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COMMERCIAL DUNGENESS CRAB, SHRIMP AND MISCELLANEOUS SHELLFISH FISHERIES OF THE COOK INLET MANAGEMENT AREA, 1994

REPORT TO THE ALASKA BOARD OF FISHERIES

COMMERCIAL FISHERIES MANAGEMENT AND DEVELOPMENT DIVISION

by

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INTRODUCTION

The Cook Inlet Management Area, Statistical Area H, is located in the Central Gulf of Alaska with the Prince William Sound Management Area to the east and the Kodiak Management Area to the south. The eastern boundary is the longitude of Cape Fairfield (148° 50' W. longitude) and the southern boundary the latitude of Cape Douglas (58° 52' N. latitude). The management area is divided into six shellfish districts: Southern, Kamishak, Barren Islands, Outer, Eastern and Central (Figure 1). A separate management area, Outer Cook Inlet, Statistical Area G, has been established specifically for the trawl and pot shrimp fisheries in the Outer and Eastern Districts. The boundaries for Outer Cook Inlet are the longitude of Cape Fairfield on the east and a line drawn from the westernmost tip of Point Adam to the westernmost tip of Cape Elizabeth and south along 151° 53' W. longitude on the west (Figure 2). This report covers the Cook Inlet Dungeness, shrimp, scallop, hardshell clam, green urchin, sea cucumber and octopus resources.

DUNGENESS CRAB FISHERY

Introduction

The majority of the commercial, sport and personal use Dungeness crab (Cancer magister) fishing in Cook Inlet has occurred in the Southern District which includes Kachemak Bay (Figure 1). A small amount of crabs have been harvested in the Central and Kamishak Districts. During the 1960's and early 70's commercial catch and effort were usually not a function of resource abundance; the harvest instead was a result of opportune market conditions created by fluctuation in the catches from the west coast Dungeness crab fisheries.

Although low level, sporadic effort has occurred since statehood, catch and effort first increased significantly in 1978 to 1.2 million pounds taken by 49 vessels. Subsequently favorable market conditions and the need of fishermen to find alternative fisheries have kept effort high. Since 1978 annual harvests have ranged from a low of 29,502 pounds in 1990 to a high of 2.1 million pounds in 1979. The commercial fishery has been closed in the Southern District from 1991 through 1993 due to low overall abundance. The average annual harvest for the entire management area since 1978 was 1.01 million pounds (Figure 3). Effort has ranged from one vessel in 1993 to 108 vessels in 1982 (Table 1). After 1978, 92 percent of the crabs were harvested between the months of June and October (Figure 4), and 59 percent of the annual harvest was taken from the waters east of Homer Spit; however the proportion changed considerably on an annual basis, which was a result of varying recruitment between the waters east and west of the Spit (Table 2).

Ninety percent or more of the Dungeness fleet were residents of Kachemak Bay communities of Homer and Seldovia. The fishing vessels were in the 40 foot and less size class. Smaller vessels without circulating tanks generally fished the waters east of Homer Spit while larger vessels with circulating tanks fished the deeper somewhat rougher waters west of the Spit.

Current regulations that are specific to the Cook Inlet Management Area are:

1) For the Southern District a two part regulatory season which opens the waters east of Homer Spit by emergency order on or after June 1 and closes no later than November 1, and opens the waters west of Homer Spit on June 1 and closes no later than November 1. The opening east of Homer Spit is contingent on department test fishing data indicating that the molt of adult crabs is over. This regulation was adopted by the Board of

Fisheries in 1990.

2) Closure of Southern District waters in depths of 10 fathoms or less from January 15 through April 30. This regulation is irrelevant due to the adoption of the previous regulation.

3) A regulation adopted by the Board of Fisheries in 1986 that closed the entire Cook Inlet Management Area to Dungeness fishing during the 15 day period prior to the opening of the Tanner season, allowing for the removal of delinquent gear and a fair start for the Tanner crab fishery.

4) A 150 pot limit in the Southern District (not in effect in either 1979 or 1980).

5) A gear regulation that requires consecutive numbering of all buoys.

Statewide biological regulations for the commercial Dungeness fisheries consist of a males only harvest and a minimum legal size of 6.5 inches carapace width. Gear regulations include a provision for two 4 3/8 inch escape rings per pot and a biodegradable twine escape mechanism requirement.

The Cook Inlet Dungeness fishery has evolved into a summer event for the following reasons:

1) Salmon fishermen are occupied with salmon fishing, thus creating a niche for fishermen who do not hold permits for limited entry fisheries.

2) The weather is better.

3) The catcher/seller sales to the tourist industry are at their peak.

4) Recruitment (the molt) occurs.

Historically some level of fishing has occurred throughout the year. Catch and effort, however, increase significantly after the major molt, which provides new recruit crabs. The period of significant molting for adult males in Kachemak Bay can occur from late April through mid-September in any given year although the peak months are June and July. The molt is stimulated by water temperature and physiological condition of the crabs. The inconsistency in molt timing between years is partially explained by the significant annual spring-summer temperature variation in the shallower north temperate and sub-arctic waters of Alaska.

Within Kachemak Bay itself, molting generally occurs somewhat earlier in the waters east of Homer Spit than in the waters west of the Spit where the influence of Cook Inlet proper is much greater. Newly molted legal crabs are often caught east of Homer Spit one month or more before appearing in the gear west of the Spit. Crabs east of Homer Spit are most likely resident from the first post-larval instar up to legal size. Those legal crabs captured west of the Spit, however, may actually be reared as juveniles in the waters of Cook Inlet north of Anchor Point. Catches of small crabs by upper Cook Inlet salmon set netters and casual observations of molted exoskeletons by the general public indicate significant numbers of Dungeness reside in upper Cook Inlet.

Outside of natural population fluctuations, three fishing related factors have had a notable negative impact on this fishery:

1) Depression of the stock due to handling and trapping mortality that was the result of fishing during and immediately after the molting period.

2) Extremely high effort due to ease of access by both commercial and recreational fishermen.

3) Violation of the 150 pot limit by a portion of the fleet.

Bycatch mortality of Dungeness crabs during the China Poot Bay salmon seine fishery has also been of concern to the public including the recreational users and commercial Dungeness crab fishermen. The department and the Cook Inlet Seiner's Association met in 1991 to determine if a solution to the Dungeness seine mortality could be worked out while still allowing seiners reasonable access to the fish. Based on a common consensus the department issued an emergency order closing the upper portion of China Poot Bay for the entire seine season. This was the reported locale of the major portion of the seine mortalities. The seine season for sockeye salmon generally runs from the last week in June through the third week in July while the season for pink salmon extends to the first or second week in August. The department further agreed to prohibit future commercial Dungeness crab fishing within China Poot Bay during the commercial seine season. This prohibition will eliminate a historical gear conflict.

The combination of extended heavy fishing pressure, and fishing during and immediately after the major molting period for adult males has played the most significant part in the recent sharp decline in the Dungeness crab harvest. Mortalities associated with handling and trapping may not have been significant during the 1960's and early 70's when effort levels were low and stock abundance was high; however, since then the level of fishing accelerated not only in amount of vessels and pots, but also in the amount of time each year that the gear was deployed.

In 1990 the department began a survey to further document the molt timing of the catchable Dungeness crabs and to establish an index of abundance. This survey in tandem with the crab trawl survey

indicated one or two significant year classes moving toward the fishery (Figure 5). Although these animals appear numerous, particularly when compared to the surrounding weak year classes, the following must be weighed when considering the magnitude of this group of crabs: 1) the crabs were only located in the portion of Kachemak Bay east of Homer Spit, and 2) they exhibited an extremely high level (approximately 50 %) of skipmolting in 1992 and 1993, the years when they should have fully recruited into the fishery and provided significant numbers of both recruits and postrecruits available for harvest.

Considering the aforementioned two points and the absence of any other significant catchable year classes, the stock remains in a condition that will not tolerate a high level of fishing mortality given that a substantial degree of reproductive success is necessary to take full advantage of this relatively large group of adult crabs in the upper portion of Kachemak Bay.

1993 Season Summary

The commercial fishery was not opened in the Southern District (Kachemak Bay) in 1993 due to: 1) a relatively low number of legal males particularly in the area west of Homer Spit, and 2) the necessity to protect the remaining non-legal catchable crabs in the district from handling and trapping mortality.

Limited entry was adopted into the Cook Inlet Management Area Commercial Dungeness Fishery in 1993. The limit was set at 103 pot fishermen and two ring net fishermen. Limiting entry to this large number of participants will be of no in-season management value.

1994 Management Outlook

The department will begin the 1994 Dungeness pot survey in late May 1993. The survey will be conducted on at least a monthly basis. If this survey, in association with the crab trawl survey, indicates that both a high level of the skipmolt crabs have molted resulting in substantial recruitment into both the recruit and post-recruit size classes, and that another substantial year class has recruited into the adult population both east and west of Homer Spit, then a limited commercial fishery may occur. In the meantime the commercial fishery will remain closed until department surveys signify that the aforementioned growth and recruitment have occurred.

If a fishery is warranted, it will be based on Board of Fisheries action on regulatory proposals and the following factors: 1) the timing of the molt and subsequent soft-shell period, 2) substantial recruitment, and 3) the presence of another size class of adults to replace those that may be harvested in a fishery.

The presence of another size class of adult males is important during this era of depressed stocks because one of the management goals, other than precluding the trapping and handling soft-shell crabs, is to rebuild these weak year classes by maximizing the reproductive potential of the strong year classes. If no additional adults are identified by the 1994 stock assessment, other than the ones documented in previous surveys, then permitting a commercial fishery will result in an excess harvest of the males which may cause females in the same cohort to go unfertilized thereby failing to maximize the reproductive potential of these animals.

Recent research published by the Canadian Department of Fisheries and Oceans indicates that large female Dungeness would have difficulty finding a mate in intensively exploited fisheries

because the large males are harvested by the fishery. If barren females occur in large numbers, the eventual weak recruitment will result in a continuation of the cycle of weak year classes. Moreover, there are no stocks of nearby Dungeness to provide recruitment via larval drift: the Dungeness in Kachemak Bay appear to be the major portion of the adult Cook Inlet Dungeness population at this point in time.

The commercial season in the remaining districts of the management area will be open in 1994. The only district likely to see any effort is the Central District which is in central Cook Inlet north of the Southern District. Although there are crabs resident at least part of the year in this area, fishing effort has been light as it is a difficult location to retrieve gear due to the tidal action and nature of the general outflow of Cook Inlet.

AREA H TRAWL SHRIMP FISHERY

Introduction

Cook Inlet is separated into two shrimp registration areas: Area H, which includes the Southern, Kamishak, and Barren Islands Districts; and Area G, which includes the Outer and Eastern Districts (Figure 2).

All of the commercial trawl shrimp fisheries in Area H have occurred in the Southern District. Harvests reached the five million pound level in the late 1960's and remained near that point through the early 1980's (Figure 6 and Table 4). Low stock abundance resulted in partial closures of the fishery during the mid-1980's and total closure beginning in the fall of 1986. Effort has varied from a low of one vessel during 1968 to a high of 23 in 1981. Prior to 1983, most commercial fishing occurred west of

Homer Spit, but between 1983 and 1986 virtually all effort shifted to the area east of Homer Spit. The fishery has been closed from 1986 through 1993.

The Southern District (Kachemak Bay) trawl shrimp fishery is characterized by superexclusive registration and management under the Kachemak Bay Trawl Shrimp Management Plan. This plan has three basic features:

1) An annual guideline harvest level determined from stock assessment surveys.

2) Annual harvest spread out over the entire fishing season utilizing three separate regulatory sub-seasons.

3) Sub-season harvest spread out in equal weekly guideline harvests.

Also, two areas are closed to trawl shrimp fishing: the first includes the majority of upper Kachemak Bay east of Homer Spit, originally established because this area consistently contained small, juvenile pink shrimp; the second includes Tutka Bay and Sadie Cove, established because the area encompassed by these bays lent itself to the potential of overharvest.

Pink shrimp (Pandalus borealis) historically made up the bulk of the commercial harvest, with sidestripes (Pandalopsis dispar) seasonally making up a smaller but often significant portion of the catch. Humpy shrimp (Pandalus goniurus) have at times comprised up to half of the harvest, but this species appears to undergo erratic population fluctuations; contributions to the most recent fisheries have been negligible. Coonstripe shrimp (P. hypsinotus) consistently made up less than five percent of the catch.

Trawl shrimp surveys have been conducted in Kachemak Bay since 1971. These surveys, which determine each season's guideline harvest level, have indicated significant declines in abundance and distribution of all pandalid shrimp stocks in Kachemak Bay since the late 1970's (Figure 13). These declines led to the aforementioned commercial closures from 1986 to 1993.

1993-94 Season Summary

The fishery remained closed for the 1993-94 season based on the results of the 1993 department trawl shrimp survey. The 120,000 pound population estimate generated by the survey documented the smallest population of pandalid shrimp since the inception of the survey (Figure 7). To put these survey data into perspective: the commercial fishery averaged over five million pounds annual harvest during its peak, the 1993 population estimate of 120,000 pounds is two percent of that peak. Despite some shift in size composition and distribution, all information collected during this survey indicated that the stocks remained depressed by historical standards. The commercial fishery was therefore closed for the entire 1993-94 season.

1994-95 Management Outlook

The department will not conduct the Southern District trawl shrimp survey in 1994. Data from the 1993 survey conclusively indicated that there was no chance for a stock recovery that would produce a harvestable surplus therefore justifying a commercial fishery. The trawl survey will occur again in 1995.

AREA G TRAWL SHRIMP FISHERY

Introduction

Area G is a nonexclusive shrimp registration area encompassing the Outer and Eastern Districts of Cook Inlet (Figure 2). The first year of significant harvest occurred in the 1982-83 season when four vessels caught 239,584 pounds (Figure 8 and Table 4). The catch increased steadily for the next two seasons to a peak harvest of just under 2.0 million pounds taken by 11 vessels during the 1984-85 season. Before 1992, pink shrimp comprised 90 percent of the harvests; the remaining 10 percent was sidestripes. In 1992 and 1993 the catch was comprised entirely of sidestripes as the vessels targeted on these more valuable animals.

Prior to 1985, the season for shrimp trawling in Area G was open year-round. A regulatory season, beginning June 1 and ending February 28, was adopted by the Board for Area G in the spring of 1985.

Although surveys were not conducted in Area G, fishery performance data indicate that the stocks were not characterized by a dense distribution. Even in the very early years of this fishery, trawl cpue was never high, rarely approaching 1,000 pounds per hour. Logbook information collected over time indicates that fishermen in Area G must make long tows, often with extremely low catch results. Although pink shrimp constituted the bulk of the harvest, the bycatch of sidestripes was often large enough to economically justify the overall low catch per unit of effort.

1993-94 Season Summary

The Area G season opened by regulation on June 1, 1993 and closed by emergency order in two parts: Eastern District closed on September 20, 1993, and the Outer District closed on November 16, 1993. Because there were two vessels, Alaska statute requires that catch information remain confidential. The entire catch was sidestripe shrimp.

In order to avoid overfishing of the sidestripe shrimp stock, the department set a quota for each district which was equal to the estimated sidestripe bycatch from the directed pink shrimp fishery that occurred in Area G during the mid 1980's. These quotas were 100,000 pounds of whole sidestripes per district. En route to the quota the department collected logbooks, fisherman interviews and catch samples. Catch per unit of effort data did not decline over the course of the fishery. Furthermore, shrimp samples indicated that the stock was composed of substantial percentages of both adult sexes. The fishery was therefore permitted to proceed to the preseason quotas.

1994-95 Management Outlook

Initial guideline harvest levels for the 1994-95 season will be set at last year's level of 100,000 pounds per district, or 200,000 pounds for Area G. The department plans to implement the first Area G trawl shrimp survey in June 1994. If this survey appears to be successful, it will be expanded into Prince William Sound where it will also be used to assess the sidestripe shrimp stock. Data from this survey may be used in setting the ultimate fishery guidelines for the 1994-95 fishery. Fishery performance and dockside samples will again be significant factors in determining the status of the stock.

AREA H POT SHRIMP FISHERY

Introduction

Similar to trawl shrimp, the Cook Inlet Management Area is separated into two distinct registration areas for the pot shrimp fishery: Area H, consisting of the Southern, Kamishak, and Barren Islands Districts; and Area G, consisting of the Outer and Eastern Districts (Figure 2). Historically the major pot shrimp fishery occurred in the Southern District.

Commercial catch figures show that the fishery suffered steep declines in annual harvest until the closure in 1988 (Figure 9 and Table 5). Pot shrimp fishing in Kachemak Bay was primarily undertaken by small vessel fishermen that develop their own markets. The target species is the coonstripe shrimp, the most abundant pot caught shrimp in Kachemak Bay. Spot shrimp (Pandalus platyceros) also occur in the bay but their contribution to the fishery is generally negligible. Each regulatory fishing season, which began June 1 and ended March 31, was managed via three separate sub-seasons with appropriate guideline harvest levels set for each sub-season.

Prior to 1986, guideline harvest levels were determined by the Department's two annual pot shrimp surveys as well as by voluntary commercial fishery performance information. All pot shrimp surveys were subsequently eliminated in the Cook Inlet Area. Fishery performance data in the form of voluntary logbooks were collected consistently during 1986 and 1987 and were the sole criteria used to judge stock status during those years. The department trawl surveys and information from local personal use fishermen continued to indicate that stock of coonstripe shrimp in Kachemak Bay was depressed. The fishery has been closed to commercial harvest since 1988.

1993-94 Season Summary

To determine the status of the coonstripe shrimp stock the department relies on data obtained from the trawl shrimp surveys and voluntary information from personal use fishermen. For the fourth successive year results from the spring trawl survey indicated a population estimate of less than 20,000 pounds of coonstripe shrimp for Kachemak Bay. These results showed a depressed stock when compared to historical catches that generated population estimates up to 1.0 million pounds. Furthermore, voluntary information offered by personal use fishermen since 1988 has indicated very poor catches when compared to historical averages.

The aforementioned trawl survey and personal use fishery information demonstrated that the coonstripe stock in Kachemak Bay remained depressed, therefore the fishery was closed by emergency order for the entire 1993-94 season.

1994-95 Management Outlook

All information collected during 1993 indicated that stocks of pandalid shrimp continue to be depressed in Kachemak Bay. The fishery will remain closed for the entire 1994-95 fishing season in order to facilitate growth, recruitment and reproduction in the coonstripe shrimp stock.

AREA G POT SHRIMP FISHERY

Introduction

Similar to the trawl shrimp fishery, Area G, or Outer Cook Inlet, includes the Outer and Eastern Districts (Figure 2). Currently there are neither season restrictions nor biological regulations governing the pot shrimp fishery. The target species is the spot shrimp; coonstripes and pinks are harvested to a lesser extent. Spot shrimp have comprised 57 to 94 percent of the catch averaging 83 percent. Since 1977, catch and effort have remained low, never exceeding a reported annual harvest of 20,500 pounds whole shrimp caught by 8 participating vessels in 1989 (Figure 10 and Table 6). Despite the extensive coastal area, historical information collected from this fishery indicates that the measurable stocks of spot and coonstripe shrimp occur within some (but not all) bays and are of limited abundance.

1993 Season Summary

The commercial season was open by regulation for the entire 1993 calendar year. The total catch was 8,356 pounds taken by three fishermen. Catch by species was: spots - 6,058 pounds (72%), coonstripe - 2,142 pounds (26%), and pinks - 156 pounds (2%). Fishing occurred from April into December. The bulk of the harvest was landed in Seward and served Kenai Peninsula markets. Because no more than two vessels fished in each district, Alaska statute requires that district catch information remains confidential.

1994 Management Outlook

Fish ticket and voluntary fisherman interview information are the only sources of data used to evaluate the Area G pot shrimp fishery. The information collected during 1993 gave no indication to expect either an increase in harvest or effort in the near future.

SCALLOP FISHERY

Introduction

The commercial scallop fishery in the Cook Inlet Management Area (H) began in 1983. The target species of the fishery is the Pacific weathervane scallop (Patinopecten caurinus). The Alaska Board of Fisheries responded to a public proposal by directing the department to allow restricted exploratory fisheries for scallops in 1983 and 1984. These initial fisheries were characterized by low effort due to severe permit restrictions when compared with traditional scallop fisheries both inside and outside Alaska. The most important restrictions were:

1) Legal gear limited to a six-foot wide dredge with minimum ring size of four inches inside diameter.

2) Only one unit of gear allowed on board at any one time.

3) Mandatory log book completion.

4) Contact with the Homer office prior to and at the completion of each trip.

5) An agreement to carry department observers on board if requested.

Except for some brief exploratory fishing in the Kamishak District in 1984 and in the Outer District in 1987, a single bed of scallops near Augustine Island in the Kamishak District has sustained almost the entire harvest since the fishery began in 1983 (Figure 1). Using the state research vessel Pandalus, the department conducted an assessment survey in August, 1984 to define the extent of this particular bed and to aid in establishing appropriate harvest levels.

Based on information from the 1984 survey as well as data from the initial fisheries, the Board of Fisheries adopted regulations for scallops in Cook Inlet in 1985. These regulations included a season in the Kamishak District from August 15 through October 31, a guideline harvest level of 10,000 to 20,000 pounds of shucked meats, and the restrictions mentioned previously. Commercial fishery performance has been used inseason to adjust guideline harvest levels. Harvest and effort peaked fishery during 1993 when 3 vessels took 20,115 pounds of shucked meats (Figure 11 and Table 7).

By regulation the Southern District was not open to scallop fishing in order to protect crab stocks, while the Outer and Eastern Districts were opened year round to encourage exploratory fishing.

In 1987 review of inseason fishery performance data clearly demonstrated that the Kamishak District stock had taken an unexpected decline. Substantial undocumented information indicated that the Kamishak scallop bed had been fished illegally between the 1986 and 1987 season. Regardless of the reason for the sharp decline in abundance, the department closed the fishery.

No commercial effort occurred in Cook Inlet from 1988 through 1992. Although some local fishermen expressed interest in fishing during these years, the potential of a fishery closure after one trip did not warrant the investment in time and effort because the department told fishermen that their catch data would be used to justify continuance of the fishery. Fishermen speculated that the probability of good catches were low. Information required of the fishermen would have included logbooks, shell samples, interviews, and a potential for observers.

1993 Season Summary

Scallop regulations adopted in 1985 remained in effect through 1993 with the exception of the guideline harvest range in the Kamishak District which was reduced to a range of 0 to 20,000 pounds from the previous level of 10,000 to 20,000 pounds. The department intended to closely monitor fishery performance within this district in order to justify continued fishing or closure of the fishery.

Three vessels registered for the 1993 Kamishak District fishery. These were the first boats to register for this fishery since 1987. The first vessel began fishing shortly after the season opened by regulation on August 15. The remaining two vessels began fishing in early September. The fishery closed by emergency order on September 23 with a final harvest of 20,115 pounds of scallop meats taken by three boats that made 15 deliveries. The entire catch was delivered to Homer for fresh market sales.

The department monitored the fishery via mandatory logbooks, shell samples, skipper interviews and a trip by a staff biologist aboard one of the vessels. Interviews occurred at the end of each trip. Catch per unit of effort data (cpue) and shell samples indicated that this stock of scallops compared favorably to the density and

distribution of the stock prior to decline in 1987, which was due to illegal fishing. Pounds per hour towed from the single six foot dredge vessels were 33.3 for the month of August and 38.8 for September. Mean cpue of 38.1 pounds per hour towed compared favorably to the 1985 and 1986 cpue of 39.5 and 36.2 pounds per hour, respectively. Shell sampling indicated that approximately 40 percent of the harvest was composed of two major age classes with significant contribution (25 percent) from two others (Figure 12). Analysis of shells representing the unsorted catches indicated smaller animals were present in significant numbers, but were sorted out of the catch by the fishermen because the size of the meats was too small for their markets.

Crab bycatch limits were set at 15,900 Tanners and 40 king crabs. These limits were a function of one half of one percent of the 1993 population estimate which was based on the 1993 department trawl survey. Actual bycatch from the 1993 Kamishak District fishery was 1,802 Tanner, 18 kings and one Dungeness crab. Bycatch data collected directly by the department observer verified the logbook bycatch documentation from trips where no observer was present. These bycatch data were also very similar to that from the Kamishak scallop fisheries in the mid 1980's.

Although scallop fishing was on an upswing in the Gulf of Alaska in general, no scallopers requested permits in 1993 to fish the open waters of the Gulf of Alaska portion of the Cook Inlet Management Area which essentially includes the area between Cape Fairfield and Cape Douglas. Only one documented landing from this area has occurred: in 1987 a single vessel delivered 1,128 pounds of scallops from the Outer District. Likely these waters had been further explored in prior years with negative results.

1994 Management Outlook

Given Board of Fisheries approval, the department will follow the same management strategy in 1994 that was utilized in 1993. The department will monitor the fishery via mandatory logbooks, shell samples, skipper interviews and if necessary a trip by a staff biologist aboard one of the vessels.

The probable strength of the market for scallops coupled with the apparent abundance, size and age distribution of the animals remaining on the Kamishak District scallop bed, signify that the 1994 fishery may achieve the 20,000 pound upper limit of the guideline again. Although a population estimate cannot be generated at this point for the Kamishak scallop bed, other indicators of abundance such as the stable 1993 catch per unit of effort and the presence of a size class of small scallops indicate a small, but healthy stock available for the 1994 fishery.

Although the fishery in outer Cook Inlet remains open on a year round basis, significant effort is not likely to occur because minimal historical catch indicates that scallop abundance is low. As of February 9, 1994, two scallop vessels have made exploratory trips into outer Cook Inlet. No scallops were caught and retained for market, although a few were taken by one boat and subsequently discarded.

HARDSHELL CLAMS AND MUSSELS

Introduction

Commercial hardshell clam and mussel harvests in the Cook Inlet Management Area began in 1986. The generic term, hardshell clams, generally refers to littleneck (*Protothaca staminea*) and butter

clams (Saxidomus giganteus). From 1986 through 1993, the annual harvest of hardshell clams has ranged from 14,500 pounds to 63,676 pounds. In 1989 the bulk of the clam harvest went to sea otter food for a rehabilitation project resulting from the Exxon Valdez oil spill. In the remaining years the majority of the harvest was Pacific littleneck clams that went to Kenai Peninsula and Anchorage markets. Effort has ranged from 2 to 33 hand diggers (Figure 13 and Table 8). The entire documented commercial harvest has come from Kachemak Bay (Figure 1).

Before harvesting clams or mussels for human consumption, an area must be certified for water quality by the Alaska Department of Environmental Conservation (DEC) in accordance with the National Shellfish Sanitation Program (NSSP). DEC must also check for paralytic shellfish poisoning (PSP). Lot sampling is the method that DEC utilizes to check for PSP. In 1986 DEC permitted the use of lot sampling for Chugachik Island (near Bear Cove) in Kachemak Bay. Through 1989, Chugachik Island, Halibut Cove Lagoon, Kasitsna Bay, and Jakalof Bay, all in Kachemak Bay, were certified for lot sampling. At the end of 1989 Tutka Bay was also certified by DEC (Figure 14).

Only 102 pounds of blue mussels were commercially harvested prior to 1989. In 1989 the catch rose to over 167,000 pounds. The mussels were utilized for food in an otter rehabilitation project which was a result of the Exxon Valdez oil spill (Table 9).

Currently there are no closed season or closed area regulations for harvesting hardshell clams with forks and shovels. A Commissioner's permit is required to use hydraulic diggers. Minimum sizes were established by the Alaska Board of Fisheries in the spring of 1990 for Pacific little neck clams at 1.5 inches and butter clams at 2.5 inches. Currently market conditions seem to be the dominant factor affecting the harvest of clams and mussels in

Cook Inlet, although this should not be interpreted as indicating that a large abundance of clams are available for harvest.

The department began a hardshell clam assessment program on two beaches in Jakalof Bay during 1989. The program was intended to evaluate the populations of clams on these beaches and monitor them over time in an attempt to determine the effects of both commercial and personal use harvesting. It soon became apparent that population assessment of littleneck clams was too time consuming if the data were to be representative of Jakalof Bay. Subsequently the department began a limited test dig program at Chugachik Island which is characterized by a single significant clam beach therefore simplifying the population assessment.

1993 Season Summary

Total 1993 hardshell clam harvest was 63,621 pounds hand-dug by 32 permit holders. Littlenecks comprised 100% of the hardshell catch (Table 3). Harvesting occurred in every month except in January when there was no catch and February when only one harvester dug clams. Although the remainder of the monthly catch was spread across the year, 57 percent of the total harvest came from the four month period of April through July. Chugachik Island provided 70 percent of the catch. Tutka and Jakalof Bays accounted for 9 and 20 percent of the harvest, respectively.

Blue mussel harvest for 1993 totalled 1,083 pounds taken by two diggers. The entire catch came from the Tutka, Jakalof and Kasitsna Bay area.

1994 Management Outlook

Board of Fisheries action on clam proposals, DEC beach certification, and clam abundance will all play a role in determining the 1994 Cook Inlet hardshell clam harvest.

The department is becoming increasingly concerned with the ability of the resource to sustain expanding commercial and recreational pressure. Although there are minimum sizes applicable to the commercial fishery, they only guarantee fishery dependence on recruitment into the legal segment of the stock. The department population estimate for legal clams on the Chugachik beach has declined from an estimate of 250,000 pounds in July of 1992 to 166,000 pounds in May of 1993. If fishing pressure and subsequently harvest rates continue to increase, the fishery may be dependant on annual recruitment, an event that can be highly variable for mollusks in Alaska.

Furthermore, the recreational user is becoming increasingly concerned about the escalation of commercial utilization of the littleneck clams and to a lesser extent the blue mussel resource. Not only is the recreational clam harvester interested in development in the commercial fishery, the public utilizing Kachemak Bay State Park are also worried about a decrease in the quality of their recreational opportunity.

In response to these concerns the staff has submitted proposals to the Board of Fisheries which serve as the basis of the department's management strategy for the hardshell clam fishery. First, DEC must certify additional beaches for commercial harvest. Thereafter, the key to the management plan is an alternate year commercial harvest strategy which opens half of the certified beaches on one year, and the other half during the following year. Other features of the plan will include the following commercial restrictions:

1) areas of high recreational value will be closed,

2) weekends will be closed from May 15 through September 15, and

3) a registration deadline of April 1.

If the aforementioned parts of the management strategy area adopted it will serve to spread the catch and effort over a larger area, allow for a year of unfished growth and recruitment, provide noninvasive recreational opportunity, and permit the department to anticipate effort.

The plan also includes two options for the Board to consider which affect the recreational users:

1) a minimum legal size for littleneck and butter clams of 1.5 and 2.5 inches, respectively (both of these are the same as the commercial size limits), and

2) a bag and possession limit of 1,000 littleneck clams and 700 butter clams.

These recreational fishery proposals will reduce waste of the resource, aid in maintenance of the reproductive segment of the stock, and most importantly allow for enforcement of commercial closures.

Fundamental to this plan is the expansion of the fishery, via additional certified areas. If the Board does not permit expansion, particularly into the likely productive beaches encompassed by Kachemak Bay State Park, then the department will severely restrict harvest on the remaining certified beaches in order to sustain a small commercial fishery. These restrictions may include:

1) A harvest quota for the remaining certified beaches based on the department's population estimate (Chugachik) and historical catch (Jakalof). A very negative aspect of a restrictive quota is the likelihood of underreported catch.

2) Monthly open periods which will include only the first 15 days of the month. This will allow for harvesting through one low tide cycle. This option, possibly in tandem with some total monthly closures, is the preferred option because it provides a small, but steady flow of clams to market, and does not motivate under or nonreporting of catch.

3) Establish an April 1 registration deadline which will allow the department to anticipate effort and plan additional restrictive management actions if necessary.

4) Continue to assess populations where possible and monitor cpue on a monthly basis. If meaningful declines are identified by either of these tools, then the fishery may be closed for the year.

5) Opening the remaining certified areas, Chugachik and Jakalof, on an every other year cycle is not a viable option because Jakalof would not meet minimal market demands by itself. Furthermore Jakalof provides harvesting opportunity for diggers from Seldovia who do not have access to substantial boats that will allow transportation to Chugachik.

The above mentioned alternate strategies will be further developed with public and advisory committee input.

SEA URCHINS

Introduction

The green sea urchin (Strongylocentrotus droebachiensis), the smallest of the commercial urchins, is the only urchin species in Cook Inlet which occurs in quantities sufficient to support a commercial fishery. Green urchins, and commercial fisheries for them, occur along the U.S. and Canadian coasts including the Province of British Columbia, the Maritime Provinces of Eastern Canada and the States of Maine and Alaska. Fisheries also occur in the north temperate and subarctic waters of Europe including the Soviet Union. Green urchins are harvested solely for their gonads, considered a delicacy in the Orient.

Although red urchins (Strongylocentrotus franciscanus) do occur in small, isolated beds within the Cook Inlet Management Area, their sparse abundance and distribution does not justify a commercial fishery; therefore, no permits are issued.

No commercial harvest for green urchins occurred in Cook Inlet prior to 1987. From 1988 to 1992 the harvest has ranged from 224 to 20,445 pounds of whole urchins. Catch and effort surged during the 1993-94 season when 195,403 pounds were taken by 29 divers (Table 10 and Figure 15).

By regulation each fisherman must obtain a Commissioner's Permit prior to harvesting urchins commercially. An additional regulatory requirement limits allowable methods of harvest to hand picking or the use of an abalone iron, both intended to minimize disruption of the substrate. Utilizing available published information on this species as well as the framework of current management practices for the red urchin in southeast Alaska, the department established

the following permit restrictions for green urchin harvest within Cook Inlet:

1) A minimum legal size of 2.0 inches measured across the test, which does not include the spines. The minimum size is intended to protect the broodstock and sufficient numbers of large urchins, which in turn may provide a canopy that helps protect the smaller urchins.

2) Permit duration from mid-September through mid-December, the time period when the gonads are fullest and therefore of highest market quality. The permit period may be extended past mid-December if recovery data are made available to the department.

3) Alternate year harvest strategy between that portion of Kachemak Bay east of Homer Spit and that portion west of the Spit, in order to reduce the probability of a recruits only fishery.

Although the historical harvest database is composed of only seven years, an alternate year pulse in catch can be detected. The years of low harvest or no effort are the result of the alternate year closure that includes China Poot Bay, which up to this point is the most productive bay for green urchins in Cook Inlet. It also appears that the urchins are capable of larger sizes in China Poot, and the gonads are of a high quality.

To this point, logistics have played a significant role in determining where urchin harvest occurs. Virtually all the fishing effort and all the reported harvest have come from Kachemak Bay. Since the season is during the fall/winter storm months, harvesting among the bays of the outer coast presents not only problems for the divers themselves, but also difficulty getting the urchins to market regularly. Timing of delivery to the processor is important

becasue urchin buyers are very particular regarding both recovery percentage and overall quality.

1993-94 Season Summary

Twenty nine divers harvested 195,403 pounds of whole green urchins during the months of October and December, 1993 and January, 1994. The product was purchased by three companies. That portion of the Kachemak Bay that includes China Poot Bay was open for the 1993-94 season. Initial diving effort occurred in October, but the results were not encouraging; both recovery and quality were not optimal. The season closed by emergency order on January 13 when diver interviews and a dockside sample indicated that the urchins were in the pre-spawn condition.

Permits expiring on February 28 were issued for the waters of outer Cook Inlet after the Kachemak Bay fishery closed. The department has no data regarding distribution, abundance and spawning timing for this area. Mandatory logbooks and close cooperation with the buyers and divers will allow the department to began assessing green urchin abundance in outer Cook Inlet.

1994-95 Management Outlook

As long as a strong market exists for urchin gonads, the harvest of these invertebrates is expected to generate a considerable amount of interest. The waters west of Homer Spit, which do not include China Poot Bay, will be opened by permit to commercial urchin fishing beginning September 15, 1994. All other waters of the management area, other than the area east of Homer Spit, will also be opened by permit. Historical harvest data do not indicate the potential of substantial commercial harvest. Worldwide green urchin growth data, however, demonstrate the probability that

substantial recruitment could have occurred since the last commercial fishery in these waters (1992-93).

All other permit restrictions in Cook Inlet will remain in effect for 1994. Season extensions will be determined, as in the past, on a case by case basis using the best available information.

SEA CUCUMBERS

Introduction

Prior to 1990, the Cook Inlet Management Area had no documented harvest history of the sea cucumber (Parastichopus californicus). In 1990 two divers harvested 22,525 pounds of cucumbers. The entire catch was taken from Sadie Cove in Kachemak Bay.

No information is available regarding the extent, distribution, or life history of this species in the management area. No regulations or harvest guidelines specific to the commercial harvest of cucumbers are in effect for Cook Inlet. In the absence of biological information, the limited fishery for this species is managed via Commissioner's Permit. The major provisions of the permit are mandatory logbooks, time and area restrictions.

Although sea cucumbers have been reported in Cook Inlet, particularly within Kachemak Bay, the limited commercial harvest as well as exploratory effort indicate that the stocks are neither dense nor extensive. There is another genus of sea cucumber, Cucumaria sp., which exists in noticeable abundance in portions of the Southern District. This animal however is of no commercial value.

1993 Season Summary

The 1993 cucumber harvest occurred during the months of November and December when six divers took 21,682 pounds from Sadie Cove. Exploratory effort in the remainder of Kachemak Bay and portions of outer Cook Inlet have not yielded harvestable quantities of sea cucumbers.

1994 Management Outlook

Based on recent exploratory dives by experienced divers, it does not appear that a significant fishery for sea cucumbers will occur in 1994. Permits will be issued if there is any commercial interest.

OCTOPUS

Introduction

The harvest of octopus in the Cook Inlet area has historically occurred incidentally to other directed fisheries such as the commercial Tanner crab, groundfish pot and trawl fisheries. Cook Inlet octopus harvest records are currently available only since 1983. Catches have ranged from 435 to 48,000 pounds with effort fluctuating from 8 to 41 boats (Table 11). The catch from the high harvest years was the result of bycatch. In the past five years increased interest has occurred in directing effort specifically towards octopus. Many different gear types have been tried but the resultant harvest has been negligible. Most of the effort has focused on Kachemak Bay.

There are no closed seasons or size limits for octopus at the present time, but a Commissioner's Permit is required prior to

fishing a given registration area. Cook Inlet permit restrictions include short permit duration (typically one to four months), stringent reporting requirements, and a detailed description of gear to be utilized. This last requirement prevents use of king, Tanner, Dungeness or shrimp pots in order to reduce or eliminate the probability of bycatch of those species.

1993 Season Summary

The total catch was 1,292 pounds taken by 5 fishermen. Directed fishing by three vessels resulted in a catch of 475 pounds, all taken within the waters of Kachemak Bay.

1994 Management Outlook

The high prices paid for octopus in recent years, publications promoting the potential octopus fishery in Alaska, and the attraction of an alternative fishery are all expected to produce a continued interest in octopus as a target species during 1994. The extent of this resource in Cook Inlet outside Kachemak Bay is undetermined and could ultimately affect any directed fishery. In the absence of an effective method of harvest, the Cook Inlet octopus catch is not expected to increase significantly in 1994 unless it is a result of bycatch from a groundfish pot or trawl fishery.

Table 1. Dungeness crab catch by year, Cook Inlet Management Area, 1961 - 1993.

Year	Southern district catch (lbs.)	Other districts catch (lbs.)	Total catch (lbs.)	No. of vessels	No. of landings
1961	193,683	0	193,683		
1962	530,770	0	530,770		
1963	1,665,599	11,605	1,677,204		
1964	417,005	6,036	423,041		
1965	74,211	0	74,211		
1966	12,523	117,037	129,560		
1967	7,168	0	7,168		
1968	484,452	3,407	487,859		
1969	49,894	0	49,894		
1970	209,819	0	209,819		
1971	97,161	0	97,161		
1972	38,930	0	38,930		
1973	308,777	1,271	310,048		
1974	718,729	2,514	721,243	38	619
1975	361,893	922	362,815	34	402
1976	118,903	395	119,298	19	123
1977	74,195	510	74,705	18	94
1978	1,212,571	3,208	1,215,779	49	668
1979	2,130,963	0	2,130,963	72	1,485
1980	1,875,281	0	1,875,281	54	1,183
1981	1,850,977	0	1,850,977	88	2,047
1982	818,380	505	818,885	108	2,310
1983	746,585	834	747,419	71	1,194
1984	799,638	570	800,208	102	1,687
1985	1,389,891	12,511	1,402,402	106	1,768
1986	550,968	12,894	563,862	83	1,069
1987	761,423	21,753	783,176	100	1,377
1988	677,334	41,941	719,275	84	1,305
1989	170,266	7,798	178,064	43	455
1990	28,938	564	29,502	23	112
1991	CLOSED	0	0	0	0
1992	CLOSED	Confidential	Confidential		
1993	CLOSED	Confidential	Confidential		

Note: Average catch 1978-1990 = 1.01 million pounds per year.

Table 2. Dungeness commercial catch east and west of Homer Spit, Southern District, Cook Inlet Management Area, 1978-1993.

Year	East of Spit Catch (lbs.)	East of Spit Vessels	West of Spit Catch (lbs.)	West of Spit Vessels
1978	107,470	21	1,105,101	54
1979	290,829	54	1,840,134	81
1980	375,056	44	1,500,225	61
1981	1,237,694	84	613,283	65
1982	636,789	100	181,591	71
1983	463,968	62	282,617	43
1984	563,659	82	235,979	65
1985	783,607	93	606,284	60
1986	249,183	57	301,785	34
1987	291,206	67	470,217	38
1988	426,531	55	250,803	39
1989	98,215	36	72,051	15
1990	10,495	18	18,433	10
1991[a]		Season Closed		
1992		Season Closed		
1993		Season Closed		
Average	425,746	59	575,269	49

[a] 1991-93 seasons not included in average.

Table 3. Shrimp catches from the Kachemak Bay trawl shrimp fishery in the Cook Inlet Management Area, 1969-1993.

Season	Number of vessels	Catch (lbs) Jun 1-Oct 31	Nov 1-Mar 31	Apr 1-May 31	Total
1969-70[a]	7	1,289,656	1,692,854	889,330	3,871,840
1970-71[a]	3	3,211,924	2,076,228	617,836	5,905,988
1971-72[a]	7	2,618,630	1,761,569	140,707	4,520,906
1972-73[a]	10	2,772,422	2,109,660		4,882,082
1973-74[b]	13	2,502,154	2,323,780		4,825,934
1974-75	4	2,512,764	2,519,148		5,031,912
1975-76	4	1,997,563	2,421,456		4,419,019
1976-77	5	2,545,885	2,453,101		4,998,986
1977-78	7	2,490,969	2,546,977		5,037,946
1978-79	6	2,952,733	3,060,066		6,012,799
		Jul 1-Sep 30	Oct 1-Dec 31	Jan 1-Mar 31	
1979-80	7	2,013,298	2,052,646	1,731,483	5,797,427
1980-81	15	1,780,298	2,691,746	1,704,706	6,177,129
1981-82	23	1,614,868	1,686,781	1,693,850	4,995,499
1982-83	15	998,522	1,012,388	1,009,857	3,020,767
1983-84	10	CLOSED	CLOSED	525,508	525,508
1984-85	10	519,651	528,506	518,529	1,566,686
1985-86	5	488,606	257,782	503,340	1,249,728
1986-87	3	504,206	CLOSED	CLOSED	504,206
1987-88	0	CLOSED	CLOSED	CLOSED	0
1988-89	0	CLOSED	CLOSED	CLOSED	0
1989-90	0	CLOSED	CLOSED	CLOSED	0
1990-91	0	CLOSED	CLOSED	CLOSED	0
1991-92	0	CLOSED	CLOSED	CLOSED	0
1992-93	0	CLOSED	CLOSED	CLOSED	0
1993-94	0	CLOSED	CLOSED	CLOSED	0

[a]Catches listed for comparative purposes by seasons established in 1973.

[b]June 1 - October 31 and November 1 - March 31 seasons with respective guidelines established.

Table 4. Trawl shrimp catches in Outer Cook Inlet (Area G), Cook Inlet Management Area, 1977-93.

Season	Number of vessels	Catch (lbs.)
1977-78	2	26,556
1978-79	1	1,245
1979-80	0	0
1980-81	1	4,000
1981-82	2	19,454
1982-83	4	239,584
1983-84	7	760,430
1984-85	11	1,957,959
1985-86[a]	4	421,063
1986-87	2	297,762
1987-88	1	22,231
1988-89	1	4,878
1989-90	0	0
1990-91	0	0
1991-92	2	CONFIDENTIAL
1992-93	2	CONFIDENTIAL
1993-94	2	CONFIDENTIAL

[a] Regulatory season of 1 June through 28 February adopted by the Alaska Board of Fisheries in spring, 1985.

Table 5. Pot shrimp harvest Cook Inlet Management Area, Area H, 1969-93.

Season	Catch (lbs.) Jun 1 - Sep 30		Oct 1 - May 31		Total	Vessels
1969-70						
1970-71	3,606		7,602		11,208	
1971-72	8,836		70,601		79,437	
1972-73	75,247		184,230		259,477	
1973-74	63,181		738,165		801,346	
1974-75	43,650		126,472		170,122	
1975-76	100,765		273,758		374,523	
1976-77	52,115		199,559		251,674	26
1977-78	85,511		511,938		597,449	51
1978-79	49,080		121,234		170,314	41
1979-80	59,963		177,927		237,890	49
	Jun 1 - Sep 15 Vessels		Nov 1 - Dec 31 Vessels		Feb 1 - Mar 31 Vessels	
1980-81	74,368		134,275		104,716	313,359	30
1981-82	56,092		47,859		49,885	153,836	45
1982-83	54,153		49,130		52,339	155,622	40
1983-84	21,438		CLOSED		CLOSED	21,438	15
1984-85	25,874		28,151		22,080	76,105	22
	Jun 1 - Sep 15 Vessels		Oct 1 - Dec 31 Vessels		Feb 1 - Mar 31 Vessels	
1985-86	27,312		20,737		24,048	72,097	25
1986-87	24,844	18	20,188	11	30,257	19	75,289	37
1987-88	26,216	26	5,416	8	CLOSED	31,632	30
1988-89	5,323	9	CLOSED		CLOSED	5,323	9
1989-90	CLOSED		CLOSED		CLOSED	0	
1990-91	CLOSED		CLOSED		CLOSED	0	
1991-92	CLOSED		CLOSED		CLOSED	0	
1992-93	CLOSED		CLOSED		CLOSED	0	

Table 6. Pot shrimp catch and effort in Outer Cook Inlet (Area G), Cook Inlet Management Area, 1977-93.

Season	Number of vessels	Catch (lbs.)
1977	6	1,776
1978	11	10,157
1979	5	4,211
1980	3	2,911
1981	5	2,031
1982	7	2,805
1983	13	18,679
1984	5	5,504
1985	6	3,305
1986	4	2,967
1987	9	12,458
1988	7	13,445
1989[a]	8	20,500
1990	5	8,853
1991	8	7,315
1992	3	2,804
1993	3	8,356

Average = 7,534

Table 7. Pacific weathervane scallop catches, Cook Inlet Management Area, 1983-93.

Year	District	Number of vessels	Catch (lbs) of shucked meats
1983	Kamishak	1	2,346
1984	Kamishak	3	6,305
1985[a]	Kamishak	1	11,810
1986	Kamishak	3	15,364
1987	Outer	1	1,128
	Kamishak[b]	2	360
	'87 Total	2	1,488
1988	NO EFFORT		
1989	NO EFFORT		
1990	NO EFFORT		
1991	NO EFFORT		
1992	NO EFFORT		
1993	Kamishak	3	20,115

[a]Season and harvest guideline set by regulation.

[b]Season closed by E.O. on August 21, 1987, one week after opening, due to low cpue.

Table 8. Harvest of hardshell clams, Cook Inlet Management Area, 1986-93.

Year	No. of permits	No. of landings	Pacific little necks	Butter clams	Cockles	Total pounds
1986	5	18	17,303	0	0	17,303
1987	8	69	12,214	206	2,347	14,767
1988	2	32	14,449	0	0	14,449
1989	9	41	2,584	13,675[a]	3,581[b]	19,840
1990	19	62	35,744	0	0	35,744
1991	19	78	47,586	85	0	47,571
1992	21	117	54,631	0	0	54,631
1993	33	159	63,676	0	0	63,676

[a] Includes 13,348 pounds sold as otter food as a result of *Exxon Valdez* oil spill.

[b] Includes 1,981 pounds sold as otter food as a result of *Exxon Valdez* oil spill.

Table 9. Harvest of blue mussels, Cook Inlet Management Area, 1986-93.

Year	No. of permits	No. of landings	Blue mussel total pounds
1986	0	0	0
1987	1	2	102
1988	0	0	0
1989	9	98	167,243[a]
1990	2	10	CONFIDENTIAL
1991	3	11	16,485
1992	3	11	2,501
1993	2	4	1,083

[a]Includes 165,268 pounds sold as otter food as a result of *Exxon Valdez* oil spill.

Table 10. Green sea urchin harvest, Cook Inlet Management Area, 1987-93.

Year	No. of divers	Total pounds
1987	1	224
1988	N O	E F F O R T
1989	1	15,181
1990	N O	E F F O R T
1991	4	20,445
1992	7	6,119
1993	29	195,403

Table 11. Octopus harvests in the Cook Inlet Management Area (H) 1983-93.

Year	No. of vessels	No. of landings	Total pounds
1983	41	101	32,841[a]
1984	36	77	46,698[a]
1985	40	70	48,067[a]
1986	8	16	435
1987	21	57	4,512
1988	17	43	5,569
1989	N O	R E P O R T E D	L A N D I N G S
1990	3	6	1,343
1991	8	21	2,088
1992[b]	22	55	7,447
1993	5	8	1,292

[a] Bycatch from shellfish pot fisheries.

[b] Bycatch from groundfish fisheries 1992.

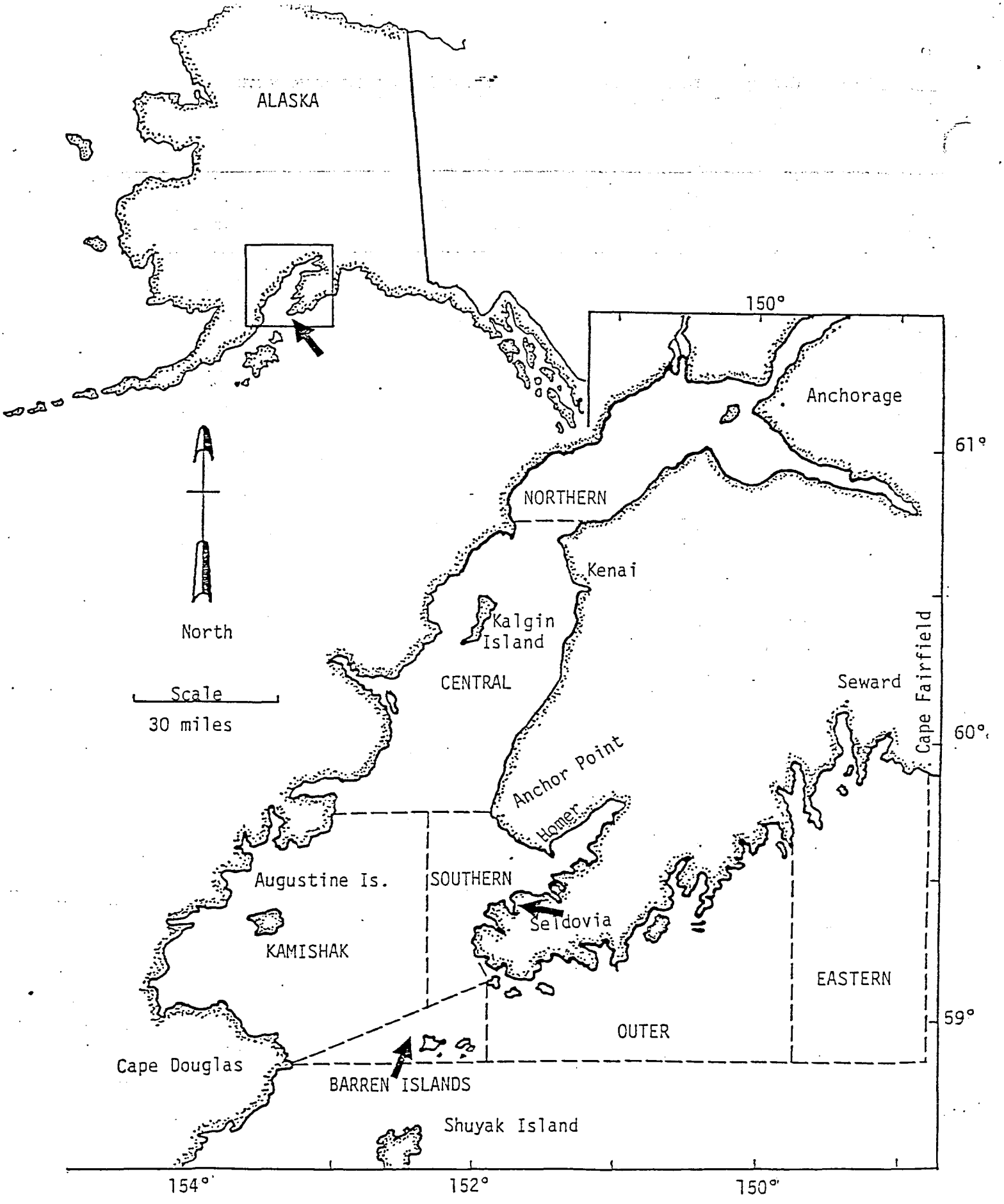

Figure 1 . Cook Inlet area district location chart.

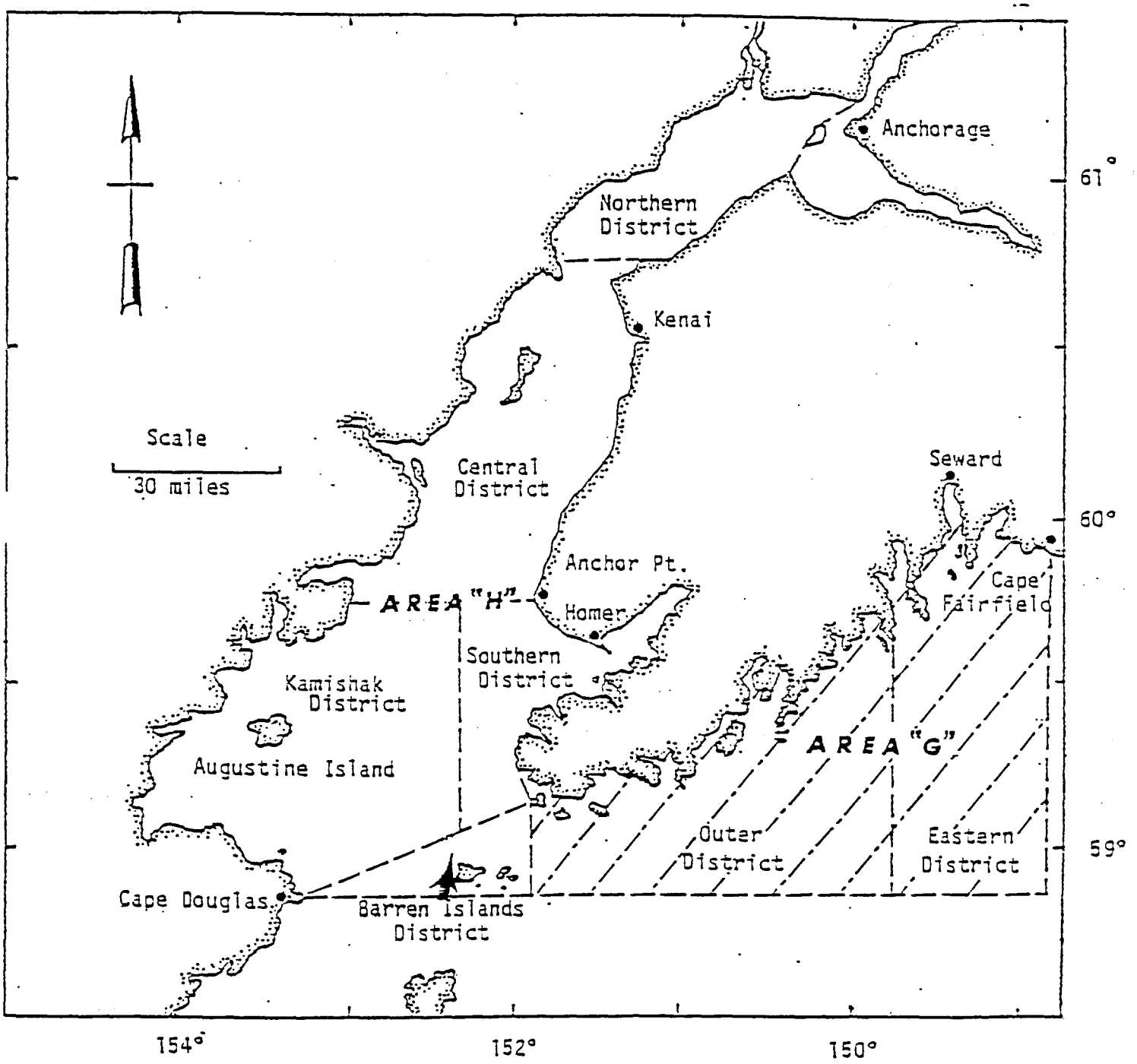

Figure 2. Cook Inlet Area ("H") and Outer Cook Inlet Area ("G") district location chart for shrimp management.

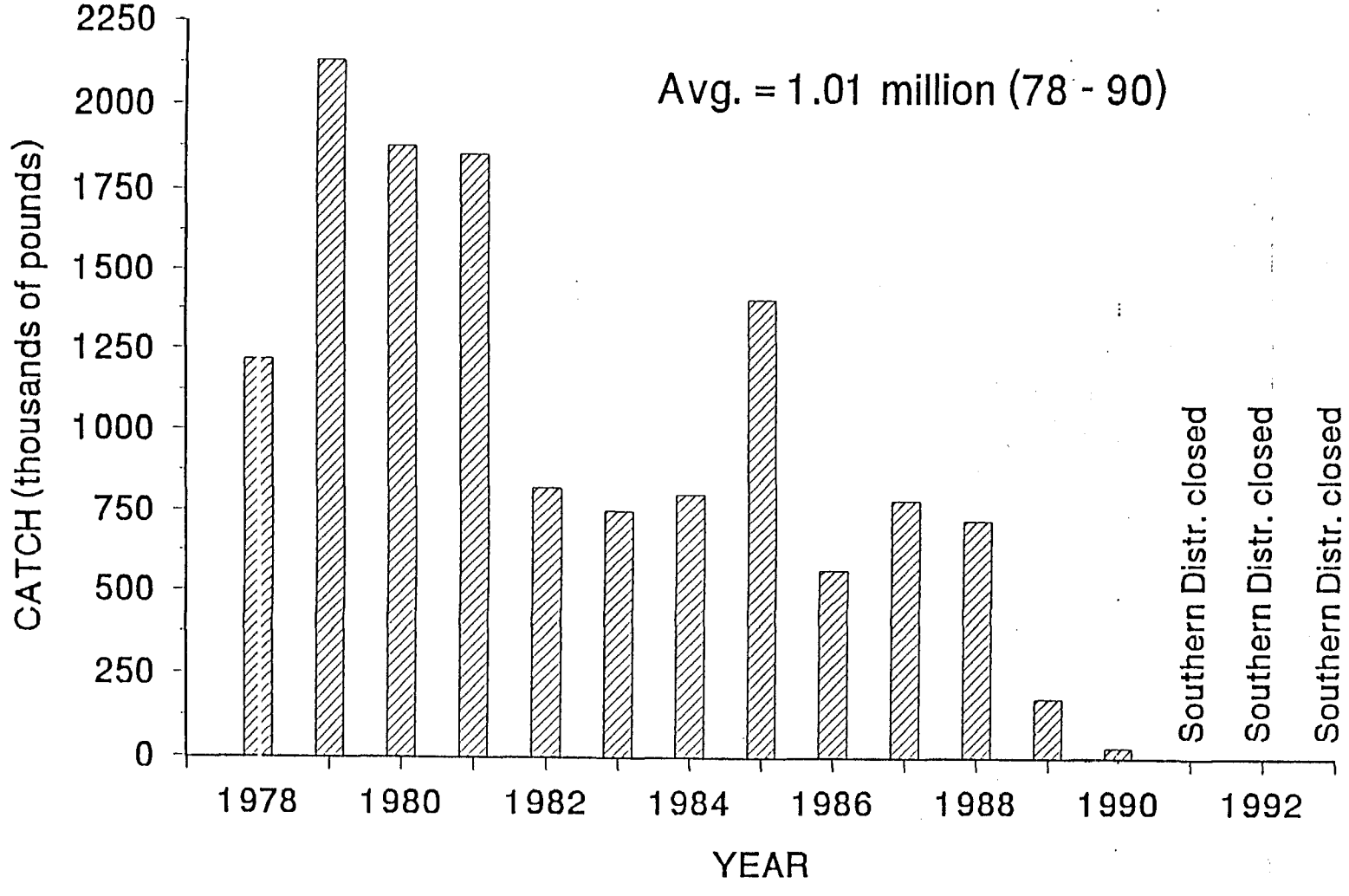

Figure 3. Dungeness crab catch by year, Cook Inlet Mgt. Area, 1978 - 1993

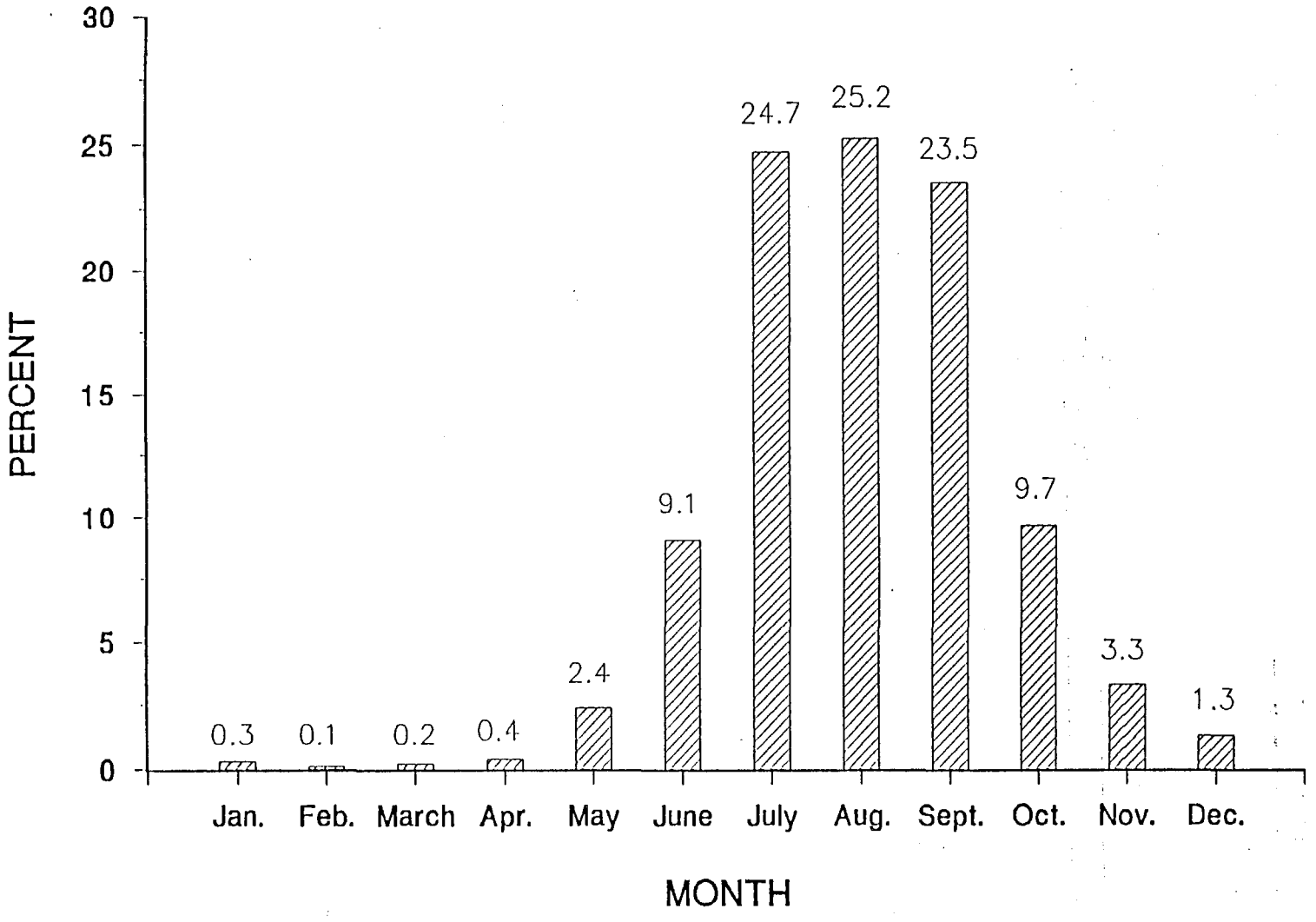

Figure 4. Dungeness crab catch (percent) by month, Cook Inlet Mgt. Area, 1978 - 1990.

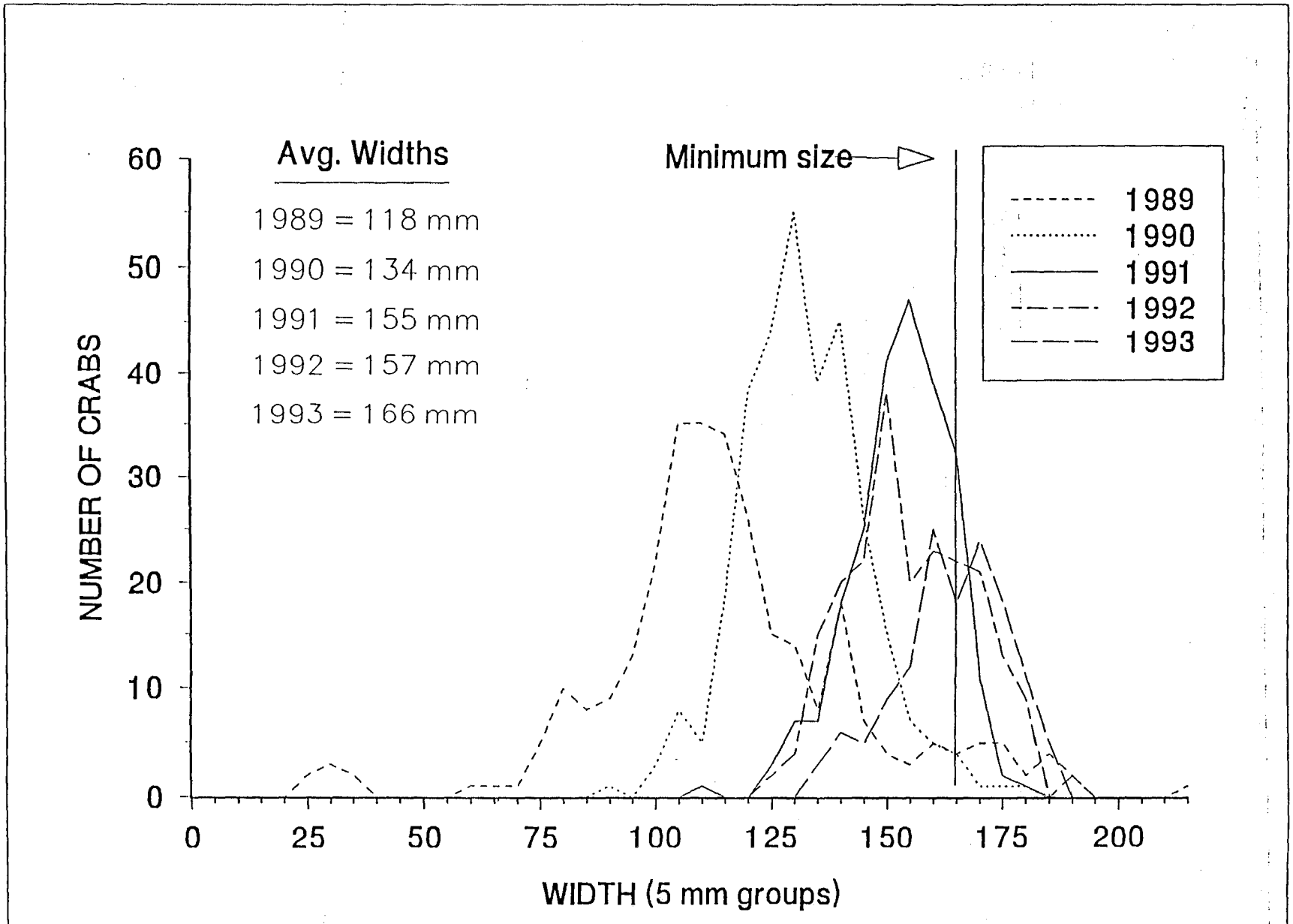

Figure 5. Male Dungeness catch, 1989 - 93, Southern Distr. trawl survey.

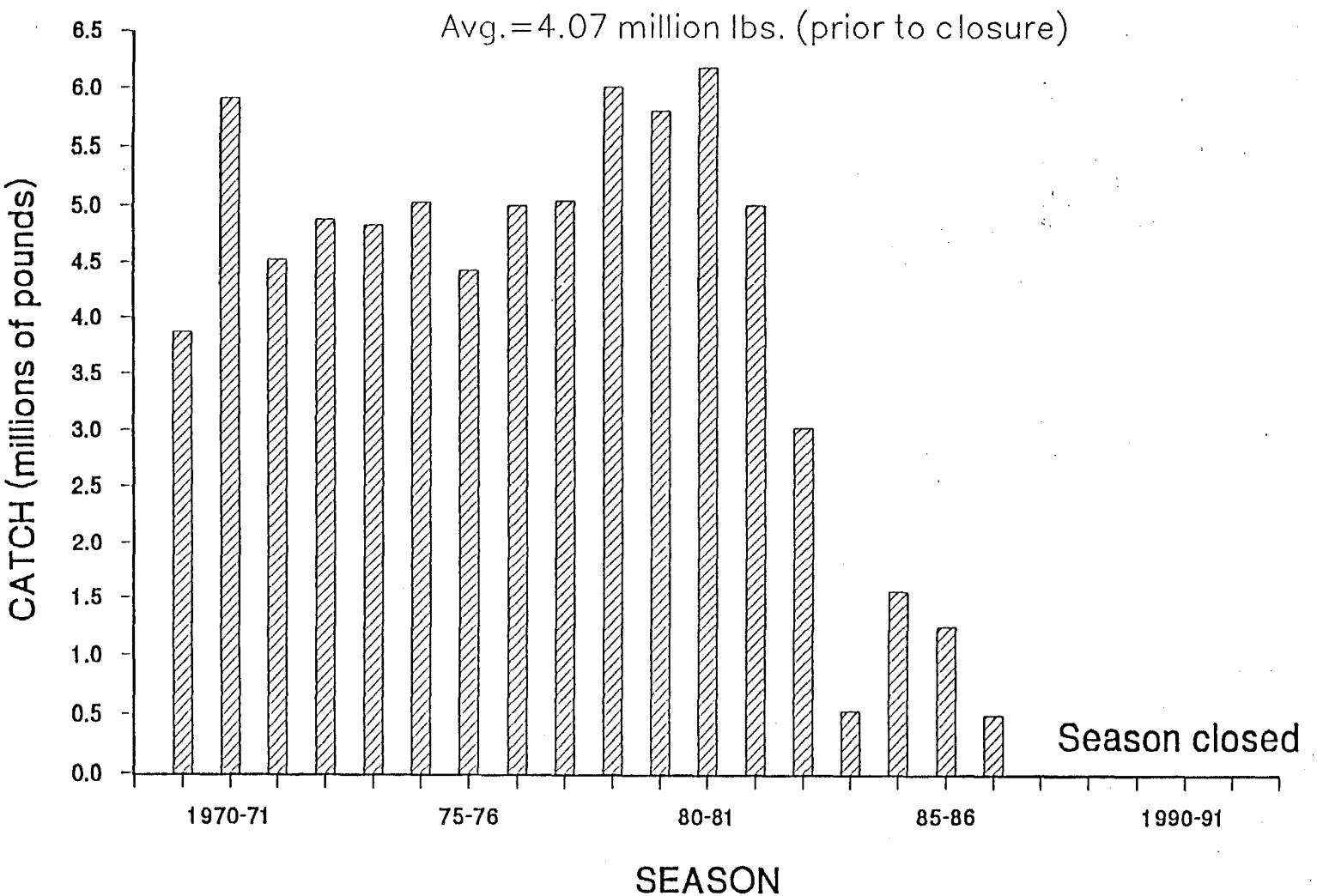

Figure 6. Trawl shrimp catch by season, Kachemak Bay, Cook Inlet Mgt. Area (H), 1969-93.

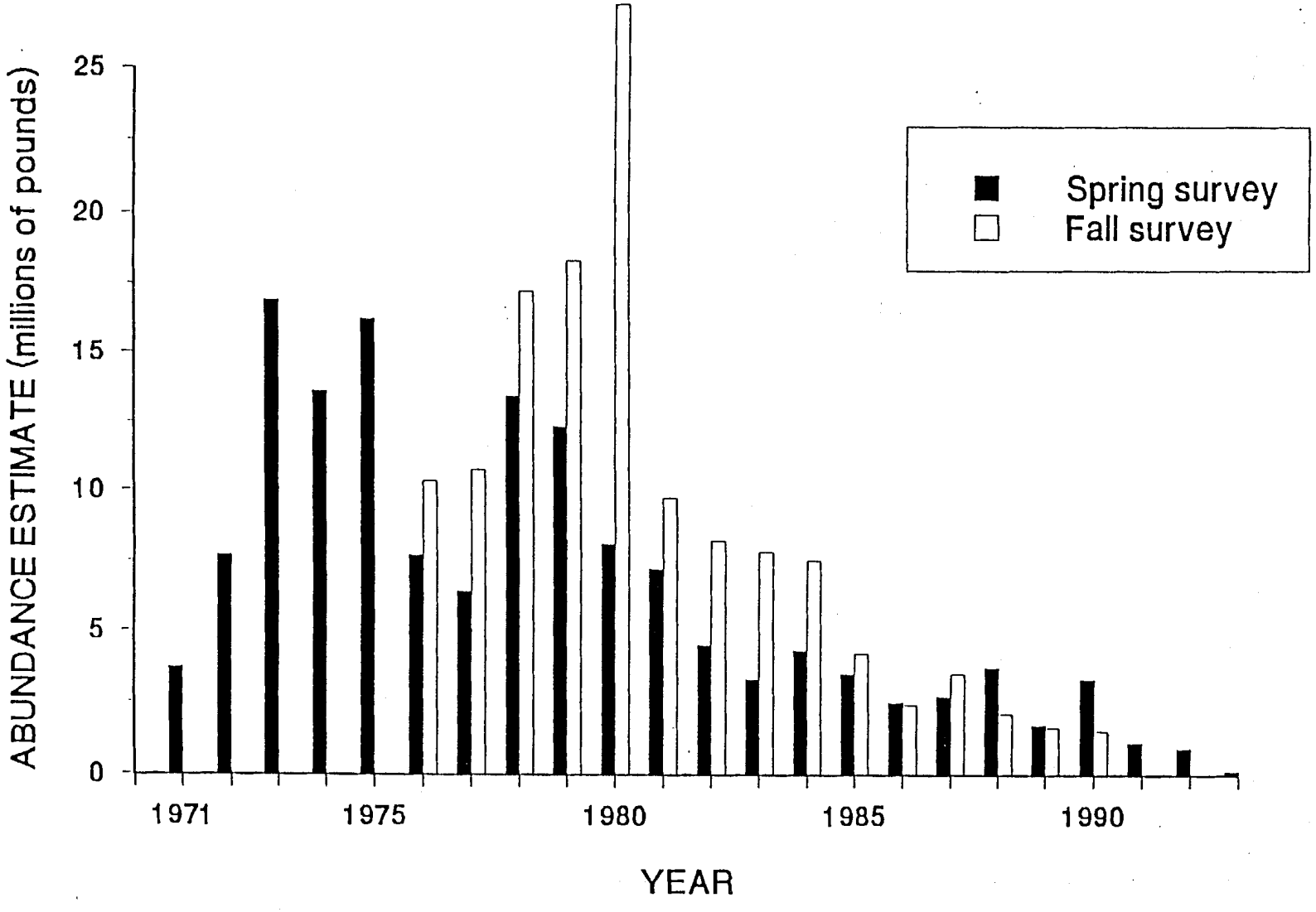

Figure 7. Pandalid shrimp population est., Kachemak Bay trawl shrimp survey, Cook Inlet Management Area, 1972-93.

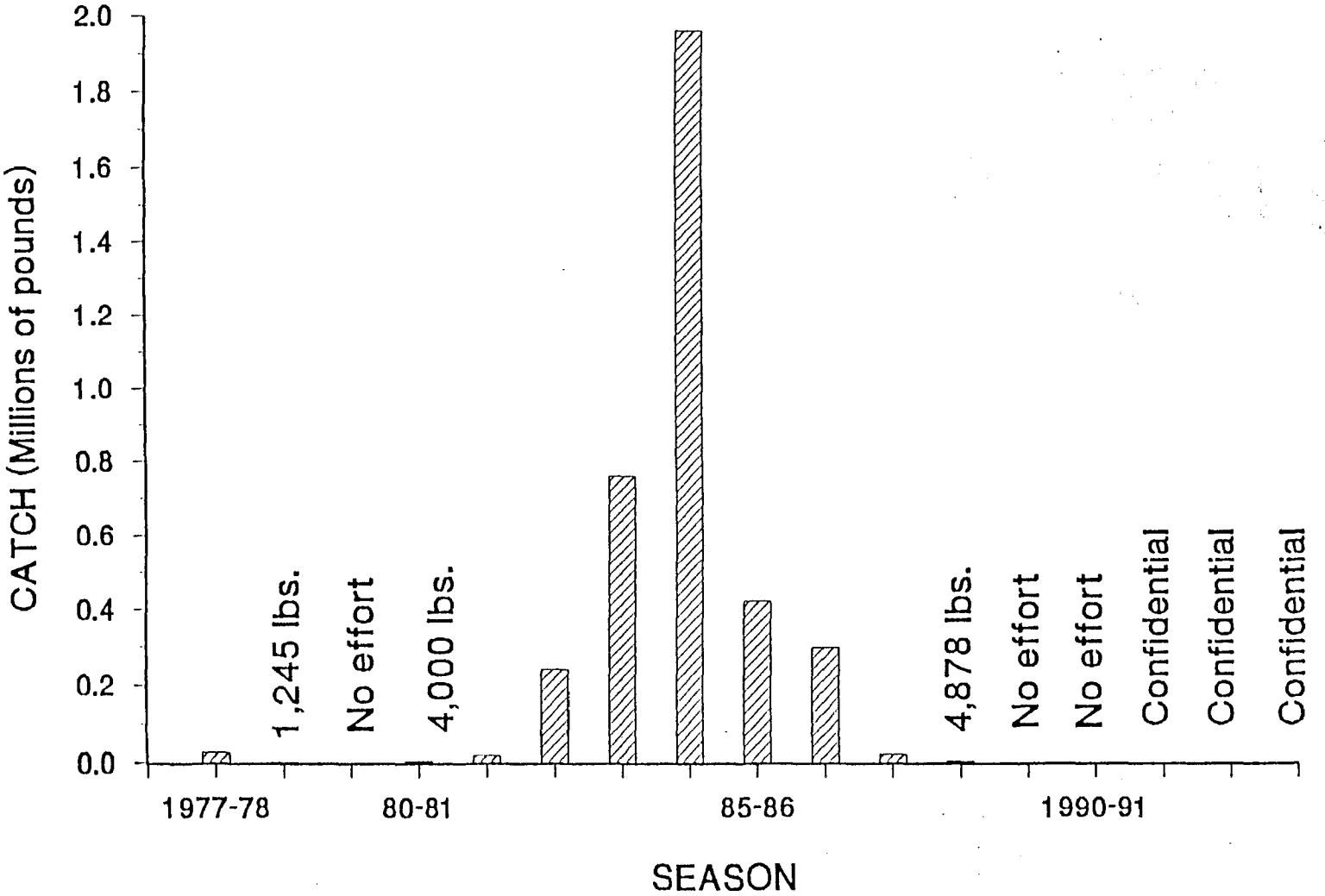

Figure 8. Trawl shrimp catch by season, Outer Cook Inlet, Cook Inlet Mgt. Area (G), 1977-1993

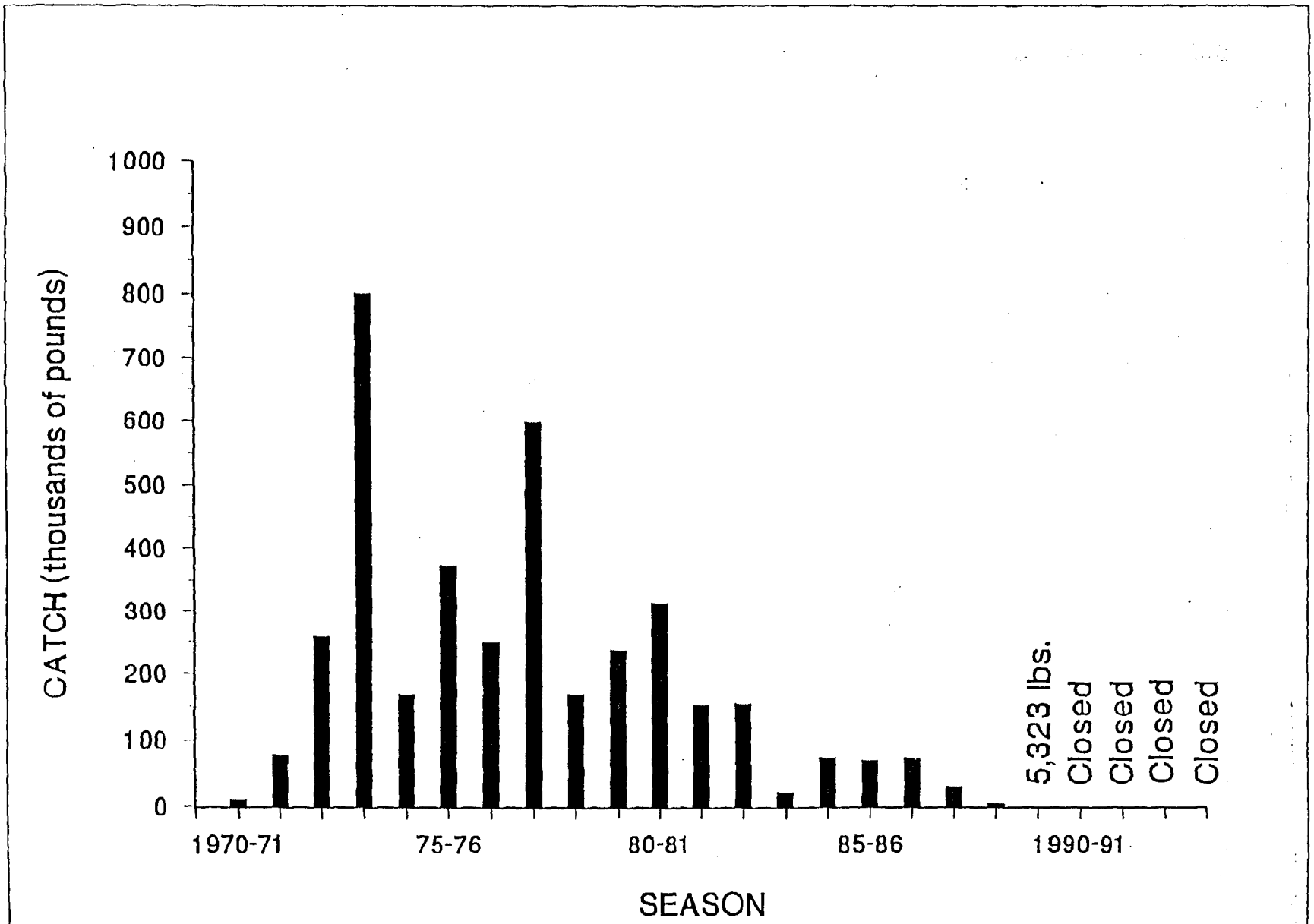

Figure 9. Pot shrimp catch by season, Kachemak Bay, Cook Inlet Mgt. Area (H) 1970-93

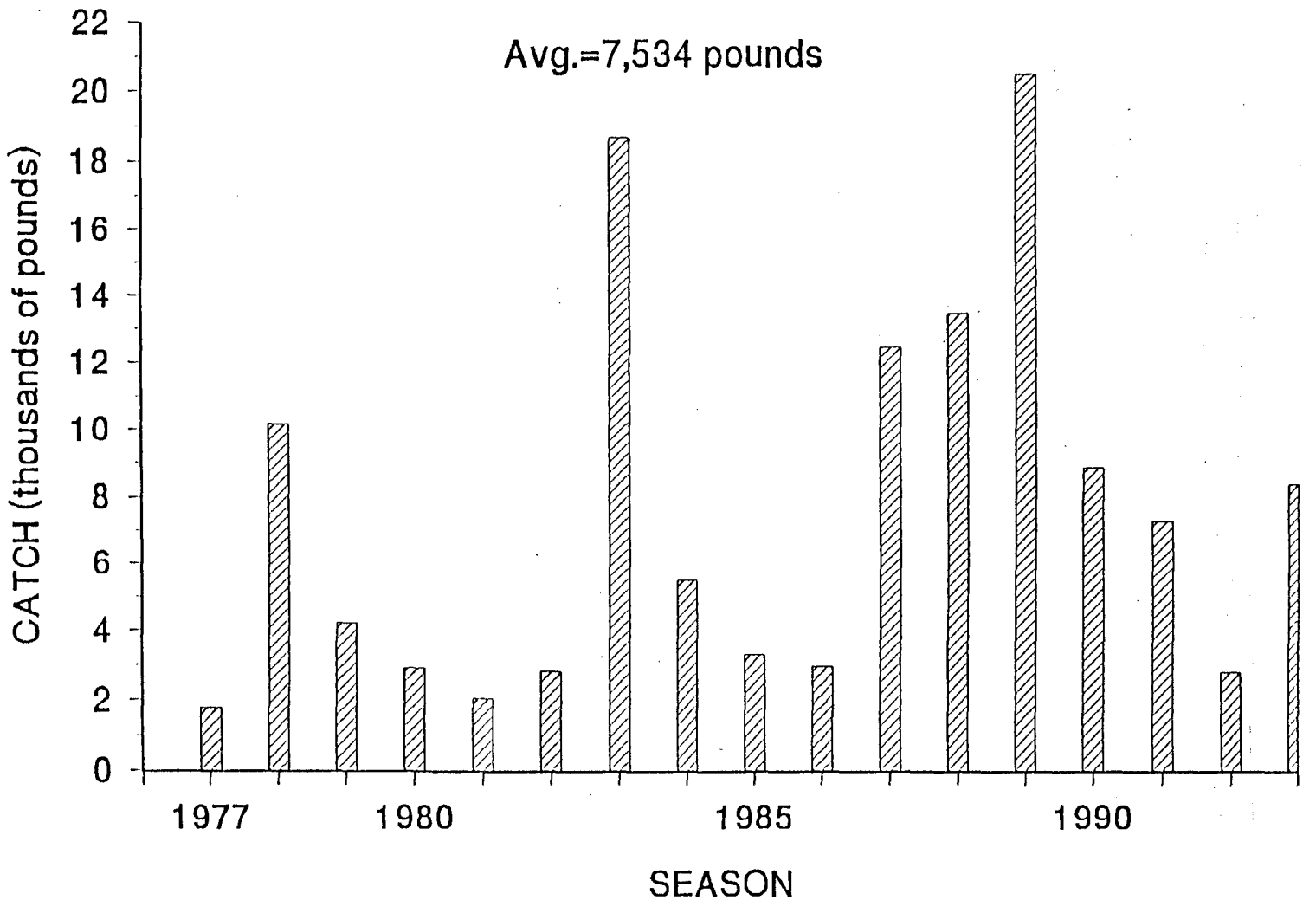

Figure 10. Pot shrimp catch by season, Outer Cook Inlet, Cook Inlet Mgt. Area (G), 1977-93.

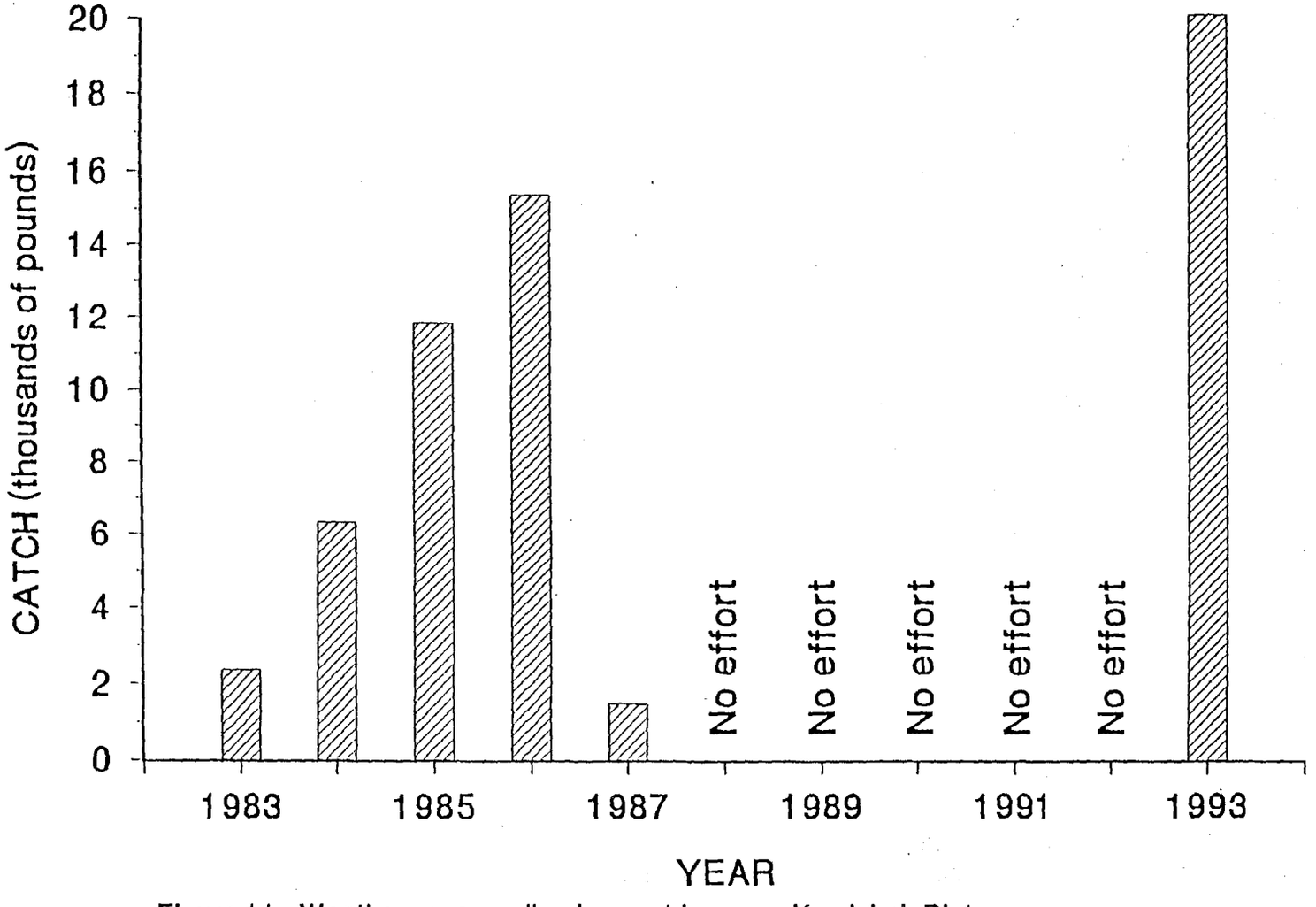

Figure 11. Weathervane scallop harvest by year, Kamishak Distr., Cook Inlet Management Area, 1983-1993.

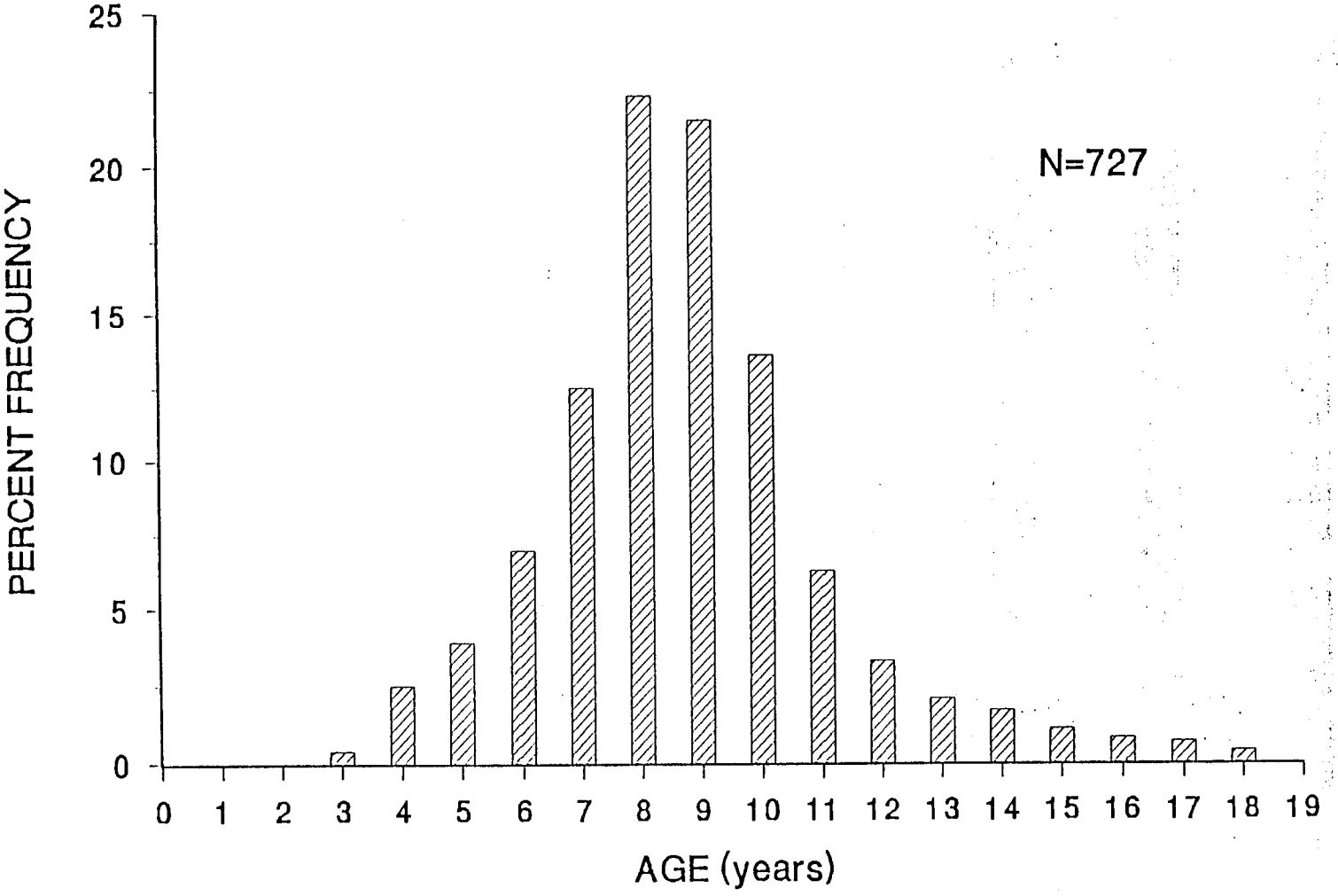

Figure 12. Commercial catch size freq., 1993 Kamishak Distr. weathervane scallop fishery.

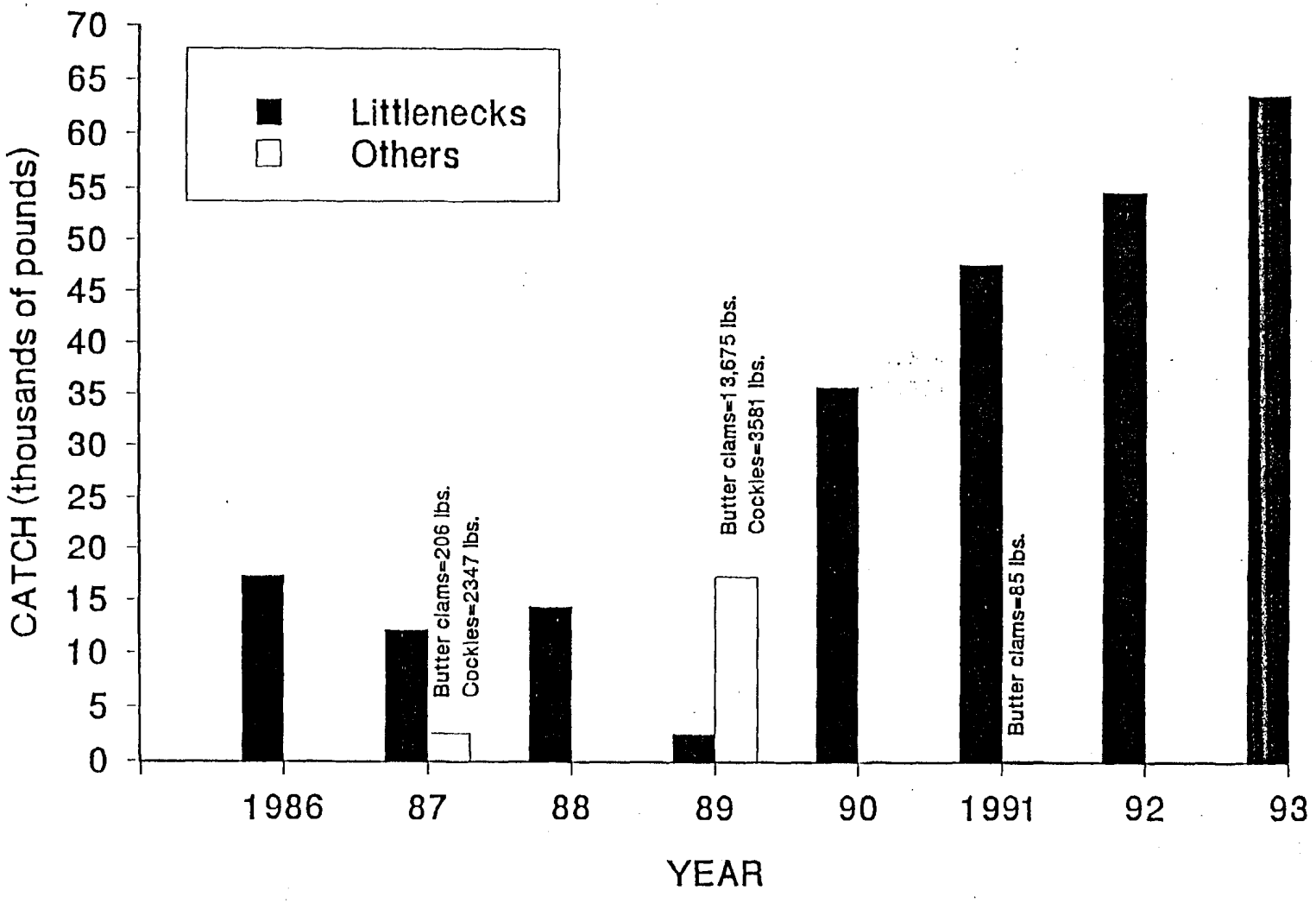

Figure 13. Hardshell clam harvest, Cook Inlet Management Area, 1986-93.

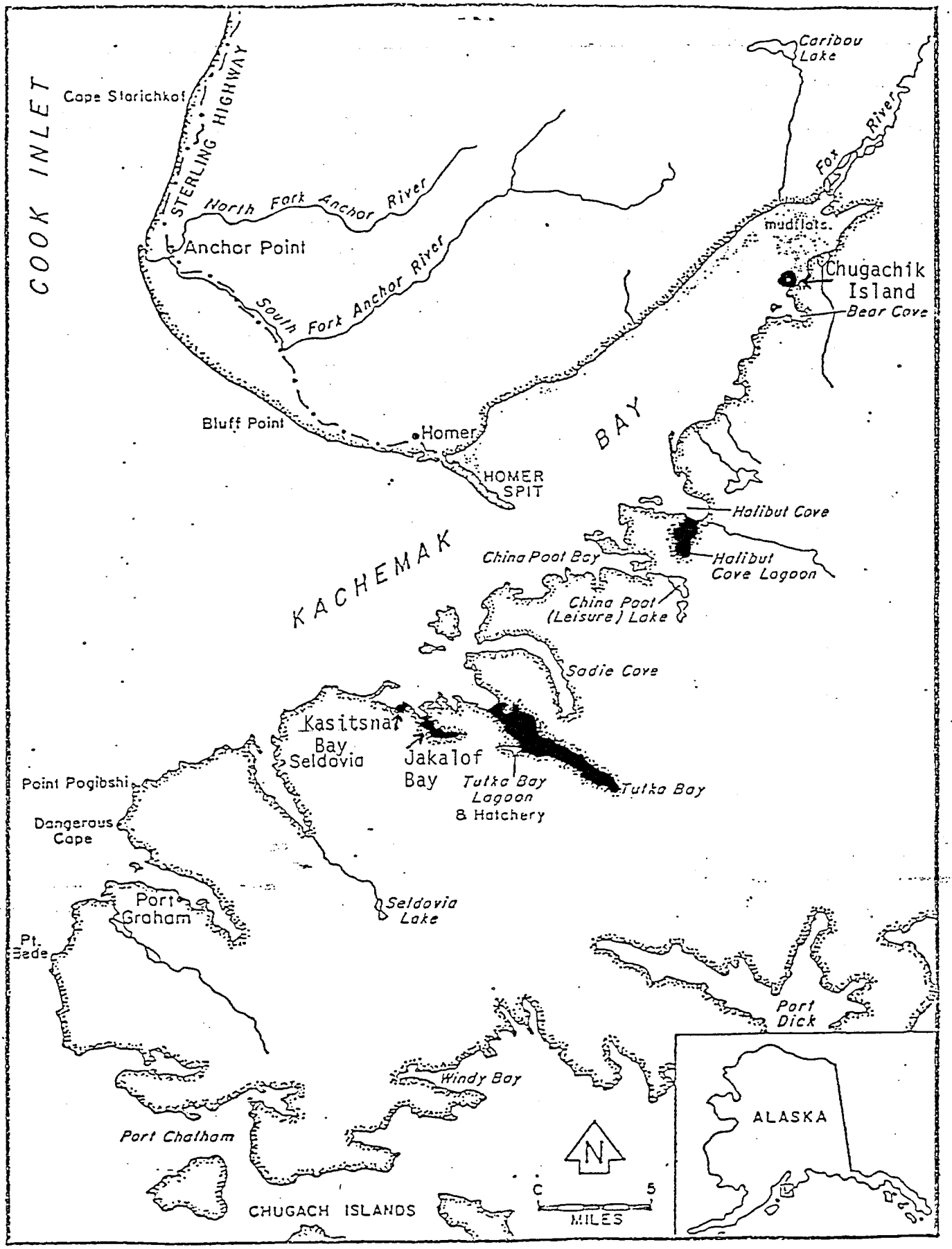

Figure 14. DEC certified commercial clam beaches, 1993.

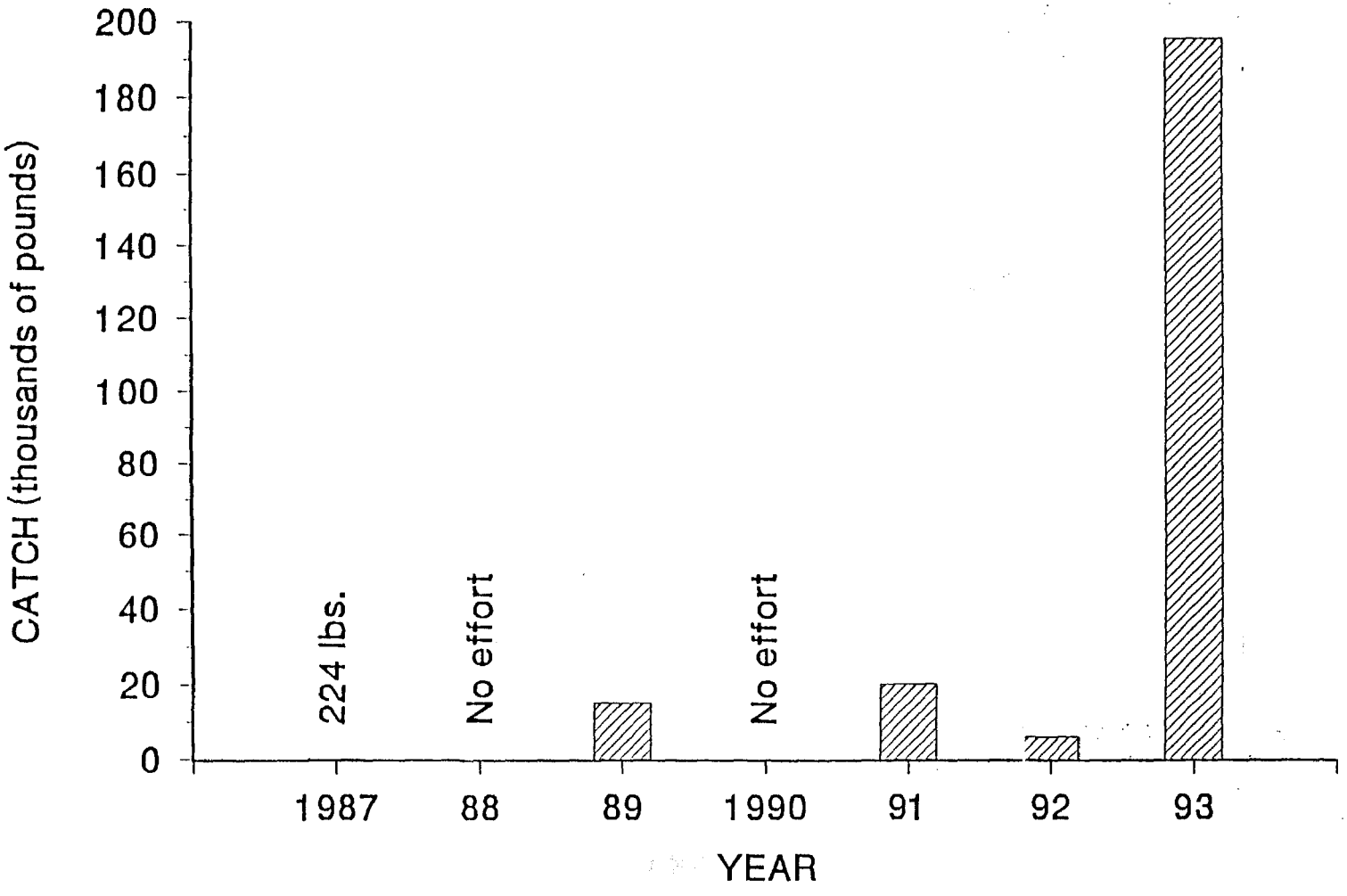

Figure 15. Green sea urchin harvest, Cook Inlet Management Area, 1987-93.