Is There a Squid in Your Future?

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INTRODUCTION

Since 1970, world production of cephalopods, principally squid, has exceeded 1 million tons a year. In certain developing countries, squid rank next to shrimp as the most important fishery export item. Prices as imports have undergone elevation during recent years as a result of increased markets and lack of substantial gains in catches (Hotta 1976). The present catch of 1 million tons can be expanded at least seven times or more only by exploiting those cephalopods present over the continental shelves of the world oceans. Speculation on the potential of increases possible by exploitation of oceanic resources suggest total exploitation rates in excess of 100 million tons per year (Anonymous 1975).

At the present time, the Japanese fishery for squid, much of which takes place in home waters, accounts for over half the world catch. Due in particular to Japanese research and fishery development activities, the potentials for expanded world squid fisheries are understood much better than was the case only a few years back (Hamabe et al. 1976).

Fishing methods vary greatly throughout the world. Of primary importance is the attraction of squid to lights with subsequent capture by jigging, seining or pumping. Other significant harvest techniques include the use of trawls and traps. It is generally recognized that a potential for well directed investigations into advanced harvesting technology offers a fertile field to the researcher.

In the United States, the fishery off California has been well established for over 20 years. The catches have varied considerably during recent years with some relationship to markets and resource availability. A large portion of the California catch is now frozen or canned for export into various worldwide markets. Some of the product is consumed domestically both as food and as bait. In the east, a great deal of interest has been demonstrated in New England and the Middle Atlantic area. Potentials are also recognized for the Gulf of Mexico and adjacent regions.

Fishery Off New England

During the period from early 1964 to 1974, the reported catch of squid off the northeastern coast of the United States (from Georges Bank to Cape Hatteras) has risen from about 1,000 tons a year to catches averaging over 50,000 tons for the years 1972-1976. Much of the increase indicated has resulted from fishing activities by fishermen from Japan, Spain, U.S.S.R., Poland and Italy (see Fig. 1). With the advent of the Fisheries Conservation and Management Act of 1976, increased interest by European and Asiatic buyers has driven up domestic exvessel prices and consequently attracted landings by regional fishermen. For the first 6 months of 1976, landings of squid at Rhode Island and Massachusetts ports had a value approaching a tenfold increase over the identical period a year previously. Reports of activity for the second 6-month period suggest equally impressive landings.

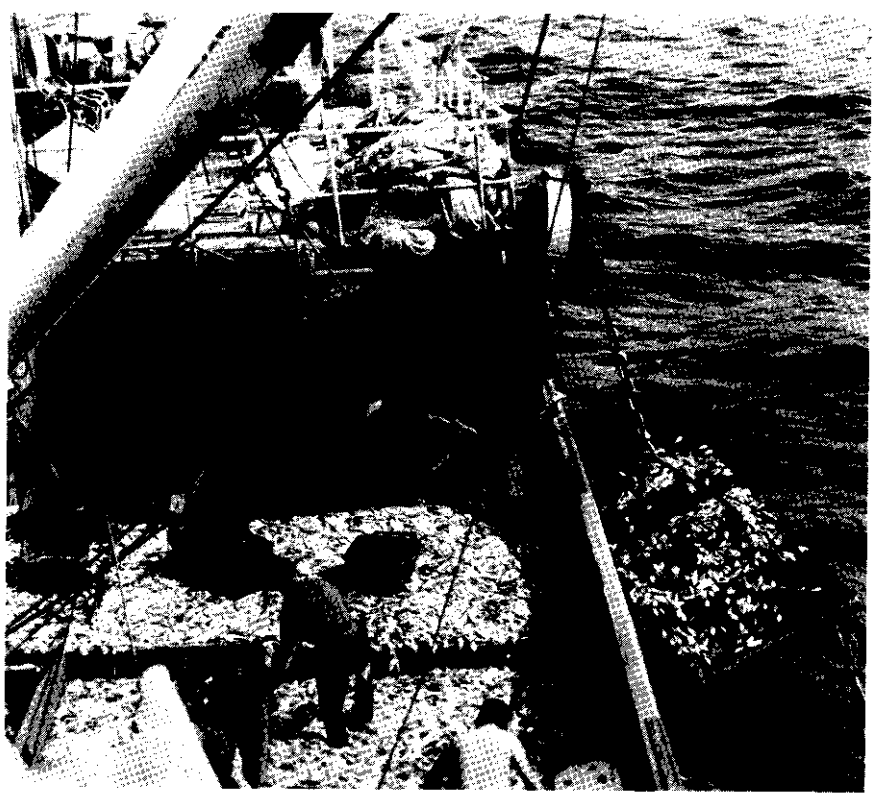

Fig. 1. A Spanish vessel catching squid off Cape Hatteras, North Carolina. In this instance, large quantities of "butterfish" are also taken as by-catch.

There are two species of squids in the western North Atlantic which are presently the object of significant commercial interest. The long-finned squid *Loligo pealei* is the more attractive of the two species in European and limited domestic markets. The short-finned squid *Illex illecebrosus* recently drew the attention of Spanish, Japanese and other European fishermen. The primary method of harvest has been by trawl although fixed traps on the shore occasionally account for significant catches. The Japanese have conducted research in Atlantic waters employing light attraction and fishing with automated jigging devices. Both species can be harvested throughout most of the year when the fishermen elect to pursue their seasonal migrations. The long-finned variety has an offshore distribution during the cool months of the year (November-May) and is distributed inshore during the warm months (see Fig. 2). The short-finned variety has a similar but less predictable distribution pattern (Rathjen 1973).

FISHERIES DEVELOPMENT ACTIVITIES

During 1973, a fisheries development program was started in New England. The participants in the program included an industry advisory group and researchers from the National Marine Fisheries Service, Sea Grant, State Marine Fisheries specialists and others. The approach followed was responsive to factors of availability of resources, harvesting and processing capability and markets. Squid was one of the several areas of concentration. The others included "offshore crabs" and trawl discards.

Harvesting

When the long and short-finned varieties are considered, there is a harvestable resource of about 75,000 tons off northeastern United States according to estimates by ICNAF scientists. Off the northeast, long-finned squid can be harvested by high opening bottom trawl along the edge of the Continental Shelf (60-100 fm) during winter. Large vessels with up to 3,000 hp. average catches of 4-15 tons per fishing day.

The **Valkyrie**, a 99-foot New Bedford trawler with 700 hp., was chartered by the New England Fisheries Development Program during early 1974 and, at that time, accomplished catches ranging from about 200-750 lb, per 1 hour of fishing. New innovations in trawl gear, specifically two boat trawls, both on and off the bottom, suggest that vessels with moderate horsepower working in pairs can effectively compete with large vessels with 2,000-3,500 hp.

Trawling is feasible for long-finned squid from May through October when the squid are inshore. Small vessels with high opening trawls can frequently catch more than 6 tons per day on the inshore grounds.

Although the numbers of traps being operated along the New England coast have undergone reduction over the past 2 decades, some still exist,

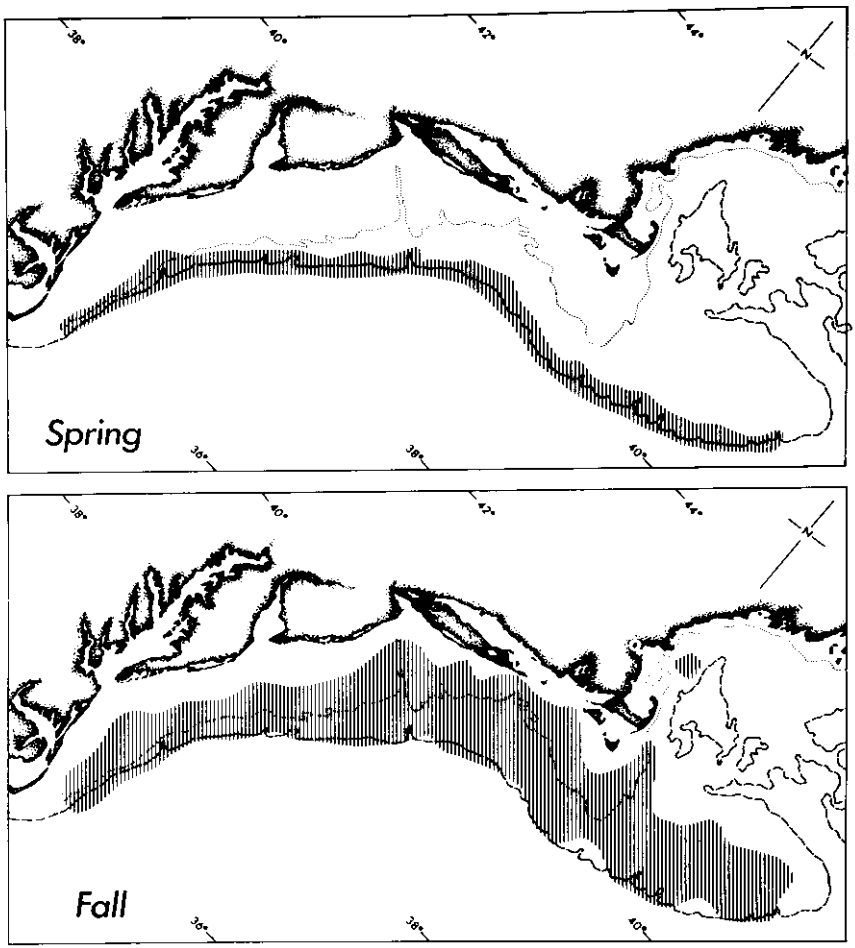

Fig. 2. Pattern of distribution of the long-finned squid (*Loligo pealei*) over the Continental Shelf off northeastern United States.

particularly in Rhode Island and Massachusetts. The traps sometimes take substantial quantities of squid during May. This is large-size squid in prime condition and it commands a premium price.

Research on new innovative approaches to squid harvesting has been underway for over 2 years. One of the most promising approaches involves the attraction of squid to a light source (Fig. 3). At the present time, it is considered possible that the squid once aggregated under the light may be harvested by seine. Some consideration is also being given to using light attraction as an adjunct to trap fishing.

During the past 4 years, Japanese research vessels have operated off New England studying the use of light attraction and "jigging" for short-finned squid.

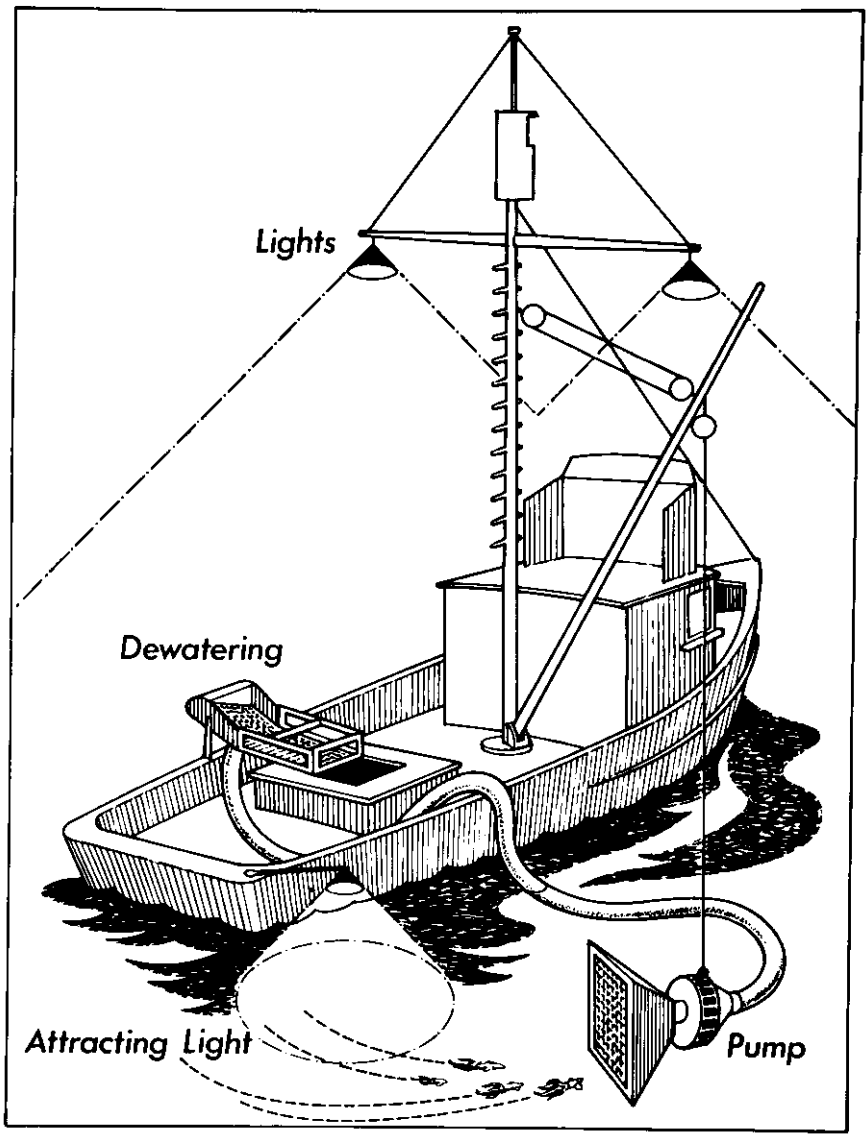

Fig. 3. A schematic depiction of a light attraction and harvest (with pump) system effectively used off southern California (Kato and Hardwick 1976).

HANDLING AND PROCESSING

Squid are comparatively easy to handle if given reasonable care. Like any fishery product, indifferent handling will result in an inferior product. Conventional icing is an acceptable method for at least 4 days. Factors to be

considered are: (1) Never allow squid to lie on top of one another (such as in a basket) for any length of time; (2) If iced in the hold, the ice to squid ratio should be varied by season (Miwa et al. 1976).

The use of a sea-water–ice combination for carrying squid is desirable. This system has been used traditionally by trap fishermen. Preliminary research on this aspect is being conducted at Gloucester.

The traditional use of squid on the East Coast of the U.S. (by domestic markets) has been primarily fresh round squid with tube lengths of 4 to 5 inches or longer. The potential for entering into foreign markets and expanding domestic use will be dependent on some processing and preparation for market.

Due basically to low volume markets, no automated sorting is now practiced in the New England fishery. A "rough cull" is performed aboard the vessel which eliminates those squid under 4 inches (ca 100mm). A weight sorting device developed in Europe has been demonstrated to New England squid processors. The unit will sort up to 5,000 pieces per hour with weight tolerances of $\pm$ 5 grams.

A variety of skinning techniques are under review by scientists at the Gloucester Laboratory. These include a review of feasible approaches using conventional and unconventional methods. In addition to skinning the squid, mechanical processing being considered includes eviscerating and cutting. A modification of the MIT roller method (Berk and Pariser 1974) has been observed recently in Europe and it is expected that this technique will be refined for possible application here during 1977. This technique skins, eviscerates and cuts squid with cleaned mantles, fins and tentacles. In California, some hand processing takes place. This includes evisceration, skinning, and trimming. One company tried a Japanese mechanical processor, but found that squid could be cleaned faster manually. A number of different frozen packs have been offered including a 1-lb package of cleaned mantles with tentacles, several bulk packs varying in size up to a 25-lb box of frozen product. Canned squid is also available from California.

MARKETING OPPORTUNITIES

At the present time, the domestic markets for squid are limited primarily to sales of fresh and frozen squid to ethnic groups in certain metropolitan areas of the U.S. There is some gourmet interest and limited sales of fancy canned product. Recent promotional efforts on both the east and west coasts have created some favorable reaction. Possible opportunities may exist for specialty convenience type packs to be offered to the mass consumer or possibly the "fast food" market area. In cooperation with the New England program, some product positioning concepts are under development through contract with the Sloan School of Management of MIT. Other possibilities in the domestic use of squid may include its use in seafood chowders or as a partial replacement for certain other shellfish, i.e., clams in chowders, soups or other preparations.

The most attractive immediate markets appear to be in Europe and Japan. Supplies caught be Japanese nationals for consumption in home markets have not kept pace with consumption. Imports of cephalopod products into Japan tripled between 1969 and 1974. This trend appears to be well established. With the increasing moves in North America and elsewhere to expand jurisdiction over fishing areas, competition for resources including squid is expected to accelerate even more.

In the northeast, Noetzel (1974) and Holmsen (1973) have reported on economics of squid fishing prospects by U.S. fishermen. The average landing price (for long-finned squid) to the fisherman has jumped from less than $0.07/pound in 1968 to about $0.25 at present. Prices to the fisherman fluctuate widely in response to supplies and fresh market demands. It is only recently that increased interest by foreign buyers set an acceptable lower range to the dockside price. At this time, interest from foreign buyers is increasing.

SQUID FISHERIES POTENTIAL OF THE GULF OF MEXICO [1]

Voss (1960 and 1971; Voss et al. 1973) has summarized the existing squid and octopus fisheries in the Caribbean and their potential for exploitation. In general his findings are that the potential for a squid fishery is difficult to determine, but that large numbers of squid are present and that various fishing methods must be tested thoroughly before an assessment can be made. To date, most squid are caught incidentally in shrimp trawls, and on a very small scale by jigging and night lighting.

Four species of squids in the Gulf of Mexico are found commonly enough to be considered having fisheries potential: *Ommastrephes pteropus, Loligo pealei, Loligo (Dorytheuthis) plei* and *Lolliguncula brevis.* We have encountered all four species in the northwestern Gulf during the past year and our observations on their general distribution and capture methods follow.

Distribution and Abundance

Ommastrephes pteropus (orangeback squid)

During two cruises aboard the R/V **James A. Gilliss** in the western Gulf, from the Yucatan Peninsula all the way to Galveston, we have consistently attracted this species to night lights in deep water beyond the Continental Shelf. Our observations concur with Voss (1971) that this animal occurs in large quantities in open ocean at the surface at night (Fig. 4).

Loligo pealei (long-finned squid)

In the northwestern Gulf during the summer of 1976, we have trawled this species in depths of 14 to 50 fm with the animal most common beyond 30 fm. It is commonly caught in the same trawls with *Loligo plei.*

[1]This section prepared by Roger T. Hanlon and Raymond F. Hixon as a result of studies underway at the Marine Biomedical Institute, University of Texas Medical Branch, Galveston, Texas. This project was supported in part by Grant No. RR-01024-01 from the Division of Research Resources, National Institute of Health.

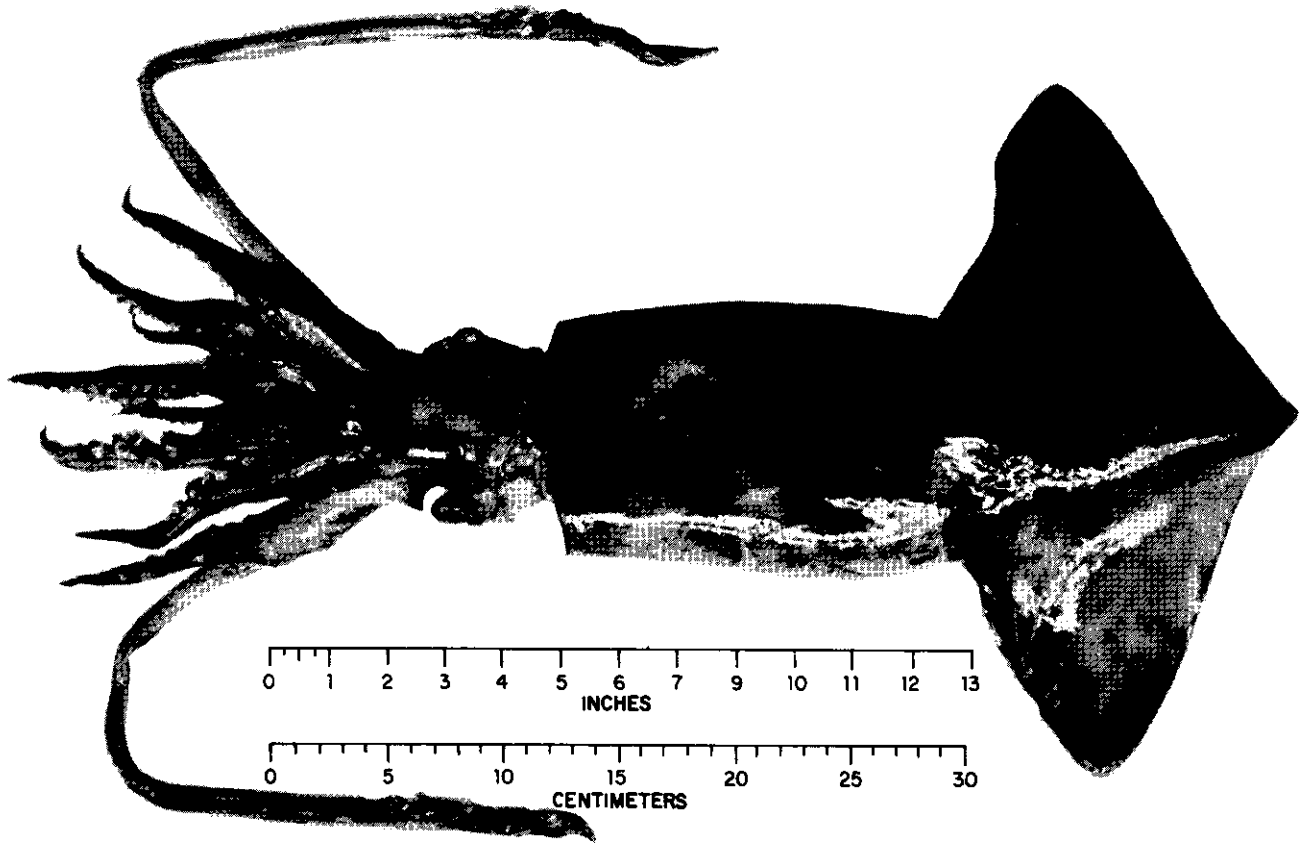

Fig. 4. "Orangeback" squid, one of the most common species in the Gulf of Mexico. Frequently found in offshore waters and attracted to light.

Loligo (Dorytheuthis) plei (arrow squid)

In the northwestern Gulf during the summer of 1976, we have captured this species by trawl and night lighting in depths of 9 to 33 fm, but most commonly between 10 and 30 fm. This species is quite abundant and at times hundreds can be attracted to night lights. Some 30-minute trawls yield up to 140 animals.

Lolliguncula brevis (brief squid)

This species is commonly trawled in bays and nearshore up to 10 fm, usually in salinities below 30 ppt. It is very abundant and sold as bait along most of the Gulf coast.

Capture Methods

Bottom Trawling

Most squid caught in the Gulf are taken by this method. Shrimpers commonly catch *Loligo pealei, Loligo plei* and *Lolliguncula brevis* but usually discard them as trash. Most of the shrimping done in this area is during the night when the squid are generally up in the water column. Their catches would be higher if they trawled during the day when the animals are demersal.

At the Marine Biomedical Institute we use a modified semi-balloon 30-foot otter trawl as well as a standard 10-foot try net for squid capture during the day. During the past year we have made 120 stations with the 10-foot net, and since June 1976 we have made 57 stations using the 30-foot net. Nearly every trawl contained squid and it was often the most common invertebrate of the catch, and sometimes the dominant catch of the entire trawl. In 30 minutes of trawling we sometimes caught as many as 140 squid in the large net, though most were small. Exact data on these samples have not been analyzed, and thus exact numbers and weights of squids cannot be given. However, it is possible that shrimpers towing very large nets for long periods during the day in areas with the proper substrate for squid may catch commercial quantities.

In a cooperative effort with the Bureau of Land Management, Texas Outer Continental Shelf project at Port Aransas, Texas, we have obtained all the squid from their bottom trawling during 1975. They used a 35-foot otter trawl for 15-minute tows at 2 knots. They are trawling during the winter, spring and summer along four transects in the northwestern Gulf, with stations ranging in depth from 18 to 134 meters. In a total of 72 trawl samples they collected 1,847 *Loligo* and 1,603 *Lolliguncula.* In general *Loligo* was more abundant in the spring and summer and *Lolliguncula* more abundant in the winter, with both species common in the day trawls. Thirteen of the tows contained no squid, but 10 of those were at night.

Night Lighting

We have conducted 17 night lighting stations in depths from 9 to 30 fm since June 1976. The results are extremely variable. We have caught approximately 200 squid on one night with dipnets in 2 hours and on others we haven't seen anything. In general, we have been able to attract squid but we have not

determined the optimum light intensity for bringing them to the surface. Usually large numbers of squid are visible on the periphery of light or at depth beneath our nets, but only occasionally do they make forays, *en masse,* to the surface to feed. By using a rheostat we have slowly dimmed the lights to draw the squid closer, but with only mild success. With sonar we have seen what appear to be very large schools of squid within 50 m of the boat during night lighting. This suggests the possibility of using a purse seine or lampara net around the school once it is attracted to the light. We hope to test this idea during the summer of 1977. We have also used mercury vapor underwater lights with occasional success.

Scientists aboard the research vessels **Oregon** and **Pillsbury** report large schools of squid on the surface at night in the Gulf of Mexico, and fishermen on shrimp boats in the northern Gulf report seeing squid attracted to their afterdeck lights at night.

Jigging

The Japanese have perfected this technique for oceanic squids. We have caught several *Ommastrephes pteropus* with single jig lures with rod and reel during deep water night light stations off Mexico. We have not had the capability to fish a large number of jigs at once to stimulate mass feeding, but the animals attack fish readily and are abundant; thus, we believe that when the proper jig is found that this method could land large numbers of squid. On one occasion we baited a large flying fish, *Cypselurus,* and caught a large *O. pteropus,* 40 cm mantle length and weighing several kilograms.

Thus far over the shelf area we have jigged only during night lighting, and at three stations we have caught a few *Loligo (Dorytheuthis) plei.* It is a matter of finding the correct size and shape of the jig that *Loligo* will attack. We have tried seven types of jigs thus far and only one has caught *Loligo*—a small (7 cm) clear plastic jig shaped somewhat like a fish with a single row of barbless hooks. Many times we have seen squid rush at jigs, inspect them from only a few inches, but never grab them. We are building two hand-cranked jig machines to fish many jigs at once to stimulate feeding. On the nights that the squid took jigs we only caught the larger squid in the school. We have not yet attempted jigging for squid during the day while they are demersal, but this may be possible.

DISCUSSION

Preliminary work during 1976 has shown that there are many squid along the northwest coast of the Gulf, and that the best capture method is trawling during the day on the Continental Shelf. Although we are using a relatively small net for a short duration tow, we have at times caught enough squid to indicate that they are sufficiently numerous to support a small fishery. When we are able to correlate their distribution and abundance to physical parameters such as temperature, salinity and substrate, then long duration, high-speed tows with large trawls in likely areas may produce commercial quantities. In bays and near

shore, *Lolliguncula brevis* is caught in abundance by bait shrimpers who keep only a few for bait and discard the rest. This animal has a fine flavor and is a potential food item. *Loligo plei* is found in a broad band in depths of 9 to 33 fm, the areas most fished by shrimpers at night. By trawling during the day shrimpers could supplement their income. In Galveston, the California squid *Loligo opalescens* is sold as a food item in fish markets. *Loligo plei* and *Loligo pealei* are almost identical in size, shape and texture and there is no apparent reason why they could not be sold. *L. pealei* occurs in the deeper, outer shelf areas that are not well explored and it is worth looking at this area since this squid is known to occur in large numbers off the northeast coast of the United States.

Night lighting, squid jigging, and seining remain as potentially fruitful capture methods for squid, but a great deal more exploratory work must be done.

When resource availability is better determined in the Gulf of Mexico, then progress being made in the fisheries of California, the northeast, and worldwide can be assimilated into development plans. The squid fisheries are clearly one of the real opportunities of the future.

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