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fredericton, N. B.
march 4-5, 1969

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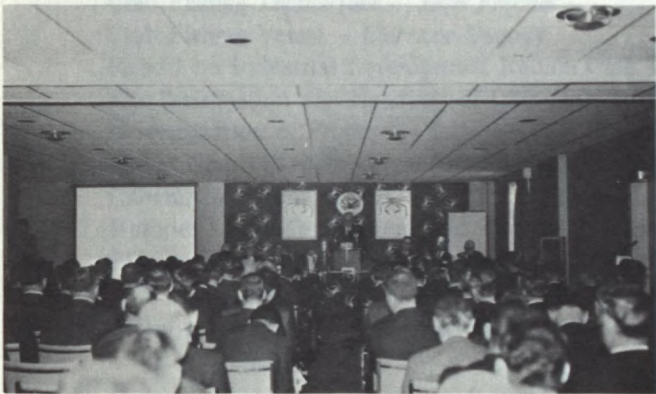
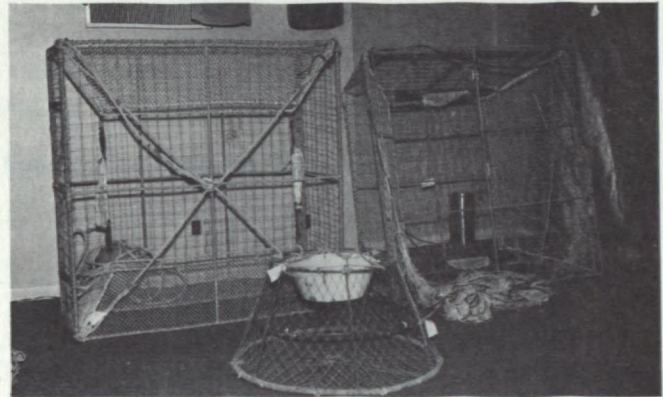
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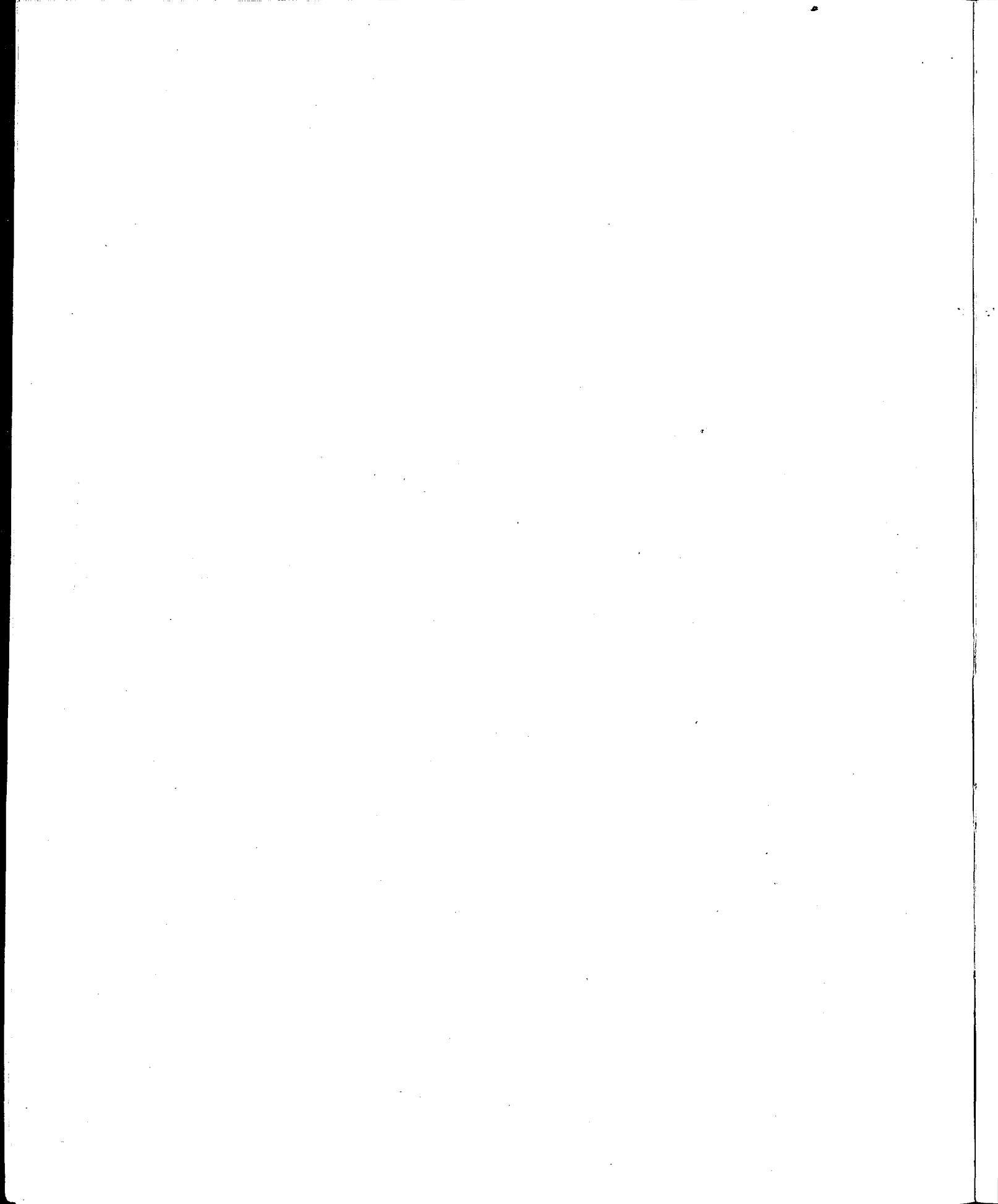
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Upper left, Premier Louis J. Robichaud of New Brunswick opening the meeting; upper right, Dr. A.W.H. Needler, Deputy Minister of Fisheries and Forestry and chairman of the meeting, introducing speakers at the first session; centre left, left to right, Mr. and Mrs. S. L. Simpson, British Columbia crab processing specialists, and L. S. Bradbury, Director of the Industrial Development Branch, Fisheries Service, Department of Fisheries and Forestry, who was chairman of the co-ordinating committee; centre right, some of the crab traps on display; lower left, general view of one of the sessions; lower right, two participants in the meeting discuss the merits of one of the traps on exhibit.



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OFFICERS OF CONFERENCE AND SECRETARIAT

General Chairman	<i>Dr. A. W. H. Needler,</i> Deputy Minister of Fisheries and Forestry, Ottawa
Chairman of Co-ordinating Committee	<i>L. S. Bradbury,</i> Director, Industrial Development Branch, Fisheries Service, Department of Fisheries and Forestry, Ottawa
General Secretary	<i>Jack Rycroft,</i>
Editor of Proceedings, Conference Publicity	<i>James Kinloch</i>
Registration	<i>W. J. Clark</i>
Time Control	<i>Georges Imbeault</i>
Secretariat	Industrial Development Branch, Fisheries Service, Department of Fisheries and Forestry, Ottawa
Liaison Officer	<i>René Savoie,</i> New Brunswick Department of Fisheries.

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Published under Authority
of
HON. JACK DAVIS, P. C., M. P.
Minister of Fisheries and Forestry

Making the most of our Fisheries



Mr. Davis

by
Hon. Jack Davis, P. C., M. P.
Minister of Fisheries and Forestry

Mr. Davis was the guest speaker at the luncheon for Conference participants on March 5. Following is his address:

Mr. Chairman, Fellow Guests, Ladies and Gentlemen: I am going to be brief. I also want to cover a lot of ground. I want to talk about planning in our fisheries and I want to talk about guidelines which we can use to help improve our performance in the future.

This is a tall order. It is a tall order, not only because I want to say all I have to say in 20 minutes, but also because of the complexity of the fishing industry itself. One doesn't usually bracket lobsters with salmon or crabs with herring. But conservation is an important concept these days. Like good management it is essential, not only to the preservation of our fisheries as a resource, but also to the increase in income of our fishermen in this country.

We have our success stories and we have our failures. We have our breakthroughs and we have our uncertainties. Our east coast lobster industry can, I think, be described as a success story. Our Atlantic salmon fishery, by contrast, is a failure, or nearly so. Our new queen crab industry constitutes an important breakthrough. And the future of our dynamic herring fishery is perhaps open to question. Whether it should be allowed to expand to several times its present size is a question to which we must address ourselves, now — not some time in the indefinite future.

Planning is desirable. But planning is difficult in the fisheries. Often the resource turns out to be smaller than we think or hope it is. Also it has a habit of declining without notice. Often it can be tapped by foreign fishing fleets, and

frequently our own Canadian fishing effort is increased without any attention being paid to the fundamental forces of supply and demand.

Such are the hazards of harvesting a hidden resource. Such are the hazards of harvesting a resource whose response to our total fishing effort cannot be forecast with any degree of accuracy. And such are the problems of an industry in which there has been unlimited entry and in which the average income of the average fisherman is usually below — well below — that of the Canadian community as a whole.

How much better it would be if we could assess the resource with some degree of certainty, if we could determine its maximum sustainable yield, and if we could allocate a limited number of boats, a given amount of gear and a select group of fishermen to do the job. Then we would have a predictable situation. Then we would have stability of output and sales. And then we would be able to get the highest possible return, not only on our investment in vessels and gear, but also in terms of wages and salaries paid to the fishermen themselves.

Our old-fashioned lobster fishery comes closest to this ideal. Though the resource itself has been reduced by too much fishing over many years we know where it is and how it can be sustained. Foreigners cannot touch our lobsters. Also we have our own system of licence limitation. We are in a position to limit the amount of effort necessary

to harvest a sustainable catch. We are in a position, in other words, to make the most of our Canadian lobsters as a resource.

There are several known (or fairly well-known) quantities here. We know a good deal about the size, extent, and quality of our lobster resource. We can estimate its maximum sustainable yield. Fishing is confined to Canadian waters, and our investment is limited to a given number of boats and traps which are properly licensed to take lobsters on a commercial basis.

Gone are many of the problems of a "common resource" industry. Gone are the headaches of an unlimited fishery. And gone, also, are the prospects of part-time or casual fishermen making serious inroads into the future commercial lobster fishing industry itself.

We are now able to increase the maximum sustainable yield over a period of time. We can also, by way of the Federal Government buying up lobster boats, reduce the overall investment needed to harvest our sustainable catch. And we can, by expanding the supply of lobsters on the one hand and reducing our fishing effort on the other, raise the income of the average east coast lobster fisherman to almost any level we like. We are, in other words, in a position to make our lobster fishery one of the best paying industries anywhere in the world.

A few minutes ago I mentioned breakthroughs. We have been talking about a major breakthrough here at this conference. I mean our breakthrough in respect to the queen crab. Our Canadian production has jumped ten-fold since the early 1960's. It has already become a multi-million dollar industry. And it is an industry which is now adding materially to the incomes of our fishermen in communities which otherwise would have had to depend on an uncertain groundfishery for its livelihood.

Yet, although I have expressed optimism, the queen crab industry bothers me. We don't know enough about the resource itself. We don't know how big it is, how extensive it is, and how fast it can be regenerated. We don't know enough about its maximum sustainable yield. But limit our fishing effort at some stage, we must. We must limit it, not only to prevent destruction of the queen crab as a resource, but also to make sure that the incomes of those who depend on this new industry will be kept at a relatively high level for many years to come.

Fortunately our queen crab is a creature of the continental shelf. It is a creature of the continental shelf because, according to the United Nations authorities, it is

"in continuous contact with the continental shelf at its harvestable stage". And being a part of the continental shelf it belongs to Canada. No other country can fish in our waters for the queen crab. No other country can take queen crab from any part of our Canadian continental shelf. So we are spared any worry in this connection.

But there is still the threat posed by the unlimited entry of Canadian companies and Canadian fishermen into our queen crab industry. As things stand now they can flock into our queen crab industry until it is not only overfished, but overequipped and overmanned. This is really what worries me. And it is what makes me think that we must seriously consider the introduction of a system of "limitation of entry" into our queen crab fishery at some time in the future before it goes the way of the King crab fishery off the west coast of Alaska. That is before it, too, is overfished and the fishing season is cut to a few weeks or months in the year.

Our east coast herring fishery really worries me. It is booming. It is attracting a great deal of new investment in trawlers and reduction plants. Since 1965 it has become a big industry in anyone's terms. But like the queen crab industry, herring as a resource is not unlimited. Also the stocks themselves have an awkward habit occasionally of disappearing. They have disappeared, at times, in the North Sea. And they disappeared, a few years ago, off Canada's west coast. True they always come back. But think of the waste in terms of idle vessels and plants and the loss of incomes to fishermen which can result from a man made catastrophe of this kind. We have to plan ahead as best we can.

As compared to the queen crab there are added hazards. This is because the herring are more mobile than the crab. Also there is the ever present threat of foreign fishermen. Often they pick up some of our herring and we never know when they will invade much of our continental shelf area and do a real job on our herring for herring's sake.

Limitation of entry into our own Canadian herring fishery, therefore, runs into special difficulties. Until we have the final say as to how the total fishery resource on our continental shelf is managed, we cannot tailor our own fishing effort to the resource itself. Certainly we cannot say, with any accuracy, what the impact of foreign fishing operations will be. We don't know how fast the resource may decline and we don't know how big a catching effort should be mounted in order to maximize average fishermen's incomes in Canada.

Here in a nutshell is the main argument for an extension, a geographical extension, of our own Canadian fishing limits. Our jurisdiction, our own Canadian jurisdiction, should I think go to the edge of the continental shelf. It should go to the edge of the continental shelf and beyond; beyond at least to the point where it is descriptive of the life-long habitat of our major groundfish species. Then we would have not only the lobster and the crab within our exclusive Canadian jurisdiction, but also many of our herring and other fish stocks as well.

Please be clear on this. I am not talking, now, about "exclusive fishing zones". I am talking, really, about "fish management zones". These national fish management zones should include all of our continental shelf area, in my opinion. But we would not necessarily exclude foreign fishermen from fishing on the Grand Banks for example. We would assess the resource and limit their effort, along with ours, to the maximum sustainable yield for the species in question. That is all. We would assess the resource and we would determine the maximum sustainable yield.

By following this regime we would be able to manage and conserve our fish stocks. We would be able to manage and conserve our herring stocks, for example. Knowing the size of the resource we would also be able to say what the maximum cropping effort should be. And, subject to negotiations with other countries, we would be able to set our own Canadian quotas with a view to maximizing our own returns on investment and incomes to fishermen in this country.

"How", you might well ask, "are we going to reach this highly desirable objective?" We can reach it through a new Law of the Sea Conference. The United Nations sponsored Law of the Sea Conferences of 1958 and 1960 set up certain guidelines. They helped establish the 12-mile Exclusive Fishing Zone and they lend creditability to the drawing of baselines. We must do these things and more. We must try to persuade other countries that each nation should have the responsibility for managing all of the fish resources out over its own continental shelf. This they should be able to do without necessarily excluding fishing vessels from other countries. But sound principles of conservation and good management would obtain and there would be an interested local, national authority to make sure that these principles were enforced for the good of all mankind.

At the outset I mentioned a near failure as well as a real success story. I described the fate of our great Atlantic salmon as a near failure and contrasted this with our

performance in the lobster fishery. The Atlantic salmon story is a sad story in the New England states and Canada. It is one of desperate efforts to maintain fish stocks in the face of overwhelming odds. The losses, unfortunately, have exceeded the gains, with the result that our Atlantic salmon fishery is now a pale shadow of its former self.

The odds, of course, are stacked against the kingly salmon. In contrast, for example, with the lobster fishery, it is a wide open operation. Also our Atlantic salmon roam far and wide. They roam out beyond the Continental Shelf and into the North Atlantic where foreign fishermen operate in great force. Here at home they are blocked by power dams and poisoned by chemical type industries. No wonder that our desperate efforts to revive our local salmon runs have often been frustrated. No wonder they have been more than cancelled out by the depredations of foreign fishermen and Canadians alike.

Mark you, the Canadian taxpayer has invested a lot of money in our salmon resource. But he is getting a poor return so far. Despite our mounting investment in hatcheries, fish culture stations and local stream improvements, we have seen our salmon resource decline to a fraction of its former self. We, in other words, are continuing to lose ground. We are losing ground despite the fact that the Atlantic salmon is becoming increasingly valuable, not only from a narrow commercial, but also from a sports or recreational point of view.

Those of you who are from New Brunswick know all about our new salmon fish culture station at Mactaquac just up river from here. You know that we hope to rehabilitate the Saint John River using the new \$3 million facility, built by the New Brunswick Government and turned over last fall to the Federal Government to operate, to increase the returns of young salmon to the sea. But you also know that the Saint John River, up stream of Mactaquac, is now a great wasteland in so far as the Atlantic salmon is concerned. Big dams now block their upward migration beyond Mactaquac. Also the oxygen supply has been so depleted by industry as to make the upper reaches of the Saint John River uninhabitable in so far as most other fish species are concerned.

We must change all that. We must make all of the Saint John River waters, including the upper reaches of the Saint John itself, a habitat for bigger and healthier salmon. We must clean up this watershed so that it is a real asset from a recreational point of view. And we must prevent new processing industries from poisoning the waters of the Saint John River in other ways.

Few people realize that we have the power, under the Fisheries Act, to close plants down. We can even send company executives to jail for non-compliance. Pollution, to the extent that it destroys fish, is a punishable offence. Dead fish are evidence that an offence has been committed and we will certainly be on the lookout for evidence of this kind — evidence that pollution is taking place, that poisoning has reached unacceptable levels and that the health of human beings, as well as of fish like our Atlantic salmon, may hang in the balance.

Out on the high seas we have another and even more difficult problem to contend with. We have an unlimited salmon fishery in which foreigners can participate in an unlimited way. True we have some international agreements to fall back on. But they do not include the apportionment of a sustainable catch among the countries which are members of I.C.N.A.F. (the International Conference on North Atlantic Fisheries) for example. Until apportionment of what is assessed to be a suitable catch exists, and until we can shape our own fishing effort to match our own Canadian share of the resource, we will have little incentive to build more hatcheries on our rivers or protect our salmon spawning grounds in other ways.

I realize that I have already run over my allotted 20 minutes so I will close with a few sweeping generalizations — generalizations to which I have already alluded:

- We must be more conservation minded in the development of our fisheries as a resource;
- We must recognize that sound management and good conservation practice are inseparable one from the other;
- We must push our "fish management zones" out to the point where we can bring the exploitation of our major fish stocks under control;
- We must limit cropping to the maximum sustainable yield of a given resource; and
- Where possible, we must limit our own Canadian fishing effort so as to maximize the return to Canada and to Canadians.

I have said a mouthful. Also, I have said it in a hurry. I could have said more. I could have talked about a comeback in our whaling industry. And I could have forecast the development of an expanded new shrimp fishery in the Gulf of St. Lawrence. But suffice it to say that our Canadian fishing industry, besides needing more and better management, offers fresh opportunities for expansion. Suffice it to say also that the opportunities are there if only we have the drive, and the good sense to make the most of them.

I have talked about guidelines — guidelines in the closely related areas of conservation and management. I have talked about pushing out our offshore management zones to the edge of the continental shelf. I have talked about the need, not only to assess each resource in turn, but also to crop it in such a way as to maximize the return to the fishermen themselves. But these goals are not likely to be achieved without limiting our total catching effort — without limiting entry into our more manageable industries, the total output of which is limited as well.

Economics has sometimes been described as "a dismal science". But the broad sweep of economics must transcend narrow, individual, company and regional considerations. It must deal with the wise, long term allocation of resources. And it must result in the greatest possible catch of fish by the smallest number of vessels and gear.

This is why I think that we, in this country, must pay more attention to economics and less attention to our traditional ways of doing things. The biologists and the engineers have been a great help. But their advice has often been lost on an industry which has been unable to help itself. Governments have therefore had to come to its aid. In future they must also come to the aid of the industry, not only by providing scientific advice, but also by creating an economic and administrative environment in which it is possible for most of our fishing companies to make a profit and for all of our commercial fishermen to make a good living for themselves.

Of course we must exploit every new idea which may come our way. We must also catch more fish species like the sand lance, the whiting and the capelin — more abundant fish species in nature's overall scheme of things. And we must use the latest techniques to process and market them as well.

All of this of course calls for more money. It calls for a greater investment in new vessels, new gear and new processing plants and it calls for a greater investment in fish storages and fish marketing schemes. But new investments are inhibited by uncertainty. They are frustrated by chaos. So we must manage our affairs with greater certainty. We must stabilize our operations — both government and industry alike. We must draw our own guidelines and set up our own management systems. Only if we are prepared to do this will the fruits, both of modern technology and of a resilient Atlantic fishery, be ours for the asking.

Opening Addresses

The Chairman, Dr. A.W.H. Needler, Deputy Minister of Fisheries and Forestry, Ottawa, expressed his pleasure in opening the meeting, and called on Premier Robichaud of New Brunswick and the Deputy Ministers concerned with fisheries in the five Atlantic Provinces to address the assembly before the sessions got under way.



**HON. LOUIS J. ROBICHAUD,
PREMIER OF NEW BRUNSWICK**

On behalf of the government and of the people of New Brunswick, I want to extend to all of you a most hearty welcome to the capital city of our picture province. I am very pleased and honoured that you have chosen the beautiful city of Fredericton as the meeting place for this conference, and I am confident that everybody will enjoy his stay among us here.

It is easy for me to recall having met a lot of you gentlemen on a similar occasion. It was around three years ago, I believe, during the Canadian Atlantic Herring Fishery Conference, held right here in this city. I have a suspicion that my Minister of Fisheries and his Deputy have something to do in attracting to this fair city, once in a while, such a large group of fishermen and people involved in the fisheries industry, the experts from the five Atlantic provinces and Ottawa. This sort of attraction towards a province which was better known in the past for its forest and agricultural products is to the credit of those responsible for the development of a strong fisheries sector among our resource based industries. I mean the fishermen themselves, the fish processors, and the federal and provincial departments of fisheries, who are all working together towards a common goal, which is the optimum utilization of the resources of the sea for the benefit of all those directly and indirectly employed in the fishing industry.

The commercial fisheries of this province have pioneered in many fields of activity and are fast expanding. Our earlier predictions have now been exceeded to the extent that we have accomplished in three years what we had planned to do over a period of six years. My only comment on such a happy situation is to conclude that we have obviously conservative planners in our Department of Fisheries. Fish landed in 1968 exceeded the previous years, figures by 52% in volume and 44% in value. This achievement was possible through the co-ordinated efforts of fishermen, fish packing firms, and the staffs of both Departments of Fisheries. The fact that greater emphasis has been put on diversification at all levels of production means that we can predict a bright future for the fisheries of New Brunswick, and also, of course, for the rest of the Atlantic area and the Province of Quebec.

Mr. Chairman, I am confident that this meeting will be as successful as the Herring Conference in bringing about a large but orderly development of the crab fishing industry, which as you know, is a common heritage of all Canadians. We in New Brunswick have progressed very rapidly in that field, and the new fishery has become in a matter of about three years an important factor in the economy of our coastal regions. It has been estimated that some 800 people found employment in the crab fishing and

processing operations last year in our province. Approximately 1.5 million pounds of crab meat were put on the domestic and foreign markets, and the wholesale value of the product exceeded \$2.5 million. This success story was not strictly, as some might think, the result of a gold rush. It was rather the end product of a well co-ordinated project put forward by our Department of Fisheries with the technical and financial assistance of the Federal Department of Fisheries and Forestry, and the full co-operation and participation of fishermen and fish packing firms.

As far as Federal-Provincial relations are concerned, this joint project was one of the finest examples of

co-operation and co-ordination that could be conceived under our Canadian constitution. For this reason, we might even suggest that the design of the crab appearing on your agenda would then well serve as the emblem of future documentation related to the establishment of closer liaison and co-ordination between the Atlantic provinces and Canada.

In closing, I wish you every success during your deliberations, and I invite you to come to Fredericton and to New Brunswick as often as possible to discuss the crab fishing industry or any other industry that you might think worth a very thorough discussion and study.



**DR. A.W.H. NEEDLER,
DEPUTY MINISTER OF FISHERIES
AND FORESTRY OF CANADA,
CHAIRMAN.**

Mr. Premier, on behalf of all those present at this conference, I wish to tender our thanks for your welcome and for your words of encouragement. I assure you that we have been encouraged to come to Fredericton for this conference partly because New Brunswick is the province which has taken the greatest part in the development of this fishery, but also because we were so encouraged by the reception and the facilities we had at our last conference here. Thank you very much.

This conference, although we have said it is not officially one of the conferences called by the Federal-Provincial Atlantic Fisheries Committee, and although it has been arranged by the Department of Fisheries and Forestry of Canada, is nevertheless one of a series of conferences in which the five Atlantic provinces have taken part. These conferences have dealt with quite a variety of subjects — vessel design, vessel construction materials, fish protein concentrate, the herring fishery, and even seaweeds.

However, this particular one is to my mind as about as exciting as any of them.

A few years ago no-one would have predicted that there would be a fishery for what we call queen crab, worth several million dollars in this year. However, the fishery does exist; its existence is the result of some organized exploration followed by a good bit of enterprise on the part of the fishermen and of the industry. At this stage we don't know quite where we are going. We don't know the size of the resource, we don't feel that we have developed the best methods of catching crabs, of processing them for quality control, and we don't know what government regulations might be needed to preserve the stock and maintain quality. We don't want to rush either into over-fishing or into over-restriction. We don't want to put the industry into a straitjacket, and nevertheless we want to build an industry which will be a lasting source of livelihood to as many

people as possible. So the purpose of this conference is to explore all of these subjects quite frankly.

A conference of this sort develops a consensus, and arising from a conference of this sort there is a better



**MAURICE LESSARD, ASSOCIATE DEPUTY MINISTER,
DEPARTMENT OF INDUSTRY AND COMMERCE,
QUEBEC.**

Quebec is often considered, in the fisheries context, as a part of the Maritime provinces. I must admit that I am happy with such a status since, over the past 10 years, it has resulted in excellent relations with my colleagues of the Maritime provinces. This has allowed me to participate actively in the development, study and progress of fisheries. The Federal-Provincial Atlantic Fisheries Committee has been active for 10 years. Through this agency, we have learned to develop amongst ourselves an outstanding rapport which has resulted in the implementation of joint projects designed to develop the important fisheries resources.

Our past meetings on specific subjects have resulted in outstanding developments in the industry, sometimes occurring at a more rapid pace than anticipated. A moment ago, the Premier of New Brunswick said that the projected 6-year crab development program had been implemented in a 3-year period.

understanding and quite often, action is based on discussions in this sort of meeting. The meeting of course isn't expected to be an executive meeting. It doesn't decide. It is a meeting to exchange ideas and to recommend.

Today's conference finds us assembled with greater hopes than ever in anticipation of the Maritime Provinces making a great step forward in the exploitation of this most promising crab resource.

A most significant aspect of this development is that it has enabled many vessel owners to diversify their fishing operations to the great benefit of our fishermen and the industry generally. The disastrous consequences which can result from a fishery restricted to the exploitation of one species or group of similar species, like groundfish, are well known.

Today, your presence in such great numbers is an indication of your lively interest. I am confident that you will support the efforts of all governments concerned with the rational development of this resource. Your active participation and constructive criticism will resolve many of the questions. To each of you, I wish much success during this Conference.



**BRIAN MEAGHER,
DEPUTY MINISTER OF FISHERIES,
NOVA SCOTIA**

Before making my brief remarks I would like to make a few comments that I think would be of interest in discussing the crab industry of the Atlantic Provinces. I would like to make mention of a young French Acadian from Nova Scotia, Mr. Louis Deveau, formerly an employee of the Industrial Development Service of the Department of Fisheries at Ottawa, which was unfortunately unable to retain his services over a period of time. He moved on to greener fields. I remember taking Louis on a trip to Cape Breton three or four years ago, and going to a little French Acadian community called Cheticamp. Just when we arrived near the co-operative plant there, Louis said to me, "There is something unusual going on here" — this was in the month of September. He said, "I smell lobsters boiling". I said, "I am afraid you are wrong, that is the smell of fish meal, and the manager of the plant will be very flattered that the smell of fish meal, which usually is not too pleasant, indicates that his plant is in such good condition". When we went around the wharf we found that the fishermen there had been bringing in queen crab which, of course, had been known to a great many of us for a great many years.

The fishermen were cooking the legs and eating them along with some other beverages that seemed to wash down the product very comfortably, and on the spur of the moment Louis chartered a boat to go out and do some exploratory work with queen crab, and that was really the beginning of the development of the queen crab industry. Mr. Deveau and what is now the Industrial Development Branch of the Fisheries Service of the Department of Fisheries and Forestry deserve high marks for their efforts in promoting this industry, which in Nova Scotia is not as yet too important since we are, as the Premier said, conservative with a small "c", not having gone into the industry as heavily as New Brunswick, and we give full

marks to the Department of Fisheries in New Brunswick for really promoting the industry here.

It reminds me also that many times people feel that civil servants are a drug on the market, as you might say. They are not as aggressive behind big desks, and really don't do much work, but as a matter of fact after a quarter of a century of work as a civil servant, and of watching a good many people work under me, I feel that a great many civil servants do as much work as people do in private industry and get paid less for doing that work. I am reminded also, just in passing, of the remarkable achievements done by another member of the Industrial Development Branch, Mr. Wes Johnson, whom most of you know, who has been a dynamic factor in developing the herring industry on the Atlantic coast. I firmly believe that without Wes Johnson we wouldn't have the herring industry that has developed during the past few years. His work both with purse seiners and with the dramatic development of the midwater trawl I think is a great tribute to him and to his Department, and to his Director and Deputy Minister who gave him a free hand.

Ladies and gentlemen, I am pleased that the Industrial Development Branch acted favourably upon the request of the Atlantic Queen Crab Association that a meeting be held to discuss the development of the crab fisheries in the Atlantic Provinces. From our point of view, the establishment of a crab fishery is important for two main reasons. First, it creates much needed employment, and second, it helps to diversify our fishing efforts, and I think that this is very very important in the Atlantic Provinces.

We should like to see the employment created by this new fishery continue indefinitely, and for this reason, we are anxious to make the best use of our resources. We hope that our fishing practices will result in a continuing fishery

such as that for the Dungeness crab in British Columbia waters, and not like the production of king crab in the Pacific Ocean, which had a production of 1.5 million pounds in 1950 and went to 159 million pounds in 1966, then dropped to perhaps about a quarter of that in 1968. We would like to see the growth of this fishery in our province and in the other provinces follow an orderly pattern without frantically affecting the expansion of catching units and shore installations. While we have great faith that our groundfish fishing industry will remain an important factor in our economy we, the industry and governments, have been trying to diversify our fishing efforts. Success in herring and crab enterprises have justified our work in this direction.

From the results of our 1968 Red Crab Explorations on the edge of the Continental Shelf off the coast of Nova



**DR. LEONCE CHENARD,
DEPUTY MINISTER OF FISHERIES,
NEW BRUNSWICK**

Spider crabs, or queen crabs, as they are being gallantly called in recent years, have long been a nuisance to fishermen who were dragging the bottom of the Gulf of St. Lawrence for codfish and other groundfish species. The long-legged, triangular shaped crustaceans would get entangled in their gear and had to be picked out by hand from their catches and thrown back into the sea, except for a few which ended up in the boiling pot in the galley.

Lately, due mainly to a joint effort by fishermen, fish processors and governments to bring more diversification into an industry plagued by unyielding traditional methods and techniques, these oddities of the deep have suddenly awakened the imagination and interest of fishermen, investors, scientists, government officials and gourmets.

Scotia we expect that we will be fishing and processing this species from a point in the southwestern part of our province during the present year. It is important that the fishing industry, allied industries that supply and equip our vessels and plants, and government personnel acquire as much knowledge as possible concerning all the various aspects of our crab fisheries whether established or potential.

When I look at the agenda, Mr. Chairman, I believe you have included all the aspects of the fishery about which we have information and knowledge, and I am sure we will all come away from this meeting much better prepared to make the best possible use of our Atlantic crab resources.

Early in the '60s, some fish processing firms in the Shippegan area attempted to process crabs that were landed by local draggers. Although they put out a reasonably good product, the fishery was not developed. A year or so later, the Exploratory Fishing and Education Branch of our Department became acquainted with the potential of this unexploited resource and sought the financial and technical assistance of the then Industrial Development Service, Federal Department of Fisheries, to undertake a full-scale experimental project to study ways and means of catching and processing the crab, whose real name is *Chionoecetes opilio*, on a commercial basis and to explore new fishing grounds for future operation.

Some \$190,300 was spent by the governments on this experimental project since 1966 in New Brunswick and at

the close of the 1968 fishing season, 10 plants were processing queen crabs, 50 boats were fishing 1,825 crab pots and last year's landings amounted to 7,650,000 pounds, valued at \$684,000. The fishing and processing operations provided additional employment for some 800 persons. The estimated market value of the frozen product was over \$2.5 million. Five additional crab plants are presently under construction in the Caraquet-Shippegan area and, apparently, a few more fish processing plants are being modified to process crab meat as well.

As can be expected, this important fishery development did not materialize overnight, and I will review with you the steps taken in New Brunswick to achieve it.

Guided by the experience of fishermen who had encountered crab during their dragging operations, and by reports published by Brunel of the Quebec Biological Laboratory, Grande Riviere, and by Deveau and Aucoin of the Industrial Development Service, the Exploratory Fishing and Education Branch launched a pilot project at Shippegan in early summer of 1966 under the supervision of Mr. Rene Savoie. Mr. Louis Deveau of the Industrial Development Service co-ordinated the activities of the Federal Government from Halifax and federal observers were placed on the project to collect data and record statistics.

In June 1966, a 60-foot wooden side dragger, the M.V. "Gloucester 31", skippered by Mr. Will Mallet of Shippegan, was chartered by our Department for four months and exploration was conducted in the Gulf of St. Lawrence. After difficulties were encountered in keeping crabs alive, a steel tank was constructed in the fish hold for live holding. The tank (10' X 11' X 5' 6") was constructed of 3/16" steel plate and filled the hold completely. A pumping system provided constant circulation of sea water in the tank.

Both dragging operations and trap fishing were carried out. At the same time, we made arrangements with Gully Fish and Food Products Co., owned by Basile Roussel of Le Goulet, to process the anticipated catch of the "Gloucester 31". The firm installed the necessary equipment under the guidance of Mr. Hiram McAllister of Alaska, a technical adviser with I.D.S., and processed the 46,000 pounds of crab brought in that first year. The Vocational Training Branch of the New Brunswick Department of Education provided financial assistance to cover part of the cost of training plant employees in the new technique of queen crab processing.

The 1966 production of crab meat was about 10,000 pounds, and the finished product won market acceptance as canned and frozen products.

With that promising initial result, the experiment was continued in 1967 under the direction of Mr. J.E. Henri Legare, director of the Exploratory Fishing and Education Branch and Mr. Frank King, the I.D.S. representative from Halifax.

Our department chartered again the "Gloucester 31" for a period of 25 weeks to demonstrate the feasibility of landing commercial quantities of crabs over an entire fishing season using a special type of traps. The owner of the boat was guaranteed a revenue of \$1,200 a week. That meant that it had to land 300,000 pounds of crabs at 10 cents a pound during the season to earn that basic sum of money. Arrangements were again made with Gully Fish and Food Products Co. to process the catch. The boat landed 366,536 pounds of crab during the 25 weeks of the charter.

Meanwhile, a second fish plant, of the W.S. Loggie Company, equipped two vessels with crab traps and started processing crab at Shippegan around July of 1967. Their catch added up to approximately 300,000 pounds.

Experiments to keep crab alive in the metal tank were continued in 1967 on the "Gloucester 31". However, as soon as surface temperatures rose in early July, crab mortalities increased to such a point that the vessel was forced to abandon the system and use ice instead for the remainder of the season.

In early 1968, Mr. Roussel informed us that he had sold his entire production of 1967 and that he could have sold more. The meat was sold in frozen blocks because difficulties were encountered in the processing of canned crab meat. Several tests were made by Mr. Sam Simpson of British Columbia, another technical adviser with I.D.S., to solve the problem. This gentleman and his charming wife spent several weeks in New Brunswick and throughout the Atlantic provinces during the summer season. Their expert assistance was greatly appreciated by everyone involved in the new fishery.

The North Shore was a hive of activity in the winter of 1968. Traps were being built in the metal shops, there was an unusual amount of activity in the boat yards to get them ready and processors from Petit Rocher in the north to Cocagne in the southeast were actively planning crab operation.

1968 was a year of expansion. The program of the Exploratory Fishing and Education Branch was aimed at equipping more boats for crab fishing, testing the efficiency of a new refrigeration system on the "Gloucester 31", exploring for new crab fishing grounds and developing a modern crab processing operation.

Our department assisted in the conversion of six 48-foot draggers to crab fishing and each was provided with traps to expand our experimental program and to cover more ground.

Exploration for new crab fishing grounds was carried out in other areas of the Gulf of St. Lawrence. The chartered "Gloucester 31" covered 168 stations at 2½-mile intervals on a grid pattern extending 32 miles offshore from Miscou Island. This program of exploration will be discussed by Mr. Rycroft later on, so I will not elaborate beyond saying that all the data collected during the charter was made available to the scientists of the Fisheries Research Board's Biological Station at St. Andrews.

Federal observers were placed on the boats, on the wharf and in the plants to advise fishermen in proper handling techniques. Mr. and Mrs. Simpson were again hired as technical advisers by the Industrial Development Service and it appeared at times that they were the most wanted people in New Brunswick.

Even though converted groundfish draggers and Danish seiners have so far demonstrated their ability to adapt themselves easily to the new fishery, the Boatbuilding Branch of our Department conceived the idea of a specially designed crab boat of steel construction. Plans and specifications have been prepared by Mr. Nihat Ozerdem, our naval architect, and attempts are being made in collaboration with the engineers and naval architects of the Federal Department of Fisheries and Forestry to incorporate the most up-to-date information and techniques. Mr. Clarence Duguay, Director of our Boatbuilding and Maintenance Branch, will explain to you later the details of the proposed boat.

The development of the crab fishery in New Brunswick far exceeded our wildest projections. It has, at the same time, created many new problems. It is to the credit of those responsible for the development of the crab fishery to have had the foresight to pause for a few days in the

capital city of Fredericton to discuss these problems. It is my hope that they will come up with management policies or guidelines for the commercial exploitation of crab populations on a "sustained yield" basis, so that landings may be continued at a high level in coming years. Fortunately, the type of traps presently used seems to enjoy a high degree of selectivity, admitting very few females in the trap.

I have preached caution throughout the year but as everyone knows the lure of profits is irresistible, and since we live in a democracy, I can only advise. To the processors seeking my advice, I strongly suggest that the number of plants be limited for the next few years so that the potential can be determined before a heavy investment in plant and equipment is made. To those who are going ahead, I recommend diversification in their over-all operation. Species such as pink shrimps, lobster, *Cancer* crabs and molluscs can be processed along with the Atlantic crab.

Many important questions face this meeting. How much crab will be needed to satisfy the requirements of the five Atlantic provinces? How many boats? Can the crab populations sustain heavy fishing on a continuing basis? Should we encourage the establishment of more plants?

In New Brunswick, I foresee that to satisfy the requirements of the plants in 1969, some 16,000,000 pounds of crabs will be needed (an increase of 109% over 1968). If 1968 is an indication of a trend and assuming the weekly catches are maintained at the same level during the 1969 season as they were last year, the fishery will require the landings of 75 boats.

This is a very heavy quota to meet and I advise each processor to line up his own fishermen to be assured of regular landings. With the proliferation of plants, we are bound to see a sharp competition for the raw product and processors must be ready to face this eventuality and its consequences. I am not saying this to scare anyone, but as the French saying goes: "Un homme averti en vaut deux", or as you aptly say, "Forewarned is forearmed."

I hope that each of you will come up with his contribution to make the meeting a useful one. When looking at the agenda, I notice that discussion periods have been set aside during the meeting; therefore, should you have questions, please save them for that period.



**EUGENE GORMAN,
DEPUTY MINISTER OF FISHERIES,
PRINCE EDWARD ISLAND**

My remarks are going to be extremely brief. Were I to take up any of your time I would simply re-echo the questions referred to by Dr. Needler and Dr. Chenard. When we first conceived the idea of having such a conference it was because so many questions were unanswered in this phenomenal development and because of the phenomenal interest that has attended the crab industry in the Atlantic Provinces. We felt often, when we looked at this, that we were reaping a virgin crop and that we were deceived by the returns and projections that we saw before us, and this is why we all came here today to learn and to listen to the advice not only of the technicians in government levels who have taken part in this development,

but also to the industry people who are in the forefront of the development. That is why this committee that we are on is very happy indeed to see that what we conceived as a mini-conference, if you could call it that, has developed rather into something somewhat larger, evidencing the interest and, we hope, forecasting the good advice or the good knowledge that may proceed from this.

As I say, if I were to take any more time I would simply go over what has been already said, and I think that whatever time will be saved will be best put into the discussion which will initiate a little earlier.



**ERIC GOSSE,
DEPUTY MINISTER OF FISHERIES,
NEWFOUNDLAND**

I am very glad that we could hold this conference in Fredericton. It's a lovely old town. I suppose New Brunswick could be considered the centre of the crab fishing industry. In Newfoundland, of course, it is only in its infancy. We have one joint project going with the Federal Department of Fisheries and Forestry at Hants Harbour. There are some indications that we have large quantities of crabs around our coast. Fishermen have found them in all our bays as far north I think as White Bay. This species can become as important to us as the lobster industry. It will be a great boon to the inshore fishermen, who have always suffered because they have been tied to

one species, codfish, and as you know, during the past year we have had a pretty rough time of it. We need to diversify; we have done something with herring, we have gone from thirty million pounds in three years to about three hundred million pounds.

I hope that as a result of this conference more operators in Newfoundland and elsewhere will become more interested in this species, and that as a result we can build up for our inshore fishermen a sizeable addition to what is now, on the whole, an ailing industry.

PANEL DISCUSSION



Dr. Smith

Biology and Conservation of Queen Crab

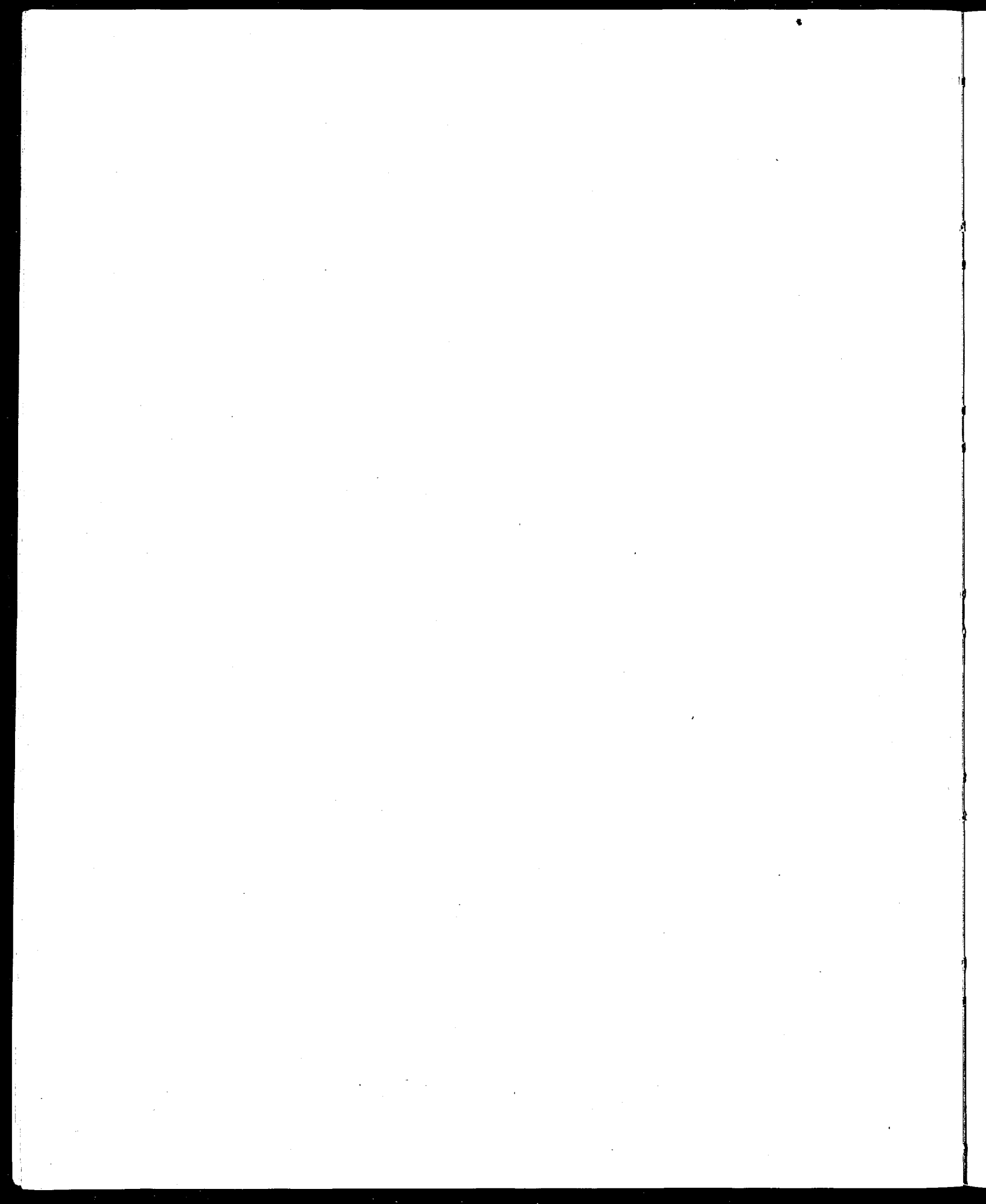
REMARKS BY PANEL CHAIRMAN DR. G.F.M. SMITH,
RESEARCH CONSULTANT,
FISHERIES RESEARCH BOARD OF CANADA, OTTAWA.

There are biological problems in a new and developing fishery, in particular the general problem of how big the fishery can be for the size of the resource. This is not an easy question to answer. One can say well, why not just try it on for size and see what happens, and if you go slowly enough this is certainly a safe way of doing it. If you go too fast and find the resource is not as big as had been hoped you are in serious trouble economically. You have over-expanded, the base for the industry is not what you thought it was, and you are in trouble. The kind of things that need to be known to answer the questions of the size of the stock and its availability for exploitation are not only how many animals are there, but also how fast do they grow, what is their birthrate, and what is their natural death rate? In addition to that, what death rate from exploitation from the fishery can this population stand? These questions cannot be answered instantly; that takes time and also requires a fishery. In other words, a sampling for such estimates requires that there be a fishery that does cause a fishing mortality in order to see what it does. Again, this must not be so rapid that it can't be kept up with. So this kind of problem is, in general, the problem of any newly exploited natural resource, whether it be fish or fur or forest. Reproductive rates, death rates and growth rates are very important. These things are ones that the biologists routinely try to estimate by various techniques. I think you will be impressed this morning with how little is known of the queen crab, not how much is known, and our four speakers will attempt to display to you what they do know, and what they would like to know, and how they propose to find this out.

The kind of thing that also is of concern is what is the distribution of the animal. I don't mean just local for a fish-

ery, but where does this animal live in general. This requires that you know what the animal really is. Is it a separate species here than up off Labrador or is it not? We would think almost certainly in this case not. But the animal of the same scientific name also occurs around the rim of the North Pacific, both the east and west side. This is an animal that is marketed by the Japanese in the United States under the name of snow crab. It has the same scientific name. There is some slight doubt, and this will be discussed later, I think. If this is exactly the same animal biologically, it leads us to think that the resource on the eastern coast of Canada may be very extensive, much larger than has actually been found so far. This remains to be proved. It has not been proved yet, but if it has a very wide world distribution you might expect its local distribution, although spotty perhaps, to be very extensive.

It is known that in Japanese waters the animal lives down to very deep depths and is captured there by a variety of means, and that it lives in very cold and deep water, somewhere around the freezing point of fresh water, from -1°C to $+2^{\circ}\text{C}$. So these are the things that are of interest, and our knowledge, as I say, in Canadian waters, is very limited indeed. We hope that the gentlemen we have with us on the panel will be able to point out not only our knowledge but our deficiencies in knowledge. In the subsequent discussion in which we will have questions from the floor, we will be able to answer at least a few of your questions. I guarantee nothing more than that, because the questions can easily floor us — we can say we don't know yet. This is too easy to say — I hope they will speculate, when necessary, in a reasonable sort of a way.



Biology and Conservation of Queen Crab



Dr. Wilder

I planned just to make some general remarks on the conservation of the queen crab. These are based on experience with lobsters, other crabs and so on. I hope to keep my remarks quite brief, in order to give more time to Dr. Watson's presentation. Dr. Watson has actually been doing most of the biological research on this species in the last year or so, and I am sure you will find some of the information he has uncovered will be quite interesting to you.

You all know that this fishery started just a very short time ago when the landings jumped from a million pounds in 1967 to about ten million pounds last year. The question is what is going to happen from now on. As more boats and more gear are used, I think we can safely predict that landings will continue to increase. Judging from other fisheries in other areas, different kinds of animals and so on, we would expect this fishery to reach a peak, be followed by a decline in landings, and finally have production level off at a point where the fishery operations are in balance with the stocks. Now what this peak will be, how long it will take us to get there, and what the level-off point will be we have no way of predicting. I might mention that in the lobster fishery the peak was reached in about 15 years, but that's quite a while ago. More recently in the king crab fishery in Alaska, there is a suggestion that their peak was reached in about 15 years also. How long a decline might take and just how this will develop no-one can predict. It depends on the size of the resource, it depends on the distribution of the animals, it depends on the price of the animals which in turn will determine how hard people are willing to fish for them. In other words, what will be the rate of exploitation.

by

Dr. D.G. Wilder

Fisheries Research Board of Canada,
St. Andrews, N.B.

As the stocks decline with an intensive fishery, if that in fact develops, we would expect the sizes of crabs to decline with, particularly, the large old ones becoming scarcer. We would certainly expect declines, perhaps market declines in your catch per unit effort or the number of crabs you get in a particular trap haul. So with this kind of a background we have been wondering about conservation measures, to make wise use of this resource, and a number of suggestions have been made. I should point out that the biologists have had about five summers to do preliminary, somewhat superficial, observations, and we have only been really working on this animal for about a year. To get the necessary biological knowledge for sound management will take many years. We haven't the time for that yet. It also, as Dr. Smith pointed out to you, requires an active, viable fishery that is quite widespread and is exploiting a fairly large segment of the available stocks of crabs. Of course such a fishery is just in its infancy, and we have no records of landings other, really, than for the last two years.

While we haven't a great deal of information, I should point out that it has been accumulating rather quickly. With a new animal, when you are so completely ignorant, there are a great many things to find out, and I think that Dr. Watson has made some interesting strides in this direction. But in our present state of knowledge I think we should be careful not to rush into regulations that may prove unnecessary, and may in fact deter the development of the fishery, the methods of fishing, and so on. So let me just briefly consider some of the regulations that have been mentioned or considered.

I will start with minimum size limits. The purpose of a minimum size limit, of course, is to allow more animals to

mature; that's one purpose. Of course our female crabs start to mature at about 2" carapace width, they are all mature by 3" — much too small to be of any commercial value, so there is no need there for a size limit. The males are a little bit different. They reach a much larger size. We are not sure when they mature, but Dr. Watson has figures suggesting that it is around 3" — that's a point we will have to clear up. Again, this is a size considerably below the limits that you people are interested in commercially. So a size limit to ensure reproduction does not seem justified at the present time. Another reason for size limits is the hope that the small crabs you may release will survive and grow well enough to increase your over-all production. We know so little of the growth rate of these crabs and we know nothing of their survival rate, so there is no assurance that throwing back small crabs will actually increase the yield. It could theoretically reduce it; this is possible. We are not prepared at the present time, in our present state of ignorance, to pick any particular size limit and to recommend it. The benefits from a size limit depend of course on how hard you are fishing the stocks. If you are fishing them very, very hard, a size limit is more necessary and more valuable. But we don't know how hard you are fishing the crab stocks. We have no real knowledge of this yet. Another point with regard to size limits, crabs do not stand handling as well as lobsters; they don't survive as well. They are not handled as carefully. They are not handled individually because they are caught in large numbers and they have a relatively low unit value as compared to a lobster. So the difficulty in getting fishermen culling their catch to release crabs at sea should not be underestimated. On the other hand, if they bring the crabs ashore and have them culled there, most of them do not survive a return to the fishing grounds. So because of these difficulties I say again that we are not ready to recommend a size limit.

Closed seasons have been suggested. They are used in certain countries. They are intended in part to cut down the fishing effort, and shorten the season so that there is less fishing effort expended. But this seldom works that way. You usually end up with a concentration of boats and more gear fishing hard in the short season, so you have about the same effect on the stock. Another reason for a closed season is to avoid crabs in poor condition, for example. This may be an important point, and maybe eventually we will come to closed seasons, but I think at this stage it might seriously restrict development of this fishery if we said, for example, that no fishing was to be allowed in months that might be specified by Dr. Watson.

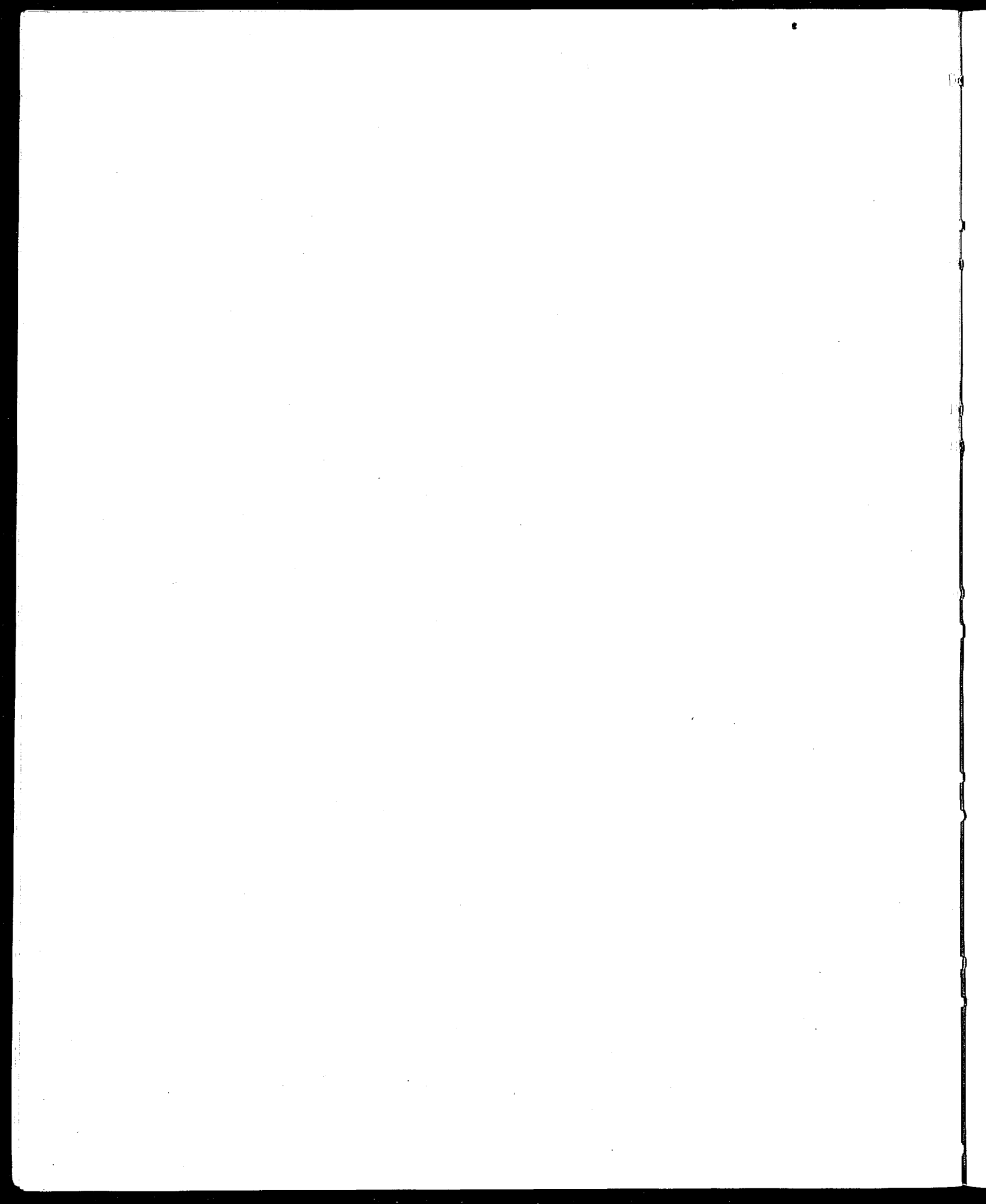
Gear restrictions — there have been views that all kinds of gear should be outlawed, such as otter trawls, Danish seines, tangle nets, and so on and so forth. I am pretty sure that there is quite good evidence that such gear can damage crabs and so reduce the quality of your pack. I think that is fairly well established. But you must remember that as the stock density comes down your catch per trap is going to decline, and it could reach the point where trap fishing in deep water for spider crabs becomes less and less profitable. In that case, you might have to try and use gear that can catch crabs cheaper, and one possibility that crosses my mind is that the crab fishery in part, might become an adjunct, say, to the groundfish fishery using Danish seines. That is going contrary to industrial thinking, but you have to look ahead to what the future landings are likely to be, and the whole economics of the picture.

We have thought that if people wish to protect female lobsters and small males better than they are now protected it might be possible to build traps with escape gaps in them, so that the smaller animals are released on the bottom with no handling by man, no exposure to air, and so on. Now while we haven't done the work, this seems completely feasible, and I think experiments could decide quite easily whether escape gaps in metal crab traps would be desirable. This would be relatively easy to control from the protection point of view. There are relatively few crab traps, and they are quite rigid. Their construction is quite solid, so that the spaces would not be altering as they are, say, in mesh sizes of trawl nets and so on, or as they are sometimes altered in wooden lobster traps. This seems as though it would be a possibility, but it would need to be worked on to determine what the optimum space would be. A few others have expressed concern that these durable metal traps that you lose, and in some cases you are losing 30% of what you are setting — some people have expressed concern that these keep on fishing. The trap catches some crabs and other animals which in turn act as bait for fishing the next day and the next week, and so on. We are not sure to what extent this occurs, but if it does occur it seems quite feasible that a section in the trap that would disintegrate in time be built into the trap so that after a period of X months or weeks, whatever it might be, the trap is no longer in a position to catch crabs.

One other point that has been suggested, and that has been in use with some fisheries, is to establish a quota. We would say that no more than so many million crabs can be landed annually; when that number is reached we close it off. Like all regulations, this one has advantages and

disadvantages. The big problem with this one at the moment for queen crabs is that we wouldn't know what quota to set. Without any background to the fishery we don't know what your grounds are capable of producing. Is it ten million pounds, twenty million pounds, forty or sixty? If we tried to set a quota on the basis of the last two years' landings we might be completely wrong and very restrictive to the future development of the fishery. So I

don't think we are ready for quotas yet. In general, in our present state of knowledge, we are not recommending regulations that may prove too restrictive and may be difficult to modify after they have been adopted for a few years, but we do think that the question of saving spaces and perhaps disintegrating sections of traps as a first step bear serious consideration.



Biology and Conservation of the Queen Crab



Dr. Watson

FISHERIES FOR THE GENUS *CHIONOECETES* IN OTHER COUNTRIES WITH A NOTE ON THE OCCURRENCE IN LABRADOR

World Distribution of Chionoecetes

Apart from its absence in the N.E. Atlantic, *Chionoecetes* spp. is virtually circumpolar in distribution. Off the coast of Asia its southern limit is off Kinkazan (E. Japan). In the Sea of Japan the species are *C. opilio elongatus* and *C. japonicus*. The genus extends northwards to the Sea of Okhotsk, around the Kamchatka peninsula into the Bering Sea. In North America it extends from the Bering Sea southwards to the Kodiak area of Alaska where it occurs mainly as the species *C. bairdii*. Further down the coasts of Washington and Oregon, the deeper water *C. tanneri* assumes greater importance.

In the N.W. Atlantic *C. opilio* extends from the Gulf of Maine northwards to the Gulf of St. Lawrence, Labrador and the West Greenland coast. No reports have been made of its occurrence in the seas and bays between Greenland and Alaska.

The Fishery in Japan

This fishery is large and long established. The crab known locally as Zuwai-Gani is caught mainly by Danish seining in vessels of 14-40 gross tons which make one-day trips. Some pots are used, mainly for the deeper-water form *C. japonicus*. Fig. 1 shows the distribution in the Sea of Japan and the areas most heavily fished.

Two papers presented for panel
discussion by Dr. J. Watson,
Fisheries Research Board of Canada,
Biological Station, St. Andrews, N.B.

Landings

The most productive area is the S.W. Japan Sea off Kyoto, Fukui and Tottori Prefectures (80% of the production from the Sea of Japan).

The annual catch of crabs represents approximately 18% of the total marine products of the Sea of Japan but brings in 50% of the total revenue made by fishermen. It is therefore a very valuable resource. Fig. 2 summarizes the landings from 1952-1966. It can be seen that a sharp initial rise in landings was followed by a relatively slow rise over the next 10 years. The large landings of 1964 to 1966 have apparently shown a downward trend in the last 2 years and there is genuine concern for the resource at the present time. Fishing intensities of over 41% have been calculated (Sinoda, 1968)*.

The Crab

The species fished commercially is mainly *C. opilio elongatus* which is distinct from its North American counterpart *C. opilio* (O. Fabricus). However, its habits, life history and biology appear to be very similar.

Regulations

Both males and females are processed, the minimum legal size being 75 mm (3") carapace width. Restricted seasons are enforced to allow mating, moulting and breeding to proceed. These are: November 1-March 31 - males; November 16-February 15 - females.

*Sinoda, M. 1968. Bull. Jap. Soc. Sci. Fish. 34(5): 391-394.

Bering Sea

Approximately 5 million lb of *C. bairdii* are taken by the Japanese tangle net fishery in the Bering Sea.

Exports

Much of the catch is canned and sold as Snow Crab in the U.S.A. at \$2.50 per lb retail. In the U.K. it is sold as Zuwai Crab retailing at \$1.50 per lb.

Alaska

A closely related species, *C. bairdii*, along with other *Chionoecetes* species, is trapped in fairly large quantities in the Kodiak Island region. The following table summarizes the Alaska catch data:

Year	Landings lb
1962	1,220
1964	13,940
1966	217
1967	118,392
1968	2,213,209 to 30 September

Prior to 1967, the total catch was only a few thousand lb. These crabs were caught incidentally to king crab operations. In 1967 the crab assumed greater commercial importance due to reduce king crab catches in 1966.

Closures imposed on the king crab fishery in 1968 and further closures in force this year prompted the Alaskan fishermen to begin fishing specifically for queen crabs using specially designed queen crab traps. For the first 9 months of 1968 the catch was over 2 million lb and is expected to reach 10 million this year.

Russia and Korea

Both these countries have fisheries for *C. opilio*. However, no figures are available as yet for landings, values, or the size of the fleet. Russia catches approximately 5 million lb of *C. bairdii* from her tangle net fishery in the Bering Sea.

Greenland

C. opilio occurs in fairly large numbers along the west coast of Greenland (Fig. 13) from Lat. 70°N southwards. As yet no commercial fishery has been reported.

Occurrence in Labrador

The British research vessel "Ernest Holt" caught in November 1962 over 3,000 lb of *C. opilio* in 85 fath off Hamilton Inlet Bank (55° 20'N, 56° 30'W) during a 1-hour trawl haul. Such a large catch indicates that commercial quantities may be available for exploitation by Canadian fishermen.

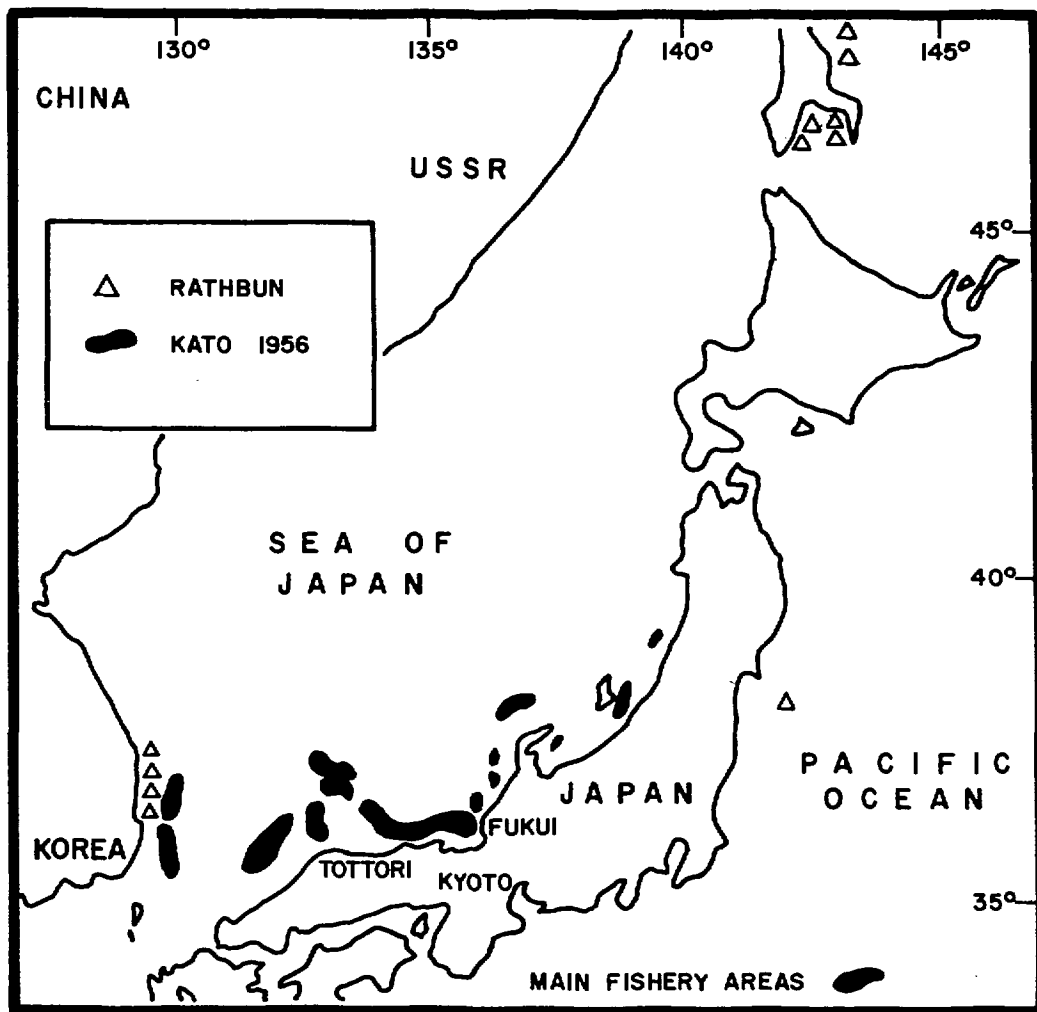


Fig. 1 The distribution of *Chionoecetes opilio* in the Sea of Japan.

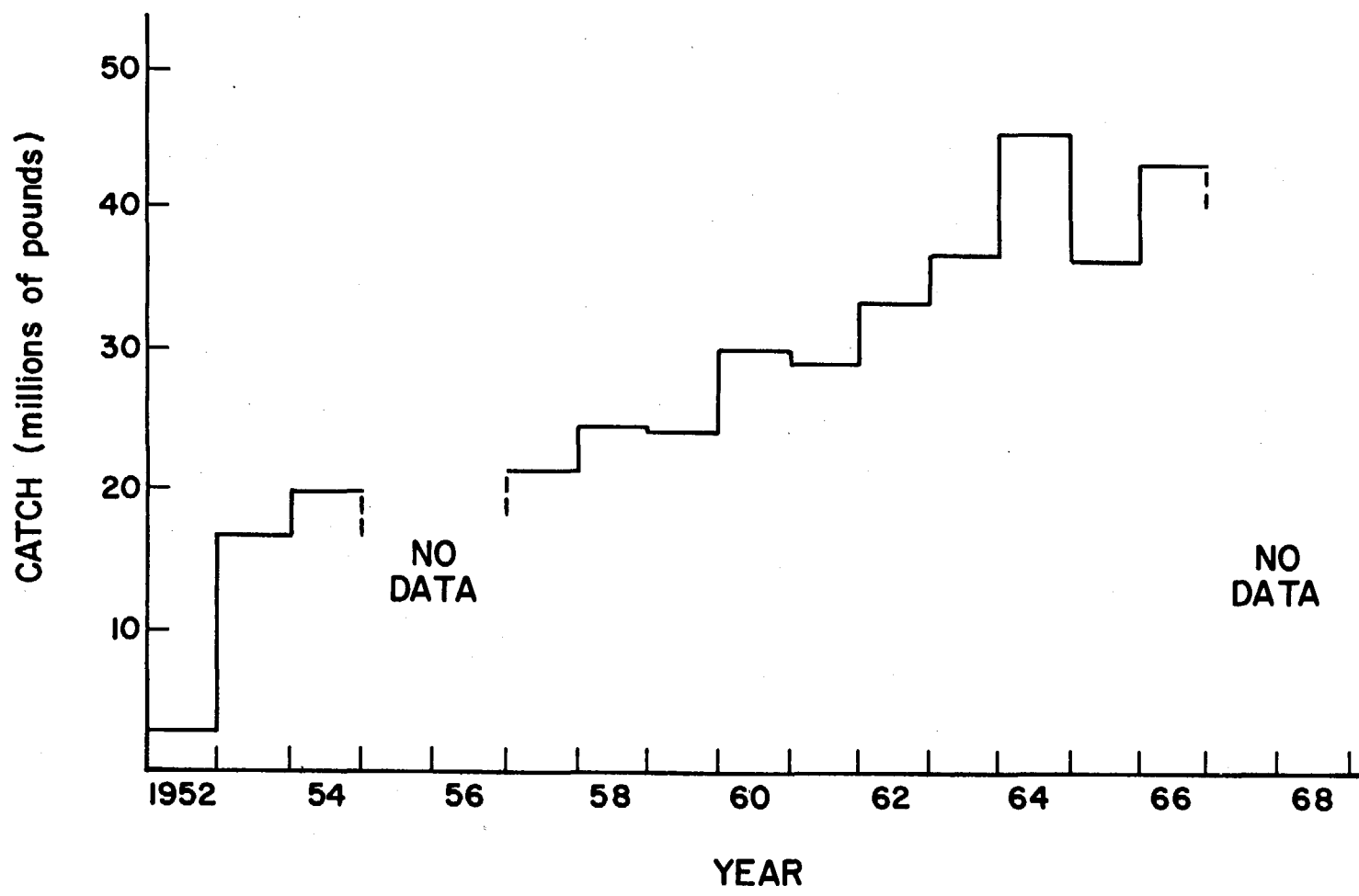
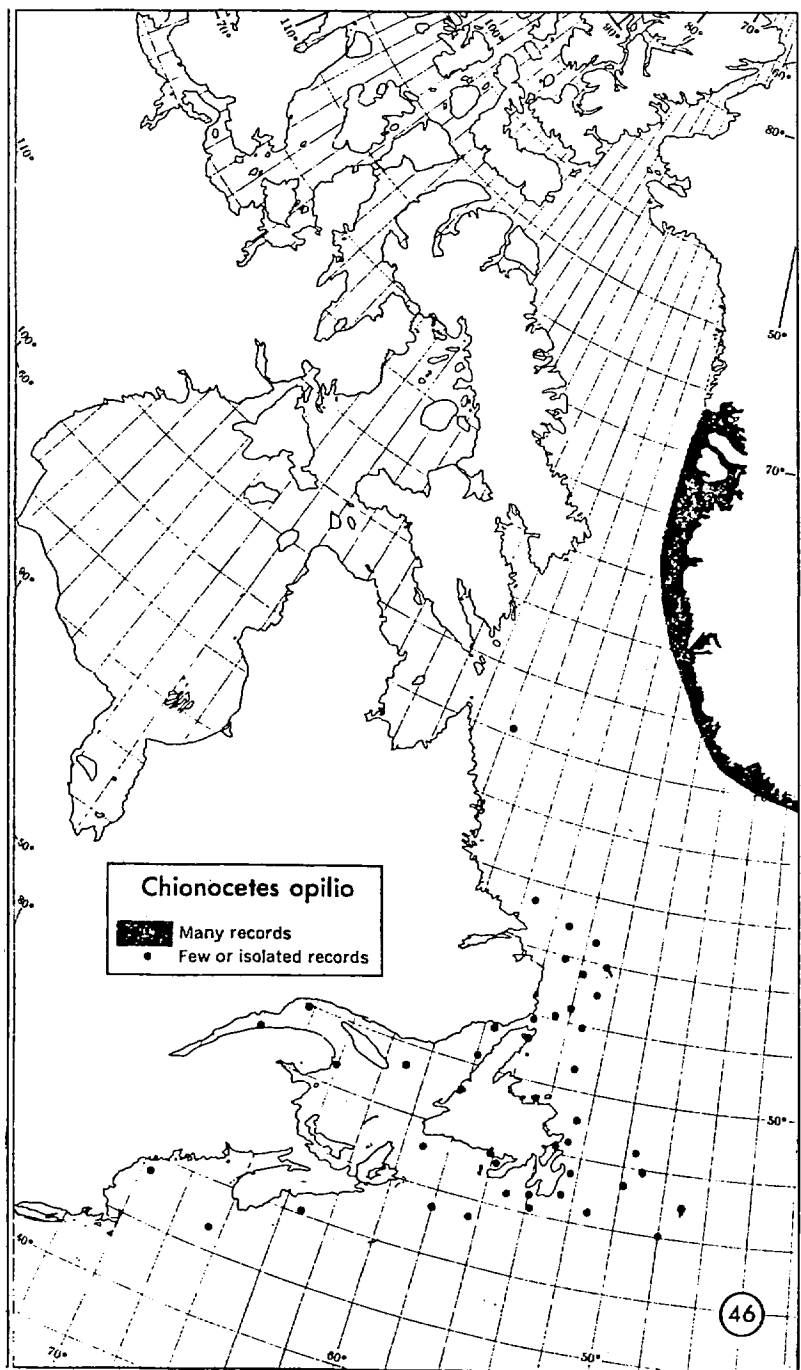


Fig. 2 Annual catch of *C. opilio* in the Sea of Japan



SCALE
1:25,000,000

Fig. 3. Distribution of *C. opilio* in the N.W. Atlantic.

BIOLOGICAL INVESTIGATIONS ON THE SPIDER CRAB CHIONOECETES OPILIO

Abstract

The mating process was observed in the laboratory. In nature mating occurs in spring and fertilized eggs develop during the year to be released as larvae the following spring. The females carry 20,000-140,000 eggs. After a larval period of approximately 4 months crabs settle on the bottom and grow by moulting into mature adult forms. Maturity occurs at approximately 50 mm and 60-70 mm carapace width for females and males respectively. Males at maturity are estimated to be 4 years old and are thought to become commercially available at 7 yr (4"), or 9 yr (4½"). Shell condition varies with season. Most soft-shelled males are encountered during August. No soft-shelled females were caught but new hard shells were common in July and August.

C. opilio was concentrated on mud or sandy mud bottom in 50-90 fath. No information is available on seasonal vertical migrations into shallow or deep waters. Present information suggests little lateral movement.

Recommendations for storage of crabs in water and air are given. Publications of the experiments are available.

The traps used commercially with mesh sizes of 5½-6" are highly selective for large males. Over 80% of the catches were males 4" and above. Trigger wires prevented escape of crabs but reduced the catching efficiency in most cases.

1968 landings increased tenfold from 1967. No reduction in the size-frequencies of crabs landed was observed. However, catch per trap haul in a heavily fished area (Chaleur Bay) was lower than that observed for less exploited (Cheticamp) and unexploited (Gaspe coast) areas.

A long-term study on the biology of the spider crab *Chionoecetes opilio* was begun in 1968. Preliminary studies had previously been carried out by Brunel (1960, 1961 and 1962) and Powles (1967, 1968A, B). An attempt will be made to outline the results of the 1968 field season and provide preliminary answers to some of the questions being asked by the industry.

Reproduction

The only barren mature females found this year were caught in June and represented less than 1% of the female catch that month. All other mature females caught were

bearing fertilized eggs or had recently liberated their larvae. The high fecundity of the population indicates that there is as yet, no shortage of adult males capable of fertilizing the females.

Copulation and Breeding

Successful copulation and breeding have only been observed in the laboratory where an 83-mm male successfully mated with a soft-shelled female which had just moulted to maturity (carapace width 52 mm). However, analysis of mature females throughout the year (Fig. 1) suggests that copulation takes place very soon after larval release, sometime from May to July and the female lays its new batch of eggs soon after copulation. Sperm is stored in the sperm sacs to which are attached the ovaries. Ova pass through the sperm sac, become fertilized, and emerge from the genital pores to become attached to the abdominal appendages forming the egg mass.

The Egg Development

Fig. 1 shows the development of eggs throughout the year. New orange-coloured eggs gradually change by cell division to form the embryonic larva. Eye spots appear on the eggs during September but reach a maximum during the winter months when the eggs become dark brown to purple in colour.

Hatching occurs from late April to June, the larval period lasting approximately 4 months. At the last larval moult settling occurs and the first true crab form appears. These juveniles continue to moult into adult crabs. Copulation and breeding occur soon after larval release and the life cycle continues.

Fecundity

The number of eggs carried by a female varies with size from 20,000 (carapace width 50 mm) to 140,000 (carapace width 90 mm). Fig. 2 summarizes these data.

Growth, Moulting and Age

Growth in crustaceans occurs when the hard shell is periodically cast off. The intervals between moults increase with age and growth often varies from place to place. All recognizable hard parts are shed leaving no structures such as annual growth rings as aids to age determination. Estimation of age therefore is extremely difficult. Crustacean growth and age determination can be studied in various ways. Some of the most frequently used approaches

are (1) growth in the laboratory, (2) detection of modes in size-frequency data, (3) release and recapture of tagged specimens, (4) growth in cages kept in the sea, (5) growth of animals which moult in commercial traps.

The first two of these approaches have been used at St. Andrews. Approach (3) requires a tag which will not be lost during the moult and will be easily visible to the fisherman. All our experiments to develop such a tag have failed so far for the queen crab. Approach (4) may be used this year, but it has the disadvantage of restricting the animal's movements and limiting its food supply. No crabs have been observed to moult in commercial traps.

Growth and Age

Adults 70-140 mm kept in the laboratory since February 1968 have yet to moult. Juveniles 5-45 mm carapace width held since October 1968 have moulted and provided important growth information. The use of Hiatt's (1948) method for plotting crustacean growth data, the size-frequency modes present in juvenile queen crab populations, and comparison with published data on queen crab growth in Japan permit preliminary estimates of growth and age for the Canadian Atlantic queen crab. Fig. 3 shows the size-frequency of small crabs collected by beam trawling in Chaleur Bay. Even on this rather small sample definite modes are apparent. Fig. 4 shows the growth increments obtained in the laboratory to date. Superimposed on this laboratory curve are data taken from Kon (1968) which represent the modes of size-frequencies taken in the field. It can be seen that up to 35 mm initial carapace width our data agree. After this size our data are scanty, therefore little can be said about growth of larger forms. However, assuming that Kon's data up to 66 mm post-moult width are correct, it will take the male only eight moults from the first crab stage to reach this size. If there were two moults per year, males of this size would be 4 years old. Further projection beyond this stage is pure hypothesis but may be useful as a first working model for this meeting. I will assume annual moulting from 65-100 mm and bi-annual moulting thereafter. Typically the percent carapace width increase at each moult decreases with age. Up to 50 mm the observed laboratory increase was over 30%. The percent increase up to 100 mm was assumed to be 20-18% and 10% thereafter. Table I and Fig. 5 provide the data for the first working model of the growth and age of *C. opilio* males. One hundred and two (102) mm carapace width is equivalent to 4 inches, the presently acceptable size for commercial crabs. It can be

seen from this model that approximately 7 years will elapse before this size is reached. After 9 years the crab should reach 114 mm or 4½ inches carapace width. The largest crab caught to date has been 156 mm and from this model it would be approximately 15 years old.

Shell Hardness

The shell conditions of about 20,000 crabs were observed in Chaleur Bay during 1968. Shell hardness varies seasonally (Figs. 6 and 7). Males moult from June to September. No soft females were caught, but new shells were evident from June to October, indicating moulting at some earlier time.

Size at Maturity

Morphometric studies and analyses of the reproductive organs of males and females indicate that maturity may occur at similar sizes.

Morphometric Studies

1. *Female*: The maximum width of the abdomen (segment 5) was plotted against carapace width (Fig. 8). A distinct break at 50 mm carapace width indicates the onset of maturity and the typically broad abdomen associated with mature females.
2. *Males*: In many Crustacea the relative proportion of the claws increases with regard to carapace width at maturity. Claw length and breadth plotted against carapace width (Fig. 9) show distinct breaks at 60-70 mm carapace width which indicate the attainment of maturity at this size.

Examination of Reproductive Organs

1. *Female*: A female was judged to be mature if it was carrying eggs or empty egg cases. Fifty per cent maturity occurred at a carapace width of 50 mm (Fig. 10).
2. *Male*: Weight of the vas deferens plotted against carapace width (Fig. 11). Maturity seems to occur at 70-80 mm carapace width. However, this figure should be viewed with caution as only a few samples have been analysed to date. Furthermore, it is not known whether a male upon reaching maturity is capable of mating immediately. One point is certain however. A male of 83 mm in the laboratory successfully mated with a female which the following day produced a batch of fertilized

eggs. It is likely that males smaller than this size will be able to successfully mate. Japanese researchers have quoted the following minimum sizes at maturity: female 50 mm, male 66 mm. Further research is clearly necessary to determine the minimum size at which a male can successfully breed.

Depth Distribution

Rathbun (1925) lists the depth distribution of *C. opilio* to be from 10-1200 fathoms. In the Gulf of St. Lawrence this species has been found from 20-130 fath. Table II shows the average catch per trap haul in relation to depth in an unexploited area using 6' X 6' X 30" traps and a standard bait throughout. Crabs are abundant 30-100 fath water, the majority being concentrated in 50-90 fath. This research was carried out by the Province of New Brunswick and was limited to the period late July to late August. The same pattern emerged from our FRB cruise in the same area during September. No information is available as to whether the distribution pattern remains constant throughout the year, but with monthly cruises in 1969 the variation in distribution with depth should be evaluated.

Tagging and Movements

Tagging crabs for growth information was discussed previously. Tagging also provides invaluable information for determining seasonal movements and rate of exploitation by the fishery. Both factors are important for rational management of the fishery.

In 1966, 272 crabs tagged with numbered vinyl "spaghetti" tied around the carapace were released in the Grande-Rivière area. Thirty-one tags have been returned to date. Table III shows the yearly returns and the estimated movements. Clearly, no extensive movements have been detected; some crabs released for 2 years were caught near the release point. Japanese workers similarly find little movement among queen crab populations. The low intensity of fishing to the end of the '67 season accounts for low returns. Most of the crabs must have died or moulted by 1968 because they should have been caught by the intensive trap fishery present during that season.

In 1968, 300 crabs tagged through the leg with a numbered plastic "sphyron" tag were released in and around Gaspé Bay in October. The shell of each crab was further clipped according to size. It is hoped that either the tag or the mark will last through a moult. In 1969, an

extensive pre-season tagging will be carried out in the Gaspé and Cheticamp areas. Two types of tag will be used: (1) shell marks for growth studies, (2) tie-on numbered vinyl tags for movements and fishing intensity studies.

Food

Queen crabs are quite omnivorous and various kinds of bait will attract them. Stomach content analyses have shown that small Crustacea, e.g. shrimps, hermit crabs and amphipods; bivalves; bristle worms; and brittle stars form important components of their diet. Analysis of the bottom fauna has shown that these forms are abundant on the muddy and sandy mud bottoms which *C. opilio* seems to prefer.

Physiological Studies

Oxygen Consumption

Studies were made to determine the rates of water flow required for storage of live crabs in tanks. Routine oxygen consumption at 5°C was not appreciably different from lobsters tested at the same temperature (Fig. 12). It is recommended that for routine storage the water flows recommended by McLeese and Wilder (1964) for lobsters will be sufficient. Oxygen consumption by the crabs increased by about 50% when food was present (Fig. 13) indicating that water flow should be increased proportionately when crabs that have recently been feeding are stored.

Temperature Resistance

Mortality among groups of crabs was measured at various temperatures in water and moist air to provide information on their temperature resistance and on suitable temperatures for their live storage. These studies were made by Dr. D. W. McLeese.

1. *Temperature resistance in water.* Crabs caught by trap off Cheticamp, Nova Scotia, were held in the laboratory for 1 to 9 weeks and acclimated to 5°C or less. Time to 50% mortality for crabs tested at temperatures ranging from 12 to 20°C were observed (Fig. 14). Generally speaking, crabs do not need to be stored for more than a few days between capture and processing. Temperatures of 17°C and above caused rapid mortality and should be avoided. Temperatures between 12-16°C caused 20% mortality in 10 days (50% in 18.8-29.0 days) and may be satisfactory for short-term storage. For

long-term storage, temperatures must be lower than 12°C.

2. *Temperature resistance in moist air.* Resistance to three temperatures in moist air (RH 90-100%) was determined with crabs held within $\pm 9^\circ\text{C}$ of each test temperature. Time to 50% mortality decreased from 8.5 days at 3°C to 1.9 days at 13°C (Fig. 15). These results were similar to those for 0°C acclimated lobsters (McLeese, 1965).

None of the crabs in moist air at 3 and 8°C died within 4 days which suggests that live storage in cold, moist air is practical for short periods of time.

Trapping Behaviour

Experiments with unmodified entrances and entrances covered by trigger wire showed that escapement occurred from the former only. However, traps with trigger wire caught fewer crabs than unmodified traps.

Experiments with different sized meshes showed that the current mesh size, 5½-6 inches, used commercially is reasonably efficient in allowing escape of commercially unacceptable crabs. Over 80% of trapped crabs are more than 4 inches carapace width. However, similar experiments to those on lath spacing in lobster traps may be necessary to prevent the capture of small, unwanted males and females.

The Resource and Fishing Effects

The Fishery

Serious commercial interest in queen crabs commenced in 1967. Previously landings were small (12,000-74,000 lb per annum) and restricted to exploratory vessels and catches made incidental to trawling or gill-netting operations. In 1967, approximately 15 vessels landed 1,008,879 lb. In 1968, approximately 80 vessels landed more than 10,500,000 lb*. In 1969, more vessels are expected to commence fishing operations and landings should increase significantly. Fig. 16 shows landings by province for 1967 and 1968.

*Data exclude Newfoundland for which landing data were unavailable.

Fishing Pressure

At this early stage of our research, no reduction in the size-frequency of crabs landed is apparent. Figs. 17 and 18 show size-frequencies of trap-caught animals in the Chaleur Bay and Cheticamp areas. Clearly, the Cheticamp fishery has a higher proportion of large males, 97-99% of the catch being over 4 inches. Fig. 19 shows the October 1968 size-frequencies in Gaspé Bay. It can be seen that this area supports a larger population of small crabs. It is possible that the large, old males may have been cropped off by the many years of gill-netting operations in this area. Increased fishing pressure on the apparently sedentary stocks will crop off most of the large, old crabs rather quickly and a significant reduction in the average size-frequency is to be expected.

Catch per Trap Haul

Information collected from log books supplied to fishermen has shown that Chaleur Bay has a lower catch per trap haul than the Cheticamp area (Fig. 20) which has been less heavily fished and a much lower catch per trap haul than the unexploited area off Gaspé surveyed by the Province of New Brunswick last year (cf Table II). Catches became so poor in Chaleur Bay in August that many vessels moved to the Bonaventure area for the remainder of the summer. Catch per effort data can help us spot fishing pressure effects rapidly and are essential for the rational management of a fishery. One cannot urge too strongly the need for the continuing support of fishermen in keeping good log records if we are to do something worth while for this fishery.

With such an explosive situation on our hands it is clear that the industry will require answers to biological questions much more quickly than we can provide them. However, our task will be helped somewhat if the closest co-operation between federal and provincial agencies and commercial operators is observed.

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Table I. Growth and age of *C. opilio* males.

Pre-moult width mm	Post-moult width mm	Increment mm	%	Moult no.	Age	Source of data
2.2	3.1	0.9		—	1st Crab	Kon (1968)
Megalopa						
3.1	4.6	1.5	48	1		Present work and Kon (1968)
4.6	6.5	1.9	41	2	1 yr	
6.5	9.7	2.2	34	3		
9.7	13.5	3.8	39	4	2 yr	Kon (1968)
13.5	19.6	6.1	45	5		
19.6	27.3	7.7	39	6	3 yr	
27.3	36.8	9.5	35	7		
36.8	49.2	12.4	34	8	4 yr	Hypothetical data
49.2	65.2	16.0	33	9		
65.2	78.0	12.8	20	10	5 yr	Hypothetical data
78.0	91.0	13.0	18	11	6 yr	
91.0	104.0	13.0	15	12	7 yr	
104.0	114.0	10.0	10	13	9 yr	
114.0	125.0	11.0	10	14	11 yr	
125.0	137.0	12.0	10	15	13 yr	
137.0	151.0	14.0	10	16	15 yr	

Table II. *C. opilio* sizes caught per trap haul in relation to depth of water off Gaspé July/August 1968.

Depth		Catch per Trap Haul				
range	av.	Berried female	Soft	< 4"	> 4"	
20-29	24	2.8	+	3.2	34.9	
30-39	34	2.5	+	4.4	38.5	
40-49	45	5.9	+	7.0	64.4	
50-59	54	8.7	+	10.8	105.1	
60-69	63	21.5	+	8.8	107.0	
70-79	73	10.2	+	7.5	92.8	
80-89	83	2.0	+	7.0	78.6	
90-99	92	0	+	7.0	40.0	
100-109	100	0	0	0	12.3	
110-119	110	0	0	0	0	
120-129	128	0	0	1.5	1.5	

+ = < 1 per trap haul.

TABLE III

Tag returns and movements of *C. opilio* in the Bay of Chaleur.

Date of release	Recapture Date					
	1966		1967		1968	
	Duration	Movement (miles)	Duration	Movement (miles)	Duration	Movement (miles)
July 20/21	1 week	0	16 mth	2	25 mth	?
1966	1 "	0			26	15
Aug. 8/24	1 "	0	10	2	21	5
1966	1 "	0	10	2	21	5
	1 "	0	11	2	22	1
	1 "	0	11	1	22	1
	2 "	0	11	1	23	1-2
	2 "	0	12	0	26	4
	2 mth	1	12	2		
	2 "	1	14	4		
	3 "	1	14	4		
			14	8-20		
			?	4		
Total recaptures	11		12		8	
Vessels fishing	1		3		60	

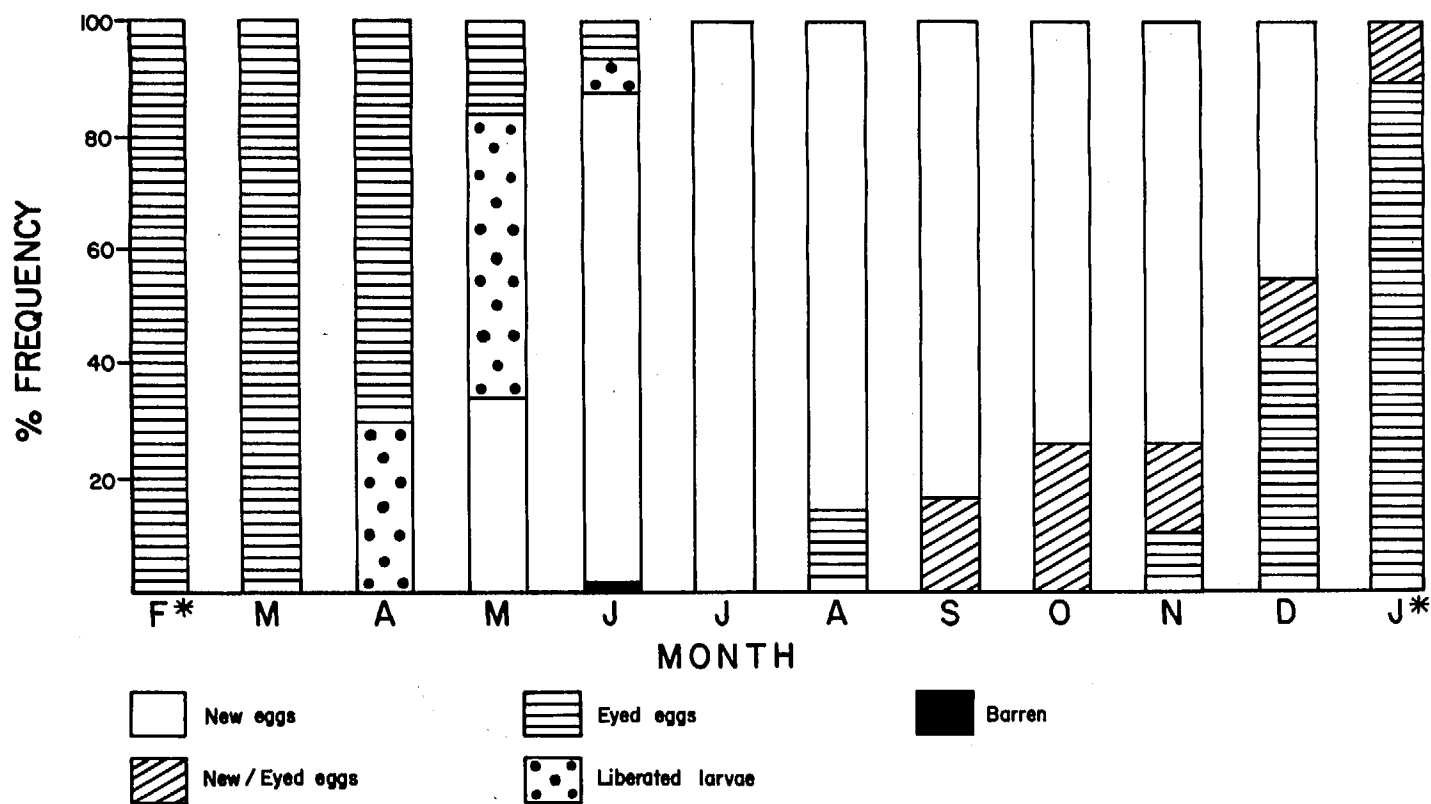


FIG. I SEASONAL EGG DEVELOPMENT - C. opilio

* Not measured - estimate only.

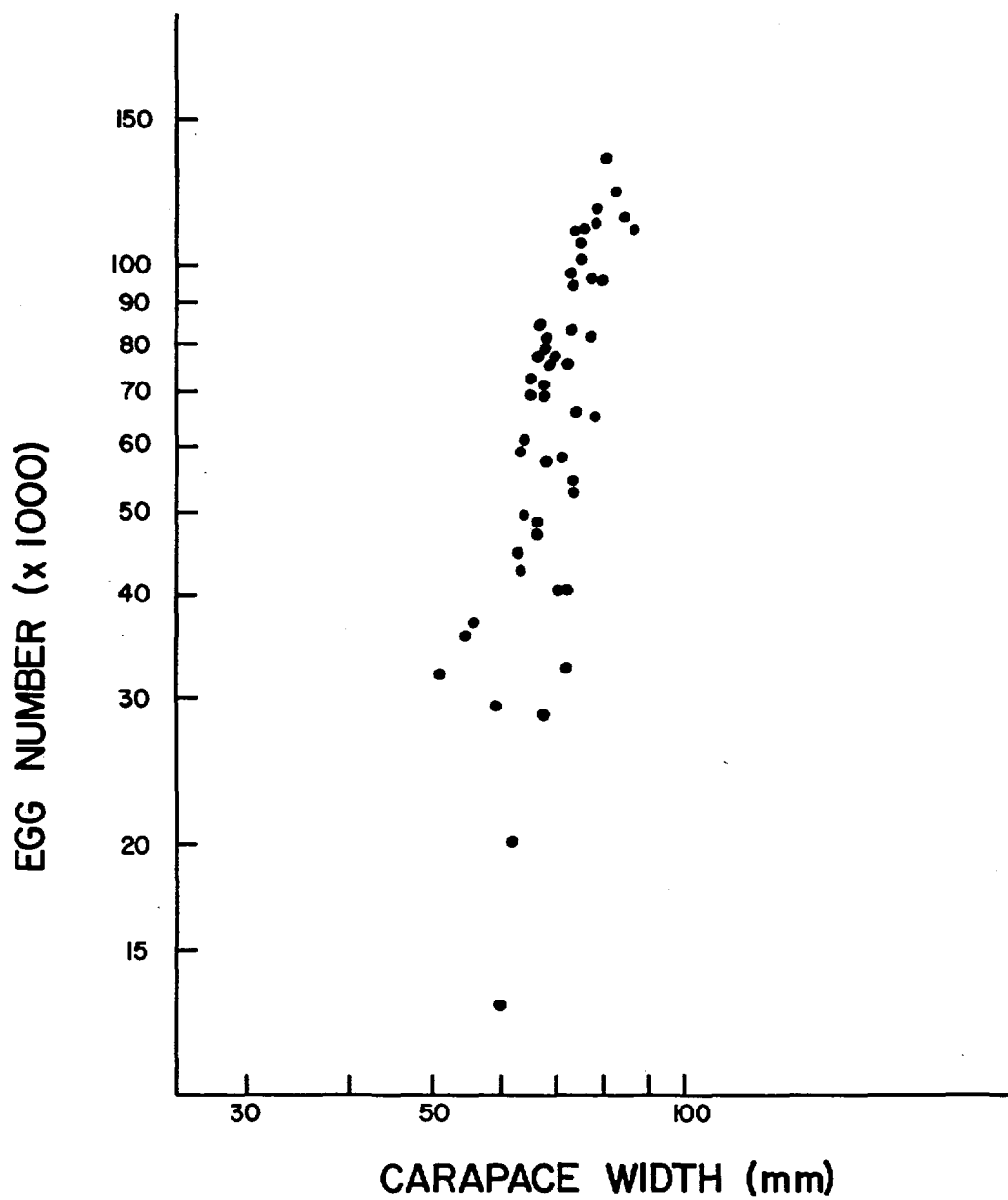


FIG. 2 NUMBER OF EGGS CARRIED BY FEMALE
C. opilio

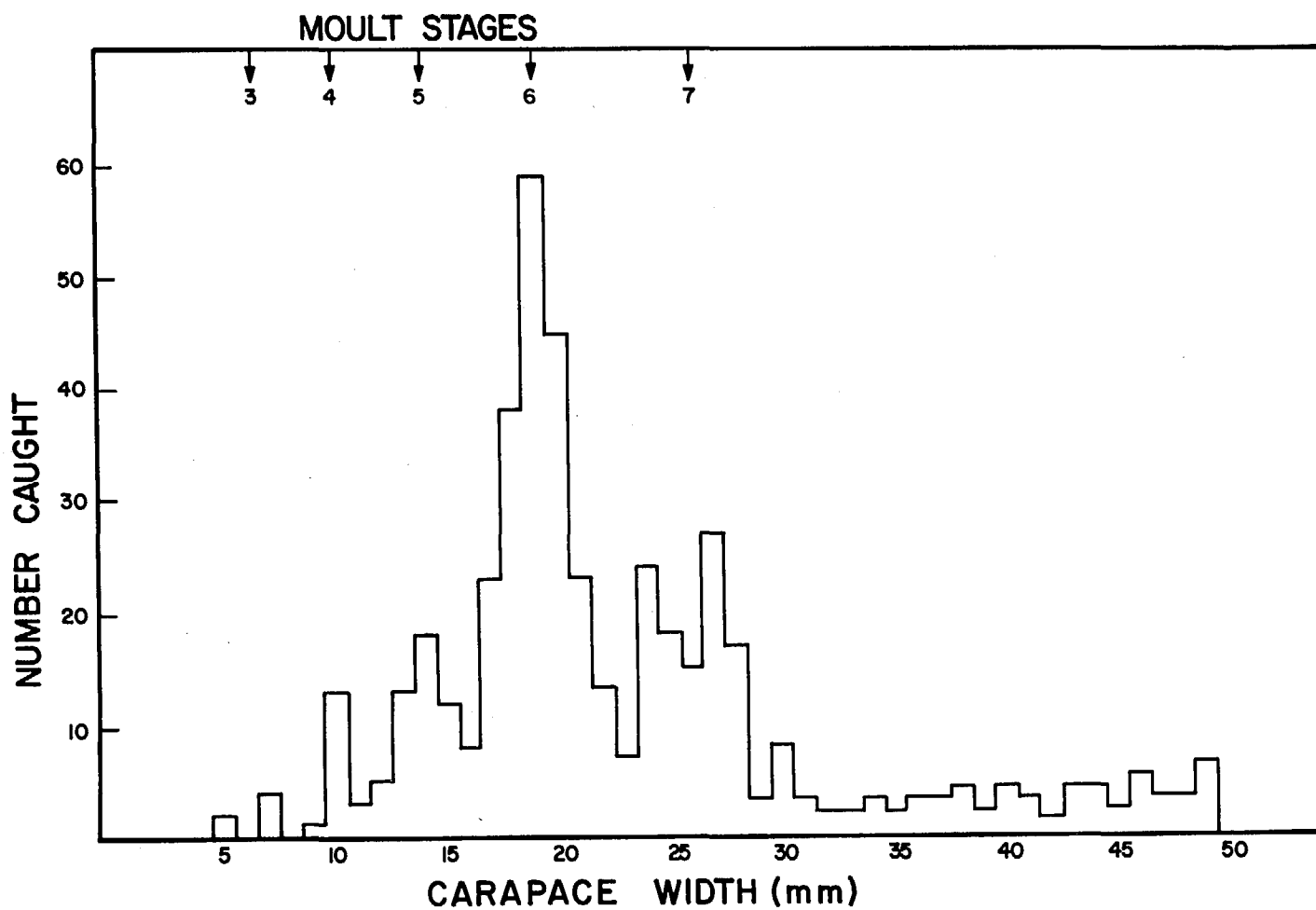


FIG. 3 CARAPACE WIDTH FREQUENCY - JUVENILE *C. opilio*

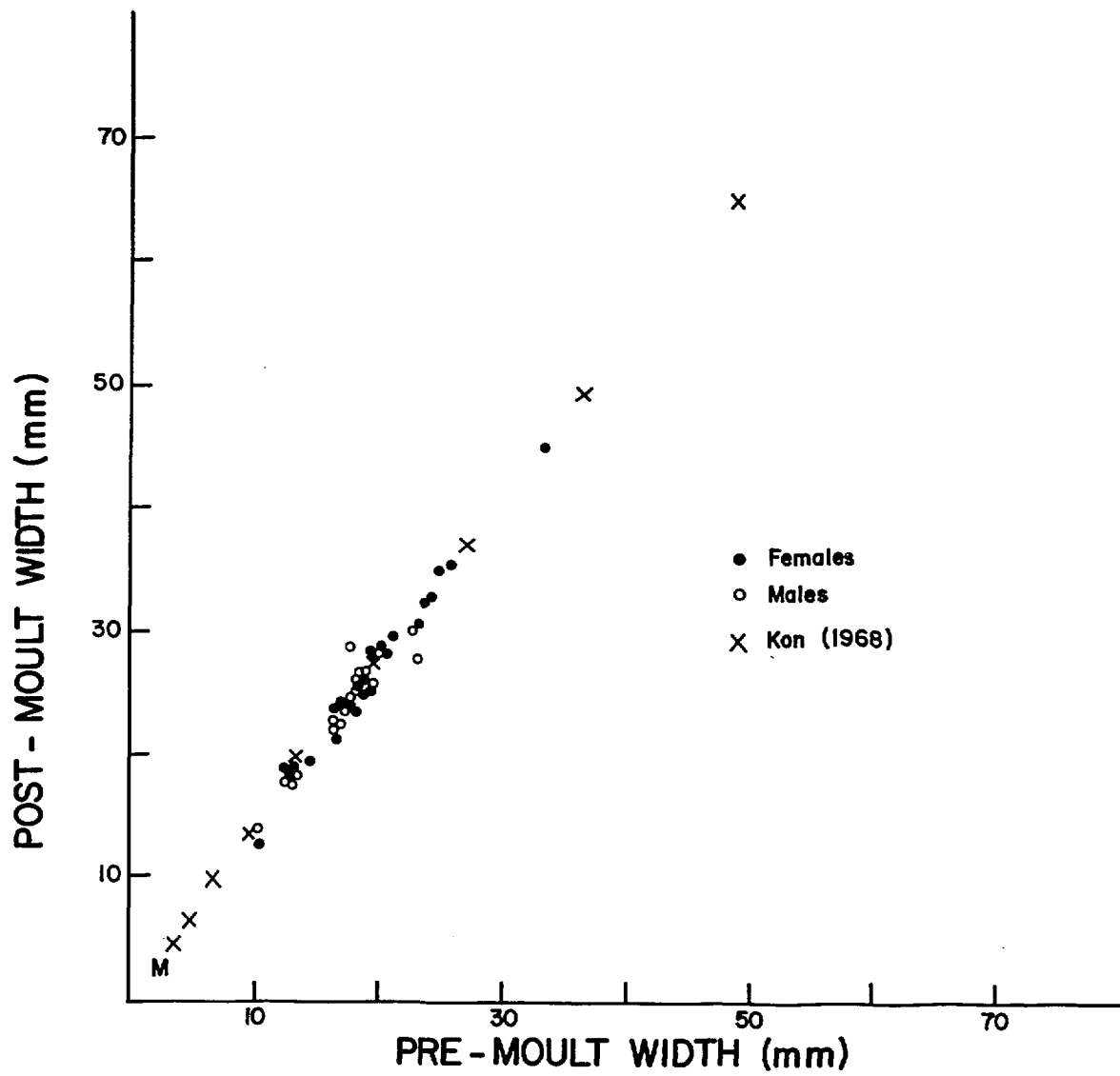


FIG. 4 GROWTH OF C. opilio

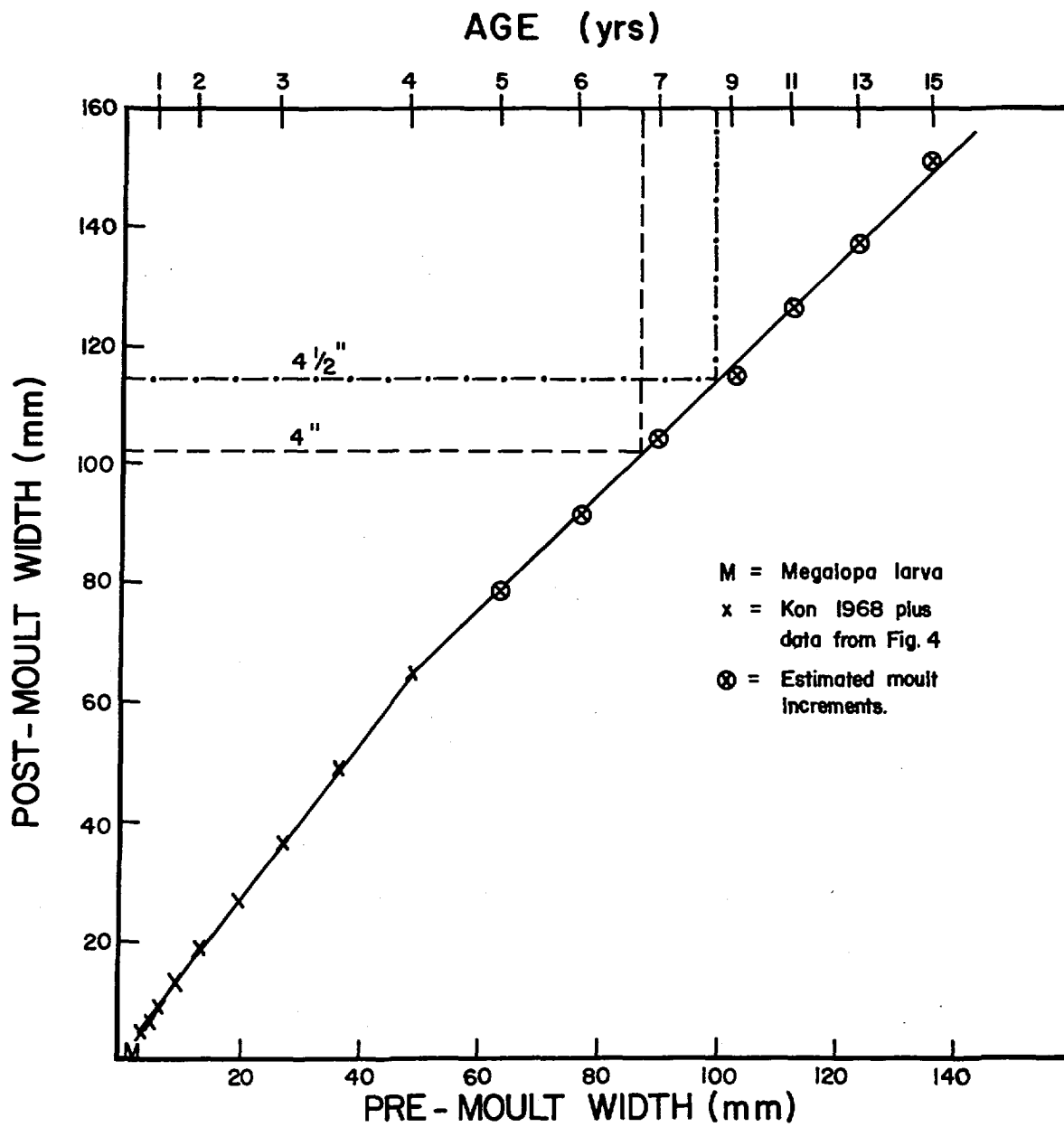


FIG. 5 PRELIMINARY WORKING MODEL FOR GROWTH AND AGE OF C. opilio

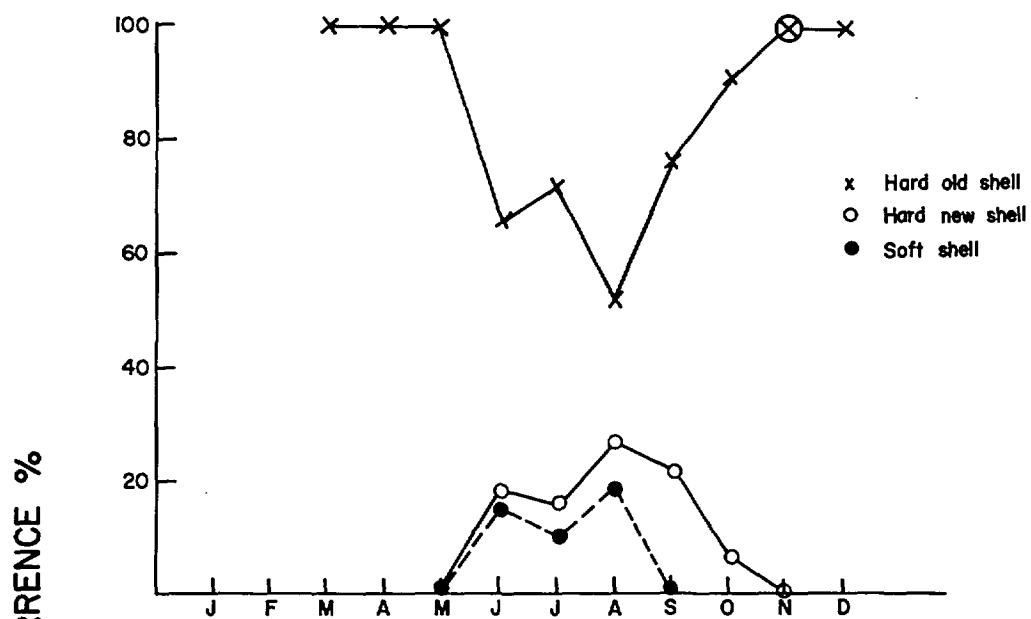


FIG. 6 SEASONAL SHELL CONDITION - MEALES

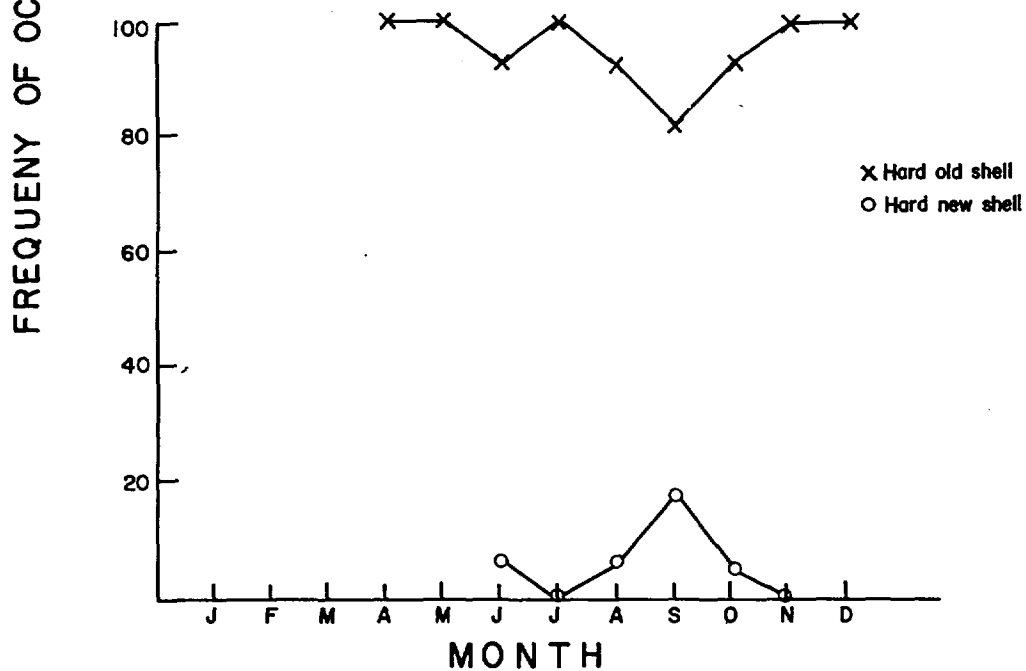


FIG. 7 SEASONAL SHELL CONDITION - FEMALES

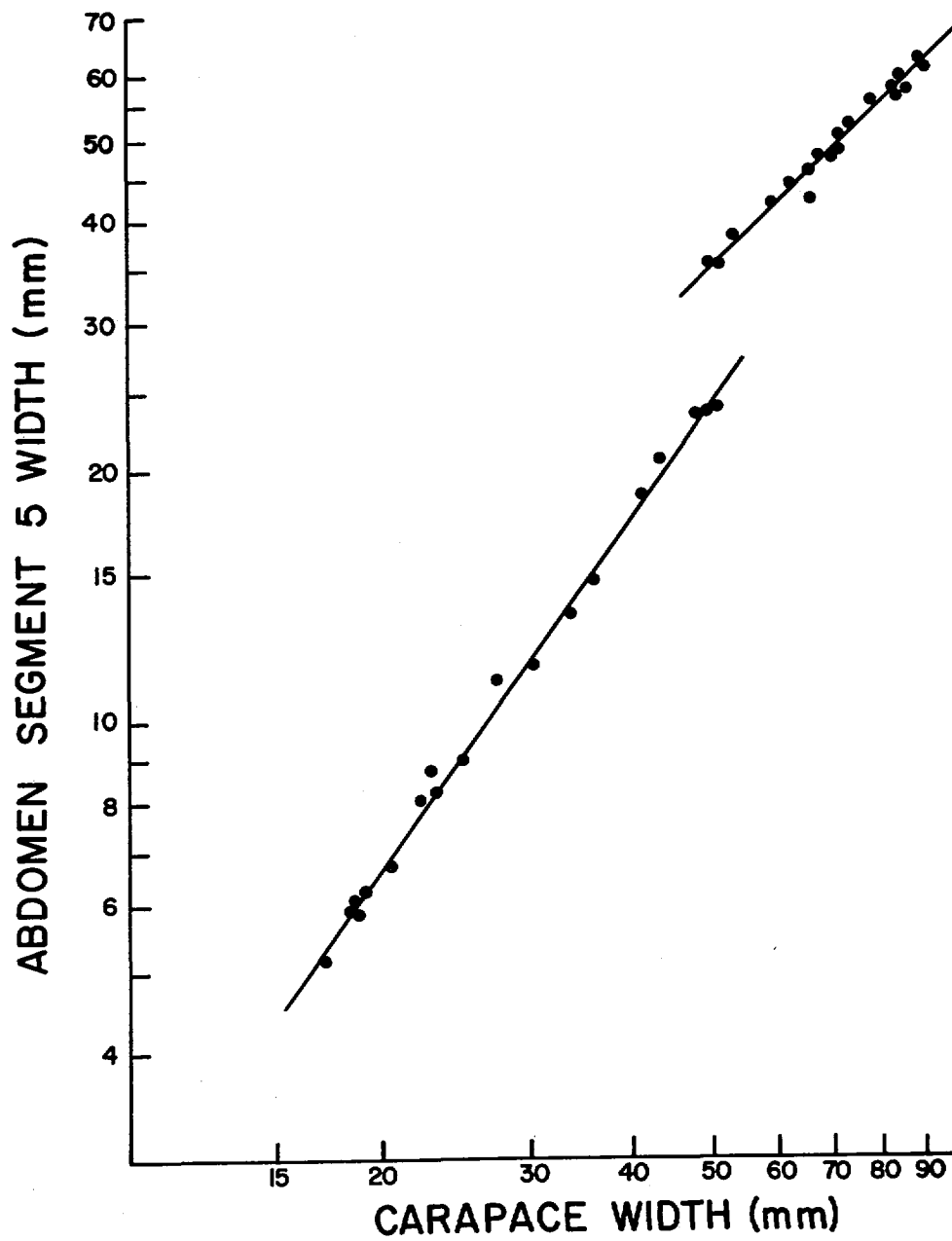


FIG. 8 RELATION BETWEEN CARAPACE WIDTH AND ABDOMEN 5 WIDTH - FEMALE C. opilio

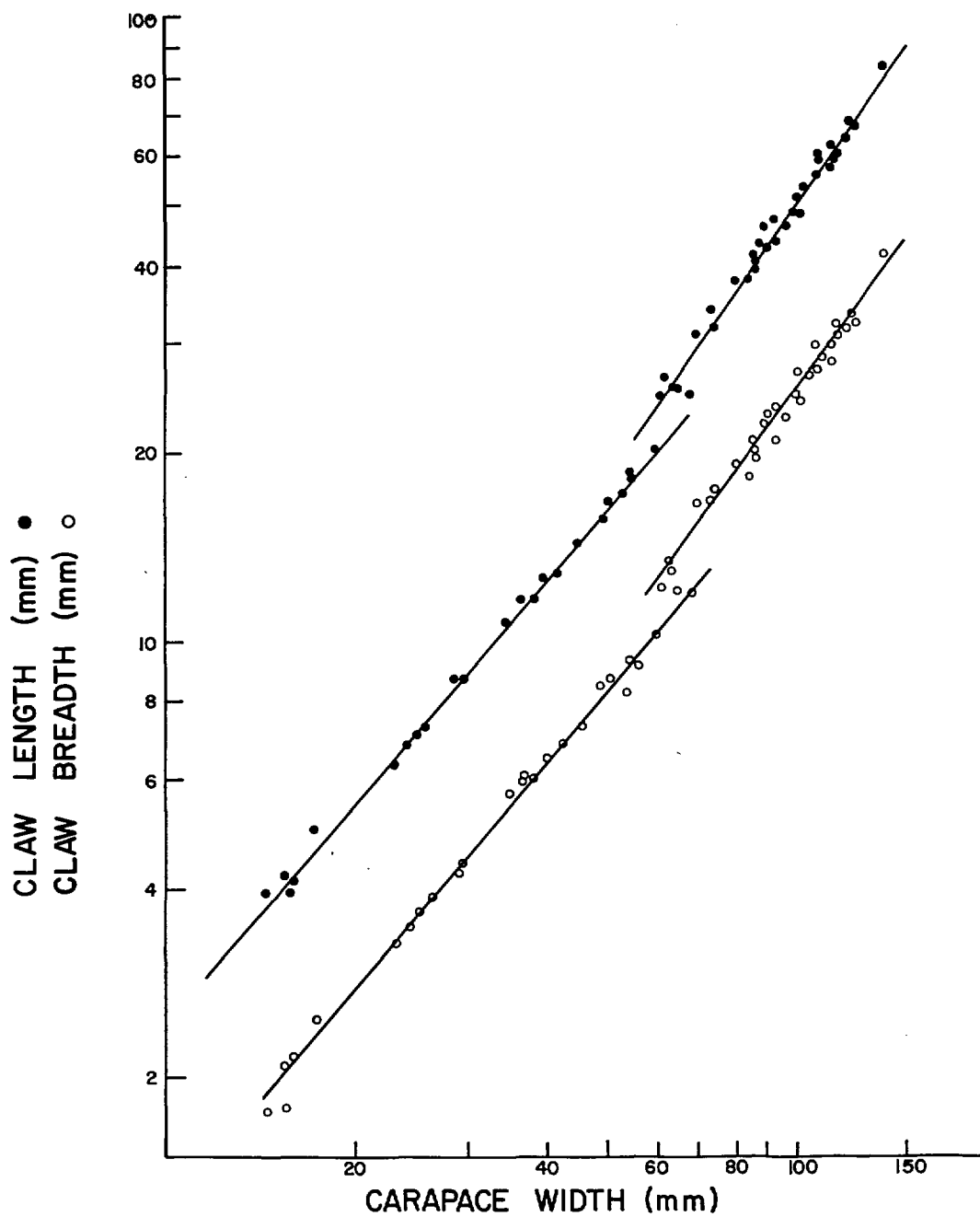


FIG. 9 RELATIONSHIPS BETWEEN CLAW LENGTH AND BREADTH WITH CARAPACE WIDTH IN MALE C. opilio

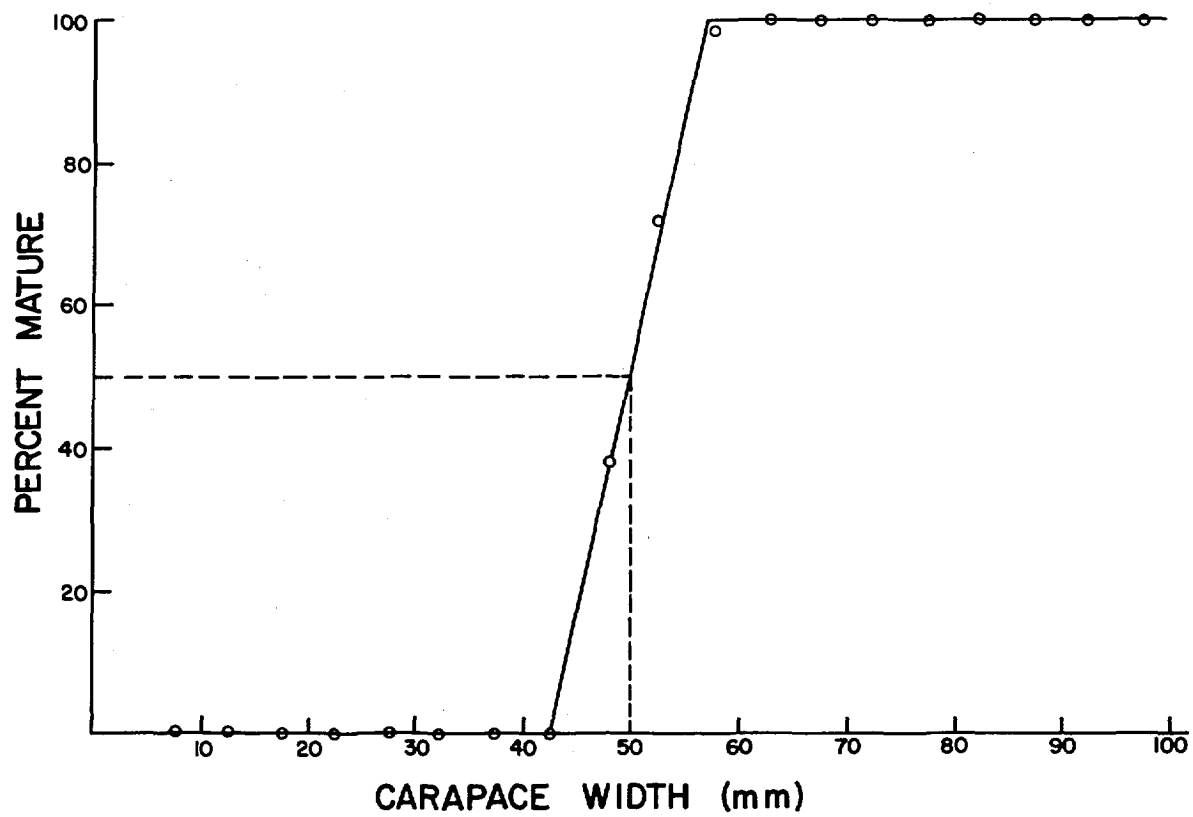


FIG. 10 PERCENT MATURITY - FEMALE C. opilio

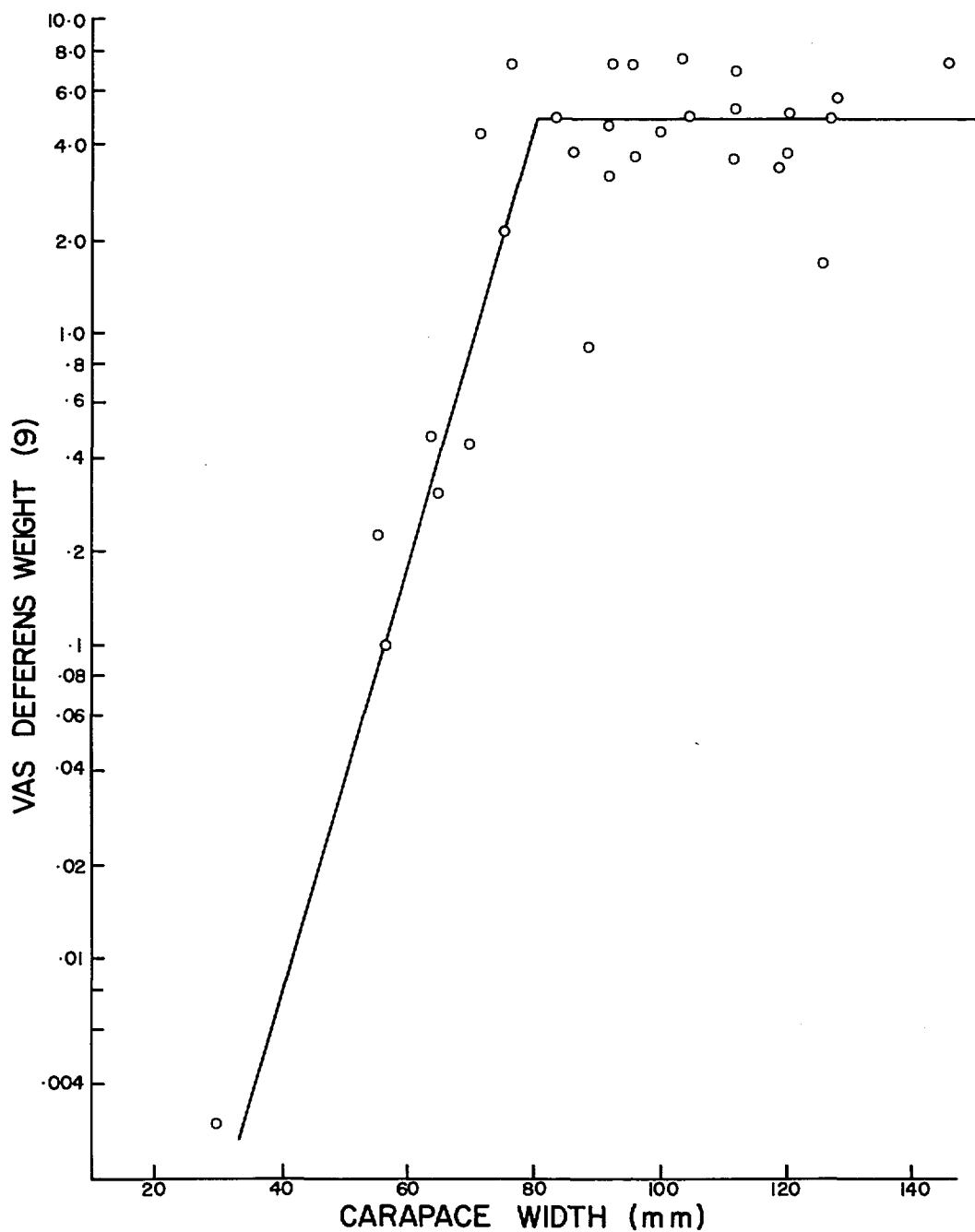
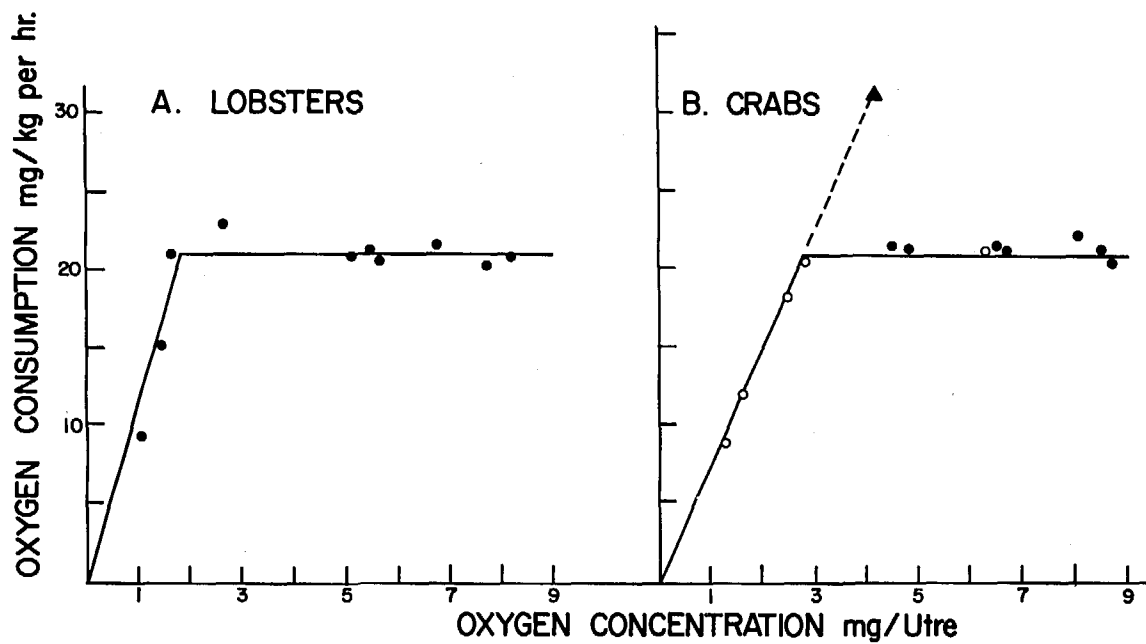


FIG. II VARIATION IN WEIGHT OF VAS DEFERENS WITH CARAPACE WIDTH



**FIG.12 ROUTINE OXYGEN CONSUMPTION AT VARIOUS AMBIENT OXYGEN CONCENTRATIONS
(AFTER McLEESE AND WATSON 1968)
ACCLIMATION AND TEST TEMPERATURE 5° C**

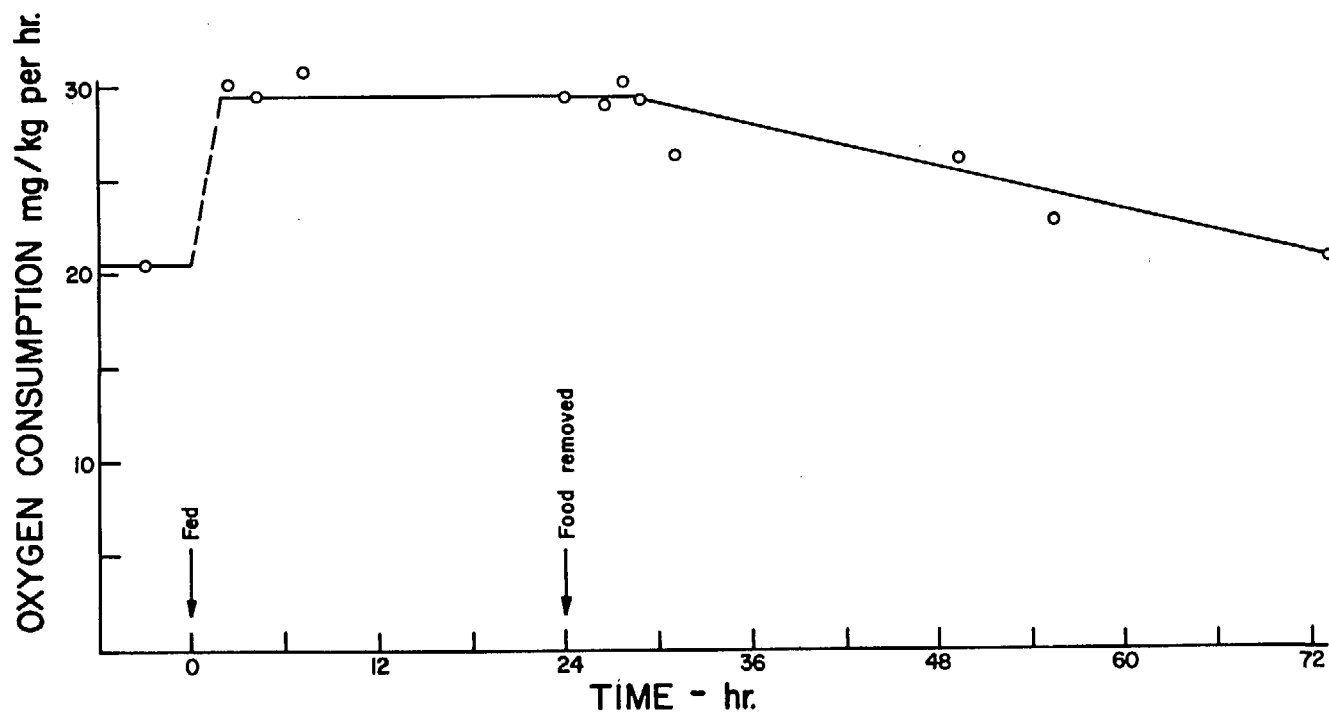


FIG. 13 RATES OF OXYGEN CONSUMPTION FOR A GROUP OF 38 CRABS (25kg) BEFORE AND AFTER BEING FED AT 5°C (AFTER McLEESE AND WATSON 1968)

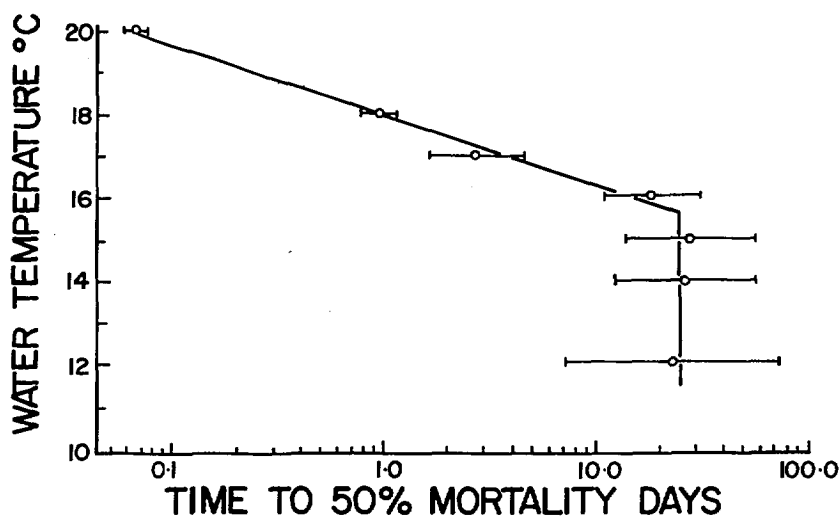


FIG. 14 TIMES TO 50% MORTALITY AND 95% CONFIDENCE LIMITS AT VARIOUS WATER TEMPERATURES FOR *C. opilio* ACCLIMATED TO 5°C (AFTER McLEESE 1968)

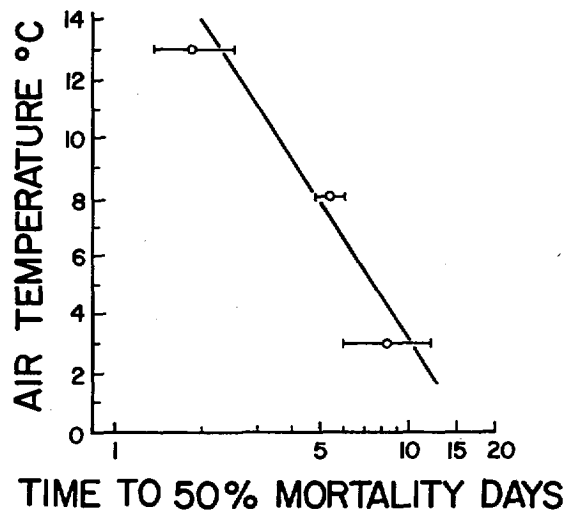


FIG. 15 TIMES TO 50% MORTALITY AND 95% CONFIDENCE LIMITS AT THREE TEMPERATURES IN MOIST AIR FOR *C. opilio* ACCLIMATED TO 5°C (AFTER McLEESE 1966)

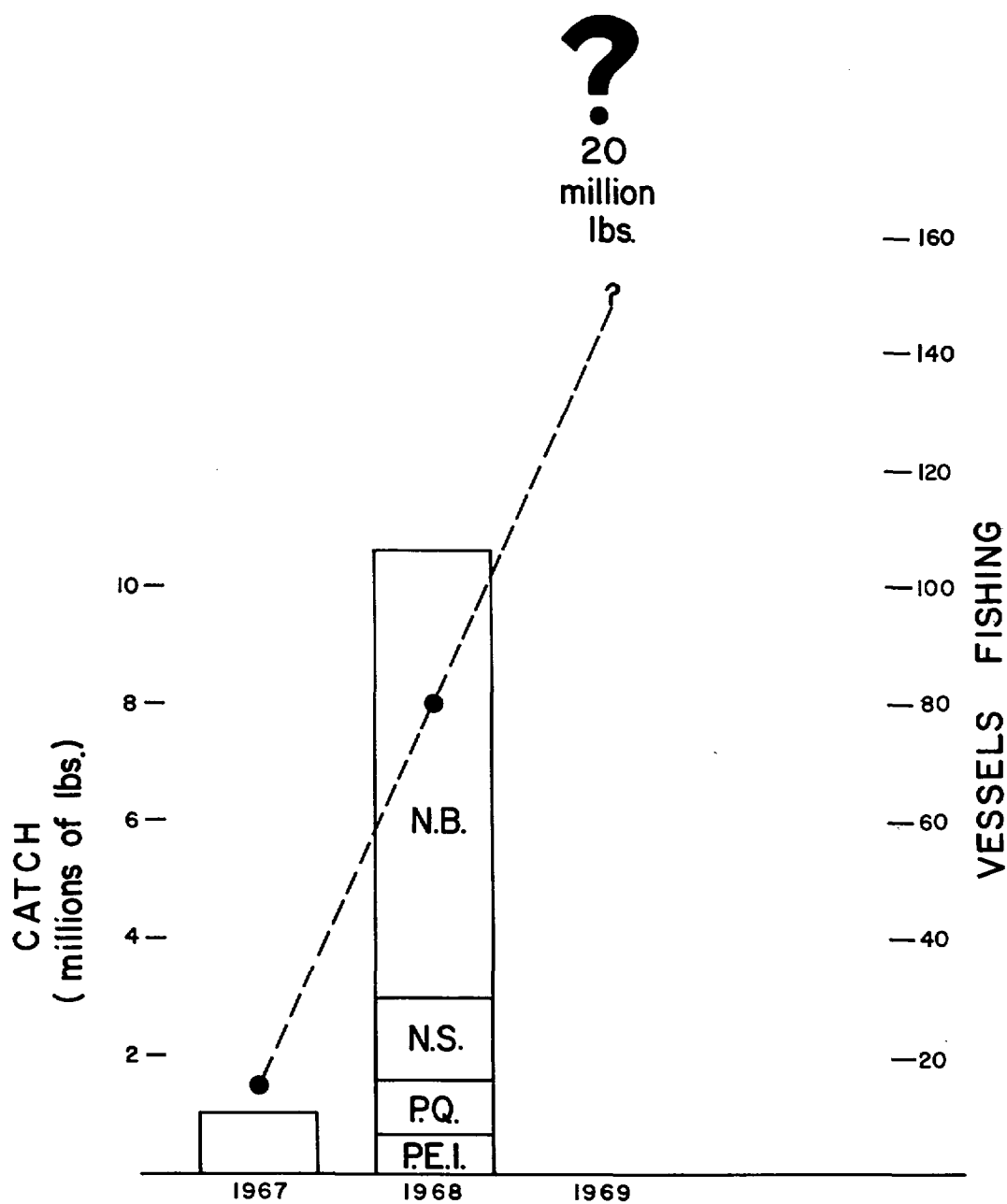


FIG. 16 COMMERCIAL LANDINGS OF *C. opilio* IN THE ATLANTIC PROVINCES OF CANADA

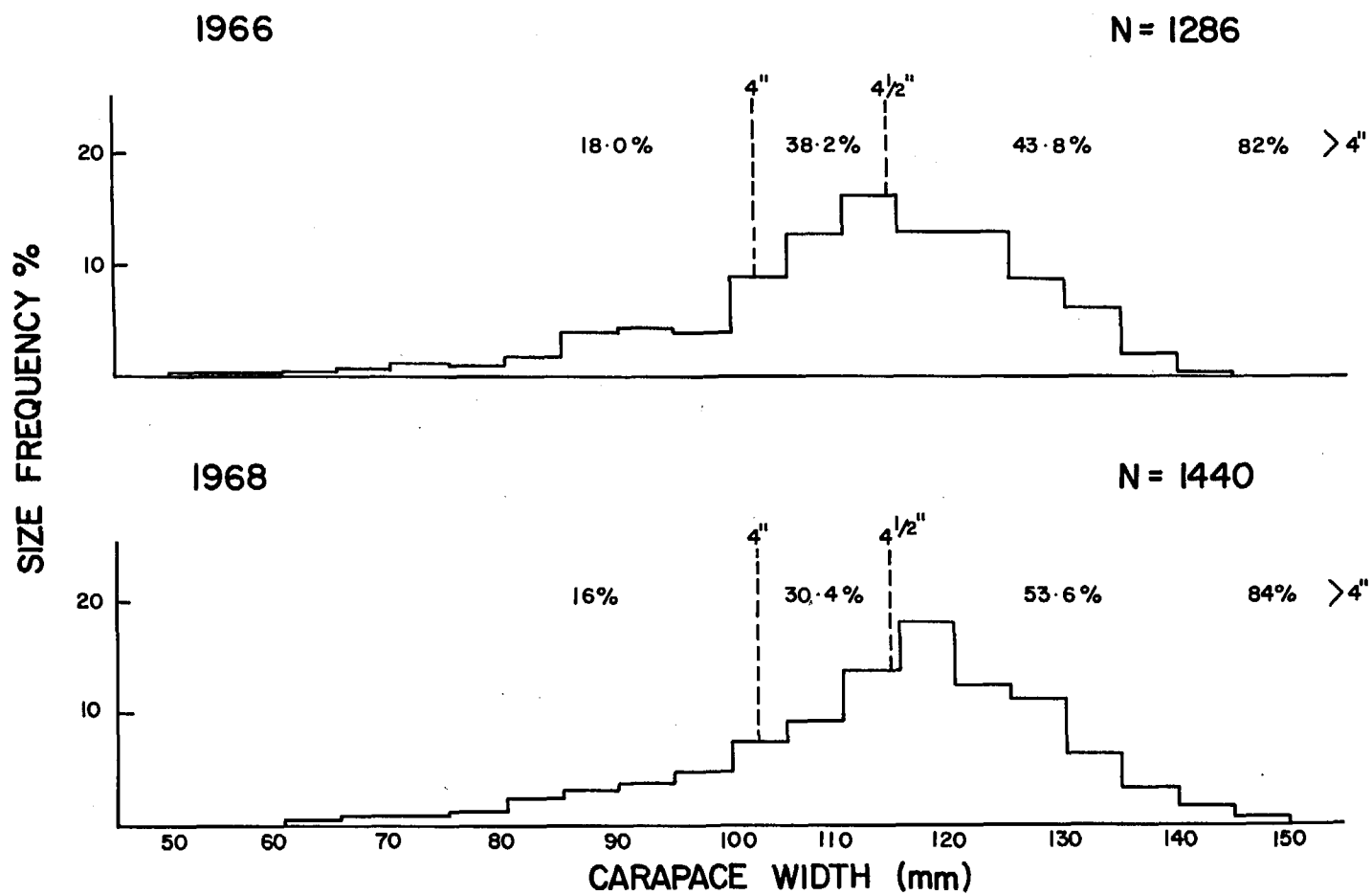


FIG. 17 SIZE FREQUENCIES - CHALEUR BAY - TRAP CAUGHT

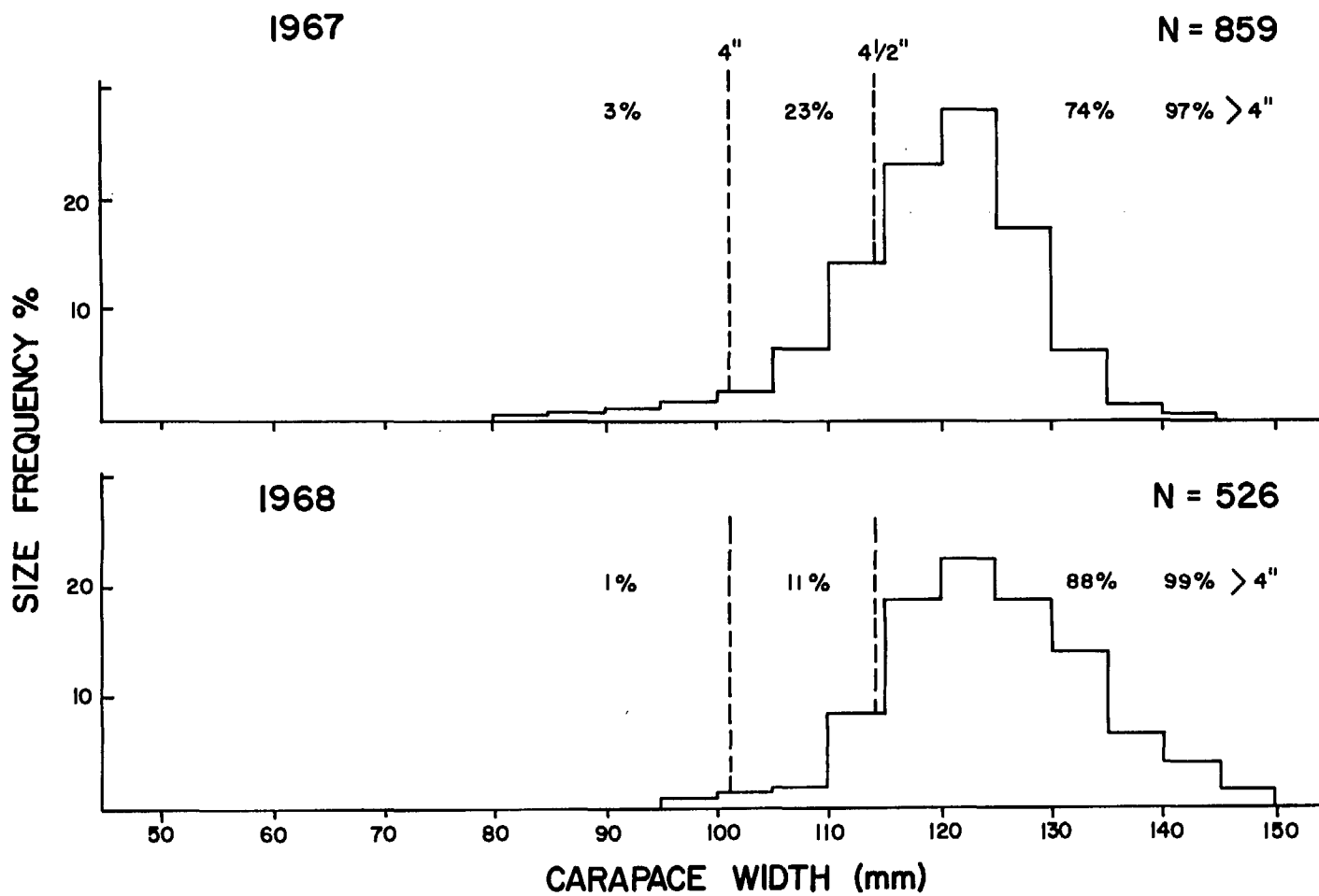


FIG. 18 SIZE FREQUENCIES - CHETICAMP - TRAP CAUGHT

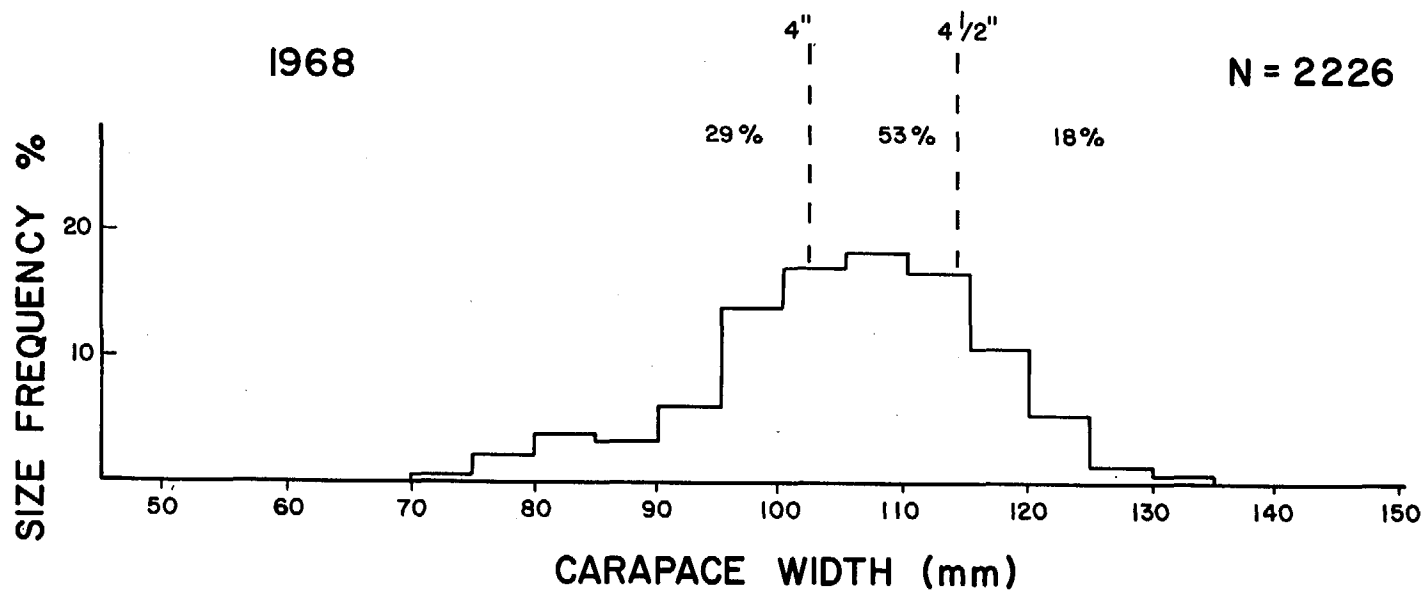


FIG. 19. SIZE FREQUENCIES - GASPÉ BAY - TRAP CAUGHT

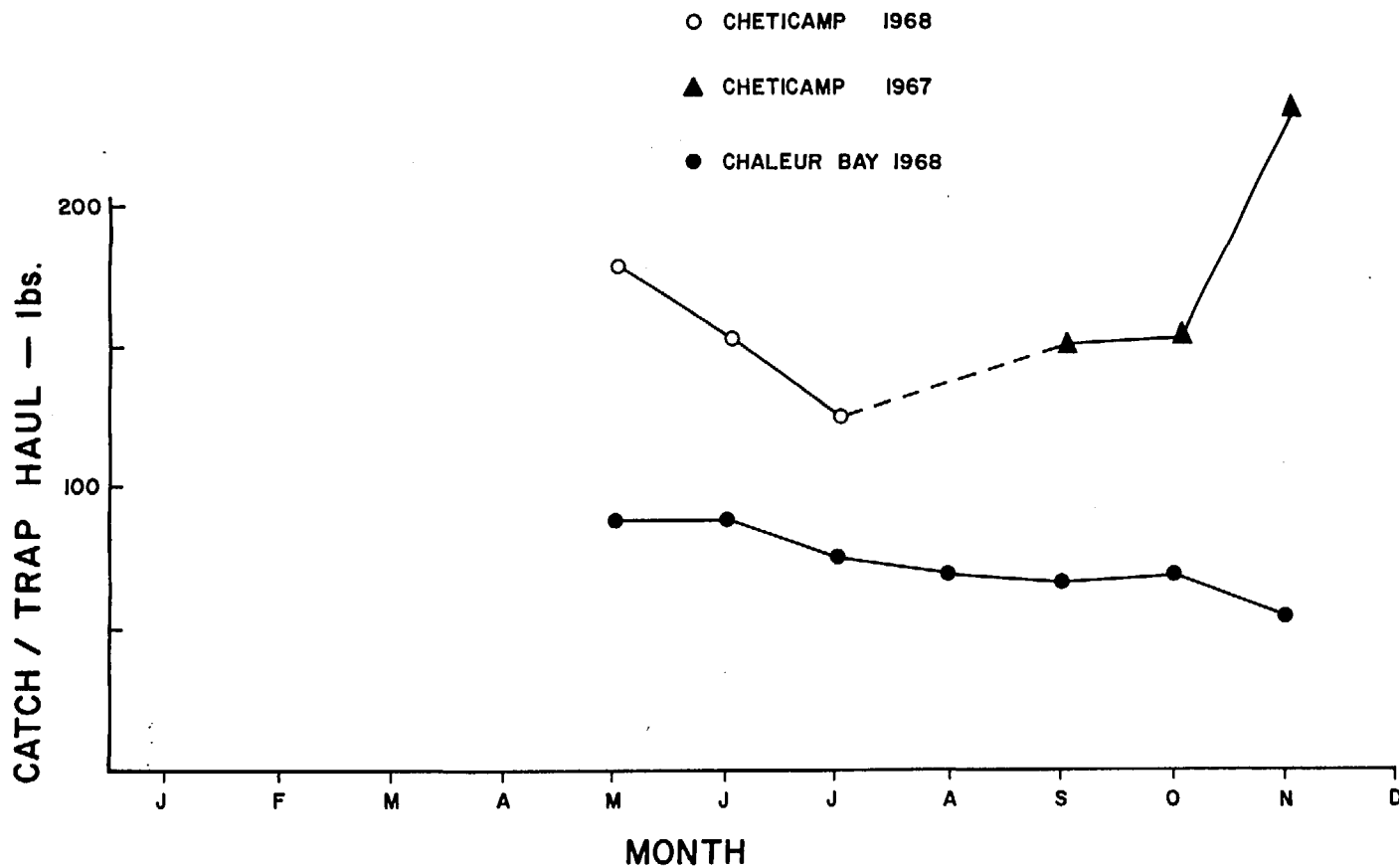
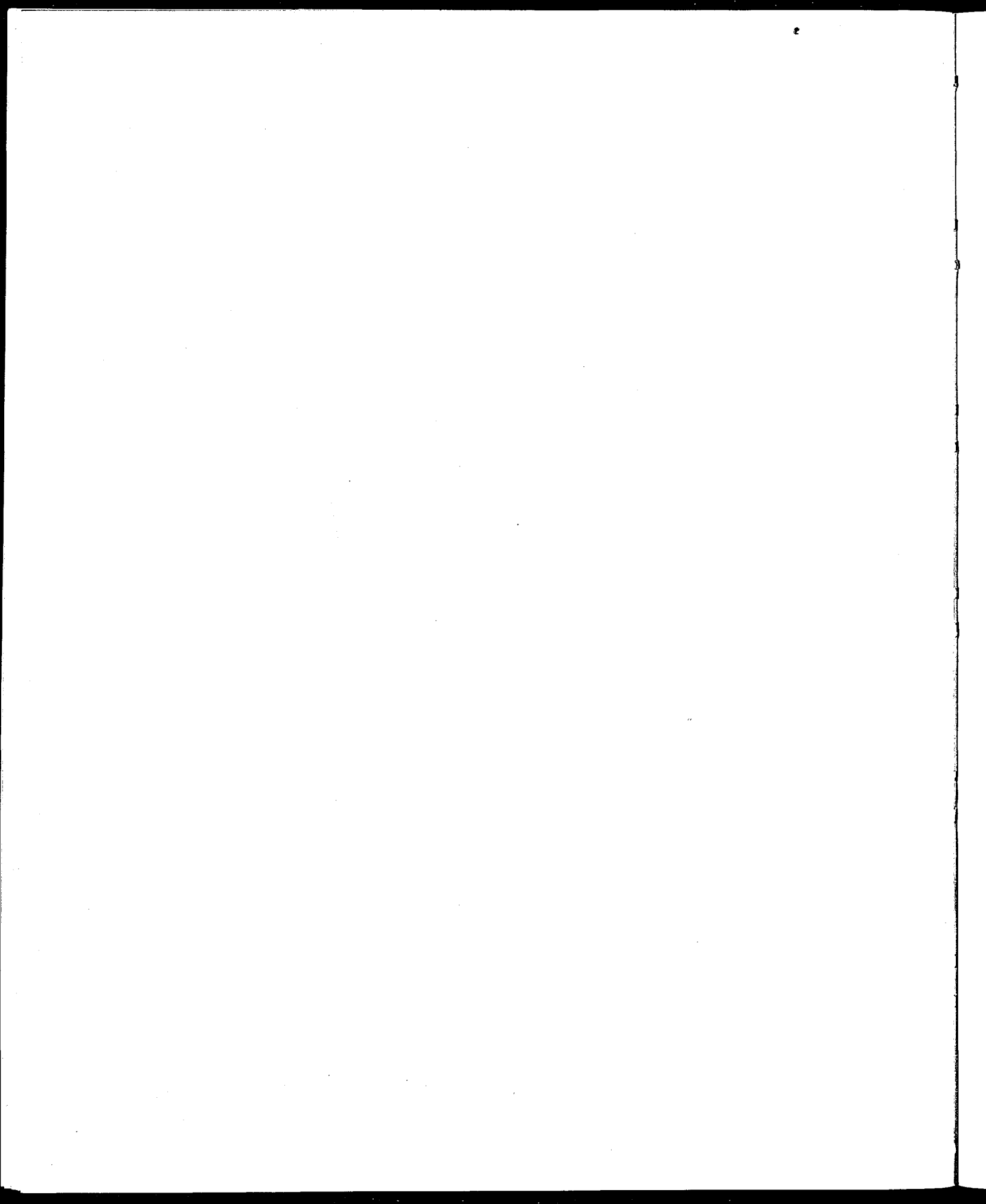


FIG. 20. CATCH PER TRAP HAUL IN THE CHETICAMP & CHALEUR BAY AREAS BY COMMERCIAL VESSELS



Biology and Conservation of Queen Crab



Mr. Mercer

by
M.C. Mercer, Fisheries Research Board of Canada,
Biological Station, St. John's, Newfoundland

Dr. Wilder has gone into the problems of managing the fishery and Dr. Watson has outlined the research which is going on now at St. Andrews.

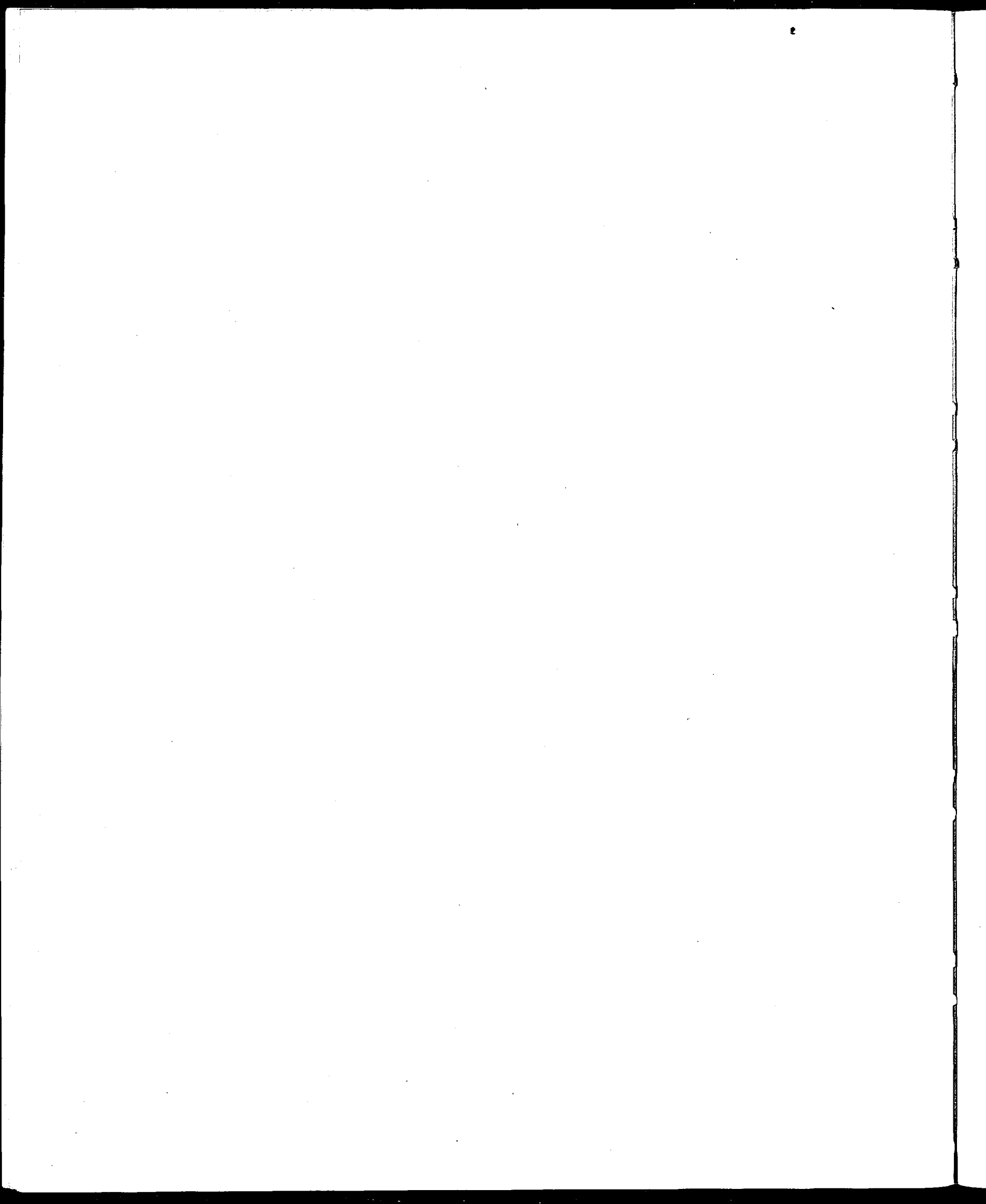
I will mention very briefly what we are doing in Newfoundland. We are just really beginning to start work on queen crabs and there is nothing very much we can add to what is known of the biology now, merely to tell you what we are intending to do.

Last year we began our research when we employed a student from the university to conduct a survey for crabs on the southeast part of the coast. We got a considerable amount of data on the sizes of the animals there, and shell conditions and so on. We have material which we intend to work on to study maturities.

This year we will be expanding somewhat through the co-operation of the Industrial Development Branch of the Fisheries Service of the Federal Department of Fisheries and Forestry. We will be getting a lot more samples from other areas around the coast, and we will be comparing the data we get from these areas for sizes, shell conditions, and sizes at which the animal is matured. In addition to this, we will be doing considerably more work where the com-

mercial fishery is active, and this is on the south-east coast. We intend to carry out a fairly extensive tagging program, taking two or three thousand animals to get an idea of the intensity of fishing that is going on there now. We will be collecting data on sizes of crabs there again this year to compare with what we got last year, to find any differences.

The little data that we do have suggest that crabs in the Newfoundland area are smaller than those taken in the Gulf of St. Lawrence, and the depth distribution is somewhat different, this being related, of course, to the temperature conditions. Most of the data that we will be collecting this year will be of a somewhat similar nature to that collected by Dr. Watson, and we are intending to get as much comparative material as possible. This in short is what we are intending to do. There is nothing, as I have mentioned, that I can add here now on the biology of the animal; merely to indicate that we are starting up an active program. We will be recruiting a new scientist to work on queen crabs this year, and we have technical support for him. So, within the next two or three years we should accumulate a lot more data on the biology of this animal in the Newfoundland area.



Biology and Conservation of the Queen Crab



Mr. Hutchison

by

J.G. Hutchison,
Conservation & Protection Branch, Fisheries Service
Department of Fisheries and Forestry of Canada, Ottawa.

I should like to provide first a very brief description of a national objective of the Conservation and Protection Branch of the Fisheries Service, Department of Fisheries and Forestry, so that you will have perhaps a more precise picture of our role as applicable to the subject before us, namely:

To conserve and, where possible, expand the primary fishery resources of Canada through recommended enactment of sound regulations.

To achieve this objective requires of course close liaison with and advice from the Fisheries Research Board, the Resource Development Branch and in some cases discussion with the Provinces to determine the need for regulatory measures. It requires participation in deliberations at all appropriate levels within our Service to ensure that Regional Directors of Fisheries have the best possible information upon which they can formulate adequate and practical recommendations. It requires, as does any program or plan, continuing review to measure effectiveness and if necessary modifications to correct revealed deficiencies. It requires further that our Field Officers assist in all possible ways to ensure that catch data and any pertinent information be expedited and transmitted for the assistance of biological investigations.

The regulatory tools available to management are fairly numerous and can be used in combination, e.g., seasons, gear dimensions, (mesh size), fishing zones, quotas, gear limits, controlled entry.

The Atlantic queen crab fishery has now developed to its present level without any conservation regulations. In

view of its projective expansion and prior to this conference, we have received suggestions that the point has been reached at which some measures might be considered to ensure maintenance of stocks in perpetuity and a sustainable annual yield yet to be determined.

We have had regulations for some years in the Pacific Region. It is a different animal there and somewhat different gear but it might be useful to list the measures being used:—

- minimum size carapace; no crabs to be landed without carapace; escape hole; licence identity on gear markers; individual trap limits; some closed areas and seasons for special reasons; prohibition of the use of pointed instruments for capture.

There is also a personal citizen's bag limit of six per day without licence for home consumption.

Some effort has been expended in endeavours to devise a weak link release for lost traps to prevent "ghost fishing". This has not been successful to date with the steel mesh traps being used there.

Turning to Atlantic operations—

- (a) We are very close to bringing into effect Gear Marking Regulations which will cover single or multiple crab trap sets. This is not, of course, a conservation measure but designed to assist fishing operations.
- (b) We are aware of the possibility of a requirement for an escape device but in this respect we have noted suggestions that the current trap mesh size of 5½" —6"

is reasonably efficient in allowing the escape of commercially unacceptable crabs. The question to be answered is whether there is a management need for the escapement of larger specimens.

- (c) It would seem that efforts should be expanded in seeking to devise an effective weak link for escape from lost traps. This may not be as difficult as in British Columbia because of the plastic trap construction materials used on the Atlantic Coast. We have noted

with interest Mr. Simpson's suggestions for disintegrating sections.

In conclusion, we look forward with enthusiasm to the opinions to be expressed in discussions here, and I am sure the Department's Regional Directors or their representatives share this view. I have already found the information provided by previous speakers on this panel to be of substantial value.

General Discussion

Mr. Jean Frechet, Federal Department of Fisheries and Forestry, submitted the following question to Dr. Watson: "We hear that king crab stocks have depleted, since not enough males are left to fertilize females. Considering the degree of similarity to queen crab stocks, how important is this factor in reproduction of the species?"

Dr. Watson: "I think the situation in the king crab industry is not quite the same as that we have here, because they are obviously taking more males than we are leaving at the present time. It is not a problem in our fishery at the moment, because all the females we have found are berried and they all have fertilized eggs."

Mr. J. Camille Gallant, of Souris, P.E.I., asked Dr. Watson to explain in detail exactly how he measures carapace width. Dr. Watson said he took the widest point of the carapace. He demonstrated his method by the use of photographs, and described the special measuring gauge which was used.

Dr. Wilder was asked if he agreed with the following statement: "When considering an escape ring in traps one should remember that they are also a form of entrance unless triggered."

Dr. Wilder replied: "I think that goes without saying. However, we don't usually think of rings as escape mechanisms, we think of what you might describe as slits so that the crab can simply walk out. If you space these bars properly, small crabs can walk out without any large ones escaping, and certainly no large ones going in through that same space, so that the spaces, at least with lobsters, can be made extremely selective. You can do a very good job of separating the sizes you want from the sizes you don't want."

Mr. Mercer was asked if tagging, similar to that mentioned by Dr. Watson, would be carried out in Newfoundland waters in 1969. Mr. Mercer said it would be, that current plans were to take two or three thousand animals in two bays on the southeast coast, Bonavista and Trinity, primarily to determine the intensity of fishing on the stocks there.

Dr. C. Blackwood, of the federal Department of Fisheries and Forestry, said: "We have received a number of resolutions from the Queen Crab Association. One concerns the taking of queen crab using otter trawls. Recently we have interviewed a large percentage of fishing captains. They are agreed that otter trawls should not be permitted to take queen crab. Another resolution concerns minimum mesh size for traps, and once again the fishing captains seem to be agreed on a 5-inch mesh size for traps. Another resolution from industry requests the Department to require a minimum carapace size of 4¼ inches. Fishing captains interviewed are, to a man, against this; they prefer a 4-inch minimum carapace size". Dr. Blackwood wondered if Dr. Wilder had any additional comments on these points.

Dr. Wilder: "The first comment would deal with otter trawls. I think it is generally agreed that such devices can damage crabs, and so reduce the quality of the pack. Crabs can get fairly rough treatment in an otter trawl. On the other hand, such gear is used for spider crabs in Japan, although not otter trawls, but Danish seines. Furthermore lobsters, which we usually think of as a trap fish, are caught in otter trawls on our continental slope. Two to five million pounds are landed annually in deep water there; these would be virtually inaccessible by any other method. In other words, you are getting into a question of economics, and I think that with the spider crab industry, under the present circumstances, crab trap fishing is fine but what will happen if our abundance of crabs drops to the point at which it is difficult to make a profit

fishing large traps in deep water? You are catching crabs at the rate of one to two hundred times the rate at which you are taking lobsters. For example, you are taking one to two hundred pounds per trap haul, whereas in the lobster fishery we have got down to the point where we are catching around one pound per trap haul. The prices are different, of course, but this is the likely thing that may happen. If you abolish trawls now for all time maybe we will make a mistake, I don't know for sure, but that is my line of thinking.

"I don't think that mesh size is as efficient a selective device as spacing of bars, at least that would be my guess with an animal like a crab, with its long legs, but it works reasonably well. I think Dr. Watson's results suggest an even larger space than five inches. I think he would suggest that six inches will still retain what we consider to be our marketable crabs. As for the difference between 4, 4¼ and 4½ as a minimum size, we wouldn't want to express an opinion at all. As Dr. Watson says, we have no actual growth data on that size. I think of the difficulties the department would have in trying to enforce such a regulation, and I think of the destruction of under-sized crabs. I think the same purpose could be accomplished with a great deal less expense and effort by the use of selective gear designed to get rid of the small crabs at sea without the business of catching them, measuring them, releasing them and inspecting them, and so on."

Mr. Joseph G. Gallant, of the Department of Manpower and Immigration, Moncton, asked Dr. Watson what, besides man, were the common enemies of the crab.

Dr. Watson: "Before I answer that, I should like to elaborate on Dr. Wilder's answer. I would say that they do have regulations in Japan. The minimum size limit there is three inches. They also take females, and it is almost exclusively a Danish seine fishery. These vessels make approximately one-day trips and just land them in this condition. Of course, most of their product is canned, whereas most of ours at the present time is a frozen pack, and therefore bruising, etc., is more important to us.

"Now, on common enemies, the only ones that we have found so far as being quite common are codfish. Small crabs are quite common in codfish stomachs. However, we have no information on predation on the adults. We just don't know what predators take them, if any."

Mr. A.D. Crerar, of the Atlantic Development Board, Ottawa, asked if any members of the panel would care to speculate on crab distribution. "For example, is any sandy mud bottom, 50 to 90 fathoms, zero degrees centigrade, suitable? "

Dr. Watson gave some indication of distribution by using maps, and said that the meeting would get more information on exploration from Mr. Jack Rycroft of the Federal Department of Fisheries and Forestry. "As far as sandy and sandy mud bottom with zero degrees Centigrade water is concerned," he said, "there is quite a lot of it. There is a publication available from the Marine College Laboratory in Dartmouth. The Gulf of St. Lawrence has been surveyed for bottom sediments, etc., and temperatures, and there is a chart available showing sandy mud and muddy bottom, sandy bottom, rocky bottom, etc., in the Gulf."

Mr. H.A.R. Steltner of St. Catharines, Ontario, asked if a mathematical model had been established for computer treatment of information and if this might be of a scientific or industrial nature. He also asked what random access and retrieval systems were contemplated.

Dr. Smith said: "I have some views on this general matter which are rather oblique to this question, not quite answering it directly. Mathematical models are not the be-all and end-all of solving population problems. A model is not a difficult thing to invent; it is a difficult thing to make work. This is because it requires real meaningful truthful data-information, in other words, that is correct. This is always the problem in making mathematical models really work, to give you an answer that is definitive and practical for the purposes intended. The sampling process of getting information, the kind that you have been hearing of this morning, provides growth data, reproduction rate data, birth rates, survival rates, fishing mortality rates and so on. These are extremely difficult things to measure in precise terms. They are rather

easy to measure in very general terms, but the very general terms do not give you a very precise answer. In fact, if you put poor data into a computer, you get out a poor answer, no matter how sophisticated the computer is or no matter how sophisticated the mathematical model is.

"I think there have been no programs set up as yet for queen crab nor would I expect any to be contemplated in the near future until there is some firm precise data to put into the computer program. Programs for this kind of thing are available and computers are available. There is no mechanical difficulty here. The difficulty is really in getting firm, clear, meaningful quantitative biological data."

Dr. Watson: "There is a computer model being made at the present time in Seattle, at the U.S. Bureau of Commercial Fisheries, where they are working on the Tana crab, which is a different species but the same type of crab as we have. This is in its infancy, and all they are trying to get out are gross estimates of the yield."

Mr. Arthur R. Murray, of Halifax, asked if the mesh size of tunnels should be the same as on the outside of traps.

Dr. Wilder: "I really can't answer that question. The question of mesh size for all crustacea has been debated. There are very few good experiments. I notice the model over here constructed and designed by Mr. Imbeault has relatively small mesh at the tunnel entrances, and this was highly recommended for lobster traps in England. They put special fine mesh on the entrance heads and claimed that this increased the catch of lobsters. As far as the catchability of the trap is concerned, I do not know. Mr. Imbeault will be talking about trap designs later on and may have further opinions on that point."

Dr. Wilder was also asked what effect gillnetting for cod or turbot would have on crab stocks, because many crabs become entangled in gillnets and are damaged and crushed when the net is hauled around the gurdy.

Dr. Wilder: "I understand that crabs can be caught in cod nets set deliberately on the bottom to catch crabs, and this is moderately destructive of them. They are damaged when they are removed. On the other point, the normal use of cod nets and what effect that would have on crabs, I would think not much." Dr. Wilder asked Dr. Watson for his opinion on this. Dr. Watson said that nets had been used for years, and he thought that both trawls and gillnets would have an effect, but did not know how serious this would be.

Mr. D.N. Cormack, of the New Brunswick Development Corporation, said: "So far discussions have been of a relatively local nature. Is there any co-operation with ICNAF members on technical data or future conservation?" Dr. Smith replied: "The answer is no so far as ICNAF is concerned, because this is not one of the internationally fished species and is not a subject matter for ICNAF any more than the lobster. It is at the present time a local Canadian fishery without any international implications at the present moment."

Mr. Roger Bedard, of the Department of Industry, Trade and Commerce, said: "European buyers state that the percentage of leg meat in the Japanese snow crab is 60 per cent and that of the body meat is 40 per cent. In queen crab the percentages seem to be reversed. Is the percentage difference of leg meat between the two species that much?"

Dr. Watson: "I am not too sure about the Canadian percentages. The only thing I can offer is that the Japanese species tends to have longer legs; whether this is the case or not, I don't know. I really cannot answer this because I am not aware of the figures."

Mr. Raymond Griffin of Montague, P.E.I., asked if the mortality rate with Danish seines was as great as with otter trawls, and if not, why not."

Dr. Watson: "I don't know. We haven't done any experiments on Danish seine or otter trawl mortality so far. We have mainly been using traps to catch our animals. We have used otter trawls, but we have no data on what effect the otter trawls are actually having on the crabs that aren't caught. We do

know that the crabs that are caught, if they are not in soft shell condition, are quite healthy. But they live in such depths that we can't go down and have a look at the bottom after the dragger has passed over it."

Mr. J.E. Henri Legare of the New Brunswick Department of Fisheries, Fredericton, asked for a brief outline of the Research Board's program for the coming summer on queen crab.

First of all, what we hope to do this year is to get into the Gulf as soon as ice conditions permit, and as soon as we get boats. This probably will be about mid-April. We want to get in that early because of the reproductive period, etc., and we want to get in there also to do pre-season work before the fishery starts so that we can have some idea, through tag returns, what the fishing intensity is and also what the movements are. From then we shall be sampling approximately two weeks in every month—sampling at different depths in different areas to try and find out what the density is at different depths and on different types of bottom. We will be taking samples of the animals and trying more accurately to determine what the size is at maturity of the males, whether they are moving during the season, i.e., whether during the breeding season there are local movements either to shallow or to deeper water along with the females. This could help fishermen in determining where to move. However, I must add that with a research boat we are limited in time. We can't go all over the Gulf, otherwise we just go around chasing our stern. It is impossible to work over the whole of the Gulf, therefore we have to choose pre-selected areas, and these areas will mainly be an area off Gaspé stretching out into the Orphan Bank area and an area in Chaleur Bay. The reason we have chosen these is because one is an area which has been fished reasonably intensively last year and the other one has hardly been touched at all.

"We will be sampling for sizes of crabs that have been landed, we shall be sampling for commercial vessels, to follow any changes that might occur in the size frequency being landed so that we can determine more readily the rate of change of the decrease which is expected in size distribution. We shall also be tagging for growth. We don't as yet have a tag which is visible to the fishermen yet can be retained by the crab molts. This is a difficult problem, and they haven't really solved this for lobsters yet. What we will be doing is actually physically marking the top of the shell of the crab, coding it according to its size, making marks in the shell and hoping that these will be retained after molting. The big problem with this of course is that the fishermen can't see it very well, and it is more than likely that we may have to recover these from the plants. Even if we get a few of these tagged animals back and get ten or twenty positive results on growth then that will be something at least, so that we can build up this model of growth which is very very important to us at this time."

Exploratory Fishing for Crabs - Atlantic Area



Mr. Rycroft

Exploratory Fishing as Defined by Industrial Development Branch

The growth and development of the Canadian fishing industry is directly related to the extent and availability of commercial fish stocks. Fishing pressure on known stocks increases with the introduction of improved fishing methods, more efficient vessels, machinery and gear. It therefore becomes increasingly important to establish new fishing grounds and encourage the utilization of unexploited and under-exploited stocks.

In its exploratory fishing programs, the Industrial Development Branch of the Department of Fisheries and Forestry utilizes a combination of knowledge, skills and experience in fishing operations followed by conclusive demonstrations of the potential of the resource for exploitation by the commercial fishery. Costs, risks, and scientific skills involved in such exploratory work are, generally speaking, beyond the capability of individual enterprises.

The Industrial Development Branch is concerned with the location and/or assessment of commercial stocks of fish in areas where they are thought to exist either on the basis of broad scientific studies or as reported by commercial fishing vessels but not exploited by them. These exploratory operations do not duplicate scientific studies into behaviour characteristics of the stocks, or their population dynamics in relation to management. Such studies are carried out by the Fisheries Research Board of Canada.

Exploration by the Industrial Development Branch may be further defined as follows:

- 1) Assessment of currently available distributions, commercially useful concentrations and amounts of previously unexploited stocks for the benefit of the fishing fleet and to encourage the establishment of new fishing industries;
- 2) Locating and establishing the extent of new fishing grounds;
- 3) Studying and plotting the seasonal changes of commercial stock concentrations in order to permit more efficient exploitation;
- 4) Determination of the efficiency of specific fishing gears on known stocks.

Resume

The phenomenal growth of the Atlantic queen crab fishery since 1964 is very gratifying to all concerned. The Industrial Development Branch has been closely associated with this development, in co-operation with the fisheries departments of the Atlantic Coast provinces. The 1968 production of more than 10 million pounds landed weight may seem a large amount, but this can be expected to increase to as much as 20 million pounds in 1969. Approximately 100 boats are now fishing crab, and of course this number is bound to increase also.

Practically all the landings of queen crabs in 1968 were taken from two relatively small areas, one off the north coast of Cape Breton and the other off the Gaspé Coast. These areas are conveniently close to several fishing harbours, but they cannot be expected to withstand the

continually increasing fishing pressure indefinitely. We are, therefore, continuing our efforts to locate new stocks, and this report describes both the exploratory programs undertaken in 1968 and those planned for the current year.

Exploration Carried Out By
The Federal Department of Fisheries and Forestry
1968

The over-all objective of the program required that exploratory fishing be carried out, mainly in depths of from 50 to 100 fathoms, throughout the Gulf of St. Lawrence with the exception of that portion of the west coast of Newfoundland which lies to the northward of latitude $50^{\circ} 30' 00''$ N and part of the Quebec coast extending from Cape Whittle to the Straits of Belle Isle.

In order to sample as many of the potentially productive areas as possible in a systematic way a program plan was formulated. It can be seen that overlapping was avoided by plotting the areas already being exploited, together with those which the provinces intended to explore. (fig. 7).

1. Program Plan (Appendix 1)

Areas selected for exploration:

- a) Waters enclosed by the 50 and 100 fathom curves off the north end of Cape Breton Island. This area represented an extension of the ground that had been fairly extensively fished during the 1967 season (fig. 7).
- b) Waters enclosed by the 50 and 100 fathom curves, extending from the above area in a generally WNW direction, and following the drop off to a position coinciding with latitude $48^{\circ} 29' 00''$ and longitude $63^{\circ} 09' 00''$ (fig. 7).
- c) Waters enclosed by the 50 and 100 fathom curves lying off the South Coast of Newfoundland from Cape Ray eastward to longitude $58^{\circ} 00'$ west (fig. 7).
- d) Waters enclosed by the 50 and 100 fathom curves from the south western end of Newfoundland at Cape Ray, extending into St. Georges Bay, and thence in a generally NE direction along the Coast of Newfoundland to Pt. La Fontaine at about latitude $50^{\circ} 30'$ north.
- e) Waters enclosed by the 50 and 100 fathom curves from Cape Whittle, Quebec, at latitude $50^{\circ} 10' N$ and longitude $60^{\circ} 00' 00'' W$, in a generally westerly direction to about the longitude of Sept Iles, Quebec, and thence in a

generally SW direction to Pt. des Monts at latitude $49^{\circ} 19' 00'' N$ and longitude $67^{\circ} 22' 30'' W$.

- f) Waters enclosed by the 50 and 100 fathom curves commencing at Cap Des Rosier, Quebec, and following the curve of the Gaspé coast in a generally westerly direction to about the longitude of Matane.
- g) Waters enclosed by the 50 and 100 fathom curves around the entire coast of Anticosti Island.

In addition to these areas a total of 15 locations throughout the Gulf were selected with depths in excess of 200 fathoms. Five traps were to be set at each of these deep locations in order to obtain further information of the depth range of the queen crab. Not all of the above areas were explored. The original plan had been to utilize two vessels for these rather extensive areas, while in fact only a single vessel was engaged in the exploration.

With the exception of the Anticosti Island area and the area in mid-Gulf as described in schedule b) above, all areas received at least token attention, sufficient to provide some indication of the crab population. Areas of promise were explored more carefully and extensively, and reasonably substantive data has been compiled of these grounds.

"St. Cecilia II" (figs. 1-4)

This 65 foot wooden combination vessel is one of a number which were built in the Atlantic Provinces from plans drawn by William Reid, Naval Architect, Vancouver, for Industrial Development Branch. The "St. Cecilia II" is capable of carrying out several widely divergent fishing operations including stern trawling, Scottish seining, long lining and purse-seining. This design has now been shown to be very well suited for crab fishing. In addition to DX Navigator Loran, a Decca Navigator Mark XI with Plotter was rented and installed for the duration of the charter by the Industrial Development Service.

2. Fishing Gear and Deck Equipment

The exploratory fishing was carried out with conventional traps which for all practical purposes were identical with those used by the commercial vessels (figs. 5,6). Dimensions were $6' \times 6' \times 2\frac{1}{2}'$. The trap covering was of twisted polypropylene web, with $3''$ mesh size in the tunnels and $5''$ on the body of the trap. Each trap was rigged with 140 fathoms of $9/16''$ diameter poly buoy line rope. This length of buoy line was found to be necessary when working along, and frequently over the 100 fathom

edge. The original surface buoys that were provided were of 30" circumference. These were found to be inadequate for use in waters where there was a strong current, even if three were attached, and subsequently buoys of 40" circumference were substituted. With the exception of a few traps that were baited on two occasions with frozen squid, frozen herring was the bait used throughout the course of the operation.

The traps were hauled by means of the hydraulically driven combination drag/seine winch, to which was adapted a Beccles rope coiler.

A short steel boom, with the heel secured atop the after end of the wheelhouse was trimmed to clear the rail in the waist of the vessel, and an open-cheek, buoy line block, was secured to the outboard end of the boom, in line with the winch warping head. In running the traps, the buoys were first hauled over the rail. The bight of the buoy line was fed into the block, and turns taken on the warping head. The buoy line was then inserted into the coiler, and hauling proceeded until the trap was swung over the rail. Sixteen traps were normally carried.

3. Fishing Procedure

Before setting traps in any area, the chart was studied in order to obtain basic information such as depths, nature of bottom, and particularly the compass headings that would be most likely to follow the edge of the ground. The latter seldom turned out to be more than a rough indication of the actual heading, but it served to get the set under way. In setting commercial gear on a strange ground, for the first time, it is naturally wise to make a simulated run, while watching the sounder. This tactic was employed during the latter stages of the exploration.

In a new area it was usual to make the first set along the outer limits, that is to say along the 100 fathom curve. In order to facilitate hauling, the traps were always set in as straight a line as possible, and this could only be achieved by starting the set sufficiently inside the actual edge so that a reasonably straight course might be steered without encountering every contour of the edge. It was seldom possible to maintain a single course for the length of the string, but abrupt course changes, such as would be necessary, if the depth was increasing to the point where the trap might be lost, were avoided whenever possible.

In starting the set, the vessel was brought to full speed on the indicated heading, and the signal was given to heave the buoys overside. The first and last traps of a string

carried an extra float, as an end marker. With the floats away the buoy line was paid out while the vessel was held on course at full speed. When a very few fathoms of slack remained to be run out, the trap, which was being held on the rail by one man, was allowed to slide clear. The Decca reading, depth of water, nature of bottom, and the time were taken at this moment. With the vessel making 10 knots, a fifteen minute run was necessary to cover the 2½ miles to the position of the next drop. A careful course was steered and the heading was logged, in order to facilitate the hauling of the string. When position number two was reached the trap was set as described above, and setting continued until all traps were away.

On completion of the hauling and setting operation, if time permitted, it was customary to make a run over the ground that had been selected for the next drop. Frequently this would result in an adjustment of the search pattern, when excessive depths or unfavourable bottom occurred that was not in accordance with the chart.

4. Areas Explored (figs. 8-10)

- a) North End Cape Breton Island
- b) West Coast Newfoundland, St. Georges Bay to Pt. Riche.
- c) Port aux Choix, Newfoundland (Pt. Riche to Pt. Ferrole).
- d) Cape Whittle - East end Anticosti Island, Quebec.
- e) North Coast Quebec, Perroquet Id. to Baie Comeau.
- f) Gaspé Coast.
- g) Labrador Coast, Hamilton Inlet.

Although seven areas are listed above under the heading *Areas Explored*, not all can, strictly speaking, qualify as such. Extensive areas of the exploration grid were found to have such a uniformly unsuitable bottom that it was judged futile to accord them more than token attention.

The operation started on April 25th and ended December 15th. Although only one boat took part rather than two as originally planned, sufficient work was carried out to show that certain areas are definitely unproductive, while others have indications of commercial quantities of crab.

Area A

From April 25th to May 17th, the "St. Cecilia II" worked the extreme westerly perimeter of the Cape Breton

ground between Cape St. Lawrence and Cape North. Depths fished varied between 58 and 110 fathoms and lifts of 0 to 33 commercial sized crabs were experienced. (For the purpose of this Report 4¼' carapace width will be considered "commercially" acceptable).

During most of the time that was spent in this area, the draggers reported that very few crabs were being taken in their tows. One commercial crabber, working the proven Cheticamp ground, also reported minimal production from traps. However, shortly before the operation at Cape Breton Island was terminated, on May 17th, it became evident that a change was taking place, as reports of draggers obtaining big tows of crab were becoming more frequent. Coincidentally the commercial crabber reported that production was picking up sharply. There was no corresponding increase at this time insofar as the "St. Cecilia II" was concerned, perhaps because dragger activity precluded the chance of setting along the "drop offs", and the exploratory fishing was confined to the flats. Several of the draggers agreed that only those tows that were made right along the edge, produced significant lifts or crab. The occasional tow that was made on top of the shelf, apparently produced little or no crab. One Danish seiner, fishing from 3 to 5 miles northerly from Cape St. Lawrence at this time, also reported that very few crabs were being taken. Of the total of 50 traps that were hauled off the north end of Cape Breton Island, during the period that has been referred to, one string that was set closest inshore, between the Capes, produced the best result, which was an average of only 16 commercial crabs to the trap lift. All traps were set on either mud, or sand and mud bottom.

The surface water temperatures during the foregoing period was 2.1 degrees C. on May 3rd when the first reading was taken, and 4.4 degrees C. on May 17th when the operation in Cape Breton Island area was terminated.

Area B - West Coast Newfoundland

Exploration of the West Coast of Newfoundland began on May 20th, with the setting of 15 traps in St. Georges Bay, in depths from 51 to 84 fathoms. All told the "St. Cecilia II" spent five days of actual exploratory fishing in this bay, and the results were completely negative. Not a single crab was taken from the 68 traps hauled during this period. For the most part the traps were set on good appearing bottom, mud and sand, but harder bottom was also tested. The surface water temperature, showed only a small variation, 4.7 degrees C on May 21st, increased to 5 degrees C. by May 27th.

On May 25th a deep check, comprising five traps, was made at a position 276 degrees true, and 47 miles distant from Cape Anguille, Newfoundland, (Lat. 48° 00' 00" N - Long. 60° 35' 00" W). The shoalest trap was set in 217 fathoms and the deepest at 256, mud bottom. This test was also negative. The surface temperature, at this position, registered 4.9 degrees C.

During the period May 28th to June 10th 114 test sets were made along the west coast of Newfoundland from Cape St. George almost to Port Saunders, and with the exception of six traps, which will be reviewed separately, the results were totally negative. It was found that the bottom, generally speaking, in depths of from 50 to 100 fathoms, between Cape St. George and Cow Head, was rough and rocky, and not of the type on which crab have consistently been found.

The bottom, in depths of 49 to 120 fathoms extending from Cow Head to Port Saunders, was found to be uniformly of mud and suitable for crab, but here also not a single crab was taken. It cannot be claimed that the negative results from 114 traps, distributed over approximately 150 miles of coastal shelf, is conclusive (for instance, depths inside the 50 fathom curve, were not tested) but the depths at which these tests were made, between 50 and 100 fathoms, have, in other areas, proved the most productive and the absence of any showing whatsoever, cannot be regarded with anything but pessimism.

The exception that is referred to above, is a deep hole, or gully, which lies directly off, and extends into Bonne Bay. The seaward end of this small gully lies well inside the 50 fathom line. It is locally referred to as the "Flounder Hole" and previous reports, from the draggers, indicated that crab were sometimes abundant there. A spot check of six traps was set in this hole, on good mud bottom, in depths of 58 to 62 fathoms. These were hauled May 30th, producing a total of 315 commercial crabs, for an average of 52 per trap. The crabs were of a good size, most being over 4½" across the carapace. They were well filled out, and of very good quality.

During this period, two spot checks were made in the deep waters of the Gulf, approximately midway between the Newfoundland and Quebec shores. Five traps were set at each of two positions, corresponding to Lat. 49° 32' 00" N, Long. 59° 33' 00" W, and Lat. 49° 54' 00" N, Long. 59° 10' 00" W, respectively. These traps were set on good mud bottom, 137 to 149 fathoms, but the result was

negative, not a single crab being taken from these 10 test locations.

Area C – Cape Whittle – Anticosti

During the period of June 11th to June 24, the exploration was continued in the vicinity of Cape Whittle and at the east end of Anticosti Island.

The traps were set in a generally southerly and south-westerly direction from the Cape, out to the 100 fathom shelf, which is from 35 to 40 miles off the Quebec shore. The bottom was found to be not uniformly smooth, and where areas of sand and mud were located, they often gave way abruptly to formations of hard rocky bottom. Generally, the area did not appear suitable for concentrations of crabs. Some crabs were located, however, the average per trap lift being about 9 commercial crabs. Those that were taken farthest offshore, close to the 100 fathom edge, were generally of a uniformly good size, and clean, but most of the token production from this area was below average in size, and generally of a dirty appearance. Cripples were numerous, with barnacles, other parasites, and considerable discoloration.

One full day was spent cruising at full speed, along the 50 to 100 fathom shelf, westward to Natashquan. In this manner an echosounder recording was obtained, covering approximately 100 miles of shelf, but rough and rocky bottom prevailed almost continuously.

A single string of 15 traps was set on mud and sand, in 100 to 113 fathoms, at the eastern end of Anticosti Island, and this yielded an average of 29 commercial crabs per trap of fair sized clean crabs, but the per trap yield remained below the minimum for a commercial operation. This area would appear to warrant further exploration particularly in depths of from 100 to 120 fathoms.

Area D – Gaspé

On the 19th and 20th of July two strings comprising 32 traps were hauled between Cape Gaspé and Cap de la Madeleine. The depths varied between 44 and 91 fathoms, with a generally uniform bottom, sand and mud. 802 crabs of commercial size were taken from the 32 traps, (average trap lift 25 crabs) a level still substantially below commercial requirements. At this time, the commercial crabbers working in the Grande Rivière area were reported to be averaging about 80 lbs to the trap lift, so that the yield from the two Gaspé strings was approximately 50% of the commercial average on nearby proven ground.

At this time the vessel was directed to proceed to Port Aux Choix, Newfoundland. Prior to leaving, and in order to satisfy a natural concern for the effectiveness of the gear on board the "St. Cecilia II", it was decided to conduct a spot check, on proven ground. Accordingly 6 traps were set inside Gaspé Bay, commencing directly off the Cape, and extending for a distance of approximately two miles into the bay proper, in 27 to 40 fathoms. The following morning the traps were lifted and a total of 1057 crabs, of commercial size, were counted from the six traps, giving an average of 176 per lift. This was by far the best result that had been obtained since the exploration was started and the test was gratifying in that confidence in the effectiveness of the equipment was assured.

Area E – Port Aux Choix

In the spring there is a considerable fleet of boats concentrated at Port Aux Choix, engaged in the cod gillnet fishery. This fleet often numbers in excess of 50 vessels, and on an average, from spring until late fall, there are probably at least 30 vessels continuously engaged in this fishery.

When the "St. Cecilia II" was previously on the Newfoundland coast, bait was sometimes taken at Port Aux Choix, and these visits provided the Technical Supervisor with an opportunity to talk with these fishermen, who had local knowledge. One of their major problems was the number of queen crabs that were consistently found in the gillnets. With no market in Port Aux Choix, or anywhere in the area, crab was regarded only as a nuisance.

If the nets were pulled daily, the crab caught per boat was perhaps 200 to 300 lbs. However, the amount would increase very sharply if the nets were left for two or three days, due to bad weather, and in such cases it became apparent that the crab population was a real handicap to the gillnet operations. Reports of vessels having to leave areas where they were obtaining good production of cod, due to the excessive labour involved in removing crabs from the nets, were very common. In fact it seemed that every boat in the fleet had experienced this at some time. The skippers all agreed that the condition was the worst (the crab most abundant), in the spring and fall, with a tendency for the crabs to diminish periodically, during the summer months. Estimates of the amount of crab *occasionally* taken by a single vessel, in one day was as high as 3000 lbs.

The first set was made on July 24th along the edge of the drop-off in depths of from 53 to 110 fathoms on mud

bottom. The vessel then proceeded to Port Aux Choix and information from several of the local fishermen indicated that the crabs were considerably less abundant than they had been throughout May and June.

On the following day the string of 16 traps were hauled and a total of 702 crabs of commercial size were counted, providing an average per trap lift, of 44 crabs, or approximately 66 lbs. This was the best production that had been obtained since the start of the operation, with the exception of the few traps in Gaspé Bay. In addition to the commercial crabs that are referred to above, 155 soft shell crabs, mostly of commercial size, were also taken. The following day 14 traps were hauled in the same area, from depths of 51 to 79 fathoms. The average was somewhat lower from this string (36 commercial crabs per trap lift) and the percentage of commercial size soft shell crabs was about the same as that for the preceding day. A set was then made to the Northeast, between Flat Island and Pt. Ferrole, in depths of 44 to 57 fathoms.

For six days, from July 27th until August 1st, a continuous westerly gale held every vessel in harbour. Fishing was resumed on August 2nd and the string of 15 traps hauled for a total of 557 commercial crabs. Three of the traps were on hard bottom, and these were empty, so that the production referred to above was actually obtained from 12 traps. On this basis the average per trap lift was 46 crabs, or approximately 64 lbs.

On August 3rd, 15 trap lifts made in the same general area produced a total of 823 commercial crabs, for a lift average of 55. On August 4th 15 traps yielded an average of only 18 crabs, but this was attributable to the ground on which the gear had been set. In the Port Aux Choix area particularly, the productive crab ground seems to comprise relatively small patches of good bottom on which crab are undoubtedly sometimes abundant. These spots are often surrounded by areas of rough, rocky bottom, which will produce nothing but toad crab. If traps are concentrated in the areas of good bottom, good results of commercial significance may be obtained.

On August 5th the average obtained from a 13-trap string that was again set off Point Riche, was 57 commercial crabs, or approximately 80 lbs per trap lift. The following day a string that was set somewhat more to the south produced an average of only 14 crabs per trap.

On August 8th the "St. Cecilia II" departed for the North Coast of Quebec, and for the next two and one-half months the exploration was conducted along that coast,

between Perroquet Id. and Baie Comeau, a distance of approximately 165 miles.

A course was taken from Cape Whittle, past Natashquan, to a position approximately off Mingan. This represented a part of the area that had previously been selected for exploration, but the echo sounder data obtained from this, and a subsequent run over the same ground, indicates a uniformly rocky bottom, inside the hundred fathom curve.

Westward from Perroquet Island at about the longitude of Magpie, the bottom inside 100 fathoms changes and for a very considerable distance the inshore shelf, from the shore to beyond the 100 fathom contour is generally of mud and sand. There are a few rocky outcrops between Magpie and Sept Iles, but they are of limited extent, and the bottom between these two locations is generally suitable for crab. It was on this shelf, extending offshore from Magpie to about Port Cartier, that the exploration program was most successful.

Area F - North Coast Quebec

On August 9th, the first set was made between Sheldrake and Cape Cormorant. The vessel was then taken into Sept Iles for some small electronic repairs, and to complete other arrangements. A run was then made to Cap Chat, where some additional traps were taken on board. Bait was then taken at Fox River, and placed in cold storage at Sept Iles.

Fishing resumed on August 16th with the hauling of the string which is referred to above. Eleven traps, hauled from 61 to 84 fathoms averaged 124 commercial crabs, with an estimated weight of 160 to 170 lbs. This was one of the best lifts that was obtained during the two months that the vessel was in the area, and it should be noted that these 11 traps were baited with frozen squid, while all subsequent traps were baited with frozen herring.

614 individual lifts were made over an area which may be identified as the coastal shelf lying generally inside the 100 fathom curve between Havre St. Pierre in the east, and Pte. aux Morts, in the west except for two strings of 16 traps each which were set at the west end of Anticosti Island. Including these 32 traps, 175 of the total, were set in Jacques Cartier Passage, eastward from Mingan, in the gully between Anticosti Id. and the Quebec shore, and since these were largely unproductive, a more accurate assessment will result if these positions are dealt with separately.

From August 16th to October 2nd, a period of 48 days, the *St. Cecilia II* was continuously engaged in the exploration of this area, and 439 positions were fished. All of these traps were set at one-mile intervals, and practically all were in depths of 25 to 120 fathoms.

Six tests that were made in depths less than 20 fathoms were devoid of crabs. Apart from these, and a few individual traps that were inadvertently dropped on hard bottom, all of the positions fished produced crabs. The records show quite a variation in the number of individuals per trap, varying from 12 or less to over 200. However, most of the traps yielded a strong commercial average.

In general, the 439 positions were distributed over the entire area that has been described. Not all of the strings were precisely parallel, or spaced evenly apart, although all the traps in a single string were uniformly dropped at one-mile intervals, and the results indicate a fairly consistent good population throughout the area. Large individual lifts were obtained from all depths between 25 to 120 fathoms, but frequently, traps that were fished between 60 and 80 fathoms appeared to out-produce those that were either deeper or shallower.

Soft shell crabs of commercial size occurred in practically all of the traps, in reasonably uniform proportion, throughout the course of the operation but only two females, both unberried, were observed. Some variation in size was evident, and the crabs that were taken between Cape Cormorant and Moisie Bay were of a somewhat larger average size than those taken to the east and west of these positions. As a rule, crabs taken in depths of less than forty fathoms tended to be discolored and have excessive parasite growth. Good lifts were obtained from the passages between the islands that comprise the Sept Iles group, but fishing here is hazardous, due to the heavy traffic.

Another factor to be considered is the probability that this was not the period of greatest abundance, as indicated by dragger captains who reported that some tows, made off Thunder River, and in the area of Banc Rouge, in the spring and early summer, produced a great number of good crabs, whereas practically no crabs were being taken by the few draggers that were on the ground, during the exploration.

During the period of October 2nd to October 15th 176 positions were fished from the west end of Anticosti Island, close to Banc Parent, eastward into Jacques Cartier Passage to a position off Baie Johan Beetz, on the Quebec shore. This area proved to be a disappointment, and none

of the traps produced commercial quantities. A showing of crabs was obtained at the west end of Anticosti Island, with the best of the traps producing a couple of dozen crabs, but even this petered out as the exploration progressed to the eastward, and east of Perroquet Island the results were completely negative.

The exploration of the north shore of Quebec was concluded with 32 spot checks between Baie Comeau and Point des Monts, in 60 to 110 fathoms, on good mud/sand bottom. The average from these traps (38, crabs of commercial size) was higher than that obtained to the eastward, between Port Cartier and Pte. Aux Morts. The crabs taken off Baie Comeau were generally not of the quality that was obtained from the grounds to the eastward of Port Cartier which were somewhat smaller and much discolored, typical of crab found on the outer limits of a productive area.

At the end of October the vessel called at Caraquet, N.B., where additional traps were taken aboard in preparation for a brief expedition along the Labrador coast to Hamilton Inlet. A further call was made at Port Aux Choix to obtain fuel and bait, and numerous reports were received from the gillnetters which indicated that crabs were more plentiful than during August. The *St. Cecilia II* left Port Aux Choix on November 10th, and anchored that night at Chateau Bay, on the Labrador coast.

Labrador

In the period November 12th to 15th, working under marginal weather conditions, 63 traps were hauled along the Labrador Coast. These tests were made from a position commencing off Camp Island to Domino Run, in depths of 60 to 90 fathoms. The bottom generally was similar to that encountered along much of the west coast of Newfoundland, for the most part rocky, with occasional limited areas of mud and sand. Not a single queen crab was found in any of the 63 tests. There was a great abundance of toad crab, some traps having 400 to 500 individuals. Throughout this four-day period, the surface water temperatures offshore were from 2.0 to 2.25 degrees C. The current along this coast was very strong, and although the wind was offshore almost continually there was a heavy breaking swell. Snow squalls were frequent, with air temperatures between 21 and 34 degrees F. On the 15th, eighteen traps were set on Hamilton Bank in 70 to 85 fathom, uniform mud/sand bottom. During the 16th and 17th the wind was 30 to 35 knots from the Northwest, and the vessel remained anchored in Porcupine Harbour.

On November 18th 17 traps were hauled (1 was lost) and 2003 crabs, measuring from 4" to 4½" were taken. These were very uniform in size and of excellent quality. The traps had been baited with frozen squid, obtained at Port Aux Choix. The string extended for a distance of about 18 miles and the production per trap was generally uniform. Weather conditions throughout the day were bad, and the vessel returned to Porcupine Harbour with all traps on deck.

It turned colder during the night, and there was considerable ice forming in the bay. Traps and buoy lines were frozen fast to the deck, and it was evident that further work in the area would be hazardous. The vessel therefore departed shortly after daylight for Blanc, Sablon. When approaching Belle Isle the forecast was for easterly gales, and so the destination was changed to Flowers Cove, which offered better shelter.

Several gales were experienced for the next three weeks with winds to 80 knots, which made it virtually impossible to resume fishing. A final attempt was made on the 5th of December, when eight traps, fitted with doubled up buoy lines, were set east of St. Paul's Island, in depths of from 234 to 258 fathoms. That night a southeast gale developed, and strong winds continued without a break for the next week. During this period two attempts to retrieve the string were frustrated by extreme weather conditions and only one of the eight traps was recovered. There were no crabs of any kind in this trap. On December 13th, the operation was terminated and the St. Cecilia II was delivered to the owners at Cheticamp.

Summary of Results of the Exploration

The North end of Cape Breton Island is a part of the ground which is already under exploitation by vessels from Cheticamp and others from more distant points. In the normal course of commercial operations, these vessels will spread out and adjacent areas of promise will automatically be investigated.

It seems unlikely that any fishery for crab will develop on the west coast of Newfoundland, south of Port Aux Choix, with the exception of the very small area off Bonne Bay. Not a single crab was taken from any of the tests, from Cape Ray to Point Riche, a distance of nearly 200 miles, and this would appear to preclude any chance of the area being a productive region. There is a possibility that crab may be found inside the 100 fathom contour. Unsuitable hard bottom is the rule, rather than the exception, at least as far north as Cow Head. The most

negative aspect, in considering this area of the coastal shelf, is the fact that the bottom, for a distance of over 50 miles, between Cow Head and Point La Fontaine, although appearing to be of the type that is favoured by queen crab, was also completely barren. This is the only major area that was encountered in the entire course of the operation, which, although uniformly of mud/sand formation, failed to produce a single crab.

The deep hole off Bonne Bay lies easily within the reach of the small vessels that are based just within the entrance of the Inlet. Although not large in extent, it is possible that crabs may range into the Inlet. But regardless of this possibility, the deep area does have a concentration of crabs that may be of interest. This small local resource might easily provide a supplementary source of income for the resident fishermen of Bonne Bay, whose current livelihood is marginal.

The absence of crab, which seems to prevail south of Point La Fontaine, Newfoundland, changes abruptly at about the latitude of Point Riche. With respect to the possibilities for commercial development, the Port-aux-Choix area is difficult to define. The results were inconclusive, and further investigations will be necessary before firm conclusions can be drawn. It seems probable that the investigation did not coincide with the time of the greatest abundance of crabs.

The grounds between Point Riche and Point Ferrolle did not appear to be extensive, comprising relatively small, smooth areas which frequently gave way to areas of rocky bottom. The edge on the Quebec side, extending to the southwest of Point Riche, was not extensively explored, and any proper assessment of the area will require that this be done. However, a single plant operation would seem reasonable at Port-aux-Choix. It seems certain that a substantial daily production could be delivered by the fleet of day boats, although it is not suggested that such a plant would rely on the crabs being produced by gillnets, but rather that such production could substantially supplement the supplies from perhaps three or four conventional trap vessels. Combining these sources, it seems feasible that a sizeable operation could be maintained.

On the Quebec side, the area to the northeast of Great Mecatina Island, in a line with Greenly Island, would appear to warrant further exploration, and any discoveries there would greatly enhance the prospects for a viable operation at Port-aux-Choix.

All the shelf waters of Anticosti Island may still be regarded as an area of potential. In places, the 100 fathom line extends several miles offshore, and the possibility exists that extensive productive grounds may exist around this large Island. The single string of fifteen traps that was hauled at the eastern end of the Island during the course of the St. Cecilia II explorations, averaged about 30 commercial crabs, which may at least be considered sufficient to encourage further exploration.

The Quebec north shore, between Perroquet Island and Port Cartier, has concentrations of crab which should be adequate for commercial operations, and the area is large enough to support a substantial fishing effort. An operation at Thunder River, where there are existing freezing and cold storage facilities and other services, would appear worth considering, and Sept Iles is another location which may attract interest as the industry develops. The season in the Sept Iles area would be similar to that of other areas of the Gulf, commencing about mid-April and terminating at the end of November.

The results obtained from a single string of 17 traps, that was hauled on Hamilton Bank, were impressive and would appear to warrant further extensive exploration of this region.

Crabs are known to inhabit the Gaspé Coast shelf, over the entire distance from Cap des Rosiers to Matane, and possibly even farther to the west. However, no big lifts were obtained from the spot checks that were made. The shelf is extremely narrow, and frequently there is less than a mile of ground between the 50 and 100 fathom curves, and this factor alone would appear to sharply limit the potential of this area.

One important factor that must be considered in assessing the over-all results of the exploration is the indifferent condition of the bait that was frequently used. Frozen herring was normally obtained on weekends from government bait stations that were often remote from the area being explored. The vessel had no refrigeration facilities, and during the warm weather the bait, especially when in bulk rather than block form, soon deteriorated. The importance of fresh bait, in obtaining optimum results, is recognized, and from this it may be deduced that the production from at least some of the test traps was lower than might be expected from commercial gear.

FEDERAL/PROVINCIAL COST SHARING EXPLORATORY PROGRAMS

QUEBEC

Excellent results were obtained by a vessel fishing from the Magdalen Islands in an area between Orphan and Bradel Banks. It is estimated that this extremely rich area would measure 100 miles by 50, from 45 to 75 fathoms. Catches averaged more than 150 crabs per trap, and fantastic individual lifts weighed up to 1,000 pounds of crabs per trap. On the first day, six traps yielded 4,300 pounds.

Between Orphan Bank and Magdalen Islands, production was lower but still better than the yield from the Gaspé area.

PRINCE EDWARD ISLAND

Gillnetters fishing on the northwest coast in 20 fathoms of water began to catch increasing numbers of crabs in late July and August. However, the crabs had almost disappeared entirely from the nets after about two months. This seems to indicate an inshore migration, possibly a spawning run, and this interesting phenomenon should be investigated further.

NOVA SCOTIA (fig. 10)

The most important aspect of the 1968 exploration for crabs carried out by the Province of Nova Scotia was the confirmation of the existence of good stocks of red crab in water depths from 200 and 300 fathoms, off the edge of the Continental Shelf.

Impressive catches, as high as 163 crabs per trap with an over-all average of approximately 66, indicate that this area would support a fishery. It is rather interesting to note that red crab appear to prefer a fresh mackerel bait, in contrast to queen crab in the Gulf of St. Lawrence which are caught most successfully with fresh herring.

Smooth, soft mud bottom is preferred by both red crab and queen crab. The latter species were caught in concentrations between 60 and 100 fathoms southwest of Cape St. Lawrence, Cape Smokey and Canso, but other areas surveyed generally yielded poor results.

NEWFOUNDLAND (fig. 11)

During the summer of 1968, exploratory fishing operations for queen crab were carried out in the following areas:

- (a) The inshore and offshore waters of Conception, Trinity and Bonavista Bays;
- (b) The inshore and offshore waters of the south coast of Newfoundland from Port-aux-Basques to Placentia Bay.

Two vessels were chartered, the east coast survey being carried out by a converted 50-foot Newfoundland longliner, and the south coast survey by a 65-foot west coast combination type vessel. The former vessel was equipped with conventional Canadian constructed crab traps measuring 6' X 6' X 2½', and conical shaped Japanese traps. The latter used only Canadian built traps. In area (a) in 90 to 300 fathoms, good signs of queen crab were noted with some areas producing better than others. On the south coast a great area was explored, but commercial populations were discovered in Fortune and Placentia Bay only.

In addition, three observers were engaged to report on incidental catches of crabs in areas where turbot gillnetting was being carried on. It should be noted that these areas were outside the main survey perimeters. We were thus able to gain valuable information which we have been able to use in our 1969/70 planning.

In the 1969/70 program, the following areas will be explored:

- (a) From Fogo Island through Notre Dame Bay, White Bay and Green Bay to St. Anthony.
- (b) The area northwest and south of Port-aux-Choix.
- (c) The southern waters of Labrador as far north as the northeast edge of Hamilton Banks.

NEW BRUNSWICK (fig. 12)

An area adjoining the northwest perimeter of the Gaspé commercial crab grounds was systematically sampled by the New Brunswick Department of Fisheries, and there were strong indications that crab populations extend out into the Gulf for a considerable distance outside the proven grounds. Catches were irregular, but this could be attri-

buted to natural phenomena, and chances are that a commercial operation is feasible on this ground.

In 1969 the New Brunswick Government will extend the area of exploration even further into the Gulf towards Bradel and Orphan Banks.

EXTRACT FROM "CANADIAN FISHERMAN" DECEMBER, 1967

SPECIFICATIONS - ST. CECILIA II

COMBINATION VESSEL. 65' L. 19' B. 9' 6" D.
Completed June 25, 1967.

OWNER: Cheticamp Fish Co-op Limited, Cheticamp, Nova Scotia. BUILDER: Fraser & Chiasson, Cheticamp, Nova Scotia. DESIGNER: William Reid, Vancouver, British Columbia.

COST: \$145,000. FISH HOLD CAPACITY: 120,000 lbs. SPEED: 12 knots.

HULL: Wood. DECK-HOUSE: Wood.

POSITION-FINDER: Marconi DX navigator—COMM-100 Loran. RADAR: Marconi 48m. RADIO-TELEPHONE: Marconi CN-86. ECHO SOUNDER: Simrad Skipper 512-12 white line.

MAIN ENGINE: Caterpillar D-343 diesel, 6 cyl., 385 h.p., at 1200 r.p.m. PROPELLER: Kennedy, fixed, 3 blades, 52" dia. X 44" pitch. AUXILIARY SET: Russel-Hipwell, S.R.-2 Lister, 12 h.p. GENERATOR: Alternator 32 volt, 60 amp. TAILSHAFT GENERATOR: Kurtz-Root, 5 k.w., 32 volt. VOLTAGE REGULATOR: Delco-Remy. BATTERIES: Surret, 32 volt, set 4, 240.

PUMP: Marine Products, 536-B, 2". STEERING GEAR: Wagner T-10, hydraulic. WINCH: Swann, 275-combination drag & seine, hydraulic. GALLEY RANGE: Lunenburg Foundry, 33, oil. HEATING SYSTEM: Hot air, 50 A.S.M., Oil, Smith-Webasco.



Fig. 1 Ste. Cecilia II

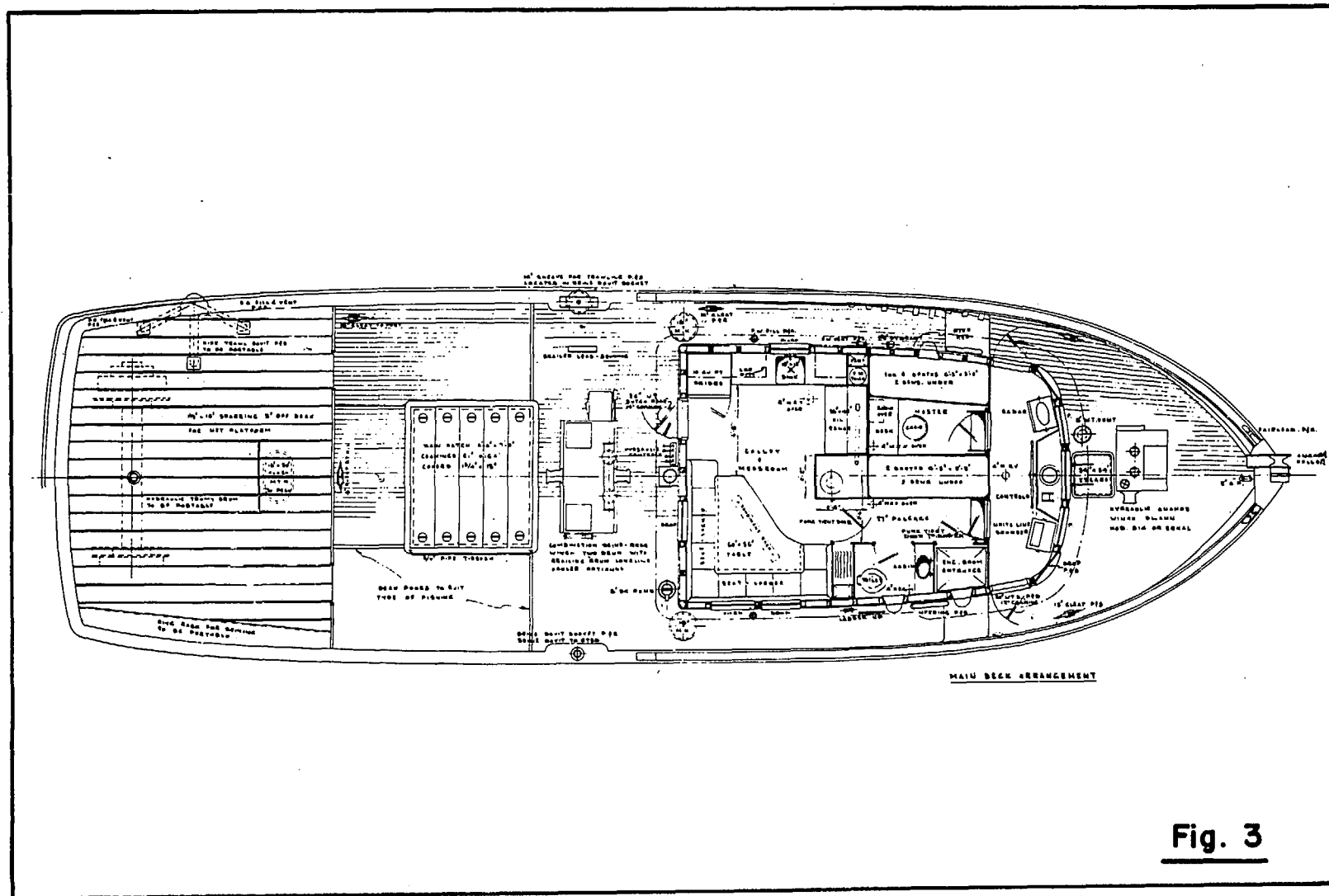


Fig. 3

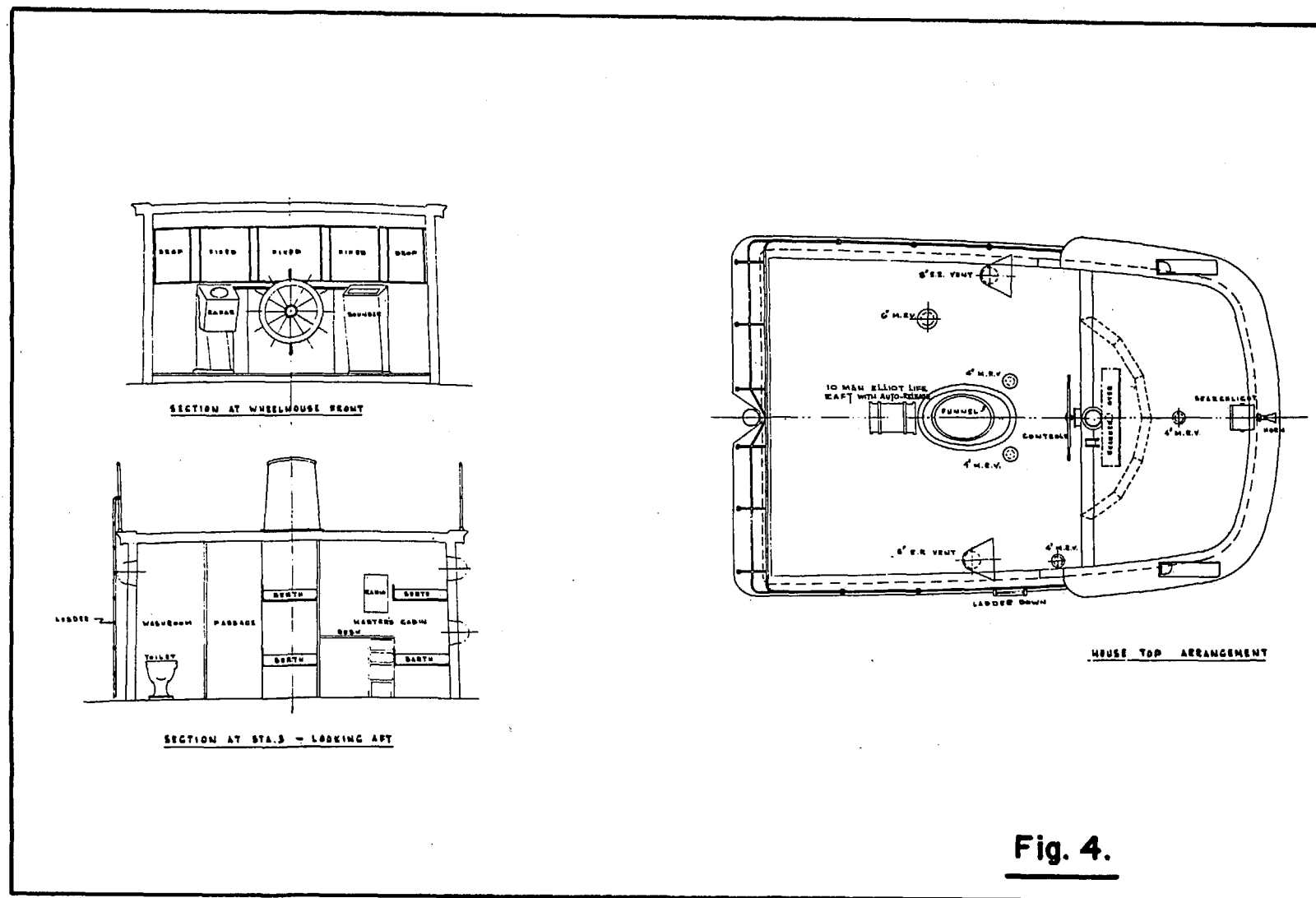
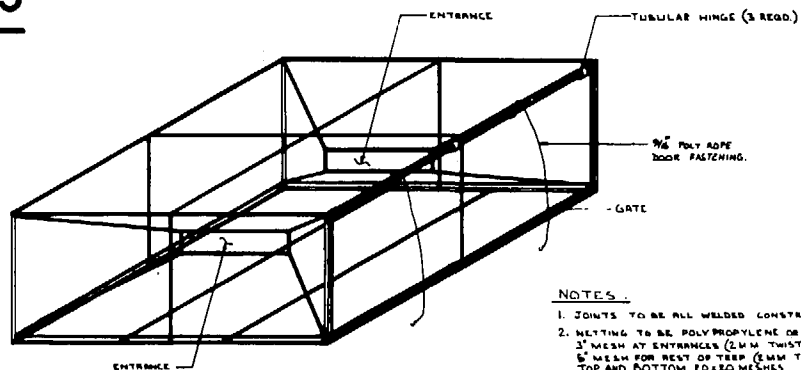


Fig. 4.

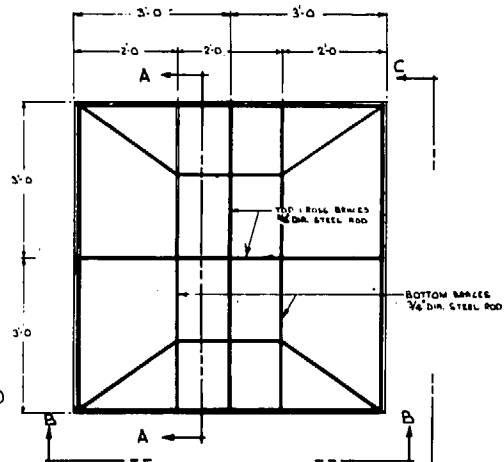
Fig. 5



ISOMETRIC VIEW

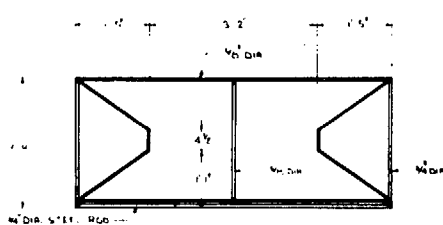
NOTES

1. JOINTS TO BE ALL WELDED CONSTRUCTION
2. NETTING TO BE POLYPROPYLENE OR EQUAL
3" MESH AT ENTRANCES (2 MM TWISTED)
6" MESH FOR REST OF TRAP (2 MM TWISTED)
TOP AND BOTTOM EDGED MESHES
SIDES 20x8 MESHES
6" MESH SPACE 1" MESH EVERY 3/8"
START AND FINISH 1/8" FROM EACH CORNER.
LACING TO BE 2 MM DOUBLE TWINE.



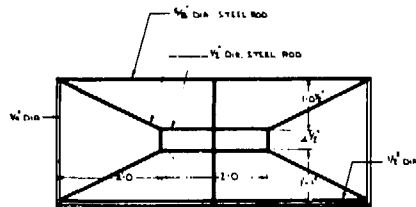
PLAN VIEW

SCALE: 1/8" = 1'



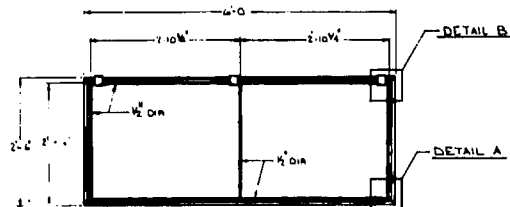
SECTION 'A-A'

SCALE: 1/8" = 1'



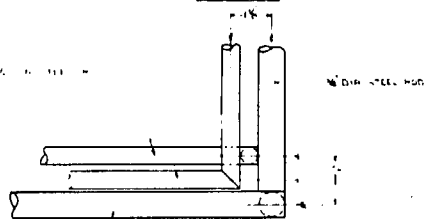
ELEVATION 'B-B'

SCALE: 1/8" = 1'



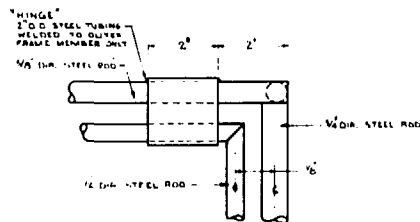
ELEVATION 'C-C'

SCALE: 1/8" = 1'



DETAIL A

SCALE: 1/8" = 1'



DETAIL B

SCALE: 1/8" = 1'

DEPARTMENT OF FISHERIES NEW ZEALAND		T. MILLERSON
72" SQUARE QUEEN CRAB TRAP (CONTINUATION OF DETAIL)		AS NOTED
		FCB. 1.146B
		I.D.V.-103-C

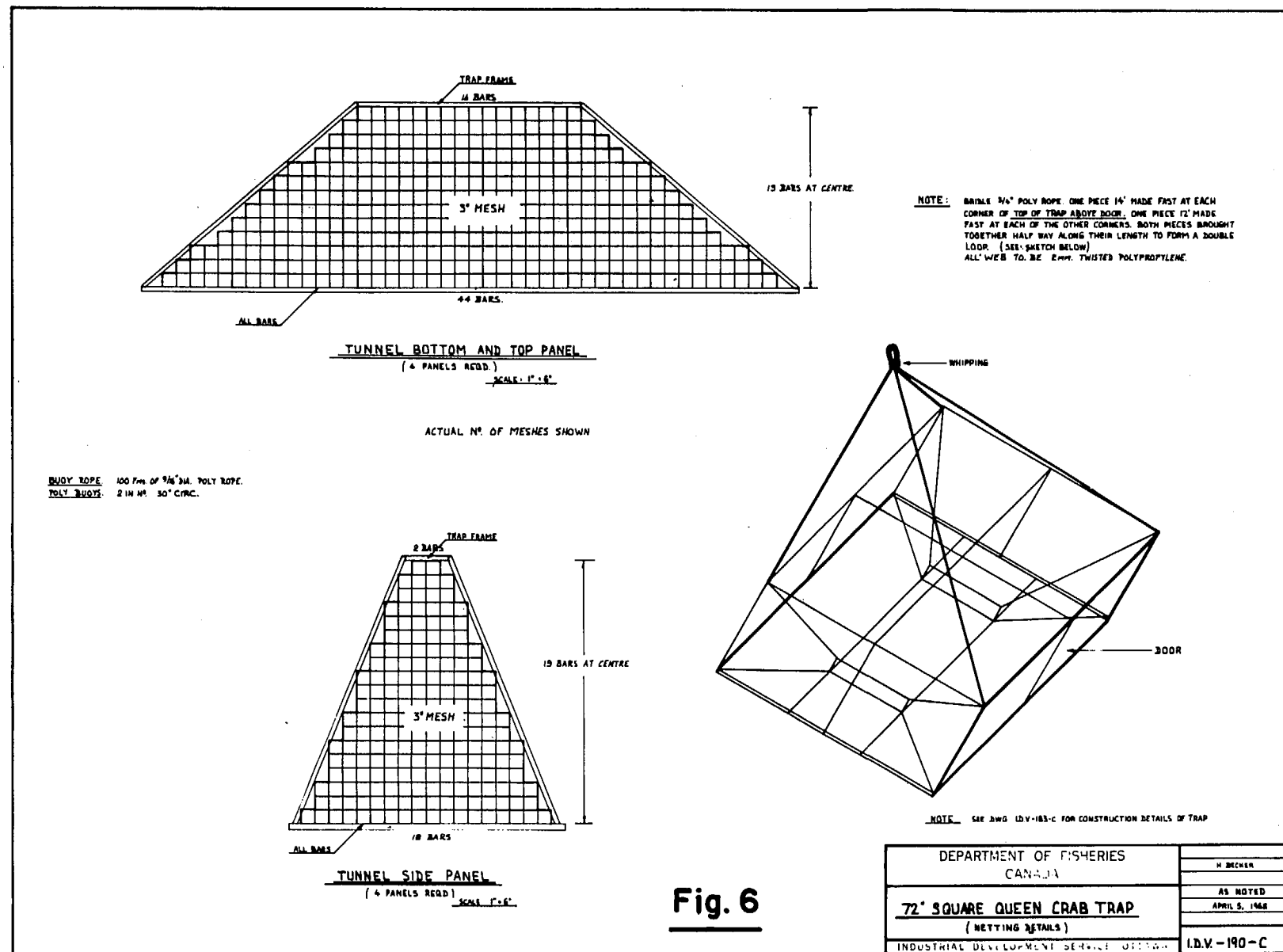
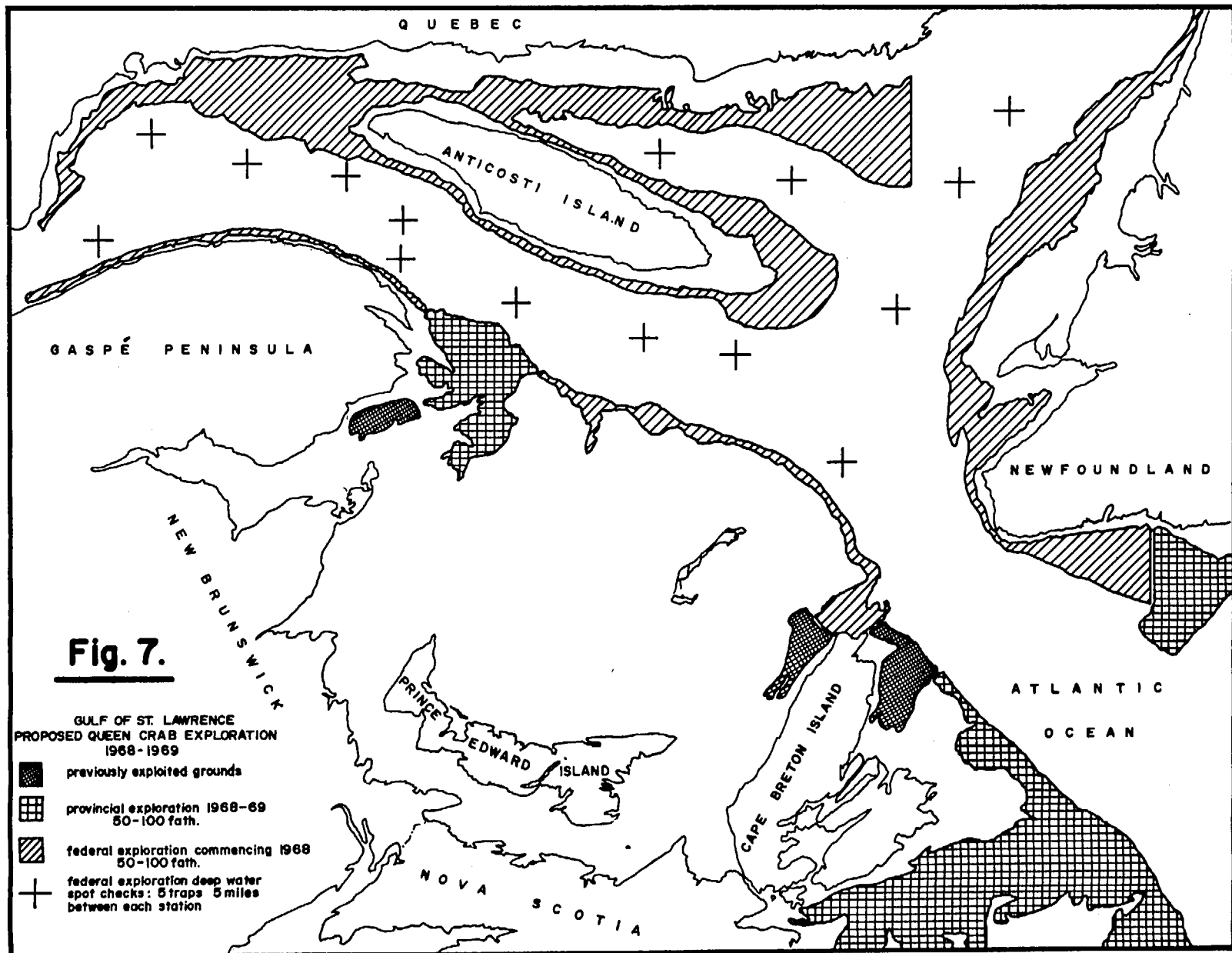
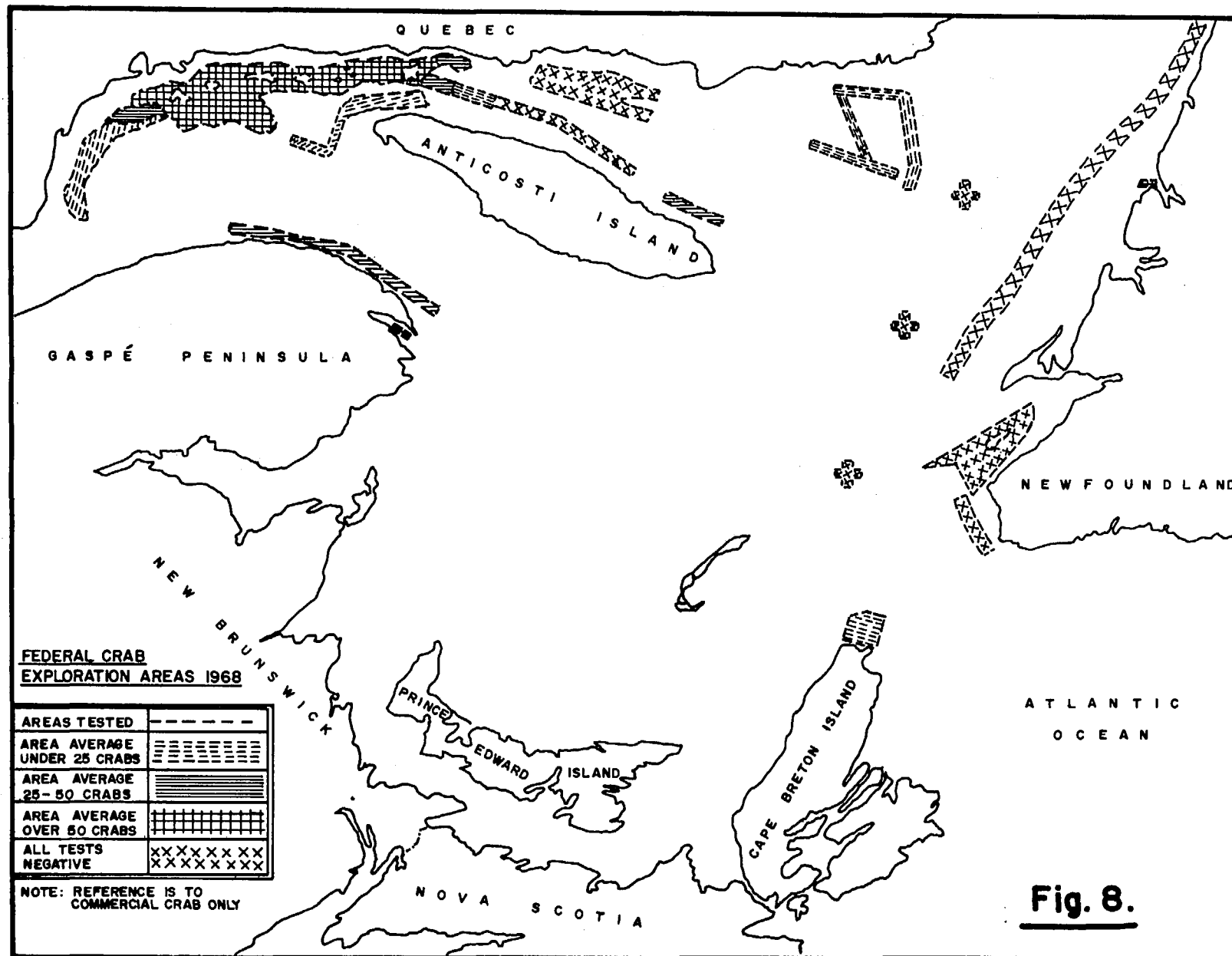


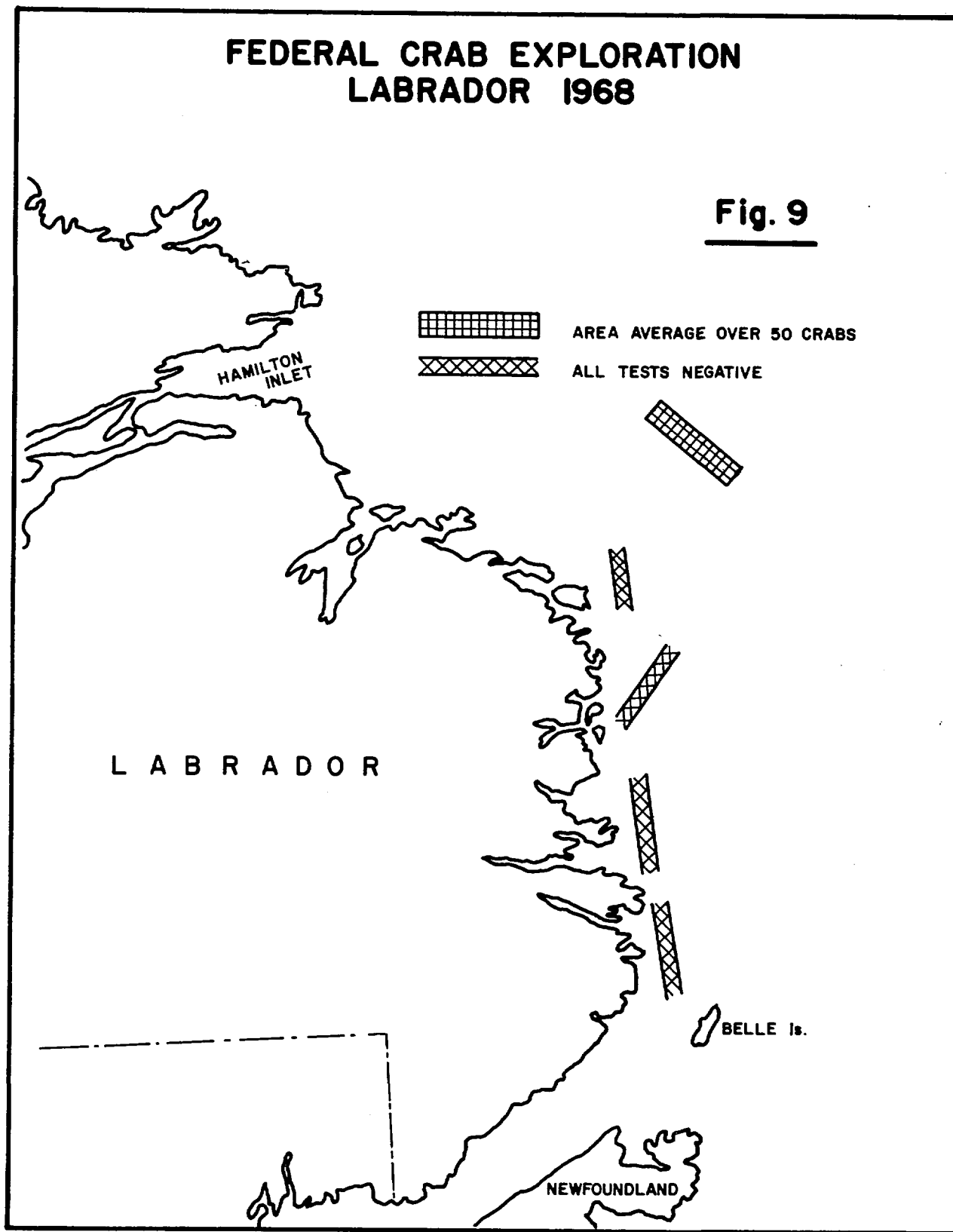
Fig. 6





FEDERAL CRAB EXPLORATION LABRADOR 1968

Fig. 9



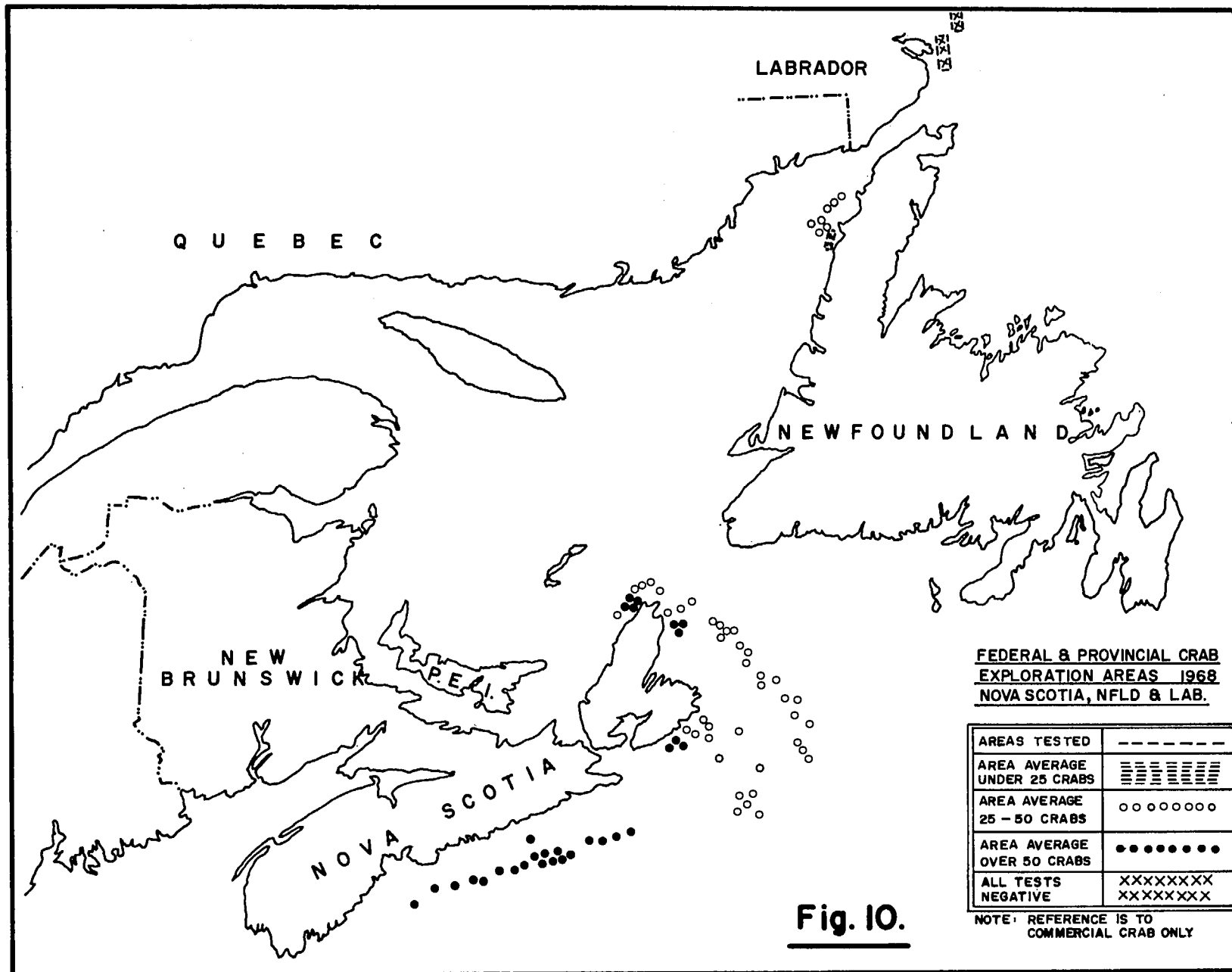
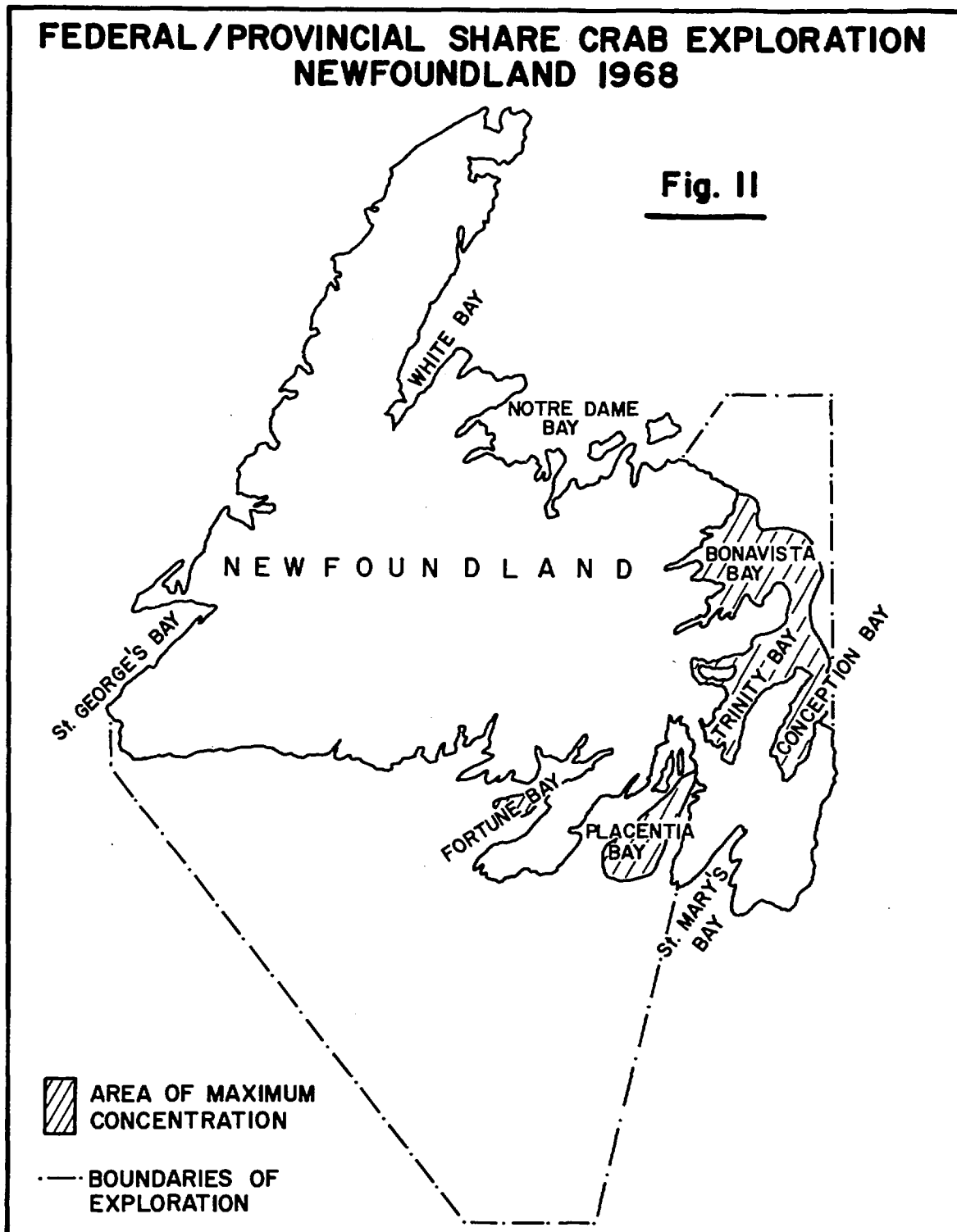
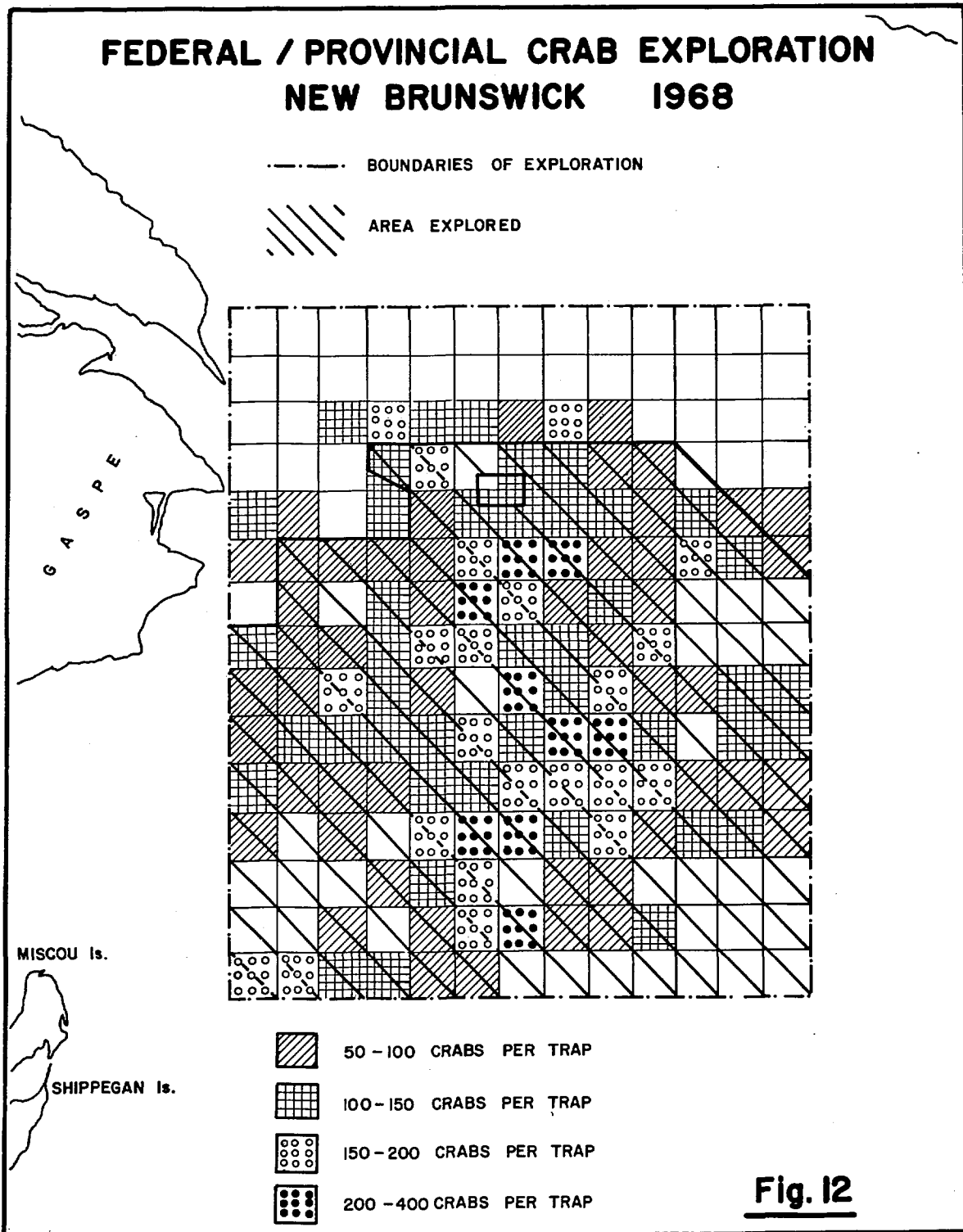


Fig. 10.

FEDERAL / PROVINCIAL SHARE CRAB EXPLORATION NEWFOUNDLAND 1968

Fig. II





APPENDIX I

PROGRAM PLAN—FISHING OPERATIONS DIVISION INDUSTRIAL DEVELOPMENT BRANCH Fisheries Service, Department of Fisheries and Forestry Exploration for Queen Crab, Atlantic Area, 1968.

OBJECTIVES

The Industrial Development Branch of the Federal Department of Fisheries and Forestry intends to explore extensive areas of the Gulf of St. Lawrence by means of crab traps in order to establish the distribution and abundance of this species.

Queen crab is becoming an increasingly important resource in the Atlantic commercial fishery due to the stimulus of preliminary experimental catching and processing which has been carried out under federal/provincial cost sharing arrangements during the past three years. Many vessel owners are presently rigging out for crab fishing and processing plants are gearing up to handle the anticipated production.

Investment in catching and processing of queen crabs is increasing rapidly, and this will result in intense fishing pressure on known stocks. Exploration, therefore, becomes extremely urgent, not only because a crab trap fishery could revitalize depressed sections of the fishery in certain areas, but also to ensure that sufficient stocks exist to provide a continuing supply to equal the increasing demand.

Figure 7 shows approximately the areas which have been exploited and potential areas which will be explored (a) under federal/provincial cost sharing arrangements, and (b) by the Department of Fisheries and Forestry as a totally federal project.

A general report will be published at the conclusion of the 1968 program, and in addition, interim reports will be published periodically.

METHOD

Approximately 40,000 square miles of the Gulf of St. Lawrence may produce queen crabs in commercial quantities. Because of the size of the area, a highly systematic search pattern must be employed.

Lines drawn horizontally and vertically at 2½-mile intervals will provide a basic search pattern. Decca positions at each point permit an accurate and easily recorded search to be conducted. While traps set on these positions could miss small concentrations of crabs, any area of significant population would certainly be bisected and a more intensive search could then be carried out.

By using Decca, the possibility of time lost due to fog will be eliminated. Radar reflector buoys will be employed for the deep water spot check positions. Any search area can be temporarily abandoned and returned to at a later date with no loss of time due to overlapping caused by inaccurate positioning.

Prime search areas plotted in this manner represent a total of more than 5,000 positions to be fished.

A 65-foot vessel equipped to carry a total of 15 traps on deck could be expected to fish 15 positions per working day. This would represent 85 miles of travel plus time to haul and re-set the traps—in all, a total of approximately 12 hours per day. Sixteen positions have been plotted in the first instance, but it is thought that the number may have to be reduced, depending on the efficiency of the operation.

Two vessels equipped and operated as described could complete a preliminary survey of all likely areas in approximately 150 working days. The average number of fishing days these vessels normally operate in a season is 100, and it is therefore not anticipated that all the areas can be sampled in one season.

IMPLEMENTATION

Two vessels of about 65' L.O.A. will be chartered by the Industrial Development Branch. One of these, "St. Cecilia II," will commence operations on or about April 15, 1968 in the area closest to Cape Breton, Nova Scotia. The second vessel will be integrated into the operation at a later date.

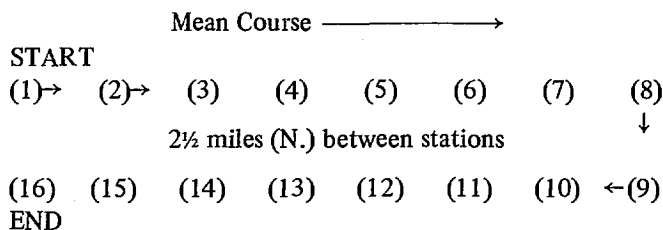
The Industrial Development Branch will provide 60 traps, 6' X 6' X 30' complete with buoys, lines, etc., ready to fish. In addition, platform weigh scales, radar buoys, bait, ice, and catch/sample record forms will be provided.

A technician field supervisor, experienced in all aspects of crab fishing, will be assigned by Industrial Development Service to the project. Where there is a requirement for an additional observer/reporter, this service will also be provided by the Industrial Development Branch.

*EXPLORATION FOR QUEEN CRAB—
ATLANTIC AREA—I.D.B. 1968
GRID PATTERN SAMPLING PROCEDURE—
DAILY ROUTINE*

Referring to the master chart, a mean course is selected to allow the most efficient coverage of a particular area.

Day One—16 traps are set as per the following pattern.

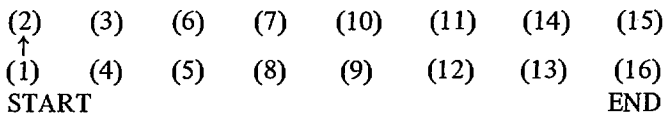


Each station is to be recorded in terms of decca bearings and water depth (see catch record form).

It can be seen that the vessel will be in a position 2½ miles from trap #1 when the 16th trap has been set. Normally the vessel anchors here for the night.

Day Two—depending on the general shape of the area to be covered. One of two lifting patterns may be used.

Either (1)



Or (2) lift traps in sequence they were set on day one.

All traps remain onboard after lifting.

If lifting sequence (1) is used, the vessel will finish up in position to start setting after steaming 2½ miles along the mean course.

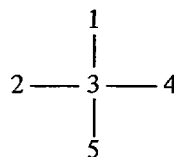
If lifting sequence (2) is used, the vessel will finish up in position to start setting after steaming 2½ miles 90° away from the mean course.

DEEP WATER SPOT CHECKS

The grid pattern described above is set up in such a way that when the vessel reaches a position adjacent to one of the deep water spot checks, it will be possible to complete the deep water set and a part of the normal pattern in a single day.

It can be seen that the main search areas lie between the 50 and 100 fathom contours. This appears to be the preferred range of depth for queen crabs. It is considered important, however, to sample deeper areas as so little is known about this animal.

A cross pattern with 5 traps will be used for this purpose (figure 1) with 5 miles between traps, vis.



*FISHERIES RESEARCH BOARD
CATCH/SAMPLE RECORDS*

Attention is drawn to the specimen catch/sample record form, the completion of which will provide important information to assist an investigation by the Fisheries Research Board into the life history of the queen crab. This investigation is sponsored by Industrial Development Branch in order to determine presently unknown factors which will influence the development of the fishery, such as life span, age at maturity, age of males at acceptable market size, sex ratio and preferred diet. Every effort should be made to sample one trap each day.

*INSTRUCTIONS FOR RECORDING OF DATA
ON FRB RECORD SHEET*

The purpose of this work is to provide FRB scientists with information on the size distribution, sex composition and life history of the queen crab. This information along with other records collected during the season on research and commercial vessels will be used to improve our knowledge of the sizes and quantities of crabs on the grounds, the ratio of males to females, and the effects of depth, temperature and season on crab abundance and biology.

The following notes should make the record sheet easier to understand:

1. Use a new sheet for each sample examined and be sure to record the details of position, time hauled, depth, etc. as accurately as possible.
Any special observations such as other animals in the trap, rough weather prior to hauling, etc. to be entered in the remarks box.
2. If there are more than 100 crabs in the trap, make sure that the sample measured is free from bias. One method of ensuring this would be to dump the crabs into a tank of sea water and fish out the crabs with a dip net until 100 have been measured.
3. Measure the maximum carapace width to the nearest millimetre.
4. In the column for sex determination record:
M for male; F for female
5. If a female is berried, record in this column:
N for new eggs
E for eyed eggs
L if the tail flap has empty egg cases present which indicates recently liberated larvae
6. Under the column "Shell Condition" record:
 - 1 for a newly moulted, very soft-shelled crab
 - 2 for a crab which is not newly moulted but the legs are easily bent and the shell is quite soft and free of other animal growths
 - 3 for a shell which is hard and the horns of the rostrum ("nose") and other spines are sharp and well defined. Very few, if any, animals such as barnacles on the shell
 - 4 for a hard-shelled animal which has horns and spines worn and dull and many other animals growing on the shell

*INDUSTRIAL DEVELOPMENT BRANCH
CATCH/OBSERVATION FORM (FIGURE IV)*

These are self-explanatory. Each trap lift is to be recorded with the required weights, measurements and observations. It should be possible to carry out this work during the 20-minute (approximately) steam between traps. Accurate data recording is most important.

DUTIES

TECHNICAL SUPERVISOR: will ensure that the exercise is carried out efficiently and accurately. He will be responsible for decisions in the field where these affect adherence to the project plan, vis:

1. Number of traps worked per day.
2. Amount of data recorded.
3. Coverage of specific areas.
4. Movement of the vessel from place to place.

Command of the vessel remains the responsibility of the captain. If, in the opinion of the supervisor, the vessel is not run efficiently to the detriment of the project, he should report the facts immediately to Ottawa.

All record forms, together with a brief daily report, should be submitted on a weekly basis.

OBSERVER: will be responsible for keeping daily records and observations under the direction of the Technical Supervisor.

TRAPS

These will be standard 6' X 6' X 30". Each trap will be equipped with 100 fathoms 9/10" diameter poly. rope and 2 X 30" diameter buoys.

Radar reflector vertical buoys will be used for the deep water spot check traps as these will be 5 miles apart.

BAIT

Frozen herring bait will be used consistently in order to ensure that there will not be any bias in the catch per unit of effort in any given area. Bait and ice will normally be picked up weekly at the nearest convenient plant.

THE CATCH

All crabs are to be handled very carefully and should be returned to the water immediately after being weighed and measured. This procedure may be changed at any time at the discretion of the Fishing Operations Division, Industrial Development Branch.

I.D.S. EXPLORATORY CRAB SURVEY, RECORD SHEET FOR F.R.B.

VESSEL _____ DEPTH _____
 DATE _____ BOTTOM TYPE _____
 POSITION _____ BOTTOM TEMP. °C _____
 TIME HAULED _____ SPECIES _____
 HOURS SET _____ TOTAL NO. IN TRAP _____

REMARKS:

CRAB NO.	CARAPACE WIDTH (MM)	SEX	IF BERRIED NOTE EGG STAGE	SHELL CONDITION	CRAB NO.	CARAPACE WIDTH (MM)	SEX	IF BERRIED NOTE EGG STAGE	SHELL CONDITION
1					26				
2					27				
3					28				
4					29				
5					30				
6					31				
7					32				
8					33				
9					34				
10					35				
11					36				
12					37				
13					38				
14					39				
15					40				
16					41				
17					42				
18					43				
19					44				
20					45				
21					46				
22					47				
23					48				
24					49				
25					50				

Crab Fishing Techniques



Mr. Frechet

The Canadian history of the commercial fishery of Atlantic crab is only one decade old. A first limited attempt was made by the Quebec United Fishermen between 1959 and 1965 to freeze dragger-caught spider crab legs in polyethylene bags. Less than 100,000 pounds were thus processed.

Then, in 1962, a joint project between the New Brunswick and the Federal Fisheries Departments developed a rock crab fishery after the 2-month lobster season with a view to keeping lobster plants active for longer periods. Under the supervision of Mr. R. A. Prince of the Industrial Development Service of the then federal Department of Fisheries, the traditional lobster pots were fitted with a flat oval entrance which allowed rock crabs in but kept lobsters out. Undersized rock crabs could return to the sea through an escape hatch. Concurrently the double outrigger Gulf of Mexico method of trawling for crabs was demonstrated by fitting a large open lobster boat. A highly qualified skipper from North Carolina instructed the crew in this very efficient outrigger fishing technique.

Also in 1962, the Industrial Development Service took the initial step of introducing the king crab trap of the Pacific coast to catch the queen of the Atlantic Ocean floor off New Brunswick.

Instead of catching queens, only males turned out. However, this limited experiment paved the way to the growing industry which has assembled all of us here today.

There are probably more methods used in the world for capturing crabs than for any other one creature of the sea. It will therefore be impossible to describe or analyse them in depth within the limits of time allocated. We will

by

Jean Frechet
Chief, Fishing Operations,
Industrial Development Branch,
Fisheries Service, Department of Fisheries
and Forestry, Ottawa.

briefly see these methods but spend a little more time on the most popular trap method and conclude with views on future developments.

There are two major classes of crab fishing techniques: the seven coastal methods:—

- 1 — dip net (épuiette)
- 2 — push net (râteau)
- 3 — oyster tongs (pinces)
- 4 — haul seines (seine de rivage)
- 5 — pound nets (pêche à fascine)
- 6 — crab fyke (pêche en cœur)
- 7 — hook net (pêche à cerceaux)

and the seven offshore methods:—

- 1 — trotline and longline (palancre)
- 2 — tangle net (filet maillant)
- 3 — pots and traps (casier et trappe)
- 4 — dredge (drague)
- 5 — scrape (chalut sur étrier)
- 6 — Danish seine (seine danoise)
- 7 — otter trawl (chalut à panneaux)

Each method offers unlimited variations and models depending on region or even differing with each fisherman.

Dip net

The dip net is made of an 8-foot long pole fitted with a ring holding the dip net. Usually operated from the bow of an open boat, it is used mainly for catching soft crabs or peelers. It is important to "nick" or break the hinge of the main claws of peelers to prevent wounds or bruises and destruction of each other. Peelers are also sorted and placed

in a different drained container from that used for soft crabs.

A few drops of oil on the sea surface will improve the visibility of the bottom if the weather is windy. This method is used in shallow water where crabs moult in the deltas of rivers, like the Mississippi delta. Soft crabs constitute an expensive regional delicacy in Louisiana and returns to fishermen are excellent.

Peelers are kept alive in floating tanks until they have shed their hard shell and are then ready for a lucrative live market.

Push Net

Used for the same purpose, the push net is twice as large but is flattened so as to rake the shore. It is pushed in front of the fisherman in wading boots, like a small drag net. The pole is shorter but stronger.

Oyster tongs

The oyster tong is well known on the Canadian Atlantic seaboard and is like a big pair of wooden pliers with teeth to collect molluscs and crustacea in shallow waters.

Haul Seines

The "shut off" or shore haul seines are like miniature purse seines. They may range from ten to 1,000 feet in length, and from 3 to 50 feet in depth. They are handled manually or with power skiffs and shore capstans or powered winches. Set at right angles to the beach, they are towed in one direction so as to sweep, as long as possible, a portion of the sea shore which is free of obstructions. A bunt or bag located in the middle is made of stronger netting so as to collect the catch which is brought up to the shore.

Pound Nets,

Crab Fykes and Hoop Nets

These three methods are relatives of our Canadian cod or eel traps and herring weirs. They are made of a leader directing the stocks towards an enclosure through a funnel type of entrance. The pound net is made of netting while the fyke uses wire fences. The first has a floating cork line and a leaded bottom line while the latter is staked. The only difference in the hoop net is that either wooden, metal or plastic hoops or rings support the webbing in the pound or collecting end.

Trotline and longline

Both trotlines and longlines are baited lines but the trotline has no gangings like the longline.

In the trotline, chunks of bait are inserted in the twisted weave of the line. Tough fish, meat or squid constitute the most effective bait. Rough fibers are smooth fibers in the longline so as to retain the crabs which stick to the long line with their claws.

To heave the longline, a gurdy or drum winch is used. A roller precedes the gurdy and automatically removes the crabs clinging to the trotline. Crabs fall in a basket or dip net.

On the Quebec North Shore, particularly in the Johan Beetz Bay region, fishermen have been using longlines for a long time to catch crabs. Rough lambs' wool balls were used at the end of the gangings. Some were dyed in bright colors while others were simply dipped in whale or fish oil to lure crab. These stuck easily to the rough fibers of wool while being hauled from depths of 30 to 130 fathoms.

Tangle Net

The crab tangle net is a wide mesh strip of webbing fished very close to the bottom. Depending on species, the mesh size will vary from 7" (rock crab) to 20" (king crab) and hung in a draping fashion from 60% to 40% of the stretched mesh length. It is important to have the knots in a vertical position, that is with the threads coming out of the knot up and down, not sideways. A lead core rope is indicated as a ground line while traditional floats may be omitted and replaced by floating webbing of light density. Preferably, a plastic hose or synthetic light density rope will be used as a cork line. Ties between the webbing and the side ropes should be made with an untreated natural fiber to allow a rapid destruction and to prevent continuous fishing in case of losses. This constitutes a valuable conservation measure since nets, lost for many years, have been found with recent catches.

Tangle nets are set across the bottom current direction for optimum efficiency. A drum winch equipped with distant spooling roller guides constitutes the most efficient net heaving method.

Pots and Traps

Shapes and materials used in crab pots and traps have unlimited variations in the world. Woods, and natural fibers, metals and synthetic materials are used in their

construction. A number of shapes have been tested by Mr. Imbeault, who will submit an account of the results achieved in the paper that he will present at this conference.

The most popular in use are of bell, rectangular and circular shapes. Mesh sizes or spacing of laths wide enough to allow the escape of nonmature or noncommercial sizes of crabs should be used. Otherwise, one or two escape hatches should be fitted in the side of the pot with an automatic trigger to prevent re-entry.

Following tests on the productivity of a variety of traps, carried out by Mr. Imbeault, and discussions with crab fishermen and behaviour studies carried out by biologists, two unfilled requirements for operations in Canadian Atlantic waters, and particularly in the Gulf of St. Lawrence, became evident:

1. To have a trap well anchored in the mud, the latter type of bottom appears to be the preferred habitat of queen crabs. Since most of these grounds are swept by fast moving currents, because mud bottoms are very slippery and because crab traps are tied to rather sizeable ropes and large floats and buoys, traps have a tendency to slide on the slippery bottom and to vibrate. This state is accentuated when the crab fishing grounds are wind-swept by storms which create steep waves with little distance between crests.
2. To have a trap that would occupy as little space as possible aboard fishing vessels. This might have been solved with collapsible traps, but they present problems of strength and time-consuming assembly on the moving and crowded decks of rather small boats.

It is felt that both these requirements have been filled in the modified trap (being demonstrated here) which will rest on deck and sink in the mud because the webbing is four inches above the lowest steel frame. This steel frame has anchoring capacity, which is an advantage over the natural buoyancy of wooden frames. It is also stronger.

Another real problem is the deterioration in strength of nylon netting caused by rust. This can be eliminated by coating the framework of the trap with a tough skin (1/8" thick) or polyvinyl chloride (P.V.C.) resistant to sea water, oils, abrasion and corrosive chemicals.

Dredge

The crab dredge is quite similar to the scallop dredge and is operated in the same manner. The underside of the drag bar is fitted with 4-inch long iron teeth which remove crabs buried in the mud.

Scrape

The crab scrape is equivalent to a beam trawl. It consists of a bag of webbing fitted to a triangular steel frame. The drag bar is not fitted with teeth.

Unlike the dredge it is not towed in pairs but a single scrape, or as many as five, are towed behind a vessel with limited power. The scrape, being a small trawl, may be used in coastal waters but is generally used in large number behind a tow bar in offshore waters.

Danish Seine

The Danish seine consists of a netting bag fitted with long wings. Each wing is fitted with extremely long (about 1/2 - mile) heavy ropes of a high density which are set on the bottom in a diagonal shape. Both ropes are either pulled with a winch (Danish method) or towed by the fishing vessel and concurrently pulled by a winch (fly dragging or Scottish method).

The Danish seine stands between the purse seine and the trawl net. Like the purse seine, it encircles the fish mainly through the effect of long ropes set on the bottom and pulled together. Like the trawl net it is towed, but only over a short distance, to collect the fish assembling between the ropes in the path of the seine.

Its crab catching efficiency is not derived so much from the ropes dragging over the bottom, since observations have demonstrated that crabs jump off the bottom but are not as frightened as fish, and tend to stay outside the path of the seine. However, since no bobbins are used, crabs are caught more easily than in an otter trawl fitted with bobbins.

Otter Trawl

This well known piece of gear consists of a conical bag of netting with a ground line usually fitted with bobbins to prevent sinking in mud or to roll over bottom obstructions. Its mouth is kept opened sideways with boards acting like kites and with floats on the headline. It is towed with two wire ropes or warps.

Most crab otter trawls are used in pairs, one on each side of the fishing vessel and towed from the end of long booms (the outriggers or double rigs).

Comparative Evaluation

Coastal crab fishing methods should be used commercially only for specialty products bringing high returns to the fishermen, like soft shells or peelers. They are not recommended for any regular commercial crab production.

Offshore crab fishing methods, however, are all efficient producers. Trawling will definitely yield maximum catches, but has many drawbacks. Excessive damage to crabs occurs while trawling. Trawling is limited to a certain type of bottom where bobbins will allow rolling over natural obstructions.

Bobbins, however, will definitely cut down the production of crabs by rolling over them, particularly during the mating or moulting season, when they have a tendency to bury themselves in the mud.

Trawling or any other towed gear has a main drawback over traps or pots, since the operating costs will be much higher in fuel, gear and engine maintenance. The trawling method will yield a low quality product with bruises, losses of legs, a generally high mortality rate and no selectivity as to size of crabs.

The tangle net may be an efficient producer of crab, but the apparent good results are discouraging since the majority of catches will be destroyed during the time-consuming and tedious crab removal process. Legs will be broken, bruises will occur and the crabs left will be so weak that only immediate processing could be considered.

Longlines and trot lines also have disadvantages in comparison with pots. The baiting with small chunks of meat or fish is time-consuming.

Many crabs are lost while heaving the lines. The productivity of lines is also much lower than that of pots per unit of effort.

After a decade of experimentation, we are now convinced that pots offer more general advantages than any other gear in the efficient production of crabs of good quality.

The shallow water crab pot may be very wide but the deep water pot should be smaller. It is also now evident that the steel rod could be advantageously replaced by stronger and lighter angle bars, particularly in the rectangular pot.

Much more productivity can be achieved with a mechanized crab pot operation. At this point, the long line of crab pots appears to be the most promising method. With this in mind, I have conceived a new type of long line crab pot hauler which I wish to submit for your evaluation as well as your criticism. Such a hauler could be operated not only over the side of a side trawler, or over the stern of a ramp or rampless stern trawler, but would find its maximum use on board a catamaran. Indeed a catamaran could be fitted central open deck, have the lifter fitted between the stems and have a trolley which would allow a continuous and fast emptying process. The nesting pots could be retained for another ground or immediately set from the stern. It is thus estimated that the productivity of a 65-footer could be increased up to ten times. The large pot could still be used but the smaller Japanese nesting conical pot, which costs only 15% as much as the large rectangular pot but catches 40% as much, would be particularly advantageous. This arrangement is strongly recommended for the deepwater red crab fishery.

On the basis of present operations of individual traps the most efficient and practical vessel size is in the 55- to 65-foot range. Much larger vessels were fitted as factory vessels which could fully process crabs on board and freeze the final product. However, such vessels could hardly handle more traps than the 55- to 65-footer. That is up to 70 traps, even if they were equipped with presently available crab pot trawlers or with hydraulically operated bending arms, giraffes or cranes. To these large 90-footers or even longer vessels, the use of crab pot longlines and of a special lifter like the one proposed would permit the use of up to four or five times the present number of traps.

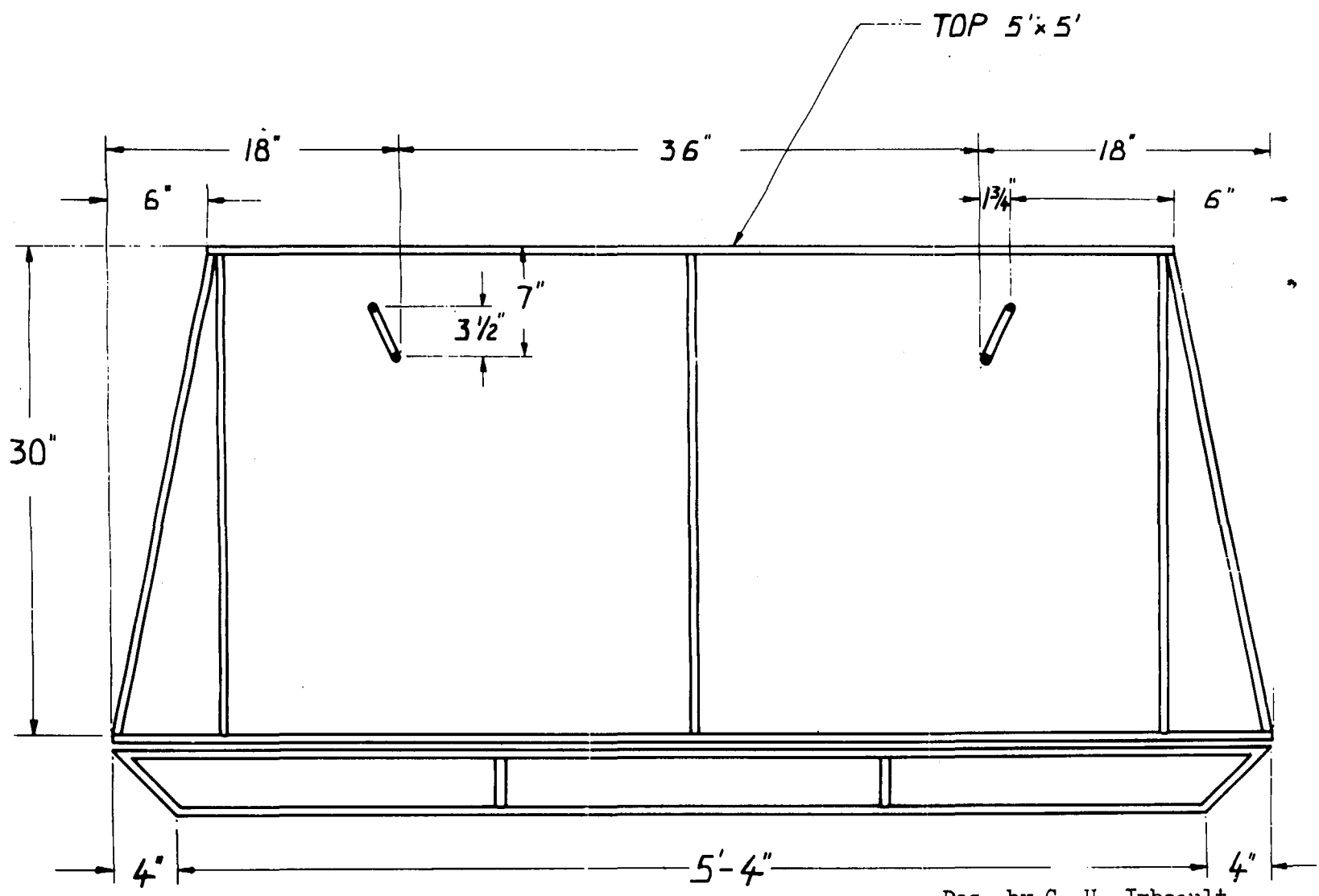
The Industrial Development Branch for the past two years has been working on the design of catamarans which would be ideally suited for queen crab fishing. Not only would the gear and crab handling be improved but such a light, non-costly and fast vessel would be quite an asset in the pot long-lining fishing method.

In conclusion, I wish to invite all of you: fishermen, technologists, processors, behaviour biologists, engineers, marketing specialists, economists, administrators and even legislators to combine your efforts in the development of this crab fishery, which may eventually bring as much as the lobster fishery to the Atlantic coast.

We have to complete the exploration of all species of crabs on this coast. We have to improve our catching, processing and marketing methods. We cannot forget that quality is a prime requirement in crab production. I also

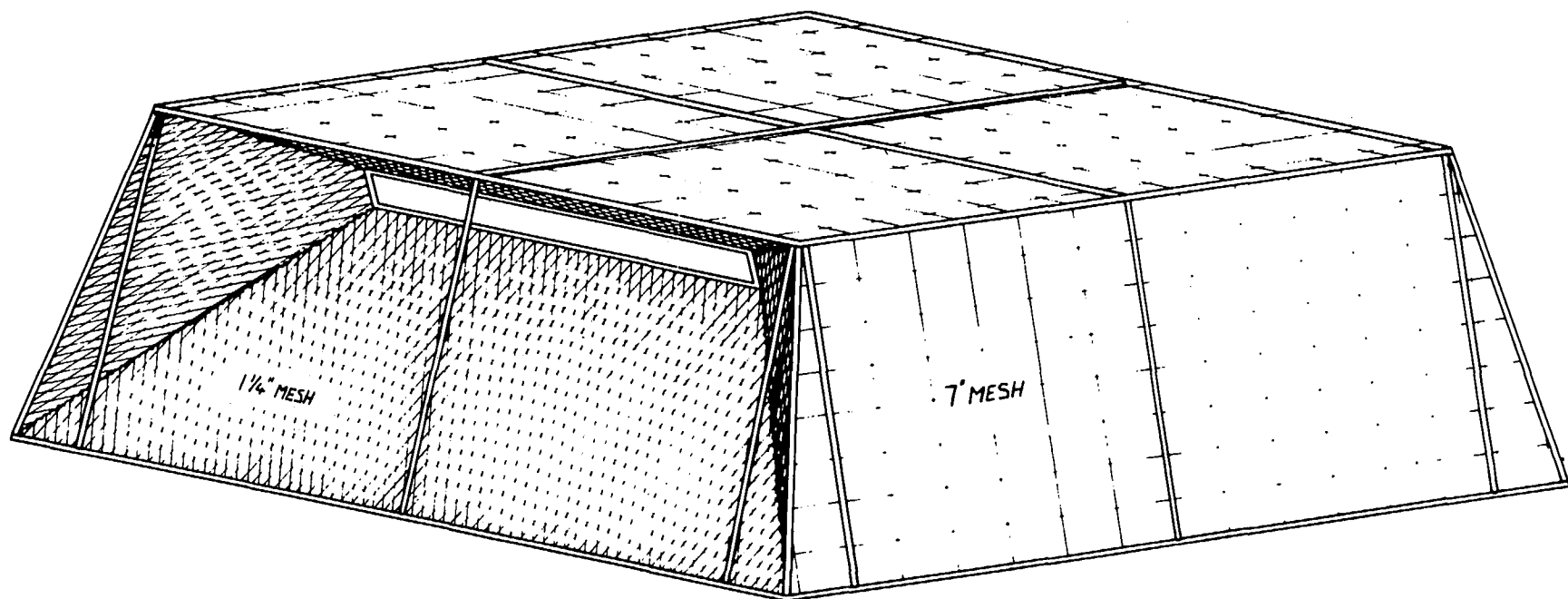
wish that some male crabs will be left so that the wonderful harems of female crabs may have as many kids as Turkish harems of the past.

Finally, I wish to express "mes hommages" to those who have turned this idea of ours into a wealthy industry; and I mean particularly Mrs. and Mr. Simpson.



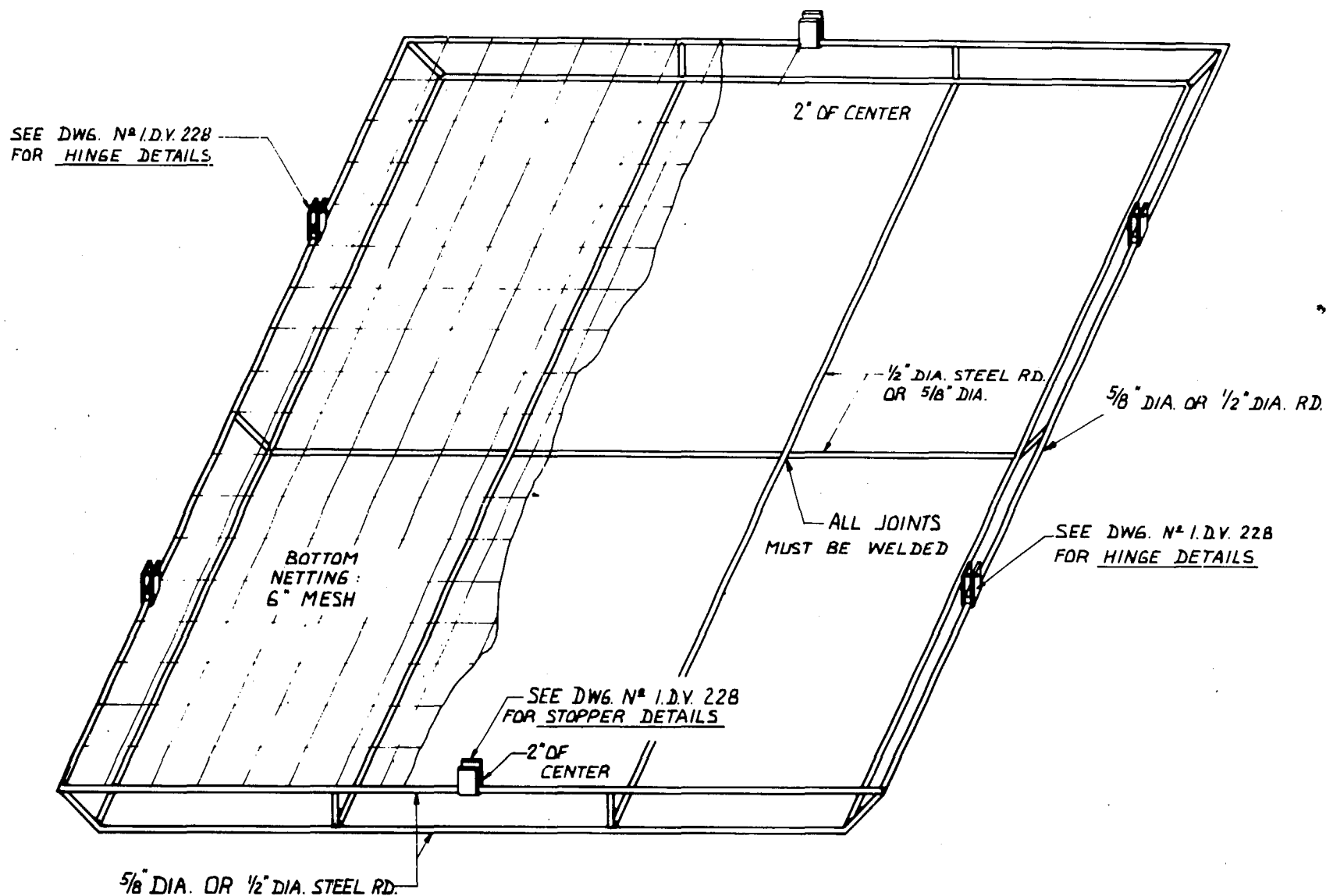
SIDE VIEW

Des. by G. H. Imbeault
Dr. by Miss H. Becker
Date: Dec. 5, 1968
Industrial Dev. Service
Dept. of Fisheries of Canada



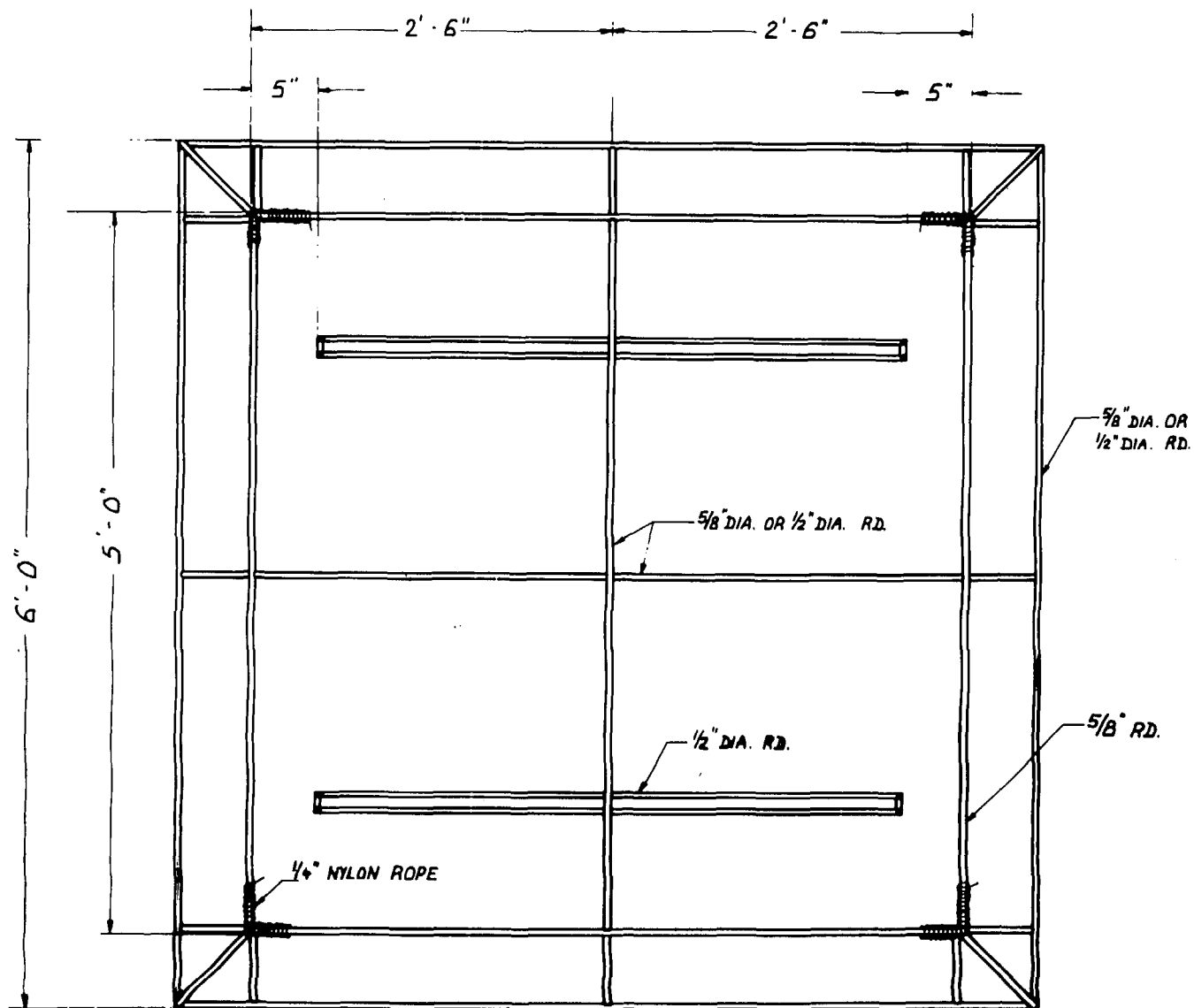
ISOMETRIC VIEW OF TOP

Des. by G. H. Imbeault
Dr. by Miss H. Becker
Date: Dec. 5, 1968
Industrial Dev. Service
Dept. of Fisheries of Canada

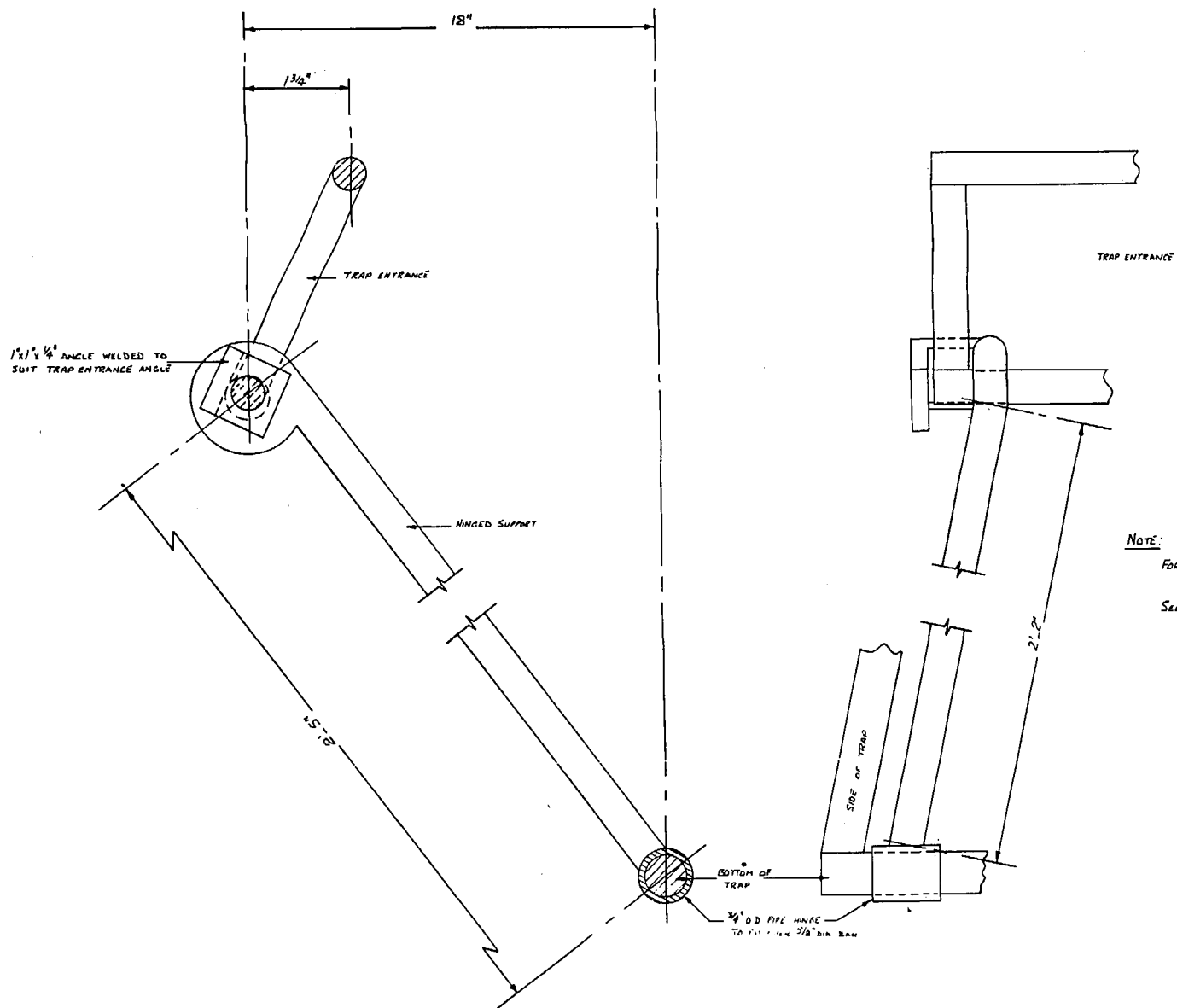


VIEW OF BOTTOM

Des. by G. H. Imbeault
 Dr. by Miss H. Becker
 Date: Dec. 5, 1968
 Industrial Dev. Service
 Dept. of Fisheries of Canada

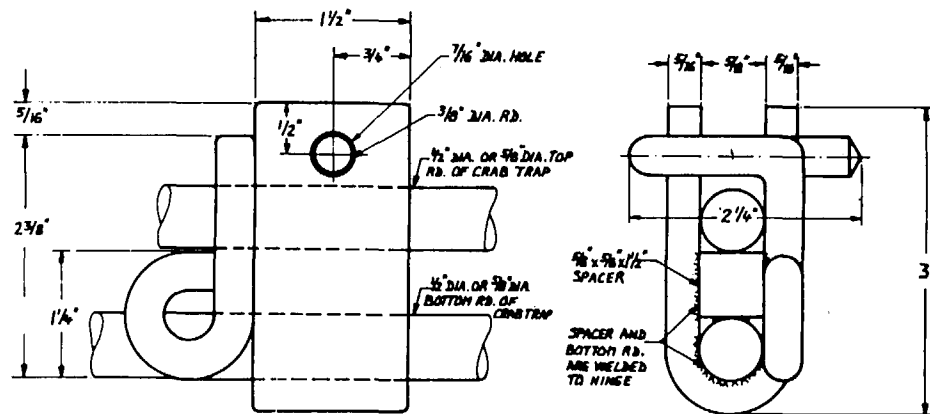
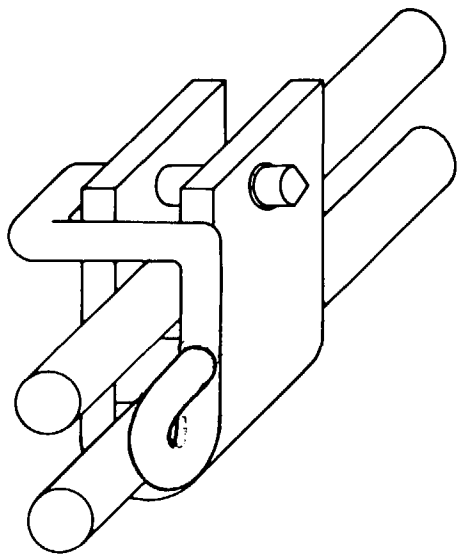
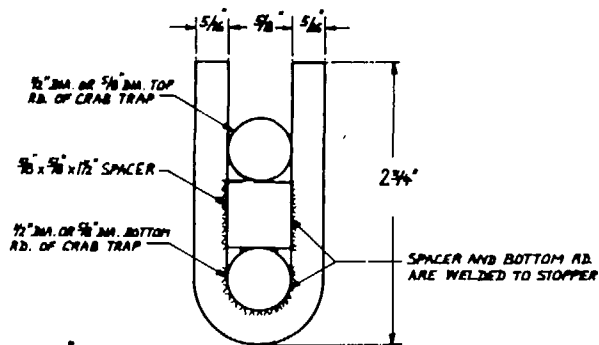
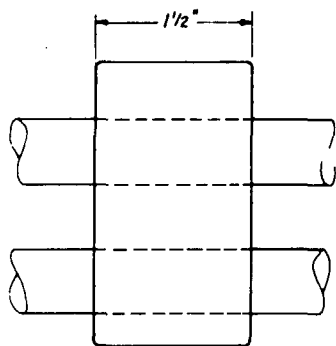
PLAN VIEW

Des. by G. H. Imbeault
 Dr. by Miss H. Becker
 Date: Dec. 5, 1968
 Industrial Dev. Service
 Dept. of Fisheries of Canada

NOTE:

FOR EACH TRAP 2 RIGHT HAND
2 LEFT HAND REQUIRED
SEE DWG. 1DV.227 FOR LOCATION.

DESIGNED BY: C. IMBLAUET
APPROVED BY: [Signature]
DRAWN BY: G. TURNBULL
SCALE: NONE
DATE: JAN 21 1969
DWG No. 1DV.227-E

"HINGE""STOPPER"

SEE DWG. NO. I.D.V. 227-3 FOR NESTING CRAB TRAP

DEPARTMENT OF FISHERIES
CANADAHINGE AND STOPPER DETAILS FOR
NESTING CRAB TRAP

INDUSTRIAL DEVELOPMENT SERVICE, OTTAWA

DES. BY: G. HUBBARD

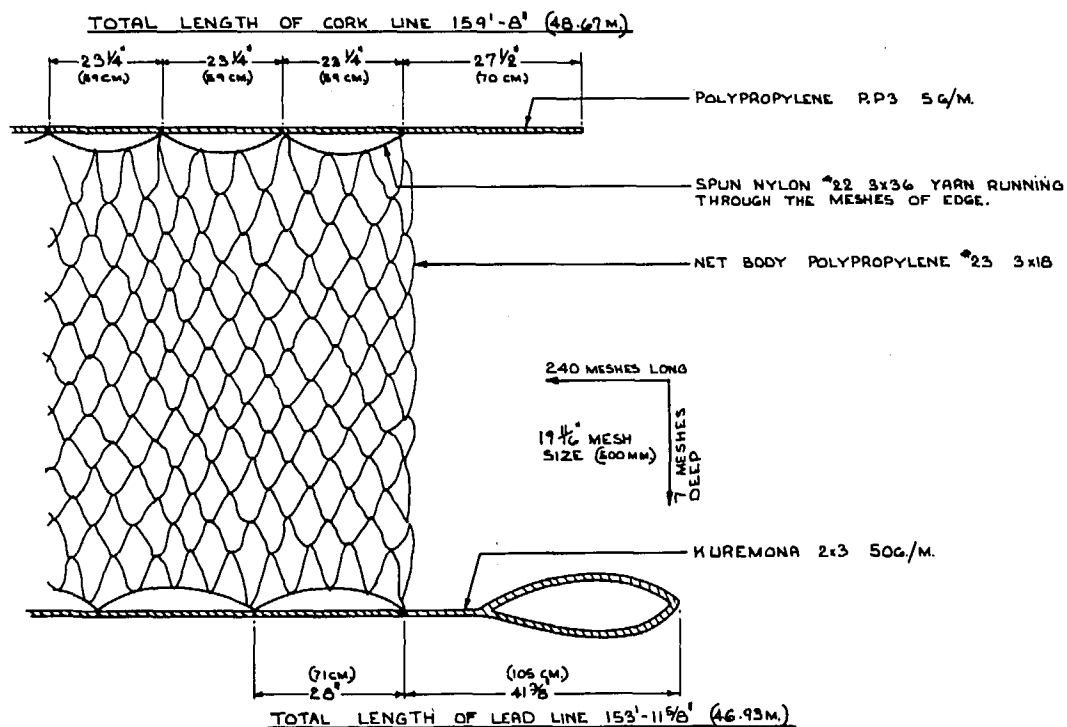
OR. BY: R. BROWN

APP. BY: [Signature]

SCALE: 1/4" = 1"

DATE: JAN 9 1967

DWG. NO. I.D.V. 228-8



WEBBING ----CORK LINE → 60.04 %
LEAD LINE → 64.40 %

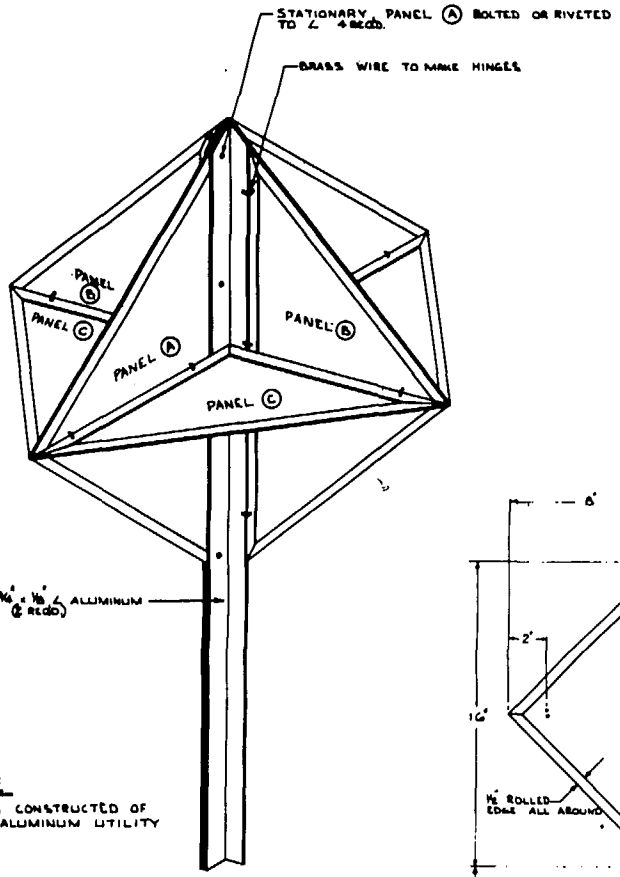
NOTE:
LIFTED AT ABOUT 10 DAY INTERVALS

TRACED FROM SKETCH SUPPLIED

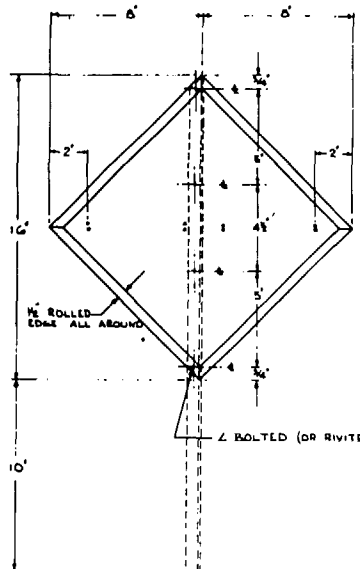
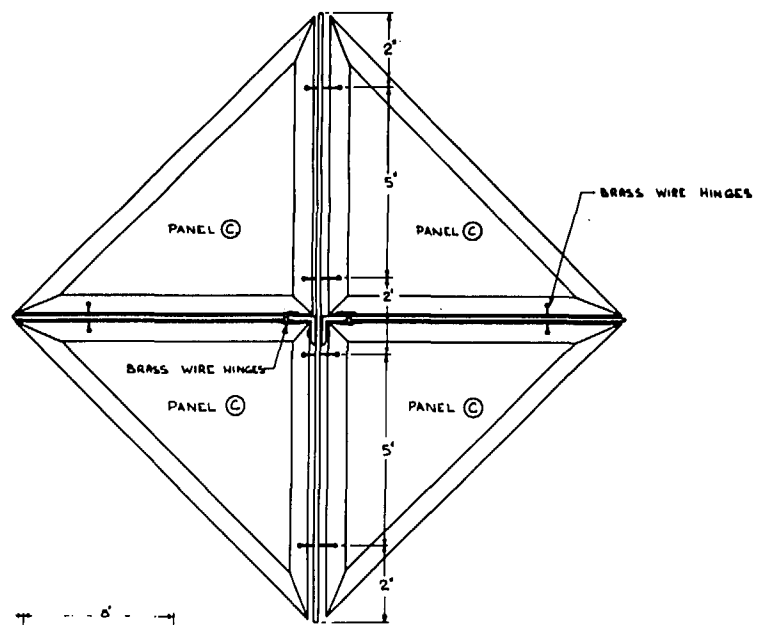
TANGLE NET FOR CRAB

DEPARTMENT OF FISHERIES, CANADA
INDUSTRIAL DEVELOPMENT SERVICE
OTTAWA

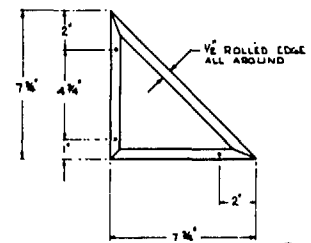
DATE SEPT, 1962 DR: T.M. CHK: N° LD.Y. 151-



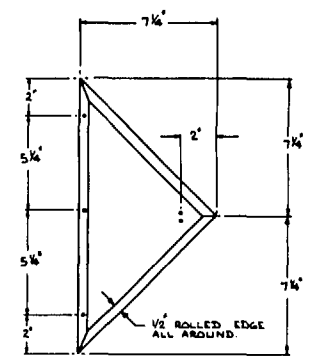
ISOMETRIC VIEW OF REFLECTOR
NOT TO SCALE



STATIONARY PANEL (A)
SCALE: 1/4"=1' 1 REQD.



COLLAPSIBLE PANEL (C)
SCALE: 1/4"=1' 4 REQD.



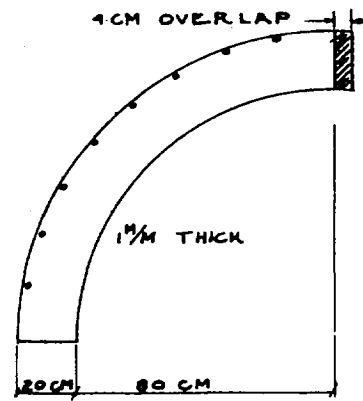
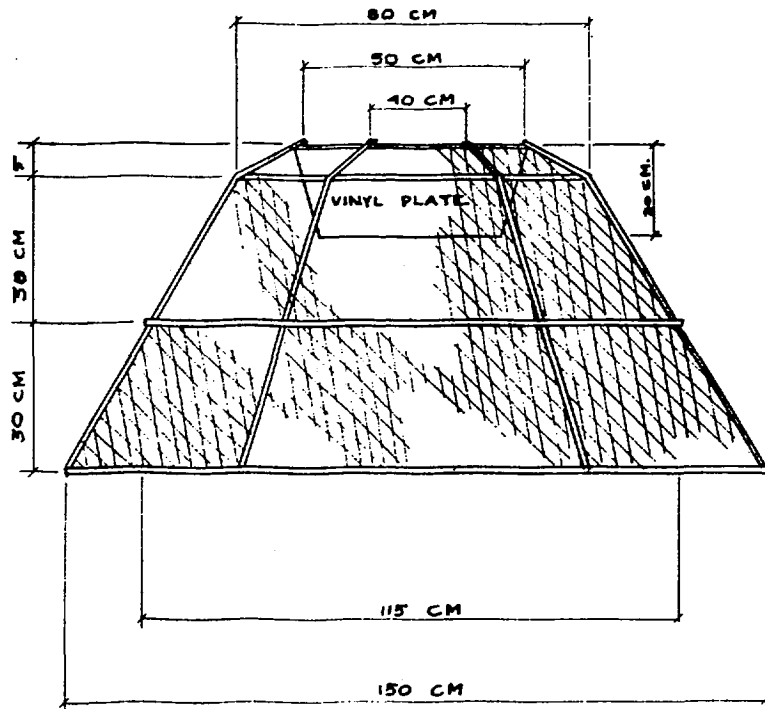
COLLAPSIBLE PANEL (B)
SCALE: 1/4"=1' 4 REQD.

NOTE:
ALL PANELS CONSTRUCTED OF
20 GAUGE ALUMINUM UTILITY
SHEET.

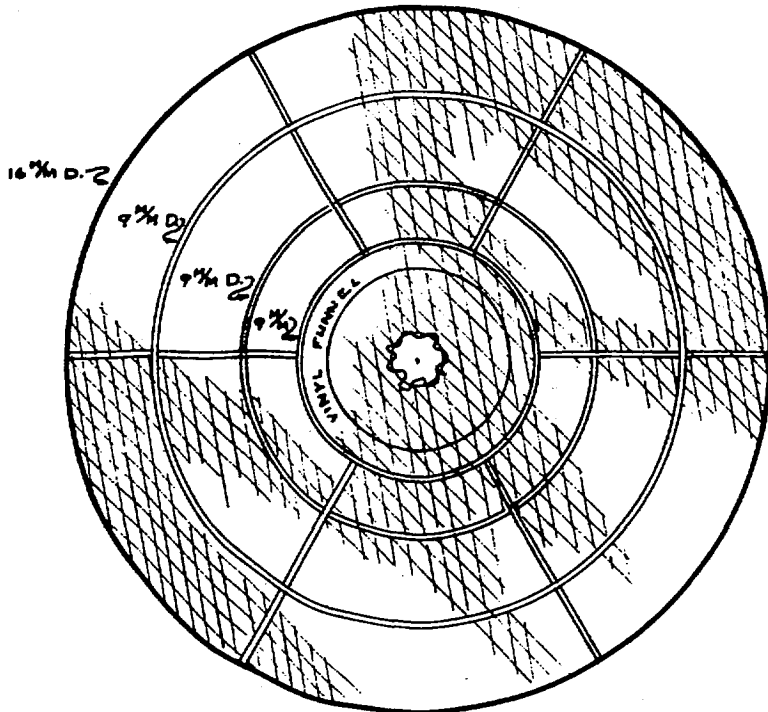
3/4" x 3/4" x 1/8" ALUMINUM
LEG (2 REQD.)

REFLECTOR FOR RADAR BUOY	Y. MCALLON AS NOTED MAY 22, 1968
	I.D.V. 191-C

TAIYO TYPE CRAB POT

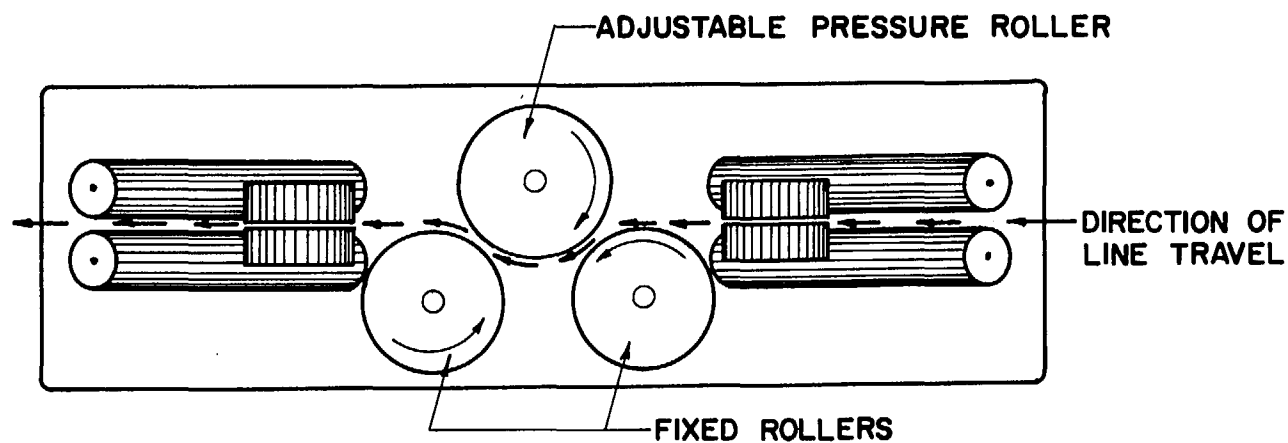
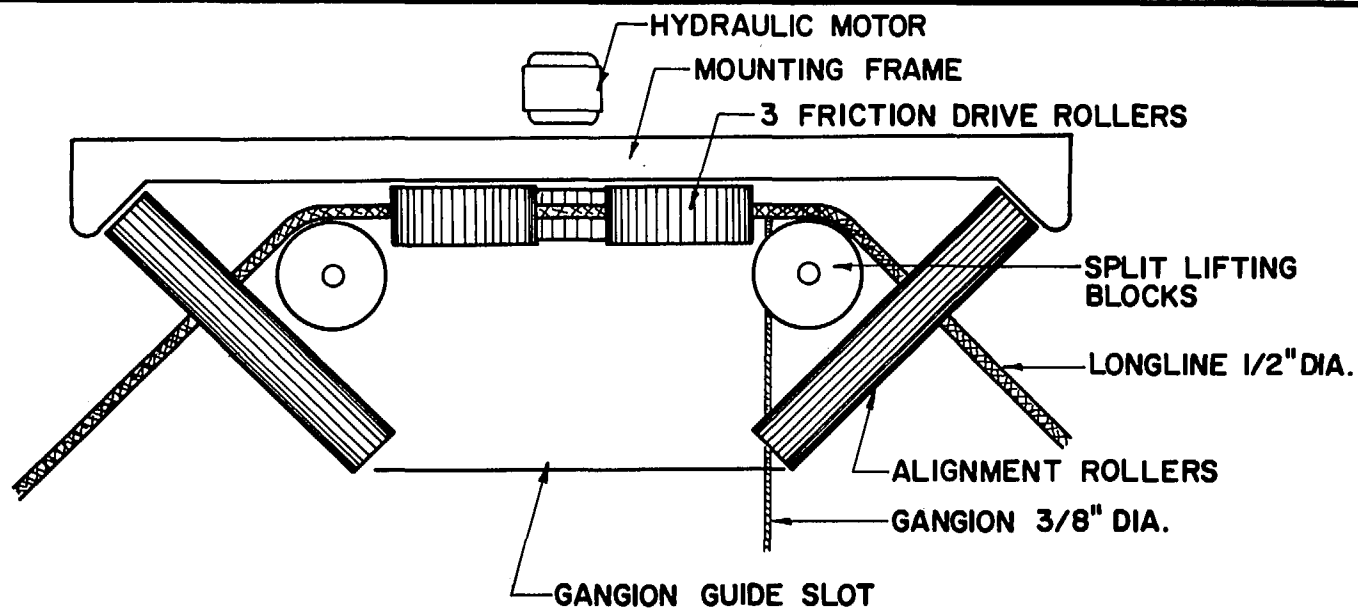


VINYL PLATE

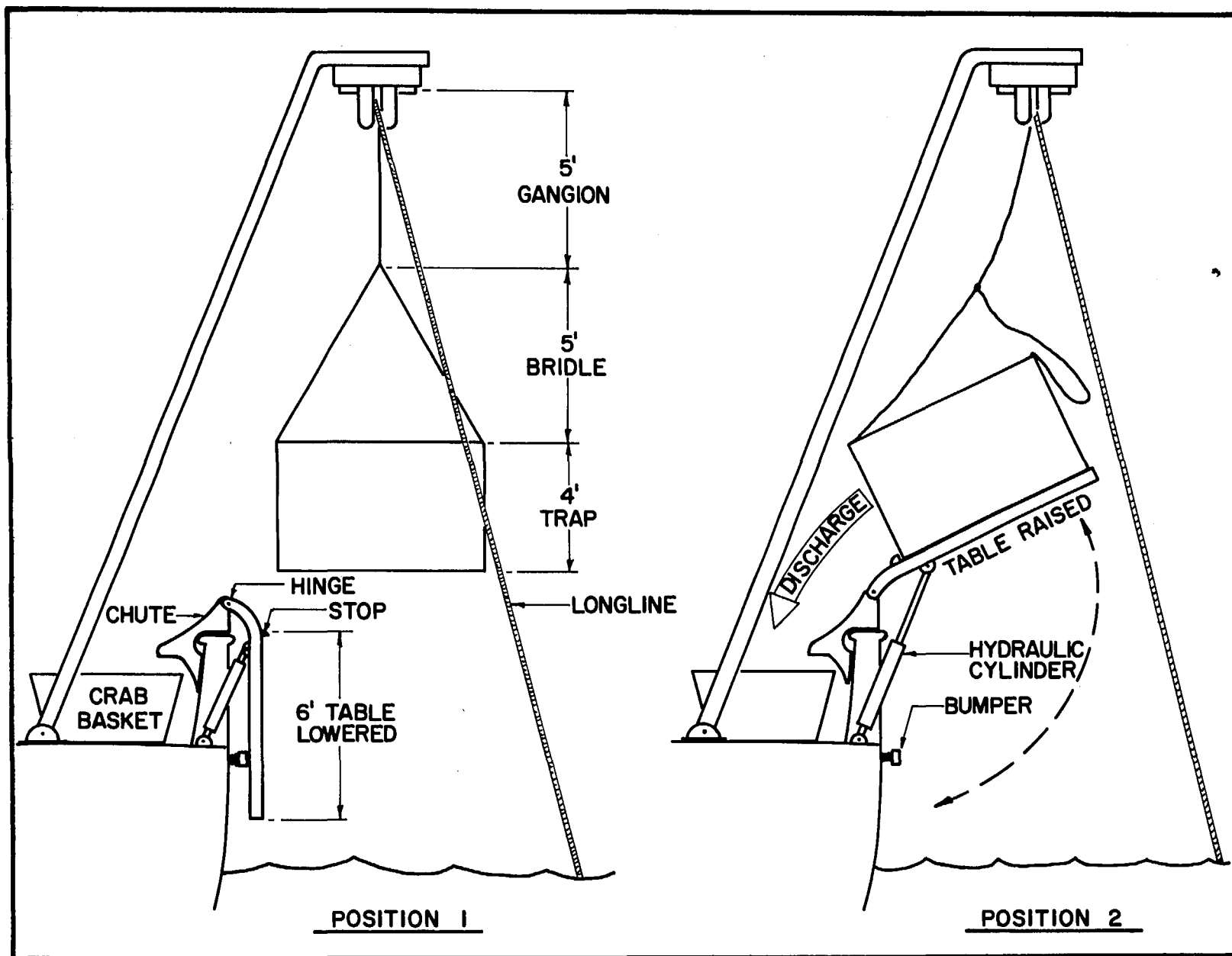


BILL OF MATERIALS

- BOTTOM IRON RING - 16 M/M
- METAL FRAME - 9 M/M
- ENTRANCE FUNNEL - 1 M/M VINYL
- 150 M/M MESH AROUND FUNNEL
- 125 MESHES FROM FUNNEL TO BOTTOM HOLE



CRAB TRAP LONGLINE LIFTER



CRAB FISHING VESSEL



Mr. Duguay

by
Clarence L. Duguay, Director
Boatbuilding and Maintenance Branch
New Brunswick Department of Fisheries

ABSTRACT

This paper describes the general characteristics of a steel combination boat intended for the crab fishery in the Gulf of St. Lawrence.

INTRODUCTION

On the basis of limited information obtained from crab fishermen, the Pacific Crab Fishery and experts in the field, our Boatbuilding and Maintenance Branch decided to design a prototype crab fishing vessel to operate in the Gulf of St. Lawrence.

Mainly for economical reasons, both in capital and operating costs, it was agreed at the outset between the prospective owner, the builder, the Fishermen's Loan Board and ourselves, that the proposed vessel should be in the 60-foot class, of steel construction and be of multi-purpose design.

In anticipation of possible changes in the fishery, which occurs frequently these days, it was certainly desirable to design it as a combination vessel which would be easily converted and adapted to other types of fisheries without additional costs.

The basic function of the vessel will be crab pot fishing and stern trawling for groundfish. Other fishing methods can be accommodated fairly readily.

A refrigerated brine spray system is being designed to preserve the catch.

The design of this vessel is now completed with the following characteristics:

The over-all length of 57 feet, steel construction, single chine, single deck, 5 watertight bulkheads, engine room, quarters, deck house and wheelhouse forward, leaving a clear deck space aft for gear and catch handling.

Principal Characteristics

O.A.L.	57' - 0"
D.W.L.	53' - 9"
Breadth	18' - 0"
Depth amidship	9' - 4"
Maximum draft aft	10' - 5"
Maximum draft midship	8' - 10 1/2"
Displacement D.W.L., S.W.	66 L. Tons
Displacement L.W.L., S.W.	106 L. Tons
Fuel oil capacity	1350 gals.
Fresh water capacity	250 gals.
Speed	9 Knots

Principal Characteristics

Radius of operation	275 Naut. Miles
Accommodations	4 men

Fish hold No. 1	960 cu. ft.	Gear Ratio	4.5 to 1
Fish hold No. 2	940 cu. ft.	Auxiliary engine	24 H.P. complete with generator, bilge pump and hydraulic pump.
Total hold capacity for crab	1900 cu. ft. - 16 L. Tons	Crab Pot Hauler	Marco or equal
Total hold capacity for groundfish	1900 cu. ft. - 34 L. Tons	Trawl winch	Hydraulic Combination
Crab pot stowage on deck	15	Electronics	Radar, sounder, radio telephone and Loran
	<i>Equipment</i>	Electrical	32 Volt D.C.
Main engine	365 H.P. cont. 1800 R.P.M.	Steering gear	Hydraulic

A refrigerated brine spray system is being designed to preserve the catch. The design of this vessel is now completed with the following characteristics:

The overall length of 32 feet steel construction, single engine, single deck, 2 lightweight outboard engines, room, quarters, deck house and wheelhouse forward, leaving a clear deck space aft for gear and catch handling.

Overall length	32 ft.
Beam	10 ft.
Depth	4 ft.
Maximum draft	10 ft.
Maximum draft amidship	8 ft. - 10 1/2 ft.
Displacement D.W. 1	64 L. Tons
Displacement D.W. 2	100 L. Tons
Full capacity	1320 gals.
Crab hold capacity	250 gals.
Speed	9 Knot

Principal Characteristics
 Radius of operation
 275 Nant. Miles

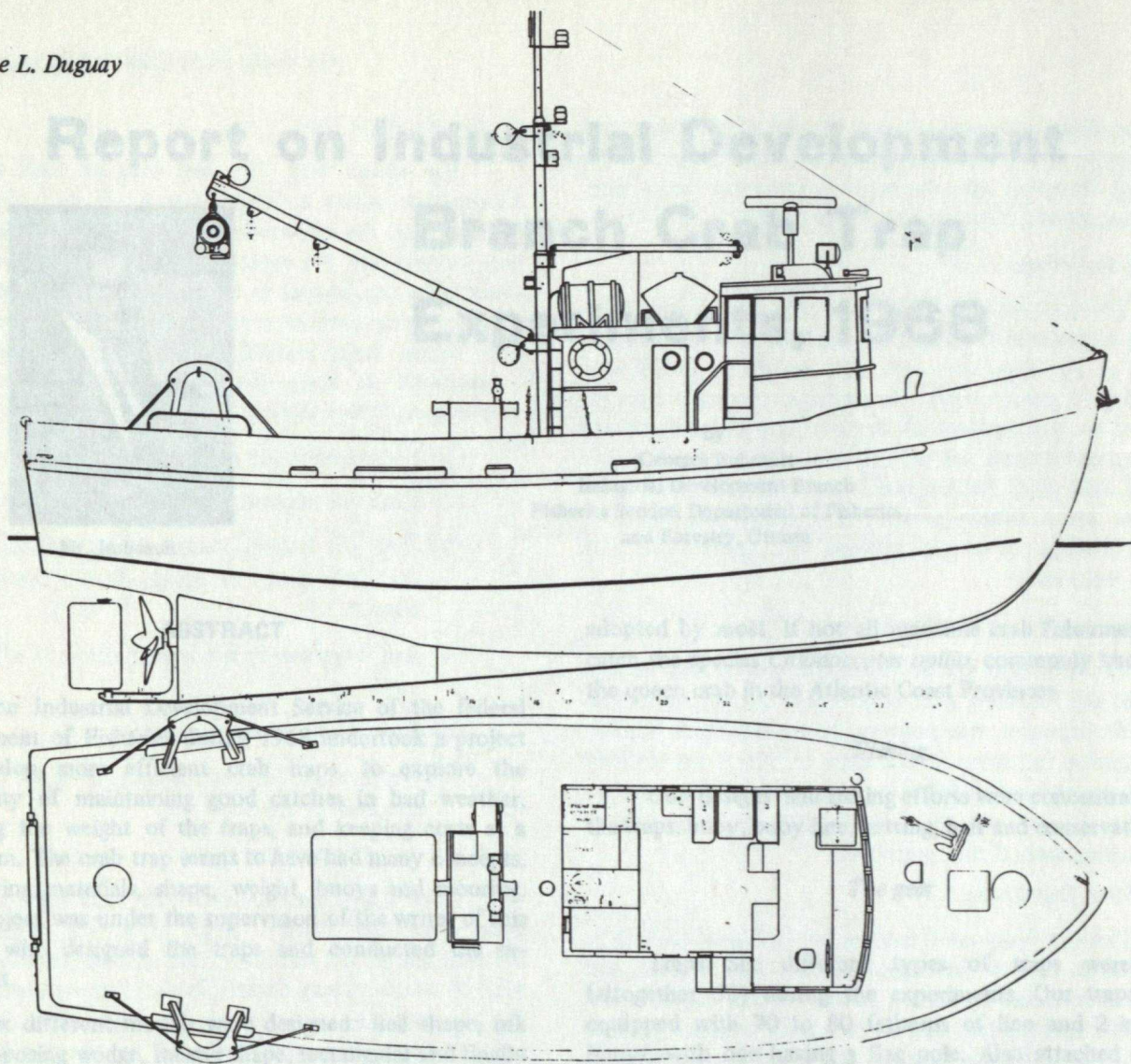
ABSTRACT
 This paper describes the general characteristics of a steel construction boat intended for the crab fishery in the Gulf of St. Lawrence.

INTRODUCTION
 On the basis of limited information obtained from crab fishermen, the Pacific Crab Fishery and experts in the field, our boatbuilding and maintenance branch decided to design a prototype crab fishing vessel to operate in the Gulf of St. Lawrence.

Mainly for economical reasons, both in capital and operating costs, it was agreed at the outset between the prospective owner and the fisherman's boatboard and ourselves that the proposed vessel should be in the 50-foot class of steel construction of light construction design.

In anticipation of possible changes in the future, which occurs frequently these days, it was certainly desirable to design it as a combination vessel which would be easily converted and adapted to other types of fisheries without additional costs.

The basic function of the vessel will be crab pot fishing and stern trawling for groundfish. Other fishing methods can be recommended fairly readily.



57 FT. COMBINATION BOAT FOR CRAB FISHING AND DRAGGING
PROFILE & PLAN

Boatbuilding and Maintenance Branch
DEPARTMENT OF FISHERIES
Centennial Building, Fredericton, N.B.

Particulars

Length, O.A.	57'-0"	Displ. Loaded	106 L. Tons
Length, W.L.	53'-9"	Power	365 H.P.
Beam	18'-0"	Speed	9 KN.
Depth	9'-4"	Hold Cap.	1900 C.F.
Draft, Max.	10'-5"	Accom.	4 Men
Displ. Light	66 L. Tons		

Designed by M. N. Ozerdem

Type R. 1

Drawn by M. N. O

Apr. 5, 1968

Scale 1/2" - 1'

Drawing No. 1-70-6

No. 1 Revision, Feb. 27, 1969