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REPORT BY THE

Comptroller General

OF THE UNITED STATES

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The Fishery Conservation And Mangement Act's Impact On Selected Fisheries

In response to a joint request from the House Committee on Merchant Marine and Fisheries and its Subcommittee on Fisheries and Wildlife Conservation and the Environment, GAO assessed the impact of the Fishery Conservation and Management Act on selected fisheries. This report addresses the Committee's specific questions and provides detailed information on three selected fisheries--Gulf shrimp, New England groundfish, and Alaskan crab.

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UNITED STATES GENERAL ACCOUNTING OFFICE

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CED-79-57

APRIL 3, 1979

COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

B-177024

To the Chairman and Ranking Minority Member
House Committee on Merchant Marine and Fisheries
and the Chairman and Ranking Minority Member
Subcommittee on Fisheries and Wildlife Conservation
and the Environment
House Committee on Merchant Marine and Fisheries

In a June 2, 1978, letter, you requested that we issue a series of studies assessing the progress and problems of the Fishery Conservation and Management Act of 1976. You asked us to study the (1) activities of the regional fishery management councils established by the act and their interactions with the Department of Commerce's National Oceanic and Atmospheric Administration's National Marine Fisheries Service, (2) impact of the law on selected fisheries, and (3) adequacy of programs the Service administered to conserve and develop fisheries. 1/

Our first report, "Progress and Problems of Fisheries Management Under the Fishery Conservation and Management Act" (CED-79-23), was issued on January 9, 1979. This second report addresses your questions regarding three fisheries--Gulf shrimp, New England groundfish, and Alaskan crab.

Specifically, you were interested in the

--effect regulating foreign fishing within our fishery conservation zone and actions by other nations to restrict U.S. access to their shrimping grounds has had on U.S. shrimp interests,

--effect limiting foreign fishing in the U.S. fishery conservation zone has had on New England groundfish stocks,

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1/Fishery refers to the act of or place for commercial and recreational fishing for a particular species or group of species.

--effect the New England groundfish fishery management plan has had on domestic fishermen, and

--changes occurring in investment in the New England groundfishery.

You were also interested in the

--status of the United States/Canadian negotiations over common east coast fishery conservation zone boundaries and related fishery management questions and

--status of and opportunities for U.S. development of the Alaskan king, tanner, and dungeness crab fisheries.

Our January 9, 1979, report on fisheries management pointed out that although progress has been made certain problems, such as limited biological and socioeconomic data upon which to base fishery management plans, jurisdictional conflicts, and limited public acceptance, have hindered the effectiveness of the act. Some of these problems are illustrated by the fisheries discussed in this report.

Answers to each of your questions are briefly summarized below. Appendixes I through III contain more detailed information on each of the three fisheries.

GULF SHRIMP

Regulating foreign fishing within our fishery conservation zone generally has had little effect on U.S. shrimp interests. Foreign shrimping in U.S. Gulf waters was negligible before the act, and there have been no foreign vessels shrimping in U.S. Gulf waters since the act was implemented.

U.S. shrimp interests have been minimally affected by foreign nations restricting U.S. access to their shrimping grounds. The amount of U.S. commercial shrimp caught and its total value were greater in 1977 than in 1976, although the price per pound paid to fishermen was lower in 1977 than in 1976. About 266 million pounds of shrimp valued at $297 million were caught in 1977 compared to about 210 million pounds valued at $275 million caught in 1976. The average price per pound paid to fishermen was $1.31 in 1976 and $1.11 in 1977.

The only significant displacement of U.S. shrimp fishermen is off the coast of Mexico, which implemented its 200 mile conservation zone before the United States did. The United States accepted a "phase down-phase out" shrimping agreement with Mexico. The agreement covers the period August 1, 1976, to December 31, 1979, and provides for gradual reduction of U.S. shrimping activities in Mexico's conservation zone from 318 vessels and a harvest of 2,750 metric tons (about 10 percent of U.S. Gulf shrimping efforts) to no shrimping. As vessels shrimping off Mexico return to U.S. waters, the amount of shrimping in U.S. waters increases. Given the limited shrimp resources, this results in lower catches per unit of effort and less income per unit of effort. In fact, there is growing evidence that the shrimp fishery is overcapitalized.

NEW ENGLAND GROUNDFISH

Large foreign fishing fleets began fishing off the New England coast in the early 1960s. Heavy fishing by foreign fleets adversely affected the economic position of domestic fishermen and significantly contributed to the decline in New England groundfish stocks.

The act prohibits foreign fishing in U.S. waters unless the foreign fishermen are granted a permit to take certain fish. Foreign fishermen have only been granted permits to harvest underutilized groundfish species which U.S. fishermen will not harvest. Foreign fishermen have been prohibited from taking the domestically valuable groundfish species, including cod, haddock, and yellowtail flounder.

The New England groundfish fishery management plan, proposed by the New England Regional Management Council and approved and implemented by the Secretary of Commerce, sets quotas on the amount of cod, haddock, and yellowtail flounder domestic fishermen can harvest. The plan's economic effect has been minimal, however, because when the quotas are reached they are increased. In all, the annual quotas have been revised six times since March 1977, negating the conservation measures of the plan.

The amount of groundfish caught and prices paid to the domestic fishermen have varied by species. Cod and haddock catches have increased since 1976, but price per pound has decreased. Yellowtail flounder catches have steadly decreased since 1976, while prices have steadily increased.

Employment in the New England groundfish ~~harvesting~~ industry has also increased.

Investment in the New England groundfish industry has increased. The New England groundfish fleet has increased since the act was passed, and 45 new vessels have been or are being constructed under Federal loan-guarantee programs. In addition to the harvesting sector, employment has also increased in the processing sector.

Basically, the U.S./Canadian negotiations involve two issues--a boundary dispute and fishery management policies. The boundary dispute involves an area of Georges Bank--one of the most prolific fishery areas in the Northwest Atlantic--which both countries claim as their territory. The management issue involves the question of how and by whom fishery resources common to both countries should be managed. Currently each country is allowing its fishermen to take fairly large quantities of valuable groundfish from the disputed zone.

Department of State officials involved in the negotiations told us that as of March 1979 the United States and Canada had tentatively agreed to resolve the boundary dispute through third party arbitration. With regard to the fishery management issues, State Department officials said that the United States and Canada tentatively agreed to restore reciprocal fishing rights along the east coast and to delineate the percentages of fish each country will be entitled to take from the Georges Bank. A joint U.S./Canadian fishing commission will also be established to provide fishery management.

ALASKAN CRAB

Alaskan crab accounts for about 58 percent of Alaska's shellfish catch and about 87 percent of the total value of Alaskan shellfish. Alaska managed its crab fisheries in the territorial sea before the act was implemented; now the fisheries in the Fishery Conservation Zone are managed by the North Pacific Fishery Management Council and the Service and by the State in the territorial sea.

King crab resources are fully utilized, and since 1974 the king crab harvest has remained relatively stable with about 100 million pounds harvested annually. Because the resource is fully utilized, little potential exists for expanding the king crab fishery.

Tanner crab offers good potential for future development and expansion. Two species of tanner crab--bairdi and opilio--are caught by Alaskan commercial tanner crab fishermen. U.S. fishermen concentrate on the larger, more valuable, bairdi crab, while foreign fishermen generally catch the smaller opilio. Although the bairdi crab resource is well utilized--about 125 million pounds were harvested in 1978--great potential exists for expanding its domestic harvest. Because of the big market demand for crabs, Service officials expect increased domestic fishing for opilio crab over the next several years.

The dungeness crab fishery is a relatively insignificant commercial fishery. The abundance and catch of dungeness crab fluctuates greatly from year to year. This fishery is expected to remain relatively small. The low availability of dungeness crab and the attractiveness of more valuable fisheries inhibit any significant dungeness crab fishery expansion.

In performing this study we reviewed pertinent correspondence and records and held discussions with representatives of the New England, Gulf, and North Pacific Fishery Management Councils; the Service; the Department of State; and various State agencies. We also interviewed fishermen, fish processors, and vessel owners.

As you requested we did not take additional time to obtain written agency comments on the matters discussed in this report. However, the statistical data in this report was discussed with regional officials of the Service for technical accuracy.

As arranged with your offices, unless you publicly announce its contents earlier, we plan no further distribution of this report until 2 days from the date of the report. At that time we will send copies to interested parties and make copies available to others upon request.

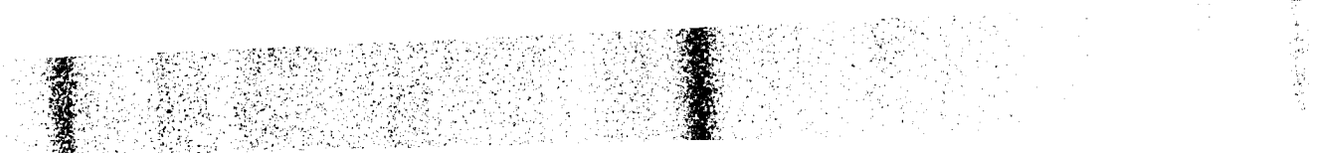
Sincerely yours,

Comptroller General
of the United States

Contents

ABBREVIATIONS

ADF&G	Alaska Department of Fish and Game
GRT	gross registered tons
NEFDP	New England Fisheries Development Program
NMFS	National Marine Fisheries Service



GULF SHRIMP FISHERY

INTRODUCTION

This appendix discusses the Fishery Conservation and Management Act's impact on the Gulf shrimp fishery. In addition to describing the Gulf fishery and commenting on its management and future outlook, the appendix responds to questions concerning the effect regulating foreign fishing within our fishery conservation zone (within 200 miles of our coast) and actions by other nations restricting U.S. access to their shrimping grounds has had on U.S. shrimping interests.

APPENDIX SUMMARY

The following items outline the major points in this appendix.

--In terms of the value of the catch at dockside, the shrimp fishery is the most valuable of all domestic fisheries, with the Gulf of Mexico producing about 83 percent of the value of all shrimp landings.

--Council and National Marine Fisheries Service (NMFS) officials expect no major changes in the Gulf shrimp fishery in the near future. Six species of shrimp are harvested in the Gulf. The three major species--brown, white, and pink--are being harvested at maximum sustainable yield. 1/ The three minor species--sea bob, rock, and royal red--are not being harvested at maximum sustainable yield limits. Although catch of the minor species is increasing, additional potential exists for expanding the harvest of these species.

--The capacity of processing firms in Gulf States exceeds the landed catch of raw U.S. Gulf shrimp. From 1968 to 1976, catches averaged about 73.1 percent of processing needs. The result is fewer operators entering the industry, concentration of shrimp processors into fewer firms, and increased use of imported raw shrimp for processing.

--Regulating foreign fishing within our fishery conservation zone generally has had very little

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1/Maximum sustainable yield is the total allowable catch that each species can sustain without damage to the parent stock.

effect on U.S. shrimp interests. Foreign shrimping in U.S. Gulf waters was negligible prior to passage of the fishery act, and there has been no foreign shrimp fisheries in U.S. Gulf waters since the act was implemented.

--The effect on U.S. shrimp interests as a result of actions taken by other nations to restrict U.S. access to their shrimping grounds has been fairly small. The only significant displacement of U.S. shrimp fishermen is off the coast of Mexico, with which the United States accepted a "phase down-phase out" agreement covering the period August 1, 1976, to December 31, 1979. The agreement provides for gradual reduction of U.S. shrimping activities in Mexico's economic zone from 318 vessels and a harvest of 2,750 metric tons (about 10 percent of U.S. Gulf shrimping efforts) to no shrimping effort. As vessels shrimping off Mexico return to U.S. waters, the amount of shrimping effort in U.S. waters increases. Given the limited shrimp resources this results in lower catches per unit of effort and less income per unit of effort.

--The Gulf Fishery Management Council is in the process of generating a fishery management plan for Gulf shrimp. Problems facing writers of the plan involve computing the optimum yield, 1/ interaction of Federal and State laws governing shrimp resource management, and overcapitalization of the shrimp fleet operating in Gulf waters.

DESCRIPTION OF THE FISHERY

The shrimp fishery is the most valuable of all domestic fisheries. From 1964 through 1977, shrimp averaged 23 percent of the value of all fish caught in the United States. The U.S. value of all fisheries for 1977 was $1,515 million, with shrimp accounting for $355.2 million of the total. The most important area for shrimp production is the Gulf of Mexico. From 1964 to 1977 the Gulf produced 83 percent of all shrimp caught.

1/Optimum yield is the amount of catch that will provide the greatest overall benefit to the Nation and is determined on the basis of the maximum sustainable yield modified by relevant economic, social, or ecological factors.

Fishery effort

In 1975 there were about 3,800 Gulf shrimping vessels employing about 21,800 fishermen and about 5,000 Gulf shrimper boats employing about 8,200 fishermen. A vessel catches 5 tons or more, while a boat catches less than 5 tons.

The Gulf shrimping fleet is the largest in the United States. Since 1970 Gulf shrimp vessels have averaged 76 percent of the U.S. fleet, and the Gulf fleet constitutes 83 percent of the gross tonnage in the U.S. shrimp fleet.

Although many Gulf shrimping vessels are still made of wood, the trend is to larger offshore vessels; 75 to 80 feet or more in length, made of aluminum, steel, or fiberglass; and having extended range and the capability to function with a variety of fishing gear without structural changes. Vessels used in the inshore shrimping fleet generally do not exceed 40 to 50 feet long. Many owners of smaller wooden Gulf shrimp boats have increased their fishing efficiency without a great amount of capital by converting their single rig trawlers to double rigs.

Marine recreational shrimping in the Gulf is increasing rapidly, but only general inferences can be made of the magnitude of recreational shrimping along the coast. Fishery managers recognize the importance of the recreational catch to the shrimp fishery, but obtaining accurate data on the recreational catch has proven to be difficult and costly.

The growth in the number of Gulf saltwater anglers (fishermen who use hooks) in recent years has increased demand for several marine species used as bait, including shrimp. The popularity of bait shrimp has given rise to a bait shrimp industry with economic importance in some areas of the Gulf.

Value of product and price trends

The following table shows the prices paid to fishermen for all shrimp species from 1968 to 1977.

Value of Landings by State

Year	Florida West Coast	Alabama	Mississippi	Louisiana	Texas	Total Gulf
	(thousands)					
1968	$12,695	$ 7,964	$ 3,677	$25,623	$ 45,870	$ 95,829
1969	12,021	8,788	4,011	33,358	42,884	101,062
1970	13,108	8,040	3,810	34,614	48,614	108,186
1971	12,985	11,451	4,362	43,285	64,191	136,274
1972	17,309	14,661	4,966	47,066	80,099	164,101
1973	22,601	14,165	3,698	44,511	86,879	171,854
1974	21,445	13,490	3,225	32,203	67,679	138,042
1975	27,799	17,843	3,825	40,968	87,902	178,337
1976	37,545	30,393	8,418	79,688	119,389	275,433
1977	39,971	33,487	10,113	87,183	125,620	296,374

Source: National Marine Fisheries Service.

APPENDIX I

The value of catches has steadily increased from 1974 through 1977 although the average price per pound paid to fishermen fell to $1.11 per pound in 1977 from $1.31 per pound in 1976. According to economists working on the shrimp fishery management plan, the main causes of the recent increases have been

--an increased domestic and world demand for shrimp,

--general inflation, and

--a reduction in shrimp product inventories after the 1974-75 period.

The following table shows wholesale prices for 1968 to 1976 for shrimp products processed in the Gulf area.

Year	Raw Headless (note a)	Raw Peeled (note a)	Breaded Raw (note a)	Cooked and Peeled (note a)	Canned (note b)	Dried (note a)
1968	$1.03	$1.55	$0.94	$2.39	$10.92	$1.90
1969	1.09	1.75	1.00	2.04	10.29	1.74
1970	1.04	1.45	.99	1.57	10.51	no data
1971	1.28	1.69	1.07	2.51	11.14	1.87
1972	1.44	1.90	1.24	1.95	13.28	2.42
1973	2.42	2.25	1.48	3.44	18.91	3.87
1974	1.74	1.80	1.44	3.11	16.25	2.72
1975	2.35	1.77	1.61	3.36	16.74	4.92
1976	2.79	2.67	2.02	3.82	19.74	3.81

a/Price per pound of finished product.

b/Price per standard case (6.75 pounds) of canned shrimp.

Source: National Marine Fisheries Service.

Processing and marketing of gulf shrimp

Processors include shrimp handlers who peel and devein, cook, freeze, bread, can, or prepare specialty items, such as cocktails, shrimp burgers, or stuffed shrimp.

In 1976 the Gulf States processed about 173 million pounds of shrimp valued at $454 million. Based on dollar value, percentage breakdowns for shrimp processed in the Gulf were: frozen, raw, headless shrimp, 56.3 percent; breaded shrimp, 20.4 percent; peeled and deveined shrimp, both cooked and raw, 15.6 percent; canned, 7.1 percent; and others including specialties, 0.6 percent.

NMFS last reviewed its list of shrimp processors in 1976. At that time there were 120 processors in the Gulf States.

The capacity of processing firms in Gulf States now exceeds the raw shrimp catch. Statistics show that Gulf State processors have had to rely on shrimp harvested outside the Gulf since 1960 when catches roughly equaled the processing plants capacity. From 1958 to 1967, catches were about 84.2 percent of processing needs and from 1968 to 1976, catches declined to 73.1 percent of processing needs. The result is fewer operators entering the industry, concentration of shrimp processing into fewer firms, and increased use of imported raw shrimp.

Foreign shrimp imports enter the Gulf States throughout the year but are the heaviest from October through January. Mexico and India are the leading sources of imported shrimp, but other important sources include Taiwan, Panama, Ecuador, Indonesia, and the Middle East.

The processors may market their product by either going through brokers, selling directly to independent wholesalers who in turn resell to retailers, or going directly to these entities. Some processors also export shrimp either directly or through brokers. In 1977 the United States reported exports of about 35,055,000 pounds of fresh, frozen, and canned domestic shrimp valued at $78,797,000.

EFFECT REGULATING FOREIGN FISHING HAS HAD ON U.S. SHRIMP INTERESTS

Regulating foreign fishing within 200 miles of our coast generally has had little effect on U.S. shrimp interests. Foreign shrimping in U.S. Gulf waters was negligible before the act was passed and presently there are no foreign shrimp fisheries in U.S. waters.

Estimates of foreign catch of shrimp in what are now U.S. Gulf waters for the period 1971 to 1976 are listed below.

Bordering State	Year	Foreign country: Cuba	Mexico	Panama	Total estimated catch
		Estimated catch (Pounds)			
Florida	1971	57,440	0	0	57,440
	1972	10,240	0	0	10,240
	1973	20,480	0	0	20,480
	1974	75,000	0		75,000
	1975	135,000	105,000	0	240,000
	1976	0	0	0	0
6-year average		49,693	17,500	-	67,193
Texas	1971	0	2,783,300	0	2,783,300
	1972	0	83,820	0	83,820
	1973	1,710,000	0	0	1,710,000
	1974	1,110,000	90,000	0	1,200,000
	1975	1,665,000	225,000	0	1,890,000
	1976	722,750	0	126,000	848,750
6-year average		867,958	530,353	21,000	1,419,312

Source: National Marine Fisheries Service.

The Cubans shrimped in the waters off Texas from June to August of 1973 to 1976. These are the peak months of the brown shrimp harvest by U.S. shrimpers in these waters. During this period it is estimated that an average of 30 Cuban vessels fished 29 days a month to harvest an average of 408,000 pounds a month.

Mexican boats also shrimped in the waters off Texas, primarily in June, July, and August. The catch was greatest in July 1971 when 345 Mexican vessels harvested an estimated 2.3 million pounds. The 1972-76 catch was far below this level.

Cubans shrimped in Florida waters with catches up to 135,000 pounds annually. Cuban fishing in these waters occurred mainly in the winter and involved from 1 to 10 vessels. Mexican's only harvest off Florida was a July 1975 catch of 105,000 pounds by seven vessels.

EFFECT FOREIGN ACTIONS HAVE HAD ON U.S. SHRIMP INTERESTS

Foreign nations' actions to restrict U.S. access to their shrimping grounds has had minimal effect on U.S. shrimp interests. For example, U.S. commercial Gulf shrimp landings and dockside prices in 1977 were greater than in 1976, as shown below.

Year	Pounds	Value
	(000 omitted)	
1976	210,078	$275,187
1977	265,903	296,785

Source: National Marine Fisheries Service.

In 1975 Mexico announced its intention to extend its economic jurisdiction to 200 miles. In February 1976 Mexico published a constitutional amendment establishing an exclusive 200 mile economic zone. The amendment became effective on July 31, 1976. The United States accepted a phase down-phase out agreement with Mexico. The agreement covers the period August 1, 1976, to December 31, 1979, and provides for gradual reduction of U.S. shrimping activities in Mexico's economic zone as shown in the following chart.

Period	Metric tons	Number of vessels	Percentage reduction
Aug. 1, 1976 to July 31, 1977	2,750	318	40 percent from previous levels
Aug. 1, 1977 to July 31, 1978	1,925	223	30 percent from 1st year of agreement
Aug. 1, 1978 to July 31, 1979	1,100	127	60 percent from 1st year of agreement
Aug. 1, 1979 to Dec. 31, 1979 (5 months)	344	95	70 percent from 1st year of agreement
Jan. 1, 1980	0	0	-

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The phase-down has not affected shrimp fishermen employment; however, it has increased working hours and lowered the amount of income per hour worked. As vessels fishing off Mexico return to U.S. waters, the amount of shrimping in U.S. waters increases. Given the limited shrimp resources, this results in lower catches per unit of effort. Although the average price for shrimp is expected to rise, it is estimated that the increased price will only partially offset the increased fishing costs per pound of shrimp caught, thus resulting in less income per unit of effort.

The United States shrimps or has shrimped off the coasts of Brazil, Guyana, Surinam, and French Guiana.

From 1972 to 1977, a series of United States/Brazil Shrimp Agreements were in effect. With the expiration of the last of these agreements on December 31, 1977, Brazil insisted that future U.S. access to shrimp in waters claimed by Brazil would be allowed only (1) pursuant to joint venture arrangements established under Brazilian laws and regulations and (2) after agreement between Brazil and the United States regarding the framework under which such joint ventures might be developed. Since December 1978 the United States has been negotiating with Brazil to make arrangements under which the traditional U.S. shrimp fishery might resume in Brazilian waters.

U.S. vessels are still shrimping off the coasts of Guyana, Surinam, and French Guiana. The vessels are owned by a few wealthy independent investors and are manned by foreign crews. Accordingly, there has been little displacement of U.S. shrimp fishermen in these areas.

MANAGEMENT AND FUTURE OUTLOOK OF THE FISHERY

The Gulf Council is in the process of generating a fishery management plan for shrimp in compliance with the provisions of the Fishery Conservation and Management Act. The Council commissioned the Center for Wetlands Resources, Louisiana State University, to develop the plan.

According to the Center's team coordinator, the plan will contain an overview of the fishery and consider commercial and recreational interests and involvement, socioeconomic characteristics of the fishery, management options, biological assessments, and other considerations necessary to estimate optimum yield. As of December 1978,

the Council estimated that the plan was 90-percent complete, and the contractor would probably deliver the final draft to the Council in February 1979. The Council must then hold public hearings on the plan and submit it to the Secretary of Commerce for review and approval. Allowing 8 months for hearings and Secretarial review and approval, the plan will probably not be implemented before January 1980.

Anticipated problems

Three major problems face the writers of the Gulf of Mexico shrimp plan: (1) computation of the optimum yield as required by the act, (2) interaction of Federal law with State laws governing shrimp resource management, and (3) overcapitilization of the shrimp fleet operating in Gulf waters.

Optimum yield is difficult to accurately estimate because the environmental conditions, that to a large extent determine the success of the new shrimp crop, occur very close to the beginning of the season. Shrimp generally do not live more than one season, so they are either caught or they die, and shrimp are such prolific spawners that a few pregnant shrimp in the spawning grounds can generate a large new crop of shrimp. If quotas based on inaccurate optimum yield figures are set too low, unharvested shrimp will not live until the following year and the resource will be lost: a poor situation for fishermen, conservationists, and consumers.

The States control inland waters and territorial seas which contain the estuaries where events occur that critically affect the annual shrimp crop. If the Gulf States do not protect this habitat, the shrimp crop will be reduced and any management measures the Council might choose to take would be useless.

Addressing the problem of loss of estuarine habitats of the major species, the draft plan recommends that, as a priority item, the Gulf Council

> "* * * establish an internal committee to review and assess the status of the fishery habitats of the Gulf with particular attention to those factors which might further stimulate downward trends in quality of fishery habitats."

The plan recognizes that the Council, in trying to implement this recommendation, will have to interact with the State agencies on laws, regulations, and policies affecting the estuarine habitats and will have to negotiate with the

individual States to adopt Council recommendations in waters over which the Council has no control.

There is evidence that more labor and equipment is being committed to harvesting shrimp in the Gulf than is necessary. The result is that catch per unit of effort is going down. This over-fishing does not hurt the renewable shrimp resource, but is inefficient because money being used to catch shrimp could be used in other, more needy, sectors of the economy.

Future outlook

Knowledgeable Council and NMFS officials expect no major changes in the Gulf shrimp fishery in the near future. In their opinion, the major species of shrimp are being harvested at maximum sustainable yield levels and are not being biologically over- or under-fished. Overall shrimp catches are increasing only slightly, and catch per unit of effort is decreasing slightly.

Some potential exists for expanding shrimping for the minor species. Processing capacity in the Gulf is greater than the landed catch of raw U.S. Gulf shrimp. Accordingly, some capacity exists to process more of the minor species of Gulf shrimp as fishing effort for those species increases.

NEW ENGLAND GROUNDFISH FISHERY

INTRODUCTION

This appendix discusses the Fishery Conservation and Management Act's impact on the New England groundfish fishery and responds to the following four questions. What is the:

--Effect of limited foreign fishing on New England groundfish stocks?

--Impact of the groundfish management plan on domestic fishermen?

--Effect on investment in the New England groundfish fishery?

--Impact of the U.S./Canadian fishing dispute on New England fishermen?

APPENDIX SUMMARY

The following items outline the major points in this appendix:

--Foreign fishermen have only been granted permits to harvest underutilized groundfish species which U.S. fishermen will not harvest and have been prohibited from taking the domestically valuable groundfish species, including cod, haddock, and yellowtail flounder.

--The New England groundfish fishery management plan sets quotas on the amount of cod, haddock, and yellowtail flounder domestic fishermen can harvest. The plan's economic impact has been minimal, however, because the quotas, when reached, have been increased, thus negating the plan's conservation measures.

--Foreign catches for underutilized groundfish have declined. In 1975 such catches were 280 million pounds, and from January 1, 1978 through October 31, 1978, foreigners caught only 34 million pounds. Underutilized groundfish species provide an opportunity to increase domestic catches and reduce domestic fishing of over-fished groundfish species. However, the reduced foreign effort has not been replaced by an increased domestic effort.

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--Domestic fishermen continue to catch the traditional species because of higher prices and established markets. In 1975 and 1977 domestic fishermen caught 117.1 million pounds and 138.1 million pounds, respectively, of cod, haddock, and yellowtail flounder. Until quotas on traditional species are firmly adhered to and strictly enforced, fishermen are able to catch large amounts of the traditional species and have no incentive to fish for the underutilized species.

--Therefore, a necessary first step to get fishermen to fish for underutilized species is to establish and enforce firm quotas on the traditional species. Also, fishermen may need to be assured of an adequate market and price for the product before they will fish for the underutilized species.

--Investment in the New England groundfish industry has increased. The New England groundfish fleet has increased since passage of the act. Forty-five new vessels have been or are being constructed under Federal loan-guarantee programs. Employment has increased in the harvesting and processing sections.

--Department of State officials told us that as of March 1979 the United States and Canada have tentatively agreed to submit the boundary dispute to third party arbitration and have tentatively agreed on certain fishery management policies.

EFFECT OF LIMITED FOREIGN FISHING ON NEW ENGLAND GROUNDFISH STOCKS

One purpose of the act is to control foreign fishing. The act prohibits foreign fishing unless a permit is obtained from NMFS. Permits are only granted for fish that the domestic fleet will not harvest. Since the act became effective, foreign fleets have not been granted permits to fish for cod, haddock, or yellowtail flounder. The permits granted to foreign fleets have been for so-called underutilized or nontraditional fish, such as squid, whiting, and hake.

Since the act, foreign fishing and total groundfish landings have declined. New England groundfish include cod, haddock, flounder, red hake, white hake, pollock, ocean perch, and whiting. Domestic landings of cod and haddock, two of the three species included in the New England groundfish management plan, have increased. One of the plan's objectives is to control the catch of these traditional species, since they are most in danger of being overfished. However, domestic fishermen continue to focus on cod and

haddock because of the established markets and relatively higher prices.

Although domestic fishermen have basically displaced foreign fishing, so-called underutilized (or nontraditional) groundfish species which the act encouraged to be fished are not being fished as expected. These fish, which are relatively abundant, are not even being harvested at pre-act levels. In effect, the foreign catches of these underutilized species have not been replaced by increased domestic fishing.

Domestic and foreign fishing before and after the act

Large foreign fishing fleets began fishing off the New England coast in the early 1960s. Extensive foreign catches adversely affected domestic fishermen and contributed to a decline in groundfish stocks, especially cod and haddock. By 1965 foreign fishermen caught over 60 percent of the 445 million pounds of cod, haddock, and yellowtail flounder harvested. In 1976 foreign fishermen caught 12 percent of the 120 million pounds of cod, haddock, and yellowtail flounder landed. The table on the following page shows U.S. and foreign catches from 1960 to 1978.

The act sought to reduce the extensive foreign overfishing experienced during the 1960s. This has been accomplished since the total foreign groundfish landings have declined considerably since the act took effect. The table shows that in 1975 total foreign groundfish landings were 302 million pounds while in 1978 only 34 million pounds have been landed through October. On the other hand, total annual groundfish landings by the New England fleet have increased from 245 million pounds in 1975 to 300 million pounds in 1977.

Other groundfish catches have declined

Foreign catches for underutilized groundfish (i.e., excluding cod, haddock, and yellowtail flounder) were 280 million pounds in 1975, 91 million pounds in 1977, and 34 million pounds as of October 1978. Underutilized groundfish species provide an opportunity to increase domestic catches and reduce the domestic fishing of cod and haddock. Since the act took effect, however, reduced foreign fishing has not been replaced by increased domestic fishing. For example, in 1975 and 1976, 2 years before the act, foreign fishermen caught 205 million and 114 million pounds, respectively, of whiting in New England waters, while domestic fishermen caught only 33 million and 37 million pounds, respectively. In 1978, after the act took

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Fisnermen	Species	1960	1965	1970	1975	1976	1977	Thur October 31, 1978
		(000 omitted)						
U.S.	Cod	30.4	33.5	49.3	55.3	55.2	73.8	57.4
Foreign	"	.1	59.7	24.5	19.5	11.0	13.8	-
		30.5	93.2	73.8	73.6	66.2	87.5	57.4
U.S.	Haddock	99.9	125.7	21.8	16.1	12.7	28.4	31.9
Foreign	"	1.0	215.4	6.6	3.2	3.3	6.3	-
		100.9	341.1	28.4	19.3	16.0	34.7	31.9
U.S.	Yellowtial Flounder	4.2	10.7	10.2	41.4	37.3	35.9	17.8
Foreign	"	-	.04	.06	-	-	-	-
		4.2	10.74	10.26	41.4	37.3	35.9	17.8
Subtotal U.S.		134.5	169.9	81.3	112.8	105.2	138.1	107.1
Subtotal Foreign		2.2	275.1	31.2	22.7	14.3	20.1	-
Subtotal (traditional)		136.7	445.0	112.5	135.5	119.5	158.2	107.1
U.S.	Other Flounder	(Not available)			35.9	42.4	52.2	37.7
Foreign	"				2.7	-	.2	-
U.S.	Ocean Perch				32.0	32.1	35.0	31.1
Foreign	"	(Not Available)			3.2	1.2	.4	-
U.S.	Pollock				20.9	23.8	28.3	19.1
Foreign	"	(Not Available)			11.6	6.9	7.3	-
U.S.	Silver Hake				33.2	37.2	33.0	29.3
Foreign	"	(Not Available)			204.6	114.3	78.9	29.8
U.S.	Red Hake				1.9	2.7	2.5	-
Foreign	"	(Not Available)			57.6	39.4	4.3	4.5
U.S.	White Hake				8.0	9.0	10.9	5.0
Foreign	"	(Not Available)			-	.4	-	-
Subtotal U.S.					131.9	147.2	162.0	122.2
Subtotal Foreign					279.7	162.2	91.1	34.4
Subtotal (underutilized)					411.6	309.4	253.1	156.5
Total U.S.					244.7	252.4	300.1	229.3
Total Foreign					302.4	176.5	111.2	34.4
GRAND TOTAL					547.1	428.9	411.3	263.7

Source: National Marine Fisheries Service and the International Commission for Northwest Atlantic Fisheries.

effect, foreigners were allowed 95 million pounds of whiting, but through October they only had caught 30 million pounds. Domestic fishermen, however, caught less than 30 million pounds of whiting through October 1978. In view of the decreased foreign catches, domestic whiting catches could be significantly increased but domestic fishermen continue to catch the traditional species--cod and haddock--because of higher prices and established markets.

IMPACT OF THE GROUNDFISH FISHERY MANAGEMENT PLAN ON DOMESTIC FISHERMEN

The Atlantic Groundfish Fishery Management Plan was implemented on March 15, 1977. The plan's goal is to rebuild stocks of cod, haddock, and yellowtail flounder, while allowing fishermen to harvest these fish at levels that would not damage the stocks. Although the plan imposes annual commercial quotas to control the amount of these groundfish caught, cod and haddock catches have increased since the act took effect to levels exceeding the initial quotas.

Since 1975, prices have been relatively stable for cod, have decreased for haddock, and have increased for yellowtail flounder.

The following table compares 1975-78 catches and prices for cod, haddock, and yellowtail flounder. Since 1975 cod catches and prices have fluctuated very slightly. Although catches decreased slightly in 1976, they rose by more than 33 percent in 1977 to about 73.9 million pounds. The catch, in fact, exceeded the initial 1977 quota by about 18 million pounds. Cod prices, on the other hand, rose in 1976 and then fell; the 1978 price is only slightly higher than the 1975 price.

Haddock catches declined from 1975 to 1976 and have since risen. The 1977 haddock catches were more than twice the initial quota. The exvessel price rose from 1975 to 1976 and has since declined to less than the 1975 price.

Yellowtail flounder catches have declined steadily since 1975. As the catch decreased, the price for yellowtail increased. In 1978 yellowtail catches have been less than half of the 1975 catches, while the 1978 price is more than 77 percent higher than the 1975 price.

Period	Landings	Exvessel price
	(million of pounds)	
	Cod	
1975	55.4	$0.23
1976	55.2	.26
1977	73.9	.22
1978 (through Oct.)	57.5	.24
	Haddock	
1975	16.2	.33
1976	12.8	.44
1977	28.4	.33
1978 (through Oct.)	31.9	.31
	Yellowtail Flounder	
1975	41.5	.35
1976	37.4	.41
1977	36.0	.47
1978 (through Oct.)	17.9	.62

Source: National Marine Fisheries Service.

Landings of other groundfish, such as red hake, pollock, and silver hake generally decreased (see p. 15) while price increased. Generally, the prices for these fish are still substantially lower than the prices for cod, haddock, and yellowtail flounder. For example, in 1978 the prices of cod and haddock were about $0.24 and $0.31, respectively, versus an average of about $0.16 for other groundfish. As a result, domestic fishermen are more interested in catching cod and haddock than other species.

Quotas are frequently revised and not effectively enforced

The New England Regional Fishery Management Council and the Secretary of Commerce have revised the quotas six times since they were originally established. The numerous revisions confuse everyone involved--fishermen, processors, and enforcement agents. The quotas established by the groundfish plan are not enforced, and, as a result, the quotas provide little or no deterrent to overfishing. Further, NMFS regulations, which accompany the quotas, are complicated and thus very hard to enforce.

In addition to confusing regulations, enforcement is hampered by a limited staff and mild penalties. NMFS has only 12 enforcement agents to cover the New England coast. With so few enforcement agents, there is little chance of a fishing vessel with an excess catch being caught. We were told by fishermen and processors that over-quota catches are common and usually unreported. Fishermen frequently land their catch at night when enforcement personnel are not on duty or at smaller, remote ports that are not patrolled. The extent of unreported catches is unknown but has been estimated to be as high as 40 percent of reported catches. Also, despite the regulations to the contrary, fishermen apparently continue to discard small cod and haddock, keeping only the larger, higher priced fish. Lack of accurate catch statistics, in turn, makes the process of setting realistic quotas difficult.

When fishermen are caught violating the regulations, they may be fined. We found, however, that few fines have been paid and that those fines that were paid had been greatly reduced by the Secretary of Commerce. For example, one New England fisherman was initially fined $23,000 for catching fish in excess of his quota, but the final fine which was actually paid was only $200. We were informed that the fine was lowered to avoid litigation and close the case.

Efforts to market underutilized species

Although one of the purposes of the act was to encourage the development of fisheries underutilized by domestic fishermen, such development efforts are not new. NMFS and New England States made several development and marketing efforts to encourage fishermen to catch underutilized groundfish species. NMFS officials responsible for fisheries development said the inadequate enforcement of cod and haddock quotas has hindered development of underutilized species because fishermen, able to catch large amounts of the higher priced cod and haddock, have no incentive to fish for the underutilized species.

Efforts of NMFS Fisheries Development Division

Two branches within NMFS's Northeast Region Fisheries Development Division--Fishery Development Services and Marketing Services--are responsible for promoting underutilized species. The Fishery Development Services Branch, with a staff of two, helps the fishing industry resolve problems related to harvesting, processing, and marketing. It works in conjunction with the New England Fisheries

Development Program (NEFDP) and through contracts with universities and other groups. None of the current contracts deal with developing groundfish. According to an NMFS official, the Branch's efforts have been extremely limited due to reduced funding.

In NMFS's Northeast Region, which covers 19 States, the Marketing Services Branch staff consists of 3 people, down from 20 in 1969. Only one staff member is located in New England. The staff's efforts include publishing booklets which provide consumers with nutritional facts and recipes for various underutilized species. Other projects include a study of foreign and domestic markets for underutilized species.

Efforts of the New England Fisheries Development Program

NEFDP, an industry/government partnership, was formed in 1973 to develop underutilized species. One of the program's objectives was an indepth review of all underutilized fish species to determine which could be most readily caught, processed, and marketed. From its inception, NEFDP worked closely with NMFS to develop fisheries for squid, herring, mackerel, whiting, and red hake.

According to NEFDP data, by 1976 its program had resulted in substantially increased catches of underutilized fish, especially squid and herring, as well as increased value for whiting, despite a reduced catch. However, from 1976 to 1977, we noted that the catch of both whiting and red hake had declined, and during the same period, cod catches increased by over 18 million pounds and haddock by 15 million pounds.

An NEFDP official told us that fishermen continue to catch cod and haddock because of consumer demand and higher prices for these species than for other, less desirable species. As a result, programs to encourage catching underutilized fish have not been successful.

Other impacts

We found that the New England fishermen are dissatisfied with the groundfish management plan for two reasons:

--The quotas in the plan are too low.

--The frequent revisions to the plan are confusing.

Fishermen do not believe assessments

New England fishermen and processors do not generally believe the biological assessments of fish stock size are accurate and distrust the quotas, which are allocated on the basis of these assessments. As justification for such beliefs, two fishery industry officials cited the re-establishment of higher quotas, as discussed below, as NMFS's admission of error.

Also, several fishermen told us that scientists, when making their assessments, do not go to areas where fish are known to be. Fishing industry officials stated that a few scientists have informally told them that the cod and haddock quotas could be increased without harming the stocks.

Regulatory changes confuse fishermen

New England fishermen are confused by the frequent revisions to the management plan. The original March 1977 plan established annual commercial quotas for cod, haddock, and yellowtail flounder. The quotas were, in part, designed to conserve these fish and allow for replenishment of their stocks. However, by early November 1977, these quotas were exceeded. The quotas were then increased, on an emergency basis, since closure would have caused an economic hardship to the industry. The 1977-78 annual quotas are shown below for each species in millions of pounds.

Effective date	Cod	Haddock	Yellowtail flounder
Mar. 15, 1977	55.1	13.7	30.9
Nov. 3, 1977	74.1	23.2	35.3
Jan. 1, 1978	47.7	11.0	30.9

Because of overfishing, these annual quotas were changed on April 1, 1978, July 1, 1978, and again on July 19, 1978. Finally, to avoid a prolonged closure, the Council and the Secretary of Commerce established a revised fishing year which began October 1, 1978, with the following quotas (in millions of pounds): cod, 61.7; haddock, 32.9; and yellowtail flounder, 17.9. In addition to these quota changes, vessel trip limits have been revised 22 times since March 1977. Although the quotas were revised to prevent economic hardships to the industry, the frequent changes have confused fishermen and processors and have hampered the Federal enforcement effort.

APPENDIX II

INVESTMENT IN THE NEW ENGLAND GROUNDFISH INDUSTRY

Statistical data, in many instances, is not available to accurately measure investment changes in the New England groundfish industry since the act was passed. However, available data indicates that the investment in the New England groundfish industry has increased. The increases include fleet size, number of processing plants, and employment in both the harvesting and processing sectors.

The New England groundfish fleet

Fishermen, NMFS, and New England Regional Fishery Management Council officials agree that the size of the New England groundfish fleet has increased since passage of the act. However, precise data on the extent of the increase is not available.

According to an NMFS analysis, the New England groundfish fleet is made up primarily of about 600 otter trawl vessels of varying sizes from 5 to 125 gross registered tons and over. The otter trawl, a net towed on or close to the ocean floor, has become the predominant gear for catching groundfish. According to NMFS, in 1977 the composition of the otter trawl fleet was as follows:

Vessel size (gross registered tons)	Number of vessels
Less than 5	Not known
5 to 60	328
61 to 125	181
125	86
Catch by other gear	Not known
Total	595

Otter trawl vessels over 5 gross registered tons accounted for over 80 percent of the 1977 cod landings and essentially all of the haddock and yellowtail flounder landings. This is the only inventory of the New England groundfish fleet taken by NMFS. As of September 1978 NMFS had

issued about 900 permits to allow domestic otter trawl vessels to fish for cod, haddock, and yellowtail flounder--the three species included in the groundfish plan. NMFS did not know how many of these vessels were actively fishing for these three species but told us that it is an indication of an increase in the size of the groundfish fleet.

Since the passage of the act, fleet size increases include 45 new vessels that have been, or are being, constructed with Federal financial assistance. These vessels, for the most part, are modern, steel-hulled, stern trawlers and are being built in southern boatyards--mainly in Florida, Alabama, and Mississippi.

NMFS officials said that some smaller vessels, such as shrimp boats, have been converted to seasonally trawl for New England groundfish. Although the number of these vessels is unknown, these boats do not have a significant impact because of their small size and storage capacity.

According to NMFS, no major modernizations of groundfish vessels have been done since passage of the act. NMFS officials said that it is more feasible to construct modern steel-hulled trawlers rather than modernize those old vessels.

Impact of Government programs in the construction of new vessels

NMFS administers two programs to assist fishermen in constructing, reconstructing, or reconditioning commercial fishing vessels: The Fishing Vessel Obligations Guarantee Program and the Capital Construction Fund Program.

The guarantee program guarantees loans up to 87-1/2 percent of the cost of constructing or modernizing fishing vessels through private lending institutions. The construction loans may have maturities up to 25 years. The remaining 12-1/2 percent of the vessel's cost is furnished by the vessel owners. NMFS's Northeast Region has approved loans for new construction of 45 vessels for the New England groundfish fleet since passage of the act.

The Capital Construction Fund Program provides tax incentives to fishermen to construct, reconstruct, or buy fishing vessels. This program allows fishermen to defer payment of the Federal taxes they would otherwise have to pay.

Processing plants

According to NMFS statistics, the number of New England plants processing cod, haddock, and flounder fillets and blocks increased by 35 percent from 1973 to 1977. The quantity and value of fish processed by these plants also increased during this period.

	1973	1977	Percentage increase
Number of plants	49	66	35
Quantity (millions of pounds)	45.8	61.3	34
Value (millions of dollars)	$47.4	$88.4	86

This data shows that the number of processing plants and quantities processed have increased by about one-third for this period. In fact, from 1976 (the year before the act took effect) to 1977, the number of plants increased by 12 percent and the quantity processed increased by 30 percent. This further indicates that processing plants and quantities processed have increased since the act took effect. Also, dollar value of the quantity processed has increased by 86 percent.

Employment

Since NMFS did not know how many fishermen were employed in the New England groundfish industry, we contacted the Massachusetts Division of Employment Security and the Atlantic Fishermen's Union for this information. A recent Woods Hole Oceanographic Institute Report stated that Massachusetts accounts for 67 percent of the New England offshore fishing fleet and 54 percent of the commercial landings. Accordingly, this data should be fairly representative of New England.

In Massachusetts fish harvesting employment increased by 11 percent from 1974 to 1977. (Such employment includes all Massachusetts fishermen who work on boats over 10 tons and includes those who fish for all species of finfish and shellfish.) Also, union officials of the Atlantic Fishermen's Union in Gloucester, Massachusetts, a major Massachusetts groundfish port, informed us that the number of Gloucester fishermen increased from about 650 in 1976 to 1,000 in 1978, an increase of over 50 percent. They believed that most of these fishermen were engaged to

some extent in the New England commercial groundfish fishery. Based on this information, we believe that employment in the New England groundfish harvesting industry has increased since passage of the act.

According to NMFS statistics, while the number of processing plants have experienced relatively steady increases from 1973 to 1977, employment in these plants has fluctuated from year to year. Overall, however, average monthly employment for cod, haddock, and flounder processing has increased from 1,659 to 1,852 employees, an increase of 193 jobs, or 12 percent.

U.S./CANADIAN NEGOTIATIONS

The U.S./Canadian negotiations basically involve

--boundary disputes and

--fishery management policies.

The boundary disputes involve an area of Georges Bank--one of the most prolific fishery areas in the Northwest Atlantic--which both countries claim as their sovereign territory. The management issue involves the question of how and by whom fishery resources common to both countries should be managed.

Boundary dispute

Both Canada and the United States have passed laws to control foreign fishing by establishing a 200-mile offshore fishing zone. Canada's fishery conservation law took effect in January 1977; the United States law took effect in March 1977. However, when Canada and the United States applied their 200 mile boundaries to their respective coastlines, two conflicting lines resulted. This established a so-called disputed zone claimed by both the Canadian and U.S. Governments. (See map on next page.)

This disputed zone is caused by applying different measurement principles to each country's coastline. Both principles involve complicated legal issues and each is a recognized basis for establishing international borders. Canada's New Brunswick and Nova Scotian coastline and the United States New England coastline are too close to each other to allow each country to establish their own 200-mile boundaries. The U.S. boundary is

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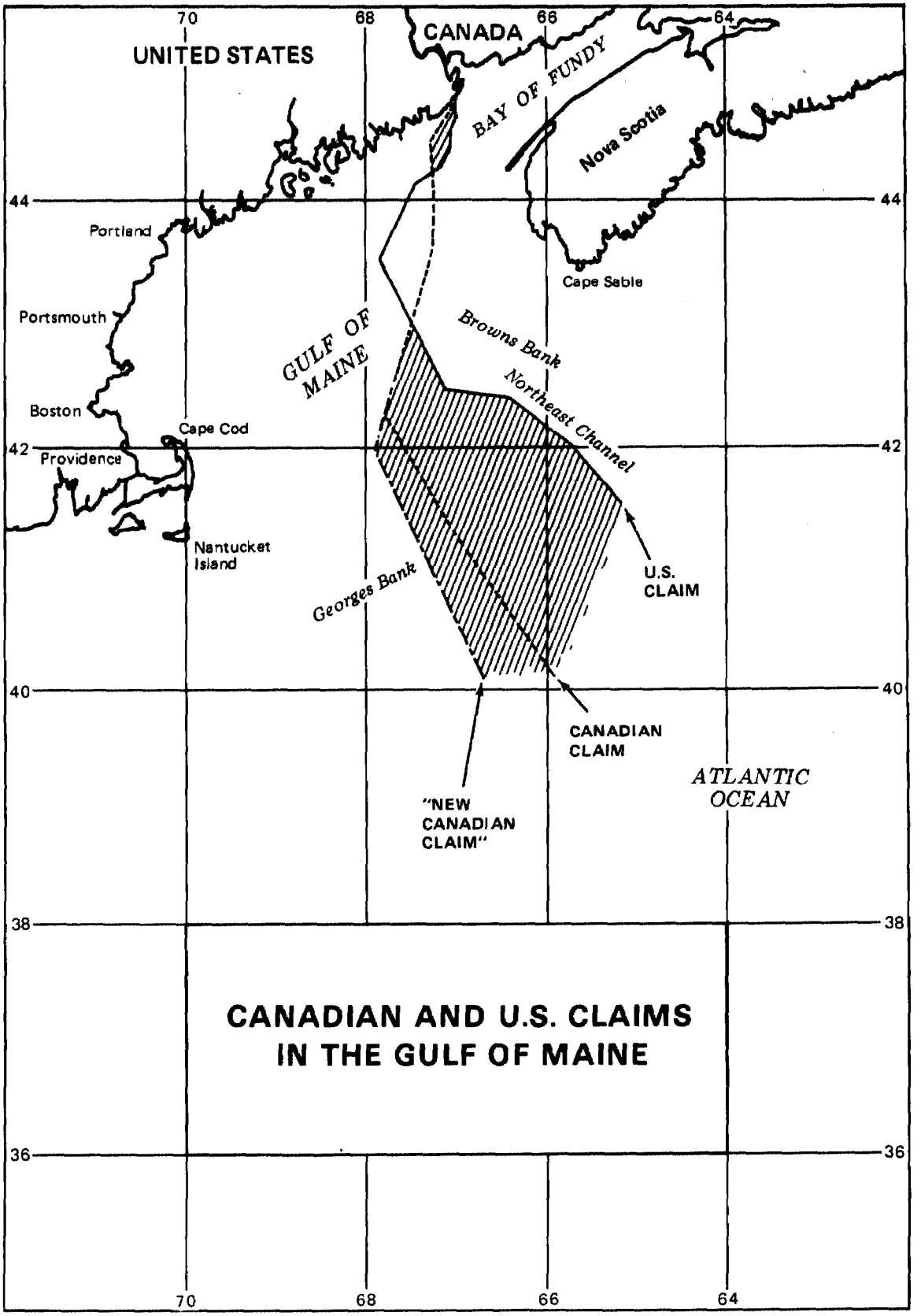

CANADIAN AND U.S. CLAIMS IN THE GULF OF MAINE

based on the Continental Shelf principle, which considers the Shelf as an extension of the country's continental land mass. Canada's boundary is equidistant from each country's respective coastline.

Recently, Canada increased its claim to the Georges Bank disputed zone. Canadian negotiators claimed that Cape Cod and the offshore islands of Massachusetts should not be considered part of the State's coastline when measuring an equidistant line between the two countries. Under this concept, Canada is now claiming an additional 1,500 square miles of Georges Bank which is a very productive scallop fishery.

Since the act became effective, there has been increased fishing pressure on cod and haddock stocks in this disputed area. The following table shows the United States and Canada's cod and haddock landings in the disputed area:

	United States			Canada		
	1976	1977	1978	1976	1977	Thru Nov. 20, 1978
	(metric tons)					
Cod	2,573	4,256	4,646	460	not	8,000 (estimated)
Haddock	1,340	2,431	4,055	1,355	known	10,000 (estimated)
Total	3,913	6,687	8,701	1,815	-	18,000

Source: National Marine Fisheries Service and the International Commission for Northwest Atlantic Fisheries.

Interim arrangement to manage fishing

From 1977 through June 1978, an interim fishing arrangement between Canada and the United States allowed each country to fish in this disputed zone until a common boundary could be agreed on. Under this arrangement, Canada has a quota of 4,000 metric tons of cod and 3,100 metric tons of haddock. Canada accepted this allocation on an interim basis until a common boundary could be established.

In June 1978, however, Canadians rejected this interim arrangement to protest what it considered to be United States overfishing in the disputed zone of Georges Bank. Then in October, after the United States revised its fishing year, Canada relaxed its quota restrictions in this zone. Canada allowed its larger vessels one unlimited fishing trip and its smaller vessels as many unlimited trips as weather permitted during the remainder of calendar year 1978.

The Canadian Government wanted higher allocations of cod and haddock consistent with U.S. quota increases in the disputed zone. Canadian officials assert that by October 1, 1978, its vessels had only harvested approximately 2,000 metric tons, or about half of its allocation. However, NMFS believes this is conservative and the actual catch is much higher. While data on the amount of fish taken is not available, NMFS estimates that Canada harvested 10,000 metric tons of haddock and 8,000 metric tons of cod in the disputed zone of Georges Bank. This is considerably higher than the established quotas.

Apparently, Canada decided to allow open fishing because it claimed it could not catch its quota of haddock before the end of the calendar year. The State Department expressed its concern over this situation, and, as a result, Canada announced that effective November 20, 1978, it would discontinue its policy of unrestricted fishing in the disputed zone and reverted to earlier trip restrictions.

Status of negotiations

Department of State officials told us that as of March 1, 1979, the United States and Canada had tentatively agreed to settle their boundary and management disputes. Regarding the boundary disputes, the agreements provide that the United States and Canada will submit the issues to binding third party arbitration.

Regarding fishery management issues, both countries have agreed to restore reciprocal fishing rights along the east coast. Among other things, the agreement lays out specifically what percentage of the fish caught in the Georges Bank area the two countries are entitled to: scallops, 73 percent Canada and 27 percent United States; cod, 17 percent Canada and 83 percent United States; haddock, 21 percent Canada and 79 percent United States; and, after 6 years, herring, 33 percent Canada and 67 percent United States. A joint U.S./Canada fishing commission will also be established to monitor the agreement and to provide cooperative management of fish stocks.

ALASKAN CRAB FISHERY

INTRODUCTION

This appendix discusses the Alaskan crab fisheries and responds to your questions concerning the status of and opportunities for U.S. development of the Alaskan king, tanner, and dungeness crab fisheries.

APPENDIX SUMMARY

The following items outline the major points in this appendix:

--Alaskan crab accounts for about 58 percent of the Alaskan shellfish catch and about 87 percent of the total value of Alaskan shellfish to fishermen.

--King crab resources are fully utilized and since 1974, the king crab harvest has remained relatively stable with about 100 million pounds harvested annually. Because the resource is fully utilized, little potential exists for expanding the king crab fishery.

--Tanner crab offers good potential for future development and expansion. U.S. fishermen concentrate on the larger, more valuable baridi tanner crab, while foreign fishermen generally catch the smaller opilio. Although the baridi crab resource is well utilized, great potential exists for expanding the harvest of opilio crab. Because of the strong market demand for crabs, NMFS officials expect greatly increased domestic fishing for opilio crab over the next several years.

--The dungeness crab fishery is a relatively insignificant commercial fishery whose abundance and catch fluctuates greatly from year to year. The low availability levels of dungeness crab and the attractiveness of more valuable crab fisheries inhibit any significant dungeness crab fishing expansion, and dungeness crab is expected to remain a relatively small Alaskan fishery.

DESCRIPTION OF THE FISHERY

The primary targets of the Alaskan commercial crab fisheries are the king, tanner, and dungeness species. In

APPENDIX III

terms of catch and value, the king crab is the most important crab fishery, but in recent years the tanner crab fishery has risen in importance. The dungeness crab fishery is a relatively minor Alaskan crab fishery.

Alaskan crab accounts for a significant segment of Alaska's shellfish industry. Specifically, in 1976 Alaskan crab catches made up about 59 percent of Alaska's shellfish catch and about 87 percent of the total shellfish value of $96.6 million to fishermen.

In 1966 king crab catches totaled 159 million pounds--the highest in history. Catches declined in the following 4 years but have stabilized in recent years at about 100 million pounds annually. The general decline in king crab catches is in contrast to a rise in tanner crab catches through 1978, except for 1975. In 1978 tanner crab catches exceeded 125 million pounds. The value of both king and tanner catches generally increased in the 1970s. Dungeness crab catches have fluctuated between 1.2 million and 6.4 million pounds since 1971.

Processing and marketing

Crab caught off Alaska is initially processed in shore-based, Alaskan plants or in floating processing plants. These processing plants usually handle other fish besides crab. Only a few firms dominate the Alaskan fish processing industry. In recent years, foreign investment in Alaskan-based processing companies has increased. Japanese companies are the principal foreign investors in companies which process tanner crab.

Major domestic markets for king crab are found on the east coast and California. Some king crab is exported. A significant amount of tanner crab is exported, and the domestic tanner crab market has steadily expanded through 1976. Tanner crab production data is not yet available for 1977 and 1978. Dungeness crab, however, is marketed principally on the west coast.

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While some information was available on most aspects of the Alaskan crab industry, inadequate data on other aspects may affect the decisionmaking responsibilities of fishery management agencies. In some cases data on the Alaskan crab fishery was nonexistent, inaccurate, inconsistent, or just not available.

There have been recent efforts to improve the data base for Alaska's shellfish industry. In October 1978, the Alaska Commercial Fisheries Entry Commission issued a preliminary report on the "Alaska Shellfish Bio-Economic Data Base." The study was initiated to provide NMFS with physical and economic data bases for the Alaskan shellfish fishing fleets. The study examined catch and earnings data, catalogued available sources of data, and recommended future research topics. The Commission's work was performed under a contract with NMFS.

TANNER CRAB

Species description

Two of the six species of tanner crab--Chionoecetes bairdi and opilio--are the major targets of the Alaskan commercial tanner crab fishery. Bairdi, generally larger than the opilio, is found in the eastern North Pacific Ocean. Off Alaska, opilio is found mostly in the North Pacific and Bering Sea. Commercial size male tanner crab usually range from 7 to 11 years of age and weigh from 2 to 4 pounds.

Tanner crab, like shellfish in general, grow to maturity by shedding the outer shell. Molting is the term applied to the shellshedding process and other associated growth processes. Harvesting at the time of molting, usually mid-June to October, is undesirable.

Fishery description

U.S. fishermen concentrate on the larger, more valuable, bairdi tanner crab, while the foreign fishery is directed at the smaller opilio. Domestic fishermen have yet to devote significant efforts toward the opilio tanner crab.

The domestic fishery

U.S. fishermen first fished for tanner crab off Alaska in 1961. That year's harvest totaled 6,800 pounds and was valued at $680. The domestic tanner crab harvest reached about 3 million pounds in 1968 and rose to about 11 million pounds 1 year later. Generally, the fishery continued a steady growth until 1975, when the harvest decreased due to several factors--poor markets, high inventories, and a price dispute between fishermen and buyers during the 1975 fishing season. The harvest increased rapidly after 1975, reaching a historical high of about 125 million pounds in

1978. The following table summarizes the trend in the domestic tanner crab catch and value to fishermen.

U.S. Tanner Crab Catch and Value

1968 to 1978

Year	Pounds	Value
	------(000 omitted)-------	
1968	3,248	$ 324
1969	11,207	1,133
1970	14,473	1,417
1971	12,880	1,369
1972	30,135	3,731
1973	61,719	10,756
1974	63,906	13,052
1975	46,857	7,019
1976	80,712	a/16,057
1977	98,329	b/30,823
1978	125,157	(c)

a/Obtained from the Alaska Commercial Fisheries Entry Commission.

b/According to "Fisheries of the United States," 1977, NMFS.

c/Information not available for 1978.

Several factors contributed to the recent rapid development of the domestic tanner crab fishery. While the king crab fishery suffered from declining harvests (1966 to 1970), the tanner crab, except in the Bering Sea, was available in relatively larger abundance than king crab. Also, harvesting tanner crabs provides additional income to fishermen during the winter months, when king crab and salmon generally are not harvested.

Location and season

The major tanner crab fishing areas are off Kodiak, Alaska, and in the eastern Bering Sea. The Bering Sea fishery is the predominant tanner crab area. For example, the Bering Sea catch totaled about 54 percent of the 1978 tanner crab catch. In 1978 the combined tanner crab catch in the Bering Sea and off Kodiak accounted for over 80 percent of the Alaskan tanner crab catch.

Tanner crab fishing seasons vary by management area. In 1978 the southeast Alaska fishing season started September 1 and ran through May 1; in the Bering Sea the season ran from November 1 through June 15. While the seasons may start as early as September, the majority of the domestic catch is harvested during February through June. The 1977 catch peaked in May, while the 1978 catch peaked in March.

Vessels and gear

Fishing fleet characteristics vary depending on the tanner crab fishing area. Vessel sizes range from small inshore vessels to vessels of 95 to 100 feet. No precise count on vessels involved in the tanner crab fishery exists. The Alaska Commercial Fisheries Entry Commission records the number of vessels fishing tanner crab in specific management areas but the total number of vessels in the fishery is not available since vessels may fish in more than one area. Bering Sea vessels fishing for tanner crab increased from 27 in 1975 to 66 in 1976, reflecting the growth of the Bering Sea fishery.

According to NMFS officials, new multiuse crab boats cost about $2.5 million and face a 2-1/2 year backlog before construction can be started. Such vessels can also be used in groundfish fishing.

Fishermen

No precise data is available on the number of tanner crab fishermen. Tanner crab fishermen usually fish in the spring and may also fish for king crab in the fall. In the Bering Sea area the fishermen are mostly from Seattle, Washington, but some Alaska residents fish this area. Kodiak is the home base for a large percentage of the Bering Sea fleet.

Prices

Prices for tanner crabs are established at the beginning of the season in negotiations between the fishermen's associations and several large processing firms. Prices for tanner crab vary by management area. As shown below, these prices have increased greatly since 1971. According to a major Kodiak processing plant official, his company paid about $0.44 a pound for tanner crab in 1978 and expects to pay between $0.48 to $0.50 a pound in 1979. Another Kodiak processing company representative reported paying an average of $0.43 a pound in 1978.

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Year	Range of price per pound
1971	$0.09 - $0.11
1972	.11 - .13
1973	.17 - .18
1974	.18 - .21
1975	.13 - .17
1976	.19 - .48
1977	.27 - .43

Source: Alaska Department of Fish and Game.

The foreign fishery

Before 1964 tanner crab harvested in the eastern Bering Sea was caught only incidentally by king crab fishermen. After 1964 the foreign fishery, managed under U.S. bilateral agreements with Japan and the U.S.S.R., restricted catches to hard-shell male crabs. Foreign tanner crab catch quotas were first established in 1969. Later bilateral agreements prohibited the use of tangle nets, which contributed to mortality of females and small crabs.

The bilateral agreements were modified every 2 years, progressively lowering foreign quotas for tanner crab. Regulation of the foreign fishery emphasized conserving the declining king crab resource and the developing U.S. tanner crab fishery.

After passage of the Fishery Conservation and Management Act, the 1977 NMFS preliminary management plan for king and tanner crabs of the eastern Bering Sea and the 1978 tanner crab fishery management plan established foreign allocations for tanner crab.

The following schedule summarizes the tanner crab catch and foreign allocations from 1969 through 1978.

Year	Japan		U.S.S.R.	
	Allocation	Catch	Allocation	Catch
	(metric tons a/)			
1969	18,149 b/	19,953	40,000 cases	d/7,081
1970	18,149 b/	20,633	40,000 do.	6,492
1971	17,015 c/	17,853	35,000 do.	4,769
1972	17,015 c/	17,687	35,000 do.	e/
1973	15,880	15,816	4,764	do.
1974	15,880	15,864	4,764	do.
1975	10,200	10,467	3,060	do.
1976	10,200	8,100	3,060	do.
1977	12,500	12,471	f/	f/
1978	15,000	14,965	do.	do.

a/One metric ton equals 2204.62 pounds.

b/An additional 15-percent allocation was provided.

c/An additional 10-percent allocation was provided.

d/Each 1,000 cases equals about 43.55 metric tons of live crab.

e/U.S.S.R. was allocated catch quotas in these years but did not fish.

f/No catch was made in these years according to an NMFS official.

Note: Figures between 1969 and 1976 are whole weight estimates based on an average whole weight of 2.5 pounds a crab, since allocations and catch in those years were given in numbers of crabs.

Source: National Marine Fisheries Service.

Fishery management

The North Pacific Fishery Management Council, NMFS, and the Alaska Department of Fish and Game (ADF&G) manage the tanner crab fishery. The Council and NMFS are responsible for managing the domestic and foreign fisheries between 3 and 200 miles offshore, while ADF&G is responsible for managing the domestic fisheries within 3 miles of the coast.

The Council developed a tanner crab fishery management plan for both the domestic and foreign fisheries for 1978. The plan established measures to achieve the optimum yield from the tanner crab fishery while maintaining sufficient stock to sustain the resource. In addition, the plan designated fishing seasons, area closures, gear regulations, restrictions on sex of crab harvested, harvest levels, and minimum size limits.

The Council estimates that 450 million pounds of opilio tanner crab could be harvested in the Bering Sea at maximum sustainable yield levels. In 1978 the total U.S. catch of tanner crab was about 125 million pounds. These figures illustrate the tremendous potential for opilio tanner crab.

ADF&G manages fisheries through regulations developed by the Alaska Board of Fisheries. Alaskan statutes and regulations require registration of vessels and fishermen, designate fishing zones, and limit the size and sex of retained tanner crab, and the type and amount of fishing gear.

Processed products

Alaskan tanner crab production has been increasing in recent years. In 1976 Alaska produced 30 million pounds of processed tanner crab, valued at $36.7 million. The amount of crab produced in 1976 increased 59 percent over 1975, with the increase primarily occurring in tanner crab meat destined for domestic markets. The 90-percent increase in value from 1975 to 1976 reflected a relative increase in meat production and a stronger market demand. The following schedule summarizes the processed value of tanner crab from 1970 through 1976.

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Year	Fresh/Frozen Sections and whole a/	Fresh/Frozen Extracted Meat	Canned Meat	Total
	(000 omitted)			
1970				
Pounds	1,120	1,166	829	3,115
Value	$ 441	$ 1,619	$1,604	$ 3,664
1971				
Pounds	703	1,092	529	2,324
Value	$ 347	$ 1,418	$1,128	$ 2,893
1972				
Pounds	3,834	2,974	695	7,503
Value	$ 1,601	$ 5,504	$1,804	$ 8,909
1973				
Pounds	15,718	6,485	1,098	23,301
Value	$14,729	$15,037	$3,922	$33,688
1974				
Pounds	15,348	1,907	1,048	18,303
Value	$ 8,479	$ 4,072	$3,102	$15,653
1975				
Pounds	18,147	243	705	19,095
Value	$16,468	$ 622	$2,282	$19,372
1976				
Pounds	27,208	3,071	1,822	32,101
Value	$21,617	$ 9,322	$5,805	$36,744

a/Primarily sections, according to Alaska Sea Grant Report, Number 77-5, May 1977.

Source: Alaska Department of Fish and Game.

Most of Alaska's tanner crab processing is concentrated in a few large companies located in Kodiak and the Dutch Harbor area. According to ADF&G statistics, 44 plants processed tanner crab in 1977, including shore-based processors and factory or freezer ships. State data shows an increase in processing operations in the western region of the State. According to ADF&G statistics, processors intended to use 24 freezer ships to process tanner crab in 1978, many of which were to operate in the western region of Alaska.

Tanner crab markets

Tanner crab is generally marketed under the product name "snow crab." In 1976 exports totaled about 31 percent of Alaskan-produced tanner crab. Alaskan-produced, frozen extracted meat and canned products are sold primarily in U.S. coastal areas.

Domestically, most snow crab was consumed in meat form, either canned or frozen. Until 1976 there was almost no domestic consumption of sections. But according to a major Alaska producer of tanner crab, sections will be the prominent product in the future because of their lower cost and ease of production. According to a May 1977 Alaska Sea Grant Program report, snow crab now enjoys nationwide recognition and popularity. Its future in the domestic market seems to be limited only by availability, a price too high to maintain its competitiveness with king crab nationwide, or regional crab favorites in coastal areas.

Distribution channels for king and tanner crab are basically the same. Usually, after processing in Alaska, frozen tanner crab is shipped to cold storage plants near Seattle. Generally, after processing or repackaging, the product is sold to local wholesalers. Products destined for markets in other parts of the country are shipped from Seattle to storage plants at major distribution centers. Wholesalers sell tanner crab primarily to institutional markets (restaurants) and retail food chains. A smaller percentage of the frozen product goes to retail stores. The following table summarizes the range of wholesale prices for tanner crabmeat in Chicago, Illinois, and New York, New York, from 1972 to 1978.

Range of Tanner Crabmeat Wholesale Prices Per Pound

Year	New York	Chicago
1972	$1.61 to $3.04	$2.73 to $3.00
1973	2.90 to 3.38	2.89 to 3.38
1974	2.27 to 3.41	2.23 to 3.31
1975	2.06 to 2.51	1.98 to 2.60
1976	2.61 to 3.96	2.62 to 3.78
1977	3.60 to 4.10	3.78 to 4.05
a/1978	3.99 to 5.65	5.14 to 5.38

a/Through September 1978.

Source: National Marine Fisheries Service.

Data on the geographical distribution of crab is limited to the identification of some major distribution center locations: Los Angeles, California; Denver, Colorado; Minneapolis, Minnesota; Philadelphia, Pennsylvania; Boston, Massachusetts; New York; and Chicago. The May 1977 Alaska Sea Grant Program report stated that in 1976 the California region consumed about 27 percent of the total Alaskan snow crab production.

About one-third of Alaska's 1976 production was exported. Japan is the primary foreign market for tanner crab, most of which is exported as sections. The following table summarizes total U.S. exports of tanner crab.

Year	Pounds (note a)
	(000 omitted)
1971	68
1972	51
1973	13,832
1974	7,770
1975	4,192
1976	9,936
1977	16,708
b/1978	26,119

a/1971-76 exports were to Japan only. No data was available for U.S. exports to other countries, but exports to other countries were negligible, according to the May 1977, Alaska Sea Grant Program report.

b/Through June 30, 1978.

Future outlook

According to an October 1978 Alaska Sea Grant Program draft report the greatest potential for expanding the Alaska tanner crab fishery is in the Bering Sea. Tremendous expansion potential exists for opilio tanner, but domestic fishermen and processors have not yet significantly entered the opilio fishery. An NMFS official said that, in 1978, only three domestic vessels fished for opilio. According to the Alaska Sea Grant Program draft report, at least one processor is processing opilio tanner; however, an NMFS official said several other processors were purchasing equipment to process opilio.

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Opilio tanner crab is generally considered a substitute product for bairdi. Both an established foreign market for opilio sections and a domestic market for canned opilio exist which could be supplied by domestic fishermen. According to NMFS officials, opilio molts later than bairdi; therefore, tanner crab fishermen could have a longer tanner crab fishing season if opilio were developed.

Despite these promising prospects, certain obstacles inhibit the opilio fishery's development. Opilio is concentrated in the Bering Sea where weather conditions are severe in winter months. Since opilio is generally a smaller crab than bairdi, more is processed into meat than into sections. Consequently, opilio costs more to process. Also, according to an NMFS official, opilio is more susceptible to dead loss due to having less ability to withstand changes from cold sea water to the warmer sea water circulated in fishing vessel holding tanks during the long journey from north in the Bering Sea to processors.

The Alaska Sea Grant Program draft report stated that the tanner crab fishery can be expected to shift effort to opilio to continue current high production levels. The report stated that if present marketing of opilio is successful, the domestic fishing effort for opilio could increase rapidly over the next several years.

KING CRAB

Species description

Four species of king crab are commercially fished--red, blue, brown, and golden. The red king crab is the major commercially caught king crab, with much lesser quantities taken of blue king crab. Brown and golden king crab are not caught in significant quantities. King crabs may grow to 24 pounds in 15 years, but commercially caught crabs average 7 pounds and are 8 or 9 years old. Crabs of this age measure about 3 feet with legs extended.

Fishery description

The domestic fishery

Although the domestic king crab fishery began in 1920, during the next 25 years the catch and production of this shellfish was small and infrequent. In 1947 U.S. fishermen began catching a half million king crabs annually in the Bering Sea, reaching a peak in 1966 of about 159 million pounds.

After the 1966 peak harvest the catch declined and then rebounded in the mid-1970s. Overfishing depleted the stock to such an extent that apparently only the annual crop of maturing male crabs was available. As shown below, landings dropped to only 52 million pounds in 1970. To conserve king crab stocks, Alaska brought the fishery under tighter control by imposing seasonal closures, quotas, and gear limitations. Since 1974 the king crab harvest has been about 100 million pounds annually.

Alaska King Crab Catches

Year	Pounds	Value	Average price paid per pound to fishermen
	----------(000 omitted)----------		
1964	86,721	$ 8,186	Not available
1965	131,671	12,729	do.
1966	159,202	15,670	do.
1967	127,723	14,970	do.
1968	81,805	21,816	do.
1969	57,730	15,644	do.
1970	52,061	13,190	do.
1971	70,703	19,077	$0.25 to $0.35
1972	74,427	20,519	.26 to .41
1973	76,824	44,702	.65 to .77
1974	95,214	39,154	.35 to 1.00
1975	97,629	38,251	.37 to .60
1976	105,825	70,072	.60 to 1.15
1977	99,449	111,742	.95 to 1.32

Source: National Marine Fisheries Service and the Alaska Department of Fish and Game.

King crab accounts for a significant portion of the total value of Alaskan shellfish. For each year from 1969 through 1976, in terms of prices paid to fishermen, king crab comprises at least 58 percent of the total value of all Alaskan shellfish and at least 13 percent of the total value of all Alaskan fish. In 1976 the value of the king crab catch totaled about 70 percent of all Alaskan shellfish and about 28 percent of all Alaskan fish caught.

Location and season

The greatest concentration of fishing for red king crab has occurred further offshore and to the west each year since

1974. King crab is most abundant in the Bering Sea. Other significant areas include off Kodiak Island and near the Aleutian Islands. Since 1974 the Bering Sea area has been responsible for at least 52 percent of the annual harvest of king crab.

The king crab season varies by management area, although the peak harvest is normally August through December.

Vessels and gear

Many vessels engaged in the king crab fishery may also harvest tanner crabs. Because king crab is a high value product, many fishermen can make substantial earnings during the king crab season. As a result, king crab fishermen may be reluctant to fish for tanner crab during the winter season when fishing is riskier and the harvest is a lower value item.

The westward and offshore movement of king crab fishing is reflected in the increased number of fishing vessels registered to fish king crab in the Bering Sea, and Kodiak vessels registered in the Bering Sea rose from 68 in 1973 to 142 in 1976. Kodiak area registration increased from 131 to 194 over the same period.

The U.S. king crab fleet consists of vessels ranging in size from under 30 feet to vessels over 90 feet in the Kodiak and Bering Sea areas. Crab vessels are equipped with large circulating seawater tanks to keep crabs alive for several days before returning to port. Crabs are caught in baited pots 6 or 7 feet square, 3 feet high, and weighing 500 to 700 pounds.

The foreign fishery

Japan began fishing for Alaskan king crab in 1930. After World War II the Japanese again entered the fishery. Japan's eastern Bering Sea annual catches totaled about 8.5 million pounds through 1959. The U.S.S.R. entered the fishery in 1959.

After ratification of the 1958 Geneva Convention, the United States declared king and tanner crabs as creatures of the Continental Shelf, thereby establishing U.S. ownership of these resources. Bilateral agreements negotiated with Japan and the U.S.S.R. established conditions for the operation of the fisheries, including catch quotas. Japan and the U.S.S.R. increased their king crab efforts in the early 1960s, reaching a peak in 1964. Other foreign countries have not participated in the Alaskan king crab fisheries.

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The bilateral agreements with Japan and the U.S.S.R. gradually reduced the allowable foreign catch. The U.S.S.R. last fished for Alaskan king crab in 1971 and Japan last fished for king crab in 1974.

Fishery management

Before the passage of the Fishery Conservation and Management Act of 1976, Alaska managed the domestic king crab fishery. Starting in 1964 the foreign fishery was managed through bilateral agreements with Japan and the U.S.S.R. Since 1975 only the United States has participated in the Alaskan king crab fishery.

Alaska manages king crab stocks found within 3 miles of shore, while the North Pacific Fishery Management Council and NMFS have jurisdiction over those stocks located within the fishery conservation zone. In January 1977, NMFS issued a preliminary fishery management plan for the foreign king and tanner crab fisheries of the eastern Bering Sea. The plan did not permit foreign fishing for king crab. The Council is developing a king crab fishery management plant to implement in August 1979.

The minimum size for king crab varies by management area. In 1978, for example, the minimum size in the Bering Sea for red king crab ranged from 4-3/4 to 6-1/2 inches in shell width. Female crabs and males smaller than the minimum size may not be retained.

Processed products

King crab is processed into several product forms--whole (fresh and frozen), frozen section (four legs and one claw), frozen meat, canned meat, and separate claws. Before 1973 king crab meat was the dominant product form. As shown on the following page, however, since 1973 the section has been the predominant king crab product form.

Alaska King Crab Production

(in pounds)

Year	Fresh and frozen: Whole and sections	Fresh and frozen: Extracted meat	Canned	Total
	(000 omitted)			
1964	6,696	11,698	4,601	22,995
1965	12,483	15,159	6,379	34,021
1966	12,158	25,214	8,696	46,068
1967	5,149	16,938	7,801	29,888
1968	9,524	13,863	1,837	25,224
1969	2,196	9,272	1,356	12,824
1970	6,712	7,041	1,089	14,842
1971	6,290	9,884	973	17,147
1972	8,965	9,803	915	19,683
1973	19,348	8,277	946	28,571
1974	14,473	10,224	810	25,507
1975	34,689	4,587	1,073	40,349
1976	37,600	4,960	1,170	43,730

Note: The above schedule depicts product forms as processed in Alaska. The amount of sections which are further processed into meats is significant but unknown.

Source: National Marine fisheries Service.

Processing crab sections requires less labor than extracting meat from the crab. According to the October 1978 Alaska Sea Grant Program draft report, the production of bulk sections is more cost efficient than meat production. The report cited the space constraints of Alaskan processing areas and the lack of housing for plant workers as reasons for not further processing crab into a meat product in Alaska. Most king crab processed in Alaska is sent to the Seattle area for reshipping.

Frozen crab meat is the second most important form of processed king crab. Extracted meat is generally frozen in large blocks for institutional or restaurant use. Smaller packages (8 ounces or less) are processed for the retail trade.

In addition to frozen sections and extracted meat, king crab may be marketed whole, canned, or in packages of crab claws only. Fresh or frozen whole crab is generally

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restricted to local Alaskan markets. The annual volume of canned king crab meat has been about 1 million pounds since 1970. The October 1978 Alaska Sea Grant Program draft report on the seafood processing industry stated that the high cost of the extracted meat, combined with other canning costs, increased the cost "to the point where it is prohibitive to the retail customer." The report stated that one processing company believed they were the only company that canned king crab in 1977.

Most Alaskan processing plants process both king and tanner crab. Since the king and tanner fishing seasons are at different times, no conflict in facilities exists according to the October 1978 Alaska Sea Grant Program draft report. About 46 to 49 Alaskan plants processed fresh or frozen king crab between 1975 and 1977. New plants and additions to existing plants have rapidly increased king crab processing capacity.

The value of king crab production, at the processor's level, reached a peak of about $94 million in 1976. Preliminary ADF&G statistics show that the king crab production value totaled about 58 percent of Alaskan shellfish value and 23 percent of Alaskan fish value in 1976. The following table summarizes the processed value of king crab product forms.

	Fresh and frozen			
Year	Whole and sections	Extracted meat	Canned	Total
	(000 omitted)			
1964	$ 3,453	$11,868	$ 5,941	$21,262
1965	6,518	14,300	10,847	31,665
1966	5,277	26,000	13,090	44,367
1967	2,752	20,958	13,238	36,948
1968	15,800	33,207	5,150	54,157
1969	2,091	18,569	5,922	26,582
1970	7,671	14,148	3,017	24,836
1971	7,560	21,912	2,880	32,352
1972	14,794	25,292	3,518	43,604
1973	33,035	33,738	6,095	72,868
1974	16,500	27,045	4,865	48,410
1975	68,078	11,493	4,267	83,838
1976	75,942	12,896	5,490	94,328

Source: National Marine Fisheries Service.

The decline in the value of processed king crab in 1974 was generally the result of a buildup of king crab inventories in 1973. Also, according to an official from the Northwest and Alaska Fisheries Center, NMFS, the price drop in 1974 was "a probable consequence of curbed demand and some shift to lower priced snow crab products brought on by the high [king crab] prices."

Since 1975 most king crab has been processed into sections for shipment to distribution centers or for further processing into extracted meat outside of Alaska. Before 1975 king crab processing was predominantly for extracted meat. Because of the limited number of processed whole crabs, such crabs are generally included in data for processed sections. Since 1970 the volume and value of canned king crab has remained relatively constant.

King crab markets

The market channels for king and tanner crab are generally identical. For domestic markets, frozen king crab is normally sent to cold storage facilities near the Seattle area. After repackaging or further processing, the product is sold to wholesalers for shipment to such major distribution centers as Los Angeles, Denver, Chicago, and New York. Recent wholesale price per pound history for king crab meat is show below.

Year	Chicago	New York
1970	$2.08 to $ 2.40	-
1971	2.39 to 2.48	$2.38 to $ 2.57
1972	2.63 to 2.85	2.60 to 3.50
1973	2.98 to 5.45	3.34 to 5.56
1974	3.20 to 5.20	3.18 to 5.21
1975	2.88 to 3.92	2.87 to 3.96
1976	4.12 to 5.99	4.21 to 6.01
1977	5.96 to 7.39	5.92 to 7.59
1978	a/7.74 to 10.00	a/7.60 to 10.00

a/Through September 1978.

Source: National Marine Fisheries Service.

According to an official from the Northwest and Alaska Fisheries Center, NMFS, the sharp wholesale price rise for king crab meat "during 1973 is attributed, in part to * * * highly competitive buying actions of Japanese firms." In August 1978 retail prices for king crab meat averaged $12.27 per pound based on a 10-city survey.

According to an NMFS Northwest Region official, the major domestic markets for king crab are found on the east coast and in California. He stated that king crab products are primarily marketed to institutional outlets, such as restaurants, with lesser amounts retailed directly to consumers through supermarkets.

Imports

Available data on U.S. imports of frozen and canned crab meat are not segregated by species. U.S. Bureau of the Census data shows that in 1977 about 9.7 million pounds of crab meat was imported into the United States. In comparison, exports of king and tanner crab meat in 1977 totaled more than 30 million pounds. The following table shows the trend of crab imports into the United States from 1968 through 1977.

Year	Quantity (in pounds) (000 omitted)
1968	7,488
1969	6,621
1970	5,099
1971	7,730
1972	6,592
1973	6,502
1974	6,293
1975	5,799
1976	6,970
1977	9,739

Source: Alaska Sea Grant Program.

Since 1971 over half of the crab imports have been fresh, frozen, or chilled. In 1976 and 1977 at least 29 percent of U.S. crab meat imports came from Japan. Since 1968 Canada and Japan are the leading fresh and frozen crab meat exporters to the United States. An NMFS Northwest Region official said that U.S. crab meat imports are mostly tanner crab.

Exports

In 1976 about 11 percent of the Alaskan king crab production was exported. Since 1971 U.S. king crab exports increased from 563,000 pounds to an alltime high of about 14 million pounds in 1977. The value of king crab exports

totaled about $37 million in 1977, also an alltime high. According to the October 1978 Alaska Sea Grant Program draft report, most exports are frozen and are almost entirely sections. The following schedule shows U.S. king crab exports from 1968 to 1977.

Year	Quantity		Total pounds	Value		Total value
	Frozen	Canned		Frozen	Canned	
	(000 omitted)					
1968	847	172	1,019	$ 1,045	$ 292	$ 1,337
1969	496	51	547	929	101	1,030
1970	480	200	680	788	388	1,176
1971	523	40	563	1,082	102	1,184
1972	1,325	21	1,346	2,722	40	2,762
1973	4,730	1,524	6,254	8,157	3,336	11,493
1974	2,532	707	3,239	6,279	2,433	8,712
1975	2,712	446	3,158	6,356	1,698	8,054
1976	4,099	4,200	8,299	11,898	7,133	19,031
1977	10,182	3,815	13,997	28,984	7,912	36,896

Source: National Marine Fisheries Service.

As is true for tanner crab, most king crab exports are sent to Japan. From 1973 through 1977, exports to Japan comprised from about 25 to 53 percent of total king crab exports. In 1977 Japan imported about 7.5 million pounds of U.S. frozen king crab. Other countries receiving U.S. king crab include Canada, Belgium, and the Netherlands.

According to the Alaska Sea Grant Program's October 1978 draft report, king crab destined for foreign countries is shipped from the Alaska processing plant to the importer either directly or through Seattle. Processing companies shipping king crab to Japan said that frozen sections sent there are further processed into canned or frozen meats.

Future outlook

According to the Alaska Sea Grant Program draft report, no great potential exists for expanding the king crab fishery. Alaska Sea Grant Program and other fishing industry officials believe that the tanner crab offers the greatest prospects for future development.

DUNGENESS CRAB

Species description

The dungeness crab is distinguishable from tanner and king crabs by its set of smaller and shorter legs in comparison to its body size. The dungeness crab has five pairs of legs, one pair with pincers. Commercially caught dungeness crabs weigh about 2-1/2 pounds and are primarily caught in waters less than 60-feet deep.

Fishery description

The Alaskan dungeness crab fishery is relatively insignificant when compared to the king and tanner crab fisheries. Most of the fishery is within 3 miles of the Alaskan coast. No foreign fishery exists for Alaskan dungeness crab.

The dungeness crab fishery began in 1913 and dungeness crab was first commercially canned in 1920. However, dungeness crab is a relatively insignificant Alaskan commercial shellfish product. The abundance and catch of dungeness crab has fluctuated greatly from year to year. As a result, the supply and cost to the consumer has varied. The following table summarizes catch and value trends.

Year	Pounds	Value (note a)
	---------(000 omitted)--------	
1968	13,242	$1,774
1969	11,304	1,620
1970	9,696	1,414
1971	3,749	610
1972	5,448	1,968
1973	6,423	3,427
1974	3,818	1,973
1975	3,034	1,649
1976	b/1,538	658
1977	b/1,177	Not available
1978	c/5,014	Not available

a/Dockside price paid to fishermen.

b/From the Alaska Commercial Fisheries Entry Commission.

c/Preliminary data as of August 1978.

Source: Alaska Department of Fish and Game.

Dungeness crab range throughout Alaskan coastal waters from southeastern Alaska to the Aleutian Islands. Prince William Sound, Kodiak, and southeastern Alaska areas accounted for most of the dungeness crab harvested from 1971 to 1977.

In 1977 Alaskan fishermen received from $0.30 to $0.50 a pound for dungeness crab. From 1972 through 1976 prices paid to fishermen ranged from $0.15 to $1.10 a pound.

Commercial fishermen use baited, wire pots to catch dungeness crab. The maximum number of pots allowed for each fishing vessel is determined by the State and varies by management area. According to an ADF&G official, the average size dungeness crab vessel--approximately 45-feet long--carries at least 300 pots, and larger crab vessels carry up to 1,500 pots.

Dependence upon the Pacific coast dungeness crab fishery

The Alaskan dungeness crab fishery is greatly affected by dungeness crab market conditions on the west coast. When the west coast catch is high, the Alaskan dungeness crab fishery suffers from low demand and it is not extensively fished. For example, in 1975-76, in Washington and Oregon the harvest level increased and California had one of its best seasons since 1959. The California harvest was 17 million pounds, an increase of over 15 million pounds from the previous season. Because of the large supply of dungeness crab on the west coast, market demand for Alaskan dungeness crab lessened, and the total fishing effort in Alaska decreased. Alaska's 1976 harvest fell to about 1.5 million pounds. In contrast, the large 1978 harvest was due primarily to an increased demand for Alaskan dungeness crab caused by a lower west coast harvest.

Other factors also influence the Alaskan dungeness crab harvest. For instance, in the early 1970s the dungeness crab fishery in the Kodiak area declined due to biological and environmental conditions as well as adverse market conditions.

Fishery management

ADF&G manages the dungeness crab fishery using regulations developed by the Alaska Board of Fisheries. These regulations provide that only legal-size, hard-shelled, male crabs can be harvested by commercial and sport fisheries. The minimum legal size is 6-1/2 inches in shell width. Fishing seasons vary by management area and may last year round.

Processing and marketing

Dungeness crabs are processed primarily two ways: (1) the crabs are either butchered, cleaned, halved, and cooked or (2) the largest and best crabs are cooked as a whole product. Whole and frozen sectioned crabs are shipped to west coast ports, including Seattle. Very little dungeness crab canning occurs in Alaska. Some frozen sections transported to Seattle are further processed into a canned meat product. Since 1969 most dungeness crab has been processed whole. The following table summarizes Alaska production of dungeness crab and its processed value from 1970 to 1976.

Year	Fresh/Frozen Whole and sections (note a)	Fresh/Frozen Extracted meat	Canned meat	Total
	(000 omitted)			
1970				
Quantity (lbs.)	4,989	157	106	5,252
Value	$2,310	$277	$209	$2,796
1971				
Quantity	2,231	116	46	2,393
Value	$1,155	$215	$108	$1,478
1972				
Quantity	3,577	48	93	3,718
Value	$3,074	$100	$335	$3,509
1973				
Quantity	3,987	481	19	4,487
Value	$4,039	$826	$83	$4,948
1974				
Quantity	3,540	707	10	4,257
Value	$3,390	$1,009	$59	$4,458
1975				
Quantity	2,438	-	-	2,438
Value	$2,197	-	-	$2,197
1976				
Quantity	692	398	-	1,090
Value	$ 512	$1,115	-	$1,627

a/Primarily whole crab.

Source: Alaska Department of Fish and Game.

APPENDIX III

In 1974, 40 Alaskan plants processed fresh or frozen dungeness crab. In contrast, in 1976 only 17 plants processed dungeness crab. The decrease was primarily due to poor market conditions and low harvest levels. During 1978, processors intended to use 44 plants to process fresh and frozen dungeness crab. The greatest concentration of plants centered around Kodiak, Anchorage, and Cordova.

Available data does not disclose specifically how much and where Alaska's dungeness crabs are marketed. Major distribution points are at Seattle, Los Angeles, and San Francisco. According to a representative of one of the leading processing companies, most of Alaska's dungeness crabs are processed and shipped to retail outlets.

Future outlook

In recent years the Alaskan catch of dungeness crab has not changed. Although market conditions for Alaskan dungeness crab were good in 1978 because of the smaller west coast (Washington, Oregon, and California) commercial harvest, fishing industry officials expect the dungeness crab fishery to remain a relatively small Alaskan fishery.

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