUESTION: In places like Puget Sound or the Strait of Georgia, are squid found there year-round or just at certain times of the year?

JEFFERTS: Their spawning aggregations have been noted there, but the appearance of squid other than under spawning conditions is very sporadic. They don't form big dense schools when they aren't spawning, so often what is found is a few squid or one haul here or there that had a few squid in it. I presume that they can occur there year-round.

QUESTION: What would it take to do an adequate assessment of the squid resources off the Oregon Coast?

JEFFERTS: We are trying to address that problem right now. The survey methods are the biggest obstacle at this point. Squid are not very available to mid-water trawls, at least not in adequate numbers or consistent enough catches. They have been taken incidentally or seen in the acoustic surveys of rockfish and Northern anchovy off California. I think that the next problem we are going to have to address is an adequate survey technology.

EAST COAST SQUID FISHERIES

BY

WARREN RATHJEN*

It sure is nice to talk about squid and I enjoy doing that quite a lot, but I don't know about this business of being an expert. Pete mentioned that I had recently been to Japan. I was introduced in Japan as an expert on squid. I must admit that I found that terribly embarrassing because they have armies of people that study and know about squid in Japan. I got around that by saying that where I came from, there really wasn't very much interest in squid, and consequently it was a very convenient thing to try to be an expert in it. If you will bear with me, with that explanation we'll proceed. Hopefully I will make this as painless or painful as it may be to you. I am going to use some slides.

As we've described them here today, for the purposes at hand, the East Coast, at least to us this morning, is going to be the western North Atlantic and will include eastern Canada and most of the eastern United States and really not too much else. For those of you who aren't too well acquainted with that part of the world, and I am sure that some of you are, we are going to talk about the fisheries that exist on the east and north in Newfoundland down to Cape Hatteras. We have squid that range throughout that area and we have squid that range beyond it, of course, as you do comparably here. But just for definition of our territory today, this is kind of an orientation. I might point out that one of the principal differences we have back there is that, in general terms, our continental shelf is much broader than it is along the Pacific Coast, at least in this section. Quite often we have as much as a hundred miles of shelf or more before we get out to the 100 fathom edge. For all practical purposes that is where most of our fisheries, and in this instance particularly our squid fisheries, take place.

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We have two varieties that are important commercially at this time. As on the West Coast, we have had some traditional fisheries that go back over 100 years, particularly out of Newfoundland. Although Illex, or "short fin squid," has been taken for a hundred years off Newfoundland, it does range in deeper waters all the way south to at least Florida, and it has counterpart species that go beyond and down to the coast of South America and Africa. So it is a very wide ranging species in Atlantic waters and a very important commercial species. It's a larger species generally than your California market squid or your Loligo opalescens. Occasionally it gets to 12 inches in mantle length and over a kilogram or two pounds in weight. The other critter, Loligo pealei, is more comparable to your coastal and shore squid here, and is of the same genus. It ranges from the edge of the continental shelf into inshore waters, depending on whether you are in Florida, the Gulf of Mexico or in Massachusetts at different times of the year. In recent years between these two species, Illex and Loligo pealei, there have been harvests as high as 150,000 tons or more, including the fisheries maintained by various foreign nations that have taken much greater advantage of the resource on the East Coast than we have.

Our description will start in the east and north in Newfoundland, and as they say back east, the "down east," where they have the so-called "squid jigging" grounds. That is quite a social event in Newfoundland. They all get together, usually within rowing distance of the fish plant, and drop the hook or let it drift as they sing songs and read books and tell stories. They really have a good time and only get out there for the nice weather, certain portions of the summer and early fall. Quite frequently they go out in a small dory and catch a ton or more of squid in the morning.

(Referring to a slide) That is a jig fishery. There is a jig that is representative of how the squid is caught by getting snarled when he grasps for the jig, which presumably he's attacking as a potential food item or something. The original jigs in Newfoundland were spark plugs painted red with wires connecting to them, and I guess they work quite

well for the Japanese, who got out there and showed them how to really get going on jigging technology.

(Referring to a slide) That is the guy's catch that he got in the morning. He comes ashore and sometimes goes about a mile or less to the fish house and scoops them out and gets his check and goes on home to mama. (Referring to a slide) This is on Conception Bay, just south of St. Johns at a place called Hollyroot. They are packing them for the Japanese market, at least they were when I visited there several years ago. There you see that they are putting them into trays which will be frozen in blast contact freezers, packed, and presumably exported to Japanese processors.

As we go further west in Canada, a couple of years ago they experimented with modifying some of the inshore boats using automated Japanese equipment. (Referring to a slide) This is a typical Moby longliner and she's about 48 feet long. They mounted four automatic machines on the stern, put on a spanker sail, and mounted the lights on the midline, and that was all. These little boats could catch up to 10 tons a night when the squid was really in. The story a couple years ago was that they caught so much squid nobody could handle it and so they stopped. They weren't set up for it, and frequently that is a problem, a problem you might have to face here if you get into this business.

Working further down on the East Coast, I come from Gloucester at the moment, and this is just to give you an idea of the kind of fleet that we have there. (Referring to a slide) In many cases the boats are quite old and primarily draggers that take squid while dragging for other species such as whiting, flounder, and the other species that we pursue there regularly. Most of the fleet take squid in some time of the year, but in most cases their trips are not directed at squid, so it is what we call an "incidental catch," which I'm sure you are all well acquainted with. Quite a lot of squid has been taken in the East, particularly from Cape Cod and Long Island southward in what we call "fish traps." This is where a leader is fixed on the shore and the leader intercepts the

migratory pattern back into the heart or the pound net section, and they are brailed out by the fisherman when he services the net in the morning. It is not unlike the gear that was used years ago on the salmon in southeastern Alaska. (Referring to a slide) That is a fish house. It is just to show you the way the trap fishermen handle their squid. They throw them into those barrels right onboard the trap boat. The barrels are then filled with ice or one-third to one-half filled with ice, then charged with seawater and the squid is mixed in with what we call "slurry." Then they load those barrels onto trucks and send them up to Gloucester to pack primarily for shipping overseas, but sometimes for domestic use as well.

About 15 years ago, we started getting visits from foreign fleets that were interested in squid. We have been hosting foreigners on the East Coast for a great deal longer than 15 years, but they never really targeted in on squid much until about 1968 or '69. (Referring to a slide) That is a Polish vessel working south of Nantucket out in the canyon area around Beach Canyon. When the squid come up over the edge in late May or early June, these vessels will sometimes just work along, one following the other, and work that edge over very thoroughly, enjoying quite large catches of 15-40 tons in a day. They will quite often equal the processing capacity of the vessels, which is usually in the range of 20-30 tons a day. We have a fishery that goes on for both species on foreign factory trawlers. The fishery for Illex takes place from June to October and the fishery for Loligo takes place from December until March. So we see these fellows around a good part of the year, and they cause a lot of concern to the fishermen that are based in our local ports back east.

(Referring to a slide) This is a representation of some of the data that resulted from their catches. To hopefully benefit some of our people that might ultimately get interested in the fishery off-shore, we have the catches of the foreign vessels plotted by 1° quadrangles by month for three seasons on Loligo, and this is just a corner of one of the charts. They are overlay charts that you can put on a regular navigation chart

and that number there (referring to chart) represents a high catch rate. That was 2400 and some odd pounds per hour of fishing. That is the way the catches are indicated. That's better than a ton per hour for Loligo, which is quite good fishing for that species. Loligo pealei, incidentally, on the European market is worth up to \$3000 a ton and it actually ranges from \$2000-4000 a ton.

(Referring to a slide) That's a Japanese trawler. There is a whole fleet of Japanese trawlers that work the Atlantic for all different species. There are quite a lot of these boats that work Africa for five or six months, particularly on the Sahara bank where they are after octopus, cuttlefish and squid. They work wherever the fish are that their markets are calling for. About the time we left home we had about 80 of these fellows off the coast of New York. Not only were there Japanese but also Spanish and Italians working on Loligo. A good day's catch for one of these big vessels is 10-20 tons and they average a bit less than that. You have to realize that it is a pretty valuable commodity to support the activities of the big vessels like this so far from home with a crew of up to 40-odd people on board sometimes. Of the nationalities that we work with in our fishery, the Japanese tend to be more trustworthy, if you can appreciate the expression, than some of the others, in terms of adhering to our regulations, but only when somebody is watching them pretty closely. (Referring to a slide) That's the catch of Loligo on deck of a Spanish vessel. That is one of the smaller vessels in that fishery. It is about 120 feet in length. They have a crew of about 20 people, and a daily processing capacity of approximately 15-20 tons.

(Referring to a slide) That's a bag of squid there, maybe 8000-9000 pounds. You can see the very broad cod end that is very characteristic of the nets used in the fishery. This is done to lessen the pressure on the catch presumably, although I am not sure that is possible. Most of the vessels and the gear are equipped with a variety of electronic devices, measuring head rope depths and temperature at the net and the abundance of fish or squid going into the net. The people in that

fishery, generally speaking, are quite up to par on the technology of trawling, as it is available, and exercise it, I think to a good advantage in this type of fishery. There is good reason for that because some of the surveys that the fishery service has done back east suggest that the abundance of Loligo is closely associated with certain temperatures.

(Referring to a slide) This is kind of a scientific representation of the amount of squid taken in relation to the bottom temperature for two different seasons. This was from research survey data, and I think that you can easily see that the most of the better squid catches were taken generally from 8-12° C. for Loligo.

(Referring to a slide) That is a small Spanish vessel, about 120 feet again, and typically the smallest of the visiting vessels that are working that fishery. At the moment the Spanish are the most abundant of the foreign vessels fishing the Loligo fishery. As I made reference to the Japanese adhering to regulations earlier, I would say that these people kind of sit on the other end of the scale. (Referring to a slide) There is a bag of Illex that was taken on a Spanish vessel down around Cape Hatteras in the early summer. Sometimes they would get tows of 20-30 tons and have difficulty getting it aboard. Of course 20-30 tons on deck in 80° surface temperatures is kind of a headache to work with in the summertime back east. It is not a recommended practice. Not only is it too much fish in the net, but you just can't work through it fast enough and get it packed. It's more desirable to take smaller catches if you can.

(Referring to a slide) This is to indicate the relationship of the Loligo squid catches by trawl net and the time of day. Generally this tells you that squid are off the bottom during the hours of darkness, and they are pretty hard on the bottom around high noon. In general terms that is probably when you can expect your best catches. It is not necessarily true for all species, but generally characteristic of squid.

They tend to move up in the water column during the night and go down during the daytime.

(Referring to a slide) Back again to the foreign trawlers. That is the way they are handled down in the factory area. They are washed, sorted by size and packed into trays, frozen, and in some cases put into boxes and banded. Butterfish is caught with Loligo and it is terribly attractive to the Japanese market right now. A lot of people think that the Japanese are more interested in catching our butterfish than they are in our squid, and I think there probably is a good bit of truth to that. Our fishermen are also interested in chasing butterfish right now, so there is a little bit of tension in the management process concerning the relationship of the two.

I don't think those fishermen expect to get much sleep when they are fishing. Those people are mostly expected to work, and they really know how, I'll tell you. Most of their fishing is at night and we only get 12 hours a night back there in the summer. (Referring to a slide) There are the automatic jigging machines looking aft from the wing of the bridge along the rail. And you can see all the electronic devices on the bridge. They use recording instruments quite a lot to locate squid and find the grounds that they are going to work on. They also use their experience to a considerable degree. (Referring to a slide) Here they are in the early evening. They just lighted up the lights, played games, and talked about what fishermen talk about.

When I was a visitor on their boat, after they caught a few I managed to get into the bunk and somebody grabbed me out of the sack about 2:00 a.m. That was off Long Island last spring. They didn't get much squid before midnight, but they got a little spot of them around one or two o'clock and I think within an hour they had over 3000 pounds. It really wasn't very good fishing on that particular night. They were trying more to show off to us, and they did a good job of that.

(Referring to a slide) That is the factory area, and the fish come

into a wash tank with chutes in the side of the vessel to deliver down to the chilled factory area. They get all around that stainless steel table and sort the squid by size and lay them out beautifully in these pans in which they are later frozen. They are all broken up by size and packed that way. They are chilling the squid prior to freezing, and that was kind of interesting because on this vessel they let the squid stand three to four hours. After three to four hours it would turn a deep dark red, and that's when they wanted to freeze it because that's what the market wanted. But when the squid first came on board it was all mixtures of colors. Some were red and some were white, but after they lay in those trays in that cool room for a while they just all of a sudden all got red and then boom, that's when they put them away.

We tossed around some other technology back there. Over the last 10 years or so we've tried some pretty primitive light attraction experiments. We've tried fooling around with modifying nets and generally tried to get people a little more interested in competing more actively with some of the foreigners. I think it's a different situation than you have here. We would at least like to take for our own fleets what the foreign vessels are taking, and I guess that's our primary objective from my point of view. Although it takes a bit of convincing of the industry to get them on the track, generally speaking the answer is that they can make more money doing other things and it's pretty hard to argue with that.

The new chromoscope detection gear is quite adaptable to locating and understanding the characteristics of squid movements. (Referring to a slide) This is some experimental fishing that we did off Gloucester two summers ago where we tried some jigging on our own, which was kind of a two night stand. We had the cooperation of the Koden people who had that equipment aboard. These little so-called rice grains that you see between the bottom and the surface represent the squid and at that point there was a lot of squid under the vessel. Almost all that white under the vessel is squid. We were jigging them quite heavily at that time. When they come on the jigs they really come. If the squid that you're

after take the jig, there are 30 jigs on a string on the cast, at least that's how we had this set rigged. There are two reels on a machine, and quite often two or three squids on a jig. Here you see four jigs out of the water now and every one of them has at least one squid on it. When they come around it's the most exciting thing I've ever seen. We kept them on board on deck in barrels of seawater and ice while we worked with one of those squid, as a method of handling.

(Referring to a slide) Those are Illex, and they are a kind of medium-sized squid measuring about 19 centimeters, which is around 9-10 inches. That's the way they are off Gloucester when they are striking onshore about the end of July or first of August. They stay inshore off Gloucester for two or three months and by the time they leave they'll be almost a third again their original size. They really do some growing.

(Referring to a slide) This is an offshore squid we call by the common name "orange bed squid." It is a high seas oceanic squid which is widely distributed in the Atlantic and the Caribbean. It is comparable to a species that you have here in the Pacific. You also have another one of this genus that the Japanese are fishing on not too far away from here. (Referring to a slide) That's another kind of interesting squid. It is a pretty big one that is about a meter long, which is a little bit longer than my arm. It has no common name, but we take them in the trawls right on the edge. I don't know that they have any commercial value although some Japanese people tell me they are quite edible.

Okay, we have done a little bit of marketing and that's not really my thing here this morning. This is just to give you an overview of what we have been doing on the East Coast. We sell a lot of squid to Europe from the East Coast and I think we would like to sell a lot more. It's quite valuable there. (Displaying a poster) Here is a representation of the way that some of the squid is used in the Spanish market. This was put together for household consumption, much in the mode that we pioneered here in North America. They are doing their thing with squid over there and it's taking off throughout Europe and is most heavily used in south-

ern Europe. There is even some recent interest in Norway, of all places. This is just to illustrate the possible over-enthusiasm. Give them the hard sell in the squid business. Just keep this in mind as you proceed in your squid development considerations here.

QUESTION: What size are the barrels that they pack the trap squid in?

RATHJEN: They hold 160 pounds of squid per barrel.

QUESTION: What kind of total harvest do they get?

RATHJEN: Well, they have hit as high as 150,000 tons between Canada, the foreign fishery, and the U.S. fishery. This year, in 1983, we are going to go well over 10,000 tons with our domestic fishermen and that's probably an all-time record. We had at least 5000 tons of Loligo harvested and in the freezers, or in somebody's belly, and at least 5000 tons of Illex. I suspect when these figures are upgraded our fishery will probably total 15,000 tons, which has been very good.

QUESTION: What are the differences in price between East and West Coast squid as far as the domestic market is concerned?

RATHJEN: On the East Coast the Loligo is worth twice or more than Illex. The Loligo is the most valuable, both in the export market and the domestic market. There is comparably little market for Illex domestically except as used for bait. The West Coast Loligo is gaining in importance in the export markets both in Europe and in Japan. It has always been easier to find than the East Coast Loligo pealei.

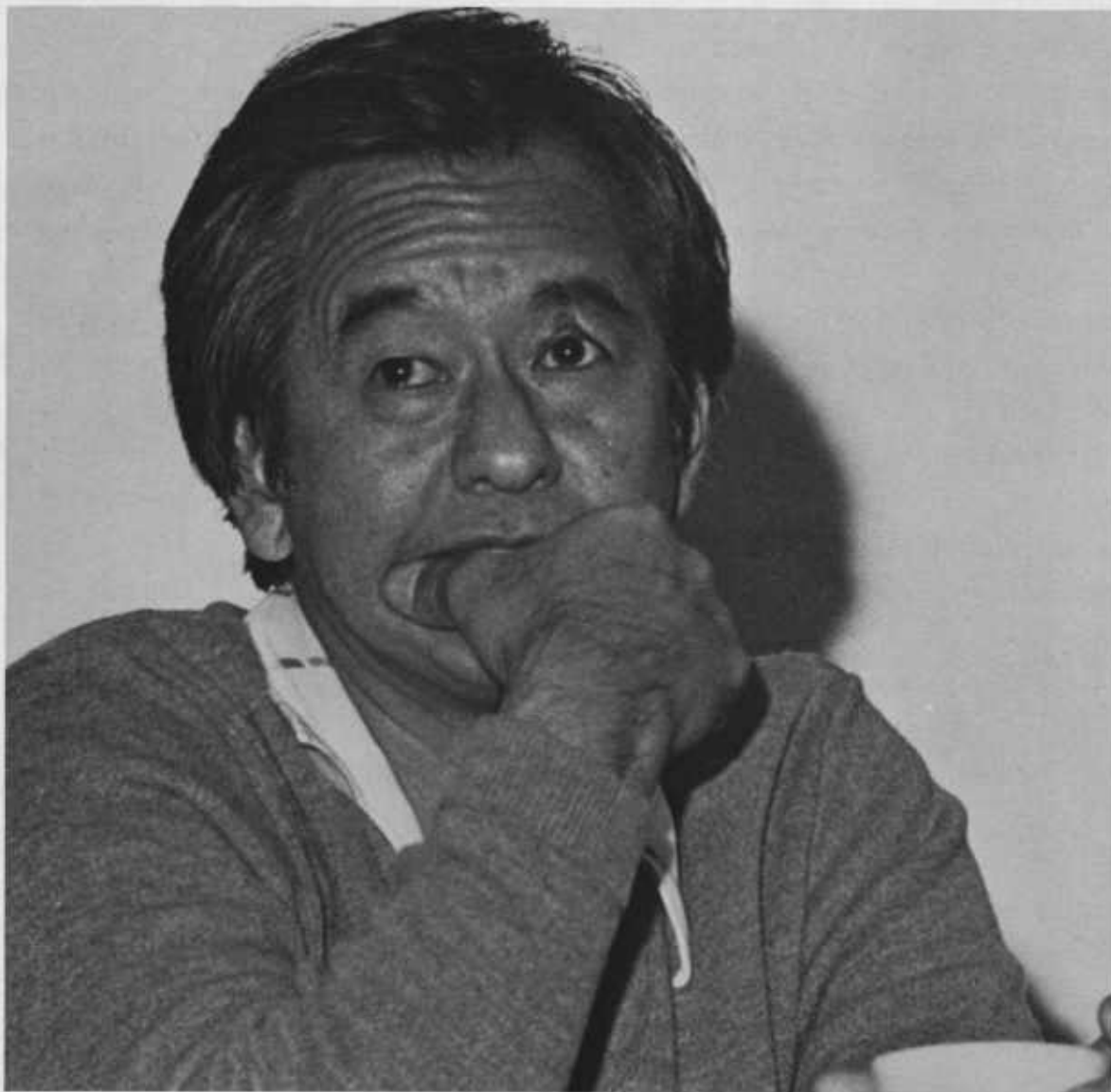
QUESTION: What is it about the species that makes one more desirable?

RATHJEN: The characteristics, the size, the thickness of the walls, and I think, more important than anything, the tradition of the people that are using it. In the European market, our Loligo is much closer to

their Loligo and the most easily substituted. You take it from there and it's just a variation on a theme. It's generally when you are entering a foreign market that you are trying to replace or displace a product, and they want to have more than the one that you are trying to sell them.

QUESTION: What percentage of the total catch of squid in U.S. waters on the East Coast is taken by joint venture fishing?

RATHJEN: I appreciate that question. We had a progress report for this past year. Almost all of that 5000 or more tons of Illex was joint ventured in one form or another. I would say that about 60-80% of the Illex was joint venture. Maybe 10-15% of the Loligo was joint ventured as an offline figure. We've got more of them coming. There is a tremendous interest in joint ventures back there. In fact, there is so much interest that a lot of us are a little bit afraid of it and it's kind of blown over the edge a little bit.



Sus Kato

AN OVERVIEW OF CALIFORNIA SQUID FISHERIES
AND CALIFORNIA LIGHT FISHERY
BY
SUS KATO*

Pete and Jake asked me to talk about the California fishery and give a background on it. First I will give a little background of the fishery which started in Monterey about 1860 or so, which makes it about the oldest fishery on the West Coast. The Chinese were the first to fish squid. They used a two-boat purse seine which was about three fathoms deep and 30 fathoms long. They attracted the squid to the surface with a lighted torch. They didn't use much light, but they were pretty successful at it. The product was mainly dried and shipped to China and to Hawaii.

(Referring to a slide) I thought that I would show a slide of a squid. One can tell the male Loligo opalescens from the female mainly by the size of the head. The males always have bigger heads. The canning of squid started around 1920 and freezing in 1926. The bulk of the product was dried until about 1932 when the silver market collapsed, silver being used for payment. Something to do with the price of tea, I think. So the fishery kind of died down until about 1943 or so when it picked up again. This occurred mainly because we were shipping a lot of squid overseas. Right after the war a lot of it went to the Philippines and other places as part of our A.I.D. effort.

The Southern California fishery started around 1958 when they started getting more consistent catches. Here are some recent catch data. The Southern California fishery that started from scratch has just about caught up with Monterey. The total catch has steadily gone up. This reflects effort as well as an increase in market size, especially in Japan in recent years. A lot of squid is also going to Europe. Most of

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the catch is used frozen, some of it fresh, and about 20% is canned in any given year. These are the three main market forms of squid.

Fishing methods in Southern California and in Monterey are kind of different. The seasons are different as well. Most of the monthly catch in Monterey is made in May, June, and July. It is only during the spawning season that the squid are caught. In Southern California, most squid is caught in December, January, and February, except this year in which we haven't caught any squid yet.

The seasons are not the only things that are different. The catch methods are also different. In Monterey the lampara net, which is a round haul net, is exclusively used because they outlawed the purse seine in 1953. The lights, which are currently used in Southern California, were outlawed in 1959. These laws were actually put into effect by the industry.

The price also differs. Historically, Monterey has always paid higher prices for their squid -- presumably because the squid are better, but there are a lot of arguments about that. In 1981 the canners paid \$115 a ton which is less than the \$280 a ton price for freezer squid. At the same time the San Pedro price on freezer squid was \$150 a ton and \$90 a ton. This year, for the first time we just can't find any squid in Southern California, probably because of some funny weather conditions. Consequently the price has gone up to \$400 a ton, which is the first time ever that the squid is more expensive in Southern California. This indicates that the quality of squid may not be that important.

I mentioned that light attraction is one way we catch squid in Southern California. We also use purse seines. Most boats are albacore boats that have a trolling rig on them and don't need much to get them ready for squid fishing. All you need are two 1500 watt incandescent lights up above, and two lights along the sides which are used to concentrate the squid. Then all you need is a big scoop. It is a simple method and very cheap, so a lot of people can get into the fishery. As I said before,

most of the boats are albacore boats and fish squid in Southern California only in the winter.

The fishing locations are primarily Catalina, the Channel Islands and also on the coast. There are two canneries in San Pedro and one in Port Vanier and most of the freezing capacity is in San Pedro. They probably handle something like 250 tons per day now which is a lot more than the 100 tons per day that they processed a couple of years ago.

Most squid are caught in shallow water from 13-18 fathoms and because the boats have to anchor to catch squid with light, there is a limitation of about 35 fathoms due to the fact that you can't drop the hook in anything deeper. If you find any squid, which is the first problem, you should look for those predators which are feeding on dead and dying squid that come to the surface as they are spawning. The fishermen use the birds, pilot whales or sea lions to help them locate squid. They are good indicators of squid. Mostly they use a fathometer. The meters range from about 28 to 125 hertz. Only a couple of boats use sonar. At nighttime, illuminance is a good way to find them, especially if they are near the surface. After they find the squid at night they drop the hook, turn the lights on, and hope that they come up. They don't always. You have to judge whether the squid are going to come up or move to a different spot. This year everybody is apparently sitting on the squid and hoping they will come up. They sit on the squid for two or three days and they still don't come up. When you get enough squid under the light you can use a brail that is about 3-1/2 to five feet in diameter with a 12 foot handle. All you do is drop the brail in the water with a boom, pull it through the squid, and up it comes. Drain the water out and dump it in the hold. It is an effective method, and you can catch 40-50 tons at night with no problem. It seems like an easy job, but in actuality it is tough, hard labor.

Being a good government bureaucrat, I thought there was an easier way to make a living. A dozen years ago Matt May and I came up with this system called "squid slurp," which is almost the same as the brail method but

uses a pump and a funnel in place of the brail. It really worked great. The pump was an eight-inch hydraulic capsule pump. We projected a wooden funnel about six feet wide out from it and put on another underwater lamp right above the funnel. The rest of the gear was comprised of a separator screen which sent the water over the sides and shot the squid right into the hold. One night we caught about 70 tons while drinking coffee. Matt made some changes on this thing, and it really works much better now. Later, we took off the top panel to avoid the surge which we found to be a big problem during rough weather. If we put this pump right under the tracking lamp, we also found that we didn't need an underwater lamp.

QUESTION: How much does this unit weigh?

KATO: Probably three-quarters of a ton. The pump has some disadvantages. When the squid are dead on top of the water they don't move, and it is very tough to pump squid under those conditions. When they are alive and moving we get 15 tons in 10 minutes, but in other cases when they are not moving, to scoop is actually faster. Also this pump will damage maybe two to five percent of the heads of the squid so the freezers don't care for it too well. In rough weather it is pretty tough to work, although we did okay in about 30-knot winds. Unloading is done mainly by brail which takes a lot of time. This is one of the reasons why you need a crew. The pump is not that advantageous when you are unloading. It is very simple; the squid are loaded in boxes and go into slush ice directly at the freezer plant. At the canneries they use fish pumps, making it much easier and faster.

The second method used in Southern California is the purse seine. They find the squid in much the same way the light boats do, but most of these boats use sonar so they can find the fish better. And they fish in the same grounds as the light boats. Matt doesn't like it because he thinks they are dredging up the eggs, which there may be some truth to. About 10-15 boats fish seines. A half dozen of them fish steadily and this is mainly dictated by the market. If the market asks the boats to fish,

they will go out and get squid because they are valuable now. In the light fishery we get anywhere from 20-70 boats, which also depends on the market conditions.

SQUID TRAWLING
GEAR & TECHNIQUES
BY
DUNCAN AMOS*

Trawling for squid has been around for a long time, but unfortunately in the past it occurred as trawling with the squid as a by-catch. In Northern Europe, squid was considered a nuisance and thrown away when caught until about a decade ago. Suddenly the squid became precious again about six or seven years ago. Markets developed and fishermen were encouraged to retain the squid. Some work was done to try to evolve trawls or methods to catch the squid in Northern European waters. I will talk about this first, then move to a discussion of the East Coast of the United States.

Ground trawls were used primarily. The standard two-panel "granton trawl," as we used to call it, which is very similar to the U.S. East Coast Yankee three-quarter trawl, was used. It was a simple trawl with full wings, two panel construction, with a head line height of about nine feet at the most. The cod end was modified and the mesh size changed down to about 1-3/4 to two inches if you were going to target squid, and of course under the very strict legislation that was introduced in Europe about two decades ago the fisherman had to declare that he was going to go for squid. Therefore he would be allowed to carry a two-inch mesh cod end. That also gave him an awful lot of other fish as well which you weren't allowed to keep supposedly, but he did. Other guys tried the mid-water trawl. Working from the German developments by Engel Trawl Company and using Superkrub doors, they used the mid-water trawl to catch squid. Of course that technique is much more species-selective because the squid come off the bottom. They are fairly near the bottom during the daylight hours, and at night they come up.

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The mid-water trawl was very successful in catching various species of squid found in Northern Europe. As an example, in 1972 I came across on a German trawler called the *Regulus* which you may have heard is now over here on the West Coast of the U.S. working up in Alaska. We fished a quota of squid on Georges Bank between 36° and 40° north, working in 40-50 fathoms with a high-rise bottom trawl. Our catch rate was two to three tons on a three-hour tow. Again, we were using cod end mesh size down to two inches, but the fore end of the trawl had 16-and 20-inch mesh in the top wings. So from that I had thought that squid are not a shepherding creature like normal roundfish or flatfish, being pushed in by the doors and bridles to the capture area of the net. I assumed that squid would not take any evasive action if they were congregated enough. I thought they would just sit there and let the trawl go over them, and then once in the cod end you've got them. At the squid symposium last year in Boston someone stated that they dropped a 1-pound explosive fairly close to squid and they never even reacted. So they don't seem to be frightened by anything including approaching trawl doors or wires, bridles, or netting. Once you get them in the capture zone of the net we can assume they will go back down into the cod end, and if the mesh size is small enough you will keep them. In the Northern European area the fishery developed. Illex were being taken in 50-100 fathoms of water and the average fisherman was picking up 30 tons a day. Now that is involving all of the vessels. That's not just one, but all the vessels.

In Scotland the squid became a by-catch in all forms of ground fishing including the Scottish seine and normal small trawlers and pair trawlers. Everybody was catching squid. There was no real directed fishery until about six years ago when we started working around the Rockall Bank which is about 200 miles west of Ireland. Again, bearing on 200-mile economic zones, that's a little piece of rock sticking up in the Atlantic with a British flag on it. Although it is 240 miles due west of Ireland, it still gives Britain another 200 miles. When we started working there we were using the "French trawl." It was a trawl design that evolved in France with 120-foot ground line and 60-foot head rope, which brings it down into the size of vessels working say 250-500 horsepower. The only

thing there was to do was to change some of the front end geometry because we wanted more height head line. When we say we changed the front end geometry, it means that we messed around with the bridles and got away from traditional two-bridle arrangements to using three. This trawl was rigged with 18-inch steel rollers through the standard flat door. A normal rig for that kind of trawl was 15 fathoms, upper and lower bridles and a 15-fathom ground wire. With the net sounder we reckoned we were getting about 11 feet on the head line. For a three-yard tow we probably picked up somewhere in the range of 800-1000 pounds of squid which wasn't very good. As I said, this one had 18-inch roller gear on it and we put another wire in. The lower wire went to the heavy gear, we put a wire up to the lower wing, and we let go the fishing line on dropper chains. The dropper chains were between 18 and 24 inches. We just experimented with that and what we really were doing was lifting the whole head bodily up to two feet so that we could assume that it was going up to 13 feet. It is very difficult to measure that kind of height with a net sounder on a ground trawl, but we thought we were getting about 13 feet and our catch rate doubled. It went up to 1400 to 1600 pounds for an eight-hour tow. It was still not very productive, but at the same time we were catching a lot of haddock, cod, ling, and whiting. All in all, the trip was successful and the fisherman was making a living.

The next idea was to go mid-water trawling in the same area and see if we could take the squid that way. During the days we always worked with a ground trawl, changing in the evenings to a mid-water trawl. Then came the problem which has appeared on the East Coast of the U.S. as well: finding the squid, determining the strength of the concentrations, and what depth they could be found, and then deciding whether it was worthwhile to go for them. We have to start employing sonars and very good vertical echo sounders.

We now move to the East Coast of the U.S. Once again, squid has been a by-catch for a long time, but now the interest has caught on again and we're using a standard American trawl very much like the granton trawl I

was talking about before, a three-quarter Yankee, simple two seam, full wing trawl, rigged with rubber cookie gear or sometimes rubber discs varied in diameter from 12-18 inches and towed by vessels of 250 and 500 horsepower. They are now tagging either flounder or flatfish, or alternatively whiting, cod and haddock, but squid is still part of the by-catch, particularly during the days. The last two successive years have been joint ventures on the East Coast for squid, and once again the vessels originally started off using the standard trawls and working the daylight hours. They produce enough squid to keep the processing vessels going but not enough to really take up the full capacity. Of course there was the traditional finfish by-catch, now being taken by the joint venture vessels, held on board in ice and returned to the vessels at the end of the day, so they could take it ashore and put it on the normal market system.

The next time that people started thinking about squid trawling was when they thought about changing the net. A company in Mystic, Connecticut called Wilcox Trawl has come up with what they call a high rise, low drag, variable sweep trawl. It is basically the same idea, but now the mesh size in the square and top wing of these trawls can be between 16-24 inches on the top part, retaining the lower half at about 5-1/4 or 5-1/2 inches. The high rise feature comes in the change of design in the square, which is much deeper now than it was before. This apparently allowed it to billow upwards with headliner between 18-20 feet. I might challenge that, because no high rise trawl designed so far has ever gone as high as the original designer said it would. If he said he's got a 24-foot high rise, chances are you are going to get about 18 feet because of all the drag and forces that act on the trawl. The point is that this trawler has proved to be very successful in taking squid. If we assume we get the minimum high rise of 18 feet with the large mesh in the square top wings and extensions, the drag is much reduced and the vessel itself can make a higher towing speed.

Now a towing speed on the East Coast is traditionally between 2.5 and three knots when you are working finfish. With this particular type of

trawl you can make 3.5 to four knots. The German trawlers who worked squid on Georges Bank in the early '70's had a towing speed between 4.5 and five knots. The Regulus is a big powerful vessel, and although they use a very large trawl that is matched to its size, they still make those high towing speeds. Again, this is daylight fishing. The only question I had at the time was whether the higher towing speed meant that you covered more ground and caught more squid even though they were scattered out a bit. What do you do at night when the squid start coming off the bottom? On the Regulus trip the catch rate would dock to about 300-400 pounds for three hours during the night even with a high rise trawl. It would appear that squid fishing is productive during the day when they are down, but how far down they go, I suppose, depends on what species of squid one is after.

It appears the high rise trawl is the one way to go. There are high rise trawls available here on the West Coast. Two or three companies make them. Noreastern Trawl would probably design you a high rise trawl to go for squid but you have got to break away from this idea of small mesh in the net body. A lot of fishermen think that with a large mesh you are going to lose fish, but even traditional finfish won't go through meshes in trawls. There is a lot of physical and video evidence to show that once fish are underneath the head line, they don't go out of the trawl until there is a severe restriction in the design of the trawl. That restriction usually comes around the extension just before the cod end. The fish squeeze together and may panic. When they panic they will try to break out. Other fish have funny swimming habits once they are in the trawl and will invariably get gilled in the small meshes, but as I said earlier, squid don't appear to be shepherded by any form of disturbance in the water. Once they are in the funnel of the trawl, we can only assume they will go right back to the cod end. The design of a trawl, a ground trawl anyway, to take squid during the daylight hours means you want to cover as much ground as possible, as fast as you possibly can. Large meshes will allow you to do that. Using large meshes means you can also reduce the diameter of the twine. So the top part of the net, the square, top wings and top extension, you can use

24-inch going to 16 going down to eight. At the lower part of the net you might want to keep around the traditional five- to eight-inch mesh, if it's just to resist abrasion on the sea bed.

The kind of ground gear you might want to use will be determined by your sea bed conditions around here. I don't know what they are, but on the East Coast we can vary from very soft mud up to pretty hard foul ground. A lot of guys have started to traditionally put on cookie gear to go for flounder. You will now see a lot of boats going around with roller gear on them, either rubber discs up to about 16-18 inches or steel bobbin gear that is maybe 8-12 inches in diameter. For squid it is probably better to use heavy ground gear because it means that you can keep on going if you start hitting foul ground and you don't have to haul to get out of the way. The use of dropper chains and a three-bridle arrangement will help to prevent any damage that might come in the lower part of the net. 18-24 inch droppers and a third wire will help to pull the twine up and clear the sea bed. It adds a little bit of height, maybe another foot, which is all to the good if you want to get squid in there. The speed at which you can tow will go up to four or five knots, if you have the power and you pick the right size of trawl.

Traditionally, as I said, on the East Coast with the three-quarter Yankee (they call it three-quarter because it is 80/60, 60 foot on the head line and 80 foot on the sweep), you can use that size of net, but if you are going to use bigger mesh and finer twines then the head line length and hanging line length can increase because the drag has gone down. You've got to be very careful that you don't oversize it so you're using all the power to pull it at three knots. If you stick to the same size of head line and foot rope, increase the mesh size, fine the twines down, you will increase your speed. Overspreading the gear because of increased speed can be avoided if you look at the door tack angles, changing the towing brackets.

I don't know again what door you use over here traditionally, but on the East Coast the steel V-formed door has outclassed the wooden door by

about 90%. Nearly 90% of the vessels working around out of Rhode Island, and some in Massachusetts, New York and Long Island, are using the V-formed door. It has a variable attachment on it so that you can change the angle of attack. By changing the angle of attack you can reduce the spread because you've increased your towing speed. You don't want to increase the spread too much because gear is very flexible. If you overspread it you are going to bring the head line down. For squid fishing you want to keep the head line up. So it would appear that towing speed, not overspreading the gear, large meshes, and fine twines have become important when it comes to squid fishing on the ground trawl.

At night it would appear that the mid-water trawl will work well. Mid-water trawls are traditionally bigger anyway, and again, if you think I have just been talking about large meshes and fine twine, think of mid-water trawls. They are all large meshes and fine twines. The towing speeds can go up, but if you are going to go for squid, I would think that you might want to consider making a smaller mid-water trawl, using a smaller one than you would if you were going to go for finfish. You still want to maintain very high towing speeds. Speeds in excess of 3-1/2 knots seem to be the ones that pay off, so if you are going to go for the mid-water trawl, don't go for a trawl that you would normally design for a vessel of your particular horsepower. Cut it down a bit and build, or have built, a trawl that is commensurate with the available horsepower. This means you will be able to maintain those high speeds.

Like everything else, it is finding the squid that is difficult. On the East Coast it would appear that the problem has always been, and will be for a while yet, how do you find the squid in the right concentrations to make fishing for them worthwhile? True, they appear at regular times through the year, and you should be able to just go out there and catch them, but it is not as simple as that. Dragging during the day has paid off because the squid appear to be down there. They may well be scat-

tered, but three-hour tows produce in excess of 7000 or 8000 pounds, and for three hours that isn't bad.

If you're using trawls with small meshes, it may be worthwhile to consider increasing mesh size, decreasing twines and trying to increase the towing speed. If you are going to do that you have got to adjust the doors. Remember that the faster you tow the more you are going to spread, and the more you spread the doors, the more you spread the gear, and the further the head line comes down. You are going to have to adjust the doors to try and reduce the spread because of the increase in speed. Ground trawling looks as though it will work on squid. What you have to find out is where the resource is, find it and fish it.

QUESTION: One of the major items you pointed out was that at 3.5 knots speed and under the catch is really poor.

AMOS: That is only my assumption. It is an assumption based on various other fisheries as well. Decreased towing speeds gives you more ground coverage. More ground coverage means you stand a better chance of catching more fish.

QUESTION: Do you know if any fish will escape?

AMOS: I'd say that fish won't escape out of the web. I don't know about squid. I assume that once squid get into that net body, they will stay there and just drift back. Maybe when they get to the constrictions just before the cod end they might panic and try to get out. I can't remember ever seeing a gilled squid in a trawl net. I am sure there are gill nets for catching squid but I have never seen one gilled in a trawl yet. Either they do get out through the meshes or they don't bother, and go back into the cod end. At this stage I might add that as a product, trawled squid is of lesser quality than squid caught by other methods, because of the abrasion they may receive in the cod end and also the crushing of the load when lifted. They are soft creatures, and some

people say that when the ink sac breaks it stains the skins and consequently creates a lower quality product.

SQUID JIGGING
GEAR AND TECHNIQUES
BY
DUNCAN AMOS*

I am now scheduled to talk about jigging. Of all the squid fishermen in the world, the Japanese are the artists. 90% of the squid taken by the Japanese is taken by so called "squid jigging," and I have some figures here to illustrate the volumes we are talking about. The squid jigging is practiced by 90% of the Japanese fleet and has also been tried in Europe and on the East Coast of the U.S. It didn't work when Europeans or East Coast Americans tried it. You might ask why. I don't know why. Maybe it is because the Japanese know exactly where the squid are and know how to get on them. Squid seem to attack a lure that goes over the side on a line which contains rings of barbless hooks. Some of the pictures that were shown this morning by Warren Rathjen showed the squid grasping that jig. When we took it to Europe, we were allowed to borrow half a dozen Japanese automatic squid jigging machines and two Japanese experts. They couldn't do it either, and it wasn't because they didn't know about squid jigging, it was because they didn't know where the squid were in our waters. They certainly know where they are on the East Coast of the U.S.

You may have up to 30 jigs on one line, so you get a 30 on the vertical line with a two-pound weight at the bottom. There is usually a drum on either side of the machine, and the drum is in the center cup so that the jig can be hauled up in the water.

Now the other secret appears to be the light attraction feature of the squid jigging boats. We did a lot of work trying to find out exactly what this was about. I am going to use a diagram so I won't get it wrong. According to what the experts told us, (referring to the diagram)

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if this is a vessel, looking from the stern, you have a mid and main mast. You shine the lights at this height. This becomes important because they reckon you have to have a shadow. The light shines in the water and this jigging machine is mounted inboard, passing over outboard rollers. A line is then passed down into the water. The scale is not very good there but what happens is that the squid sit around in here and watch as the jig comes through the interface between the lights and the shadow. They then attack the jig as it passes between the dark and the light. That's when they get themselves snagged. So we did all that and we tried to make sure that this angle was very accurate, which the Japanese told us to do. The angle of the shadow here was 40°, and that was to give us the right kind of shadow depth for the jigs to be most effective on our kind of squid. We put it all together, put the lights up and varied them. We tried different intensities, incandescent lamps, sodium lamps, mercury lamps, all kinds of different lamps and we tried it and tried it until we got the 40° angle. We went out looking for squid and switched the lights on. Power varied between 2.5 kilowatts and 12 kilowatts. We couldn't make the European squid come up in congregations sufficient to jig them. So it never really worked and never took off and hasn't to this day taken off in Europe.

With encouragement by Warren Rathjen and various other people who are interested in squid jigging on the East Coast, it has worked when the Japanese have been in charge. Warren did mention that we did some work last year with the Gloria Michelle and jigging. I was involved in arranging for the aqua sounders to be put on board the Gloria Michelle. By chance a little Japanese engineer from Koden, the company that makes the chromoscopes that are marketed by Upsco, just happened to be in the Upsco factory. So we asked him to go on board and he was the guy who really found the squid. Consequently, the jigging was successful. He found it. He turned on the machines and they literally did it themselves. They are completely automatic and the squid just came on board.

Another attempt was made last year where a Japanese squid boat was brought across to the U.S. and skippers and boats from the East Coast

were invited on board to go and see the operation. Once again, when the Japanese boat went out fishing for squid, they were very successful through their own jigging. You could find the squid concentrations, switch the lights on and start jigging. An American fisherman rigged his boat up with squid jigging machines and again went squid fishing without the Japanese expert on board, and he didn't make it. His production rate was too low to make it worthwhile. So it would appear then that the whole art of catching squid, whether it be trawl or jig, is first finding the squid. On the East Coast those squid just don't seem to react to light that much unless they are in the right mood, I suppose, or if you find them in heavy enough concentrations they will come up to the surface.

Of the two methods, jigging and trawling, I would prefer trawling. Maybe I am biased a little bit that way, but trawls seem to produce squid if you can find them. Even if you don't find them you get them. They are a by-catch on the East Coast. If you are going to target on them then you have to apply certain techniques to the trawls themselves. Maybe somebody will set up a jigging exercise here. I know there is a jigging machine agent right here in the audience who would probably be quite willing to let somebody have two machines to try out. That still means you have to go and find the squid. Once you have found them and you fetch them up to the surface, you can get them up in a concentration that would make jigging worthwhile. Lots of little ideas have been tried with these jigs by putting lights down on the jig, but that doesn't seem to enhance the catch rate of the jigging machine. It does seem to enhance the congregation of the squid, however. Like everything else, fishermen will adapt and try and change. Give them something and they will change it. You must all admit that. If I design a trawl and put it on your boat, before I've been gone 24 hours you will have changed it. And surely you can do that in squid jigging. You may want to try, if somebody will back you, to go out there and try squid jigging. Maybe you will find some other method of attracting the squid to the jigs themselves.

The only other big disadvantage with squid jigging is the out time. We

struck them in Europe but it wasn't a heavy strike. The weather has an influential effect on the jigs themselves. If you have a heavy roll on the vessel because you are running a heavy swell, it counteracts the jigging action of the lure, and as you come down, say on the port side, the lure goes back down again and the squid apparently get off because they are barbless hooks and they just slip off. We asked the Japanese guy about putting barbs in the hooks. He said that would make the production costs phenomenal and it wouldn't be worthwhile anyway. They can make it work, so why change it? So weather conditions can affect jigging, and obviously you have to have nice calm weather to do it, although I'm sure that off the coast of Japan there is some pretty heavy weather and they still seem to be able to produce squid by jigging for them.

As far as the options go, you already have trawls, and maybe that is the way you should look at it. Some changes in the trawls might be better. To increase the mesh sizes and increase the towing speeds, just consider what you are doing. If you change one thing on a trawl, you have got to change three other things somewhere along the line. One change will not suffice. Something else will change automatically. Usually one change means three other changes. So the trawl would appear to be the way to go. It still boils down to what everybody says: you have got to find them first. If you are already getting them as a by-catch, then maybe you've got to find greater concentrations. If you are already getting them as a by-catch, maybe you could increase the by-catch by increasing the towing speed, which means a change in the net. If you already get a by-catch during the day, what happens during the night? Are the squid rising up off the bottom in sufficient quantities that you might want to start thinking about a mid-water trawl to go after them? The mid-water trawl seems to be pretty common over here. Again I can't see any reason not to use the rope trawl, as the squid don't seem to have any escape reaction. They will just get under the mouth of the trawl if they are in the mouth. You might well catch them. So the trawl would appear the way to go, unless this man in the audience might give someone two machines to play with. You can go out there and try jigging for them. Jigging needs

a fairly good light concentration, you're going to have to use lights, you will need fairly good weather to do it, and you will have to find them.

QUESTION: You mentioned that the boat you were on had a chromoscope. Do you know what frequency that is?

AMOS: From what I hear and what I've read, 70 to 200 kilohertz is the best detection frequency for squid. Squid do appear to have this characteristic white rice shaped mark which gets very heavy. Now Warren Rathjen did show a little slide this morning which showed you those white bands and each one looks like a rice grain. That appears to be the characteristic mark of a squid.

QUESTION: (Referring to a diagram) Should the jig be in the shadow or the light?

AMOS: My diagram isn't too good there. You should put the refraction angle in. The jigs actually travel down through the light into the shadow. The light will obviously refract when it comes down here, so the jig comes down into this shadow zone, and that is the light. It seems the squid hang around here in the shadow, and as the jig comes out of the shadow into the light they pounce on it and grasp it and that is when you get them. This was the only angle that was worked out. Maybe you can change that angle and maybe it is better for your species of squid that the angle is different, but that is something that would have to be worked out. It is easy enough to change the angle just by changing the height of the lamps. If you're working on a mid-ship it isn't too difficult. You need to get the squid nearer the surface. When jigging is good they seem to go into a frenzy, as though it is a feeding frenzy and they will attack anything, even themselves. When they are like that, your jigs become very productive. But without that it is just like the trawling and they are going to be sporadic.

The light attraction congregates the squid. With the East Coast squid it

seems to be that when you switch the lights on the jigging boat and you can get them to congregate, they're not very far below the water. In fact, you can see them come up towards the vessel on the aqua sounder and you can see the squid jigs going down into them.

QUESTION: Basically what is the length of your jig line?

AMOS: You can go down to 30 fathoms, but again, it is better if you can get them up in the water. The technique is to get them up in the water, check what the depth is on your aqua sounder, set the line length so it is maybe two fathoms below the indicated mark, and then let it come up through the mark.

QUESTION: If you use lights at night to bring them up, what do you use during the daytime to get them to come up?

AMOS: Jigging doesn't work during the day, it only works during the night. I would say the success rate for Illex and Loligo is the same by trawling. By jigging, Loligo hasn't come to the lights yet.

PANEL DISCUSSION:
JAPANESE SQUID FISHERIES

Panel members: Bill Court¹, Frank Cary², Sus Kato³, and Warren Rathjen⁴, moderator.

RATHJEN: Sus Kato is here to lend some oriental flavor for all these people. I am not really sure why I am here. I am hoping to keep this thing on the road and keep us all out of trouble. Bill Court has already been introduced as a longtime friend and I have a lot of confidence in the way he is going to start this thing out. So he has agreed that he will kind of set the stage with an introductory remark or two and then we are going to subject you to some slides, so you can all go out and go to the john or have some squid or whatever you want to do. Then somewhere in the middle of all that we are going to phase into Frank Cary who has some recent experience with the high seas Japanese gillnetter. That should be of great interest to you, not only from the point of view of the technology of capturing squid, but what else you can catch with a gill net. So with that, Bill, if you would start the music.

COURT: Well, there is so much you can say about the Japanese squid fishing industry that I am really at a loss where to start, but I'll

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just try to accentuate some of the points that seem to be of greatest interest to us. It is helpful to understand and realize that Japan is an island nation and historically they consume a very high volume of seafood. Squid is very much available and abundant throughout Japanese waters and is landed in fishing ports the length and breadth of the country. Many people, a very large portion of the Japanese population, have been accustomed to having fresh squid for a very long time, so the market and the fishery are heavily oriented to the fresh product. Again of interest to us, the fishery is broadly divided in about three ways between jigging, trawling and the drift gill net, and there is a little bit caught in traps or set nets or whatever. Also, it is divided between the inshore and offshore, and the overseas. That is further broken down by the fact that trawling is not permitted in waters adjacent to Japan and operation by the larger boats is restricted to offshore and overseas waters. So you have a very complicated structure and there is a great deal of conflict within it. For example, there is constant conflict between the small jiggers and the large jiggers as well as between the jiggers and the trawlers. But I think what will be helpful for an American experience would be the fact that the Japanese have been jigging squid for decades.

The way that the current automatic squid jigging fishery developed was in the postwar period. Hundreds of thousands of Japanese troops came home from overseas, and there was great unemployment and high availability of low cost labor. So they would take these boats in the coastal areas and put 15 to 20 men on a very small boat. Each one would have a line with a few jigs on it. They could catch a very substantial amount of fish. Gradually the lines got longer and the jigs got more sophisticated and they could catch more squid. They caught an overabundance of squid, so they had a great problem with how to develop markets for them. Then in the early '60's Japan experienced its rapid economic growth and they pulled all these fishermen off the squid boats and put them in the factories, so they had to automate the jigging. The fact that they had such a wide coverage of the areas around Japan meant they could easily find which areas had the squid and what seasonal, temperature and climac-

tic conditions affected the fishery, so they had a great deal of experience on which to base the later development of the fishery. Then they gradually, in the '60's, moved into automating it.

Now with the higher increase in labor costs they will have a boat with say 25 machines double-reeled with 30 or 40 jigs on each reel operated with a few as five or six men. Of course, these would be freezer boats operating offshore for a period of however long it takes to catch the fish. It used to be three weeks, now it might be over three months. These would be the larger boats. The smaller inshore boats have essentially all converted over to automatic jigging. There are about 30,000 of these and maybe a thousand of the class over 100 tons. Then they have about 100-200 very large boats which have to fish in foreign waters off the Soviet Union and New Zealand. I mentioned that there is a jigging fishery and a trawl fishery. The jigging fisheries harvest somewhere between 150,000-250,000 tons a year, mostly in Japanese waters but then about 20,000-40,000 tons in New Zealand. The trawl fisheries harvest about the same amount in New Zealand and then maybe 10,000-15,000 tons off northeast and South America and some off Argentina and West Africa.

The Japanese domestic market is for about 500,000 tons a year. Up to 80% of that is caught by the Japanese. What they call domestic is really their own boats fishing in overseas waters. They have a fluctuating demand for imports that has to fill in that extra 20% up to about 100,000 tons. I think in view of time, we will leave it there and try to cover any other points in the slides or subsequent questions.

(Slides) This shows the attack method. This is just showing the very wide variety of squid. As I mentioned, the main Japanese catch is essentially three species. One is the "Japanese common squid" or the "short fin" species, which is somewhat similar to the Illex caught off the East Coast. They catch some Loligo in Japan. This is the more valuable species but larger than what they catch off the West Coast of the U.S., and has a thicker mantle and larger size than those they catch off the East Coast. Also interesting to note here, the Japanese use the

term "ika" for both squid and cuttlefish, so that is why you see both of them here.

(Slides) This is showing the squid fishing grounds by season and area in the Sea of Japan. Briefly there are three sub-populations of this Japanese common squid. They start down in the south and work northward in feeding migrations in the summer. Then about September-October they start migrating back southward and the fleets follow them up and back. They have about two months a year, February and March, where fishing is restricted.

(Slides) This just shows a variety of hooks. Sometimes they have one tier of hooks, sometimes two and sometimes three. The color and design of the jig, as well as the size and strength of the hook, vary with all the species and type of boat and type of fishery.

(Slides) This is just showing a scene of a 29-ton boat actually fishing at night. Here they have incandescent bulbs but in the last four years there must have been three or four major new innovations in lighting techniques. There have been radical changes, and everybody tries to keep up with the next one for the most current type. Here is the traditional Japanese scene of the squid fleets at night. International pilots have reported unusual concentrations that look like cities in the Sea of Japan, the North Pacific, and off New Zealand. There is so much power, sometimes 300 kilowatts, on these boats; a tremendous amount of lighting. This just shows a shot up alongside the boat of how they arrange the machines along the side. Frequently they will have a manual machine interspersed or just have people stationed at hand jiggers. This is just a close up there. There are about 10 different manufacturers of machines, really two or three majors, and even one with a hydraulic unit which went bankrupt but most of them are electric units.

(Slides) This is showing some live squid. One of the big markets in Japan is to go out and jig these fish and while they are still alive put them into live tanks and take them in, because there is a substantial

margin for the live product as opposed to the lower quality fish.

(Slides) This is just showing a three-ton boat, a small boat, you see only three machines. They're in a small harbor in northern Japan. You can even get some idea about the terrific number of boats. As I mentioned, there are well over 30,000 of these small boats in the waters between one and 30 tons. They range throughout Japan; as I said, they follow the fishery and you can imagine the competition. Obviously the catch rates have fallen drastically. They were catching up to 650,000 tons at one point and now this particular fishery is down to 140,000-200,000 tons a year. Here is another shot of the harbor giving the impression of how many boats they have crammed in there. One of the advantages of these boats is they can relatively easily shift to other fisheries. Many of them fish squid for three or more months a year and then otherwise fish longline or pots or whatever is available. Here is a shot of what they call a 10-ton boat with 10 machines. This would usually be operated by two people or sometimes, in a pinch, one.

Here is what they call one of the 500-ton class boats. You can see the line here, this boat has been modified. She used to be a very large tuna longline. Most of the 500-ton class boats were diverted from other fisheries. This is a characteristic of the Japanese fisheries if there is a great overfishing. They constantly shift from one fishery to another, so many boats, trawlers, have gone into squid fisheries. I want to call attention to that sea anchor at the top. One of the techniques of the squid jigging fishery is to put over a sea anchor to keep your flow of the current so the lines don't get tangled up when you are jigging, and it is quite an art to setting that thing. Now you see it drying on the dock and it's dipped off the bow as before.

(Slides) This is just showing the start of what they call the 99-ton class boat. The Japanese fisheries agency commissioned a special study to design a squid boat and this is what they came up with. It is a 99.9-ton class boat, which fits under the legal limits. They used to work with about 12 men and now they might work with five or six. They

have about 25-30 machines on board and a large freezing capacity for over 10 tons a day.

(Slides) Here we see a salmon rigged boat. In 1979 they were first used to fish squid in the North Pacific and they were very successful, so there was a rapid influx of boats from tuna fisheries, salmon fisheries, squid jigging and all sorts of other fisheries. Finally last year they regulated the fishery when there were 550 boats participating, plus 30 from Taiwan and 50 from Korea. These are the boats that are said to be catching salmon. The Japanese widely denied that, and the government and the industry have been very effective in telling people not to say anything, but there is some evidence that a lot of salmon was being caught. There was much antagonism in Alaska last year when the poor runs were attributed to this group.

(Slides) Here is a shot of one of the recent squid automatic jigging machines. Here again we see a sea anchor on the smaller, maybe what they call five-ton class boat; you see the lights there in the background. Here we see one of the 99-ton class boats. You can see how they use every available bit of space to cram in those machines. You may see racks alongside the machines that stick out longer; they are for manual jigging. They jig manually when the machines are running smoothly. There you see the parachute anchor hung off the bow. Interestingly, these boats are precluded from fishing in waters immediately adjacent to Japan, so they hoist them off in foreign waters.

You might want to explain this slide, Warren.

RATHJEN: That is the picture of the chromoscope recording a school of squid in Japan on a coding machine. As Duncan (Amos) explained it, everything is relative to the motion of the vessel and the particular activity of the squid. That's a particularly nice illustration of the ability of this equipment on squid when everything is going right.

COURT: As I mentioned in the lighting, also in the electronics, even

the very small boats have extremely sophisticated equipment, and whenever anything new comes out everybody immediately flocks to it. This is just showing the previously discussed principle of the lighting. This has been heavily researched and is debated to some extent, but the basic idea is the squid hiding in the dark and darting out into the light.

(Slides) We just showed the parachute anchor out here. This is just showing the manual jigging. As I mentioned, at one time everybody just fished with the hand line, then they shifted to these manual jigging reels and they still are using them on many of the boats, interspersed in between the automatic machines. Sometimes with their old unemployed people, sort of the social welfare system, you make a place on your boat for one of these and let some old guy go out and make a little bit of money.

(Slides) Here you see them getting the squid on a relatively larger boat. You see the larger reel, longer rack down on the sides for manual, and you have the automatic one I guess on the inboard side.

RATHJEN: Bill, go back to that one a minute. You might mention that trough and the way the squid is flushed down to the factory area. When the squid collects on the rack, it is raked off the rack with a long handled stick and it goes into this stainless steel trough that runs around the gunnels. On the more sophisticated vessels the troughs feed right into some tanks below in the factory area. To a considerable extent the delivery of the product right into the factory is automated.

COURT: Many of those are rigged so that almost all of the squid fall off. You periodically have to walk around and knock them down or pull them down or reach up with your hand and get them all.

QUESTION: Does it change to the horizontal concept?

COURT: Obviously the light intensity is so great you want to get them off there pretty quickly. I have worked on some of these boats where

well over half the squid coming down the chute to the packing area were still alive, so we were icing them and boxing them while most of them were still alive.

(Slides of a diagram) Here we show shots of the drift gillnet fleet fishing areas. You see the numbers one, two and three. These are seasonal indications and the progressions by years. But in 1979 they started fishing in area two and three. They were very successful and the word got around immediately. Boats appeared from everywhere and they gradually had to go further and further. Now they are fishing all the way out to this bar, which is past the number seven zone. This is a Japanese publication, so they don't show you the area they are fishing north of the 46th parallel. Some people claim they are fishing within sight of the Aleutians and over off the West Coast. But your Japanese surveillance on this fleet is very, very inadequate and a tremendous source of political debate in Japan. There is a great deal of fighting between the squid jigging boats and the drift gillnet boats and gear conflicts and resource conflicts in these areas.

(Slides) Here you see the drift gillnet people on the shore working with their nets. I have talked with many of these people and it's amazing how all of them are well schooled not to say one word about anything besides squid.

(Slides) Here again we see the biggest squid landing port in Japan. They land well over 100,000 tons a year here. These are frozen on board in blocks and here they are sorted by size. All of these landings go through the cooperative to get that 3% commission for handling and marketing.

(Slides) Here we see squid for the fresh sushi and sashimi market. This brings in a substantial premium and as it varies a little bit, the total demand of the market is maybe 25-30% of fresh caught. It is decreasing a little bit.

Between 1500 and 2300 tons of Monterey squid goes to Japan per year. Of course it varies with the supply and demand and prices and many other factors. But it is relatively popular, and fairly inexpensive. It's very successful because it is frequently packed in one pound packs which can go directly to the consumer. Many housewives, cooperatives, and farmers cooperatives are importing it and selling it directly because it is so convenient in that aspect. It is a very popular item.

(Slides) Here we see dried squid. This has been a traditional ceremonial item in Japan for well over a thousand years, and also in the past, when there were not other means of preservation it was a cheap item for distribution and consumption. Back before the war there was a tremendous volume of this type of squid exported from Japan to China.

(Slides) Here we see a processing plant, what they call "saki ika" which is a dried shredded flavored product. And here we see smoked squid rings and the saki ika.

The major fishery off of New Zealand was developed in about 1968 (don't quote me on that), and then there was a big conflict because the squid jiggers developed it and then the trawlers went in and now the trawlers get about 20,000 tons a year. You will note that off the East Coast of the U.S. it is almost exclusively trawling, only a few jigging boats.

CARY: The vessel I was on was about 420 tons and actually this photo was taken in the middle of the Pacific Ocean. This is a ship very similar to the one I was on. I took the photo on board that ship. (Referring to a slide) There is the bow of the ship and there is the stern of the ship. If you look to where the deck starts, at the lower part of the hold of the ship, you can see there is a machine. That is what pulls the lead line when the net is being landed. To the stern you can see that there are some buoys. It's a little bit hard to see, but where all those red flags are to the middle there, those are the radio buoys that are attached to the end of each set of netting.

These nets are very large. The nets are about 6000 meters long, about 4 miles, and they set about seven of these in a straight line, so altogether they are setting about 40 kilometers of net with slight gaps between each net. Forty kilometers is just under 30 miles or so.

QUESTION: How deep are the nets?

CARY: They are about 10 meters deep. The mesh size is about 110 millimeters.

(Slides) Here you can see the squid being landed, and you can see one squid in the middle. These are flying squid, which are quite a large squid. The mantle length can be about 40-50 centimeters, so the entire squid can be up to a meter. Toward the middle there, it is a little hard for me to tell, but I think that is a shark, or it could be a dolphin. I saw some dolphin being landed. Of course these would have drowned by the time they come aboard because they get caught in the net and they have no way of escaping.

(Slides) Here you can see them shaking out the squid. That man in the middle there is also the cook; everybody works on the ship, it seems like. I think there are 10 men on deck there and actually the number of crew on board is 15. Out of those 15, about seven are officers and you even have the captain working, but you don't have the man called the fisheries director working. On a Japanese ship it seems that the fisheries director is a higher position than the captain. Here we have a shark, that is a mako shark I believe, to the right there. The tube to the right, that pipe, is where the net goes. After going through that tube, the net goes to the aft area where it is stored in a bin ready to be set out.

(Slides) This is after they have been frozen. They are taken out of the freezer and put into this tank of water. Then they just pop them out of the trays. This is where you see a lot of black ink as well as squid. This is the cork line (they use a double cork line) and the webbing.

It's a fine net, a little more brittle than the one that is commonly used for salmon.

Now the reason I was aboard ship was to see if there were any salmon caught, because the North American salmon fishermen were up in arms about the possibility of these boats catching salmon. Of course I didn't see any, not one.

QUESTION: What was your geographical position?

CARY: Most of the time it was about 160° to 150° west, so if you remember that rectangle on that map on one of the slides before, it was very close to the northeastern corner of that box. This was about October, early October. I don't know too much about the migration patterns of salmon. Perhaps the time they do catch them, if they do, is during the summer. It is entirely possible that the Japanese are actually in the clear with respect to this, because it would be quite obvious if they did land salmon in Japan, and it seems that no salmon has been landed at the squid ports in Japan. Also, South Korean and Taiwan boats seem to be gillnetting for squid as well, but they are not regulated like the Japanese boats are. They may well be going after salmon if their squid catch isn't very good. I don't really know. The number of Japanese boats of the type I was on was about 300 and the number of Korean and Taiwan boats was about 130 during that same time in the fall. A lot of those boats may have been after salmon but it is hard to say.

QUESTION: What was the length of time for the sets?

CARY: You leave the nets in for about 14 hours or so. After they start putting the net in, it is about 2-1/2 hours before the last part of the last net goes in, and then of course working the net takes about six to eight hours.

QUESTION: How long before you start to haul it in?

CARY: It soaks between that time so it's hard to say how long it soaks. The first part of the net that you come to would have soaked for perhaps about nine hours but the last part of the net you come to would have been soaked for 16 hours. The average soak time was probably about 12 hours.

QUESTION: What size mesh do you use?

CARY: 110 millimeters.

QUESTION: Was it on the surface?

CARY: Yes, this is all on the surface; 10 meters from the surface. They have to watch on the fish detector where the fish come up. The time that they seem to prefer to do it is when the sea temperature goes down. They have a very accurate temperature measuring device on board. When the sea temperature goes down slightly is when they prefer to put in the net, but there are all sorts of other factors that they use to decide when to fish. They didn't do very well at all while I was on board. A lot of the trouble was the bad weather because only about half the days available were they able to fish. But during the summertime they lost only two days due to bad weather.

(Slides) Here are the buoys. That is a radio buoy which emits a certain radio frequency and you zero in on that buoy. Of course most of the time you are operating at night so it becomes quite necessary. There is also another buoy on which there is a little tiny light bulb. I always wondered why they used such a small light bulb because it is very difficult to see, but I guess the battery wears down if they don't do that.

(Slides) This is the device that pulls in the cork line and those balls rotate contrary to each other. The friction and the rotation causes the cork line to come up at a great rate. This one is the lead line device seen head-on. That's a wheel which you put the lead line onto and the friction causes the lead line to come up. This is on a stormy day, but it was a very clear day. It got pretty rough sometimes. The length of

the ship was 42 meters, and the width was about 8.5 meters. I think that's all.

QUESTION: Does anyone know how long the Sea of Japan fishery will hold out? They are graduating their fishing farther and farther away from the Japanese mainland. Is there a chance that these fisheries will fall in great decline and there will be a much greater demand or percentage of fish or squid that they will have to export, or will imports go up? Is the Sea of Japan fishery managed?

COURT: It is managed Japanese-style. They figure that they are going to get a certain amount of biomass and that there are very sophisticated, complicated environmental changes that we can't understand. If your catch of squid decreases, you will make it up by increasing something else, so they are much more liberal in the amount that they will permit. Also they have such a tremendous investment both in terms of people and equipment involved in the fishery that their management, in addition to the different philosophy, has a tremendous amount of political pressure, making it very difficult to have strict limitations. In 1956, for example, they landed something like 600,000 tons total of the common Japanese squid. Within the last couple years they have had years of 120,000, 140,000 and 160,000 tons. So that has very substantially decreased. But as we mentioned, they have been developing new resource areas and so now a very substantial portion of the Japanese landings come from the North Pacific, from other overseas grounds. They are also trying to develop some other ones.

They are particularly pleased with the fishery that we have just seen, the drift gillnet fishery because it is mostly in international waters. One significant aspect is that the Japanese have been relatively less affected by the fisheries conservations zones than other countries, for example the Soviet Union and Spain, in terms of their percentage of fish caught overseas. There has been a very substantial shift in the Japanese overseas catch in the last six years from other species to squid, so now the overseas trawlers are catching a much greater proportion of squid.

There is the possibility, as New Zealand, Africa, U.S. and Canada and some other areas where they catch squid get more strict and reduce their quotas, that there will be some net decrease in Japanese supply, and therefore a need to import more.

KATO: Their method of management seems to make a lot of sense when you look at a total catch of the same niche of species, whether squid, herring, sardines, or Spanish mackerel. For example, a few years ago there were no sardines. Last year I think it went up to three million tons and Pacific mackerel was down to zilch and they went up to two million tons and they are down again this year. It seems to work out okay. They can switch from one to the other and make use of everything they have that is available. I think for them it makes sense. In our case we don't have a market for this or that so we can't do that.

RATHJEN: I tell you something that impressed me in my very limited exposure in Japan. Through the courtesy of Bill Court I got to visit the largest fishing port in Japan. The scale of operations there is absolutely beyond our conception. There were 2000 vessels operating there when we visited, and they were all comparatively big vessels. That was down from 3000 several years ago. While we were visiting, the seine fleet, which happened to be operating way off shore from there, landed 5000 tons of mackerel before 10:00 in the morning. After I walked away from that I said I had seen it all. There were 120 processing plants in that one city which is on the east coast of Honshu. The scale is just way beyond our ability to comprehend. I am sure a lot of you have experienced this in a greater depth than I have. It really got to me.

QUESTION: On squid going into Japan we have a lot of problems, a lot of trade barriers, trade friction, and squid is a very severely restricted import quota item. Do you think you can tell us generally how this import quota system works?

COURT: The Japanese supply comes from the inshore, offshore, and their

overseas fleets, and the quota system is designed to protect the Japanese fishermen by maintaining a certain minimum price level. But at the same time there is the interest group of the Japanese consumer, so they want to satisfy them by having at least a minimum required volume. The import quota system is designed to protect the domestic fishermen and permit a level of imports only satisfactory to cover a part of the additional demand. They always want to keep the demand sufficiently stimulated, so that the market is stimulated. The volume of the quota is set every six months. It is a very complicated Japanese-style system where you have a meeting of several processors' organizations which represent various aspects of the squid processing industry. They propose how much they need and then they present this to the fisheries agency. They go over it in view of what the fishermen and the fishermen's organizations think they can supply. Then this is submitted to the Ministry of International Trade and industry import groups. They go over it and set some quota on it. Then they send it back to the Ministry of Agriculture, Forestry and Fisheries and they get this quota out.

It is basically divided up among these various players in three ways: maybe 5% would be for developmental fisheries, 40% or so for major trading companies and the rest would be given to four major associations of squid users and squid processors. There have been times for several successive six-month periods when it has been zero. It is a very political situation. It's divided up, maybe between 200-odd quota holders. Some big companies like Mitsui, Marubeni and Taiyo might have several hundred tons, many other companies only have 20 tons or five tons or three tons. Many companies that hold quotas obtain them in a political manner, and they don't ever use them except to sell them to people who want to import. It's basically to protect the fishermen and I think that it is very unlikely it will be completely phased out.

QUESTION: Aren't there some items that are exempt from quotas?

COURT: There are many items. The quotas are basically set in the fisheries where the Japanese fishermen are involved in providing a

sufficiently large portion of the supply that the government feels they have to protect their livelihood. For example, the major import items are herring, squid, mackerel, horse mackerel, and other items which the Japanese catch in substantial volumes.

QUESTION: Pertaining to the squid, aren't there certain types of items that are allowed to be imported exempt from quotas such as packaging, or partially pre-cooked or prepared by the package, like soaked in soy sauce or one thing or another?

COURT: Basically, if it has been semi-processed or flavored it can be exempted, and cuttlefish was exempted six or seven years ago. Yes, there are exceptions and at one point up to 2000 tons from Korea and some from Canada was coming in under that, but it is still very limited. It has to be completely cooked right now. If it is half cooked it is not exempt.

RATHJEN: Bill, what about the other markets -- China, Korea, Southeast Asia. Are they self-sufficient or are their exports off quota?

COURT: I believe there are opportunities. The Hong Kong, Taiwan, and Singapore markets import dried squid; I can't tell you specifically the volumes. I think there are opportunities there, but I guess the major attraction of Japan is such substantial volume and relatively good price. But no, there are substantial markets in the Chinese ethnic areas.

QUESTION: What sort of wholesale price in Japan on frozen squid and what sizes are the most common?

COURT: It varies substantially by species and size, and it can go anywhere from a C and F price of about 40-odd cents on the low to \$3.00 a pound for a high value choice Loligo species. Much of the shore frozen stuff, if it got in, would probably be somewhere between 45, 50, 55, or 60 cents a pound. Again it varies. It is constantly fluctuating. There is a tremendous range; different species are desirable for different

sizes and desired for different markets. You would have to take a particular item, but, for example, the good quality common Japanese squid, good size, might be running the equivalent of about 80 cents a pound. I would have to figure that out.

QUESTION: Can you describe the characteristics of the squid species which are more acceptable than other species?

COURT: Almost the only species a few years ago was the Japanese common squid. When that started decreasing in availability and being channeled to choice markets, the processors started gearing up for other species available from the northern Pacific and for Canadian Illex. Some of the markets are only suited to the Illex, so yes, there is some variation. What makes it desirable varies again from market to market, species to species. There is a range of well over a hundred different products on the market. The number of products increases or decreases inversely with the increase in price of squid, and also, the substitutability between species increases with the increase in price. It's mainly color, texture, size, unit price and suitability to drying, smoking, boiling or other types of processing which determine the value of the specific species.

QUESTION: Frank, could you comment briefly on the actual handling of the gill net on these factory vessels, what types of limitations they experience, say with weather. I know because they are hauling the gill net amidship instead of picking it up by the bow and setting it out by the stern.

CARY: Well, the setting out is quite straightforward. It's done from the stern and buoys are attached at both ends of the net as they are set out. In order to pick it up you first have to capture the net; in order to do that you throw a four-prong device out to the port side. That sinks a little bit and you get your cork line that way. You pull that device onto the ship. The lead lines are coming with that as well, and then the buoys come along. At that point the net is attached to the end

of the previous set or rope that is protruding from that pipe. The lead line is separated from the cork line as much as possible, but it often gets tangled up going into the pipe, in which case they have to back the whole thing out and try to sort it out. It is quite a rapid process where the net is moving along the deck. In order to dislodge the squid from the net, it is usually done with centrifugal force where you pull the net and shake the squid out. Usually the mantle of the squid gets caught in the gill net but not necessarily. Sometimes the tentacles of the squid are caught in the net and the process of dislodging the squid from the net often breaks the squid in half so there is quite a bit of damage. Also you see a lot of shark eating squid because they have been in there for quite a while. There are those kinds of problems too.

QUESTION: What about the weather?

CARY: The ship is usually going about two knots, very slowly, and maybe even one knot. They try to go straight alongside the net as much as possible, but when the weather is bad or with currents, the net can deviate from a straight line pattern. That causes problems because the ship will sometimes go over the net and then they have to back up the vessel. There is a clutch device they continually use to go backwards and forwards trying to keep at a very slow rate, sometimes having to go back. In that manner it is brought aboard. Only about half the days were suitable for fishing. It really was necessary to have fairly good weather. Of course, in the middle of the Pacific you can't ask for much. The process of putting out the net begins around 2:00 p.m. and is usually finished by 4:00 p.m. It is left to soak until 3:00 a.m. at which time the process of picking up the net begins, lasting approximately eight hours.

QUESTION: Would you comment on the drop-out rate of squid and other species?

CARY: I really wasn't able to tell because it was dark a lot of the

time. I would say it is about 10% or under. There wasn't really a substantial drop-out rate.

QUESTION: How did you arrive at the figure 10%?

CARY: That's what I am saying, I don't really know. I would guess that. I did watch some squid falling out, but it was quite seldom.

COURT: Some fisherman told me for the gill nets 10-20% and the same for those caught on jigs. The meat of the squid is so weak that there is a substantial drop from the jigs as well.

QUESTION: Is there a definite female to male ratio?

RATHJEN: There was an experience in the giant squid fishery in the Gulf of California, which is primarily a jig fishery, where predominantly males were caught. They tested the same bunch of squid around a lighted barge, or something like that, and it was almost a 50-50 mix. That implied, in that situation, that jigs were taking the males much more than they were taking the females. In other words, the males were going after the jigs and the females were not. In the fishery in Southern California it is a male thinking that he's chasing a female and that is why he gets caught. That's how we all get caught, isn't it?

COURT: One point I didn't address is in regard to the common Japanese squid and the New Zealand squid jigging. In both, the blocks are 7.5 kilos or about eight kilos. For the North Pacific fishery the squid jigging blocks are 12 kilos. The trawl boat blocks are about 12-13 kilos each and two of them are put together in one carton with a poly line. If somebody were looking for the appropriate size carton, I would say 10 kilos individually packaged, or if it were in a trawler, you could do two 10-kilo boxes or 20-kilo cartons.

PANEL DISCUSSION:
INSURING ORDERLY DEVELOPMENT OF THE
OREGON SQUID FISHERY

Panel Members: Richard Thompson¹, Bob Loeffel², Terry Thompson³, and Joe Easley⁴, Moderator.

EASLEY: I don't know any fisheries that have been assured an orderly development in the U.S. The traditional method of approaching fisheries management in the U.S. has pretty much been to let people go until it looked like the resource needed some protection and some management so that the resource would be there. After that there would be some management to make sure that the resource continued to be there for the users. It has been more of an afterthought. A lot of the research in most cases has been an afterthought also. It started long after the users started utilizing the product. We are in the same boat with the squid fisheries. I think there is very little known about squid, how much of it is there, what areas the squid span on the northern part of our Pacific Coast, when they are available, what kind of fluctuations in the biomass might be there, and what would be the best method to fish them. All of those things are still questions at this point in time. I suppose if you were the scientist, the way you would prefer to go at it would be to

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lock the thing up and take a good long look at it and decide how much there was, how much could be taken, then let some people in and test your theory. It doesn't work that way, and oftentimes it isn't very practical in the real world. This discussion will probably be more of a philosophical nature and an examination of approaches to management than giving real pat answers. On this panel we have some people that have quite a bit of history in fisheries. I am going to ask each of them to make a little opening statement and then we will just open it up to questions and see where we go.

First we have Dr. Richard Thompson. Dick has spent 30 years with the National Marine Fisheries Service and its predecessor, the Bureau of Commercial Fisheries. He is currently a fishery biologist with the Fishery Management Division of the Northwest Region out of Seattle. Sitting next to Dick is Bob Loeffel. Bob is currently the Marine Regional Supervisor for the Oregon Department of Fish and Wildlife stationed here in Newport. He has spent the last 31 years in the Department. Then we have Terry Thompson. I suppose quite a few of you know Terry. He owns and operates the 76-foot dragger/shrimper "Olympic" out of Newport. Terry spent the past 20-plus years in troll salmon, albacore, shrimp, and drag fisheries. He has done a considerable bit of looking and pioneering work locally on squid. With those introductions, I will ask Bob to start and then we will go back to Dick and Terry who can follow up, and then we'll start with some questions.

LOEFFEL: Joe Easley touched on two parts of what we would tend to put into the subject, but I want to distinguish between them. The subject that is on your agenda, and that I intend to talk about here, is orderliness, not management, orderliness of development. I think it well to understand today, at least, that I am not prepared to even offer some thoughts on management. Joe hit on some of the reasons. The status of the resource and the status of the knowledge of the resource are the reasons for it. We probably couldn't even agree on whether we could catch them, whether we could market them if we caught them or how much should be taken, but I really don't think that is all that important. We

can assume that those sorts of things will happen. Our discussion is going to deal with orderliness. I would like to mention two or three other things. One, Commissioner Barth was to be on this panel. I want it understood that I won't be talking for Commissioner Barth, and in fact, I am not going to be talking for the Department. I am just Bob Loeffel, the biologist, talking about something that I think there is quite a bit of controversy on. Probably some of you will disagree with a lot of what I say and maybe a lot of you will disagree with some of what I say. It may just be that a lot of you will disagree with a lot of what I say. If it is, then such is the plight of a fishery manager, and that is really the role that I come here in. Not as a scientist because I think, there again, there is a distinction to be made.

There are two groups of advisors to the Commission; you the industry, and you the management people. Each of you provide expertise as you have it, whether it be biological or economic. There is a degree of overlap and the Commission needs both. We are a team that is working for the resource owners, people of this state and as we have seen today, people that are residents of the U.S.

With that in mind, I would like to take a quick look at just what "orderly" means. I see one overriding point that orderliness is to me that can be asked in the form of a question. Is it really keeping everybody happy, or is it keeping nobody happy? Is it keeping you or me happy, or, as question phrasing goes, none of the above? I submit that it is none of the above. The best we can hope for out of an orderly development of a fishery is that those in the fishery will be reasonably happy and the rest of us will agree that what's going on is reasonable. As far as everybody being happy is concerned, I don't think that can happen. I think orderliness means moderation of use as we go into a fishery. Joe talked about some of the problems that lack of moderation results in. It doesn't mean sitting on the beach until we know a lot about the fishery. It means using it in moderation and gaining emphasis and impetus as information is gained. It means encouraging a market but not over-supplying it. It means providing reasonable return for those involved,

but it also means recognizing that there is an obligation, if we are going to have orderliness or some kind of commitment, for those involved to go ahead and develop the fishery as a resource to be used under an orderly scheme. There must be equity between the different segments.

We have heard about kinds of gear and we have heard about offshore and inshore in relation to Japanese fishing. We have to watch for gear conflict and minimize that. Lastly, I think we've got to see that over-fishing is avoided. I could identify a number of the opposites, and they are really that. I would like to point out that orderliness primarily doesn't require our sitting on the beach until we know a lot about the fishery. It is often and can be desirable to gain information through the use of a fishery. In regards to our prior comment about scallops, it was only through the fishery that there was a source of information available. So orderliness doesn't mean we can't go get it. I think we ought to take a look at our track record and see what has happened in some of our recently developed fisheries, as a way of talking about orderliness and just what it is we are up against on squid.

One of them that is still with us, and is a little older than what you might call recent, is the shrimp fishery. It started in the '50's, went slowly up through the '50's and '60's and has stumbled along like a 78 rpm record on a 33 rpm turntable and never really got up to speed until the early 1970's. Things began to go well and the catch, as you recall, was landed in the neighborhood of 20-24 million pounds. There was money to be made, the entry was available as people wanted it and we didn't seem to be overfishing a resource but we were utilizing it. Those are the desires of management. Then in the late 1970's I think we were hit with a triple whammy, and that is the sort of thing that I'll conclude brought some chaos. We came into a time when there were one or two large year classes available in 1977 and 1978. Landings were around fifty million pounds. Time out for fishing boats was in the neighborhood of one or two days, sometimes even one day, and a lot of money was being made. Apparently there were also unlimited markets, tax deferred pro-

grams, and loan guarantee programs that provided a lot of gear for entry into the fishery. The result was capitalization to the point that the supply simply wasn't there in the years following those two big years. The consequence of that sort of thing was typical of two other fisheries I am just going to mention. The consequence was some disorder, some anguish, considerable departure, and more recently a degree of insolvency as a result of the sudden spurt of activity that came into the shrimp fishery.

We can take that picture and kind of compress it and make it fit widow rockfish, certainly through the joint venture fishery. We had the equipment brought on scene to encourage and allow the development of the widow rockfish fishery, and it is to the credit of people like Captain Fisher, Snow Mist and others that we learned how to catch and how to market that resource. But again there was this opportunity to develop and move into the fishery, utilize it, and eventually to our discouragement, if not dismay, discover that we were fishing the stock of fish at levels that we simply couldn't maintain. We were back to the overcapitalization. Back to a degree of disorder, anguish, departure and insolvency.

Then Pete mentioned this morning the subject of the scallops. We had, in most of our views, the scallop fishery in 1981. "Remember when there were scallops?" is a kind of irony, but in fact that fishery, which flashed on the scene, literally had sparks flying in all directions from dissatisfaction. There were very mixed signals going to the Commission. We heard, "Hey, let's stop it, let's study it, let's hold back!" from those that weren't in it. We heard, "Let's go, we're geared up and we have markets!" from those that were in it. The staff was saying to the Commission that we had some idea what's out there and we could approach it this way or that. I think that under their breath the Commission may have somewhat thrown their hands in the air with all the directions they were being asked to go. They chose to leave it open then and we basically used that resource in 1981, though not completely. There were some boats that stayed on in 1982 and we have some boats still interested

in scallops. Biologically, even though we didn't have a lot of information on the resource, we did know that we were dealing with mature animals. We were dealing with ones that may have been decreasing in amount, in total bulk, and so there was a feeling that it was safe to harvest from the resource protection viewpoint and desirable from the standpoint of using the resource.

One of the problems with having them developed was that a lot of the scallops came on the market in the summertime at a low price. In that sense we certainly didn't get the greatest value out of the scallop resource that the state and the nation could have realized. Some people enjoyed some low-priced scallops, and from the consumer standpoint that was good. Otherwise the value wasn't realized from that resource. The anguish wasn't as great and the insolvency perhaps didn't result at all, but there was certainly a departure from that fishery in 1981. I haven't seen that kind of turnover in any of the other fisheries, having the entry and departure in the same year. It occurred in part because the fishery simply wasn't what it appeared to be in the way of availability, but in part because there was an interest in establishing a claim in that fishery and then in returning to others.

In hindsight I see a period of real rapid development, a period in which we got going faster than in all the cases. We had biological information available to tell us what was reasonable to harvest. A time of, if not overfishing, possibly poor use, low value received and overcapitalization. Now those are the consequences of three fisheries that I am suggesting had periods of disorderliness and had consequences that we don't really want.

So what do we do with squid? We know very little about the life history and darn little about the things that are needed for management, i.e. abundance, migrations, stock separation and that sort of thing. That dictates a "going slow" kind of mode as we go into it. We can expect that if we choose to simply go into it we will have entry, if not providing overcapitalization, making the shares small for those people who are

processors or producers. At some point down the line, history says that is what is going to happen. This also tells us that there will be a degree of disorder.

I can identify some things I think that we can do about it. One of them is to put a lid on the amount that we would remove in the first year. A quota if you prefer. Not for management purposes but in the sense of protecting the resource and not necessarily knowing what's appropriate at this time. Obtaining a general knowledge that is in balance with allowing development and protection of the resource. Another one is to go in with some kind of a permit system, an entry control that, in a sense, would keep a balance with removal set on orderliness. Then there are such things as gear types, or trip limits. Area openings can further be defined. Those are the kind of things that I think are before us if in fact we want orderliness in this fishery. If we choose to go another way it's a choice we have, but at least in the squid fishery it's one that we can make. It is ahead of us and it isn't one in the de facto sense which has been done for us.

R. THOMPSON: I would like to first say I am representing the Northwest Regional Office of the National Marine Fisheries Service. Bert Larkins is our Regional Director and he apologizes for not being able to be here today, but he is involved in some rather consequential matters relative to the salmon troll fishery, the Fishery Management Council and other important things. We do have another representative here from the office. I am in the Fishery Management Division and, like most other regional offices, we have a Fishery Development Division.

It is a stated national policy of the National Marine Fisheries Service that we are in favor of developing living marine resources in an orderly manner for the benefit of the citizens of the nation. I think Bob Loeffel has already pretty well covered orderly development. We can think of it in short term developments. The first year you might be out there making excellent catches, but I think orderliness implies a longer range development period than just one year. Every fishery that I can

think of has been sort of a boom and bust and very strict controls had to be applied. Bob has given three good examples where it has been allowed to develop without some kind of order. If something can be developed here in an orderly manner for this squid fishery we would be all for it.

I think that we have three very general concerns about that. One is the unknowns, and I will admit that about 90% of what I know about squid I have learned today. Not much has been said about the population dynamics of the various species. Incidentally, I found out that there are over 275 different species of squid that have been identified. Even on those fisheries that have been exploited for years there really isn't all that much known about their population dynamics. I don't mean just life history. I mean how many there are, when they grow, what their growth rate is, what their mortality rates are, and when is the best time to harvest that harvestable portion of the stock. Out of that develops an estimate of just what is the best harvestable portion to take, such that the maximum benefits are received now and that the population continues to be productive.

Another concern is that somebody should look at the ecosystem approach in development of a new fishery. We heard this morning that there are birds and mammals that depend upon the squid as forage, as food, and I would surely not like to see the squid fishery get into the situation that the anchovy fishery is in along the Southern California coast where anchovy quotas are actually being restricted so, in this case, there would be enough left for the brown pelicans. Marine mammals also are apparently dependent in part on the squid, and someone should look at what impact the removal of thousands of tons of squid from a certain area might have on other species in the area before you get into an irrevocable situation. That might not amount to anything, but still there are an awful lot of tree huggers around that are saying that we have to leave those anchovies out there for the brown pelicans or, perhaps in this case, leave the squid out there for the poor sooty shearwaters. These things are difficult to deal with. There are also other commercial fisheries

that might be affected by the removal of large quantities of squid. The salmon, Pacific Ocean perch, and other groundfish do feed on them, but I don't think it is known to what degree they are dependent on them. In fact, I think everything that is of a size that can consume squid probably does at the opportune time.

Thirdly, it would be the effect of the squid gear, whatever is selected, on other species in terms of incidental catches. I have prepared quite a bit of statistics and details here about why you cannot go fishing for squid with gill nets. I haven't heard that as one of the recommended types of gear for this particular fishery in this area, but we do have an agreement with Canada that no gill nets will be used to catch salmon outside the surf line. To my knowledge this is still included in the pending language of the new treaty with Canada relative to the salmon situation.

It might be worth mentioning that the Canadians did bring over two Japanese squid vessels in 1980 and they ran a test fishery off the West Coast of Vancouver Island down between 44° and 46° north latitude out around 125° west longitude, and it was felt that when they fished there in August and September they would probably not get many salmon. There was a belief that the salmon would not be in those waters at that time. But they did catch quite a few salmon. I think that Frank Cary expressed this morning the magnitude of the gear that these vessels deploy. Each night they were putting out up to 41.5 kilometers of gill nets and in 28 nights out there they caught 83 salmon, which doesn't sound like many, but if you begin magnifying that by the 500 Japanese, Korean, and Taiwanese squid gillnet boats the possibility exists that they could be taking 15,000-20,000 salmon per night in the Pacific Ocean area.

They did catch all species. Chum salmon was about half their catch, steelhead were 20% of the catch, and coho pink and sockeye salmon made up the rest of the catch. There would be a lot of disfavor and it would probably be legally identified as a very disorderly fishery if gill nets were tried for squid. I can't see Americans working as hard as those

Japanese fishermen do to set out and retrieve up to 40 kilometers of gill net each day.

In summary, I think that we in the National Marine Fisheries Service, of course, will be in favor of the orderly development of the new and viable commercial fishery for squid. We would be concerned about the overall development and the ecological effect of such a fishery and would be concerned about the total impact of the gear on other species as well as squid.

T. THOMPSON: I listened to the two gentlemen that are from the departments and what they have concluded, in my opinion, is that they don't know anything about squid. That is true from what I can gather from all the scientific studies. There isn't anything known about squid above Monterey, so it is now a zero fishery. What concerns me most is that if any of us do make any landings of any consequence, and since these gentlemen have to, by regulation, take the best scientific data available. The first landings will be the best scientific data available and then we will have supplied them with the information to shut us off. Think about it. Here we have a fishery, and for the first time we have a chance to develop a fishery in advance and have management techniques to study the fishery before the fishery even goes into effect, and it's a challenge. Cool heads can ensure a future fishery. There are not a great deal of gear conflicts. If we supply them with the information that they ask from the vessels such as the catch landings, then by law they have to manage by the figures that we supply them. I am going to ask what we do in this situation as a fleet?

LOEFFEL: I've commented here that I don't feel that from the managers' approach you have to lock up a resource whether it be squid, rockfish or scallops before you go into harvesting it. One of the reasons that you don't want to do it, and don't have to if you use moderation, is that it is simply a source of information with regard to the resource, which Terry said endangers the users of the resource. Remember that the desire is to maintain the resource.

I commented earlier that I feel the Commission is here representing the owners, in a sense the users in the commercial fishery, and you and I are advisors and harvesters. Working together is intended to perpetuate a longer term fishery.

It takes two kinds of information. One is from the fishery and to simply give it a proper perspective. The other is scientifically gathered information and initially at least, there isn't a means. I don't know about the Federal staff, but there isn't a means within our staff to provide information. It wouldn't give a complete picture if we only based our findings on scientific research.

I see the problem, Terry, and I can understand how any one of you might feel, on the short term and as an individual, that information you give is going to be used to your detriment. On the other hand, it's the kind of thing that is necessary for the long term character that is sustaining part of the fishery, and then, hopefully, if we have some orderliness, by joint agreement those in it will prosper over the long haul.

T. THOMPSON: Something like the squid, which is a short-lived animal, is going to have so many ups and downs in it that if we have a down year and we develop the fishery in a down year you are going to get data that looks poor. If you extrapolate that data, as you have done in some fisheries in the past, and apply it to a larger context it will be inaccurate.

EASLEY: You are going to have to rely on the information from the fishermen because you aren't going to get the money to go look. The fishery will have to be the best to some extent before you are going to get any money to look at it.

QUESTION: How about a three year landing start-up, taking an average rather than one year which could hurt statistically?

T. THOMPSON: We don't even know for sure if we have a fishery here. I



Offloading squid caught following the symposium off Newport, Oregon.
Photos by Don Giles.

feel we are putting the cart in front of the horse here a little bit with this meeting. It may be good and it may be bad. I'll judge the results in five years and see how the fishery has developed. We have no proof for sure that we have a fishery here. We know that the squid exists. We are not sure on gear techniques and we are not sure on landing techniques. Time will tell. I think maybe for the first time the market conditions exist that look like Northern squid may have a place in the marketplace.

QUESTION: There were two ways mentioned to catch squid that sounded interesting to me. One is the mid-water fishing, which is illegal if you use less than three-inch mesh, and the other one was bottom fishing with possible roller gear or with a net which was three-inch mesh. Technically, the law says that we can't catch them any way. I was wondering why that is.

EASLEY: There is provision in the groundfish management plan that allows for experimental permits, and if you are going to target on squid, I am sure you could get a permit.

QUESTION: So you already have the regulations built in to control it?

EASLEY: It would be an experimental fishery and whatever data would come out of it would determine controls. It wouldn't be a ground fishery, but if you ended up fishing a lot of groundfish and not much squid then I think you can pretty well guess for yourself what the conclusions would be. If you had a high percentage catch of squid to prove that you were targeting on squid and developing the squid fishery, I think we would go from there. I don't think there is anybody in management that would argue the point that you are going to need smaller than three-inch mesh to fish squid, but there is provision in those plans so you can go out and do those kinds of things.

QUESTION: Where do you get these permits?

EASLEY: At the National Marine Fisheries Service. You apply at the Northwest Region and it's detailed on the plan what you have to put into them. I'd be glad to supply it to you if you want. These permits are for conducting an experimental fishery. What the restrictions would be on them I couldn't tell you at this time.

QUESTION: How can you call it an experimental fishery when they've been so successful in Monterey?

EASLEY: I don't think they are against you going out there to lampara net.

LOEFFEL: Three years doesn't sound bad to me. I think that the question I would come back with is: what level of approach would you go for in three years? We've got a three year history in the brownie fishery, i.e. 1980, '81, and '82. Let's say that we at least brought it down. That is why in those three years I don't think there will be any problem at all. They had some real substantial growth in landings. Would those three years be open years or left with some kind of a reasonable developmental level of restriction? That is the kind of decision that we need to reach cooperatively here, since the Commission would eventually decide if it were a state regulated fishery.

T. THOMPSON: That is something that really bothers me. The Commission will decide. I don't think that there is an active fisherman on the Commission today. They are all lay people, but there is not a fisherman on it, and yet they've got complete control over it. We have to go in on one five-minute session and speak in front of this type of group and convince them that our idea is right while sitting against a full management staff. It is a rough situation for the fishermen. It means you'd better go in and be prepared, and you'd better have all your groundwork laid out in advance. You'd better have your numbers of any squid that is landed in any kind of fishery, not the Commission's numbers. Keep good records and keep them at your hands so they can be compiled by the industry to use as a rebuttal against any other statistics that are drawn

up. I hope that if anybody does try to fish squid they keep their numbers. We may need to use them for defense of our own statistics.

LOEFFEL: Terry, there has to be information. That is what I have been calling for and the only way it is going to be used is for it to surface. Whether it surfaces before it goes to the Commission and is somehow interacted with or whether it comes out at that time, still a judgment will be made on the basis of total information volume, and the more sensitive the Commission can be, the more it gives the industry a good position.

QUESTION: I assume that the regulations on fishing are designed to protect the resources of the future, which would seem to me to be an advantage to the fisherman. Is it the complaint that usually the decisions are wrong and that the quotas are too small on species?

T. THOMPSON: It depends on the attitude of the fishermen. There is some question now on black cod and there is some on brownies, but what happens is you only have the department numbers to work with. The industry itself doesn't generate its own numbers.

EASLEY: I think the problem is because the data base is so sketchy and incomplete that basically what you end up doing is trying to make some educated guesses. Who knows whose guesses are right? Some people believe the biologists will come closest with their guess, others think the fishermen will, so I don't know. We can argue that point until doomsday.

QUESTION: How about the examples that were mentioned, such as shrimp and scallops? Was the error in letting the fishermen catch too much or was the error that they were too conservative?

LOEFFEL: In the case of shrimp, there wasn't an effort to determine the numbers of the resource at the time and the growth which came on the scene was such that there wasn't a middle ground on the fishery. The

biological understanding led us to believe that economic concerns would extinguish interest in shrimp before the shrimp were jeopardized.

T. THOMPSON: I think there are environmental conditions that control it. One thing was cited out at the shrimp fishery. Even though we had a large build-up in the fleet as the product production dropped off, the fleet tended to dissipate and go into other areas. Consequently, it may lag behind some of the decrease in production, but they did go off into other areas. If you can't make money in a fishery, you move. As long as there is mobility in the fleet they will tend to move off into other areas that are better, like now. We have had a couple of boats move back into the scallop fishery. Some of us moved into the drag fishery. So it may lag, but it will decrease and stabilize, hit its level of production and price.

LOEFFEL: I agree, and the information we are trying to sort out was: did that transition in the shrimp fishery come soon enough, or have we in some way not made the best use of the shrimp resources that were available to us the last three years, and maybe even stunted the productivity for another period of time? Another thing to consider is that environmental factors are real important to success in resource planning.

R. THOMPSON: What really disturbs me is that today we are short of finances. Our government doesn't have the money available to do any ocean research work. We are in a situation where we were dependent on this landing data all the time and very little research is occurring out there, yet we come back to the point of these interactions and studies. We need to try to understand this ecosystem but no money is available. Instead of pumping so much money into enforcement it would seem to me that we would be better off pumping money into research. It would be better in the long run.

LOEFFEL: I second the idea that there needs to be some more money. If there is going to be a FC investigation on the basis that the fishing community itself can't provide the funds, then there are our biannual

budgets that are going to the legislature in this session. We're asking for an additional amount over what we have in this current budget to do groundfish work. There may well be something in it for squid that would come in as a result of Ways and Means Committee action. If you people feel that kind of information is needed, should be obtained, and should be used in making decisions on squid, then some kind of encouragement to legislators to provide this kind of funding is what we need.

QUESTION: Do we have any idea what our domestic sales of squid are versus exports by container in its total pack?

EASLEY: I can get those figures. The bulk of it is export at this point in time.

Comment from an audience member: The reason I ask that question is because I came up here as a grocer, sales person, and marketing person. Before coming I spoke to one of the largest hotel chains in America and in talking to their food people I told them why I was coming up. I said that I was going to learn about the new squid industry. They looked at me in amazement and said, "You know, we don't understand why the hotels haven't begun featuring these in their various coffee shops." I was glad to hear Bob ask if we should tack on the moderate increase at this large restaurant level. The answer is yes. We haven't begun to sell this product yet and whatever we are selling now is a drop in the bucket.

LOEFFEL: I think the reason I hedge on these numbers was that they were drafted about five years ago dealing with the California squid. These figures identify the U.S. consumption at 2000 tons domestic consumption, as compared to 800,000 tons in Asia, and 400,000-500,000 in Europe. Now maybe I am wrong. From two to five to eight is right, but when dealing with tons and millions of pounds we will have to see.

Comment from an audience member: I think I am getting it in my head that somebody is saying that we don't have all this scientific data. Mr. Kato said they operated in California for 60-odd years with no quota. If that

is not scientific data, I don't know what is. I saw sea lions on the rocks, so I don't think they are endangered. If I had it my way, I would put a limited entry on it and allow only the boats that caught squid in 1982 to fish the next three years.

LOEFFEL: In a sense zero restriction is management if we all agree that is appropriate for the status of the resource. I applaud Southern California and Monterey for their maintenance of the fishery. It has allowed good use of the resource and hasn't abused it.

EASLEY: I think there is one fact that we have to keep in mind here. What was happening twenty years ago in the Monterey Bay area is not what is going to happen now. For one thing, we have got a lot more potential effort for anything we get into than we did twenty years ago. You talked about loan programs setting up the shrimp fishery. I don't think that is what caused the big increase in the '70's in the shrimp fishery. I think it was what was happening in the salmon fishery that caused the big increase in the shrimp fishery. I think every time that management steps in it's just like punching a bag full of air. You poke it in somewhere and it pokes out someplace else. That started in this state with the hatcheries for silvers. It accelerated because there are more and more people involved so we don't have the lead time to look at things now that we used to have. I think you've got to get used to living in a much faster world. Let's try and deal with the present and what we have. We have a lot more capabilities than we had 15 to 20 years ago.

QUESTION: With the restrictions in California, have they been primarily because of the market and not because of the availability of the product until this year?

EASLEY: Yes, up until this year.

QUESTION: So what are we worried about? Are you saying that all these plants that have never processed squid before in Oregon are all of a

sudden going to be geared up producing like San Pedro in one or two years?

EASLEY: No. I think you make a very good point. The market is going to control us to start with.

LOEFFEL: I think it will, but I remind you that you and a good number of others got into production on shrimp real fast. You didn't come in this particular year but there was an awful lot of gearing up in 1977 and '78 on the part of the producer to handle a big resource that came in, and I think that could happen in squid if the markets open. To start with we have to assume that the pull chain is there and talk about readiness of development. It may not be there.

QUESTION: You keep saying that no data is available and yet the National Marine Fisheries has sent me two reams of data on squid along with the biomass figures. Isn't that what you need to go by?

R. THOMPSON: I know that the National Marine Fisheries said this through World Port Food Organization one time and released some information. One of my OSU professors said that squid in the North Pacific was a very large biomass ten years ago. Maybe the numbers have been updated but I agree with you. There have been lots of numbers thrown out but I don't see any statistics.

Comment from the audience: Some of my papers said there is a 100,000 metric-ton-biomass that will take processors a lot of years to gear up for, especially if this resource will only last two years.

EASLEY: If you have 100,000-metric-ton biomass that doesn't necessarily mean you can catch 100,000-metric-tons per year.

QUESTION: With regards to this fishery, there are going to be a lot of shrimp boats and there are going to be a lot of drag boats. How long is it going to take to wipe all the eggs out?

R. THOMPSON: It depends on the method they use. I can think of at least three different methods that can be applied that won't disturb the bottom.

EASLEY: From our own experience with drag nets and shrimp nets I don't think you would want to be right hard on the bottom fishing squid anyway. If there was an abundance of egg cases you would have a mess. In fact, it might get so bad that you couldn't fish in there. I have seen it that way with a drag net. If I were doing it, I would rig it much like a shrimp net that was off of the bottom. I don't think I would be disturbing those egg cases a great deal. They are fairly tough little items.

T. THOMPSON: For those of you who haven't had the experience of finding squid eggs, it's a nightmare. You spend the next two days shaking the net out. Any gear that is developed that is used around the spawning ground will just have to not disturb those eggs because it is going to foul the gear.

LOEFFEL: If I don't point it out Terry will. He had to show me what squid eggs look like just recently. Kathy (Jefferts), I have wondered about squid eggs and egg cases. What is the fate of an egg case loose from the bottom as a result of the fishery?

KATHY JEFFERTS: I don't think anybody knows. They take long enough to hatch. By the time they hatch they could be in Mexico.

LOEFFEL: Is that the problem?

JEFFERTS: They could get eaten or end up in an inappropriate environment. The egg cases could just fall apart.

LOEFFEL: If you take egg cases and just let them lie loose in the aquarium, they will go ahead and hatch?

JEFFERTS: Yes.

QUESTION: I would like to address a comment and a question. As East Coast processors who are here to try and get involved in the squid fishery, we are real disheartened by your comments. You speak that you know nothing about the species, and you know nothing of the assessment of the stock, but you don't speak of taking steps towards assessing the stock. Rather, you speak of management. When do you plan to assess the stock?

LOEFFEL: I have said that is one of the things that we would put in our budget for this coming year. I would hope there would be, in the supplementary sense, some money that would provide the ability to try to understand how we could assess them and then allow us to make some efforts to do so. I have offered some suggestions that what we want is orderliness. What we want is assurance that we are staying in a reasonable track in utilizing the resources. If we go out in moderation, that means either some kind of assigned entry or assigned removal of the fishery in the interim periods. That goes right back to saying that somebody, perhaps ourselves and yourselves addressing this issue, make some guesses about what is there and make some reasonable removal. Joe asked who is going to do the guessing and who is going to decide? The Commission will. But it's the kind of thing that without actual measures you go on whatever you can. Maybe we go on what two-thirds of California would say is there.

T. THOMPSON: California has basically only two locations that they fish, below San Pedro to the border and in Monterey Bay. Most of California hasn't been touched because they don't have the gear techniques to fish in the open ocean. We don't have that kind of data. There hasn't even been any research work done on it.

QUESTION: It has just been in the last year or two that there have been viable means to travel to the squid runs. This limits the amount of traveling and looking we can do. We haven't even had a good look in Northern California because the economics of it weren't there. They are getting there now. How many blast freezers do you have here in Oregon

and Washington? They will handle 100 tons a day, or a 200-ton day.

R. THOMPSON: I have a lot of faith in particular processors in this area. If they see where to make a dollar they will figure out how to get the equipment.

Comment from the audience: They were a long time in Monterey and San Pedro developing the freezers they have now. As fishermen, we waited a long time and we ran limits for the processors to see the market do this and they proceeded very cautiously. I think probably the investors here are going to look at this year's prices. They are going to look at the past average of what it has been, in other words, the world market. I think you are going to find that you guys can go fishing all you want, and then it will end up being the one who can sell the fish who is going to be the one who is going to be able to get fish.

QUESTION: Could Kathy (Jefferts) comment on the hydrocoustical data that she mentioned in her talk this morning?

KATHY JEFFERTS: It's been incidental mostly to surveys of the rockfish populations that the National Marine Fisheries Service has conducted up and down the West Coast and the surveys in California on Northern anchovy stocks.

QUESTION: So you do have some data base?

JEFFERTS: Some.

LOEFFEL: I said earlier that I felt moderation meant using enough for a while to encourage markets and not oversupply them. I think industry needs to come back in and supply the information. I am probably asking the impossible for industries to come together, just because it is tough when you ask competitors to look at the overall picture, but it is the kind of thing that would help determine what a reasonable but moderate removal would be.

QUESTION: The duty is to protect the resource. How can you concern yourself with the market?

LOEFFEL: The duties underlined for the Commission are protection of resource, promotion, and development all being the responsibility of the agency. That resource being out there and not being used is not something that the agency, if it has a way of preventing it, can allow to happen.

T. THOMPSON: I am going to the defense of the agency first. We are different than a lot of the states in the U.S. in that the state of Oregon did write in a part that says we can manage for economic utilization of the resource.

EASLEY: "Highest economic use" is the phrase they use, Terry.

T. THOMPSON: It is not strictly for conservation in this state.

EASLEY: Dick, I would like to get back to one point that you made in your presentation when you were talking about a total effort. When you look at what might be feeding on squid and what would happen to some other species if you did fish for squid. That would be a lot different than, for instance, the shrimp fisheries we have developed. We are fishing farther down the food chain than we used to. When do you think you will have any answers to these very true questions?

R. THOMPSON: I'm not saying we should learn everything about the ecosystem before getting into the fishery. I am most familiar with the case of the brown pelicans and the anchovies. It's not so much what the pelicans feel, it's the people that stand up and fight like hell for the pelicans. It creates a lot of sitting time in a council room or some management agency while you listen to people plead the case of the brown pelican. This might seem a very facetious approach to society on the part of the people who are on the side of the pelican. It's such a complicated system out there. I agree that we are never going to be able

to say if we have eighty million metric tons of squid, our herring population is going to go down twenty million tons. However, it is an approach in the American political and resource management system. It is there and some kind of consideration has got to be given to it.

LOEFFEL: I think that we are seeing that surfacing in Southern California as close as it is anywhere else. We heard comments earlier that the Japanese are really changing their position; that there is so much productivity and they will take it wherever it surfaces. This seems to be the kind of exchange that is going on between anchovies and jack mackerel, true mackerel and sardines in the southern part of the U.S. and our own Pacific Coast states. If that's the case it may become a viable management approach if, in fact, the value and quality are there. We really don't care which one we are fishing as long as we tend to target on the animals that are very high on the food chain and protect certain others for reasons of endangered or threatened species. Then we have got to look at the poorest animals and say it's inappropriate to take it.

EASLEY: I think that system of management may become a viable entity when you can predict what produces good improvement for a given stock. You are so far from that right now that it isn't funny. There are some people starting to look at it, but before anything viable occurs it will be another three or thirty years down the road. It would be a worthwhile approach if you had the ability to predict and you could do that ahead of time. The industry would go along with what is going down and what is coming up. To my way of thinking that is a long way off yet. You have to have a lot more observation than we have had.

QUESTION: What would it cost to do this particular squid study?

LOEFFEL: Right now we are starting to, in this calendar year, pull some people together and think about it. When we pull them together we take them off work on other species, so there isn't anything that I can say. The first thing we will be doing is thinking about how to go about

assessing. We can get some ideas from the fishermen and would like to go out and employ them. It will be thousand of dollars depending on the boat cost per day. A hundred thousand maybe for some kind of a close look.

EASLEY: Let me make one last point here. It seems there is no perfect system, just like I thought there wouldn't be. There should be a book on orderly development or how to achieve an orderly development. Some people think that the economics themselves are enough break and I would tend to think they probably are to start with. If you are going to pursue what the managers think would be an orderly development, you would put some restrictions on the fishery to start with and slowly increase it. That would mean either some kind of quota or some limit on the number of participants or any of the traditional management tools that they have to use. I think it would be a very bitter pill to swallow for a lot of the people in the industry that are struggling awfully hard right now. To have somebody out there beginning to pursue it and not having the choice whether they could or not is rough, so I don't think we have settled anything here and I am not too surprised.

SQUID HANDLING & PROCESSING FOR EXPORT MARKETS

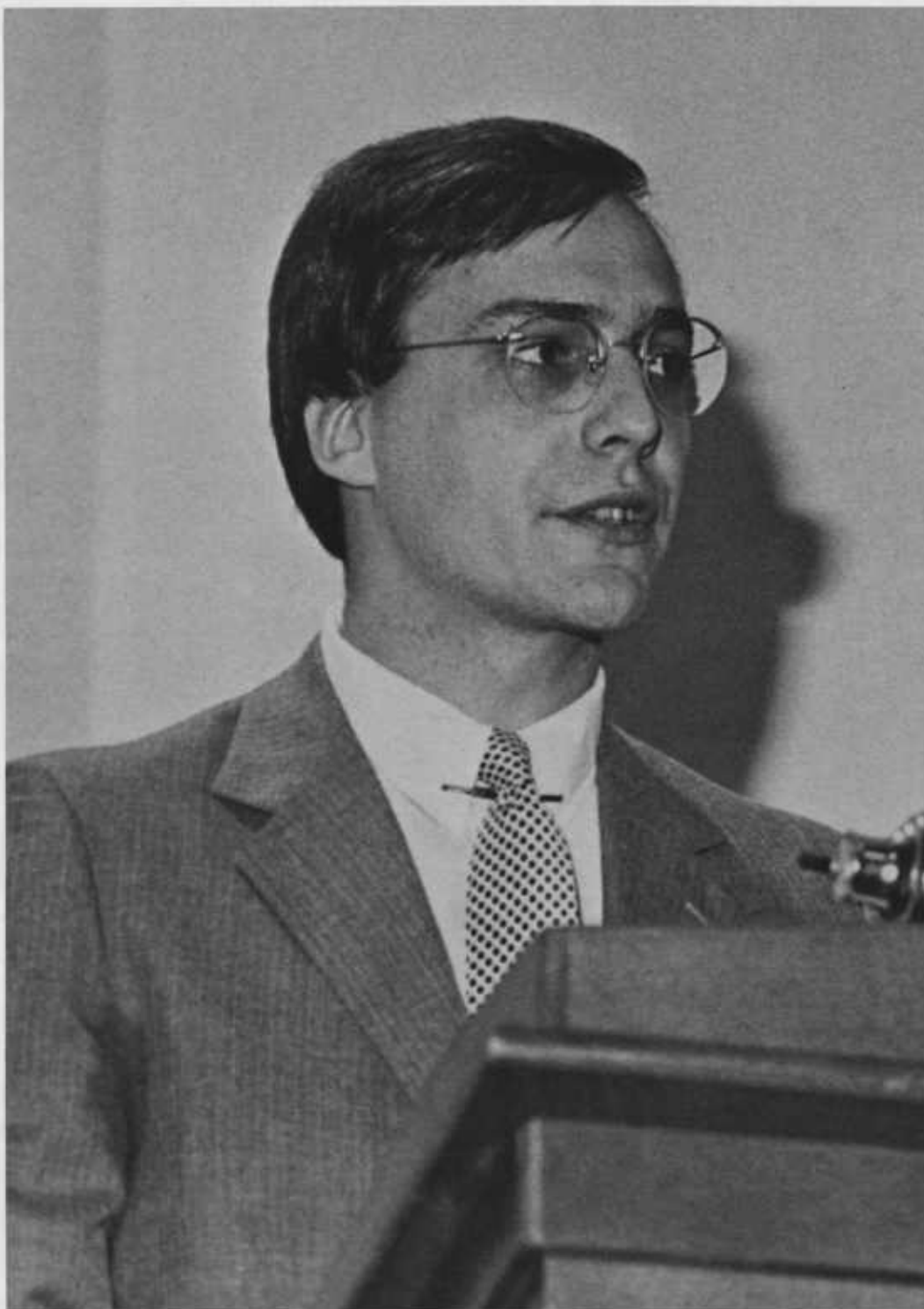
BY

ANTHONY KLOS*

I would like to thank West Coast Fisheries Development Foundation and the Oregon State Sea Grant Advisory Program and especially Bob Jacobson, Terry Elwell, and Pete Granger, who extended the invitation for me to address you this morning. We are certainly confident that we can learn from our West Coast counterparts and that perhaps these symposiums are the perfect vehicle by which to learn from each other. Through careful and thoughtful planning efforts the potential exists to develop what may be the most valuable economic resource within the fishery conservation zone. Our firm, Oceanside Fisheries, as Pete briefed you, has been in the business of processing and marketing underutilized species of the northwest Atlantic for over 30 years. Our product line consists of 35 items which are harvested principally from the Carolinas to and including Canada. Three years ago we constructed a multimillion dollar processing, freezing and cold storage facility in Gloucester. We've brought some photographs of the facility with us and would certainly appreciate the opportunity to show them to you. Squid constitutes a significant portion of our business. We produce the two species that were spoken about yesterday, Illex and Loligo. We also procure and market land-frozen squid products from around the world and frozen on-board production from South America, the Eastern bloc, and the Far East. Quite recently we've started the import of processed squid products from Europe.

First let me set the limitations of our discussion this morning. It will be limited to the two species in the northwest Atlantic, and although they were gone over at some length yesterday, let me briefly run through the two species. Illex has a range from the Gulf of Mexico to north of Newfoundland and is seasoned principally in the late summer and fall. We have buying stations from the Mid-Atlantic region north. To give you

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Anthony Klos

an idea how it compares to yours, the largest Illex that we have ever seen has been 14 inches in length and weighed over a pound. The harvest is primarily incidental and trawled. The species is also known as "summer squid" and "short fin squid" and markets for the East Coast are pretty much limited to bait, a very limited domestic market, and sale to oriental markets in a variety of forms.

Loligo, the other northwest Atlantic specie, is quite highly prized. It may have a value two to three times that of Illex. Buying range for the specie is from Cape Cod southward to the Mid-Atlantic, and the harvest, unlike Illex, is often directed. Apart from that we have a good business going in trap Loligo. This species is also known internationally as "Boston squid," or "winter squid," "bone squid," or "longfin squid." Most of us on the East Coast export Loligo into Europe.

Another limitation of this discussion is that I can only speak of foreign markets and only in terms of the principally exported product which is whole frozen. Over the past 15 years on the East Coast we've seen tremendous changes in our squid business. The resource, which once only benefited the foreigners, is slowly beginning to benefit us. The tremendous popularity of squid in foreign markets had, as a result, a great participation of the foreign fleets in the fishery off our coast. When I speak of great participation on the part of the foreign nationals, I point to the fact that during the early and mid '70's foreigners caught an average of 50,000 metric tons per year. And U.S. landings are, of course, miniscule in comparison. But it's that interest on the part of the foreign nationals that drew us into the squid business 13 years ago. Vessels of the USSR were the first recorded participants in the late '60's. The Japanese began in '67, the Spanish in '69 and the Poles and Italians in '72.

One of the first lessons that I learned in this business, and I haven't been in it that long, is that it is no good to harvest something if you can't sell it. One of the main factors which allows one to sell something at a profit is a quality product, and needless to say, you don't

arrive at that quality product without proper handling. The normal tendency of squid to deteriorate rapidly and the almost universal quality consciousness of foreign buyers are two factors which reinforce the necessity of good handling. Now perhaps the best way to approach it is to give you a few of the indications of poor handling. You have torn or missing skin, crushed ink sacs, missing tentacles, pungent odor, a mushy texture, and squid also has a tendency to rapidly change color. Illex, for example, will quickly turn from a copper to a dirty white and then to a red when it's ready for fertilizer. By and large temperature is the key to proper handling. The golden rule is to keep the merchandise cold.

Let's get involved in a little exercise here. Let's consider for a moment that some squid came out of the water in decent shape, and let's talk about how we would go about destroying the quality of the stuff. The first thing you want to do is to ice damage the product. There are a number of ways we can do that. The first is to use too much ice. If we use too much ice, we'll smash the product and bleach away that copper color that the foreigners like. A second thing we could do is use anything but crushed ice so that the sharp edges tear up the skin. A third thing we could do is not use any ice, turn the squid into garbage and forget selling it for human consumption. Another thing you want to do is offload the product, so you'll want to use a shovel. We'll tear up the skins, break the backs, crush the sacs, and then compress the product to really finish the job.

In Gloucester, as I mentioned, the Illex fishery is incidental and by trawls. Our insured day boats produce a fairly decent product, and one-day trips coupled with improved handling techniques have allowed us to market the Illex with a measure of success in the oriental markets. It's a slow development, but we are getting there and we have improved. But most severe problems arise in the offshore fishery, where trip length and catch quantity have more often than not resulted in B and C grade product. What do we do with a B and C grade product? Of course we can sell it, but we would end up on the bait market, and the bait market is

highly competitive and consequently low value. Another interest we have in coming here to your state is that we have made some sales of bait into this state and we would like to increase those sales. Since we entered the international bait market we have learned that when you get into that market, the quality criteria closely approach that for food. In 1982 we had a disastrous year for Illex in Gloucester, so we increased our range instead of buying a lot of product in the Mid-Atlantic.

At this juncture I think it appropriate to discuss a few particular handling problems. There are a number of handling problems that we encountered in Gloucester. The first was that Mid-Atlantic boats were trip boats, with the problems that I just discussed. The second is one of over-the-road transportation. Trucking carries its own scenario. First we found that off-the-boat squid was bait quality to begin with. The trucker is looking for the best possible rate. He's got maybe a 750-mile run and he's looking at nothing to return with. The processor, because it's a low value item, is looking for the lowest possible price, especially because of that stiff competition we face on the bait market. And in many instances, when you're talking about over-the-road transportation, the freight is paid by the trip or by the mile. So strictly from an economics standpoint, it would make a lot of sense to put as much weight on that truck as possible. Now if you put as much weight on the truck as possible, and as much weight as possible in the containers that go on the truck, you will compress the merchandise and end up with some real smashing problems.

Our experience, without exception, is that the Cape Cod and Rhode Island trap fishermen are the best handlers of product on the East Coast. Trap squid packed out in barrels with the appropriate seawater and ice, or slurry composition, even after being trucked a hundred miles from the Cape or Rhode Island to our plant in Gloucester, often comes into our plant still in rigor. Given the tremendous quality of this product, we'll handle it with kid gloves, and we have got a plant that is designed to do that and do a good job. Given the quality of the product out of the trap, the way it's handled in the barrels, and our processing capa-

bility, we receive a premium on the export market for that merchandise. Where I spoke just a minute ago of the relatively low price paid to the bait squid fisherman in the Mid-Atlantic, we return a price that has gone to 75, 80, or 90 cents a pound for trapped Loligo. We receive a price comparable with the ideal you saw in a photograph yesterday of the frozen on-board production.

Without a doubt the best product that we see comes out of barrels. There are three main benefits associated with those barrels. Getting back to temperature, the first is that the water and ice cools the product. The second thing it does is to wash the product. A third thing it does is eliminate crushing and ice damage by floating the product. Preserving freshness is the primary consideration on the processing side. Temperature, speed, and avoiding excessive handling are equally important in the process stage. As mentioned, East Coast firms process for export primarily whole frozen squid, so maybe I can take you step by step through that whole frozen process.

The first thing we do is to wash and rinse the product. Among European buyers, opinions vary on washing. Some argue that it eliminates too much ink. This is often the case with the Spanish, who use the ink extensively in their cooking. In any case, with any buyer, we are going to pack to that customer's specification. In all instances, however, we rinse the product with a shower cascade to remove any extraneous material. The second step is to sort out the foreign species and the damaged squid. The third step is grading and sizing. For the most part we grade squid according to the mantle length in centimeters. Again that varies from country to country and customer to customer. Spain generally requires five grades, Italy requires three grades and some customers, particularly in France, want grading according to weight or the number of pieces per kilo. In all instances the grading process is a manual process. It's not that there haven't been many attempts at mechanizing what you can imagine is a very labor intensive operation. By and large, due to the compressible nature of the product, all the attempts at mechanizing have been failures.

The next thing we do is pack the product. Again, packing style and presentation vary from customer to customer, but what we have found to be nearly universally acceptable is a 10-kilo net carton with sheets of cellophane between the layers of squid. Beyond that, when we pack these squid we fold the tentacles underneath the tube. Now folding the tentacles has two main advantages. It makes a real pretty package and it protects the tentacles from breakage. In any case, we are dealing with an export market. The importance of workmanship can't be overemphasized.

That is pretty much the extent of my talk on handling and processing. If there are any questions you may have, I would be pleased to entertain them. I would like to mention one of our aims in coming to this symposium. We have the opportunity by virtue of our activity in the squid business around the world to move Loligo opalescens. Already in place, we have markets, product knowledge, and a need. What we don't have are the necessary contacts in your state or a plant in your state, and apart from the exchange of ideas in a symposium, that is a reason why we are here. A lot of our customers have been looking for Loligo opalescens so we really had two alternatives. The first alternative was to go into California and start bumping heads. What we thought to be a more intelligent alternative approach was to come to Oregon where we were confident you had the product, and try to develop something together. Our need for your squid is immediate and our planned expansion into the West Coast is immediate. If there are any vessels, docks, processing plants, or cold storage plant owners, who as a result of this symposium are interested in going into the squid business, we would like to know about it. It's something we think we can do together and something we think we can do very well.

Again, thank you guys very much, you have been very hospitable and we appreciate the invitation to the forum.

QUESTION: Could you give us the ratios you use of ice to water and length of time versus quality in your export barrels?

WARREN RATHJEN*: We started out with about one-third barrel of ice and put the squid into it and then the water on top of the ice.

QUESTION: How could we go about doing that on board?

KLOS: What generally happens is that we are not putting them in barrels on board. We are trying to develop that, but we are running into a whole series of problems on how many barrels we can get on a boat. This is for the trawl fishery. The squid is going into the barrels when they unload the boat. We've pretty much limited the length of those trips to a day and a half maximum.

QUESTION: How long will it stay good in the slurry?

KLOS: That should be no more than five to six hours.

QUESTION: Does the boat use any ice or anything when they go out fishing?

KLOS: Yes.

QUESTION: They ice it on the boat then?

KLOS: Yes.

QUESTION: Is it true that the life of the squid from out of the water to the freezing room is only about two days?

KLOS: That's right. To get a real nice looking product, a good price, and gain acceptance in a foreign market, our experience in the Loligo fishery has been that you can't get away with much more than two days. The handling development comes slowly. Every one of the fishermen we have met here in our short two-day stay in Oregon, without exception, has been more innovative and more quality conscious than any we see on the East Coast. I'll tell you that we are 25 years behind the times there.

* (see page 11.)

QUESTION: What size is generally preferred and what changes occur in Loligo color?

KLOS: The best we can get is a nice white. The color changes are very rapid. We pack a lot of our merchandise for export with foreign technicians right in the plant. They stand right beside us and have allowed us to really improve our processing ability. Beyond that, you learn a lot from them because they're the experts. A Japanese technician once told me that a squid will go through 150 color changes. We once had a technician tell us how long the squid was in the net, how long it was on deck, the time between the deck and going into the hold, the time it took to steam home, how long it was on the dock, how long it was on the truck and how long it was in our plant, just from looking at the color.

QUESTION: What temperature is the wash water?

KLOS: We use a brine tank with a little ice in it, but it is tap water.

QUESTION: Do you want a copper or white color?

KLOS: With Illex, the summer squid, we look for that copper color. With Loligo, the Europeans are generally looking for a clear white and the best we can do is a clear white.

QUESTION: Does the Loligo not go through the color changes that the Illex do?

KLOS: It does but not as rapidly.

Comment from the audience: I have heard of boats in Florida using sea ice and finding it much better for the product than fresh water ice, plus the fact that it would make it convenient to take on board.

QUESTION: What is the approximate cost per pound or production differences in dividing into three sizes vs. five or six?

KL0S: That is really the function of the size of the squid. It can vary up to a nickel a pound.

SQUID HANDLING & PROCESSING IN CALIFORNIA

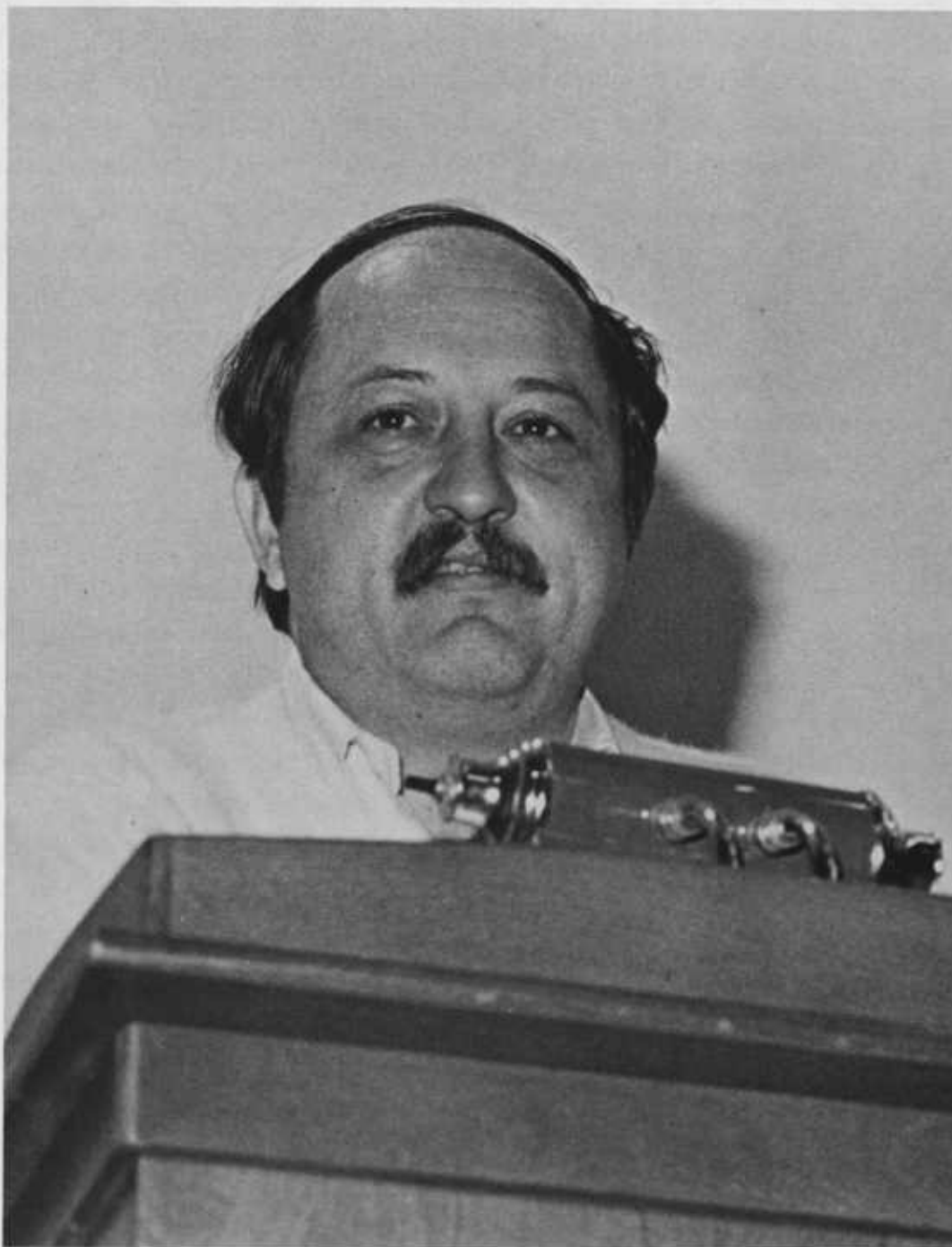
BY

PAT FLANAGAN*

What I am going to tell you about today was prepared about two or three months ago. It was given to the Pacific Fisheries Commission in Monterey and it is very possible that in the last two days there have already been changes based on what I felt was state-of-the-art two months ago. I don't know if you remember the Italian fisherman yesterday. He's definitely the stereotype of what we imagine real Italian fishermen on the West Coast to be. He happens to fish for us and in the slides he was presenting, he showed a picture of our plant without a fish pump. There are a number of reasons why that happened. It's not that we don't have the money. There are some real valid reasons why there isn't a fish pump on our dock and I'll get into that, but I was a little embarrassed. I think that if there is ever anything that fish processors hate to have pictures taken of, it's their fish plant. They're always afraid that someone is lurking out there from Food & Drug Administration and they're going to shut you down for God knows what. But anyway, a lot of what he said yesterday was very valid. The guy is really a great fisherman, one of the best in Monterey. It makes me feel good that he has come up here to try to share some of his experiences with the people in Oregon.

We're going to talk about squid. What does that conjure up in our minds, or the mind of the American housewife for that matter? It might remind you of the word "squish," which is something we do to insects and other invertebrates. And many of us, even if they are chocolate coated, still aren't going to eat them. It also conjures up an image of a soft, many-tentacled animal to which many of us have had an aversion for years. Have we been afraid that it would grab us? Destroy us? The writer Jules Verne really bestowed the squid with notoriety, making it grow to fantastic limits and possess the ability to literally rip steel

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Pat Flanagan

submarines. Perhaps Jules Verne was responsible for squid becoming an underutilized species. Certainly something to stay away from. In fact, the giant squid has been caught weighing 4400 pounds and 55 feet in length. He has been seen attacking or fighting with sperm whale, which is not a myth, but actually confirmed.

Squid is also slippery before cooked. Some of us, I know, gagged just at the thought of trying to swallow the slippery arms of the small beast. In any event, for some reason in the past, squid was an underutilized species in California and the United States, both in marketing and production. When discussing success in business, one fact must be set straight in our minds. If a product cannot be marketed successfully it will never be produced successfully, and the corollary is also true. Salesmanship is the name of the game.

But things have changed, and for the better. We have become Spanish and Italian, for example. Now we think of "calamari." We don't think about it as "squid" any more. This, for some reason, has helped. Thank God we didn't assimilate some other cultures as well or else we would be using "blekkspruter" from Norway, or "muc" from Vietnam or worse yet, "ika" from Japan. So of all the foreign terminologies, we could have picked something worse than "calamari." I think perhaps these descriptions would have been worse than "squid," and would have kept them underutilized, both in marketing and production. It really is funny when people ask me what I do. When I reply that our company is one of this country's major producers of squid today, the retort usually is, "Oh, you mean calamari?" So there is a lot behind the name and its acceptance both in production and salesmanship.

Another thing has happened in the last few years. With the release of Jaws I and II, shark suffered from the same negative attitude as squid had for years. With the production of a plastic, people-eating monster, shown right in front of us on a movie screen, we decided to strike back and start eating them. Since the production of these movies, shark sales have come to the forefront and have never lagged since. Restaurants are

no longer afraid to market shark as shark. People are realizing that shark is just as good as swordfish and are taking it home to cook now, or perhaps to get even. In any event, Americans are now beginning to eat squid and shark in large quantities for the first time in our history.

This is a phenomenon which has largely occurred with squid in the last five years. Is it an accident, or did this just occur? I think that this is predominantly occurring on the West Coast more than what we see on the East.

Our company, General Fish, has produced squid for almost 20 years under the "Quality" brand name. During this period, the most we've produced is about a half million pounds per year. This is not a lot, but production is maintained at a low level for a very good reason: quality control. As a result, while the companies were producing millions of pounds for export each year in Monterey, our company began to entrench itself in the local California area, which is a very small segment of the market. In the beginning most of our product was being consumed by certain ethnic groups, namely Italians and Orientals, both of which are very quality conscious. A large share of production went to the fresh market, being sold within 24 hours after unloading.

There are a few things which must be remembered in the production of squid, all of which pertain to the production of all seafood for human consumption. First of all, bacteria counts. I like to think of squid as a scavenger. Speaking as a producer and not as a scientist, I categorize fish as scavengers and predators. Why is this important? Scavengers retain higher levels of bacteria counts than predators do because of the type of food they are consuming. As a result, their spoilage rate, once killed, is higher than species such as sole or swordfish. In order to maintain acceptable, low levels of bacteria once caught, the product must be handled with more care and attention. Ideally it would always be heavily iced in its fresh state, and immediately frozen to bring the growth of bacteria to a dead stop.

Secondly, what about water content? All seafoods vary to some degree in the composition of protein and water. This is extremely important when dealing with squid. Fresh squid has a rubbery texture similar to abalone, and sometimes retains its quality even in the cooking process. One of the effects of freezing is the removal of some moisture from the product. A corresponding effect is some real breakdown of texture. With squid, this is a tremendous advantage. By freezing, we are already helping to tear down tissue, thus gaining the advantage of tenderizing the food and making it even more palatable.

Third, carton design and preservation procedures. Again this is extremely important in production. There is no good in producing a product of top quality and then thinking that the job stops at packing and freezing. Our company discovered that by utilizing a high wax content fiber we gained greater protection. Also, by using a one piece carton coated with wax, we could literally encase the product in water once frozen, creating one of the best glazes possible to protect against further unwanted dehydration or loss of flavor. These cartons are substantially higher in price but protect the product as much as possible. We can now maintain our product for a very long time with little deterioration through dehydration, and have in actuality maintained it for two years before sale with absolutely no complaints.

From here we must concern ourselves with the master carton. Again we use a higher grade carton than most. I will never forget a time about four years ago when our company had to negotiate in Caracas with a Venezuelan firm over the questionable claim of poor quality squid which we had shipped them. Actually, we were in a place called Punta Fio, which my wife and I both were sure was the end of the world. We had to drive an entire day through desert to get there. At one stop we were going to be arrested as smugglers of American cigarettes by the National Guard. We had shipped 40 containers of squid by ship into this port. One of the complaints was of the master carton. Upon review of the product in their freezer I had to admit that 50% of the cartons were already in a broken condition. Why? Especially if we were using the high quality master

carton. After analyzing the problem, we discovered that each one of these cartons had been handled or thrown by at least 15 different truck drivers and longshoremen to get to the final distributor. From there they were being handled at least another 5-6 times before finally reaching the consumer. Along the way these people aren't going to treat any case like a baby. In fact, they really hate to move boxes. All the pent up frustration is, no doubt, released on these cases.

Stapling and strapping was not good enough. Good geometric box design for even stacking and integral strength is extremely important. After arriving back from Venezuela we improved our cartons even further by purchasing an automatic strapping machine to band crosswise and to gain more strength. We have not had a problem since then.

Importance of coldness and weight loss. Previously we have discussed the relationship of cold to bacteria counts. Another problem we face is coldness and how it sucks out moisture. Moisture is weight, and water loss to product can be expensive. In order to reduce this problem quick freezing is critical. Today all of our squid is totally frozen within 24 hours after being caught. We use ammonia blast freezers at minus 45°, not counting chill factors and airflow. Cold storage is maintained again at minus 10° with a still air environment.

One of the largest complaints on American exportation of squid, especially from Spain, has been weight loss. This is a major impediment to worldwide acceptance of American squid. Again, it was part of the major problem which necessitated our trip to Venezuela. We were inconsistent in our weights and often short of the five pound net weight when the squid thawed. Since then we have instituted a policy of overpack. This is not something that the industry normally does. Smart processors are doing this, but the smart processors are few and far between in this business. When packed in our company, all net weight cartons of squid are packed at 5-1/4 pounds. As a result, even with dehydration, after one year, full thawed weight usually ends up at five pounds or more. The point of all this is that this production is complicated and a lot

can go wrong. When dealing with squid, problems can result when no one expects them and for the slightest reasons. By packing low volumes, we learned a lot about squid and how to produce one of the highest quality squid products in the U.S., and there is still more that has to be done.

After the product is packed it must be sold. That's what we're all here for: to make profits and money. About seven years ago, it was decided that production in our company must be increased from half a million to five million pounds per year or more. It took two years of planning to gear up for the tremendous distortions we knew that this would bring. About a quarter of a million dollars was expended on machinery development for new blast freezing capacities and also the development of the first hydraulic conveyor belt system in the fishing industry on the West Coast.

The hydraulics were efficient. With hydraulics rather than mechanical, we can vary belt speed in production, reduce downtime due to breakdowns and increase the safety of our employees. This conveyor line has not broken down once in the last five years. Anybody that deals with conveyor belts, especially in a salt air environment, can really begin to appreciate what I am saying here.

A mainframe computer was installed to handle the tremendous surge in payroll. Squid is a very labor-intensive product. All the squid is hand packed in layers, rather than thrown into the carton -- once again, to insure good glazing and protection. The computer has also been linked with daily production and random size samplings of each day's product run. All are on accurate grading by size. This allows us to accumulate some interesting statistics on sizing per year class of squid caught, as well as allowing us to offer our customers the exact size of squid they desire, small for rings, large for stuffing and steaking.

Five years ago we went full bore into production. In one year we went from half a million to five million pounds. A 1000% increase in produc-

tion, not to mention the tremendous production problems we incurred. All of a sudden we realized we had no market. This is really important for you to realize because it's nice to know that people have made mistakes and hopefully have learned from them. At this time 90% of all squid produced on the West Coast was being exported. This occurred because we had concentrated on local consumption while our competition had entrenched itself in exports. We were at a distinct disadvantage. No one knew who we were overseas. You can have the best product available but product recognition and acceptance are the keys. We didn't have this, and we made a critical mistake. We assumed that high quality will always sell. It doesn't. It has to be sold and marketed. Panic struck. And the luck of the Irish bailed us out, as it has throughout my life.

At this time the oil shortage had created a boom in South America and more predominantly, Venezuela. Everybody who produced food there was now into drilling for oil. No one was producing food. Through my wife, a Polish Argentine, we began to look for new markets to penetrate. With the use of her Spanish, we were the first California producer to take real advantage of a brand new developing market in South America. They needed squid. Our dollar was weak, and they had the dollars. As a result, for two years our company established a monopoly in Venezuela over the entire South American continent using one company to distribute to Argentina, Colombia, Brazil and others.

The third year our competition found out and tried to penetrate the market that we had established. When competition calls, the men are separated from the boys. All of a sudden our prices were too high, our product was short on weight, cases were broken, and all the other excuses which can be used and negotiated into lower pricing. As processors, you know exactly what I am talking about. We stood to lose \$60,000 just because we were suddenly overpriced and were actively being threatened by the competition price cutting.

This necessitated a trip to Caracas and Punta Fio for negotiations. After two weeks of heavy brainstorming with Italian owners, we developed

a program of reducing our loss to \$20,000. We made a commitment to improve our quality by overpack, box strapping and computerized size grading. All of these approaches would be used to justify a higher price in the future, and present our product with an image of being a cut above other producers. With our \$20,000 in price reduction, the company in Venezuela also agreed to absorb a similar \$20,000 loss. In addition, their exporter-broker made up the balance of the \$60,000 total loss in the product. With this approach we jointly financed a temporary discount promotion program, which eventually bankrupted our main competition in Venezuela. The reverberations were felt throughout the distribution line, and believe it or not, even into the U.S. before our return home. We had not only reduced our losses, but reestablished our control of the market.

How could we have been so successful? During these negotiations my wife acted as translator, and the fact that she could speak fluent Spanish really blew their minds. We spoke Spanish continually rather than English and this is extremely important in showing respect for another people's culture. This is something that Americans must really learn from the Japanese as worldwide traders, especially in squid. One of the successes of the Japanese is the fact that when they go to foreign markets they really analyze and learn how to speak that language and gain knowledge about the culture. That really gives them an edge.

As a digression here, our company is now developing a second brand name which will aim towards the Spanish speaking market. We are facing up to the fact that within a few more years more people in this region will be speaking Spanish than English.

The problems of marketing are not over yet. We had to believe in the U.S. currency. Ninety percent of the production of squid on the West Coast is being exported, and the balance is for domestic markets. Common sense says this is not healthy. With the strengthening of the dollar, we are seeing our export markets starting to dry up. Lack of diversifica-

tion in fish marketing or production can lead to bankruptcy, as can be seen in the automobile and steel industries today.

We knew we had to generate a domestic market for squid consumption. The ideal goal was to export 50% and retain 50% for domestic consumption so that we could hedge on all bets, whether the dollar was weak or strong. How could we expand the domestic market? We had to intrigue the American housewife to get her to eat squid. We have already talked about the importance of a name like "calamari" and the movie "Jaws." Both of these helped, but in themselves were not enough.

Again, the luck of the Irish played a part when a man named Isaac Cronin walked into my office about two years ago. If you have ever met Isaac, you would appreciate what a genius he is. He reminds me of the old beatnik days at North Beach and of the flower children of Haight Street. He is a typical Bohemian. He is also a fantastic writer who combines words with dedication. What makes Isaac even more unique is that he was a fisherman, and more specifically a Monterey squid fisherman. In addition, he and his wife are both excellent cooks. Isaac wanted help in writing a cookbook on squid. To make a long story short, only two companies on the West Coast really helped Isaac, Ocean Garden Products and General Fish Corporation. He struggled for a year and finally published what is now the hottest cookbook on the West Coast. It is entitled The International Squid Cookbook. One can learn not only how to cook squid by reading this book, but also a lot about the product itself. What makes this book different from any other cookbook written about seafood is the background of squid that is covered. This includes how it is fished, its tremendous nutritional value, its high protein value, its low fat content, the various names for squid, how it is used, how to clean it, and on and on including a fantastic fairy tale. It's all in the book. People have flunked their midterms in school because instead of studying they become captured by this book. In any event, over 30,000 copies have now been sold in the U.S.

Why is this important? All of Isaac's recipes were written and tested

fully. For example, I have seen many fried squid recipes but Isaac's is the best. It includes all the small hints which every gourmet cook and beginner love, and which ensure a successful end product. Our company is so committed that we buy directly from the publisher for \$4.00, sell to our retailers for \$4.50 and they, in turn, sell it for \$6.95. All of us are making money and promoting squid very effectively at no cost. The result is evident. Markets have begun to sell squid in larger quantities than ever before. When the book is introduced into a retail fish market, squid sales go up 20-40% and do not drop. A restaurant has now opened in San Francisco which serves squid exclusively. Surprisingly, its name is "Squids." This restaurant is based on all of Isaac's recipes and is considering a national franchise because of its success.

I would say that we have come a long way in getting away from the name of squid to naming a restaurant "Squids." There is a message there, and perhaps we have gotten beyond the problems of consumer acceptance. Isaac hasn't stopped there. He is one of the strong supporters for the Santa Cruz Squid Festival and the Gilroy Garlic Festival. This affair grows larger each year and there is talk of moving it to Monterey. The other day we saw a picture of a girl dressed in squid and that was Isaac's idea. I know it's crazy but it's a great way to get people talking about squid, and once they start talking about it they start to eat the stuff and begin to see what they are talking about.

So consumer education is of critical importance in the marketing of squid. Isaac isn't all there is to marketing. I would be lying to you if I said it was this easy. We have a fantastic asset going for us in marketing that is inherent in an underutilized species, and that is price. Squid is still very cheap. Even though it was a poor production year, boats this year were paid 12-1/2 cents and still made good money. Despite a very strong dollar, the product was still being sold to distributors in volume for 28 cents per pound and maintained its export value. This is not something which can be said for many other types of American seafood exports this year. Salmon is backlogged and so is tuna.

I am pleased to say that our company has reached our 50% goal in squid marketing. In other words, 50% was exported this year and 50% stayed in the U.S. for domestic consumption. We couldn't ask for a safer position to be in with any type of seafood. Even in an economic recession, squid is responsible for continued profits and a capital stability for our company. Yet the marketing problems are still there. This year production in Mexico and California was at a 12-year low. As we depend on Mother Nature, and she sure is fickle right now, we are at the point of developing a viable market. We are in danger of not being able to maintain continuity of supply. Whether by Irish luck, or perhaps a real discovery, our company predicted poor production this year through the use of the computer. Statistics compiled in production over the last three years have correlated with historical production figures, and to some degree have indicated that the assumptions made on the squid cycle perhaps are not correct.

It is very possible that squid fishing in Monterey might presently be at an optimum yield. This is quite surprising, due to the fact that a year or two ago the Department of Fish and Game was saying how underutilized it was. Realizing this early in the season, we saw the inherent danger of running out of product and how destructive this could be to marketing. As a result, we purposely restricted sales on a ration basis, slowly raised prices and consequently were able to supply our customers throughout the year. We are applying the laws of supply and demand in as soft a manner as possible to prepare for next year, in which we expect a little higher than average production. We're going to see if we're on target. If we can predict two years in a row what a season is going to do with a fish like squid, we should be able to do this on salmon, tuna, things that we can tag. I think we are getting very very close to the possibility of predicting production in the U.S. in all seasons.

The situation is not bleak however. Thanks to the biologists, we know that virgin stocks are available in other areas of California. We are presently trying to develop production capabilities for these stocks and the problems are massive. They include lack of education on the part of

fishermen and Californian producers, and an absence of coordination between different kinds of gear. There are some major problems to approaching those resources. There is another facet to the story which Mr. Granger mentioned. We are dealing with a cheap product, which is providing many jobs to our immigrant minority population. There is a problem however, with seasonal products causing real peaks and valleys in plant utilization. One answer is almost on the horizon: labor value added applications to the raw product itself. Again we see the close coordination of product marketing and the interrelationships which exist. By this I mean former processing methods were used to satisfy segmented markets. Squid is consumed in a number of different and versatile ways. The major way is whole, which allows total flexibility on the part of the cook in deciding preparation. The other ways are plant-processed steaks, tenderized steaks, tentacles only, and squid rings. Our company has now developed ways of keeping our labor working on these products 12 months out of the year, which solves the seasonal problems. It has again been experimented with on a small basis, insuring quality, and learning that we are on the verge of going into heavy production, we have developed ways of cleaning squid at the rate of 40 pounds per hour, competing closely with the squid cleaning machine we have developed in California today. Our squid steaks, I might add, when cooked properly are almost a close cousin to the abalone. Prices of \$1.80 a pound compared with \$24 a pound wholesale are definitely a plus in relationship to abalone.

Marketing seems to be very easy except for one by-product: the tentacles. People who want processed steaks do not want the legs. It's just like pigs. Everybody wants the ends and nobody wants the tail. Yet commercially everything must be sold. Within the last month we have discovered the proper marketing techniques and preliminary results seem to indicate that now squid tentacles will also be in high demand. We have talked to bars, and they are being breaded and just given away. What we are finding is that by adding salt to the breading, bar business goes up tremendously. It's also a lot healthier than eating potato chips or this other stuff you normally find in a bar.

What does all this mean in regards to success? Solving production problems on a commercial basis is always changing and never the same, depending on volume and many variables. It has become even more difficult because of the need for involvement of people and the variable they represent. There is no room in production for preconceived ideas, and constant vigilance is necessary to be aware of changing conditions and all of the variables. All variables are interrelated. For example, water currents and temperatures in the ocean have a tremendous effect and cause changes in production approaches on a day to day basis. In fact, each species has its own production problems, solutions and requirements.

Production can never be separated from marketing. Both are multi-level approaches, totally integrated and demanding a commitment to risk, capital commitment, imagination and some luck, preferably Irish. Creativity on all levels and awareness are critical.

There is a need for government cooperation with industry. We must together try to insure continued success of marketing an underutilized species such as squid. We must strive to eventual prediction of yearly production levels to avoid out-of-stock situations which are disastrous to marketing. We must begin to develop an environment which encourages higher quality control at all levels of distribution. We'll also discover how to diversify our production areas without sacrifice of quality. In short, we need to know a lot more about squid and our national fish resources. That's basically the extent of this.

There are potentially massive problems with some of the development of the underutilized species off of the California coast. I think Oregon fishermen are a lot further ahead of California fishermen. With reference to your gear, I think that you are definitely way ahead of California fishermen and have an edge on going after virgin stocks. The real problem is that the processors up here are not ready for you. In California, it is just the opposite. The processors now have made some real jumps ahead of the fishermen down there and they are going to have to respond to that.

QUESTION: What is the problem with the fish pump as far as handling is concerned?

FLANAGAN: For one thing I don't like to pay for water, and I do not believe that the fish pumps are totally a discount machine. I think that the fishermen themselves don't really trust the pumps entirely. One could figure a percentage of water and weigh it back for the fishermen, but I don't like to deal like that. I want the right weight for the fishermen and I want the right weight for myself. We developed a conveyor system that is adjustable to high and low tides, and what happens is the conveyor system extends right out into the boat, and the product gets loaded onto the conveyor system, and from then on nobody touches it. As the squid is coming in on the conveyor system the excess water is removed as well as the garbage such as kelp or incidental catches such as anchovies and herring that can be separated out very easily. When it is processed it runs into our plant, is dumped into a hopper, and is automatically weighed. From there it gets dumped onto another conveyor belt and goes up into the main storage holding tank where it is immediately put into refrigeration. Surprisingly, the conveyor belt is a lot easier to clean than a fish pump. Fish pumps are great when you are pumping volume, but that is not all one has to look at. Somebody has to keep it clean and from the time you start fooling around with the equipment until it's time to go home at the end of the night, it's not how much volume you are pumping through the plant for an hour or two that matters so much. With the machine you've got to consider that it might take two or three men to go back in and apply some sanitation procedures. Also the squid pump has some real problems as far as damaging the skin of the squid.

QUESTION: With reference to squid rings, do you have an eight-ounce or 12-ounce pack on the retail market now?

FLANAGAN: We are not at that level yet. We are on the verge of some real explosions, and I can see a time coming when we are going to have to get to that point. In reference to squid rings, I can see the possibil-

ity of using extrusion techniques and coming up with some real neat shapes that are breaded to give away to kids to eat in school. For example, we have a real problem in this country with school education. Our kids are growing up in schools and eating pizzas and hamburgers and the day is coming when they are going to be the consumer. If we are not careful, they are only going to be cooking pizza and hamburgers and no seafood. We are really going to have to start paying attention to the kids in school and I think squid is a good product that can be sold on a large scale basis very easily and not have too many things go wrong with it. I don't know how many of you have gone to conventions or anything where seafood has been served, but 90% of the time the seafood is garbage because there are some real problems in cooking mass quantities of fish. Squid has the potential of being marketed in large quantities, cooked in large quantities and is very healthy for them. What we are talking about takes a lot of money for capital investment and the machinery that is needed for grading. In order for it to be done properly, it is pretty expensive. Extrusion equipment is quite expensive and the fishing companies in Monterey really don't have that much capital available to them to get involved, so it takes a while to generate the type of money that is necessary to go into these market items.

QUESTION: I would like to ask you as a processor, Monterey is unique because the crew members on squid boats are union. What effect does this have on you as a processor?

FLANAGAN: What they talk about doing in Monterey is more of a social thing. They really don't have any effect on price. Price is a function of supply and demand. Unions have nothing to do with it, it is just how we are selling and how successful we are in selling.

AUTOMATION IN THE SQUID PROCESSING INDUSTRY

BY

DAVE HARTZELL*

We started out on an 18-month episode dealing with the University of California, trying to determine what it was that they had developed as a squid processing machine, and whether it was commercially feasible, and whether they would let it go to somebody such as myself. It took quite a bit of time, as many of you I'm sure understand who have dealt with bureaucracies before, to convince them that FMC (Food Machine Corporation) was not going to pick up the project. They had to let smaller entrepreneurs, such as ourselves, pick it up and take a run with it.

(Question directed at Pat Flanagan** in audience). What is your cost per pound in labor, Pat?

FLANAGAN: We are running about 40-50 cents a pound.

HARTZELL: Our work with our machine and most of my work has been with Monterey bay squid, Loligo opalescens, which is basically the same critter that we are looking at here. We started out with a machine that was developed by the University of California at Davis and put together in an erector set prototype. Pat's made that obsolete with his two people cleaning 40 pounds an hour. We have taken the machine and developed it to the point where it cleans approximately 80-120 squid per minute using two or three operators.

In the past, particularly as Pat might tell you, with the introduction and development in the domestic marketplace, the attack has been not just to the traditional domestic market comprised primarily of oriental, Latin

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** (See page 97)

and Mediterranean populations, but to the middle class consumer and to the chain store. A lot of the problems in getting the product to that market are putting it in a package and a product form that is pretty on the store shelf or that looks good in fish markets. What we have to offer and what we hope to offer in the next few months is an opportunity to crack that barrier and change the nature of the squid business on the West Coast and maybe in the U.S., both for domestic and international markets. There have been some instances of Taiwanese products cleaned in Taiwan and imported here at 90 cents to \$1.00 per pound. On both the East Coast and the West Coast several companies have risen. In the Monterey area I know of two, in Los Angeles I know there is one, and on the East Coast I know of two or three that specialize in buying squid and cleaning it. Some of them are fresh and some will take frozen stock and clean it. Their labor factor, at least on the West Coast, is running anywhere between 35 cents to 50 cents per pound, usually paid on a piecework basis. The yield they are getting on Loligo, if you count tubes and tentacles, is approximately 50%; tubes alone, about 33-34%.

The quality problems that are sometimes experienced over the two-day period getting the product from the fishing grounds to the plant and frozen are not quite as critical with a clean product. They are still critical, but your outward appearance of the squid changes faster than the color of the meat. When you get a clean product, you're looking for a clean, lily white piece of meat. Your changes in the squid will show up externally before they do internally. And again, I have less experience than most of the people that have handled squid and have been talking the last few days.

Most of the plants in Monterey that I have seen pump, and in some cases brail, the squid from the boat, put them in bins that are about 3-1/2 feet cubed, and put them on ice water slush. I have seen chunk ice being used as well as flake ice or crushed ice, and the reason I've been given by some of the processors is that the chunk ice will get in and break up. The squid settles and it will break up the ice and cool the squid faster.



The automated squid cleaning machine developed by the Squid Machine Corp., Santa Cruz, California. Photo by Ken Hilderbrand.

For the cleaning process, generally they will soak the squid, whether cleaning or packaging, for four to eight hours beforehand. There are a couple of reasons for this. One of them (I guess I'm not supposed to say this but I will) is that the processors will gain, I am told, 8-10% in weight by absorption of fresh water once it's placed in this ice water mixture. We all know what water does and how that is going to help the process. Also, in the cleaning process, it tends to loosen the skin and for our purposes makes it easier to clean either by hand or by machine.

Now you can see my slide presentation. This is where we started. (Referring to a slide) It is not a very good picture, but this is the prototype from the University of California. They put it on loan to us and we put it in our shop. It's been in there for the last six to eight months and we've just returned it to them. I have some diagrams that I can show in a little while showing how it works. This is the most recent machine we're working on. Its dimensions are four feet wide and about eight feet long. It has a bucket conveyor system which you can see over on the left side. The squid are placed manually in the bucket conveyor and go into the inner workings of the machine. The machine on the incoming conveyor takes the squid and cuts the eye portion out and will discharge the eye portion, or the head, to the bottom tube. The squid goes on through the machine and the tentacles come out with the beak intact. We believe that we can remove the beak before we're done. We haven't at this point tried. We're trying to get the basic runnings of the machine working before we go after removing the beak. We don't anticipate it as being a problem. The squid mantle is impaled on a peg, and the outside skin is taken off. The inside is completely eviscerated and the skin removed. The clean mantle in the tube form will come out too. You can see the panels up above that are opened. They are hydraulic interlocking panels.

Everything on this machine is run by hydraulics. It is conducive to shipboard mount, should that be necessary. In your fishery, I don't see it being applicable. On the East Coast, where you have a lot of off-shore fisheries, it does have some possibilities, but should the panels

be open, the machine automatically shuts down. The bucket conveyor we have now is only 60 inches long and would handle about two workers. We think it will take about two workers to keep the buckets full, but we're not sure at this point. We hope to get into the field fairly soon and determine the optimum number of workers needed to feed the machine and what length to make the conveyor to fit the proper number of workers.

(Referring to a slide) Up on the top on the far end you can see input/output for your hydraulics. On the far side you have on/off valves for the water system. Everything is done by high pressure water. The squid is moved around inside the machine by water jets, the skin is taken off by water jets, and the viscera are removed by water jets on the pegs themselves. That's the inside of the unplumbed version of the hydraulics. That's the bucket conveyor. That's your hydraulic actuator. I think we're running a three horse motor.

In terms of the market and what there is, we see that potentially product acceptance on the U.S. market will depend on the availability of a cleaned product. We see that internationally there has been some resistance to the Loligo opalescens because of the small size. A lot of the Loligo opalescens have gone to the bait markets instead of for human consumption. We think with the availability of a cleaned product in the form of a tube or a ring, that acceptance on the European market, especially in Spain, is likely to go up. Of course, with the Japanese it's hard to tell. Most of the quotas and most of the exports to Japan that I've seen are not coming from the United States, but are coming from elsewhere, where Japanese are involved in joint ventures. They'll increase their quotas so they can get their own fishing allocations in those waters.

If I were in the situation of processing, I would look principally to domestic and to European markets as opposed to Japanese. The one possibility with Loligo opalescens is that you do have a Japanese roe market because you are fishing the spawning population that is 100% or 80-90% roe-laden squid. It is fairly easy to separate the females from the



Top: Squid are placed on a conveyor belt which will carry them into the cleaning machine. Bottom: Squid mantles cleaned by the squid cleaning machine. Photos by Ken Hilderbrand.

males, and depending what population you are fishing, you should be able to target and get a fairly high concentration of unspent females. Right now it is done by hand. There is some work being done in California and elsewhere on mechanized sorting of roe-laden females from spent females and males.

I've got a picture of how the inner workings of our machine are done. The squid comes in at the top, the eye portion is discarded down one tube, the tentacles down another, and the mantle comes down and is impaled on the peg below and is cleaned by high pressure water. In terms of the layout of the machine I can give you rough dimensions. It is a fairly compact unit. This machine will clean 80-120 per minute. We use about 100 gallons a minute of high pressure water. We have a separate separation system where we will separate the waste from the water and have a continuous flush, so your net use is about 10 gallons per minute and you're recycling 90 gallons a minute. You have to flush the water because you've got a lot of ink and a lot of material coming out. Unfortunately the separate unit is going to be fairly expensive. We put a jet pump off the bottom so the water will come out and go through the jet pump, through the separation unit, and will get pumped back over to be reused and flushed out. Coming out of the tubes at the side of the machine are the head, tentacles, and mantle. They are spit out, and from that point you can pump and move it to any point you want by using PVC tubing and water jets to assist it, or to go to a conveyor, or however else you want to do it.

QUESTION: Is the machine adjustable for larger or smaller squid?

HARTZELL: The machine itself will be much larger. The production will probably be less in terms of pieces per unit, although again we are in a situation where we can adjust that in terms of what the catch weighs or what the processor wants to produce. Using this machine, on an eight hour shift averaging a six-count squid, we figure we can produce 5,000 pounds of clean product per eight hour shift using two or three operators and whatever you're going to have in terms of power.

QUESTION: Do you have any figures on cost?

HARTZELL: At this point we are not sure we're going to sell; we might be in a lease situation or approaching it on a joint venture situation. I did some figures on the way over yesterday and there has been over \$350,000 spent in getting the machine to where it is. We've got at least another \$150,000 before we get it to the market, by the time we get done with our patent work and everything. We take a look at the potential size of the market and there isn't a return on the straight sale, so unless we can jump in with a profit there is no way. I think that's a part of the reason the machine sat for three years.

Comment from the audience: I'd say that the machine that was shown today has made tremendous advances. After what I have seen today, I think that the industry will be very exciting.

HARTZELL: Basically the thing is built around simplicity. The engineer that I'm working with believes that they are simple and easy to maintain and the parts are easy to replace. If you are down you are not going to be down for very long.

QUESTION: Do you have the potential to slice the tubes?

HARTZELL: On the machine we don't slice the tubes, we give it to you in a tube. We will build an attachment for a secondary process to put it into a tube or to put it into rings, depending on what your market is going to be. But we've got a basic machine which will give you a tube and you can go two different ways with the tube. You get a little higher yield with the tube because when you go to the steak you're going to go to the top of that tube and cut it off and slit it. We cut about one-eighth to one-fourth inch off the bottom of the mantle, which is usually cut off anyway in order to help to skin the thing. We also do not recover the roe out of this, unfortunately. With frozen squid the roe have to stay intact and you can get some recovery on it. With fresh squid the roe sac gets blown apart and there is nothing you can do. The

thing to do in a processing situation might be to go for the roe market. If you talk to the Japanese the first thing they are going to ask you is what the roe content is. The possibility of separating roe-bearing females before you clean them can open up a potential premium market. It will also open up a door into the Japanese quota system or perhaps get around the quota system by other ways of preparing that product for the Japanese market.

QUESTION: How come a large company with a lot of money hasn't developed this machine?

HARTZELL: I don't know. There are some other machines on the market. A division of Nestle based in Switzerland has a technical division that developed one for Finest Frozen Foods who packages frozen squid rings. They sell them in the European market. They buy Canadian squid, take them overseas and process this squid into rings and send it into Spain. I haven't known anybody else that's been getting Canadian squid into Spain. They have developed a machine that doesn't skin the squid, and they are at the point where we picked up the U.C. Davis machine a couple of years ago.

QUESTION: Do you have to lay those squid a certain way on your bucket conveyors?

HARTZELL: You do have to have them going in a proper direction and that is why right now you have to hand feed them. We've got some preliminary designs. There was some work done at U.C. Davis, which we may or may not pick up on, that automatically orients the squid in the proper direction. We hope to correlate that down the line with orientation, some sort of sex sorter, and feed them into the machine. Hopefully you'll be able to dump the squid in the hopper and pick them up at the other end without much handling in between. We think that we can cut the cost of hand cleaning down to about 25% of what it is now, at which point you open up a viable market competitive on both import and export.

PANEL DISCUSSION:
RECENT DEVELOPMENTS IN
SQUID MARKETING

Panel Members: Anthony Klos¹, Thomas Steiner², Steve Hofer³, Bill Court⁴, Pat Flanagan⁵, and Terry Elwell⁶, Moderator.

ELWELL: (Referring to Ocean Garden Products) Those are the people that have been behind the big push for the grande calamari. Even though they are a Mexican company and a Mexican product, endemically I think you will find your incipient industry will benefit from this generic pull. They are putting about \$3 million into an overall marketing effort and are very excited about their product. The problem is that they don't seem to be able to find it right now. I suggest that this situation may leave some openings for you folks.

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I had a conversation yesterday with one of the fishermen here, I don't remember who it was, but he best described this nascent fishery as a "catch 22" dilemma in that even if you catch the fish, you've got to find and catch a processor. It is sort of like the chicken and egg syndrome. Which comes first? So today let's play economist and assume that we have a harvesting/processing sector here in the Northwest. I am going to ask our esteemed panel here to tell us what product forms we should have, what kind of consumer acceptance we should expect, such questions as the qualitative difference between sea-frozen and land-frozen products. I would also like them to address the hypothesis that has been presented by the grande calamari people that perhaps the panacea to marketing this product is to make it look least like our beloved cephalopod, i.e. skinless, tubes, steaks, breaded strips and so forth. The Ocean Garden Products people have predicted that within the next five years in the U.S. squid will be one of the most accepted seafood products we have on our menus.

Now without further ado, most of you know the gentlemen on our panel, Pat Flanagan, Bill Court, Steve Hofer, Tom Steiner and Tony Klos. The two new additions are Steve Hofer who is a very innovative, hard-charging seafood distributor in Denver, and next to him we have a gentleman who has spent the last decade in the institutional food trade as a food and beverage person. His last assignment was with the Red Lion chain. I think what I am going to do is just sit down here with these guys and we will just go down the row here and let them tell us what they know.

KLOS: Boy that was a mouth full, you are a real prince. I can't tell you very much about the domestic marketing, but I can tell you a little bit about marketing for foreign markets. Just let me start off by giving you a little bit of information about my own approach. It deals with the difference between marketing and selling a product. Our corporate philosophy is that we have seen too many people in the business concentrating on turning fish into cash as quickly as possible. At the same time a lot of the salesmen have a real good working knowledge of their product. What we have worked at is developing the marketing as opposed

to selling. I think that is more than a distinction of semantics. Rather than trying to force a particular product into a market, we have familiarized ourselves sufficiently with a market to go ahead and see if we can't manipulate the product a little bit. So while the marketer has to know his product, we feel that you have to know the market as well as that and spend as much time as you can familiarizing yourself with that. It reminds me of a little story of some people in Africa looking for some fish products. They went to the Florida coast and the processors down there really forced upon them some headed and gutted fish. They got into the African market and they didn't know what the hell to do with it because in this particular region the product was used in a stew, and they had never seen a fish without the head on it. I am going to drop this ball quickly and pick it up later.

STEINER: I think that I would like to limit my discussion to the squid industry and the marketing of their product in such a way that the restaurateur can utilize it in the best way possible. I think it is important for the squid industry to consider this, because this is something the wine industry has been doing for many years. About 20 years ago, the California wine industry found out they could market their wines in a much less expensive and reasonable manner if they could just get their products on a wine list in a restaurant. Why? Because they have visibility, they have an actual salesman to talk to the individual consumer in the form of a waiter. They very aggressively pursue the restaurant as a marketing tool.

I was told yesterday that 60% of seafood is consumed as institutional food, meaning hotels, restaurants, and larger food chains. To really take advantage of this tool, you have to offer a product that is going to be available on a year-round basis. Restaurateurs find it much too expensive to change menus more often than on a twice-a-year basis. So the processor is the person that I would really have to talk to. Specialty sales in the restaurant, meaning items that are not usually on a menu but offered on a nightly basis, can contribute to a fairly good portion of the market as far as fresh squid sales are concerned. But

those are going to have to be actively and aggressively pursued by marketing staffs of the processor, or perhaps people like Terry Elwell.

Another thing about the squid industry that you have to consider is the different types of product the restaurant can use. They have to diversify the product itself. We can use the tentacles fairly aggressively in our lounges, just as Pat Flanagan had discussed earlier, and I think on the higher-end, gourmet-type restaurants, tentacles are easily marketable because people there are people ordering escargot, or snails. I should call it calamari, but those types of people are not as averse to eating things that would be considered exotic, which I think calamari is at this point. We can use it many different ways, such as fresh, tubes, and breaded, and we can use it whole because a lot of chefs like to take a squid and cut it up the way they want to, and prepare it in such a manner that it becomes very appealing to the eye, and doesn't seem like the run-of-the-mill type product in every restaurant you come across. So prophecy is the important arena. The question is, three products or 20? Wally was saying the other day that on the East Coast they process squid in quite a few different ways than we do on the West Coast.

There is another problem in volume sales. You are going to be using a lot of fast food restaurants and a lot of concept restaurants that are attached to somewhat larger food corporations. For selling to those people you have to remove a stigma about squid itself. A lot of people are used to squid being overcooked so it is somewhat rubbery in texture, and that doesn't necessarily have to be the case. I have had squid where you can cut it with a fork. It's very delicate in nature. So there is an education problem there. I think that the cookbook would have a very viable effect on the market, as well as little brochures like West Coast Fisheries Development Foundation is putting out with recipes and cleaning instructions.

The last area to consider might be price. As a restaurateur I know that sometimes products sell better if they are priced higher on a menu. People consider they are getting a better quality or a more exotic

product if they are paying a higher price. This would be one area for consideration for fresh squid sales or whole squid sales to the chef. With that, I will accept questions later.

HOFER: I am a distributor in Denver and I sell strictly seafood. I guess I am the point in the distribution chain that starts with fish in the water. I am third from the end. We are talking about marketing a seafood item that hasn't gained a lot in popularity. From my position I would have to convince the restaurant guy that he should put it on the menu. Then he has to tell his waitress, who is at the end of the chain, what the special is for the evening. As it is introduced into a restaurant, I think something like squid will tend to be a special prior to being put on the menu for six months at a time. If it isn't handled this way, it won't sell. I think that what we all have to do is start with the foursome at the table at the restaurant. We need to create some way of preparing the product or describing the product, or both, or by publicity, and get acceptance to a point where one of those four people at the table will order that product. Then it starts back at the chain and then we all have to do our part.

A wholesale distributor is really almost only a pawn, just a conduit through which the product moves from the processor to the restaurant. We've been talking about the educational process involved and I think that's really the problem that we have. It is cookbooks like the one Pat Flanagan had the other day that we can use as a tool to help promote a product like squid. I would take them and then as I go through I'd talk to food and beverage people and chefs and see if I could instill in them some kind of an interest in trying it. Now if it is successful in his restaurant, we have something going. And that's the contribution I can make. I must say being here helps me because you can always sell something when you know what you are talking about, and I have learned a lot about squid the last two days.

In the last three years, my experience has been that squid has grown quite a bit in my business. I still don't sell a lot of it. It is about



Panel members Pat Flanagan, Bill Court, Steve Hofer, Thomas Steiner and Anthony Klos discuss squid marketing.

50% whole squid and 50% tubes and cleaned squid. I, by the way, have no squid and if anybody would like to see me afterwards, I would like to buy some. I can't find it anywhere. Poor Pat has got it allocated and I can't even get any out of him.

I want to make another comment about the West Coast fisheries and an experience I have had with them. I am not sure I know why. I just kind of throw this out because I feel compelled to tell you. I buy fresh fish and frozen fish from both East Coast and West Coast and there is a difference between the way it is marketed on both sides of the country. I prefer the way they do it on the East Coast. I'll tell you what I mean. I can get most species of fresh fish 52 weeks a year from the East Coast. Week to week it can sometimes be \$2 to \$3 higher for the same specie on the East Coast. On the West Coast I can get it very inexpensively. Take, for example, rockfish. I can get it very inexpensively one week at the same price I always pay for it, and then I may not get it for four weeks. I would suggest a good way to do it is the way they do it on the East Coast, where it isn't so much that you are on a pecking order and if you are a good customer you get all of it and somebody on the bottom doesn't get any, but where they raise the price to the market every week so there is always a supply for whoever is willing to pay the price. It's just a comment I have. It actually happens even with frozen fish, and even king crab. Not this year, but in the past it's either there at a pretty reasonable price or completely gone and instead of adjusting the price to the supply, the East Coast method could be adopted. That's something I'd like to see the West Coast think about doing.

COURT: My comments will be a bit different. Pat Flanagan has suggested the desirability of having a market that is 50% domestic and 50% international. In view of that, and in view of the fact that the market will be against the backdrop of the international demand, I will return to the Japanese situation and outline it in general and then try to put to sleep the idea that Japan is our major market, and also suggest how Japan might be of benefit to our industry. I repeat that Japan is the major consumer and importer of squid in the world. They import well over three times the

total volume of U.S. production, and also for perspective, they only catch about 15,000 tons a year of squid in our waters where the quotas in the Soviet Union are 150,000 tons, New Zealand about 50,000, international waters 120,000 and then lesser amounts in three or four other major areas. So the U.S. isn't that much a part of the supply and because of decreased catches in our waters, even with reductions in our quotas, the opportunity for exports from the U.S. certainly are not substantial.

What does the Japanese market have over us? I feel that the market itself gives us ideas about product lines, overall marketing approach, and just the dynamics of what a good squid market could be. The major reasons why it's not a panacea for our industry are the great variety of squid species which are available and the relatively low production costs in other producing areas as opposed to the U.S. Also, there's such a tremendous variation in Japanese demand, both in price and in volume, that it's an extremely risky business. We only need look at the disastrous experience at the eastern Canadian fishery when prices fell by more than 50% to understand this. Tremendous investments had been made to supply the Japanese market to realize the risk of that. However, Japan does import from 60-odd nations and we are one of those. It does offer some limited opportunities.

Turning more specifically to the demand in Japan, I mentioned that fresh is approximately 25%, frozen maybe 25%-odd and processed maybe 50% and increasing. I think the great opportunity for us is to look at their tremendous rate of processed products and see what examples we might derive. We've mentioned many times the great variety in species, in size and all that.

Looking specifically at quality characteristics in Japan: what is it they are looking for; what is it that determines the price? Basically, its color, size, mantle thickness, the size assortment, the neatness of the packaging, the freezing time, the cold storage holding temperature, cold storage holding time, whether it was frozen ashore or at sea, the time between catching and freezing and whether it was caught by a jig,

trawl, or other means. Also, the consistency, both in the lot itself, from that producer, from that region, or from that nation, is extremely important. For example, from the U.S., as you know, they are importing from 1500 to 2000 tons of squid from Southern California and in the industry there is a standard list of who is A ranked, B ranked, C ranked and then there are the untouchables. They are rated primarily on the basis of consistency, and the dealers' reputation for having a neat pack on top and a jumbo pack on the bottom and a wide range of size assortment. These are extremely important.

Another thing alluded to that is very significant in the Japanese market is that they generally have very high standards but they have floating standards. They use the market claim to great advantage. Whenever there are market fluctuations, when the market falls, they can find a very small mistake in even a good pack as basis for a claim. Many people in the salmon and other industries in this country have experienced this. It presents a terrific problem. It can't really be avoided though.

Looking more specifically at direct U.S. marketing efforts in Japan. As I mentioned there are some 2000 tons a year going to Japan, primarily the California product, and several of the attractive features of that, as we mentioned, are the roe-bearing squid. The particularly desirable aspect is that it's a relatively small squid and it's only available in 1-pound packs which are very convenient. They can be put right on the supermarket shelves. Housewives, cooperatives, and other groups are importing them directly. Some of the various cooperatives are importing them directly and that is a big sales point. Other products are bait. Last year I know of one producer who sold over 400 tons of sea-frozen product as bait and got up to about 42 cents a pound ex-vessel. That was a little unusual because of the decrease in the availability of supply from Canada. But that is one option. The Japanese catch about 15,000 tons of squid in our waters. About 10 or so of that is from Alaska, and several people have looked into the feasibility of that fishery. Currently it's by-catch and quite a low value species, but that's another thing to keep in mind. A very significant factor in the Japanese demand is always

going to be the reduction in domestic catch and import supply, so there will be opportunities for U.S. exporters, but quality standards are high, competitive production costs are low, and it's an extremely erratic market.

Several other comments about dealing directly. I believe it has been mentioned by Pat and others: knowing and dealing in the language in Japan, knowing the market you are dealing in, and having some awareness of Japan is extremely helpful. It certainly paid off in my experience, and several others here in the audience that have had the same experience. To really succeed in the opportunities which we have, I think that more hands-on effort is necessary. Looking at the product specifically, I think that there needs to be good hands-on understanding of the product in order to successfully market in Japan. Where and how it is caught, how it is handled, what problems are encountered, what the seasons and volumes are, and what the competing uses are. Even to the point of actually processing the product yourself, cooking it, eating it, knowing the effects of different freezing times, different cooking times, knowing the different ways the product can be used, the different problems encountered, how you can deal with those. Another would be how that product is used in Japan, who the users are, how you can best satisfy them.

Two final points, let me mention many items available on the Japanese market. There are dozens of dry products, various salted squids, dozens of pickled varieties, stuffed squid, broiled, boiled, and baked. It's in literally dozens of different processed products such as lemon-flavored, mixed with other items, and the variety of these products and the number of these products increases tremendously with the decrease in the squid market. I've been in a local market and counted 40-odd products, and certainly a lot of those aren't going to be suited to us because of excessive saltiness or dryness, or inappropriateness to our diet. I think that if some of our nutrition, food service, or retail people were to go over there and look very carefully around the various markets, different regions, and in rural and major metropolitan areas at the

different kinds of market forms, I am confident they would come up with at least a dozen products which might be very suitable. Several people here have alluded to the needs for developing the domestic market in the U.S. One of the reasons we haven't got a market is because we haven't got an item. Japan has many opportunities there, so I hope you will consider that as another avenue in developing products. Thank you.

FLANAGAN: I would like to bring up a couple of things that we really haven't talked much about. Some questions were asked that kind of tie in with marketing, but we haven't talked about the production of squid as a bait product on the West Coast. There are some questions about this from one of the fishermen from Alaska. One thing that has to be made known is that when you produce a bait product, it has to be equivalent to human standards or better. We sell a lot of bait product into Oregon, Washington and Alaska, and one of the reasons we have managed to get a higher price for our bait and get real good acceptance of it is because we have taken a lot of care in the production of that bait, knowing that the fresher it is, the more effective that bait becomes to the fisherman, whether he is fishing rockcod or crab or whatever. There are a lot of people producing bait squid who are not cognizant of this. In other words, they look at bait as the garbage. They are all concerned about the high dollar yield on an edible product and they don't worry about the bait structure because maybe they are not dealing with the fisherman as much as our company is. We deal with a lot of fishermen, and I don't want headaches back from my fishermen when the bait is no good. That has to be said so that there is no misconception if you start to develop a fishery in Oregon, whether it is for bait or human consumption. The standards we are talking about are the same, if not worse perhaps even for bait. The quality standards are extremely important.

We have only discussed a few species of squid and I have met Japanese that are so organized. I had some Japanese people come in that wanted to buy squid a few years ago. They had unbelievable names of squid I had never seen before. I figured that after a while you get to know things pretty well. You begin to feel stupid when you talk to these people.

Not only do they have different types of species, but they literally knew the production figures in any place in the world geographically. What was really frightening was that their figures were more accurate than our own government's figures were. How in the heck they are getting these figures when the American government can't even get the figures speaks well for their system.

To give you an example of how far off base the American government statistics are, a couple of years ago there was an effort to bring in some Spanish vessels off the West Coast and also the East Coast to start some factory processing. This attempt was very strongly fought by West Coast processors both at San Pedro and Monterey. Most of the processors were fighting on an emotional basis and the government was behind this. They were approaching it on a very scientific basis. Well, when we got some of the figures back, the reason they wanted to allow the Spanish to fish off the West Coast was that they felt the American processors were not processing and exporting very much to Spain. I got the figures that our government was using which showed the total export of Loligo opalescens off the U.S., but I multiplied my total production in the plant along with a few other processors I know in Monterey and I ended up with a figure that was double what the government had given. We find this happening quite a bit. I don't know why American processors have such an aversion to reporting the truth, but they do. What's happening at the 200-mile limit is that this is coming back to haunt us. The government is using statistics that have been lies and all of a sudden we are being regulated because we've lied. That works to the good and to the bad, depending on what fishery you are talking about. In Monterey they had developed an unusual technique of buying a pound of fish and ending up with two pounds. That extra pound that he gained he didn't steal totally from the fishermen. He really did come up with some ingenious ways of gaining some weight, but the thing is that the government comes in and says you didn't pay the right amount of taxes. Well all of a sudden the guy says, "How in the heck do I get down to a pound again?"

So the government has become a lot more sophisticated in analyzing their figures. But the industry itself is going to have to realize that we are going to have to be more honest in our figures, too, in order to adequately manage resources. That is extremely important for the industry to face up to, not only in salmon and squid but the whole works.

The other thing is that restaurant marketing is a key factor. San Francisco has probably one of the largest concentrations of restaurants per square mile in the United States. San Francisco is comprised of only 49 square miles and has, I believe, about 2000 restaurants. I am not talking about McDonalds. I am talking about regular restaurant operations. As a result, it is very competitive and very innovative and I think that has been one reason why, on the West Coast, squid has become a very big item domestically. It really started in San Francisco and Los Angeles and is starting to spread. As people visit these places and go back to places like Denver, you will see more changes occurring. The restaurants are a very integral part to the marketing of different product items.

The separation of whether we are going to produce squid round, rings, or fillets, is going to have a direct bearing. The differentiation of products is going to increase our market potential. I could see that if we do an adequate job right now with fish, we are probably looking for around 10 to 20 cents a pound payoff to the fishermen for raw products off the boats. In about a span of about five to 10 years I can see the fishermen getting as much as 50 and 60 cents a pound for that same product with good marketing. I can see the product selling on the wholesale level in the range of \$3-4 a pound and still being competitive.

QUESTION: What will you use for bait then?

FLANAGAN: There are tons of squid out there. The biggest problem is how we are going to get it, process it the proper way, and make sure we sell it so that we don't cut the industry off.

(In reference to Steve Hofer's earlier comment on East Coast vs. West Coast marketing) This thing has really irritated me for a long time on the West Coast. The real problem is that the West Coast is the only place in the world where we determine fish prices through a marketing association. Throughout the rest of the world it's always auctions. We see it as a distributor, not just as a producer. Continuity of supply in this business is extremely important. The East Coast has an edge on the West Coast because of this. If there is bad weather out there, and believe me, on the East Coast it is pretty rough in the wintertime, there is going to be some courageous fisherman who is going to go out there and risk his life, and he should get paid accordingly. The captain on my boat goes out and breaks his back in stormy weather, and I am going to pay him the same price as I paid him for rockcod during the summer when it was flat calm. It doesn't make any sense in my mind, yet that's the system we are working with here. I don't feel that it's a healthy system for the fishermen, and I don't think it is a healthy system for the processor and distributor. There are a lot of auctions in the world and they are all run differently. Some are probably worse than our marketing associations on the West Coast, but I think that some could be applicable here.

Comment from a member of the audience: May I add to that conversation? You fellows aren't taking into consideration, and my good friend Mr. Hofer did not take into consideration, the cost of printing a menu which runs into thousands of dollars. Now you don't change prices that readily, number one. You are not taking into consideration computer printouts the way we have them today. I have been with the business for 45 years and you don't move that quickly on the West Coast. That is why we are where we are on the West Coast thanks to the type of system. If you had the East Coast system there would be some happier people, but I assure you that the marketing end of the problem would be badly damaged compared to the way it is today. That's the other side of the coin.

FLANAGAN: I can see that because 70% of our customers are restaurants in San Francisco. Menu pricing is a serious problem. An example of a

change being made in San Francisco is that restaurants are going to blackboards. This is done primarily so they can change the prices accordingly. The restaurants want ocean-fresh seafood, and in order to do that they have got to maintain flexibility. A menu structure does not allow that. Within the next six to eight months there will be some legislation passed in California that will have a direct bearing on this. It will cause more movement toward flexible menu pricing than what we are used to.

HOFER: I traveled down here with Jim Barklow from Jake's and he was showing me the way they do it in their restaurant in Portland. They have a printed menu, but every day they do a full printed sheet of their fresh items for the day, which is very professional looking and to me the only difference is the West Coast fish. He doesn't have to change those prices very much, only a few cents, and on the East Coast the prices would vary quite a bit. The system wouldn't be any different; it's just that it's a lot easier to handle it from that point of view, but I don't think it's necessary. He even has the same problem. He either has it or doesn't have it. If he doesn't have it, I guess it's just the weather. Everybody loaded up and said, "The hell with it. It's too dark and it's too wet out there!"

STEINER: As restaurateur, most of our restaurant items in the industry range from processed items to frozen items. They are things that are bagged and easy to tear or easy to throw in a deep fryer or easy to put in a microwave. As a buyer, I look for something that is a processed seafood item because I know I can get it year round, and I also get a promise from the distributor that the price is not going to fluctuate that much. When we put together a pricing system for a menu, we look at fairly tight percentages. A good example would be if I wanted an actual food cost of 30% I would set up a nominal food cost of anywhere from 32-34% and price my menu according to that, so that I could take in small fluctuations in price and things like human error, as far as burning food or waste is concerned.

QUESTION: Have you ever worked up the cost and gone back to the distributor and said to him, "This is what I can pay for it," and had the distributor go back to the processor and try to work with them on the cost? It seems like when you are trying to move a new product into the food system it's usually at the processing end of it. He has to go bumping through the distributors trying to get to you. Many times a distributor looks at how much you've produced and says it is not enough to fool with, because they are already making money with the products they are selling. If you go to a smaller distributor, his access to you is going to be limited compared to distributors that are already doing business. It's a bucking effect. It would be a lot easier if it went the other way.

STEINER: Well, there is no question at this point that if the squid industry were to diversify as much as we would like to, as Mr. Court was inferring, that the financial gamble would be thrown on the processor in a large part. Sure, he would be developing a product line, but he is not so sure there is a market for it. As a restaurateur, and I have been in five different states including Idaho, California, and Washington, basically what I look for is what my waiters, my staff tells me. They say, "Hey, do we have any fresh salmon?" What happens is that I go to the distributor and ask if there is any fresh salmon around here. I could get a good price because when people walk in the door they know we have fresh salmon and they are dining with three other people who are ordering a New York steak. That happens a lot, but it is really hard to form a market based on that because I don't have any people coming in and saying, "Do you have calamari?"

The restaurant business has changed drastically in the last 10 years. The reason is that big business has really hit on institutional food more than ever before in history. What has happened is that the institutional food buyer will go in and purchase a product he knows will be standardized in maybe 25-30 restaurants throughout the West Coast region. Those are the kind of people I would recommend to aggressively market because they are buying the volumes, and they are buying a processed product

because they are looking for something that is going to be around.

I think a good example is the clam industry. You walk into a lot of lounges and restaurants and find clam bits offered as appetizers. Chicken is the same way. In the last five years there has been a large amount of that happening. I can't see why calamari isn't there. As a protein item it is one of the best. It is just a matter of the chicken and egg. You have a product, now you can sell it, but if it's not there, how are you going to market it?

HOFER: I think the public is going to learn about squid through the restaurants. Over 50% of the seafood sold in the U.S. is sold through food service operations. I think it's going to be the restaurant that is going to teach the public. It makes sense too because the housewife is just now learning how to prepare fish. I think they always erred on the side of overcooking it because they didn't realize it was best eaten raw and if you are going to make a mistake it should be undercooked rather than overcooked. They never liked it because they didn't know how to prepare it. Restaurants love to prepare fish. There are only so many ways to prepare New York steak, but with fish the chef can really get with it. I think that is why we are really seeing seafood take off like it is.

QUESTION: Have you ever gone to the processor and said, "If you put it in this form I will pay you so much money for it"?

HOFER: Yes, they want to change it from a dinner item to a lunch item so they want to cut down on the portion. It doesn't seem to be available, so we go back to the processor and ask them if they could do that. He always wants to know how many thousand pounds the guy wants.

QUESTION: We are processors on the Oregon Coast and we never hear from the restaurants. The distributors don't seem to be too helpful. We need to know what the restaurants need.

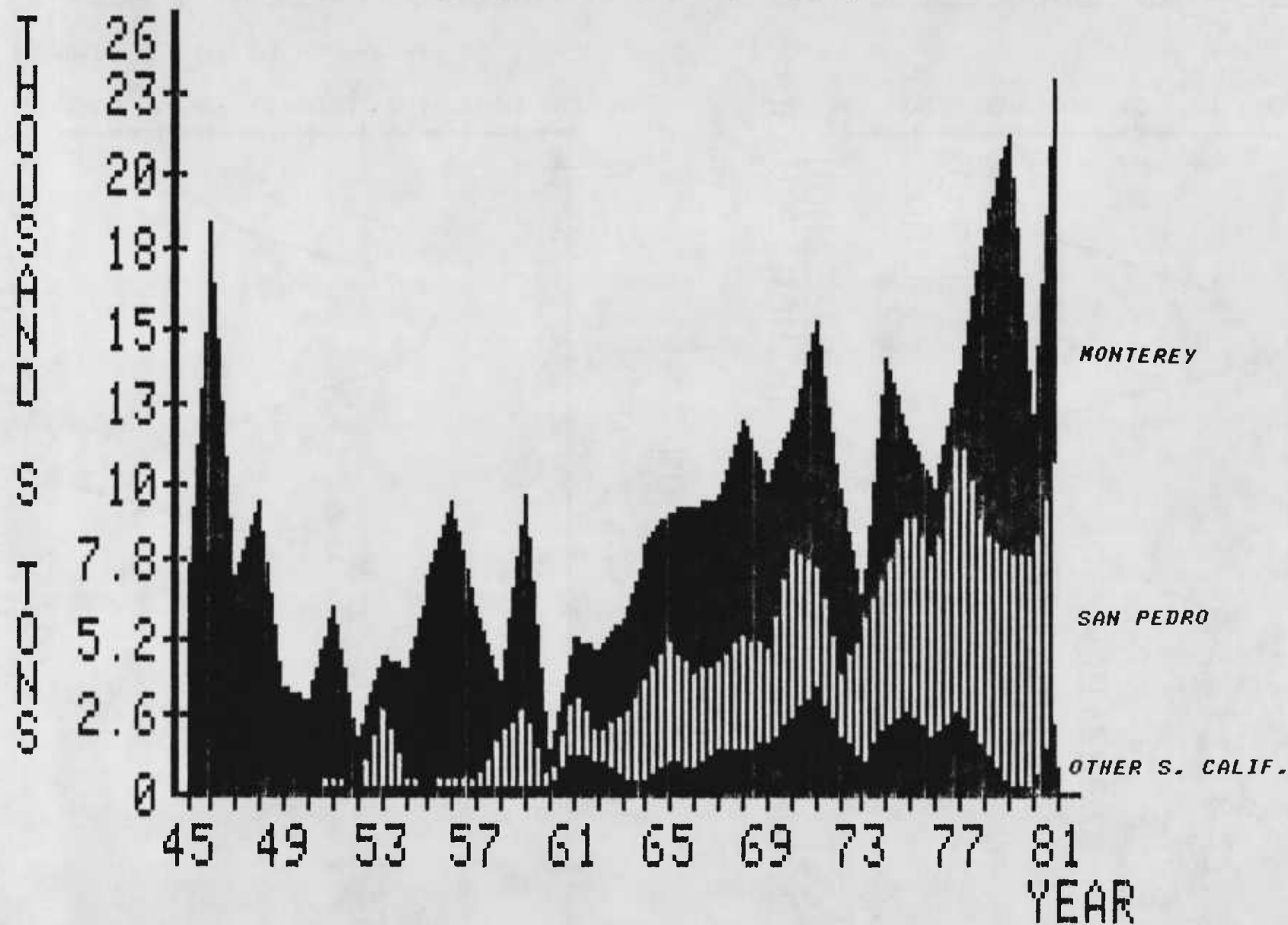
HOFER: The associations are doing more and more. I have Terry Elwell stopping in my office as a sort of middleman between the processor and the restaurant. When he comes to Denver he stops at restaurants and stops at my office and finds out what he can do for us. West Coast Fisheries Development Foundation provides me with recipes and posters for retail stores, and my opinion is that they are getting a lot better at it. It used to be sort of pie-in-the-sky esoteric stuff and now they get right down and talk to my customers and to me and they literally try to put an order together for us. I think it makes it work better. I am a lot more happy to see them because I feel like I am getting some real help.

FLANAGAN: I would like to say that in dealing with restaurants in San Francisco there are a lot of people that do not like to change. They want to do the same thing they have been doing for the last 50 years. The distributor really has to be committed to get people to change their outlook on things. It is so much easier to go along their merry way and do the things that they've been doing instead of trying to pioneer a new product.

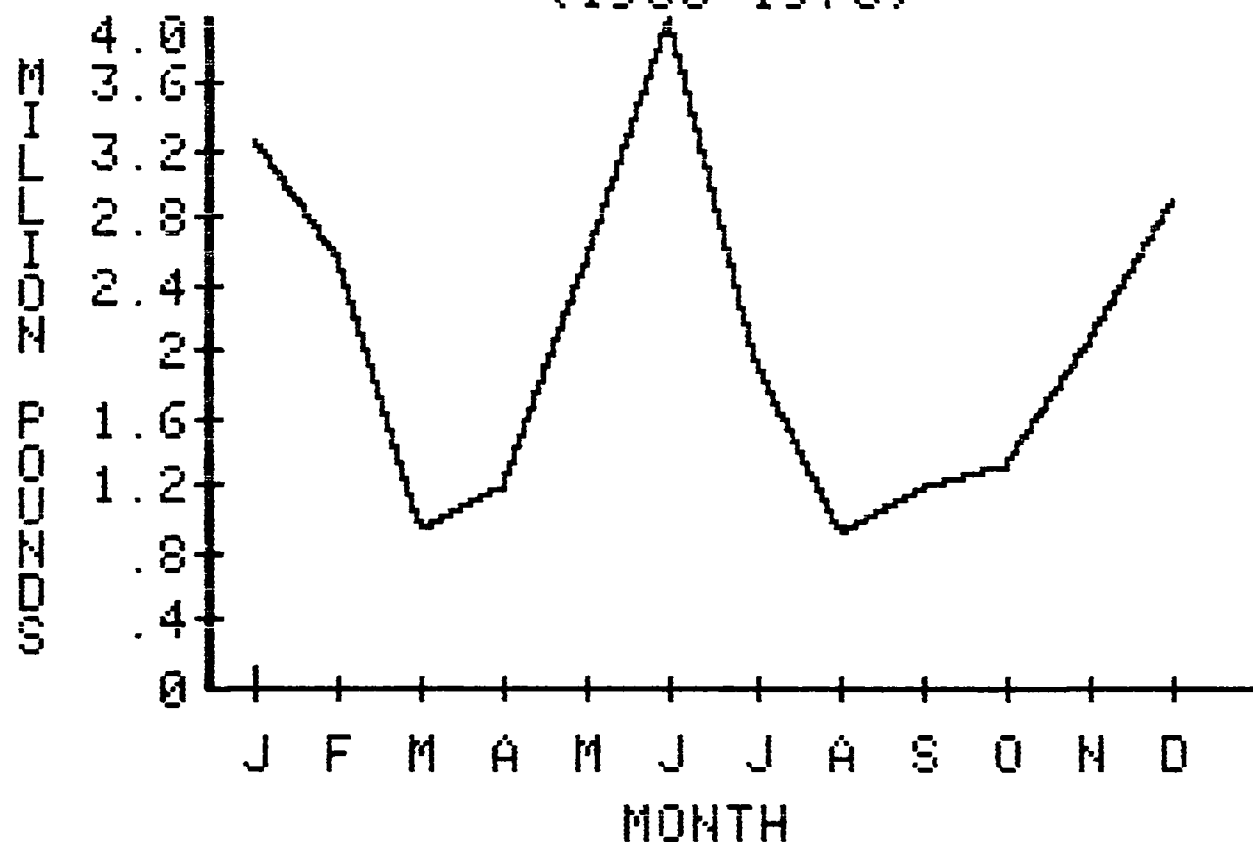
Comment from the audience: In all my years in the fishing industry, this is the first time I have ever seen fishermen sit here and talk directly to the processor, middleman, and the restaurant man at one table in one room. I want to thank you gentlemen for being here.

APPENDIX:
Selected Squid Landing Statistics

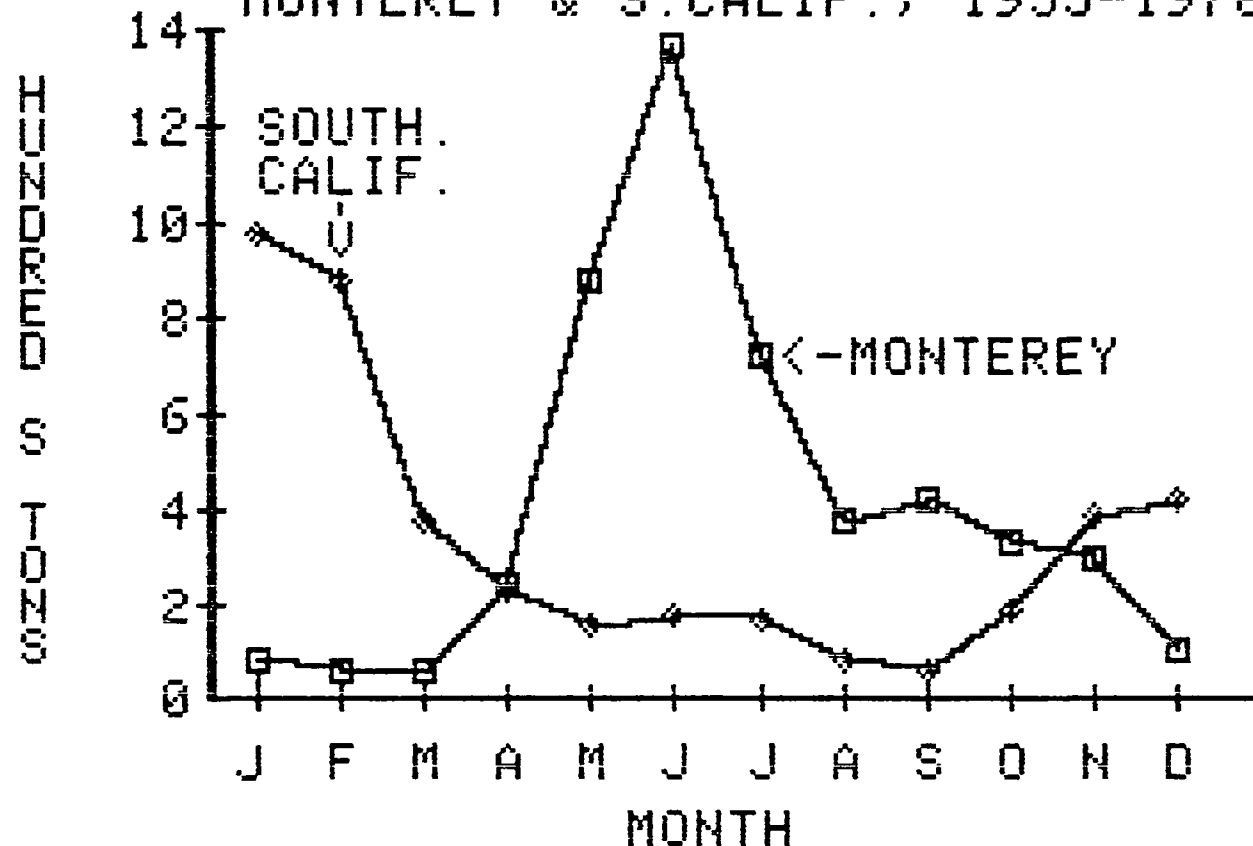
CALIFORNIA ANNUAL SQUID LANDINGS BY REGION, 1945-1981

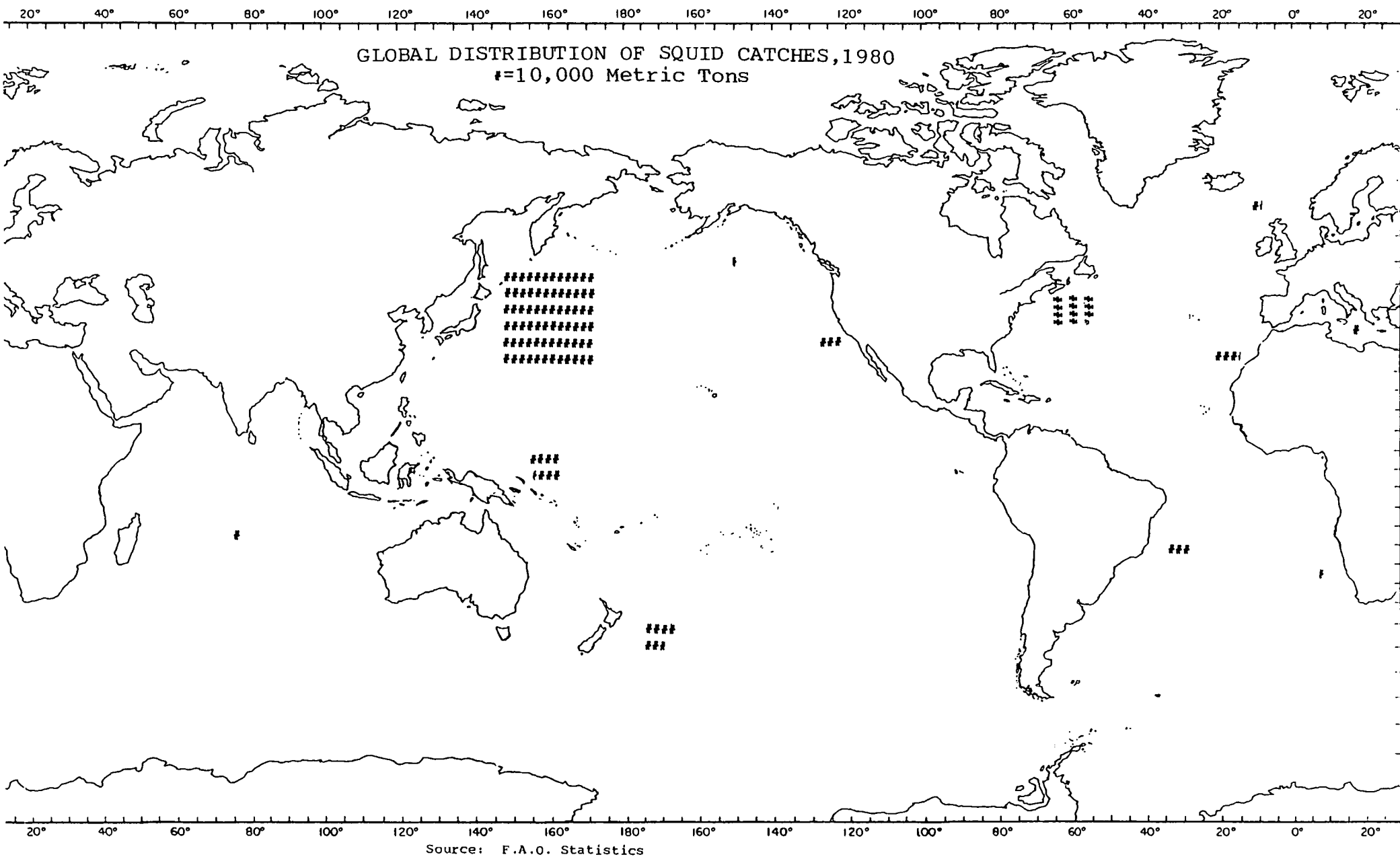


AVERAGE MONTHLY DISTRIBUTION OF CALIFORNIA SQUID LANDINGS (1968-1978)



AVERAGE MONTHLY LANDINGS OF SQUID AT MONTEREY & S.CALIF., 1955-1978





CALIFORNIA SQUID LANDINGS AND AVERAGE PRICES, BY PORT, 1945-1981.

YEAR	MONTEREY		SANTA BARBARA		LOS ANGELES		SAN DIEGO		TOTAL	
	SHORT TONS	\$/TON	SHORT TONS	\$/TON	SHORT TONS	\$/TON	SHORT TONS	\$/TON	SHORT TONS	AVER. \$/TON
1945	7587	55.88	-	-	26	95.34	-	-	7613	56.02
1946	19001	63.89	0.07	75.19	11	62.00	-	-	19012	63.89
1947	7222	53.68	-	-	47	64.19	-	-	7269	53.79
1948	9558	53.80	1.50	79.89	69	56.00	-	-	9629	53.82
1949	3408	53.40	0.40	146.28	21	100.58	-	-	3429	53.70
1950	2996	52.40	0.30	118.81	1	92.98	-	-	2997	52.42
1951	5816	54.80	0.20	200.00	375	46.20	0.40	160.34	6192	54.29
1952	1773	93.79	-	-	63	71.40	-	-	1836	93.04
1953	1763	52.41	5.00	39.87	2683	41.80	7.60	105.01	4459	46.10
1954	3738	43.19	0.10	50.00	314	47.20	24.90	30.60	4077	43.46
1955	7059	32.60	7.00	45.00	69	54.42	-	-	7135	32.83
1956	9297	34.20	6.30	50.06	439	43.20	-	-	9742	34.62
1957	5978	33.00	4.00	30.00	242	42.40	-	-	6224	33.36
1958	1951	44.87	0.10	38.10	1772	32.60	5.60	59.98	3729	39.13
1959	7126	36.80	9.50	40.00	2679	29.20	12.30	72.20	9827	34.78
1960	1118	57.60	-	-	163	46.80	-	-	1281	56.23
1961	1843	70.01	1286	26.60	2013	33.80	0.90	79.91	5143	44.98
1962	2826	42.81	977	22.20	878	28.20	2.60	80.00	4684	35.79
1963	3377	52.40	337	23.80	2066	26.80	0.20	58.06	5780	41.58
1964	4551	53.38	235	19.22	3429	24.78	2.00	49.60	8217	40.47
1965	4433	45.66	993	18.67	3884	28.33	-	-	9310	33.05
1966	5604	60.97	653	26.30	3257	28.17	0.20	160.00	9514	47.36
1967	5617	53.43	1296	29.85	2888	34.26	0.10	204.08	9801	44.67
1968	7289	54.68	1330	28.05	3847	30.52	0.30	59.41	12466	44.38
1969	5780	67.15	1518	28.40	3091	40.18	0.01	421.05	10389	53.46
1970	4314	80.33	2439	28.93	5543	45.03	0.10	203.05	12296	54.22
1971	8323	61.60	3342	29.00	4093	36.80	1.00	205.66	15759	48.26
1972	6129	63.50	1822	28.88	2128	43.21	0.30	224.45	10079	52.96
1973	620	106.33	744	41.79	4612	71.48	53.60	145.27	6030	72.06
1974	7248	120.00	1918	58.80	5100	84.79	187.40	119.20	14453	99.44
1975	2495	140.16	2560	42.77	6749	54.14	8.60	224.04	11813	69.97
1976	2511	137.68	1694	43.75	5922	54.55	26.00	144.01	10153	73.53
1977	2235	206.90	2683	71.50	9194	89.69	10.55	183.64	14122	104.86
1978	10328	212.29	1292	75.79	7295	86.82	0.20	274.31	18915	154.58
1979	14173	242.35	165	96.50	7677	98.76	0.72	477.78	22015	191.20
1980	4811	303.82	--	--	7790	100.05	--	--	12601	177.84
1981	14132	277.36	2454	107.68	9123	105.11	4.78	377.15	25715	200.07

SOURCE: CALIFORNIA DEPARTMENT OF FISH AND GAME, FISH BULLETIN, CALIFORNIA MARINE FISH LANDINGS, VARIOUS ISSUES.

WORLD CATCH OF SQUID* BY HARVESTING NATION, 1952 - 1980
(1000 METRIC TONS)

YEAR	WORLD TOTAL	JAPAN	KOREA (REP)	SPAIN	ITALY	PHILIP- PINES	GREECE	UNITED STATES	THAILAND	ARGENTINA	NEW ZEALAND	MEXICO	CANADA
1952	690.10	656.54	24.04	4.54	NA	NA	NA	2.63	NA	NA	NA	NA	NA
1953	506.21	467.93	18.33	3.54	NA	NA	NA	6.62	NA	NA	NA	NA	NA
1954	464.03	443.35	8.71	2.54	NA	NA	NA	5.35	NA	NA	NA	NA	NA
1955	476.64	343.01	18.23	4.81	NA	NA	NA	8.35	NA	NA	NA	NA	NA
1956	393.54	346.00	21.77	4.08	NA	NA	NA	10.25	NA	NA	NA	NA	NA
1957	479.81	403.70	39.46	5.62	NA	NA	NA	8.35	NA	NA	NA	NA	NA
1958	462.03	393.09	33.48	9.16	3.99	NA	NA	5.35	NA	NA	NA	NA	NA
1959	605.01	519.10	46.81	6.53	3.27	NA	NA	10.61	NA	NA	NA	NA	NA
1960	605.01	522.82	42.09	9.43	3.27	NA	NA	2.81	NA	NA	NA	NA	NA
1961	567.99	437.09	83.01	12.88	4.81	NA	NA	6.17	NA	NA	NA	NA	NA
1962	698.00	588.77	56.88	15.24	4.17	NA	NA	6.44	NA	NA	NA	NA	NA
1963	820.01	652.09	116.94	14.52	4.45	NA	NA	7.44	NA	NA	NA	NA	NA
1964	444.98	288.94	86.64	16.78	5.44	7.62	NA	8.53	NA	NA	NA	NA	NA
1965	609.45	450.15	78.38	17.96	7.08	9.98	NA	9.62	NA	NA	NA	NA	NA
1966	596.30	442.71	75.48	15.60	7.71	11.43	NA	9.89	NA	NA	NA	NA	NA
1967	688.38	488.52	41.73	18.14	10.89	9.89	NA	9.43	NA	NA	NA	NA	NA
1968	920.80	727.84	84.73	14.52	6.89	17.87	NA	11.52	NA	NA	NA	NA	NA
1969	710.88	543.77	59.87	13.79	6.89	13.06	NA	9.43	NA	NA	NA	NA	NA
1970	698.45	487.62	72.12	15.60	7.62	12.52	0.91	12.25	NA	NA	NA	NA	NA
1971	646.92	446.79	40.37	15.60	7.08	12.70	1.18	17.06	NA	NA	NA	NA	NA
1972	799.42	563.73	57.24	26.13	7.08	7.53	1.00	10.52	NA	NA	NA	NA	NA
1973	716.23	451.51	56.61	36.20	9.53	15.51	1.09	6.35	NA	NA	NA	NA	NA
1974	707.25	439.26	51.80	48.44	11.79	21.41	0.82	13.06	42.00	5.1	0.10	0.18	0.11
1975	796.79	507.94	58.88	43.36	11.70	30.66	0.73	9.53	37.78	4.24	0.07	0.45	3.29
1976	826.82	466.12	73.03	29.48	13.25	23.68	1.18	13.06	36.16	7.62	0.09	0.97	10.93
1977	845.14	459.58	38.10	23.59	18.51	25.04	0.73	11.25	52.26	2.24	0.56	0.77	30.51
1978	939.58	494.33	41.82	43.27	11.97	26.04	0.91	18.69	52.07	59.24	1.78	6.75	35.96
1979	1113.58	504.49	47.99	30.94	16.06	25.49	0.82	22.04	41.75	87.22	7.41	18.40	89.59
1980	1119.39	669.69	69.85	40.37	20.59	27.03	0.82	15.97	32.87	9.3	0.28	20.40	30.40

*LOLIGO PEALEI, LOLIGO SPP., ILLEX ILLECEBROSUS, ILLEX COINDETII, TODARODES SAGITTATUS, TODARODES PACIFICUS, NOTOTODARUS SLOANI, LOLIGINIDAE, OMMASTREPHIDAE

SOURCE: FAO YEARBOOK OF FISHERY STATISTICS, CATCHES AND LANDINGS SERIES, VARIOUS ISSUES.

SQUID IMPORTS BY SELECTED COUNTRIES

IMPORTING COUNTRY	1977 ----		1978 ----		1979 ----		1980 ----		1981 ----	
	QUANTITY (M. TONS)	VALUE \$U.S.	QUANTITY (M. TONS)	VALUE \$U.S.	QUANTITY (M. TONS)	VALUE \$U.S.	QUANTITY (M. TONS)	VALUE \$U.S.	QUANTITY (M. TONS)	VALUE \$U.S.
JAPAN										
FROZEN SQUID/CUTTLEFISH	74,732	139,960,333	118,142	204,760,226	155,868	349,363,682	94,375	235,267,897	68,776	196,718,182
SALTED/DRIED SQUID/CUTTLEFISH	1,347	9,041,526	1,594	13,763,817	1,602	17,225,733	1,868	18,596,181	N/A	N/A
SPAIN										
FROZEN SQUID	N/A	N/A	28,600	N/A	26,716	46,273,838	34,227	56,893,793	25,973	39,984,834
ITALY										
FROZEN SQUID	N/A	N/A	N/A	N/A	30,283	45,194,368	22,684	40,533,567	22,365	45,071,253
W. GERMANY										
FROZEN SQUID	N/A	N/A	N/A	N/A	1,320	2,863,388	1,733	3,846,154	3,995	5,075,221
FRANCE										
FROZEN SQUID	N/A	N/A	N/A	N/A	6,805	13,559,003	5,296	9,680,549	5,743	9,885,925
PORTUGAL										
SQUID/CUTTLEFISH	N/A	N/A	N/A	N/A	1,393	904,947	1,732	1,821,814	2,069	2,760,357

CALIFORNIA SQUID LANDINGS BY PORT AND GEAR TYPE, 1970 - 1975
(SHORT TONS)

YEAR/PORT	DIP NET	%	PURSE SEINE OR		LAMPARA NET	%	OTHER*	%	TOTAL CATCH
			RING NET	%					
1975									
SAN PEDRO	4312	62	1738	25	336	5	515	8	6901
MONTEREY	2	.1	-	-	2419	99.9	-	-	2421
PORT HUENEME	811	34	235	10	-	-	1344	56	2390
SAN DIEGO	2	29	-	-	-	-	5	71	7
TOTAL	5127	44	1973	17	2755	23	1864	16	11719
1974									
SAN PEDRO	3397	58	1464	25	981	17	14	0	5856
MONTEREY	-	-	-	-	6359	100	-	-	6359
PORT HUENEME	1644	82	115	6	-	-	246	12	2005
SAN DIEGO	84	71	26	22	-	-	8	7	118
TOTAL	5125	36	1605	11	7340	51	268	2	14338
1973									
SAN PEDRO	2294	64	1239	35	30	1	5	0	3568
MONTEREY	-	-	-	-	618	100	-	-	618
PORT HUENEME	1553	87	9	1	171	10	44	2	1777
SAN DIEGO	15	83	-	-	-	-	3	17	18
TOTAL	3862	64	1248	21	819	14	52	1	5981
1972									
SAN PEDRO	1018	45	1092	49	125	6	-	-	2235
MONTEREY	-	-	-	-	6114	100	-	-	6114
PORT HUENEME	678	40	1013	59	25	1	-	-	1716
SAN DIEGO	2	100	-	-	-	-	-	-	2
TOTAL	1698	17	2105	21	6264	62	-	-	10067
1971									
SAN PEDRO	2761	68	1203	29	134	3	-	-	4098
MONTEREY	-	-	-	-	8326	100	-	-	8326
PORT HUENEME	2361	89	276	10	18	1	-	-	2655
SAN DIEGO	1	100	-	-	-	-	-	-	1
TOTAL	5123	34	1479	10	8478	56	-	-	15080
1970									
SAN PEDRO	3424	65	1499	28	368	7	-	-	5291
MONTEREY	-	-	-	-	4031	100	-	-	4031
PORT HUENEME	2751	93	193	6	29	1	-	-	2973
SAN DIEGO	-	-	-	-	-	-	-	-	-
TOTAL	6175	50	1692	14	4428	36	-	-	12295

*INCLUDES ENCIRCLING NETS, NETS, GILL NETS, OTTER TRAWL NETS AND NON-DEFINED GEAR.

NOTE: FIGURES DO NOT CORRESPOND EXACTLY WITH OTHER SOURCES DUE TO DIFFERENCES
----- IN DATA AGGREGATIONS.

SOURCE: CALIFORNIA DEPT. OF FISH AND GAME LANDINGS RECORDS.

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