KODIAK, CHIGNIK AND SOUTH PENINSULA SHRIMP FISHERIES AND THEIR MANAGEMENT: A REPORT TO THE ALASKA BOARD OF FISHERIES

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ABSTRACT

This report summarizes Kodiak, Chignik, and South Peninsula District shrimp fishery history and management information for the Alaska Board of Fisheries (BOF). *Pandalid* shrimp species supported major commercial fisheries around Kodiak Island and along the south side of the Alaska Peninsula from 1958 to the early 1980s. Harvests taken primarily by trawl gear averaged 115 million pounds per year during the peak period from 1973 to 1977. Stock abundance and fisheries landing declined sharply in the early 1980s. Little commercial activity has occurred since that time. A management strategy developed in 1979 utilized trawl survey results as the data source for harvest level determination. Trends in stock abundance were compared to a representative biomass index (RBI), which was defined as the mean abundance estimate obtained after initial exploitation but prior to an abundance decline. The strategy defines three levels of stock strength and establishes harvest rates ranging from zero to 40% of the survey index.

Shrimp surveys were conducted in 2001 and 2002. Shrimp population estimates exceeded minimum acceptable biomass indices (MABI) required to open fishing in only two of the shrimp fishing sections. Wide Bay and Marmot Bay survey results exceeded the threshold, but did not open to fishing due to non-pelagic trawl closures. There are nine regulation change proposals concerning shrimp in the Kodiak, Chignik, and South Peninsula Districts for the BOF to consider during the March 2003 BOF meeting.

INTRODUCTION

Shrimp has been commercially harvested around Kodiak Island since 1958 and along the south side of the Alaska Peninsula since 1968. Total landings averaged more than 50 million pounds per year during the 1960s and 1970s. The northern pink shrimp (*Pandalus borealis*) comprised greater than 85% of the catch, but humpy shrimp *P. goniurus*, coonstripe shrimp *P. hypsinotus*, and sidestriped shrimp *Pandalopsis dispar* all made significant contributions to the harvest, which was primarily taken with trawl gear (Gaffney 1981). Other shrimps taken incidentally include several species from the families *Crangonidae* and *Hippolytidae*. Spot shrimp *P. platyceros* and coonstripe shrimp have occasionally been the target of minor pot fisheries. Little activity for trawl shrimp has occurred since 1982 as stock abundance and fisheries declined sharply with changing oceanographic conditions (Anderson 2000). Recent trawl surveys have shown some increase in shrimp abundance since the 1990s (Ruccio 2002).

Kodiak, Chignik, and South Peninsula are districts of Registration Area J and include Pacific Ocean waters extending from the latitude of Cape Douglas west of the longitude of Cape Fairfield and east of the longitude of Cape Sarichef (Figure 1). Thirty-six sections are described in regulation for management purposes (Figures 2-4).

HISTORY

Trawl Shrimp Fishery

The Kodiak trawl shrimp fishery began with a harvest of 31,886 pounds in 1958 when a processor installed 3 shrimp peeling machines (Jackson 1968). Also in 1958, the United States Department of the Interior, Bureau of Commercial Fisheries exploratory vessel, John N. Cobb, discovered areas with sufficient biomass of shrimp for commercial fisheries in some bays of Kodiak Island (Beals 1965). Subsequent annual catches progressively increased although activity slowed when shore plants and the fishing fleet were badly damaged by the 1964 earthquake and tidal wave. Kodiak District harvests peaked at 82.2 million pounds in 1971 (Table 1). As Kodiak shrimp catches declined in the 1970s, much of the vessel effort shifted into the Chignik and South Peninsula Districts. The highest harvest from the Chignik District occurred in 1973 when 51.6 million pounds were landed (Table 2). Some processing facilities close to the fishing grounds were also developed in the Shumigan Islands. Harvests from the South Peninsula District reached 4.3 million pounds in 1970 and peaked at 45 million pounds in 1977 (Table 3).

During the early years of the fishery the primary vessel type was a 50 to 70 foot herring seiner rigged to fish a single West-coast style trawl with a 60 to 90 foot headrope. Gulf of Mexico style double-rigged vessels first appeared in 1970. Within 3 years nearly half the fleet were vessels 70 to 100 feet in length equipped to fish 2 otter trawls simultaneously (Jackson 1983). In addition, a few smaller vessels operated beam trawls.

Stock abundance and fisheries declined sharply in the late 1970s. Factors that may have been related to the decline include an increase in Gulf of Alaska (GOA) ocean temperature and increases in shrimp predator populations. Pacific cod *Gadus macrocephalus* stocks were notably

increasing in nearshore areas. Declines in shrimp population abundance in both fished and unfished areas suggested that fishing mortality played a limited role in the population decrease.

No commercial activity occurred in the South Peninsula District after 1979. In that year a little over 3 million pounds were landed primarily from Pavlof Bay. The Chignik District produced 12 million pounds in 1980 and only 70,000 pounds the following year. No commercial activity has occurred in the District since that time.

The Kodiak District harvest declined to 10 million pounds in 1982 and then to less than 3 million pounds the following 2 years. Some commercial activity has continued in the Kodiak District since 1985. In some years, up to 4 vessels registered for shrimp fishing and operators explored the General Section, which remained open. Little production resulted with total harvest averaging less than 10,000 pounds per year from 1986 to 2002. In most years less than 3 vessels participated so the catch data remains confidential. One vessel trawled for shrimp in 2002, with the majority of the harvest sold unprocessed off the docks in Kodiak and Homer. Since 1998, 4 vessels made 24 landings for a total of 35,259 pounds (Table 1).

Pot Shrimp Fishery

Pot fishing for shrimp has been recorded since 1969 in the Kodiak District but it has never been a large fishery. No pot effort has occurred in other districts of the Westward Region. The largest harvest was 18,686 pounds of mostly spot shrimp tails in 1983 (Table 4). During most years, less than 3 vessels participated so the harvest data remains confidential. Occasionally, coonstripe shrimp have also been targeted. The total harvest of shrimp with pot gear from the Kodiak District since 1969 was 96,000 pounds of shrimp tails. Much of the historic catch came from the North and West Afognak Island Sections.

MANAGEMENT STRATEGY

No regulatory measures were promulgated in the Kodiak trawl shrimp fishery until 1970, when an egg hatch closure was enacted during March and April for some bays and nearshore areas. In 1971, a quarterly quota system was adopted to provide product throughout the year while not allowing unrestricted harvest. In the late 1970s, the quarterly quota system was reduced to a single opening for certain areas and staggered opening dates for many of the fishing sections. Other sections retained two fishing periods in fall and winter. Most of the adjustments to season dates were a reflection of industry desire to spread harvest out over a longer time period while trying to prevent conflicts with vessels and processing in other fisheries. Increased utilization of Westward Region shrimp stocks between 1970 and 1978 resulted in additional research effort directed at monitoring stock strength and condition. The Alaska Department of Fish and Game (ADF&G) conducted a voluntary logbook program beginning in 1967. Catch per unit effort (CPUE) data provided information on stock strength and condition. Harvest levels based on historic production and adjusted for pronounced CPUE fluctuations were used to manage fisheries from 1972 to1978. Unfortunately, CPUE often masked stock declines due to increased gear efficiency (Miller and Gaffney 1979).

ADF&G initiated shrimp stock assessment surveys in 1970 to provide directly comparable stock abundance indices and monitor recruitment, growth, and the effects of fishing on the population age structure. A management strategy developed in 1979 directly utilized survey results as the primary data source for harvest level determination. Harvest levels were based on proportions of abundance index thresholds. Successive indices for a given stock were shown to track abundance fluctuations in relative abundance over time (Jackson 1979). The management goal was to achieve maximum harvests without affecting reproductive potential. The strategy was based on trends in stock abundance relative to a Representative Biomass Index (RBI). This level is defined as the mean abundance estimate obtained after initial exploitation but prior to the abundance decline. It was thought that recovery to this level could reasonably be expected. Based on the RBI, a second level called the Minimum Acceptable Biomass Index (MABI) was established at 40% of the RBI level. The strategy defined three categories of stock strength based on RBI and MABI levels and established different harvest rates for each (Figure 5).

Exploitation rates for stable stocks above the RBI level were set at 25%-40% of abundance estimates. Stocks for which abundance estimates remained above the MABI level but less than RBI were considered depressed and a exploitation rate of 15%-25% was applied to promote rebuilding. Stocks for which abundance levels were less than 40% of the RBI or the prescribed MABI were considered severely depressed and no fishing was allowed. The management plan detailed biomass levels in pounds of Pandalid shrimp for 26 fishing sections (Table 5).

Estimates from surveys conducted in the fall were found to be less variable due to shrimp distribution and availability. It was noted that indices of abundance were less than true population estimates due to of survey gear efficiency and untrawlable habitat. Actual exploitation rates for the total shrimp population were thought to be proportionally less than the rates prescribed in the harvest strategy.

Parameters such as growth, reproductive success, egg clutch size, age composition and recruitment were also considered by ADF&G when setting harvest levels. The strategy provided harvest goals for multiple openings within a fishing season that generally did not exceed target harvest rates. The plan stated that unsurveyed or sporadically surveyed stocks and areas were managed on fishing performance combined with historic harvest data where available. The system was flexible during development, but in 1981 the industry demanded a formally defined plan. This led to the Westward Region Shrimp Management Plan, which was approved by the Board of Fisheries in 1982 (Jackson 1983). The objectives of the plan were to maintain shrimp stocks at RBI levels as determined by survey trawls, while allowing a fishery during rebuilding periods. A minimum level at which any harvest would occur was established and defined by this plan (MABI).

Concurrent with approval of the Westward Region Shrimp Management Plan, the BOF also enacted an additional management strategy as an “economic alternative”. Known as the Mainland Shrimp Management Plan, this alternative strategy allowed shrimp fishing in bays along the Alaska Peninsula from Cape Douglas to Cape Kumlik and around Afognak Island regardless of survey results. The six sections involved did not have the necessary survey history to develop RBIs or MABIs. The Mainland Shrimp Management Plan was repealed in 1997 although the area had provided very little production during the previous 10 years. In 1997, the BOF also adopted 5 AAC 31.590 WESTWARD AREA SHRIMP FISHERIES MANAGEMENT PLAN which closed shrimp fishing in the bays previously included in the Mainland Plan. The

regulation requires approval of a new management plan by the BOF before these bays reopen to shrimp fishing.

Authors of the 1982 management plan recognized that there were some problems that still needed to be addressed. The primary concern was the absence of RBI values for stocks with insufficient historic data. Nine fishing sections did not have enough survey or fishing history described for their shrimp stocks. Consistent management required a systematic technique for deriving RBI values for newly developed fisheries. Shrimp densities from "core areas" were expanded and used to derive RBI values in some cases. Core areas were defined as those with the longest fishery and survey history.

The second problem detailed in the management strategy was the incorporation of double fishing periods. The original management strategy specified harvest of a portion of the available stock at one point during the fishing year, ideally during the fall when stocks had attained most of their annual growth potential. However, the industry still desired a June fishery after the spring survey. The strategy developed so the appropriate annual harvest was not exceeded. The spring harvest was taken into account when setting the fall harvest goals.

A season issue remains with the current management plan structure. ADF&G conducts only a single fall survey. The current fishing season regulation or management strategy does not detail opening dates for fishing stocks that have reached MABI levels during a fall survey. For example, if an October survey found that stocks in a certain section "A" were above MABI, there is no clear direction whether the fishery should open shortly after the survey or should during the following spring at the beginning of the regulatory season. Having the fishery shortly after the survey would utilize the most recent survey results.

Another problem with the management strategy is the lack of criteria for determining age class imbalance. Harvest rates can be lowered to account for the effects of age-class imbalance on reproductive potential. However, there are no guidelines on what exactly constitutes an age class imbalance. The plan may also benefit from a review of harvest rates at various thresholds. Harvest rates for many shellfish stocks have been lowered in the last decade.

The final problem concerns trawl fisheries with multi-species catches. In years past, harvest in Alitak, Kalsin, Kujulik, and Wide Bays were comprised of humpy as well as pink shrimp. Where other species are significant in abundance, RBIs and MABIs should be developed for individual species and incorporated into harvest goals. Relative abundance of the primary species would determine the harvest rate on all species estimates combined. The overall harvest goal could be adjusted if the commercial catch species composition differed significantly from the survey.

The management strategy devised in 1982 contains significant protection for rebuilding shrimp stocks. As shrimp populations recover, ADF&G will address issues remaining with the plan and present necessary regulatory changes during up coming BOF cycles.

CURRENT REGULATIONS

State regulations for shrimp fisheries are detailed in Title 5 of the Alaska Administrative Code chapter 31. As there is no federal fishery management plan in place for offshore waters, ADF&G manages shrimp stocks from zero to 200 miles offshore. Regulations include registration, inspection and validation requirements, commercial fisheries entry permits, gear restrictions, methods of harvest, biological and economic fishing seasons, along with geographical management districts and fishing sections. Shrimp may be commercially harvested with pot or trawl gear.

Most fishing sections in the Kodiak, Chignik and South Peninsula Districts are opened and closed to shrimp trawling by emergency order. These were the historic productive fishing grounds that have not opened to fishing since 1984 based on MABI criteria. Kodiak's General Section, which encompasses waters outside the other 14 sections described in the district, is open to fishing with trawl gear from June 15 to February 28. Waters in the Chignik and South Peninsula Districts which are outside the 16 described sections are open to shrimp trawling from May 15 to February 14. Operators can participate in this fishery by purchasing an interim-use permit card and registering for area J. The historic production areas would open by emergency order only when population levels reach criteria specified in the *Westward Region Shrimp Fishery Management Plan*. Three sections in the Chignik District, Aniakchak Bay, Nakalikok Bay, and Chiginagak Bay and three sections in the Kodiak District, North Afognak, West Afognak and Mainland are closed to all shrimp fishing until a new BOF approved management plan is in place.

Non-pelagic trawl closures that affect nearly all state waters in the Kodiak, Chignik, and South Peninsula Districts also apply to shrimp trawling (Figure 6 and 7). Hard on the bottom trawls can not be used within these closure areas. This includes otter trawl and beam trawl without distinction. There are no specific requirements for gear size or construction of either trawls or pots in the Kodiak, Chignik or South Peninsula Districts.

Shrimp fishing with pot gear is open year round in the Westward Region with the exception of 6 sections closed under the Westward Area Shrimp Fishery Management Plan in the Kodiak and Chignik Districts. Pots can have a maximum 15-inch tunnel eye perimeter and may be longlined. There is no pot limit however operators cannot simultaneously participate in other pot fisheries (e.g. Dungeness crab, Pacific cod, or octopus). Vessel operators can participate by purchasing an interim use permit card and registering their vessel. Logbooks are requested but are not mandatory.

STOCK STATUS

Shrimp and other small-mesh trawl surveys have been conducted nearly continuously since 1953 in the GOA. The National Marine Fisheries Service (NMFS) or their predecessor agency the Bureau of Commercial Fisheries, conducted surveys from 1953 to 2001. Pavlof Bay on the Alaska Peninsula has been the focus of their research since 1979. Shrimp stock assessment surveys by ADF&G have been conducted in the Westward Region since 1971 targeting

important fishing grounds in the Kodiak, Chignik, and South Peninsula Districts (Watson and Bernard 1984). Both spring and fall shrimp stock assessment surveys were conducted during years when shrimp abundance and commercial fishing effort were high. ADF&G survey effort declined along with shrimp populations and fisheries in the early 1980s. Annual surveys occurred only in fall and averaged about 100 hauls per year as compared to more than 500 survey hauls per year when effort was high.

ADF&G continued to monitor shrimp populations biennially beginning in 1987 and triennially from 1989 - 2001. An additional survey was funded in 2002 by NMFS primarily to monitor long-term changes in the species community structure in the GOA. Most historic production areas in the Kodiak District were surveyed in 2001. Most of the Chignik and South Peninsula Districts were surveyed in 2002. Some areas along the eastside of Kodiak Island were surveyed again in 2002.

Shrimp comprised 26% of aggregate total catches taken during the 2001 small-mesh trawl survey. This compares to levels last seen in the 1983 survey (Figure 8). The increase in the shrimp catch was largely due to catches in Inner Marmot Bay and Wide Bay. Generally, shrimp populations in the surveyed sections were below MABI levels required for a fishery (Table 6). Stocks are considered severely depressed when below MABI levels.

Two exceptions were the Inner Marmot Bay Section and Wide Bay of the Mainland Section. Abundance indices exceeded MABI levels required for a trawl opening, however fisheries were not scheduled. The Inner Marmot Bay Section did not open to shrimp trawling as it is largely encompassed by a non-pelagic trawl closure. A small portion of the section is open to non-pelagic trawl use, however the amount of area is not of sufficient size to support a commercial fishery. No fishery could occur in Wide Bay because it also is encompassed by a non-pelagic trawl closure. In addition, Wide Bay is part of the Kodiak District Mainland Section that cannot open to shrimp fishing until a new BOF management plan is in place. Other sections such as Uyak Bay and Uganik Bay on the West Side of Kodiak Island also showed marked improvement in shrimp abundance but remained below MABI levels.

The 2002 ADF&G small-mesh trawl survey sampled South Peninsula and Chignik sections, which had not been surveyed for several years. Additional areas in the Kodiak District were also sampled. Shrimp comprised 16% of the overall catch during the 2002 survey (Table 7). The highest catch of shrimp per mile towed was again found in Marmot Bay and Wide Bay (Figure 9). However, only Wide Bay estimates were above established MABI in 2002. Survey hauls along the eastside and south of Kodiak Island were primarily composed of fish and showed little change from previous surveys. Shrimp abundance indices from the 2002 survey were below MABI levels in all South Peninsula District sections that were surveyed. The Pavlof Bay Section, which once supported one of the largest *Pandalid sp.* fisheries in the world, still has not shown sizable increases in shrimp density. Results from the 2002 survey in the Chignik District also produced abundance indices below MABI levels. Shrimp densities were similar to those found during the 1995 survey.

2003 REGULATION CHANGE PROPOSALS

There are nine proposals concerning shrimp fishing regulations for the BOF to consider in March 2003 meeting. Two public proposals request superexclusive registration designations. Proposal No. 409 would make Kodiak a superexclusive registration district for shrimp fishing with pot gear and Chignik would become a superexclusive registration district for all shrimp fishing in Proposal 412. Proposal No. 408 submitted by ADF&G, requests district registration but does not address superexclusive status.

Proposal No. 410 asks the BOF to consider opening three sections in the Kodiak District that are currently closed to shrimp fishing with pot gear. Proposal No. 413 is a similar request to open 3 sections in the Chignik District to shrimp fishing with pot gear.

Two regulation change proposals (No. 415 & 416) seek to allow beam trawl gear for shrimp fishing in the Chignik and South Peninsula Districts. Although beam trawl is a legal gear type for shrimp fishing, almost all historic fishing areas are now closed to non-pelagic trawl gear. Proposals 411 and 414 seek to limit vessel size and trawl gear size in the Chignik District.

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Table 1. Trawl shrimp catch and effort for the Kodiak District of Westward Registration Area J, 1958-2002.

Calendar Year	Fishing Year	Vessels	Landings	Harvest in Pounds	Price (Dollars)
1958		NA	NA	31,886	$0.04
1959		NA	NA	2,861,900	$0.04
1960		11	94	3,197,985	$0.04
1961		12	203	11,083,500	$0.04
1962		11	204	12,654,027	$0.04
1963		NA	NA	10,118,472	$0.04
1964		6	NA	4,339,114	$0.04
1965		11	320	13,823,061	$0.04
1966		17	551	24,097,141	$0.05
1967		23	NA	38,267,856	$0.05
1968		16	NA	34,468,713	$0.04
1969		26	935	41,353,461	$0.06
1970		18	1,024	62,181,204	$0.04
1971		49	1,746	82,153,724	$0.04
1972		63	1,398	58,352,319	$0.04
1973		50	1,283	70,511,477	$0.06
	1973/74	63	1,029	56,203,992	$0.08
	1974/75	75	1,100	58,235,982	$0.08
	1975/76	58	884	49,086,591	$0.08
	1976/77	62	762	46,712,083	$0.10
	1977/78	58	653	26,409,366	$0.13
	1978/79	50	328	20,506,021	$0.17
	1979/80	37	242	12,863,536	$0.23
	1980/81	67	462	27,101,218	$0.29
	1981/82	55	298	19,112,367	$0.27
	1982/83	40	224	10,391,207	$0.27
	1983/84	14	63	2,779,030	$0.35
	1984/85	13	59	2,942,922	$0.33
	1985/86	5	26	1,145,980	$0.20
	1986/87		Confidential		
	1987/88		Confidential		
	1988/89	0	0	0	0
	1989/90	0	0	0	0

-Continued-

Table 1. (page 2 of 2)

Calendar Year	Fishing Year	Vessels	Landings	Harvest in Pounds	Price (Dollars)
	1990/91	0	0	0	0
	1991/92	0	0	0	0
	1992/93	0	0	0	0
	1993/94	3	3	1,704	NA
	1994/95	0	0	0	0
	1995/96	0	0	0	0
	1996/97		Confidential		
	1997/98	4	7	11,905	$0.22
	1998 to 2002 [a]	4	24	35,259	NA
Averages[b]		33	556	25,917,820	$0.12

Catch confidential when less than three vessels participated.

[a]Harvest combined to protect vessel confidentiality.

[b]Average calculated from years 1960-1985.

Table 2. Trawl shrimp catch and effort for the Chignik District of Westward Registration Area J, 1968-2002.

Year	Number			Price Per Pound ($)
	Vessels	Landings	Pounds	
1968			Confidential	
1969			Confidential	
1970			890,705	
1971			Confidential	
1972/73			4,829,117	
1973/74	33	277	51,673,788	0.08
1974/75	37	323	23,392,352	0.08
1975/76	50	334	24,435,480	0.08
1976/77	48	303	27,232,630	0.10
1977/78	50	271	26,512,791	0.13
1978/79	40	201	23,257,869	0.17
1979/80	35	195	23,722,330	0.23
1980/81	54	148	12,843,270	0.29
1981/82	3	4	70,948	0.27

No commercial fishing activity has occurred in this district after 1981 and through 2002.

Table 3. Trawl shrimp catch and effort for the South Peninsula District of Westward Registration Area J, 1968-2002.

Year	Number			Price Per Pound ($)
	Vessels	Landings	Pounds	
1968			Confidential	
1969			Confidential	
1970	4	173	4,398,800	0.04
1971			Confidential	
1972/73			14,740,801	0.07
1973/74	12	347	19,987,246	0.07
1974/75	22	387	26,145,720	0.08
1975/76	24	326	20,044,112	0.09
1976/77	19	424	37,148,932	0.09
1977/78	48	409	45,003,794	0.13
1978/79	23	108	9,418,276	0.16
1979/80	10	41	3,134,367	0.21

No commercial fishing activity has occurred in this district after 1980 and through 2002.

Table 4. Pot shrimp catch and effort for the Kodiak District of Westward Registration Area J, 1969-2002.

Year	Vessels	Landings	Pounds[a]
1969		Confidential	
1970	-	20	12,302
1971	0	0	0
1972		Confidential	
1973		Confidential	
1974	6	73	10,336
1975	7	77	12,782
1976		Confidential	
1977	3	26	2,565
1978		Confidential	
1979		Confidential	
1980	4	25	4,700
1981	4	6	2,511
1982	6	18	9,754
1983	12	31	18,686
1984	6	21	4,361
1985		Confidential	
1986		Confidential	
1987	0	0	0
1988		Confidential	
1989		Confidential	
1990		Confidential	
1991	0	0	0
1992	0	0	0
1993	0	0	0
1994		Confidential	
1995	0	0	0
1996	0	0	0
1997		Confidential	
1998		Confidential	
1999		Confidential	
2000	0	0	0
2001		Confidential	
2002	0	0	0
Total			96,327

Catch information confidential when less than three vessels participated.

Each confidential year averaged 1,145 pounds harvest.

[a]Pounds are weight of shrimp tails.

Table 5. Shrimp biomass indices from the Westward Region Shrimp Fishery Management Plan, 1982.

District	Section	RBI [a]	MABI [b]
Kodiak	Kiliuda Bay	13.20	5.30
	Two Headed Island	18.20	7.30
	Ugak Bay	10.00	4.00
	Alitak Bay (Strata 2)		
	Pink Shrimp	5.30	2.12
	All species	10.70	4.28
	Alitak Flats (Strata 3)	7.00	2.80
	Marmot Island	63.90	25.60
	Inner Marmot Bay	9.10	3.64
	Chiniak Bay	3.61	1.45
	Uganik Bay	6.46	2.59
	Uyak Bay	7.98	3.19
	Wide Bay	2.61	1.05
	Puale Bay	2.98	1.19
Chignik	Chignik Bay	11.37	4.55
	Kujulik Bay	9.45	3.78
	Mitrofania Island	12.90	5.16
	Ivanof Bay	14.25	5.70
	Chiganagak Bay	1.72	.69
	Aniakchak Bay	7.20	2.88
	Nakalilok Bay	2.04	.82
	Kuiukta Bay	4.76	1.90
South Peninsula	Stepovak Bay	57.97	23.20
	Unga Straits	18.80	7.52
	West Nagai	16.47	6.56
	Beaver Bay	10.90	4.36
	Pavlof Bay	45.30	18.12
	Morzhovoi Bay	26.80	10.72

[a]Representative biomass index (million pounds)

[b]Minimum acceptable biomass index (million pounds)

Table 6. Minimum acceptable biomass indices (MABI) and population estimates in millions of pounds from surveyed Westward Region sections, 1992-2002,.

District	Section	MABI [a]	2002	2001	1998	1995	1992
Kodiak	Inner Marmot Bay	3.64	1.34	**4.36**	0.47	1.14	1.10
	Marmot Island	25.60	3.64	1.39	0.49	NS	NS
	Chiniak Bay	1.45	.12	0.63	0.10	0.18	0.38
	Ugak Bay	4.00	-	0.09	NS	NS	NS
	Kiliuda Bay	5.0	.45	0.12	0.16	0.12	0.31
	Two Headed Island	7.30	-	0.12	0.14	0.12	1.11
	Alitak Bay	4.28	-	0.51	0.25	0.02	0.18
	Uyak Bay	3.19	-	0.76	0.34	0.43	0.15
	Uganik Bay	2.59	-	1.57	0.28	1.07	0.47
	Kukak Bay[b]	NA	-	0.41	0.10	0.03	-
	Wide Bay[b]	1.05	**2.06**	**2.00**	-	0.07	0.91
	Puale Bay[b]	1.19	-	0.11	-	-	-
	Shelikof Strait	NA	-	0.05	-	-	-
Chignik	Kujulik Bay	3.75	.02	-	-	-	-
	Chignik Bay	4.55	1.09	-	-	1.00	2.01
	Kuiukta Bay	1.90	.37	-	-	0.36	0.69
	Mitrofania Island	5.16	.22	-	-	-	-
	Ivanof Bay	5.70	.01	-	-	-	-
South Peninsula	Stepovak Bay	23.20	.43	-	-	-	-
	Unga Straits	7.52	.26	-	-	-	-
	Beaver Bay	4.36	.02	-	-	-	-
	Pavlof Bay	18.12	.09	-	-	-	-

[a]Minimum acceptable biomass index

[b]Kukak, Wide, and Puale Bays are part of the Mainland Section; MABIs are established for each bay.

NA = no MABI established for survey area.

- = Not surveyed

Bold indicates population estimate above established MABI.

Table 7. Relative abundance by weight of the top 20 species occurring in the 2002 small-mesh trawl survey.

Rank	Common name	Species Name	Percent of catch by weight
1	Walleye pollock	*Theragra chalcogramma*	32.8%
2	Flathead Sole	*Hippoglossus elassodon*	21.6%
3	Arrowtooth Flounder	*Atheresthes stomias*	13.0%
4	**Pink Shrimp**	***Pandalus borealis***	**12.8%**
5	Jellyfish unidentified	Class Scyphozoa	5.1%
6	Pacific cod	*Gadus macrocephalus*	2.9%
7	Eulachon	*Thaleichthys pacificus*	2.5%
8	**Humpy shrimp**	***Pandalus goniurus***	**2.3%**
9	Yellowfin Sole	*Pleuronectes aspera*	1.1%
10	Pacific Sandfish	*Trichodon trichodon*	0.9%
11	Starry flounder	*Platichthys stellatus*	0.8%
12	Pacific halibut	*Hippoglossus stenolepis*	0.7%
13	**Coonstripe shrimp**	***Pandalus hypsinotus***	**0.6%**
14	Northern rock sole	*Lepidopsetta sp.*	0.5%
15	Rex sole	*Glyptocephalus zachirus*	0.5%
16	Big skate	*Raja binoculata*	0.4%
17	**Sidestriped shrimp**	***Pandalopsis dispar***	**0.4%**
18	Spiny dogfish	*Squalus acanthias*	0.4%
19	Alaska plaice	*Pleuronectes quadrituberculatus*	0.3%
20	Plain sculpin	*Myoxocephalus jaok*	0.3%

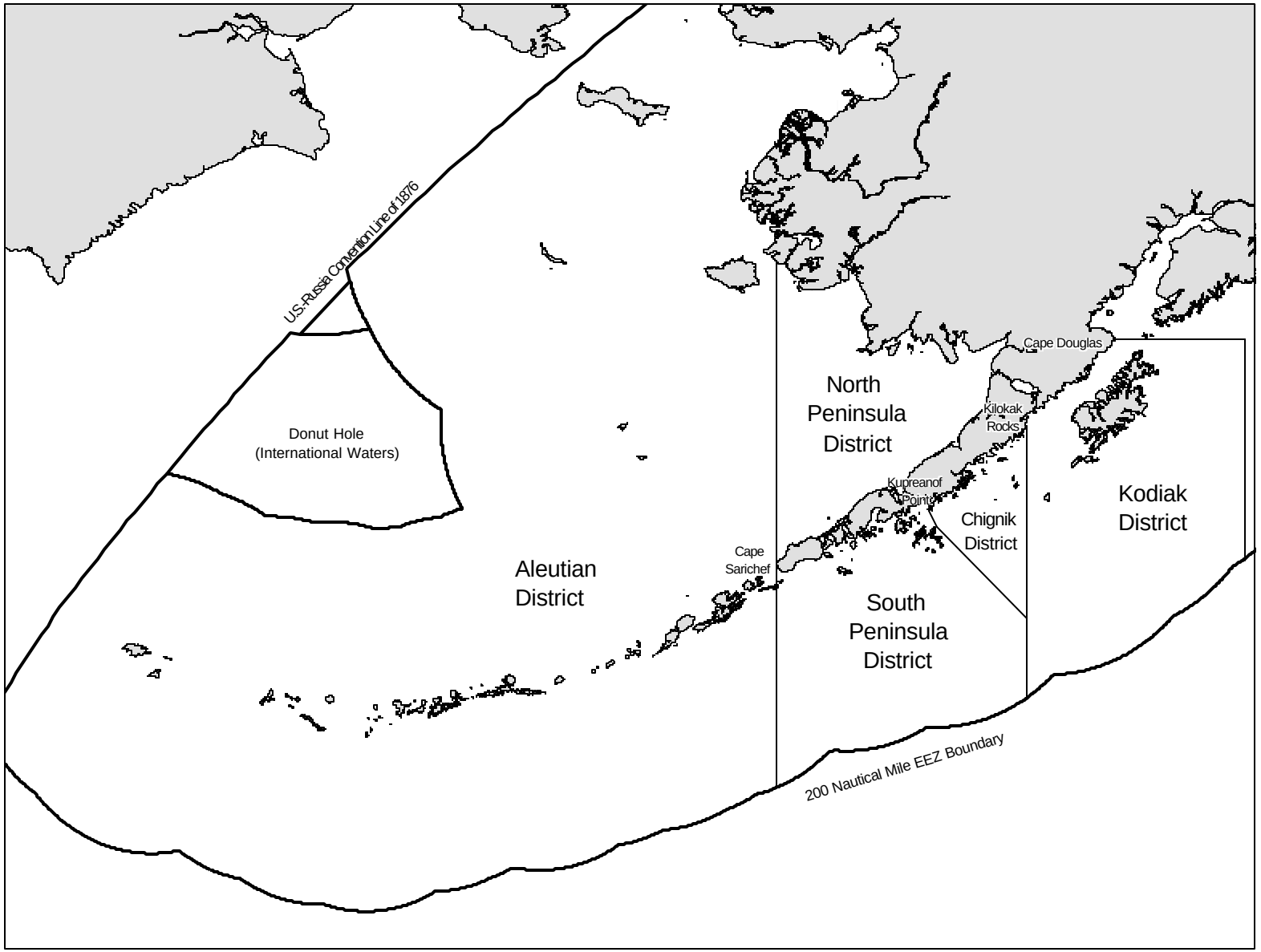

Figure 1. Commercial shrimp fishing districts of Westward Registration Area J.

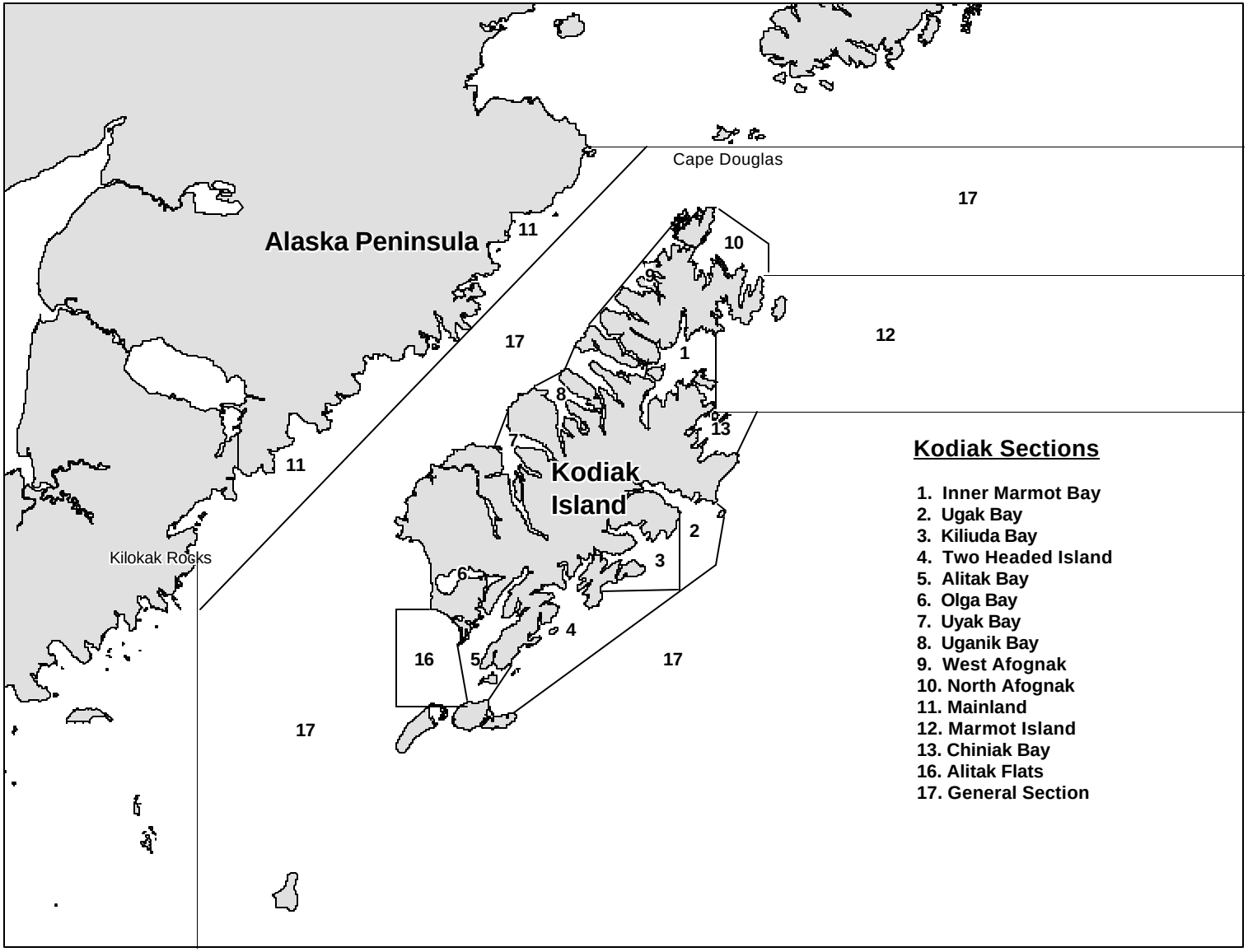

Figure 2. Commercial shrimp fishing sections in the Kodiak District of Westward Registration Area J.

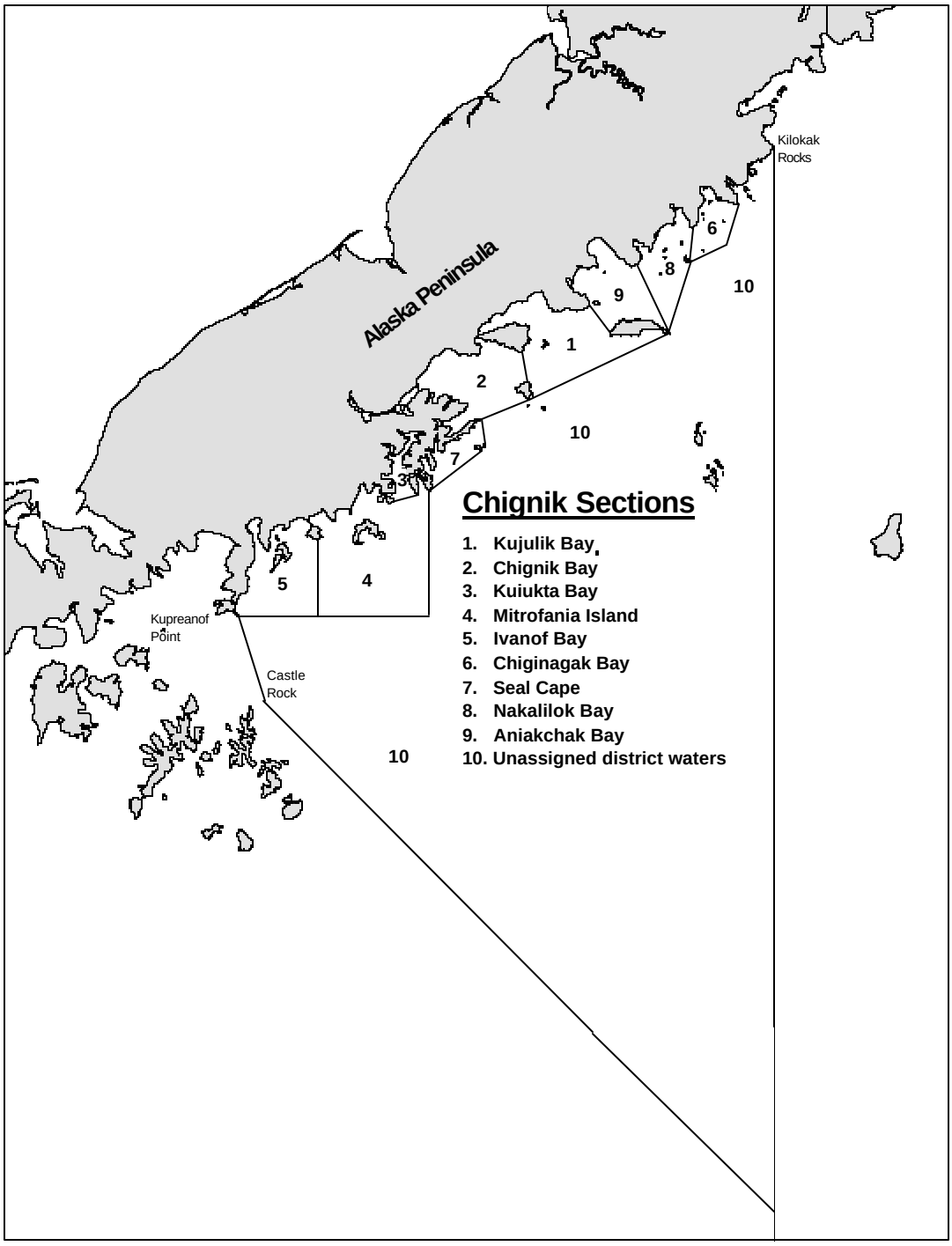

Figure 3. Commercial shrimp fishing sections in the Chignik District of Westward Registration Area J.

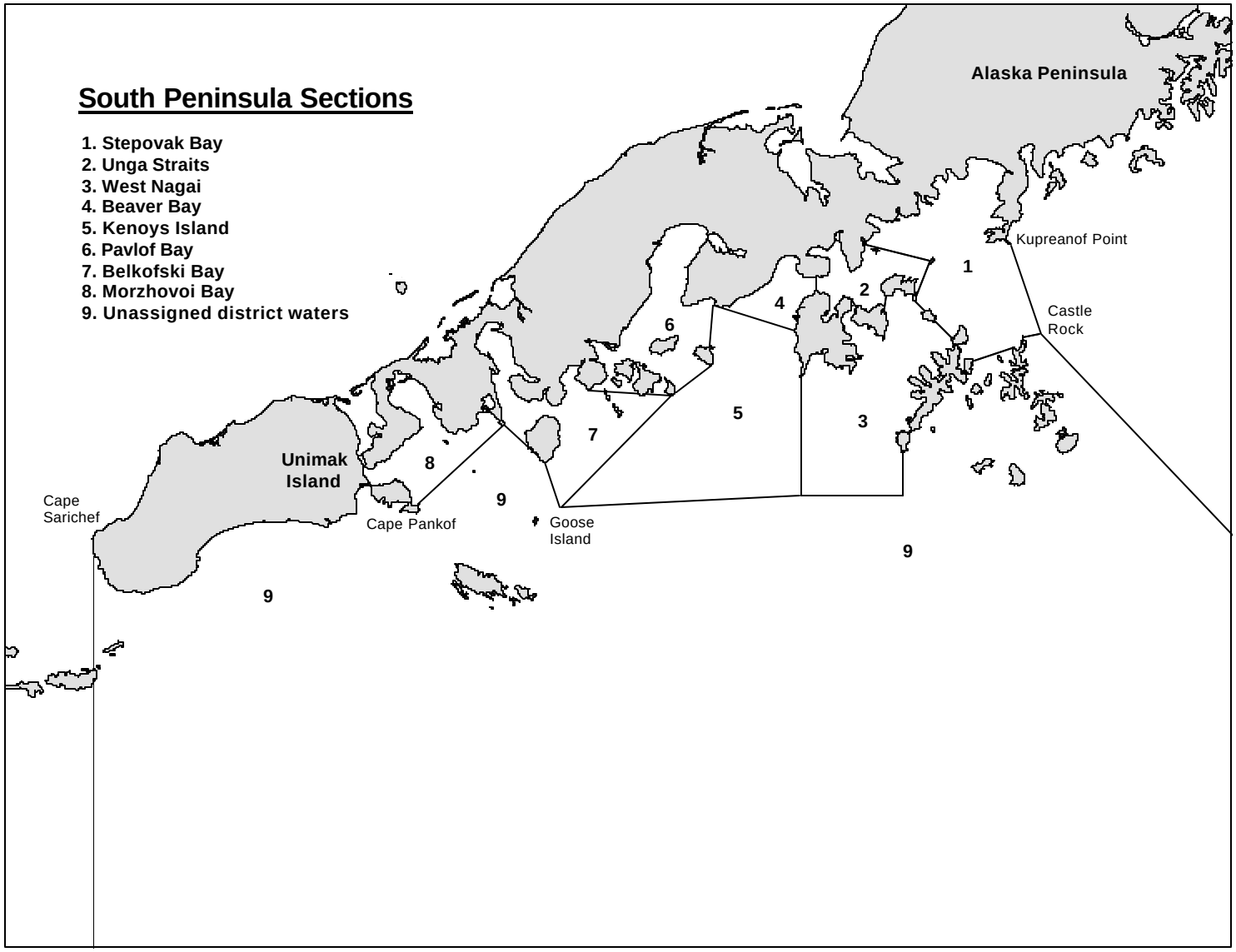

Figure 4. Commercial shrimp fishing sections in the South Peninsula District of Westward Registration Area J.

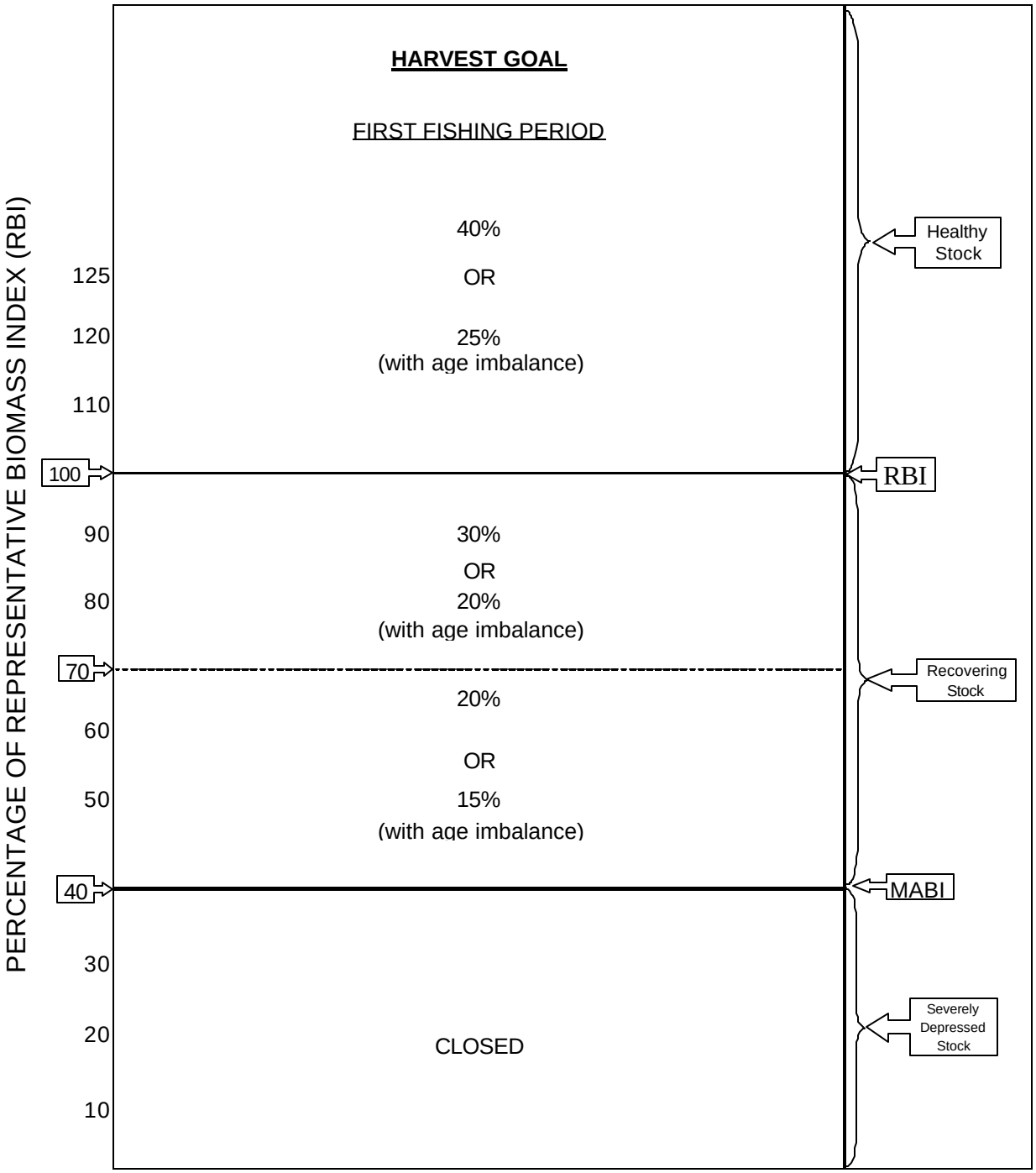

Figure 5. Harvest rate criteria from the Westward Region Shrimp Fishery Management Plan, 1982.

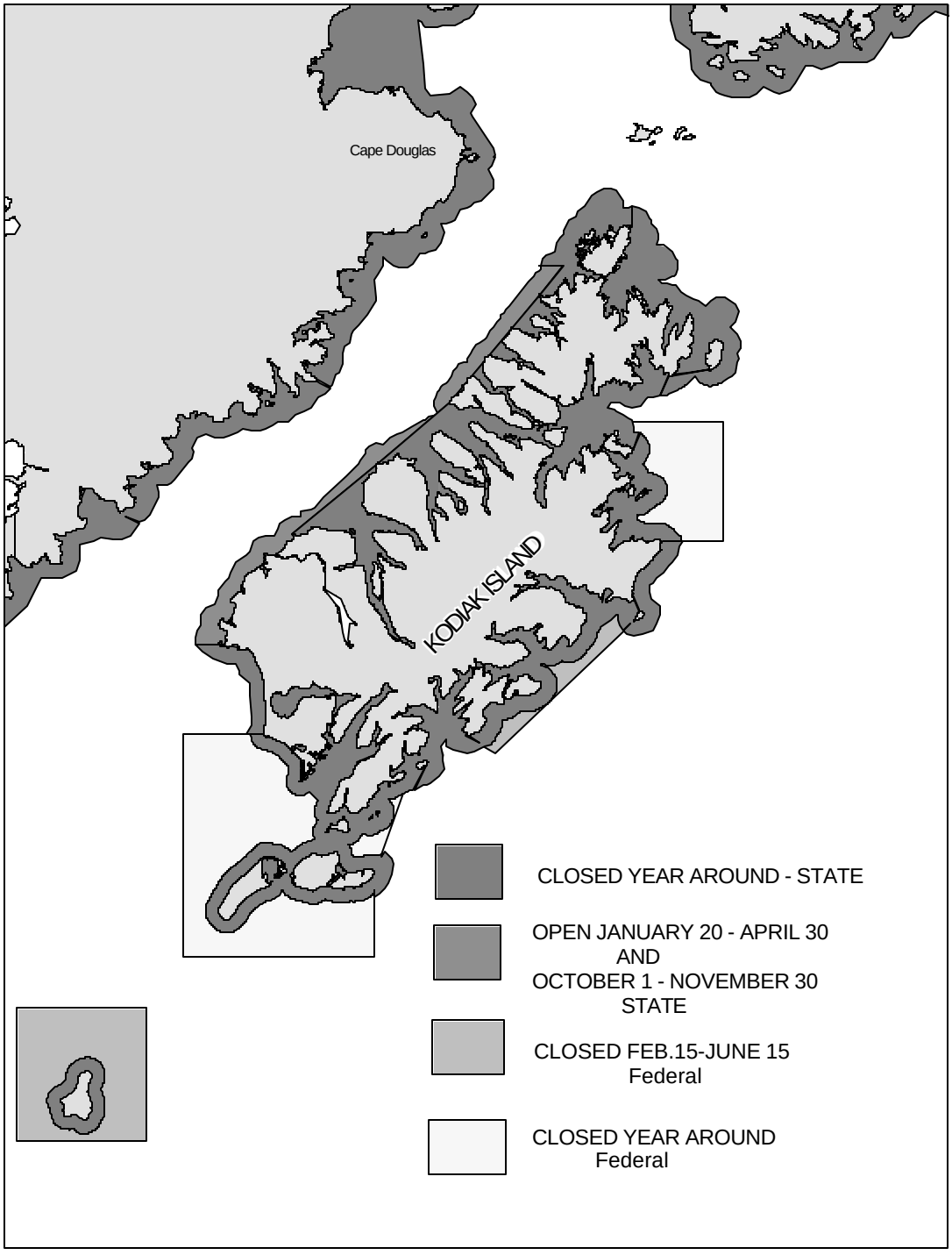

Figure 6. Non-pelagic trawl closures in the Kodiak commercial shrimp fishing district.

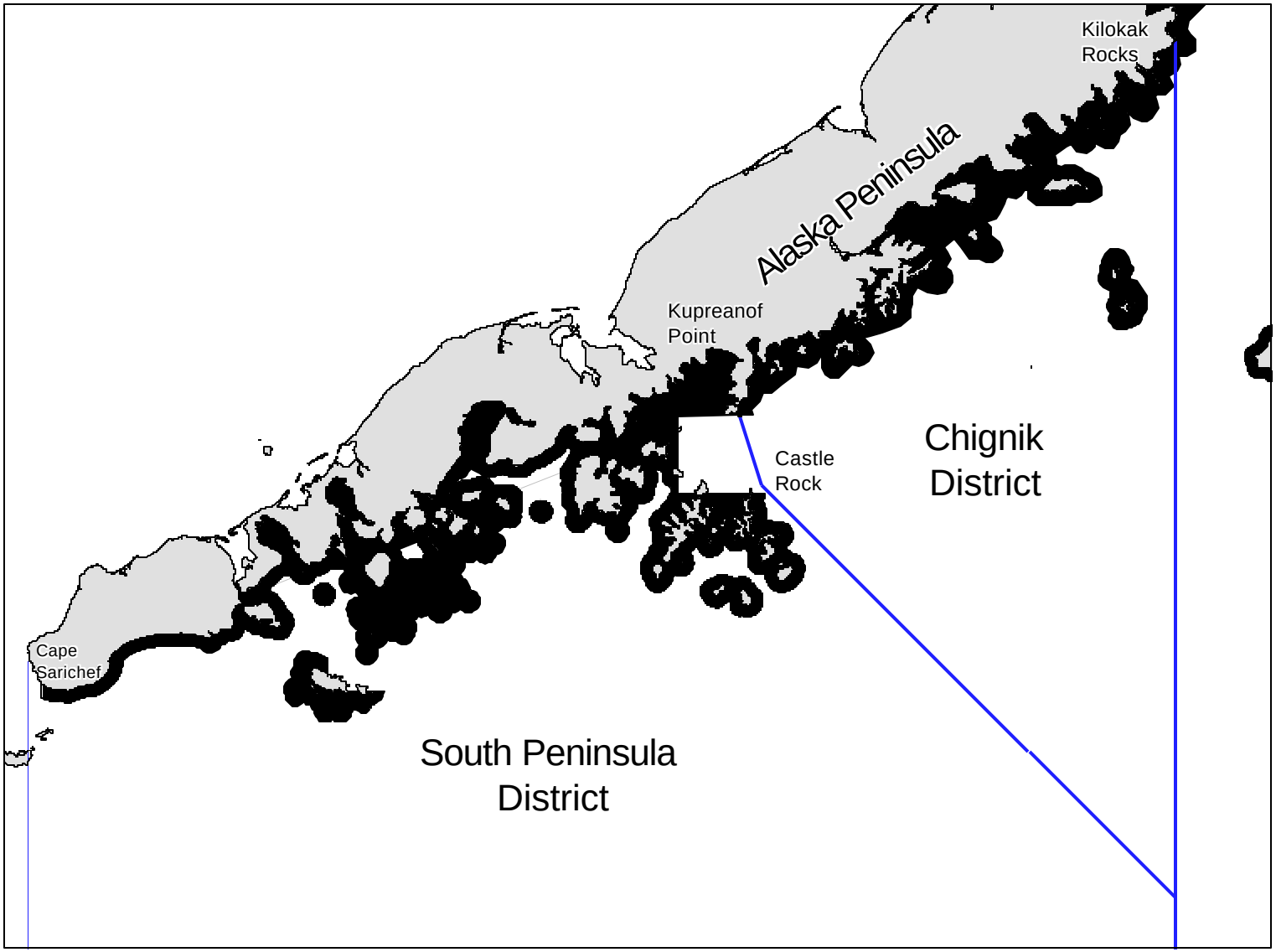

Figure 7. Non-pelagic trawl closures in the Chignik and South Peninsula commercial shrimp fishing districts.

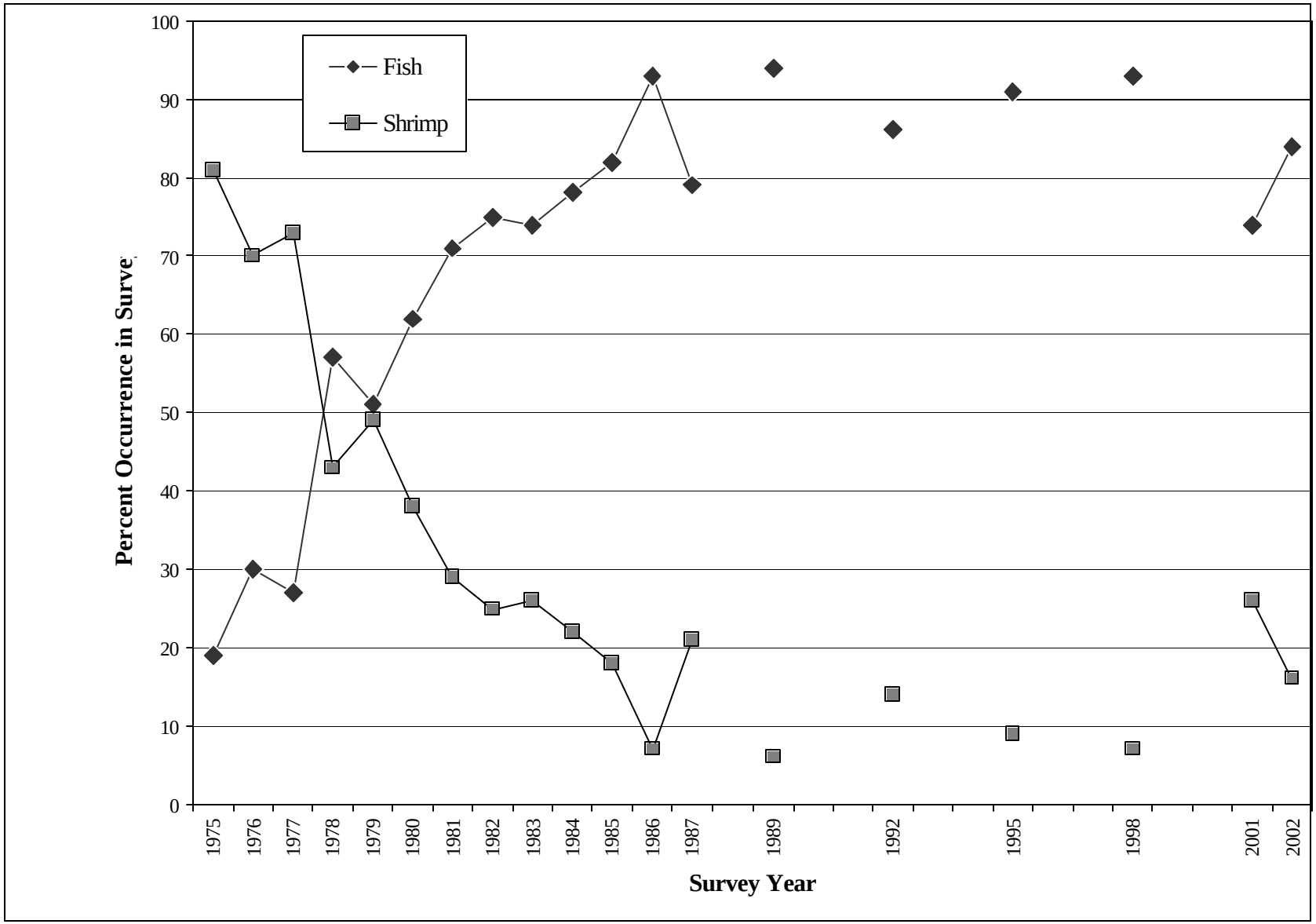

Figure 8. Catch composition from ADF&G trawl surveys conducted in the Westward Region, 1975-2002.

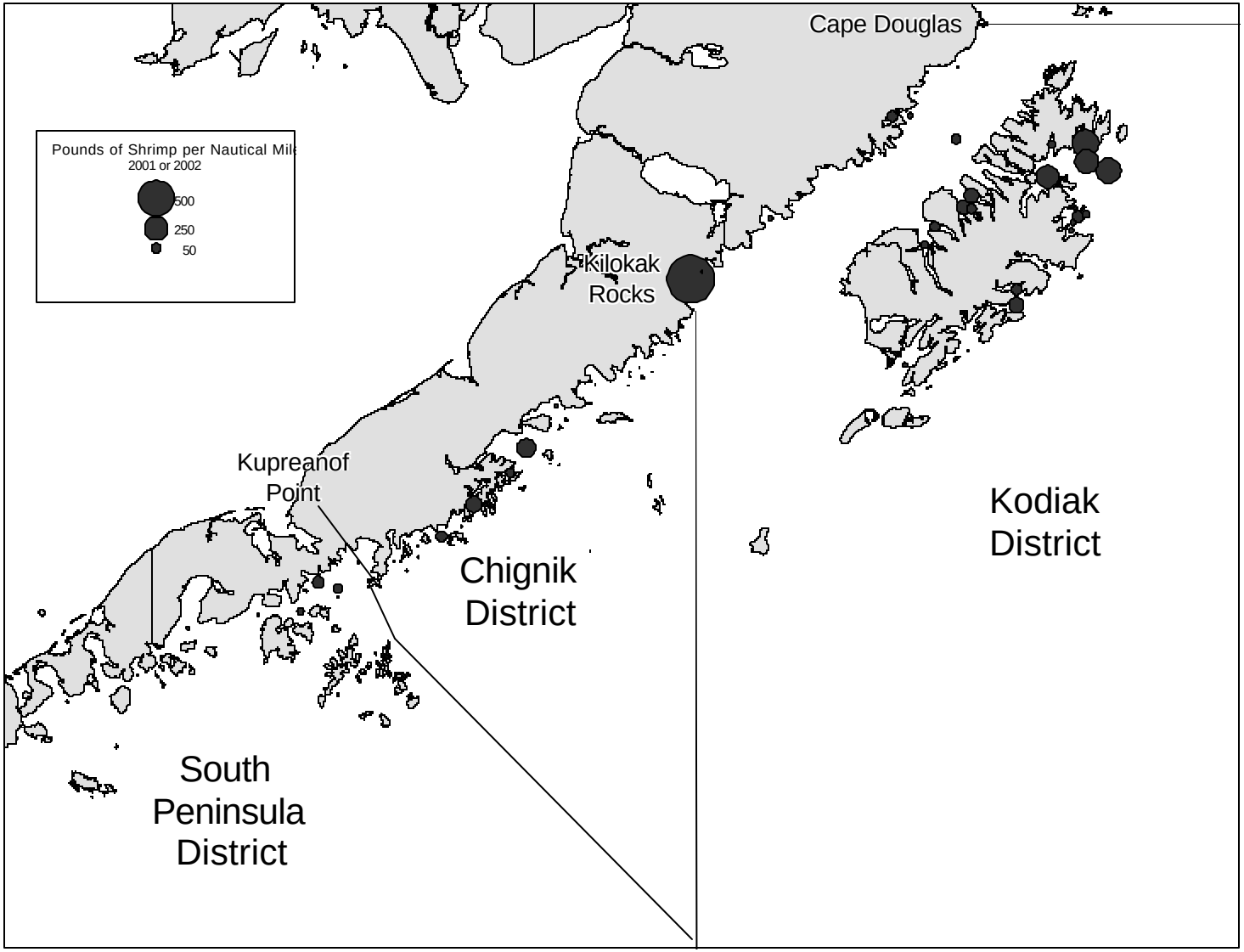

Figure 9. Pounds of shrimp per mile towed, averaged by strata, from the most recent 2001 or 2002 small-mesh trawl survey.