

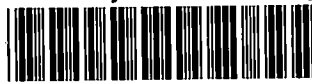


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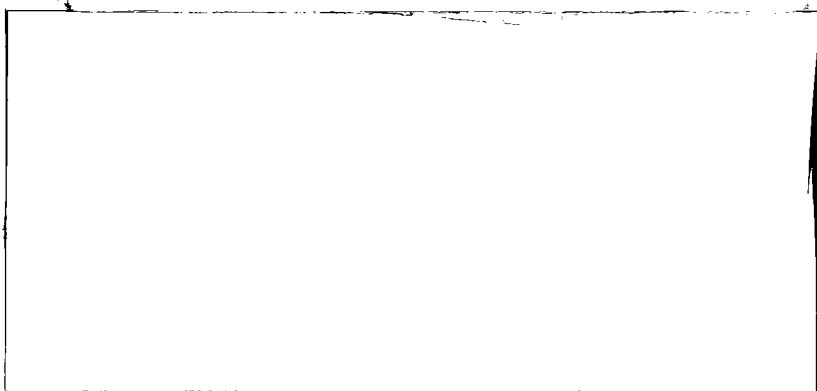
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Project Report

Fisheries Development Branch
Scotia-Fundy Region
Halifax, Nova Scotia



SQUID
THE CANADIAN HARVESTING EXPERIENCE
D. W. LEMON AND J. RYCROFT

PREPARED FOR
THE INTERNATIONAL SQUID SYMPOSIUM
BOSTON, MASS.
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CANADIAN HARVESTING EXPERIENCE

BY

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AND

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INTRODUCTION

The Canadian fishery for short-finned squid (Illex illecebrosus) has grown from a relatively insignificant fishery in the early seventies to one of economic importance with total landings in Canadian waters peaking in 1979 as well in excess of 100,000 tons. This growth in importance is best demonstrated by Figure 1 which shows that in 1972, landings of Illex accounted for about 1% of the total world landings of cephalopods (squid; cuttlefish and octopus) but by 1978 this figure had increased to 11.5%. Unfortunately, world figures for 1979 are not available; however, it is safe to suggest that had they been available, the curve would continue its upward slope. Total landings for Canadian waters are given in Table 1.

Although recent experience dictates that Canada is capable of producing tremendous quantities of squid as compared to other squid producing nations; landings are dependent on the market place which, up to this point, has been dominated by one nation; namely, Japan.

In the following discussion, an attempt is made to describe the Canadian squid fishery and outline four recent experiences with the introduction of new technologies to the industry in an effort to better utilize this valuable resource.

SOME BIOLOGICAL CONSIDERATIONS

Illex is found in the coastal waters of the north-western Atlantic from Newfoundland and Labrador to central Florida. This distribution constitutes a range of climatic conditions from arctic to virtually tropical. Major concentrations of adult squid in the summer and fall occur in Canadian waters.

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FIGURE 1

WORLD LANDINGS OF SQUID,
CUTTLEFISH OCTOPUSES
COMPARED WITH
ILLEX ILLECEBROSUS
(M.T.)

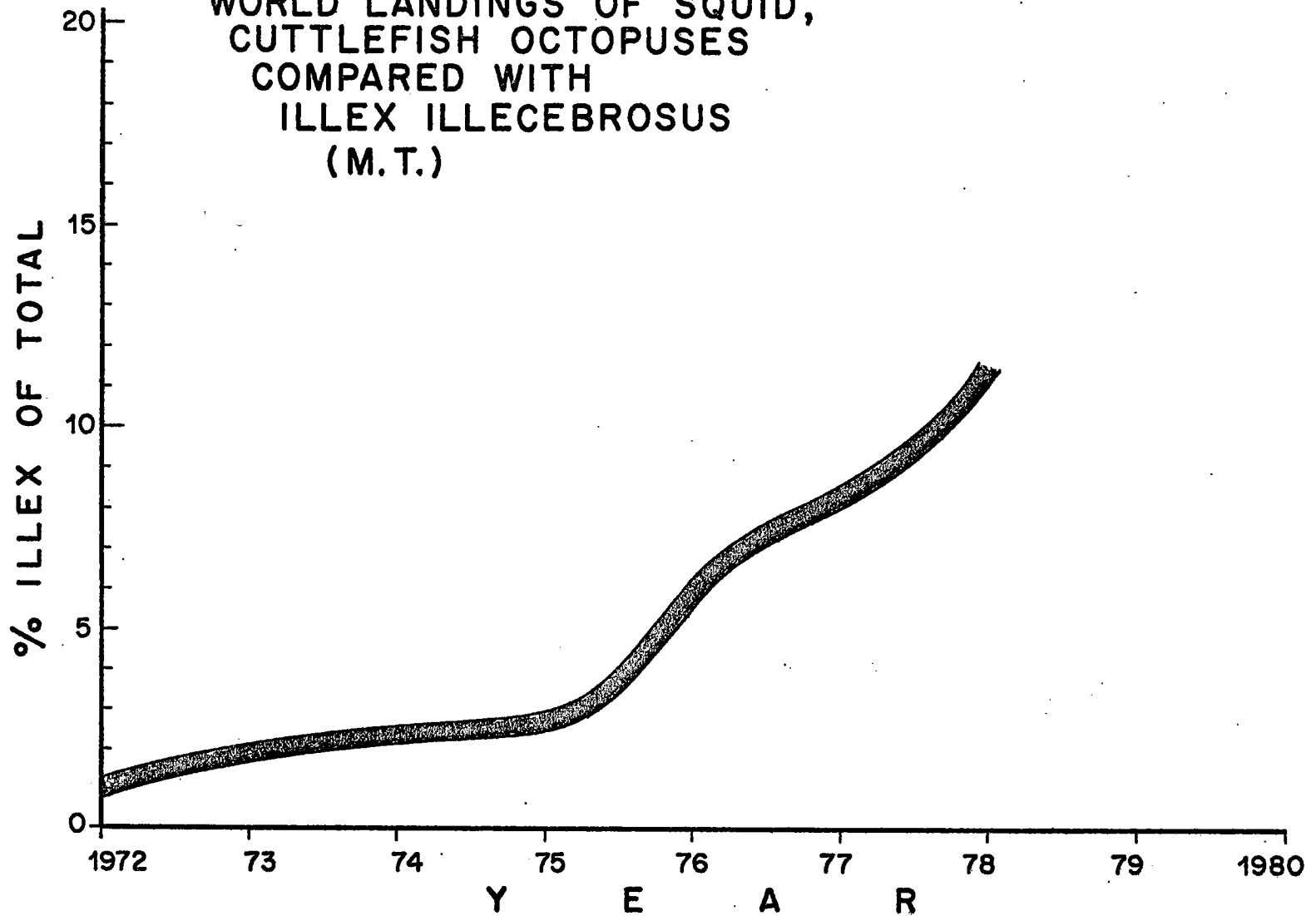


Table 1: Nominal Catches (Tons) by Sub-Area and TAC*
Applied (1972-80)

Year	Nominal catches (tons) by sub-area			Total SA 2-4	TAC* (tons)
	2	3	4		
1972	-	26	1,842	1,868	-
1973	2	620	9,255	9,877	-
1974	31	17	389	437	-
1975	-	3,751	13,993	17,744	25,000 ¹
1976	-	11,257	30,510	41,767	25,000 ¹
1977	6	32,748	50,726	83,480	25,000 ¹
1978	-	40,697	51,987	92,684	100,000
1979	-	81,320	71,279	153,099	120,000
1980	1	34,702	30,209	64,912	150,000

¹ Countries without specific allocations could each take up to 3,000 tons.

*TAC - Total Allowable Catch

The species has a relatively short life span, thought to be in the range of 12 to 18 months. It is at present impossible to set a Total Allowable Catch (TAC) that accurately reflects true abundance because the stock recruits are first seen in the year of potential harvest. The current TAC is based on an assessment of relative abundance indices for the years 1968-79 and set at a level (150,000 tons for 1981) which might seriously risk excessive exploitation. However, it may be possible in the future to accurately set TAC's shortly before the fishery commences.

Very rapid progress has been made in understanding Illex (short-finned squid) biology and distribution, however, some gaps still remain, notably where and how the species spawn. Recent research data indicates that catches of larvae and juveniles were made in the area between the edge of the Scotian Shelf and the Gulf Stream. The greatest concentrations were found around 100 meters in warm slope water near the northern edge of the Gulf Stream.

Squid first appear off the Scotian Shelf in early spring; however, the Canadian inshore fishery does not really begin until August, when squid have grown to a good size. In offshore waters, the fishery currently opens July 1.

There can be little doubt that environmental factors, especially temperature, play a role in the distribution and migratory patterns of Illex. For example, the largest catches of bottom trawl caught squid either commercially or during research surveys occurred at temperatures between 6 and 12°C. In 1980, the fishery around St. Pierre was delayed for approximately a month until the temperature rose above 7°C.

One interesting biological note is that a recent preliminary modelling of squid mortalities and yield per recruit indicates that cannibalism in large squid may be a major cause of mortality.

THE CANADIAN SQUID FISHERY

In the years before 1964, squid were caught primarily with traditional hand operated jiggers and box traps in Newfoundland waters and by traps in inshore waters off Nova Scotia, and the catches amounted to only a few thousand metric tons (MT). It should be well understood that the Newfoundland squid fishery has, in fact, existed for decades. In 1964, the Russian fleet fishing off New England landed squid as a bycatch to their directed hake fishery. Three years later, Japan began exploratory

fishing in the Northwest Atlantic, followed by Spain in 1970 and Italy in 1972. In 1970, the U.S.S.R. and Japan reported catches of squid on the Scotian Shelf. Both these nations continued to fish squid, albeit at relatively low levels, until 1975, when landings began to rise substantially. It was at that time that increased interest developed in the fishery and more foreign fishing nations became involved. Canada did not partake in this offshore fishery for a number of reasons, the major one being that none of the Canadian vessels capable of fishing on the Scotian Shelf were equipped with freezing capacity, which, as is widely known, required because of the delicate nature of the product.

The Canadian squid fishery can sharply be delineated into two sectors:

- (a) a strong inshore fishery based in Newfoundland and to a much lesser degree in Nova Scotia, and
- (b) the offshore fishery which in the past, as noted earlier, was dominated by foreign fishing interests. This, however, is changing.

The sharp division between inshore and offshore is seen throughout the Canadian fishery for all species. In the five Atlantic coast provinces, there are in excess of 25,000 registered fishing vessels under 14 meters (45 feet) in length. This is in contrast to only slightly more than 200 vessels over 31 meters (100 feet) in length.

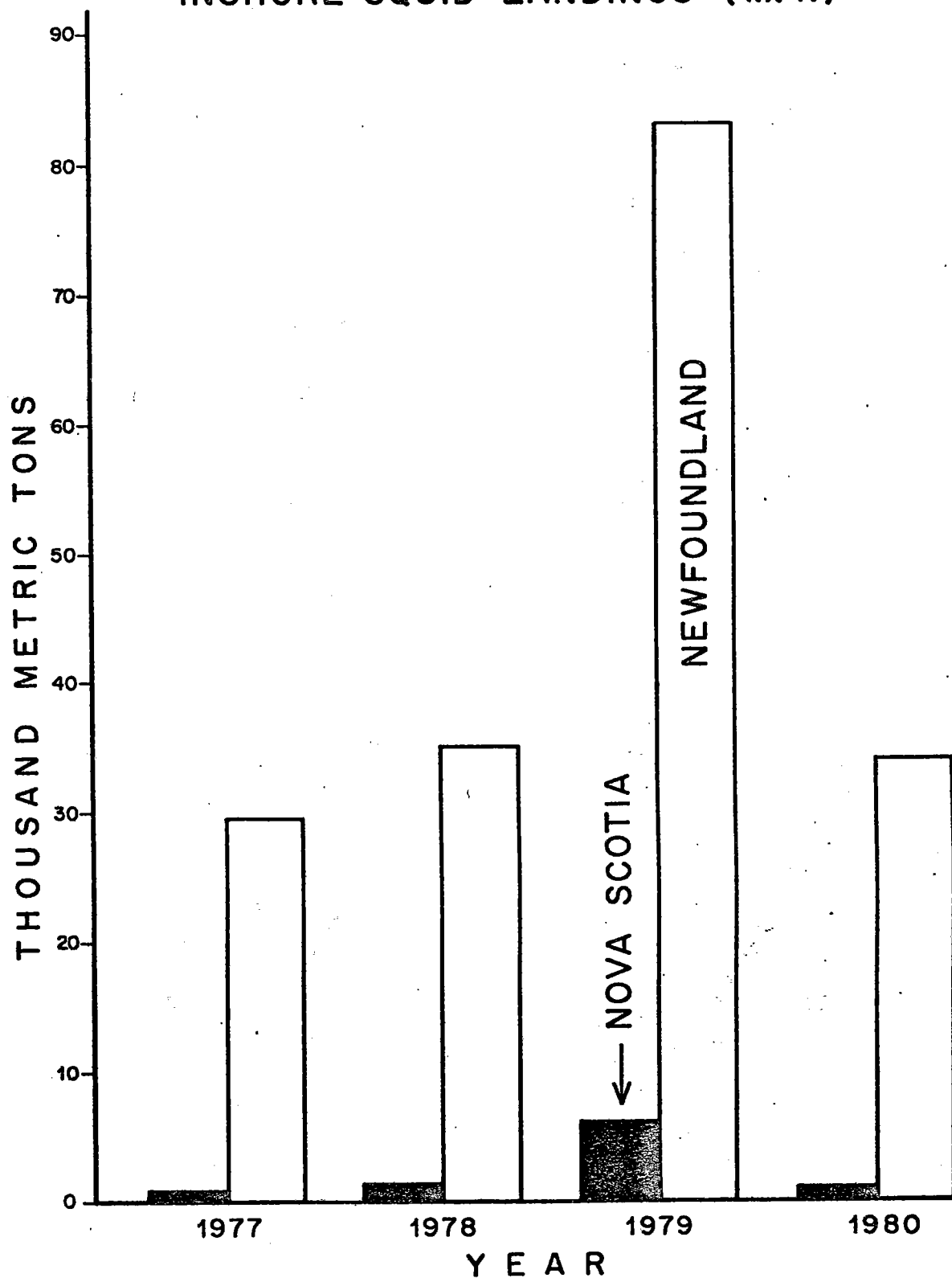
The modern Canadian fishery began in 1977 when good quantities of squid came inshore in Newfoundland, while at the same time, Japanese buyers were eager to secure squid to make up for the shortage in their market place. Figure 2 shows the areas where squid has been traditionally landed. This is not to say that in some years squid is not present elsewhere in Atlantic Canada. It is just that fishermen and processors in these other areas have not traditionally handled the product. Figure 3 details the landings over the last four years. Note that landings declined substantially in 1980 from the very high values of 1979. There were a number of reasons for this:

- (a) There is evidence that suggests that the harvestable population was not as great in that year as in the previous year. Historical data shows that inshore availability can vary from year to year.



FIGURE 3

INSHORE SQUID LANDINGS (M.T.)



- (b) In 1980, a strike occurred in the Newfoundland fishery which was not settled until after the squid season had begun, and,
- (c) There was initial uncertainty as to the level of demand existing in the market.

As stated previously, the inshore fishery is conducted, for the most part, using vessels less than 14 meters (45 feet) in length. In fact, one finds very small boats involved in the fishery in Newfoundland because in certain areas of that province when squid migrate inshore, they can be caught very close to land. It is not unusual for a fisherman to go out in the late afternoon, fish for two or three hours and return with as much as 500 to 1,000 kg of squid and, in some cases, more. In 1979, in certain areas, it was necessary for processing plants to institute boat quotas to ensure that freezing capabilities were not overextended. The predominant method of fishing is jigging. Usually a simple hand-operated roller, to which is attached a line having a number of jigs, is the operational preference, although more and more mechanized jigging equipment is being used. Other methods include traps and beach seines. The much smaller Nova Scotia based fishery is essentially the same, except one does not see the proliferation of small boats.

There has been tremendous development in the squid industry in the past four years. The processing sector has learned a great deal about handling and processing in order to produce a quality product.

EXPERIMENTAL FISHING

During the period that the inshore fishery was developing, the Department of Fisheries and Oceans, (which is a part of the Canadian Government), became involved in a number of projects and experiments aimed at further aiding in the development of the squid industry. A certain amount of emphasis was placed on the offshore fishery.

Developmental Charters

The first of these programs, the developmental charter program, was introduced in 1978 and continued in 1979. Under the program, a Canadian company was allowed to charter foreign vessels to harvest an allocation of non-traditional species, the primary species being squid. All fish caught had to be landed in Canada and a predetermined portion had to undergo further processing. Penalties were

levied for noncompliance. The goals of the program were well-defined:

- (a) to introduce to the Canadian industry the technology necessary to catch, handle onboard and freeze squid.
- (b) to develop onshore processing technology directed at obtaining value-added benefits in the market place.

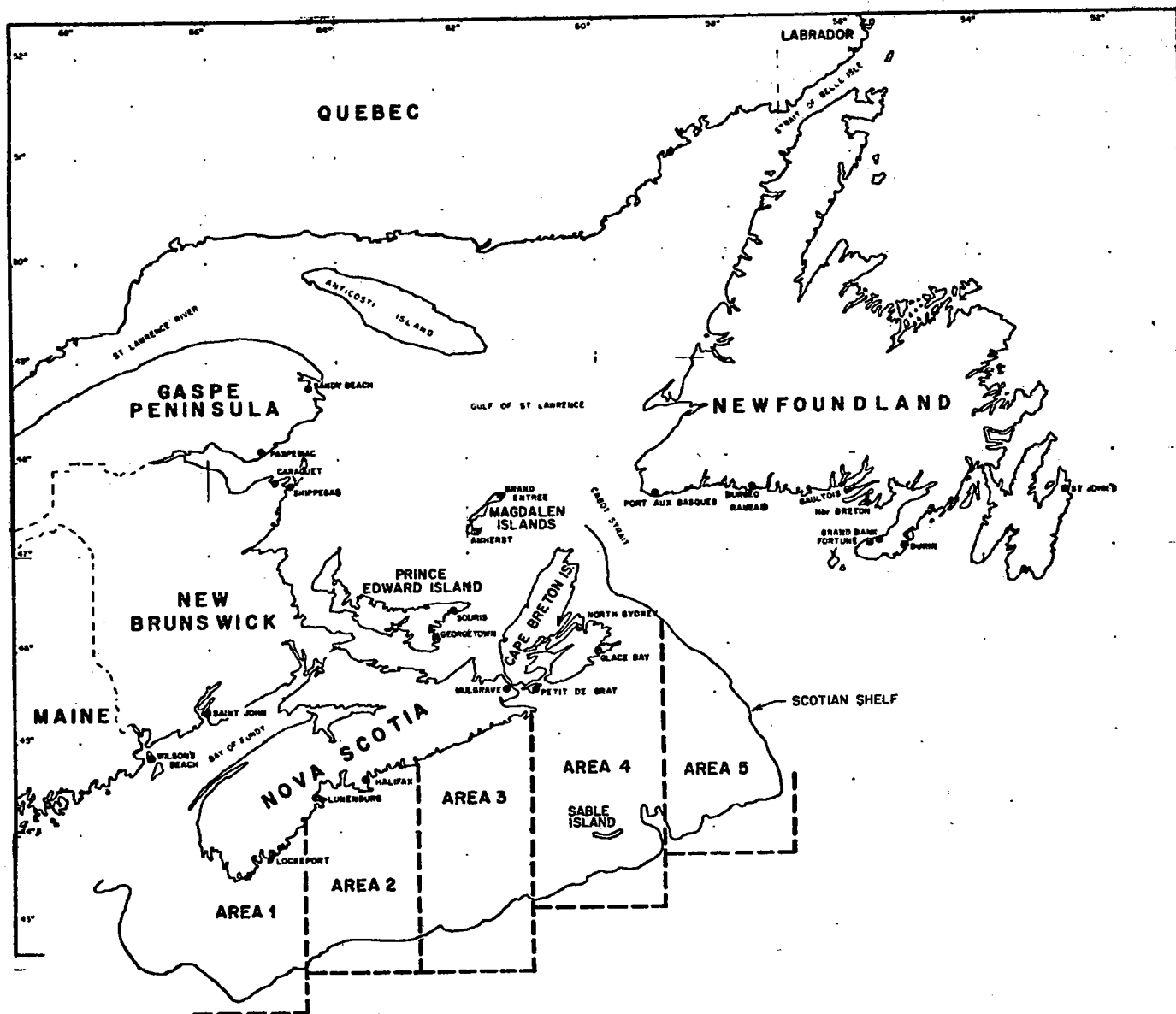
Inherent in these goals was the concept that much could also be learned about transportation, market penetration, etc. To a certain degree, the goals of the program were successfully met, especially in the case of smaller processors. As an added benefit, inplant employment in many seasonal plants was extended. Total landings under this program in both 1978 and 1979 were approximately 25,000 metric tons.

Experimental Squid Jigging - 1979

Almost all the foreign effort in Canadian waters is conducted using bottom or semi-pelagic trawls. Although squid can be caught by almost all towed or encircling gears, one method, namely automated jigging, which is used extensively in Japan, has definite advantages over other methods. These advantages are:

- (a) A high-quality product is landed. Squid caught in a trawl may be crushed as a result of the pressure exerted by the surrounding catch; as well, the incidents of bite marks in trawl-caught fish appear to be high.
- (b) It is selective in that only squid are caught; there is no bycatch.
- (c) Freezing capacity can be efficiently utilized because the quantity of catch coming onboard can be regulated simply by the number of machines in operation at any one time. This is, of course, another quality-related factor.
- (d) Bottom damage which occur with bottom trawls is avoided with jigging equipment.

FIGURE 4



In 1978, it was decided by personnel of the Fisheries Development Branch of the Department of Fisheries and Oceans in Halifax that an attempt should be made to evaluate automated squid jigging in the Canadian offshore fishery. There were a number of questions to be answered - the major one, of course, being whether or not this type of gear could be successfully used in our waters. At the same time, it was realized that any fishing of this nature could also be used to provide valuable biological data.

An agreement was reached with two fishing enterprises to supply a total of five Japanese automated squid jigging vessels. Three of the vessels were between 29 and 30 meters in length while the other two were larger being 43 and 52 meters respectively. Each of the vessels was given a 1,000 metric ton quota for a total of 5,000 metric tons. Under the terms of the agreement, it was stipulated that:

- (a) The vessels would be made accessible to anyone from the Canadian Industry who wished to observe the offshore squid jigging operation.
- (b) Complete data as to catches, costs, and other relevant items would be submitted.
- (c) In order to accumulate biological data, each vessel was required to fish for a total of 30 days at predetermined points within a specified zone (Figure 4).

A Canadian observer was onboard at all times to observe the fishing activity and collect biological data and samples.

The first two vessels arrived in Canadian waters in the middle of July and by the latter part of August, all five vessels were fishing. The last vessel left the grounds during the first week of December. Overall, the fishing was very successful; the smaller boats averaged about 10 metric tons per fishing day, while the largest of the five vessels averaged in excess of 18 metric tons per fishing day. Remember too, that catching capacity was limited on these vessels by the available freezing capacity and on many nights, a great deal more squid could have been landed than actually was.

The fishing techniques used were typical of any Japanese automated squid jigging operation. The jigging machines consisted of one, but more often two elliptical

rollers to which was attached a line of approximately 30 jigs about a meter apart.

The line, weighted at the end, is fed out over outboard rollers to the depth slightly below where the squid are present. Jigging is carried out at night when squid school near the surface. As the jigs are drawn back over the outboard rollers, each squid is flipped off the jig and lands on a plastic-coated wire frame or "net" positioned between the two rollers. From the net, the squid drops into a flume which carries it below deck for further processing. The jigging units are designed to fish continuously, and when everything is operating properly, only one or two men are required on deck. When fishing, the vessels use a sea anchor and spanker sail to maintain position (Figure 5).

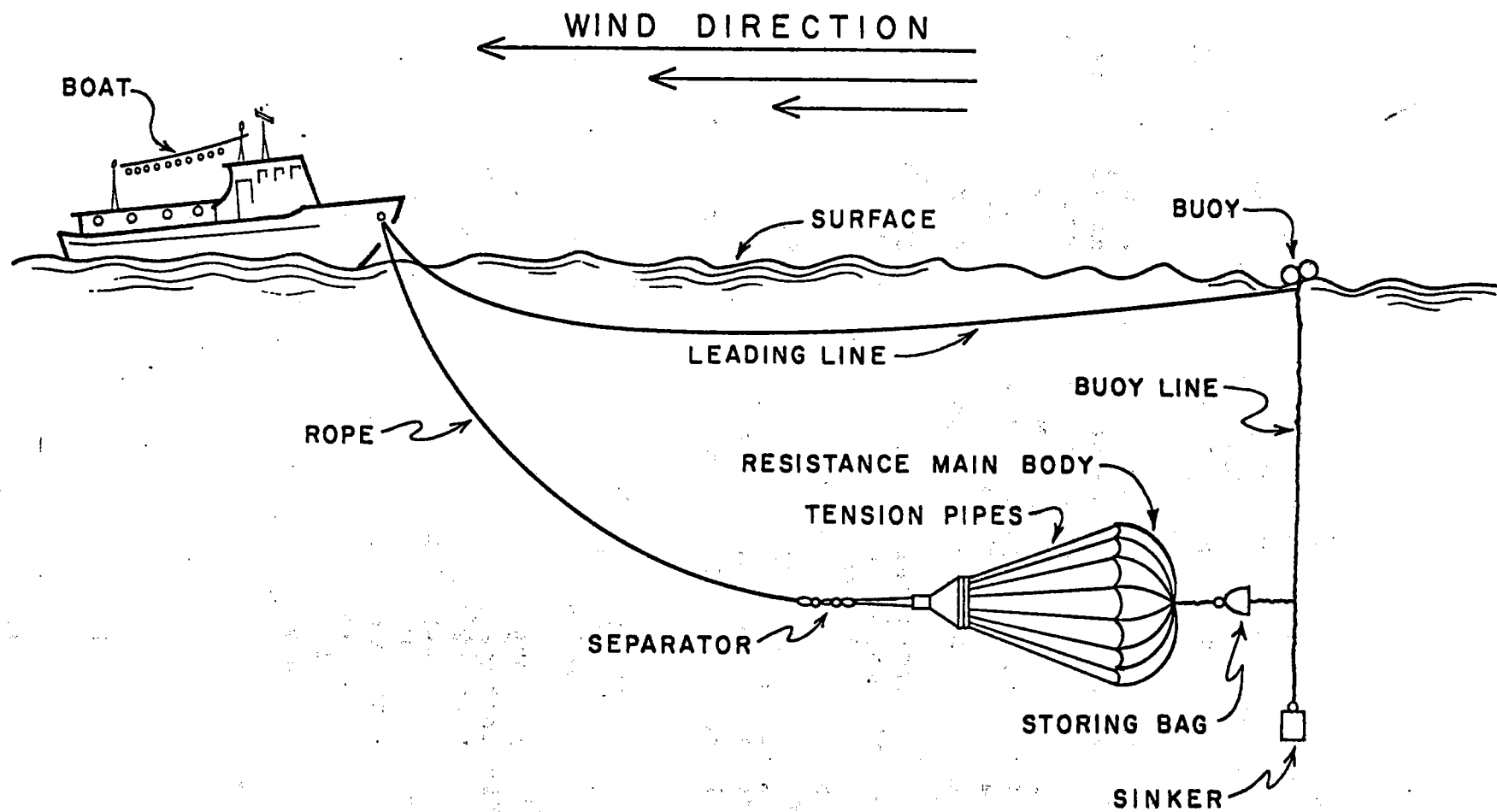
Large attracting lights were used during fishing. The lights shine on the deck and the squid are attracted to the area between the reflected glow on the water and the shadow of the vessel.

The below-deck operation on a jigging vessel is essentially the same as one would find on a small freezer trawler. Squid in poor condition are culled out and thrown overboard. The catch is then size sorted, packed in freezer trays and frozen. Care is taken in preparing the squid for freezing, they are packed in two or three layers, laid out evenly tail by tail with tentacles folded under and along the outside of the block. The traditional block size is 8.5 kg. On jigging vessels, each frozen block carries a tag indicating the number of squid per block. This is an important marketing consideration, for in the market place, all things being equal, larger squid command a higher price.

Canadian Offshore Squid Jigging

As a follow up to the initial work with the Japanese vessels, the Fisheries Development Branch in 1979 initiated a technology transfer program to involve a Canadian vessel in offshore squid jigging. It was felt that such a program would answer a number of questions concerning the potential for the development of an offshore industry and jigging was felt to be the obvious option in that it lands the best quality product and is totally selective. The vessel chosen was a 40-meter (130-foot) steel-hulled automated longliner - the M.V. ATMAR owned and operated by United Maritime Fishermen of Moncton, New Brunswick. The vessel was built in 1975 in Norway. One problem facing anyone wishing to become involved in offshore jigging in Canada is that the squid season lasts at the most five months, from August to December. It is true that the season might be extended somewhat, however, the question remains as to what kind of fishing could the vessel carry out given Canada's strict

FIGURE 5



licensing regulations. The conversion back and forth between longlining for groundfish and squid jigging represents a viable option which was a positive factor in the decision to choose the ATMAR. A number of other criteria were also influential.

The actual conversion of the vessel was not a simple matter. Freezing capacity had to be increased. Furthermore, in order to supply power for this increased capacity and for the jigging equipment and lights, two more generators to complement the existing three had to be installed.

The processing area had to be redesigned and outfitted with the necessary equipment to freeze squid; as well, a flume system to deliver the catch below was added. In all, 18 double jigging machines, port, starboard and aft, and sixty 4,000-watt attracting lights, 30 to a side, were installed. Of course, numerous other modifications and changes were necessary to properly convert the vessel.

Unfortunately, the vessel fished last season with disappointing results through no fault of the fishing equipment. It was well established that the ATMAR could catch squid. Rather, the vessel was plagued with a number of mechanical problems, over and above the initial problems one would expect when mounting a project of this size. The difficulties reached a critical stage when major problems developed with the main engine towards the end of the season.

However, finally (August 1981) the vessel is back fishing, hopefully with many of the problems resolved. Those involved with the project are extremely positive.

In 1979, an experiment was initiated with two Nova Scotia inshore fishermen in which their vessels were rigged with automated jigging equipment and attracting lights. The use of this sophisticated equipment allowed these fishermen to venture further afield and gave them a great deal more flexibility than those using traditional methods. The locations fished were in the Big Bras d'Or area of Cape Breton Island and in the Lockeport area of southwestern Nova Scotia (Figure 6). The Cape Breton based vessel was the larger of the two being 13.2 meters (44 feet) in length. It fished with six double machines and six 4,000-watt attracting lights (Figure 7). The Lockeport-based vessel was 11.4 meters (38 feet) long and fished with four double machines and four attracting lights (Figure 8). The fishing operation was essentially the same as one would find on an offshore jigging vessel except the catch was not frozen but rather landed fresh each night.

In 1979, both vessels fished for a total of 27 nights

FIGURE 6

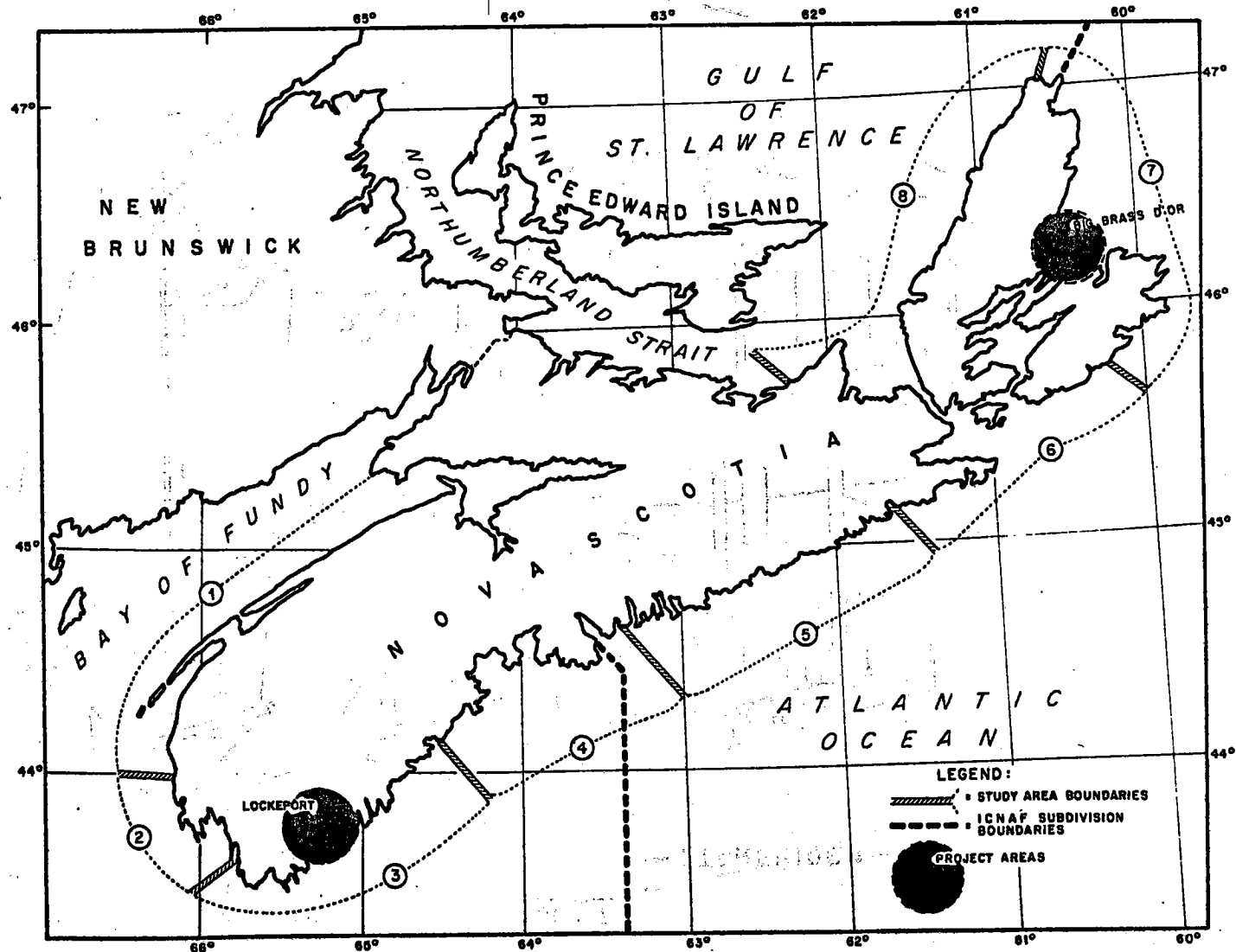


FIGURE 7

- STARFINDER -

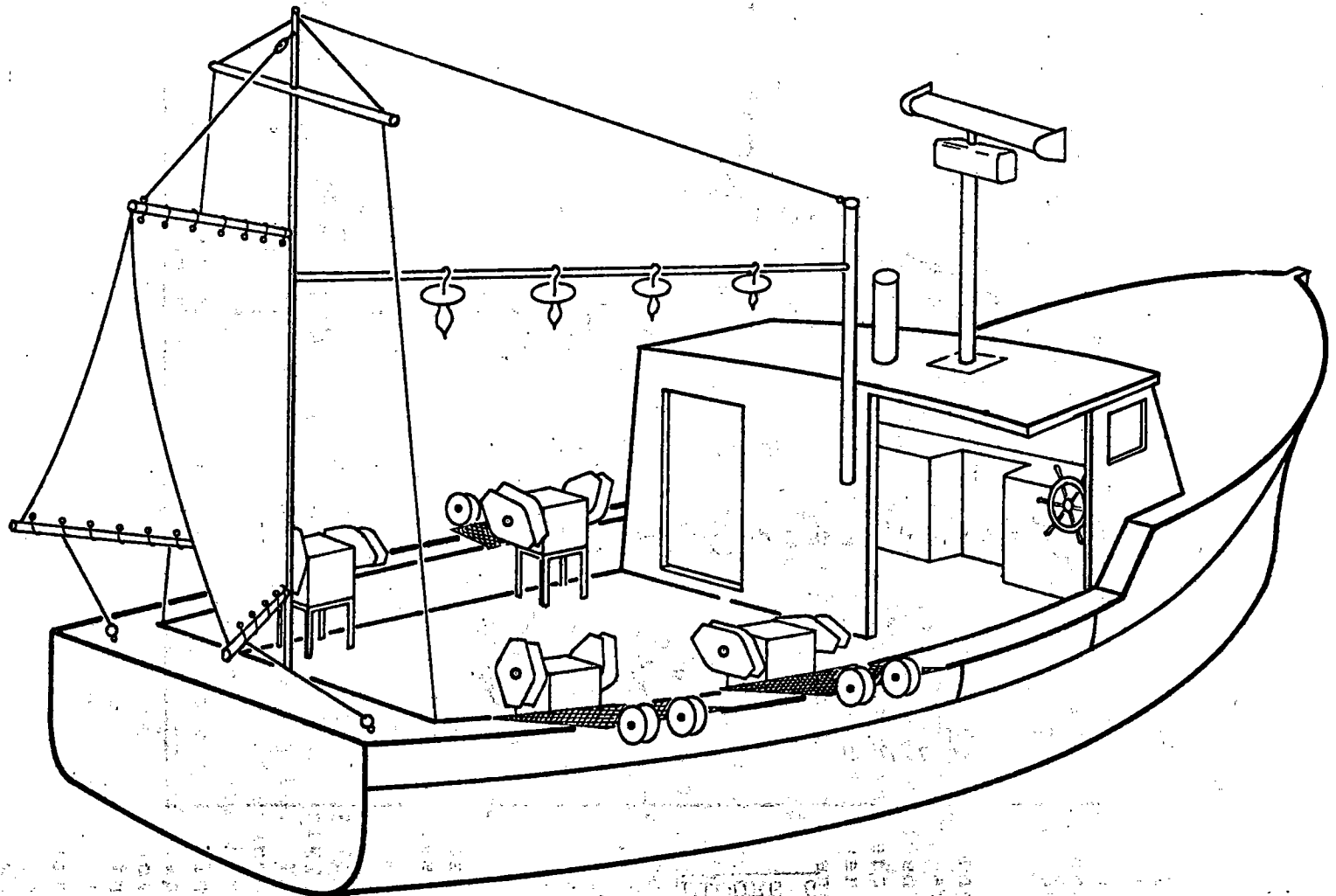
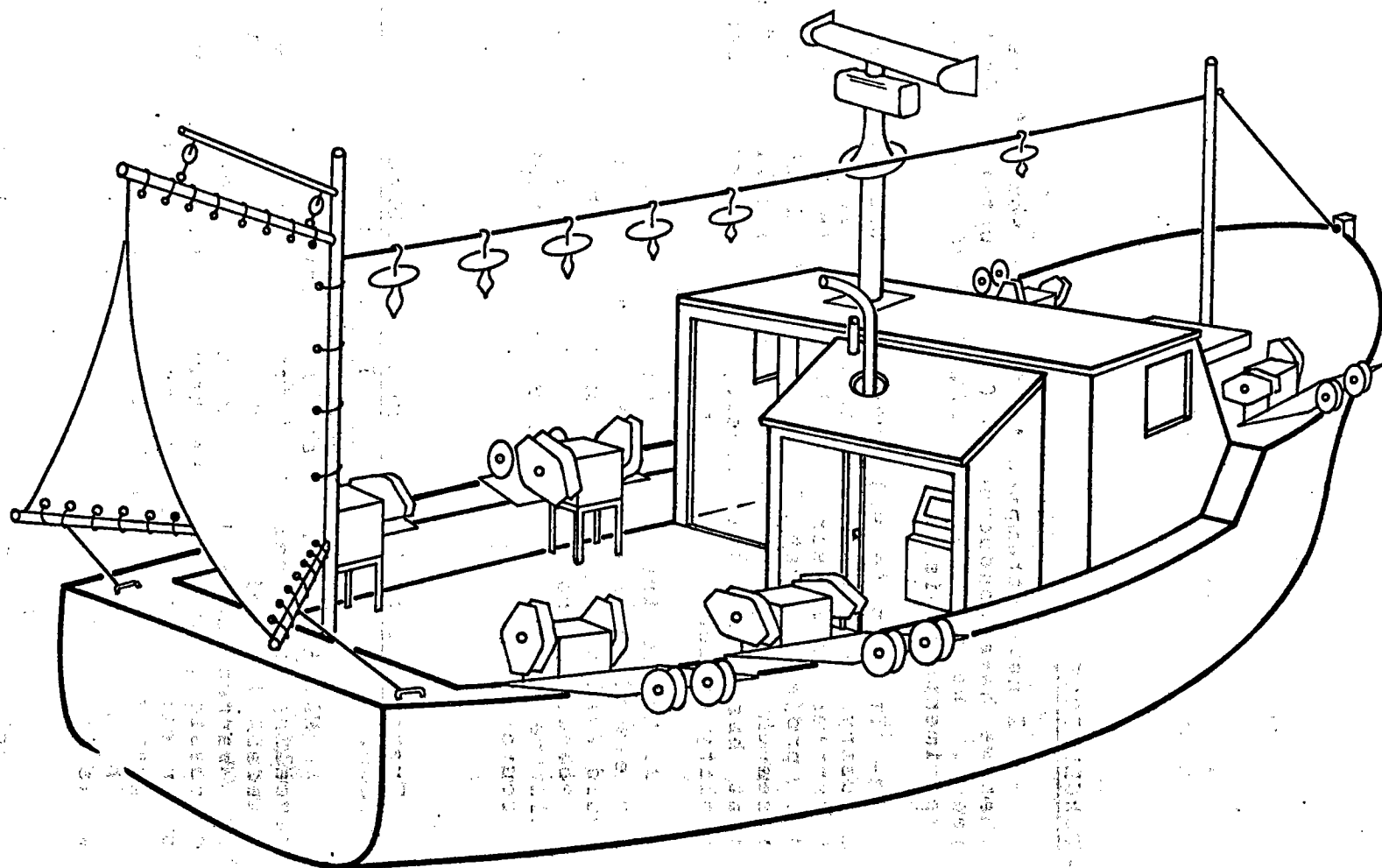


FIGURE 8

- MIZ X -



and both landed in excess of 100,000 kg. Both could have landed more, however, the local processors had difficulty in marketing the catch and fishing was therefore halted. It is also interesting to note that on some nights the vessels were capable of catching a great deal more squid than they actually did but were restricted by their limited carrying capacity.

CONCLUSIONS

I have attempted to describe some of the experiments that we have conducted in Canadian waters over the last two years. We must be careful, however, not to look at these experiments in isolation.

It must be well understood that the Canadian squid industry has matured considerably in a very short time. Government has been a participant in this process through the projects that I have described as well as through research work in our laboratories in Halifax and St. John's that has aided the development of product standards and quality evaluation methods.

It is true that some questions remain unanswered. For example, we cannot be certain as to the quantities of squid available inshore from one year to the next, but there is absolutely no doubt that the squid fishery has become and will remain in the future an important Canadian fishery resource.

Transcript of Discussion that Followed after the Paper was Presented

MR. RATHJEN: Thank you very much, David, for a very revealing and excellent summary of the recent experience in Canada. I'm going to suggest to my colleagues August Ciell and Warren Lund to lead on at least five minutes of discussion, and that we keep in mind that we have three other excellent presentations that are scheduled. I would suggest that we try and establish a direction through some of the discussions, which can be expanded in our harvesting workshop.

MR. LUND: I think this aspect of fishing (i.e. jigging) is terrific. It's something that we haven't tried. I wonder if it will work in our waters, it's fascinating, to say the least. I have a thousand questions I would like to ask. One was mentioned up here, why this type of fishing, (i.e. jigging) when this probably takes more power than towing the net? But at this point I think it should be

thrown open for questions from the floor. Any questions about this type of fishing?

MR. STINSON: Did you say it takes more power to jig squid than drag it?

MR. LUND: That's my observation. I'm wondering if it does or not. Maybe Mr. Lemon can answer that question.

MR. LEMON: I don't have an answer to that question. I think the jury is still out on it. But I think in all probability squid jigging is more energy efficient than trawling.

MR. STINSON: I think it would be. I think it would require very much less power.

MR. CIELL: 240 kw generator just to operate the lights.

MR. STINSON: That doesn't take much. An engine towing, there's quite a difference in the power consumption. Thank you.

MR. LUND: I have another question. As I understand it, this works very well with Illex squid, but does it work well with Loligo squid?

MR. LEMON: The Canadian resource is essentially Illex, I don't know the answer. Maybe people in the audience know the answer to that question. I'm given to understand it doesn't work as well with Loligo, but I don't really know.

MR. LUND: There's no question that there's a lot that we don't understand about squid and there's a thousand questions to be answered.

MR. WOYEWODA: David, there's one point maybe you didn't make quite clear. That is squid jigging in Newfoundland occurs in the day time without the use of lights.

MR. LEMON: Thanks, Andy. That's a very good point. When squid come inshore in Newfoundland you can get tremendous quantities of squid. When they do jigging in Newfoundland, they do not use lights, they go out in the daytime and jig for squid, it's that plentiful.

MR. LUND: Are there other questions out here?

MR. RYCROFT: I would like to make one comment. I talked this over with Warren Rathjen and as far as Loligo is concerned, he assures me that they are not attracted to

lights, in dense concentrations.

However, the key to the light attraction system is the positioning of the lights above the vessel. There's a certain angle beyond which it can't go. In fact, the lights shouldn't shine directly on the water. There should be an area of shadow surrounding the boat.

When the Illex come up they stay on the edge of the light. They don't go into the direct beam of the light. This is the key to the whole thing, you don't hang your lights out over the water. You position them on board, so there's an area of shadow and they come to the edge of that shadow and take the lure.

MR. LUND: Yes. We tried experimenting this year with the lights, tried jigging Loligo squid, and we found that to be true. If we hung a light directly over the water the Loligo seemed to stay outside of the light, not directly under the light.

I have another question for Mr. Lemon. When you are jigging squid, what percentage can you catch? In other words, with Loligo this year, we would see probably hundreds of squid milling around, yet we would have problems catching one. Is that normal with Illex or do you catch a large percentage of what you see?

MR. LEMON: Well, I think that with Illex, as you saw on the slides, once you start the catching process, once you catch one squid and another and another, very soon you're often hauling every jig with a squid on it. I'm sure there are a number of factors that influence catching capability, but it seemed to us in our experience that squid were biting and you would do very well.

DR. VOSS: The problem concerning jigging for Loligo or Loligo type squid varies according to the species. Different types of jigs are necessary. In Japan they use different type of jigs. So far we have been unable to use any type of jig successfully on Loligo.

In Peru the total fishery is by jigging and I think that this is going to vary a great deal according to species and according to locality, conditions, and especially the type of jig. there has to be more experimentation.

MR. LETA: I'd like to ask a couple of questions. First one, you used the term "selective" referring to this. Is this selective of squid catch one by one, selected because there's a specific area for the kind of squid?

MR. LEMON: When I said it was selective, what I meant was, one only caught squid. In other words, in the

trawl fishery, you'll have a bycatch.

MR. LETA: Another question is, did you make tests on speed, when you tried the jigging line?

MR. LEMON: You mean did we vary the speed at which the line went into water and came out? I don't think we did anything formally on that, no.