

The Canadian Atlantic Shrimp Fishery Prospects for Development

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PREFACE

The author wishes to thank officials of the industry and the Department of Fisheries and Oceans who were consulted during the preparation of this report. Comments are invited from industry and individuals involved or interested in the future course of development in this fishery.

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ABSTRACT

Toews, P.R. 1980. The Canadian Atlantic Shrimp Fishery - Prospects for Development. Can. Ind. Rep. Fish. Aquat. Sci. 117: iv + 39p.

The Canadian Atlantic Shrimp Industry is examined in the light of the emerging world supply and demand situation for northern shrimp. A leveling off in world catch levels will now, it appears, result in greater competition for supply, higher prices and enhanced developmental opportunities for countries fishing Pandalus borealis and the other northern shrimp species. The recent development of a Canadian fishery "offshore" permitting the freezing of shrimp at sea and diversification into "in shell" products, should allow Canadian producers to maximize these development opportunities.

Key words: Fisheries development, Pandalus borealis, northern shrimp.

RÉSUMÉ

Toews, P.R. 1980. The Canadian Atlantic Shrimp Fishery - Prospects for Development. Can. Ind. Rep. Fish. Aquat. Sci. 117: iv + 39p.

L'auteur examine l'industrie canadienne de la crevette de l'Atlantique dans le contexte de l'accroissement de l'offre et de la demande de crevette du Nord. L'équilibre des niveaux de prises mondiaux entraînera maintenant, semble-t-il, une concurrence accrue sur le plan de l'offre, une hausse des prix et une amélioration des possibilités de développement pour les pays qui pêchent Pandalus borealis et les autres espèces de crevettes du Nord. La création récente d'une pêche hauturière canadienne permettant de congeler les crevettes en mer et la diversification par l'introduction des produits "en carapace" devrait permettre aux producteurs canadiens de maximiser ces possibilités de développement.

Mots clés: développement de la pêche, Pandalus borealis, crevette du Nord.

1) Summary

The development of a Canadian offshore shrimp fishery as well as increased availability of the resource in the Gulf of St. Lawrence have now resulted in unprecedented growth in the Atlantic shrimp fishery. Landings increased from 8,000 tonnes in 1977 to about 14,000 tonnes in 1979 with the value of landings increasing from \$5.1 million to more than \$13.0 million. The value of exports climbed from about \$7.6 million to more than \$23.2 million during this period. These increases were facilitated, in part, by the development of a Canadian factory freezer trawler fleet capable of cooking and freezing shrimp "in shell", thereby permitting the industry to establish itself in a new and lucrative export market. These and other changes taking place in a rapidly growing fishery were accompanied by uncertainty regarding the economic and social implications of these changes. This prompted the Economic Development and Marketing Service to undertake an examination of the developing Atlantic shrimp fishery in the light of the emerging world supply and demand situation.

The high level of consumer demand for shrimp in Western European countries is of particular interest to Canadian suppliers because many European shrimp consumers, unlike consumers in the U.S. and Canada, prefer northern shrimp. The fact that a significant share of this demand is for shrimp "in shell" now provides Canadian producers with the opportunity to realize higher returns in the European market relative to those available for the peeled product. The lack of competition from Alaska, Washington and Oregon, where production is primarily oriented towards the peeled product, will continue to make the European "in shell" market particularly attractive to us. Japanese buyers are particularly interested in obtaining raw shrimp, frozen, in shell. We know that there is an unsatisfied demand for the Canadian "in shell" product in Japan but we do not know the extent to which Japanese consumers will be willing to match the prices being paid by the Europeans.

Canadian consumers have traditionally preferred the southern varieties of shrimp. However, a growing awareness about northern shrimp is now resulting in growing consumer demand for the domestic, frozen, peeled product. This, as well as the increasing availability of supply from a growing Canadian fishery permitted Canadians to consume about 50 per cent of total 1978 production. This is up significantly from the 25 to 30 per cent typical of previous years. The implication for Canada is that stimulating demand domestically will allow Canadians to consume an increasing share of total production.

World catching levels of northern shrimp now appear to be levelling off and this will likely result in greater competition for supply, higher prices and an enhanced developmental opportunity for those countries having access to the resource. The implication for Canada is that careful planning will enable us to enhance our reputation as a world supplier.

Obtaining the maximum level of return in the in shell market will require that producers pay careful attention to meeting the stringent quality and count requirements of this market. If iodine flavour or other quality problems arise frequently, it can result in a refusal of the market to accept

the product. We need to encourage our producers to sample carefully so that iodine and other quality problems are detected before the product is in the marketplace.

Shrimp size is a critical factor too. Only about 60 per cent to 70 per cent of the Labrador and Davis Strait catches are apparently in the size range that is suitable for an in shell product. This has prompted one producer to suggest that reintroducing a processing requirement at the 25 to 30 per cent level would permit a more efficient allocation of the catch into the end-product for which it is best suited. Management strategies aimed at limiting in shell production to the biggest and the best will enhance our reputation in international markets.

Particular attention should now be given to ensuring consistently high quality for catches being landed in the Gulf. We know that with careful icing, trips of up to four or five days permit landings of number-one quality. The problem in the Gulf is that a portion of the resource is located in areas which require longer trips. In the case of the New Brunswick fleet, the quality of some of the landings from six and seven day trips represents an unnecessary waste of the resource. This problem could be partially resolved by taking additional care in icing and stowing the catch. Refrigerating or even freezing the catch at sea would solve the quality problem completely. The latter alternative should first be examined carefully with respect to the economic and social implications for communities and existing fleets.

After several years of unprecedented growth in this fishery, the growth rate in catch levels is now expected to decrease considerably. Catches during the next two years, however, should be as high if not somewhat higher than in 1979. The world's shrimp fisheries provide numerous examples of sudden increases in resource availability raising expectations to be followed only by disappointment due to equally sudden, unexplainable decreases. These natural variations, as well as the need to ensure that catch rates in the fishery remain high enough to ensure economically viable catching operations, suggests that present levels of catching and processing capacity are adequate to meet future requirements.

Despite these reservations as to future opportunities for expansion in this fishery, the Atlantic shrimp fishery nevertheless has the potential to be a more lucrative fishery. Additional benefits should be realized through further diversification into in-shell end products. Experience with lobster indicates that the higher returns available from in-shell production have tended to carry this industry through the difficult periods when end-product markets soften. Efforts directed at increasing catching and processing efficiency, thereby reducing the unit costs of production, should also result in an increase in net benefits. A careful examination as to why the Quebec sector of the Gulf shrimp fishery has traditionally shown better economic performance than the Newfoundland and Maritime sectors may be useful to this end. Careful monitoring of the resource, the economic benefits as well as market conditions will allow us to respond effectively to changing conditions in this fishery.

2) Canadian Atlantic Shrimp Fisheries in Perspective

Canada's shrimp fishery is relatively small (total landings of 11,000 tonnes in 1977) when compared to the shrimp fisheries in the United States (193,000 tonnes in 1977) and in the context of total world landings of 1.5 million tonnes in 1977. The shrimp found in Canadian waters off both the East and West Coasts are the relatively small "northern" species belonging to the family Pandalidae with the predominant species being Pandalus borealis. These northern shrimp species comprise only a small proportion of world resources (approximately 13%) but are highly sought after by consumers in Western European markets due to their generally superior colour, texture and flavour. Northern shrimp varieties are not a big item in the Canadian and U.S. markets where warm water shrimp from the southern U.S. coastal states, the Gulf of Mexico, and imports from Asia predominate.

The late sixties and early seventies saw the development of considerable shrimp catching and processing capacity in the Gulf of St. Lawrence by the industry in New Brunswick, Newfoundland and Quebec. Smaller fisheries were also developing in the Bay of Fundy and the Scotian shelf. Jointly funded federal-provincial programs, directed at finding new grounds and testing various catching instruments, encouraged development of the fishery. Groundfish vessels diversified their catching operations to include the shrimp fishery in a mixed fishery for redfish and a variety of other groundfish species.

In the Gulf of St. Lawrence, shrimp landings increased from 200 tonnes in 1966 to more than 2000 tonnes in 1970 and about 5000 tonnes in 1976. The catch in 1979 was in the order of 8000 tonnes. This increase in landings during the seventies was due, in part, to the discovery of new shrimp grounds as well as increased effort of the groundfish fleet which seized the opportunity to use the higher value shrimp catch to supplement earnings from redfish and groundfish species.

In the late sixties, grounds located in the Bay of Fundy and on the Scotian shelf off Shelbourne, Nova Scotia, were being increasingly fished and by 1970 the catch was greater than 800 tonnes. Catches, however, dropped off dramatically thereafter and this fishery ceased to be viable because further harvestable year classes did not materialize.

In the mid-seventies, decreasing groundfish catches in the Gulf followed by similar decreases in the redfish catch, resulted in a rapid increase in the number of vessels gearing up to catch shrimp. Unfortunately, expectations of higher economic returns from shrimp to compensate for lower catches and earnings from groundfish and redfish did not materialize. In the Newfoundland sector, the reason was an overcrowded fishery. In Port aux Choix, where the Newfoundland shrimp fishery is centered, the number of groundfish vessels in the shrimp fishery jumped from 19 to 39 vessels between 1973 and 1976. However, actual catches of shrimp and by catch by the Port aux Choix fleet in 1976 were sufficient to cover economic costs for a fleet of only 20 vessels (Fisher, 1977).

In north-eastern New Brunswick, a similar pattern of growth in vessels gearing up for shrimp fishing resulted in a fleet of 12 to 15 vessels by the mid-seventies. Most of these vessels¹ were losing money on their shrimp operations in 1974 and 1975. The problem here was aggravated by a locational disadvantage. The New Brunswick fleet does not have productive grounds close at hand and the vessels shift their effort between the Anticosti grounds, the Esquiman Channel and South-east Cape Breton (Figure 2.1). They typically require six to eight days per trip as compared to anywhere between one to four days in Newfoundland and Quebec. Longer running time represents additional costs and lower returns from a catch which is not of prime quality by the time it reaches dockside. A total of three processing plants in Shippigan and Caraquet are equipped to process shrimp and the fishery has always provided substantial benefits in terms of employment in these communities.

Shrimp fishery operators in Quebec did not, for the most part, encounter the difficulties that Newfoundland and New Brunswick operators did in the mid seventies. The number of Quebec based vessels gearing up for the shrimp fishery had grown to about 36 by this time (with 27 of the vessels in the 60 to 65 foot category and 9 vessels in the 80 to 87 foot category). These vessels were, on average, fishing for shrimp and groundfish about 140 days per

¹ New Brunswick vessels engaged in the shrimp fishery are mostly in the 65 foot to 85 foot category as compared to vessels less than 65 feet in Newfoundland. The number of vessels engaged in the shrimp fishery increased to about 23 by 1979.

5
FIGURE 2-1

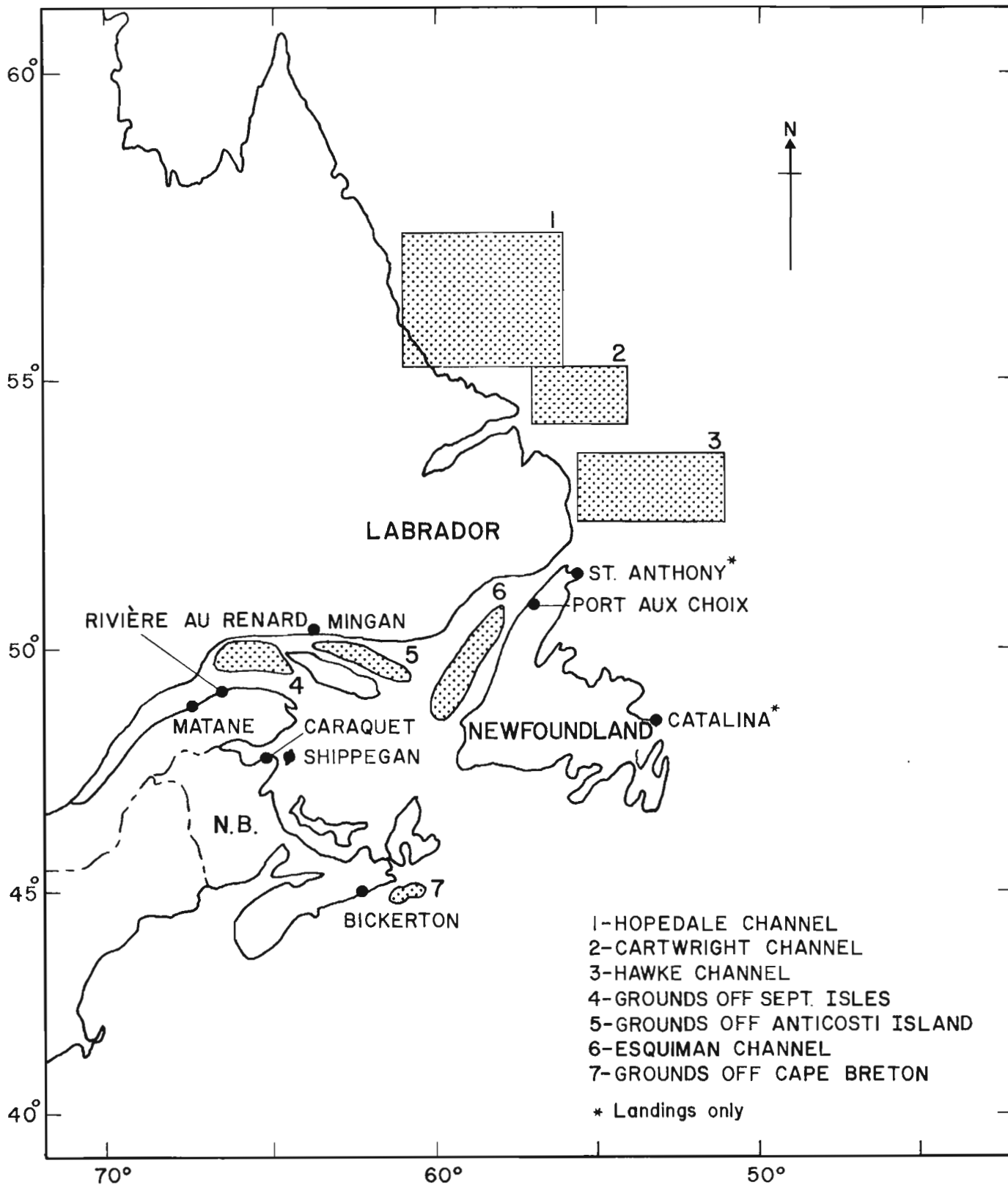


CHART SHOWING THE PRINCIPAL SHRIMP FISHING GROUNDS, LANDING POINTS, AND PROCESSING CENTRES IN THE ATLANTIC REGION.

year between 1973 and 1977. (In 1976, the Newfoundland fleet, on average, fished 97 days in the directed fisheries for shrimp and groundfish). Better economic performance by the Quebec fleet in 1974-75 can be attributed to a longer fishing season and greater effort in the fishery as well as higher prices for the catch. Unlike the mixed groundfish - shrimp fishery in Newfoundland and New Brunswick, the shrimp fishery has become the primary source of income for many of the Quebec operators. Having the primary effort directed towards the shrimp fishery as well as greater fishing effort overall, has allowed the Quebec vessels to establish a more stable pattern in shrimp landings. This has been to the benefit of not only fishermen but also processors.

The Quebec processors¹ are unique for a number of reasons. The Quebec processors specialized in shrimp right from the start. The largest processing operation, in fact, only began processing groundfish in the early seventies to accommodate vessel owners who wanted to increase earnings from groundfish. Quebec processors benefited from the expert advice of the Norwegians when the industry was getting started and (as one processor puts it) were schooled to believe that shrimp should be the "gold dust" of the Quebec fishery. The Quebec processors have also been active in arranging for raw material supply from foreign sources to extend their processing season. The fact that they were importing raw, frozen shrimp caught by the Danes off Greenland in 1974-75 helped them to remain viable during a difficult time when a number of other Atlantic shrimp processors were applying for government assistance. Quebec processors were paying fisherman 30¢/lb. for shrimp as compared to prices between 23¢ and 25¢/lb. in New Brunswick and Newfoundland at that time. Quebec processors sell their products in the same markets and at prices similar to the Newfoundland and New Brunswick processors. Higher landed prices in Quebec, which continue to the present², therefore appear to be due, in part, to greater efficiency which permits processors to pay more for raw material.

1 The Quebec processors are located at Matane, Rivière au Renard and Mingan (Figure 2.1).

2 In 1978, landed prices in Quebec, New Brunswick and Newfoundland for raw, whole, shrimp were 43¢, 40¢, and 33¢ respectively. In 1979, the average prices paid were 49¢, 40¢, and 35¢ respectively.

The losses incurred by many of the Gulf shrimp catching enterprises between 1974 and 1976 prompted the Department to implement a program to begin managing this fishery on an economic basis. In Newfoundland, the approach followed has been one of permitting no additional entrants into the fishery and making licence renewals conditional on meeting minimum landings requirements. The result has been a reduction in licences issued from 39 in 1976 to 32 in 1979 and this, as well as increased landings overall, has contributed to improved economic performance by the remaining operators.

In New Brunswick, a form of limited entry licencing has also recently been implemented. Fishing operators here, however, have been particularly hard hit by the loss of redfish and groundfish earnings and for that reason, additional temporary shrimp permits were granted to six vessels in 1979. These permits were made conditional on adopting an experimental, mid-water trawl which has been developed by the Department. The vessels however, turned out to be unsuitable for towing this trawl.

The discovery of stocks of northern shrimp off the coast of Labrador and the commencement of a commercial fishery there in 1977, contributed to solving a critical problem in the Atlantic fishery - that of providing additional supplies of raw material to under-utilized Gulf-based processing plants which were by then faced with a complete closure on redfish and lower quotas on other groundfish species. In 1977, four Canadian companies (all with Gulf-based processing facilities) were licenced to prosecute the Labrador fishery under co-operative arrangements. Fishery Products Ltd. (using two of their own freezer trawlers and two foreign factory freezer vessels) took 87% of the total Labrador catch of 2700 tonnes. Over 80% of this was thawed and peeled on shore at their Port au Choix plant, thus providing employment to the community.

In 1978, the Labrador catch increased to almost 3700 tonnes. Although Gulf-based plants processed more Labrador shrimp than in 1977, they chose to let their foreign charters cook a considerable portion of the catch at sea (23%). Until 1979, all companies granted licences were required to land at least 50% of their catch in raw form for shore based processing. The intention was to enable plants to extend their processing activity by thawing and

processing trawler frozen raw shrimp. Although there have been some problems of shrinkage and breakage when the raw shrimp are stored too long, the processing requirement appears to have been of considerable benefit to the under-utilized Gulf-based plants. Since whole shrimp cooked at sea bring higher prices in the end product market, a decision was made to drop the shore processing requirement for Labrador shrimp in 1979 and rather let the marketplace guide industry in determining an appropriate end product mix. Preliminary data from 1979 indicates that approximately 45% of the Labrador and Davis Strait catches were marketed in unshelled form, a 10% increase over 1978. Processors also had to meet commitments in terms of shore employment and the historical patterns of end-product supply to their customers.

Since 1977, three of the eleven Labrador shrimp licences have been held in reserve for the fishermen of Labrador and 1979 was the first year in which they participated in the fishery. Co-operative arrangements with foreign fishing companies have permitted the Labrador fishermen to gain experience and ideas on the type of fishery they could develop. The dropping of the shore processing requirement has now given them additional flexibility in determining their approach.

In terms of technological development projects, federal expenditures on the Atlantic shrimp fishery total about \$2 million to date. These expenditures have been divided almost equally between the Newfoundland and Maritime regions with a much smaller expenditure in Quebec. Since a number of the technological development projects have been cost shared with the provinces, total government expenditures are approximately \$2.5 million to date. Exploratory fishing off Labrador and in the Gulf accounts for over half of the total. The rest has been spent on technological development projects which have concentrated on solving the problem of the immature redfish bycatch.

In the Maritimes, extensive work has been done on developing a shrimp mid-water trawl. Tests apparently indicate that it almost eliminates the problem of the immature redfish bycatch. Secondary benefits include larger catches due to a longer fishing day and much less sorting at sea. Due to a

variety of reasons, the technology has not been transferred to or accepted by the fishing operators. One reason, mentioned earlier, is that some of the vessels do not appear to be well suited to adopting this type of trawl. Another reason put forward is that operators are not prepared to give up the income from the bycatch they have always obtained from the shrimp fishery. In this and other instances, it appears that additional effort is required to actually demonstrate the benefits to be gained from using a new piece of gear effectively.

Technological development on gear has now shifted away from the redfish bycatch problem and is being directed towards testing some of the newer and more efficient types of gear being used by the Danes, Norwegians and Germans. Technological development work has also begun in north-eastern New Brunswick aimed at testing various types of freezers on the larger vessels. It is worth noting that most small boat shrimp fisheries throughout the world are very specialized in terms of vessels and gear. They usually fish only for shrimp. Additional technological development and demonstration aimed at increasing the shrimp catching efficiency of our small vessels is now in progress.

We have also gained some experience in managing this fishery on an economic basis. The main thrust here has been one of limited entry. The management objective for this measure has been of of permitting earnings to be commensurate with the level of investment and the skills required to do well in this fishery. Careful monitoring of the economic benefits which this fishery is providing to Newfoundland operators was done in 1976 and is now being conducted again in 1980.

3) World Supply Situation

Supplies being made available by the world's shrimp fisheries have been increasing at an average rate of about 4% per annum since 1965. New fisheries have been springing up rapidly in the developing countries in response to the attractive prices and returns available in the end product markets of the United States, Japan and Western Europe. While sixteen countries reported landings to FAO in 1950, this number had grown to 75 in 1977. The major producers in 1977 were India (207,000 t) the U.S.A. (198,000 t), Brazil (94,000 t), Mexico (72,000 t), Malaysia (64,000 t), Vietnam (62,000 t) and Japan (45,000 t). While the seven countries above accounted for 51% of the total 1977 world landings of 1,446,000 tonnes, 68 countries caught the remaining 49%.

Annual catches of "northern" shrimp¹ since 1965 have varied between 9% and 15% of world shrimp production. The main producers in 1977 were the USA (88,000 t), Denmark (36,000 t), Norway (26,000 t) and West Germany (18,000 t) who together accounted for 78% of total world production of northern shrimp (Table 3.1).

It is evident that the Fishery for northern shrimp is highly concentrated, and unlike the fishery for the larger southern varieties, there have been few entrants into this fishery since 1965 (the exception is the USSR). It should also be noted that despite the rather gradual increases in total world production, the catches of individual countries have fluctuated widely reflecting varying degrees of abundance from year to year. During the sixties, the European share of the total world catch dropped from 87% in 1965 to less than 60% in 1969. This was due mostly to the emergence of a large Alaskan fishery for Pandalus borealis. It was also due in part to lower catches by certain European countries, most notably the Netherlands who have traditionally fished for Crangon crangon and the Norwegians (who have traditionally fished for Pandalus borealis).

¹ Predominantly Pandalus borealis in the North Pacific and North Atlantic. Also included are smaller quantities of P. montagui, P. bonnierii, P. jordani, and other pandalid species. Crangon crangon found in the North-east Atlantic, although somewhat different, has also been included.

TABLE 3.1

WORLD LANDINGS OF NORTHERN SHRIMP¹ (tonnes)

| | <u>1965</u> | <u>1969</u> | <u>1974</u> | <u>1977</u> | <u>1978</u> |
|----------------------|--------------|---------------|---------------|---------------|-------------|
| <u>North America</u> | 10,798(12%) | 43,374(38%) | 77,620(47%) | 98,993(45%) | 82,584 |
| Canada | 777(1%) | 1,950 | 4,720 | 10,893(5%) | 11,327 |
| United States | 10,027(12%) | 41,424 | 72,900(44%) | 88,100(41%) | 71,100 |
| <u>Europe</u> | 75,228(87%) | 68,039(60%) | 82,719(50%) | 104,469(49%) | |
| Belgium | 1,180 | 1,724 | 1,652 | 1,212 | |
| Denmark ² | 10,300(12%) | 12,386 | 13,562 | 35,970(17%) | |
| France | 2,722 | 3,402 | 2,041 | 2,196 | |
| FRG | 28,312(33%) | 27,613 | 28,656 | 18,239(8%) | |
| Netherlands | 17,422(20%) | 11,705 | 7,525 | 4,026(2%) | |
| Norway | 10,480(12%) | 6,397 | 15,878 | 26,481(12%) | |
| Spain | | | 10,062 | 13,100(6%) | |
| Sweden | 3,499 | 1,770 | 2,003 | 2,019 | |
| UK | 1,318 | 1,318 | 1,340 | 1,226 | |
| <u>Others</u> | 907(1%) | 3,312 | 6,516 | 13,075(6%) | |
| Iceland | 907 | 3,312 | 6,516 | 7,149 | |
| USSR | - | - | - | 5,926 | |
| TOTALS | 86,932(100%) | 113,000(100%) | 166,855(100%) | 216,537(100%) | |

¹ Source FAO Yearbook of Fisheries Statistics (including Pandalus borealis, Crangon crangon and other Pandalid Species.)

² Catches by Greenland and the Faroe Islands are included in the catch for Denmark.

During the seventies, the Americans managed to increase the size of their catch considerably. Catches off Alaska were 34,000 tonnes in 1970 and reached their peak in 1976 with a catch of 58,000 tonnes dropping slightly to 53,000 tonnes in 1977. The Oregon catch was 6,000 tonnes in 1970 and gradually increased to a peak catch of 26,000 tonnes in 1978. Canadian landings had grown to about 11,000 tonnes by 1977 and together with the U.S. landings, produced peak landings of almost 99,000 tonnes on the North American continent in 1977. This was about 45% of the total world catch of northern shrimp in that year (Table 3.1).

During the seventies, the Europeans also succeeded in increasing their total catch considerably, due mainly to catch increases by two countries, Denmark and Norway. Denmark has now taken the lead in European production due to the development of a large fishery (mostly Pandalis borealis) off the west coast of Greenland (34,000 tonnes in 1977).¹ The Norwegians managed to achieve a rather dramatic comeback from their 6400 tonnes catch in 1969 to take a record 26,500 tonnes in 1977. The Norwegians have till now been granted a considerable slice of the West Greenland catch (13,000 tonnes in 1976 and 7,500 tonnes in 1977) but their share here is expected to decline. They have also increased their catch considerably in the North Sea. West Germans were, until recently, Europe's largest producers. Like the Dutch, they catch mostly Crangon crangon and decreases in those stocks put them in third position in 1977 (Table 3.1).

Preliminary catch statistics for 1978 indicate that catches of northern shrimp will be down somewhat from the record 1977 year. The Alaskan catch in 1978 was down 44% from the record 58,000 tonne catch of 1976. The 1977 West Greenland catch was a record 42,000 tonnes dropping to 34,000 tonnes in 1978 and the TAC was lowered to 29,500 tonnes in both 1979 and 1980. There are indications that this TAC will not be increased in the near future. In the past, lower catches such as these have resulted in increased competition for the available resources and an accelerated effort to find and develop newer and usually costlier sources of supply.

¹ Catches by the Faroe Islands and Greenland are included in the total for Denmark.

There is evidence that the sequence, whereby continuing increases in price (due to increases in demand) have always resulted in increased supply, is weakening. The MSY for total world shrimp resources has been estimated at about 1,487 thousand tonnes (Longhurst 1970, Fullenbaum 1970)¹. Since the world catch was 1,446 thousand tonnes in 1977, the MSY estimate may already have been exceeded. A recent slowing down in the overall growth rate for world shrimp fisheries (averaging about 2.5% between 1974 and 1977 as compared to an average greater than 6% between 1965 and 1977) supports this because record price increases during the past four or five years are no longer bringing forth the quantities they once did.

The future world supply situation for the northern shrimp varieties is only slightly more optimistic. Longhurst has estimated MSY for northern shrimp at 240,000 tonnes (Longhurst, 1970)¹. If we continue to match recent world growth rates (averaging 8% between 1974 and 1977), the MSY estimate will be surpassed in 1980. If the growth rate for the northern shrimp fishery slows down to the 2.5% level (that has been characteristic of recent growth rates in total world shrimp production) production will surpass the MSY estimate in 1982. Although the MSY figures are only estimates, there is a high probability that production levels for northern shrimp and shrimp in general will level off in the early eighties. Some resource experts have suggested that the MSY for northern shrimp may already have been surpassed. A levelling off in world catching levels will result in greater competition for supply, higher prices, and an enhanced developmental opportunity for those countries having access to the resource.

¹ These figures must be considered as very rough estimates since they were calculated before the discovery of major new fisheries during the seventies.

4) Canadian Supply Situation

The development of an offshore shrimp fishery as well as an increase in resource availability and of fishing effort in the Gulf of St. Lawrence have permitted substantial growth in the Atlantic landings over the past few years. Catches of 8,000, 10,000 and 14,000 tonnes in 1977, 1978 and 1979 represent a growth rate of over 25% per annum during this period. Growth of this magnitude is not expected to continue. Catches during the next two years will, however, in all likelihood be as high, if not somewhat higher, than in 1979.

Uncertainty as to the Canadian supply position over the longer term is due to a number of reasons. The first is related to the difficulty of projecting resource availability. Recruitment success varies considerably from year to year and can be predicted no longer than two years in advance. The world's shrimp fisheries provide numerous examples of sudden increases in resource availability raising expectations only to be followed by disappointment due to equally sudden, unexplainable decreases. This brings the whole concept of sustainable yield, particularly MSY, as applied to shrimp fisheries, into question.

A second and equally important limitation is an economic one. Although resource surveys may indicate the maximum sustainable yield of a given stock to be, say, 5,000 tonnes, the effort necessary to take this catch will be proportionally much higher than that necessary to take a lesser amount such as 3,000 tonnes. Thus, the landed price may only permit economically viable utilization to a considerably lower level.

A number of successful year classes in the Gulf of St. Lawrence during the seventies have now resulted in increased abundance of the resource. Whereas prior to 1978, catches in the Esquiman Channel did not exceed 1,350 tonnes, in 1979 the Gulf fleet took some 3,000 tonnes out of the northern portion of the Esquiman Channel with some 500 tonnes being taken out of the southern portion. The catches per unit of effort in the southern portion of the Esquiman Channel and Anticosti Island areas have not been as high as in the northern Esquiman and Sept Iles area and this, as well as the greater distance

from landing points, has resulted in catches which are considerably below MSY estimates (Table 4.1). In these cases, the factor limiting greater exploitation of the available biomass appears, for the most part, to be an economic one.

TABLE 4.1 ATLANTIC COAST RESOURCE ESTIMATES

| | <u>Estimates of Sustainable Yield or Present Allowable Catches (tonnes)</u> | <u>Landings 1979 Preliminary (tonnes)</u> |
|--|---|---|
| <u>Gulf of St. Lawrence</u> ¹ | 16,000 | 8,000 |
| - Esquiman Channel (northern) | 3,500 | 3,000 |
| (southern) | 5,000 | 500 |
| - Sept Iles area | 3,500 | 3,500 |
| - Anticosti Island area | 4,000 | 1,000 |
| <u>Labrador</u> | 6,200(1979 TAC) | 3,800 |
| - 2G | 500 (1979 TAC) | NIL |
| - Cartwright Channel | 800 (" ") | 800 |
| - Hopedale Channel | 3,200 (" ") | 3,000 |
| - Hawk Channel | 1,700 (" ") | 4 |
| <u>Davis Strait</u> | 2,000 (" ") ² | 1,700 |
| <u>Scotian Shelf</u> | 2,000 (" ") | <u>800</u> |
| <u>ATLANTIC TOTALS</u> | | <u>14,300</u> |

¹ The figures for the Gulf of St. Lawrence are estimates of Maximum Sustainable Yield (MSY).

² Canadian allocations in the Davis Strait depend on the outcome of negotiations with the EEC.

Labrador stocks will apparently support long term catches in the order of 4,000 to 10,000 tonnes. The total available catch for the Labrador area was set at 6,200 tonnes in 1979. Catches in the Hawke Channel and in area 2G, however, have not been as high as had been anticipated. Additional fishing experience in these areas should result in an increase in the total Labrador catch.

At this point we do not really know what we can expect from the Davis Strait/Baffin fishery on a long-term basis. The Canadian share of this fishery is negotiated with the EEC each year as part of a joint management scheme and is complicated by the fact that we do not have definite information on the proportion of the stock residing in the Canadian zone. Canada's allocation was 1,000 tonnes in 1978, though none of this was taken. Our allocation was increased to 2,000 tonnes in 1979 and almost the whole allocation was taken that year. The Canadian allocation for 1980 was set at 2,500 tonnes.

A new fishery has been emerging in the Louisbourg and Whitehead holes off south-east Cape Breton. These stocks appear to be capable of sustainable yields in the total area of about 5,000 tonnes and a TAC of 2,000 tonnes was set for 1979. Again, the factor limiting greater exploitation of the available biomass appears to be mostly economic. Except in specific areas of high concentration, catch rates, in some cases have been too low to permit economically viable exploitation up to the TAC level.

The Bay of Fundy and Eastern hole off Shelbourne, Nova Scotia, yielded 800 metric tons in 1970 but this fishery has dropped off rapidly by 1972 and has since then not yielded commercially harvestable quantities. These stocks appear to be on the fringes of natural distribution of P. borealis and when environmental conditions (temperature appears to be the most critical) exceed the limits required for the survival of eggs and larvae, successful year classes do not materialize. A similar situation appears to hold true for the U.S. New England shrimp fishery which has yielded as much as 11,000 tonnes but

in recent years has been closed. The Bay of Fundy will likely yield modest quantities in occasional years but has not been included in the supply forecast because it does not appear to be a sustainable catch.

On the West Coast, stocks of Pandalus jordani in the Nootka and Tofino areas appear to be capable of yielding 1500 tonnes on a sustainable basis. A couple of hundred tons of P. borealis will also likely continue to be harvestable from the colder, bottom waters of mainland estuaries along the B.C. coast.

The Atlantic producers have, until recently, concentrated mostly on frozen, peeled production. This is changing. Increasing demand and higher prices for "in shell" raw and cooked northern shrimp products in Europe and Japan along with the development of a Canadian freezer trawler fishery off Labrador and in Davis Strait, have now resulted in an increasing share of the catch being sold in frozen, whole form. In 1978, about 38% of the total volume of Atlantic production consisted of "in shell" products (Table 4.2). This proportion is expected to increase in the coming years but is limited by the fact that the smaller size ranges (25-30% of the total Labrador catch) are not suitable for the in shell market.

Seasonality of production has an important impact on demand because many end product markets choose the supplier who can deliver year round. The Canadian industry, till now, has concentrated mostly on frozen end products and cold storage has enabled it to schedule supplies to the market. It is interesting to note that fishermen who were prosecuting stocks in the Bay of Fundy fishery used to "salt-cook" considerable quantities aboard their small vessels. This was a winter fishery (January-March) and cold temperatures contributed to the maintenance of a high quality catch, part of which was shipped in chilled form to Europe. The new Cape Breton fishery now offers us year round, ice free accessibility and the opportunity to further increase the production of fresh chilled end-products at the time of year when they are scarcest and in high demand.

TABLE 4.2

ATLANTIC COAST

PRODUCTION OF CANADIAN SHRIMP PRODUCTS¹
(tonnes)

| <u>Year</u> | <u>Fresh in Shell</u> | <u>Frozen in Shell</u> | <u>Fresh peeled</u> | <u>Frozen peeled</u> | <u>Total</u> | <u>% Canadian Production</u> |
|-------------|-----------------------|------------------------|---------------------|----------------------|------------------|------------------------------|
| 1970 | 40 | 46 | 0 | 662 | 748 | 78 |
| 1971 | 144 | 60 | 8 | 593 | 805 | 87 |
| 1972 | 9 | 54 | 0 | 268 | 331 | 72 |
| 1973 | 29 | 165 | - | 484 | 678 | 78 |
| 1974 | 20 | 106 | - | 940 | 1,066 | 83 |
| 1975 | 7 | 113 | - | 1,153 | 1,273 | 86 |
| 1976 | 92 | 239 | 38 | 1,382 | 1,751 | 68 |
| 1977 | 14 | N/A | 24 | 1,515 | N/A ² | - |
| 1978 | 299 | 1,052 | 41 | 2,160 | 3,552 | 88 |

¹ Source: Raynes G., The Market for Canadian Atlantic Shrimp, Marketing Branch, Fisheries and Oceans (with revised figures for 1977 and 1978).

² An estimated production figure for 1977 is about 2500 tonnes. Production on the Pacific Coast was 495 tonnes in 1977.

Summary of Supply Implications for Canada

- a) Growing demand and ever increasing prices have led European countries who fish the "northern" shrimp varieties, to search farther afield and prosecute costlier fisheries. Continuation of the above could result in total world maximum sustainable yield estimates of 240,000 tonnes being exceeded in the early 1980's. Canada and other countries that have substantial, sustainable sources of supply stand to benefit considerably from such a situation.

- b) After several years of rapid growth in catch levels (8,000, 10,000 and 14,000 tonnes in 1977, 1978 and 1979), the growth rate in the Atlantic shrimp fishery is now expected to decrease considerably. Uncertainty as to the long-term supply situation is due to natural and largely unexplainable variations in shrimp availability from year to year, as well as the limitation imposed by catch rates falling to uneconomic levels well before levels of maximum sustainable yield are reached. The implication for the Atlantic shrimp fishery is that catching capacity should be carefully controlled so as to permit economically viable operations during years of decreased resource availability.

5) World Demand Situation

Strong growth in world shrimp fisheries has been due mainly to increases in end-product prices brought on by increasing consumer demand. The United States, Japan, Canada and quite a number of western European countries have been demanding quantities substantially larger than they can produce and this has resulted in an increasing share of world production going into exports (greater than 50% since 1970).

The United States has always been the world's largest shrimp consumer and until recently, the number one producer. It is also the world's largest shrimp importer and is a major exporter of both the northern and southern shrimp varieties. The volume of Canada's shrimp imports from the United States in recent years have been about twice as large as total Canadian production. The U.S. is also one of our major export customers. The role of the United States as a supplier and customer, as well as the economic significance of its proximity, makes it important to understand the factors which shape the U.S. shrimp industry.

In the United States, per capita consumption of shrimp increased by 60% between 1960 and 1977 (1.393 lbs to 2.238 lbs). Given the increase in population, total apparent consumption increased by 88% during the same period (114 t to 220 t product weight). Whitaker has studied trends in demand for fresh and frozen shrimp in the United States between 1950 and 1969 and found that "the demand curve for shrimp has not been constant. Rather it has been shifting-upward and to the right. This situation indicates a big increase in the demand for shrimp".¹

There are a number of reasons for the increase in the U.S. demand for shrimp. Strong growth in personal disposable income, a co-ordinated promotional effort by the industry, an excellent distribution network, product variety, and the versatility of shrimp as a food appear to be the main ones (Whitaker, 1970). It is generally agreed that income increases is the most important

¹ Whitaker, D.R. 1970 Trends in World Shrimp Demand and Production. Psc. Conf. in Cdn. Shrimp Fishery, P. 330.

factor. Co-ordinated promotional activity is unique to the U.S. shrimp industry. The Shrimp Association of the Americas was formed in the 1950s for promotional purposes and, partly due to their efforts, demand has been stimulated throughout all regions in the United States.

The traditional "count" or classification of shrimp into various size categories is the most important determinant of price in the port, wholesale and retail markets of the United States. The larger Penaeid varieties of shrimp caught in southern waters command higher prices mainly because of higher throughput and yield in processing, suitability for the lucrative breaded market, and a consumer bias in favour of largeness (Whitaker, 1970). The Alaskan producers fishing high count P. borealis have always been at a disadvantage because of this pricing arrangement. They have compensated by developing high volume, efficient, catching and processing operations.¹ They have also been marketing aggressively in Europe.

A look at monthly ex-vessel, wholesale and retail prices for southern shrimp between 1975 and 1978 illustrates a number of the structural features just mentioned. (Table 5.1). Prices at all three levels (but especially ex-vessel and wholesale) fluctuate sharply reflecting the effect of short term variations in catch, inventory positions, imports, etc. Average monthly prices for large sizes (21-25 count) are as much as 100% above the smallest category (51-60 count) for many months.

If we look at the following wholesale prices for greater than 150 count Alaskan shrimp during the past three years, we find that they have been gradually increasing within the range of prices typical for 31 to 60 count, raw southern, headless shrimp.

Wholesale Prices for Alaskan Shrimp (Seattle)

(price range for I.Q.F. peeled and frozen block end-products)

Dec 77 \$2.30 - \$2.60/lb. (US)

Dec 78 \$2.65 - \$2.85/lb. (US)

Dec 79 \$3.75 - \$4.75/lb. (US)

¹ C. Mitchell estimated that the Alaskans were producing frozen peeled shrimp at 26¢ lb FOB in 1970.

Table 5.1 - Exvessel, wholesale, and retail prices of raw headless shrimp, monthly, 1975-78

| MONTH | Exvessel <u>1/</u> | | | Wholesale <u>2/</u> | | | Retail <u>3/</u> | |
|-----------------------------|--------------------|-------|-------|---------------------|-------|-------|------------------|-------|
| | 21-25 | 31-40 | 51-67 | 21-25 | 31-40 | 51-60 | 21-25 | 36-42 |
| -----Dollars per pound----- | | | | | | | | |
| <u>1975</u> | | | | | | | | |
| January | 1.59 | 1.26 | 0.84 | 1.94 | 1.62 | 1.21 | 2.88 | 2.54 |
| February | 1.82 | 1.46 | .98 | 2.19 | 1.75 | 1.30 | 2.84 | 2.54 |
| March | 2.07 | 1.63 | 1.13 | 2.49 | 1.94 | 1.44 | 3.04 | 2.56 |
| April | 2.32 | 1.84 | 1.28 | 2.79 | 2.18 | 1.64 | 3.50 | 3.01 |
| May | 2.65 | 2.08 | 1.37 | 3.07 | 2.56 | 1.76 | 4.22 | 3.44 |
| June | 2.55 | 1.95 | 1.23 | 3.01 | 2.49 | 1.75 | 4.08 | 3.42 |
| July | 2.56 | 1.95 | 1.26 | 2.92 | 2.38 | 1.65 | 4.31 | 3.45 |
| August | 2.67 | 2.08 | 1.35 | 3.09 | 2.52 | 1.79 | 4.19 | 3.44 |
| September | 2.85 | 2.23 | 1.36 | 3.17 | 2.62 | 1.74 | 4.19 | 3.72 |
| October | 2.90 | 2.30 | 1.34 | 3.30 | 2.72 | 1.75 | 4.33 | 3.72 |
| November | 2.96 | 2.39 | 1.40 | 3.41 | 2.80 | 1.76 | 4.49 | 3.79 |
| December | 3.04 | 2.48 | 1.41 | 3.49 | 2.90 | 1.94 | 4.76 | 4.02 |
| <u>1976</u> | | | | | | | | |
| January | 3.21 | 2.57 | 1.43 | 3.67 | 3.04 | 2.06 | 4.56 | 3.79 |
| February | 3.24 | 2.84 | 1.55 | 3.96 | 3.27 | 2.25 | 4.74 | 3.64 |
| March | 3.46 | 2.82 | 1.60 | 3.97 | 3.30 | 2.26 | 4.90 | 3.86 |
| April | 3.59 | 2.98 | 1.75 | 4.26 | 3.60 | 2.41 | 5.04 | 3.96 |
| May | 4.06 | 3.17 | 1.79 | 4.72 | 3.84 | 2.44 | 5.18 | 4.45 |
| June | 4.03 | 2.74 | 1.33 | 4.77 | 3.60 | 2.25 | 5.14 | 4.39 |
| July | 3.42 | 2.26 | 1.42 | 4.41 | 3.08 | 1.94 | 5.03 | 3.85 |
| August | 3.01 | 2.17 | 1.55 | 3.78 | 2.80 | 2.05 | 5.21 | 3.56 |
| September | 3.30 | 2.37 | 1.56 | 4.02 | 3.02 | 2.17 | 4.74 | 3.36 |
| October | 3.15 | 2.31 | 1.35 | 3.81 | 2.90 | 2.11 | 4.86 | 3.69 |
| November | 3.53 | 2.58 | 1.45 | 4.08 | 3.03 | 2.15 | 5.14 | 3.59 |
| December | 3.65 | 2.66 | 1.45 | 4.17 | 3.22 | 2.22 | 5.14 | 3.59 |
| <u>1977</u> | | | | | | | | |
| January | 3.73 | 2.81 | 1.53 | 4.18 | 3.20 | 2.16 | 5.26 | 4.39 |
| February | 3.83 | 2.88 | 1.60 | 4.27 | 3.32 | 2.22 | 5.44 | 4.54 |
| March | 3.96 | 3.04 | 1.75 | 4.36 | 3.39 | 2.33 | 5.49 | 4.27 |
| April | 3.67 | 2.69 | 1.48 | 4.33 | 3.31 | 2.30 | 5.60 | 3.94 |
| May | 3.64 | 2.56 | 1.35 | 4.28 | 3.14 | 2.11 | 5.66 | 3.68 |
| June | 3.70 | 2.25 | 1.19 | 4.36 | 3.01 | 1.84 | 5.45 | 3.69 |
| July | 3.59 | 2.09 | 1.30 | 4.30 | 2.71 | 1.79 | 5.19 | 3.55 |
| August | 2.93 | 2.16 | 1.34 | 3.77 | 2.63 | 1.94 | 5.29 | 3.19 |
| September | 2.61 | 2.10 | 1.27 | 3.44 | 2.70 | 1.96 | 5.29 | 3.28 |
| October | 2.75 | 2.05 | 1.25 | 3.28 | 2.54 | 1.89 | 5.17 | 3.12 |
| November | 2.82 | 2.08 | 1.22 | 3.50 | 2.59 | 1.96 | 4.76 | 3.13 |
| December | 2.66 | 2.01 | 1.20 | 3.32 | 2.56 | 1.93 | 4.33 | 3.01 |
| <u>1978</u> | | | | | | | | |
| January | 2.84 | 2.08 | 1.25 | 3.44 | 2.65 | 2.02 | 4.53 | 3.06 |
| February | 2.77 | 2.07 | 1.30 | 3.48 | 2.68 | 2.08 | 4.54 | 3.11 |
| March | 2.87 | 2.19 | 1.42 | 3.46 | 2.69 | 2.06 | 4.73 | 3.49 |
| April <u>4/</u> | 3.28 | 2.48 | 1.88 | 3.69 | 2.76 | 2.16 | 4.84 | 3.38 |
| May <u>4/</u> | 3.34 | 2.53 | 1.91 | 3.79 | 2.86 | 2.21 | 4.90 | 3.58 |
| June <u>4/</u> | 3.38 | 2.53 | 1.64 | 3.87 | 2.95 | 2.18 | 4.74 | 3.54 |
| July <u>4/</u> | 3.38 | 2.52 | 1.60 | 3.93 | 3.00 | 2.19 | 4.69 | 3.79 |

1/ Weighted average, all species, South Atlantic and Gulf

2/ At New York, N.Y.

3/ At Baltimore, M.D.

4/ Preliminary

Prices of Alaskan shrimp appear to move quite independantly of prices for southern shrimp. This appears to be because consumers in the United States perceive Alaskan shrimp to be a distinct product, and differentiate between it and the larger southern varieties.

By country, the United States was our major export customer in 1976, 1977 and 1978.¹ In these years, the U.S. purchased 44%, 31% and 26% of Canadian exports. (Table 5.2). The exports for the most part, consisted of cooked and raw, frozen, peeled products. If we compare the average export prices in the United States with those of our major European customers, we note that the U.S. prices of \$.90 and \$.98 in 1976 and 1977 were less than half of most European prices. This differential lessens significantly for 1978 and data for the first 10 months of 1979 reveals that returns from the U.S.A. are now more similar to those in Europe (Table 5.2).

The lower prices in the United States in 1976 and 1977 appear to have been due to extreme upward and downward price fluctuations. For example, in 1977, average returns in April, September and July were \$2.56/lb., \$2.11/lb. and \$2.10/lb. respectively. In August, October and June the average export prices were \$.33/lb., \$.54/lb. and \$.66/lb. respectively. Although no definitive reason is available to explain the fluctuations, Statistics Canada has suggested that they were probably due to price fluctuations for the raw, peeled product. Prices in the U.S. market for the first 11 months of 1979 indicate that these fluctuations in price have not occurred during the past year.

The CIF Gloucester, Mass. price for the Canadian produced, 110-150 count, I.Q.F., cooked, peeled product was about \$3.75 (US) in late 1979. Canadian shrimp was apparently selling at a discount of 10-15¢ per pound compared to the Alaskan product (Raynes, 1979).

¹ The U.K. was our major export customer up till this time (taking 57% of exports in 1975) and according to preliminary data, assumed the number one position again in 1979.

TABLE 5.2 CANADIAN SHRIMP EXPORTS (1975-1979)¹
(fresh and frozen products, Canadian dollars)

| | 1975 | | | 1976 | | | 1977 | | | 1978 | | | (January-November) 1979 | | |
|-------------------------------|------------------|--------------|-------------------------------------|------------------|--------------|-------------------------------------|------------------|--------------|-------------------------------------|------------------|--------------|-------------------------------------|----------------------------|--------------|-------------------------------------|
| | Volume tonnes | Share (%) | Avg. Export Price dollars/lb. | Volume tonnes | Share (%) | Avg. Export Price dollars/lb. | Volume tonnes | Share (%) | Avg. Export Price dollars/lb. | Volume tonnes | Share (%) | Avg. Export Price dollars/lb. | Volume tonnes | Share (%) | Avg. Export Price dollars/lb. |
| United States | 83 | (7%) | \$1.83 | 782 | (44%) | \$.90 | 615 | (31%) | \$.98 | 530 | (26%) | \$2.09 | 588 | (17%) | \$3.16 |
| United Kingdom | 640 | (57%) | \$1.80 | 479 | (27%) | \$2.08 | 479 | (24%) | \$2.42 | 500 | (24%) | \$2.98 | 910 | (26%) | \$2.93 |
| Fed. Rep. Germ. | 96 | (8%) | \$1.94 | 118 | (7%) | \$2.11 | 284 | (14%) | \$2.56 | 440 | (21%) | \$3.04 | 198 | (6%) | \$3.46 |
| Norway | 112 | (10%) | \$2.13 | 15 | (1%) | \$2.08 | 155 | (8%) | \$1.93 | 134 | (6%) | \$2.70 | 232 | (7%) | \$2.55 |
| Sweden | 52 | (5%) | \$1.87 | 262 | (15%) | \$1.75 | 94 | (5%) | \$2.63 | | | | 315 | (9%) | \$3.05 |
| Denmark | 86 | (7%) | \$2.00 | | | | | | | | | | 327 | (9%) | \$2.31 |
| France | | | | | | | | | | | | | 386 | (11%) | \$1.34 |
| Japan | | | | | | | | | | 327 | (16%) | \$1.68 | 336 | (10%) | \$2.30 |
| <u>Total Canadian Exports</u> | 1,106 | (100%) | | 1,759 | (100%) | | 1,968 | (100%) | | 2,068 | (100%) | | 3,481 | (100%) | |

¹ There are considerable differences in the mix of peeled and in shell end-products being exported to various countries and the differences between the average prices must be interpreted with caution. For example, the lower average price of \$1.68/lb. in Japan in 1978 was due to a growing market for in the in shell, frozen product in that country.

Information on the level of European demand is difficult to obtain. The demand for shrimp products in Western Europe is increasing rapidly due to increases in income that in some instances have been greater than in North America. Improvements in the distribution system and promotion have also created an atmosphere conducive to the successful marketing of high priced seafoods. Increasing reliance on imports to satisfy demand has made it an attractive market for exporters of both the southern and northern shrimp varieties with the former typically being imported in about twice the quantity of the latter. The northern shrimp varieties have always been preferred by consumers in northern Europe and this has resulted in a distinct market with prices which move quite independently of prices for larger, southern shrimp (Heminings, 1970). Unlike the United States, flavour, texture and colour, as well as size, are important determinents of price. European demand for northern shrimp is met mostly by the Danish, Norwegian and Icelandic sellers with increasing competition from the Americans and Canadians as they try to increase their share of this lucrative market.

Although shrimp eating habits vary considerably between the various countries, many European consumers share a strong preference and a willingness to pay high prices for northern shrimp "in shell". This preference is particularly strong in the northern European countries where the cooked, in shell product is in high demand and generally under supplied. The CIF prices in Oslo, Norway for both in shell and peeled end products, in Table 5.3, are broadly representative of prices which Canadian producers are now obtaining throughout Western Europe.

TABLE 5.3 CIF PRICES FOR NORTHERN SHRIMP IN OSLO, NORWAY

(Canadian dollars, January, 1980)

Cooked, In shell, Frozen

| | |
|--------------------|---|
| 90-120 count/kilo | \$ 1.58-\$ 1.85/lb. (depending on quality) |
| 120-160 count/kilo | \$ 1.16-\$ 1.47/lb. (depending on quality) |

Raw, In shell, Frozen

| | |
|-------------------|-------------|
| 90-120 count/kilo | \$ 1.31/lb. |
|-------------------|-------------|

Cooked, peeled, frozen

| | |
|---|-----------------------|
| 100-150 count/lb. | \$ 4.00/lb. |
| 150-300 count/lb. | \$ 3.80/lb. |
| greater than 300 count (including broken pieces) | \$ 3.40 - \$ 3.50/lb. |

The relative advantage to be gained from marketing in shell products lies in the fact that edible meat only accounts for approximately 20 to 25% of total body weight. Assuming 25% yield, prices for the edible meat portion in the cooked, 90-120 count/kilo category thus become approximately \$6.32 to \$7.40/per pound and \$4.64 to \$5.88 per pound in the 120 to 160 count/kilo category. The price of the edible meat for the raw, in shell product becomes approximately \$5.30 per pound. One producer estimates that the returns from cooked, in shell production are roughly double those of peeled production, after the costs of production have been considered.

Getting the top prices for the in shell products is very dependant on meeting the count specifications of the buyer. For instance, if sampling reveals that the count is four or five animals higher than specified on a number of samples, the price can drop 15%.

Getting top prices is also very dependant on meeting quality specifications. There have been isolated instances of iodine flavouring causing marketing difficulties for the in shell product in Europe. One European broker who handled over 350 tonnes of the Canadian product in 1979, states that more than a quarter of a recent 40 tonne shipment was not accepted because of iodine flavour. If quality problems of this nature occur frequently, the penalty can become one of refusal of the market to accept the product. Iodine flavour is a common problem in shrimp fisheries. It, apparently, is related to the food which the shrimp eat and the problem does not occur throughout the whole fishing season. Careful sampling of catches can help in detecting the problem. This minimizes it's detection in markets where maintaining a reputation for consistently high quality is so important.

Prices for the raw, in shell product in the 90 to 120/kilo category have been averaging about \$1.30 per pound during the past few months. Prices in this market have been more unsettled than for the cooked, in shell product. This appears to be due to the influence of Japanese buyers who are gradually increasing their share of the supplies available in this market.

Prices for the peeled, cooked product are not significantly different than those in Canada and the United States. Canadian producers compete with producers in Alaska, Washington and Oregon in the European, peeled market. Lower catches in the United States in 1978 and 1979 have now resulted in additional demand for the Canadian peeled product in Europe.

Consumption figures for individual European countries (or even estimates for Europe as a whole) are not readily available. Mitchell estimated total consumption in 1968 at 75,000 t live weight (Mitchell, 1971). If we assume a 4% growth rate per annum (similar to the growth rate in consumption in the U.S.), total European consumption was 107,000 t in 1977 which would be about 3000 t greater than the total European catch in that year. Continuing growth in consumption at 4% would demand 125,000 t in 1981 and 141,000 t in 1985. Assuming that the European catches stay at about the 1977 level of 104,000 t and the 4% growth rate in consumption is realistic, their demand for northern shrimp imports in terms of a simple, import/export commodity balance

would be about 21,000 t in 1981 and 37,000 t in 1985.¹ Total catches by Canada, the U.S. and Iceland will probably be in the order of 110,000 t during this period.

The recently published Worldwide Fisheries Marketing Study (Shellfish Annex) concludes that there is potential for roughly doubling our shrimp exports to Europe by 1985 (1200 tonnes in 1978 to 2300 tonnes in 1985, Table 5.3). The study points out that Canada's ability to exploit international shellfish marketing opportunities will depend on two factors. First, we must increase our ability to recognize and cater to individual market idiosyncracies and secondly, we must improve the appearance and quality of our products. Whitaker has pointed out that shrimp importers in this market tend to consider price first. This does not mean that the price has to be the lowest in the market but it has to be competitive relative to quality, size and packaging desired (Whitaker, 1970). We will therefore also have to pay particular attention to ensuring that our costs of production enable us to compete on the basis of price.

Demand for shrimp in Japan, like the United States and Western Europe, has been escalating rapidly due to consumers having increased disposable income. Japanese consumers have traditionally eaten substantial quantities of the southern varieties and the Japanese fishing industry has set up numerous long-term, co-operative supply arrangements with Asian countries in order to satisfy demand. Their imports of shrimps and prawn products could apparently exceed 160,000 tonnes by 1985.² Our export of about 300 tonnes of northern shrimp to Japan in both 1978 and 1979 now opens up the opportunity for expansion in this market. Japanese buyers are particularly interested in obtaining whole, green shrimp frozen right after landing which makes our Labrador catch of interest to them. One Japanese buyer has indicated that he would have been willing to buy 2000 tonnes of raw, frozen Labrador shrimp in 1979 but only managed to procure about 80 tonnes. Canadian producers will no doubt be increasing the share of exports going to Japan if returns are competitive with those from European buyers.

¹ The balance does not, of course, account for quantities that European producers may choose to export.

² Shellfish Annex to the Worldwide Fisheries Marketing Study: Prospect to 1985; Fisheries and Oceans, Industry, Trade and Commerce, 1979.

TABLE 5.4

| <u>Shrimp & Prawns</u> | <u>CANADIAN EXPORTS</u> | | | | |
|----------------------------|-------------------------|-------------|-------------|------------------|-------------|
| | <u>(tonnes)</u> | | | | |
| | <u>ACTUAL</u> | | | <u>POTENTIAL</u> | |
| | <u>1974</u> | <u>1976</u> | <u>1978</u> | <u>1981</u> | <u>1985</u> |
| U.S.A. | 153 | 732 | 530 | 800 | 1,000 |
| Western Europe/EEC | 383 | 669 | 978 | 1,200 | 1,340 |
| Western Europe/Non-EEC | 39 | 290 | 210 | 600 | 960 |
| Japan | - | 13 | 326 | 100 | 400 |
| Far East | 1 | 14 | 19 | 20 | 20 |
| Caribbean | - | 3 | - | - | - |
| TOTAL | 576 | 1,771 | 2,063 | 2,720 | 3,720 |

Source: Shellfish Annex to the Worldwide Fisheries Marketing Study: Prospect to 1985, Fisheries and Oceans, Industry, Trade and Commerce, Nov. 1979

6) Canadian Demand Situation

Canadians do not consume large quantities of shrimp. However, an increase in consumption from .75 lbs./capita in 1973 to 1.15 lbs. per capita in 1978, is indicative of considerable increases in consumer demand during the seventies.¹ We have always shown a strong preference for the southern, warm water varieties, which have traditionally been imported from the United States and other countries fishing these species. Consumption of the imported fresh and frozen end-products (mostly IQF, peeled) accounted for 70 to 75% of total consumption between 1973 and 1978 (Table 6.1).

Although Canadians have traditionally shown a strong preference for the southern shrimp varieties, recent increases in domestic consumption of our northern shrimp are encouraging. A three to fourfold increase in Canadian production between 1973 and 1978 has been accompanied by a twenty fold increase in consumption of Canadian produced shrimp (from less than .01 lbs./capita to .19 lbs./capita - Table 6.1) in this period. There also appears to be additional demand for the Canadian product which cannot be met because of limitations in supply (Raynes, 1979). One producer estimates that present levels of demand within Canada are sufficient to allow supply increases in the order of 25 percent.

Canadians are becoming more sophisticated in their shrimp eating habits. There has been a significant shift in consumption away from canned to frozen products. Whereas approximately 2400 tonnes of the canned product were imported into Canada in 1976, this decreased to 1500 tonnes by 1978. It's estimated that canned imports did not exceed 1200 tonnes in 1979. Virtually all of the canned product consumed in Canada is Gulf of Mexico shrimp which is packed in Louisiana. The canned product, often referred to as "cocktail" or "salad shrimp" is available in all shrimp size categories but the smaller shrimp are the most popular.

¹ By way of comparison, the U.S. per capita consumption was 2.23 lbs. in 1977.

TABLE 6.1

STATISTICS FOR CANADA ON PRODUCTION, EXPORTS, IMPORTS AND
PER CAPITA CONSUMPTION OF SHRIMP, 1973-1979 (tonnes)

| | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 |
|---|-----------------------|------------|-----------------|-----------------------|-----------------------|-----------------------|-------------------|
| CANADIAN PRODUCTION (fresh and frozen products) | 869 | 1284 | 1480 | 2575 | N/A ¹ | 4044 | N/A |
| % Atlantic | (70%) | (83%) | (86%) | (68%) | (Approx. | (88%) | |
| % in shell | (30%) | (12%) | (12%) | (15%) | 3000) | (36%) | |
| CANADIAN SHRIMP EXPORTS (fresh and frozen) and % of Canadian products | 813(94%) | 576(45%) | 1062(72%) | 1771(69%) | 1970 | 2068(51%) | 3480 (Jan-Nov) |
| DOMESTIC SALES OF CANADIAN SHRIMP (fresh and frozen) | 56 (.01) lbs/cap. | N/A | 418(.04) | 804(.07) lbs/cap. | N/A | 1976(.19) lbs/cap. | N/A |
| SHRIMP IMPORTS (fresh and frozen) | 5494(.55) lbs/cap. | 6810 | 6618(.69) | 7403(.71) lbs/cap. | 8936(.84) lbs/cap. | 8828(.82) lbs/cap. | 7273 (Jan-Oct) |
| (canned) | 1957(.20) | 1674 | 2087(.20) | 2399(.23) lbs/cap. | 2212(.21) lbs/cap. | 1540(.14) lbs/cap. | 942 (Jan-Oct) |
| TOTAL CANADIAN CONSUMPTION | 7507 | N/A | 9123 | 11410 | N/A | 12344 | N/A |
| PER CAPITA CONSUMPTION (lbs) | .75 lbs/cap. | N/A | .89 lbs/cap. | 1.02 lbs/cap. | N/A | 1.15 lbs/cap. | N/A |
| CANADIAN POPULATION | 22,042,800 | 22,369,000 | 22,697,100 | 22,992,600 | 23,257,600 | 23,482,600 | 23,671,500 |

¹ An estimated production figure for 1977 is about 3000 tonnes. The official figure of 2157 tonnes is inconsistent with the fact that total landings in 1977 were 28 % higher than in 1976. Some of the frozen, in shell production from Labrador was probably omitted.

It is interesting to note that an 860 tonne decrease in canned southern shrimp consumption between 1976 and 1978 is also the time when we see the most significant increase (1170 tonnes) in the consumption of northern shrimp (Table 6.1). Market experts agree that the northern and southern shrimp varieties fall into quite separate submarkets and that the market for cold water shrimp is affected only indirectly by changes in demand and supply conditions in the larger market for warm water shrimp. This implies that consumers, in general, are unwilling to substitute one for the other. Accordingly, an increasing market for the Canadian northern shrimp and a declining market for the imported southern canned varieties would be considered coincidental.

The trend of increasing domestic consumption of Canadian produced shrimp and decreasing consumption of the imported varieties appears to be having a beneficial effect in helping to reduce Canada's overall trade deficit in shrimp products. The deficit was \$64.2 million in 1977 and decreased to \$61.9 million in 1978. The decrease was also due to the fact that the value of exports increased by over 50% (\$7.6 to \$11.5 million) while the quantities exported increased by only 5% (Table 6.1). The value of imports increased by only 3% (\$71.8 to \$73.5 million) due to a 7% decrease in quantities imported.

Domestic consumption of Canadian produced shrimp has been limited by a lack of supply (Raynes, 1979). Until recently, brokers had difficulty in procuring supply during the months of January, February and March when the Gulf fishery is closed. Increasing volume and security of supply is now resulting in more sustained consumer interest in the product. Canadians are learning to appreciate many of the unique qualities of northern shrimp. These qualities are a smaller size, a more pronounced flavour, with a lower incidence of iodine taste, a more attractive appearance, firmer texture and higher quality relative to the warm water species (Raynes, 1979). Wholesalers and retailers report that Atlantic shrimp entering the Canadian market is, in general, of very high quality. Despite all of these very positive features, the price for I.Q.F., peeled Atlantic northern shrimp is among the lowest (Table 6.2). The price is not a bad one, but it is the lowest.

TABLE 6.2

A SAMPLING OF CANADIAN WHOLESALE AND RETAIL SHRIMP PRICES

| <u>Wholesale Prices-Toronto¹</u> | <u>Retail Shrimp Prices - Ottawa²</u> |
|---|---|
| <u>Gulf of Mexico Shrimp</u> (frozen, peeled, uncooked) | <u>Gulf of Mexico Shrimp</u> (frozen, peeled, uncooked) |
| 10-15 count - \$ 8.75 | less than 20 count - \$ 14.00/lb. |
| 15-20 count - \$ 8.55 | 20 - 30 count - \$ 12.95/lb. |
| 21-25 count - \$ 8.15 | 41 - 50 count - \$ 7.95/lb. |
| 25-30 count - \$ 7.90 | |
| 30-35 count - \$ 6.95 | <u>Canned Shrimp</u> (Gulf of Mexico) ³ |
| | small (4oz tin-\$2.39) -\$ 9.56/lb. |
| <u>Northern Shrimp</u> | medium(4oz tin-\$2.75) -\$11.00/lb. |
| Alaskan (frozen, peeled, cooked) | large (4oz tin-\$3.29) -\$13.16/lb. |
| greater than 50 count - \$ 4.35 (U.S.) | |
| Canadian Atlantic shrimp | <u>Canadian Shrimp</u> (frozen, peeled, cooked) |
| (frozen, peeled, cooked) | |
| 150 to 200 count - \$ 4.25 | - greater than 300 count |
| | Matane "baby shrimp" -\$ 5.45/lb. |
| | - greater than 300 count |
| | Port au Choix shrimp -\$ 6.15/lb. |
| | (sold in 300 gram package for \$4.75) |
| | - Pacific coast northern shrimp (frozen, peeled cooked) \$6.95-\$7.95/lb. |

¹ Wholesale prices are for January 1980 and include broker's fee.

² Retail prices for frozen shrimp are January, 1980 prices in an Ottawa specialty fish store except for the Pacific coast which is the price range for the Canadian produced, west coast product in several Vancouver area fish stores.

³ Canned shrimp prices are from of an Ottawa area supermarket.

Shrimp prices in Canada, like everywhere else, are very much a function of the count (Table 6.2). The January, 1980 Ottawa price for the smallest, Gulf of Mexico, peeled varieties was about 20% less than the largest at the wholesale level and about 40% less at the retail level. Northern shrimp were priced about 30% to 50% below the smallest category of southern shrimp at both levels. Size becomes less significant as a determinant of price within the northern shrimp category itself. Prices for canned, southern shrimp seem extremely high in comparison to the frozen product - particularly for the small ones. Consumers seem to be reacting to these higher prices and buying less.

The price in Canada for domestic frozen peeled shrimp is also very much a function of what the going price is in Europe and elsewhere. In 1979, the prices which Atlantic producers were getting for I.Q.F., peeled shrimp were very similar in Canada, Europe and the United States. The fact that supply is being allocated between foreign and domestic markets to achieve similar levels of return is a feature of a healthy market. The fact that Canadian demand in 1978 was sufficiently high to attract about 50% of total Canadian production rather than the 25 to 30% that was typical for the few years previous is very encouraging. The implication for Canada is that stimulating demand will allow us to increase the proportion of total Canadian production being consumed by Canadians.

Summary of Demand Implications for Canada

- a) Most of the significant events in the world shrimp industry during the past twenty five years have been motivated by strong growth in consumer demand for shrimp in the United States, Europe and Japan. Although, it is generally agreed that this increasing demand has been due mostly to the rising affluence of consumers in those countries, experience in the U.S. suggests that well co-ordinated promotional efforts can stimulate demand significantly.

- b) The high level of consumer demand for shrimp in Western European countries is of interest to Canadian suppliers because many European shrimp consumers, unlike consumers in the U.S. and Canada, prefer northern, cold water shrimp. European demand for cooked and raw northern shrimp "in shell" and a pricing system which pays a premium for quality, now provides Canadian producers with the opportunity to realize higher returns in the European market relative to those available for the peeled product. There is also considerable consumer demand for northern shrimp in the United States and Japan but some of the demand appears to exist at price levels lower than those in Europe.

- c) Canadian consumers have traditionally preferred the southern varieties of shrimp. However, a growing awareness about northern shrimp is now resulting in growing consumer demand for the domestic, frozen, peeled product. This, as well as the increasing availability of supply from a growing Canadian fishery have now resulted in a significant increase in the share of total supply being sold domestically. The implication for Canada is that stimulating demand domestically can allow Canadians to consume an increasing share of total production.

7) Some Policy Considerations for Canada

It appears that a levelling off in world catching levels for the northern shrimp species, during the next few years, will result in greater competition for supply, higher prices and an enhanced developmental opportunity for those countries having access to the resource. Experience gained in new catching and processing technologies, over the past few years, have now put our Atlantic industry on a firm footing to take advantage of these new opportunities and make the fishery even more successful than it is a present. This has implications with respect to the way the resource is marketed, processed, harvested and managed.

The Labrador and Davis Strait shrimp fisheries have now permitted Canadian producers to allocate an increasing share of production into the cooked and raw "in shell" markets in Europe and Japan. This market has allowed the producers to realize significantly higher returns than those available for the peeled product. Preliminary data for 1979 indicate that the quantity marketed as a frozen, in shell product in 1979 was about 1800 tonnes, about 60% above the level in 1978. This market is particularly attractive to Canada because of the lack of competition from Alaska, Washington and Oregon where the fishery is oriented towards peeled production. There is an unsatisfied demand for the raw, in shell product in Japan. What is not so certain is how much of this demand is at the higher price levels now being paid in Europe. Having even a rough estimate of this would be useful for planning.

Obtaining the maximum level of return in the in shell market will require that producers pay careful attention to meeting the stringent quality and count requirements of this market. If iodine flavour or other quality problems arise frequently, it can result in a refusal of the market to accept the product. During this past year, isolated instances of buyer refusal to accept an iodine flavoured product, suggests that we need to encourage our producers to sample their catches for iodine so that it is detected before the product is in the marketplace.

Shrimp size is a critical factor as well. Buyers in northern Europe are not interested in buying small, in shell shrimp and this requires that producers sort very carefully. If sampling by buyers reveals that count specifications are frequently missed, they reduce the price considerably.

Only about 60% to 70% of the Labrador and Davis Strait catches are apparently in the size range that is suitable for an in shell product. This has prompted one producer to suggest that reintroducing the processing requirement at the 25% or 30% level would permit a more efficient allocation of the catch into the end-product for which it is best suited. Catching operations that do not have processing facilities could sell small shrimp to those who do.

Particular attention should now be given to insuring consistently high quality for the iced catch being landed in the Gulf. We know that with careful icing, trips up to four or even five days permit landings of number one quality. The problem in the Gulf is that a portion of the resource is located in areas which require longer trips. Grounds in close proximity to landing points thus tend to be better utilized than those lying farther afield. Strict adherence to good icing and storage practices should help to improve the quality of some of the catches being taken further afield. This will enhance the already enviable reputation which the Atlantic industry has for producing high quality, peeled products.

After several years of unprecedented growth in this fishery, the growth rate in catch levels is now expected to decrease considerably. Catches during the next two years, however, should be as high if not somewhat higher than in 1979. The world's shrimp fisheries provide numerous examples of sudden increases in resource availability raising expectations to be followed only by disappointment due to equally sudden, unexplainable decreases. These natural variations, as well as the need to ensure that catch rates in the fishery remain high enough to ensure economically viable catching operations, suggests that present levels of catching and processing capacity in the Atlantic shrimp fishery are adequate to meet future requirements.

The real challenge facing the industry in the eighties will be one of achieving best use of the available resource. This involves increasing the unit value of end-products through efforts like further diversification into inshell end-products. It also involves efforts aimed at increasing efficiency in catching and processing thereby reducing unit costs of production to permit higher overall returns.

8) References

- 1) Annual Statistical Review of Canadian Fisheries (1977), Vol. 10, Department of Fisheries and Oceans
- 2) FAO Yearbook of Fisheries Statistics (1977), Vol. 44, Food and Agricultural Org. of U.N., 343 p.
- 3) Fisher C.F. (1977) An Economic Assessment of the Newfoundland Shrimp Fishery - 1976 Report - Economics and Intelligence Branch (Nfld. Region Dept. of Fisheries and Oceans, 116 pages.
- 4) Fishing Gazette (Journal)
 - International Shrimp Issue (1979) Vol. 96, #6, 132 p.
 - International Shrimp Issue (1978) Vol. 95, #6, 130 p.
- 5) Hemming, A.J. (1970) The Demand for Shrimp (International Shrimp Marketing) Proc. Conf. on the Cdn. Shrimp Fishery, P. 363-368.
- 6) Longhurst, Alan R. (1970) Survey of Crustacean Resources, FAO Fisheries Technical Paper #97, FOA, Rome, 425 pages.
- 7) Miller, M.F. (1975) The Role of Shrimp Imports in Declining Seafoods Market, U.S. Dept. of Commerce Report, 50 pages.
- 8) Miller, M.F. and Surdi, R.W. (1974) Shrimp - A New Picture for 1974 - Notes and Analysis Associated with the Industries Heavy Inventory Position in 1974.
- 9) Mitchell, C.L. and McEachern, D.B. (1970) Economic Considerations, Canada's East Coast Shrimp Fishery, Proc. Conf. on the Cdn. Shrimp Fishery, P. 369-378.
- 10) Mitchell, C.L. and McEachern, D.B. (1971) Northern Shrimp Market Prospects: Implications for Canada's Shrimp Industry, Economics Branch, Dept. of Fish. and Forestry.
- 11) Raynes, Graham W. (1979) The Market for Canadian Atlantic Shrimp, Department of Fisheries and Oceans, Ottawa.
- 12) Shellfish Market Review and Outlook, Vol. S-40, March, 1978 and Vol S-41, November, 1978, U.S. Dept. of Commerce.
- 13) Whitaker, D.R. (1970)
 - Trends in World Shrimp Demand and Production Proc. Conf. on the Cdn. Shrimp Fishery (P. 329-361).
 - Trends in the United States Shrimp Fishery Proc. Conf. on the Cdn. Shrimp Fishery (P. 397-425).
 - Worldwide Shrimp Developments in 1969 Proc. Conf. on the Cdn. Shrimp Fishery (P. 426-432).
 - The New England Shrimp Fishery Proc. Conf. on the Cdn. Shrimp Fishery (P. 433-440).
- 14) World-wide Fisheries Marketing Study - Prospects to 1985 - Shellfish Annex (1979) Fisheries and Oceans; Industry, Trade and Commerce (34 pages).