GRAPHICS 5 - 8

III. B. L. COMMERCIAL SHELLFISH

Commercial Shellfish: Major commercial shellfish resources found in or near the lease area include shrimp (five species), and king, tanner, and Dungeness crab. Weathervane scallops are commercially harvested also, mostly in the Kodiak area. Substantial populations of razor clams and hardshell clams exist along the beaches near the lease area, but they are harvested primarily for sport and subsistence; commercial effort on these stocks is slight. Table III.B.2.-7 shows multi-year catch statistics and ex-vessel values (1978 dollars) of various shellfish species caught in Shelikof Strait and landed in Kodiak.

King Crab: King crab have been taken in virtually all of the proposed lease area south of Anchor Point (graphic 5). Areas of greatest catches are Kachemak Bay, a large area that encompasses Kamishak Bay, the central inlet toward the Barren Islands and northcentral Shelikof Strait, and a small area in Viekoda Bay and Kupreanof Strait. The southern end of the proposed lease area approaches a highly productive area at the southwest end of Kodiak Island. Of the entire Kodiak ADF&G management area, Shelikof Strait provides a relatively small portion (6 percent in the 1979-80 season) of the king crab catch. Catch data for the inlet and the strait are shown in table III.B.2.d.-1. The 1977-1978 and 1978-1979 harvests were well below average, largely due to two, successive weak year classes which entered the fishery during 1976 and 1977.

An increase in recruitment observed recently has reversed this downward trend and has resulted in an upswing in the commercial harvest during the 1979-80 season. A total of 17 processors processed king crab in the Kodiak area during the 1979-80 season. All processors operated in the city of Kodiak with the exception of one shore-based plant at Alitak Bay. Vessel effort in the Kodiak area king crab fishery reached a record high with 247 vessels fishing. Current regulations allow each vessel to fish 100 pots. The ex-vessel price was split during the 1979-80 season, beginning at \$1.075 per pound in September and dropping to \$0.95 per pound in October. Total ex-vessel value is estimated at \$14.5 million, a decrease from the \$19.2 million value of the 1978-79 fishery.

The king crab resource in lower Cook Inlet has supported a profitable harvest for many years, with a 20-year average annual catch of over 1814400 kilograms (4,000,000 lbs). However, the harvest for the 1977-78 season was a much lower 771120 kilograms (1,700,000 lbs), and in 1978-79 was less than 544320 kilograms (1,200,000 pounds). This sudden sharp fall-off in the catch may indicate that the lower Cook Inlet king crab fishery is on the

verge of a period of decline (see table III.B.2.d.-2).

The king crab fishery operated during every month of the year through the 1960's. Now it opens September 1 in the Kodiak management area, and August 1 in the Cook Inlet management area, and remains open until November 30 in the Kodiak area, and until March 15 in the Cook Inlet area, or until the guideline harvest level is reached. On December 1, the fishery opens for 8-inch crab in the Kodiak area, and remains open through January 15. In the Cook Inlet area, the 8-inch season is opened and closed by emergency order, but is restricted to the August 1 through May 15 time

King crab move into relatively shallow water in winter where their eggs hatch during February through April. This is followed by moulting and mating so that the female carries eggs for about 11 months of the year. During this time, the adults are quite concentrated.

King crab are known to concentrate in Kachemak Bay for spawn-Much less is known about the Shelikof Strait and Kamishak Bay stocks. Nearly all of the bays on Kodiak Island are known or suspected to harbor spawning concentrations, and virtually all shallow water is used by crab during spawning. In the Shelikof Strait area, greatest concentrations are undoubtedly in the Uganik Bay, Viekoda Bay, and Kupreanof Strait areas. The spawning location used by Kamishak Bay king crab is not known. They clearly move into shallower water in winter, into Kamishak Bay, but areas of concentration are not known, nor is the extent of inshore movement.

Tanner Crab: The tanner crab fishery is relatively recent; new grounds are still being located. In the Kodiak management area, tanner crab has become the predominant winter and spring shell-fishery. Annual landings in Kodiak over the past few years have averaged between about 13.6 and 33.3 million lbs. (table III.B.2.d.-2); the wide range largely due to disputes over prices and competition with other fisheries.

Tanner crab have been taken in virtually all of the lease area south of Anchor Point. Areas of greatest catches are Kachemak Bay, the entire western half of lower Cook Inlet, the northern half of Shelikof Strait, and a strip along the southern half of the eastern side of Shelikof Strait. Catch data for the lower Cook Inlet and Shelikof Strait for the years 1969-1979 can be found on table III.B.2.d.-2.

Tanner crab is a relatively new commercial fishery in the Kodiak area, as it is elsewhere in Alaska. The first commercial catch here was recorded in 1967 when almost 50349.6 kilograms

Catches rose steadily, reaching 4298269.1 kilograms (9,475,902 lbs.) in 1971-72. As king crab abundance declined in the late 1960's and early 1970's, markets for tanner crab improved and prices paid to fishermen for this species rose. Not surprisingly, fishing effort increased accordingly. By the 1972-1973 season, tanner crab had established itself as the dominant winter and spring fishery. A 30-million ton limit was set by the Alaska Board of Fish and Game during the 1973-74 and 1974-75 seasons as a conservation measure. The low \$13.6 million pound harvest in 1974-75 resulted from a long strike. Commercial harvests for the 1975-76 through 1978-79 seasons ranged between 20 and 33 million pounds. A guideline harvest of 10-25 million pounds is in effect for the 1979-1980 season. The Kodiak tanner crab harvest during 1978-79 totaled about 1326082 kilograms (29.2 mil. lbs) and had an ex-vessel value of approximately \$16.2 million...The 1979-1980 catch is projected to be 770000 kilograms (17 mil. lbs) worth an estimated \$9.7 million.

lbs.)

(111.000

Seventeen processors in the Kodiak area bought tanner crab during the 1978-79 season. A total of 218 vessels fished tanner crab during this season, a record high.

The tanner crab fishing season has included landings in every month of the year; however, there were problems with crab dying in the tanks before delivery during summer. Apparently, tanner crab could not survive summer surface water temperatures. The fishery has been restricted to the winter-spring time period. In Kachemak Bay, the season extends from December 1 through April 30. All these areas are closed earlier when the catch reaches the guideline harvest level and seasons may be changed by the Alaska Board of Fisheries.

Very little information exists on the life history of tanner crab. Spawning areas are not known; however, available data suggest that spawning is widely distributed. Studies conducted in Kachemak Bay and lower Cook Inlet (Trasky, et al., 1977) found king crab spawning and settling areas, but did not document a tanner crab spawning area in Kachemak Bay. Concentrations of juveniles have been found in the vicinity of Cape Douglas and in the Iniskin Bay area. The species is more widely distributed than king

<u>Dungeness</u>: Catches of Dungeness crab (graphic 6) have been widespread throughout the proposed lease area south of Anchor Point, but greatest catches have occurred in outer Kachemak Bay, in the lower central inlet, and along both shorelines of Shelikof Strait except near Afognak Island.

The fishery has fluctuated since it began in 1961, primarily because of market conditions. Catch data for the inlet and the strait are shown on table III.B.2.d.-3. The bulk of the

catch is taken from July through October in both the Cook Inlet and Kodiak management areas. The Cook Inlet area is open yearround except for two areas in Kachemak Bay; inner Kachemak is open from September 1 through April 30, and the northern portion of the outer bay is open May 1 through December 31. In the Kodiak management area (Shelikof Strait), Dungeness crab may be taken from May 1 through December 31, except south of Cape Ikolik where the season does not open until June 15.

The Kodiak area Dungeness crab fishery dates back to 1962 when a catch of 861840 kilograms (1.9 mil. lbs) was recorded. From 1969-1978, the average ex-vessel value of Dungeness crab harvested from Shelikof Strait and landed in Kodiak was \$225,904 in 1978 dollars (written communication dated October 16, 1980, Kodiak Island Borough OCS Advisory Council). During the 1979 season 597114 kilograms (1.3 mil. lbs) were harvested. Eighty percent of the harvest occurred from June through August. The Shelikof area accounted for about 31 percent of the total Kodíak catch. Three processors paid \$0.65 to \$0.75 per pound. ex-vessel value of the 1979-80 harvest was \$943,000.

The Dungeness crab harvest, usually a minor component of the Cook Inlet shellfish catch, abruptly rose in 1978 to its highest level in 15 years. For the first time, at over 544320 kilograms (1,200,000 lbs), the Dungeness crab harvest exceeded the king crab catch in weight. The Department of Fish and Game reports that the exceptional Cook Inlet harvest was, in part, a response to an attractive market created by an unusually poor Dungeness season in the Pacific Northwest. Consequently, future levels of fishing effort and yields for the lower Cook Inlet Dungeness crab fishery are not easy to forecast. On the historic record, Dungeness crab has been one of the most erratically harvested species in Cook Inlet (see table III.B.2.d.-3).

Dungeness crab spawning areas are not identified anywhere in the lease area; little knowledge exists. Movements of Dungeness crab are poorly known. Ιn Kachemak Bay, tagging data have indicated that they move to deeper water in the fall (October through November). It is during this time of year that the catch rate decreases markedly. In the early summer, about June, the catch rate rises as the crab apparently move to shallower water. Dungeness are believed to carry their eggs through the winter as they do in areas further south.

Shrimp: The shrimp fishery (graphic 8) in the lease area is conducted in Kachemak Bay, in Kukak Bay on the Alaska Peninsula, and in virtually all of the bays on the west side of the Kodiak Archipelago including the north end of Afognak Island.

The pink shrimp (Pandalus borealis) is the primary species harvested, but the humpback shrimp (P. goniuris), coonstripe shrimp

(P. hypsinotus), spot shrimp or prawn (P. platyceros), and sidestripe shrimp (Pandalopsis dispar) are also utilized. A small fishery specifically targeted at the large spot shrimp for local markets exists in Kachemak Bay.

Prawn pots or traps are used to harvest the shrimp which occur primarily in rocky areas. The majority of the shrimp harvest, however, is trawl caught from vessels ranging in length from about 12 to 27 meters (40 to 90 ft). As the shrimp fisheries in Kachemak Bay and Shelikof Strait are widely separated, differ in nature, and are in different fishery management units, they are discussed separately.

Shelikof Strait, south of the latitude of Cape Douglas, is part of the Kodiak management area, and has been the site of a shrimp fishery since the early 1960's. Although catches from this area (table III.B.2.d.-4) have been a relatively minor portion of total Kodiak area catches, the most consistently productive sections. Uyak, Uganik, West Afognak, Northern, and Kukak, have yielded total annual catches of 1.8 to 3.5 million kilograms (4.0 to 7.8 mil. lbs), with a mean of 2.4 million kilograms (5.2 mil. lbs) during the six fishing seasons, 1973-74 through 1978-79. In the 1978-79 season, Wide Bay and Puale Bay, on the Alaska Peninsula, produced 4.4 million kilograms (9.6 mil. lbs).

This catch occurred when severe catch declines in known shrimp grounds of the Kodiak and Alaska Peninsula areas forced fishermen to explore unfished areas. The Uyak and Uganik sections on Kodiak Island have consistently produced the highest annual catches since 1973-74, with the Kukak Bay and West Afognak sections ranking as the third and fourth consistently large producers, respectively. Annual fluctuations do not necessarily represent changes in abundance, but rather fluctuations in fleet effort in response to discovery and development of more productive fishing grounds elsewhere. From 1973-1978, the average ex-vessel value of shrimp harvested from Shelikof Strait and landed in Kodiak was \$923,505 in 1978 dollars (written communication dated October 16, 1980, Kodiak Island Borough OCS Advisory Council).

The commercial fishery for shrimp in lower Cook Inlet (table III.B.2.d.-4) takes place almost exclusively in Kachemak Bay. Exploratory fishing has located populations of shrimp in other areas of Cook Inlet; however, exploitation of stocks outside Kachemak Bay has been limited. Although shrimp are harvested in Kachemak Bay by both pots and trawls, the major portion of the catch is taken by trawls. Over a 9 year period, 1970-1978, Kachemak Bay has yielded catches of shrimp ranging from 2.0 to 3.3 million kilograms (4.4 to 7.2 mil. lbs). Indications are that shrimp catches will continue at about the same level.

The Kodiak area has an important shrimp fishery. Development of

this fishery began in 1958 when a total of 1.3 million kilograms (2.9 mil. lbs) was harvested. From 1960 onward, the various shrimp grounds in the Kodiak area were steadily developed, peaking in 1971 when slightly more than 37 million kilograms (82 mil. lbs) were taken. Since that date, however, catches have fallen off dramatically.

Major portions of the Kodiak district remained closed during the 1978-1979 season because of the severely depressed status of the shrimp. A district guideline harvest level of from 3.6 to 10.5 million kilograms (8 to 23 mil. lbs) was set for the 1979-81 seasons. The 1979-80 harvest of 5847062 kilograms (12.9 mil. lbs) was a 37 percent decrease from the previous year's harvest. The 1980-1981 catch is expected to be on the low end of the guideline harvest range.

Six Kodiak area processors handled shrimp during the 1979-80 season. In all, 37 vessels participated in this fishery, making a total of 242 landings. Otter trawlers dominated, harvesting about 95 percent of the catch in the Kodiak area, and beam trawlers or shrimp pots accounted for the rest of the harvest.

Prior to 1971, there were no closed seasons, and the fishery was pursued throughout the year. In 1971, some areas were closed during March and April, the period of shrimp egg hatching. Beginning in 1973, the months of March and April have been closed throughout the Kodiak management area; while in Kachemak Bay, the months of April and May have been closed. With the increased fishery in recent years, there have also been closures for management purposes.

Shrimp life history involves a period during which the female carries developing eggs. In pink shrimp, this is about six months. Shortly before the eggs hatch, the ovigerous females tend to congregate in deep holes near the mouths of bays where they remain for egg hatching. Studies were conducted in Kachemak Bay that followed the larvae through their pelagic phase until settling so that the outer portion of Kachemak Bay is a known shrimp spawning area. No other areas are known to be shrimp spawning areas with the same level of established knowledge. The fished populations have been observed to congregate in the outer portion of a bay, in a deep hole, where egg hatching occurs. Thus, shrimp areas are probably located in Kukak Bay, Wide Bay, Puale Bay, Uyak Bay, Uganik Bay, Viekoda Bay, Malina Bay, Perenosa Bay, and probably a few other bays.

Razor Clams: Razor clams occur throughout the lease area wherever there are sandy beaches. Known razor clam beds are identified on graphic 2.

In Cook Inlet, a small commercial razor clam fishery exists at Polly Creek, north of Tuxedni Bay, and there is believed to be commercial potential in Chinitna Bay. Extensive recreational and subsistence digging for razor

clams occurs along beaches from Cape Starichkof to Cape Kasilof on the east side of the inlet. In recent years, nearly one million clams per year have been harvested from these beaches.

The Kodiak razor clam fishery is the oldest shellfish fishery in the Kodiak area. Most of the catch has been centered around Swikshak, Big River, and Kukak Bays on the Alaska Peninsula. early 1970's During the (1970-1974), 45455 to 90909 kilograms (100,000 to 200,000 lbs) were harvested at Swikshak and Big River beaches as bait for the dungeness crab fishery in the area. Since 1974, the razor clam harvest has been minimal in the area due to poor market conditions and restrictive State and Federal regulations in processing the product. Swikshak beach is currently the only beach certified for harvesting of razor clams in the Kodiak area.

Weathervane Scallop: The fishery for weathervane scallops (Patinopectin caurinus) has been conducted primarily on the east side of Kodiak Island with about 10909 kilograms (24,000 lbs) per year or 3.5 percent of the total catch coming from Shelikof Strait during 1970 though 1976 (table III.B.2.d.-6). The catch has been primarily on the eastern and western shores of the southern half of Shelikof Strait (see graphic 2).

The scallop fishery began in 1967, and expanded in the Kodiak area to 0.64 million kilograms (1.4 mil. lbs) in 1970, and decreased thereafter, with the last landings made in 1976. A considerable amount of exploration was conducted by the fishermen, and it is considered likely that all productive areas have been identified.

Table III.B.2.d.-1
King Crab Commercial Harvest
By Area and Fishing Season
1969-70 to 1978-79
(thousand lbs)

	Cook	[nlet	Kodiak by Stock	
Fishing Season	Southern District	Kamishak Barren Is. District	5	6
1969-70	1,465	1,689	1,748	789
1970-71	1,540	2,116	880	1,438
1971-72	1,998	2,868	236	258
1972 - 73	1,391	2,756	206	529
1973-74	1,962	2,236	360	386
1974-75	1,811	2,965	1,045	156
1975-76	1,667	1,833	1,161	304
1976 - 77	978	3,130	722	314
1977-78	601	1,090	244	142
1978-79	666	2,713	349	116
Average	1,348	2,484	76 6	464

 $^{^{1}}$ Multiply by .0004535147 to obtain metric tons.

Source: Blackburn, J.E. 1980. p.41.

 $^{^{2}}$ Southern District of Cook Inlet is essentially Kachemak Bay.

³ Stock 5 is central Shelikof Strait and catch is primarily in Viekoda Bay and Kupreanof Strait. Stock 6 is northern Shelikof Strait in the vicinity of Cape Douglas.

Table III.B.2.d.-2 Tanner Crab Catch by District Lower Cook Inlet Fisheries Area 1969-70 to 1978-79 (pounds)

Year	Southern ²	Kamishak/ Barren Islands	Outer/ Eastern	Total
1969/70	1,147,154	71,196	104,191	1,322,541
1970/71	1,046,803	541,212	3,000	1,591,015
1971/72	2,462,956	974,962	804,765	4,242,683
1972/73	2,935,662	3,361,023	1,266,937	7,563,622
1973/74	1,387,535	4,689,251	1,891,021	7,967,8 07
1974/75	967,762	3,150,462	656,660	4,774,884
1975/76	1,339,245	3,281,084	850,964	5,471,293
1976/77	2,009,633	1,765,926	824,520	4,600,079
1977/78 ²	2,806,568	2,077,092	502,049	5,385,709
1978/79 ²	2,323,420	300,000	40,000	2,663,420
Average	1,801,365	1,838,601	631,357	4,271,323

¹ Mulmiply by .0004535147 to obtain metric tons. Preliminary data.

Source: Alaska Department of Fish and Game. 1979. Lower Cook Inlet Report to the Board of Fisheries.

Table III.B.2.d.-3 Dungeness Crab Commercial Harvest By Area and Fishing Season 1969-1978 (pounds)

Fishing	. Cook Inlet Southern		Shelikof Strait			
Season	District ²	N.	Mainland	S. Mainland	Westside	
1969	49,894					
1970	209,819					
1971	97,161					
1972	38,930					
1973	310,048					
1974	721,243					
1975	362,815					
1976	119,298					
1977	74,705		1,675	1,115	6,971	
1978	1,214,716		16,629	296,304	204,486	

Multiply by .0004535147 to obtain metric tons.

Sources: Cook Inlet data: Alaska Department of Fish and Game. 1979. Personal Communication. Shelikof Strait data: Alaska Department of Fish and Game, Marine and Coastal Management Project. 1978. "Table 2-16." Resource Report for Cook Inlet Sale No. 60.

Table III.B.2.d.-4 Shrimp Catches for the Kachemak (Southern) District, Cook Inlet (pounds)

		mp Catches		p Catches
	Nov 1-Mar 31	Jun 1-Oct 31	Jun 1-Sept 30	Oct 1-May 31
Guideline	:			
Harvest	2,500,000	2,500,000	100,000	500,000
Year		ar		
1973-74	2,323,780	2,502,154	63,181	738,165
1974-75	2,519,148	2,512,764	43,650	126,472
1975-76	2,421,456	1,997,563	100,765	273,758
1976-77	2,453,101	2,545,885	52,115	199,929
1977-78 ^{2/}	2,537,259	2,490,967	89,986	506,124
1978-79				,
1979-80				

 $[\]frac{1}{2}$ /Multiply by .0004535147 to obtain metric tons.

Source: Alaska Department of Fash and Game, Marine and Coastal Management Project. 1978. "Table 2-11." Resource Report for Cook Inlet Sale No. 60.

Table III.B.2.d.-5 Shelikof Strait Trawl Shrimp Harvest by Fishing Section for the 1973-74 Through 1977-78 Fishing Seasons (pounds)

Fishing	1973-74	1974-75	1975-76	1976-77	1977-78
Section	Season Harvest	Season Harvest	Season Harvest	Season Harvest	Season Harvest
Uyak Bay	1,482,421	722,166	329,190	478,911	2,309,710
Uganik Bay	1,935,597	1,600,994	842,553	908,027	1,481,186
W. Afognak	843,806	664,154	831,461	986,024	258,730
Northern	1,417,357	3,090,640	1,033,971	1,065,966	46,407
S. Mainland	69,483	0	121,930	214,185	274,484
Kukak Bay	2,150,814	480,484	1,023,566	217,998	776,989
TOTAL Shelikof Strait	7,899,478	6,558,438	4,182,671	3,871,111	5,147,506
TOTAL Kodiak					
District	56,203,992	58,235,982	49,086,591	46,712,083	26,409,366

Multiply by .0004535147 to obtain metric tons.

Source: Alaska Department of Fish and Game. 1980. "Table 24." Westward Region Shellfish Report to the Alaska Board of Fisheries. Kodiak, AK. Alaska Department of Fish and Game, Marine and Coastal Habitat Management Project. 1978. "Table 2-13." Resource Report for Cook Inlet Sale No. 60.

Table III.B.2.d.-6 Historic Commercial Catch of Weathervane Scallops in the Kodiak Area and the Shelikof Portion of the Kodiak Area (pounds)

Year	Kodiak Area Total	Shelikof Strait	. ——
1967	7,788		
1968	872,803		
1969	1,012,860		
1970	1,417,612	3,000	
1971	841,211	15,306	
1972	1,038,793	74,140	
1973	935,705	19,812	
1974	147,945	6,895	
1975	294,142	43,801	
1976	75,245	oʻ	
1977	0	0	
1978	0	0	
1979	24,826	3	

lMultiply by .0004535147 to obtain metric tons. Shucked weight only. 2Data for Shelikof Strait is not readily available for 1967-69. 3Data for Shelikof Strait is not readily available for 1979.

Sources: Alaska Department of Fish and Game. 1980. 1979 data from: "Table 36." Westward Region Shellfish Report to the Alaska Board of Fisheries. Kodiak, AK. Blackburn, J.E. 1980. p. 49.

Table III.B.2.d.-7 Commercial Harvest and Average Ex-Vessel Values of Shelikof Strait Shellfish

Species	Time Period	Total Catch (lbs)	Mean Annual Catch (1bs)	Average Ex-Vessel Value (1978 Dollars)
Tanner Crab	1969-1978	53,999,798	5,999,977.5	3,299,987 (@55¢/1b)
King Crab	1969-1978	10,888,434	1,209,826	2,129,293 (@\$1.76/lb)
Shrimp	1973-1978	33,852,000	5,597,000	923,505 (@16.5¢/1b)
Dungeness Crab	1969-1978	2,904,481	322,720	225,904 (@70¢/lb)

Kodiak landings.

Southern district of Cook Inlet is essentially Kachemak Bay.