

# REVIEW OF THE KING AND TANNER CRAB FISHERIES IN PRINCE WILLIAM SOUND

Report to the Alaska Board of Fisheries



by

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## INTRODUCTION

The Prince William Sound (PWS) Management Area (Area E) includes waters of PWS and the Gulf of Alaska bounded by the longitude of Cape Suckling (143° 53'W) on the east and Cape Fairfield (146°50'W) on the west (Figure 1). Due to low abundance, the Alaska Board of Fisheries adopted regulations in March of 1999 to close commercial, sport, personal use, and subsistence harvests of king and Tanner crabs in all waters of PWS and the adjacent Gulf of Alaska. This report summarizes past commercial fisheries for Tanner *Chionoectes bairdi*, red king *Paralithodes camischaticus*, blue king *Paralithodes platypus*, and golden or brown king *Lithodes aequispina* crabs within Area E. The report also reviews current assessment information, as well as past management actions taken to conserve these crab resources (Berceli et al. 1999).

## TANNER CRAB

### *Commercial Fishery*

PWS is divided into four Tanner crab management districts (Figure 2). The Northern and Hinchinbrook Districts include most of the waters inside PWS proper, while the Eastern and Western Districts encompass waters of the Gulf of Alaska and southwestern PWS. Historically, the commercial Tanner crab harvest was equally divided between the Gulf of Alaska and PWS portions of the management area.

Registration for the PWS Tanner crab fishery is "superexclusive". A vessel registered to fish Tanner crab in PWS may not participate in any other Tanner crab fishery within the state during that registration year. Conversely, a vessel registered to fish in another registration area may not fish in PWS during that registration year.

Other regulations distinctive to the PWS Tanner crab fishery include: a gear limit not to exceed 75 king and Tanner pots per vessel; a buoy tag requirement; harvest restricted to male crab; and a minimum carapace width of 5.3 inches (135 mm) for all retained crab. Past regulatory fishing seasons opened January 15 and closed March 31.

The PWS commercial Tanner crab fishery began in 1968 when 1.2 million pounds were landed (Table 1). The harvest peaked in 1972-1973 at 13.9 million pounds, prior to the 1976 adoption of a minimum legal carapace width. Harvests decreased during the late 1970s and early 1980s, followed by district closures during 1984 and 1985. Small postrecruit fisheries during 1986 to 1988 yielded relatively stable harvests of approximately 0.5 million pounds (Table 1, Figure 3). However, harvest patterns showed dramatic declines in Western District harvests and no catches in the Eastern District.

Plausible explanations for the collapse of Tanner crab stock within PWS include factors related to fishing mortality and environmental conditions. Overharvest of all segments of the stock may have occurred prior to the 1976 adoption of a male-only fishery with a minimum carapace size limit of 5.3 inches. For example, the 3.8 million pound harvest in 1974 included 2.7 million pounds of crab smaller than the current minimum size limit (Donaldson 1991). The legal male segment of the stock may have been overharvested because annual fisheries were limited by regulatory season length rather than an abundance-based guideline harvest level. Handling mortality of undersized and female crab may have contributed to the stock decline, particularly during fishing seasons of seven months duration. Finally, environmental conditions may have changed, causing greater mortality of Tanner crab larvae, impaired growth and reproduction, and increased production of crab predators such as gadoid fishes.

### *Non-commercial Fisheries*

Prior to the area closure in August 1999, sport, personal use, and subsistence Tanner crab fisheries remained open on a year-round basis throughout most of PWS. Despite low and declining abundance estimates, daily bag and possession limits remained at 20 male crab. Minimum legal sizes differed by fishery; 5.3 inches (135 mm) for personal use and subsistence fisheries and 5.5 inches (140 mm) for sport fisheries. Legal gear types for sport and personal use fishing included pots, ring nets, dive gear, dip nets, and hooked or hookless hand lines. Pot gear was limited to 5 pots per person and 10 pots per vessel for all non-commercial fisheries. However, any legal gear type defined in regulation (5 AAC 39.105) may have been used in the subsistence harvest of Tanner crabs. Pots were required to have a biodegradable escape mechanism, but there was no escape ring requirement.

There was no mechanism to directly monitor effort or harvest of Tanner crab in historical non-commercial fisheries. Data from Sportfish Division's most recent mail-out survey indicated a harvest of 189 Tanner crab in 1998 prior to the fishery closure in 1999 (D. Craig Whitmore, ADF&G, Sport Fish Division, Anchorage, personal communication). Limited data developed through household interviews by the ADF&G Subsistence Division staff suggested that subsistence harvests totaled less than 4,900 Tanner crab among all PWS communities in 1997 (ADF&G 1999).

### *Stock Status and Management Measures*

The department has conducted assessment programs for Tanner crab within the Prince William Sound Management Area since 1977 (Berceli et al. 1999). Surveys were conducted with pot gear through 1991 (Donaldson 1991). Pot survey objectives were to provide indices of legal and sublegal male Tanner crab and to monitor reproductive success of female Tanner crab. This information was used to determine relative stock

condition, as well as to set preseason harvest guidelines for the commercial fishery. Pot survey data indicated a steady decline in the numbers of male and female Tanner crab (Table 2). During the pot survey time series, the mean catch rate of Tanner crab decreased 86 percent.

Recognizing the inherent weaknesses of pot surveys, such as soak variation and the relative nature of the indices, the department implemented trawl surveys in 1991 (Kimker and Trowbridge 1992; Bechtol 1999). An advantage of trawl surveys is that population abundance estimates can be generated by using an area swept equation. Trawl surveys are also used by the National Marine Fisheries Service for the Bering Sea surveys and by the department to assess crab stocks in other management areas.

Population estimates generated from ADF&G trawl surveys demonstrate that PWS Tanner crab remain depressed (Table 3, Figure 4). Estimated abundance of legal male crab in the Northern and Hinchinbrook Districts decreased from 108,624 in 1993 to 3,362 in 1999. This decline resulted from poor recruitment to the legal segment of the stock, likely due to successive weak prerecruit classes and skip molting in the prerecruit-1 and smaller size classes.

Tanner crab abundance estimates generated from the 2001 survey for the traditional PWS survey stations indicated an increase relative to recent surveys, particularly for the pre-recruit male and all female components of the population. However, the legal male population estimate of 4,923 Tanner crab is the second lowest since the inception of the trawl survey. In 1999 and 2001, the department also performed five survey tows in the Valdez Arm and Port Valdez area (Figures 5 and 6). Although survey catch rates for both male and female Tanner crab in the Valdez area approximately doubled from 1999 to 2001, there is no historical trawl data for comparison and overall densities are low relative to other surveyed areas within Alaska (Bechtol et al. 2002).

The department first closed commercial and subsistence fisheries for Tanner crab by emergency order within the Hinchinbrook Entrance and Orca Bay portions of PWS in 1982 and the personal use fishery in these areas in 1987. Waters of Orca Bay and the north Montague area are key production areas for Tanner crab in PWS. Both areas have historically provided newly mature male and female Tanner crabs. The north Montague area has been closed to all harvest of Tanner crabs since 1991 and the Orca Bay area has been closed since 1982. The closures were effected to rebuild the stock and provide protection to juvenile and newly mature crabs.

The department also closed the entire PWS Management Area to the commercial harvest of Tanner crab annually since 1989. Despite these long-term closures, the Tanner crab stock continued to decline. Although healthy localized aggregations of Tanner crab may exist, ADF&G is concerned about the need to protect the existing population to maximize its reproductive potential when environmental conditions are favorable to Tanner crab production.

## **KING CRAB**

### *Commercial Fisheries*

Red, blue and golden king crabs are found in PWS. Red king crab are sparsely distributed throughout PWS, with historic concentrations occurring in the eastern Sound and Hinchinbrook Entrance (Figure 1). Blue king crab are found in the Port Wells and Harriman Fjord areas; small aggregations may also occur in other glacial fjords of western PWS. Golden king crab are found in central and western PWS at depths of 150-400 fathoms. Waters in the Gulf of Alaska portion of the management area have no documented concentrations of king crab, except for a sparse distribution of golden king crab.

PWS is a superexclusive registration area for king crab. The minimum legal carapace width is 7.0 inches (178 mm) for red and golden male king crabs, and 5.9 inches (150 mm) for male blue king crab. Past regulatory seasons provided two open periods: October 1 to December 20 and January 15 to March 15.

Commercial harvests of king crab from PWS date to 1960 when 246,965 pounds were landed (Table 4; Figure 7). Catch reporting by species did not begin until the 1979-80 season. The 1972 harvest of 296,200 pounds is believed to have been primarily blue king crab. During 1979 to 1984, stocks of both blue and red king crabs declined. Fisheries for both species remained closed from the 1984-85 season to the 1991-92 season. This closure coincided with the development of the golden king crab fishery from 1982–1989 (Figure 5). The golden king crab stock is relatively small, as indicated by fishery catch per unit of effort data coupled with declines in average weight, size, and geographic distribution. The commercial golden king crab fishery was closed in 1992, but reopened for a month during 1994-95 season. Harvests during this opening, although confidential due to the number of participants, were low.

### *Non-commercial Fisheries*

The historical non-commercial king and Tanner crab fisheries shared many similarities. These fisheries remained open year around despite low abundance. Minimum legal crab sizes, legal gear, and gear limits were identical. Similarly, subsistence gear types were very liberal. The daily possession and bag limit for all non-commercial fisheries was six king crab.

There was no mechanism in place to directly monitor the effort or harvest in the non-commercial king crab fisheries of PWS. The ADF&G Sport Fish Division's most recent mail-out survey estimated a harvest of 58 king crab in 1999 (D.C. Whitmore, Alaska Department of Fish and Game, Sport Fish Division, Anchorage, personal



communication). Limited data developed through household interviews by the ADF&G Subsistence Division staff suggested that subsistence harvests totaled less than 150 king crab among all PWS communities in 1997 (ADF&G 1999).

### *Stock Status and Management Measures*

The department does not actively assess golden king crab stocks. In 1988, the Alaska Board of Fisheries adopted a guideline harvest range (GHR) of 40,000-60,000 pounds for golden king crab in Area E. The GHR was adopted to help stabilize declines in average size, weight, and distribution that had been observed in the legal segment of the golden king crab stock since the fishery began 1982. The GHR was apparently established too late because the 1989-90 and 1991-92 fisheries failed to attain even the low end of the range. Fishery performance data from the 1994-95 season demonstrated that golden king crab stocks in PWS remained at a low level of abundance. The same data provided no indication of impending recruitment to the legal segment of the stock and reported catch of sub-legal male and female crab was very low. The commercial fishery for golden king crab has remained closed since the 1994-95 season.

The department does not assess blue king crab in PWS. The blue king crab fishery has remained closed by emergency order following the 1991-92 season. Fishermen targeting blue king crab during the 1991-92 season reported few undersize male or female crabs. Increased recruitment from immigration is unlikely because even historic aggregations were small and widely dispersed.

The department has assessed the relative abundance of red king crab within the eastern portion of PWS in conjunction with Tanner crab surveys since 1977. The frequency of king crab captures is believed to be an index of their abundance. During the pot survey time series, king crab catches ranged from a high of 193 crab in 1978 to 0 crab in 1991 (Table 2). Trawl surveys in traditional index stations over the past decade have demonstrated that red king crab populations remain depressed and are unlikely to recover in the near future. In March 1999, the Alaska Board of Fisheries formally closed king crab fishing to all user groups until stocks have sufficiently recovered and a harvest strategy is adopted by the board.

Since the early 1980s, the department has issued emergency order closures to conserve king crab stocks. All fishing has been closed by emergency order since 1982 in Hinchinbrook Entrance and Orca Bay and since 1991 in north Montague to protect the low abundance of king and Tanner crabs in these areas. Aside from the very low-level harvests in the 1991-92 exploratory fishery, commercial fisheries for red and blue king crab were closed from 1984-85 to the present. Similarly, except for the fishery in 1994-95, the commercial golden king crab fishery was closed from 1992 to the present. These closures were effected to rebuild the stock and provide protection to juvenile and newly mature crabs. Despite the long-term closure of these areas, data indicates that all king crab stocks in PWS remain depressed with insufficient abundance to support directed

fishing. In response to public concerns regarding the closure of the subsistence king crab fishery, the department has drafted a survey plan to assess golden king crab stocks in western PWS. This plan has been submitted as a funding proposal on several occasions but has failed to establish a priority among other research needs.

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Table 1. Commercial Tanner crab harvests from the Prince William Sound Management Area, 1968- 2001.

Season	Vessels	Landings	Harvest by Area (lb)				Mean Weight (lb/crab)	Number of crab	Percent New-shell Recruits	
			Inside	Outside	Total	Total				
1968-69						1,235,613				
1969-70						1,284,597				
1970-71						4,159				
1971-72						7,788,498				
1972-73						13,927,868				
1973-74			1,658,000	8,500,000		10,158,000				
1974-75			1,187,000	2,667,000		3,854,000				
1975-76			3,322,482	3,810,262		7,132,744				
			Northern Hinchinbrook	Western	Eastern	Total				
1976-77 <sup>a/</sup>	23	316	782,048	766,650	701,725	70,925	2,321,348			
1977-78	38	591	994,721	1,161,831	2,079,549	570,573	4,806,674	2.2	2,184,852	
1978-79	51	783	649,977	708,562	2,248,545	3,443,471	7,050,555	2.1	3,357,408	
1979-80	49	561	140,228	332,583	1,462,059	4,057,847	5,992,717	2.0	2,996,359	
1980-81	30	304	152,196	812,352	1,561,207	250,076	2,775,831	2.1	1,321,824	
1981-82	29	216	351,139	722,834	1,503,253	288,425	2,865,651	No Data		
1982-83	40	304	471,422	31,447	921,663	45,308	1,469,840	2.1	699,924	
1985 <sup>b/</sup>	0	0	Closed	Closed	No Effort	No Effort	0			
1986	14	35	137,720	236,241	160,829	587	535,377	2.1	254,941	26
1987	23	65	152,834	222,052	196,246	0	571,132	2.1	271,968	51
1988	21	46	55,929	226,509	191,654	0	474,092	2.1	225,758	34
1989	0	0	Closed	Closed	Closed	Closed	0			

Closed from 1989 to Present

<sup>a/</sup> New districts established as well as a minimum legal size.

<sup>b/</sup> Calendar year season established.

Table 2. Tanner and king crab catches by pot and trawl surveys of traditional survey stations in Prince William Sound, 1977-2001.

Pot Survey Catch Abundance						
Year	Number Of Pots	Female Tanner Crab	Male Tanner Crab	Total Tanner Crab (both sexes)	Mean Tanner Crab Per Pot	King Crab (both sexes)
1977	51	1,972	2,773	4,745	93.0	30
1978	146	1,099	6,376	7,475	51.2	193
1979	237	3,210	16,831	20,041	84.6	161
1980	240	2,092	11,012	13,104	54.6	103
1981	216	1,064	8,114	9,178	42.5	36
1982	224	849	4,734	5,583	24.9	30
1983	180	573	3,225	3,798	21.1	3
1984	178	610	3,440	4,050	22.8	18
1985	163	212	2,191	2,403	14.7	15
1986	168	570	2,473	3,043	18.1	18
1987	138	1,010	2,336	3,346	24.2	1
1988	119	750	1,195	1,945	16.3	2
1989	114	459	1,640	2,099	18.4	5
1990	109	255	1,336	1,591	14.6	5
1991	81	331	724	1,055	13.0	23

Trawl Survey Catch Abundance						
Year	Number Of Tows	Female Tanner Crab	Male Tanner Crab	Total Tanner Crab (both sexes)	Mean Tanner Crab Per Tow	King Crab (both sexes)
1991	35	1,786	1,884	3,670	104.9	0
1992	38	1,514	1,783	3,297	86.8	2
1993	38	761	1,254	2,015	53.0	2
1994	38	905	1,098	2,003	52.7	2
1995	33	358	534	892	27.0	0
1996		Biennial survey schedule initiated, no survey				
1997	37	341	380	721	19.5	1
1998		No Survey				
1999	33	138	183	321	9.7	1
2000		No Survey				
2001	34	1,864	1,307	3,171	93.3	0

1999						
Valdez	5	57	63	120	24.0	1
All Areas	68	254	329	583	8.6	21
2001						
Valdez	5	106	155	261	52.2	0
All Areas	52	2,917	2,167	5,084	97.8	5

Table 3. Tanner crab population abundance estimates based on trawl survey catches in the Northern and Hinchinbrook Districts, 1991–2001.

		<b>Males</b>										
Size (mm)	Shell Age	Year										
		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
<73	New	620,890	522,363	406,364	581,695	249,368		214,853		121,162		1,005,288
73 - 92	New	537,060	287,565	95,881	70,772	31,681	N	56,792	N	7,558	N	292,830
93 - 112	New	215,572	367,261	98,978	34,103	16,820		32,361		3,131		136,488
	Old	40,529	90,965	92,826	85,066	46,709	S	16,946	S	22,521	S	33,794
113 - 134	New	70,933	135,806	108,525	18,154	4,797	U	10,161	U	1,300	U	24,506
	Old	145,542	158,309	134,404	155,455	79,397	R	22,852	R	15,782	R	22,943
135 - 157	New	20,280	9,474	54,420	4,015	0	E	1,776	E	0	E	1,959
	Old	81,057	53,397	51,453	46,562	24,864	Y	8,898	Y	2,499	Y	2,965
>157	New	935	843	0	0	0		0		0		0
	Old	2,773	1,600	2,751	627	0		0		863		0
Legal Males		105,045	65,314	108,624	51,204	24,864		10,674		3,362		4,923
Total Males		1,735,571	1,627,583	1,045,602	996,449	453,636		364,639		174,817		1,520,773
		<b>Females</b>										
Juveniles		1,128,480	613,447	403,803	609,771	216,771		154,775		19,665		1,112,632
Mature		516,811	808,266	296,547	211,894	106,640		339,719		112,506		500,129
Total		1,645,291	1,421,713	700,350	821,665	323,411		494,494		132,172		2,131,622

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Table 4. Commercial king crab harvests from the Prince William Sound Management Area, 1960-2001.

Season	Harvest Biomass (pounds)	
	All King Crab	
1960	246,965	
1961	236,081	
1962	31,478	
1963	43,569	
1964	14,028	
1965	5,500	
1966	11,000	
1967	41,800	
1968	200,000	
1969	48,100	
1970	94,300	
1971	144,200	
1972	296,200	
1973	207,916	
1974	85,379	
1975	53,423	
1976-77	17,087	
1977-78	86,595	
1978-79	114,000	

Season	Vessels	Landings	Harvest Biomass (pounds)				Avg. wt. Golden
			Red King	Blue King	Golden King	All King Crab	
1979-80	18	109	52,026	13,662	0	65,688	
1980-81	14	65	32,433	7,282	20	39,735	No Data
1981-82	11	43	25,358	5,634	0	30,992	
1982-83	31	187	30,809	10,433	147,016	188,258	9.7
1983-84	18	69	16,467	5,324	50,535	73,226	8.8
1984-85	4	14	235	closed	40,232	40,467	No Data
1985-86	4	11	closed	closed	51,800	51,800	5.8
1986-87	4	11	closed	closed	65,674	65,837	6.1
1987-88	4	15	closed	closed	68,270	68,270	6.6
1988-89	5	14	closed	closed	48,442	48,442	6.6
1989-90	0	0	closed	closed	closed	0	
1990-91	2	2	closed	closed	2,180	2,180	No Data
1991-92	2	2	60	0	780	840	No Data
1992-93	0	0	closed	closed	closed	0	
1993-94	0	0	closed	closed	closed	0	
1994-95	1	**	closed	closed	**	**	

1995-96 to 1999 Seasons closed by emergency order.

Seasons closed by regulation effective August 1999.

(\*\*) Harvest data is confidential due to the limited number of participants.

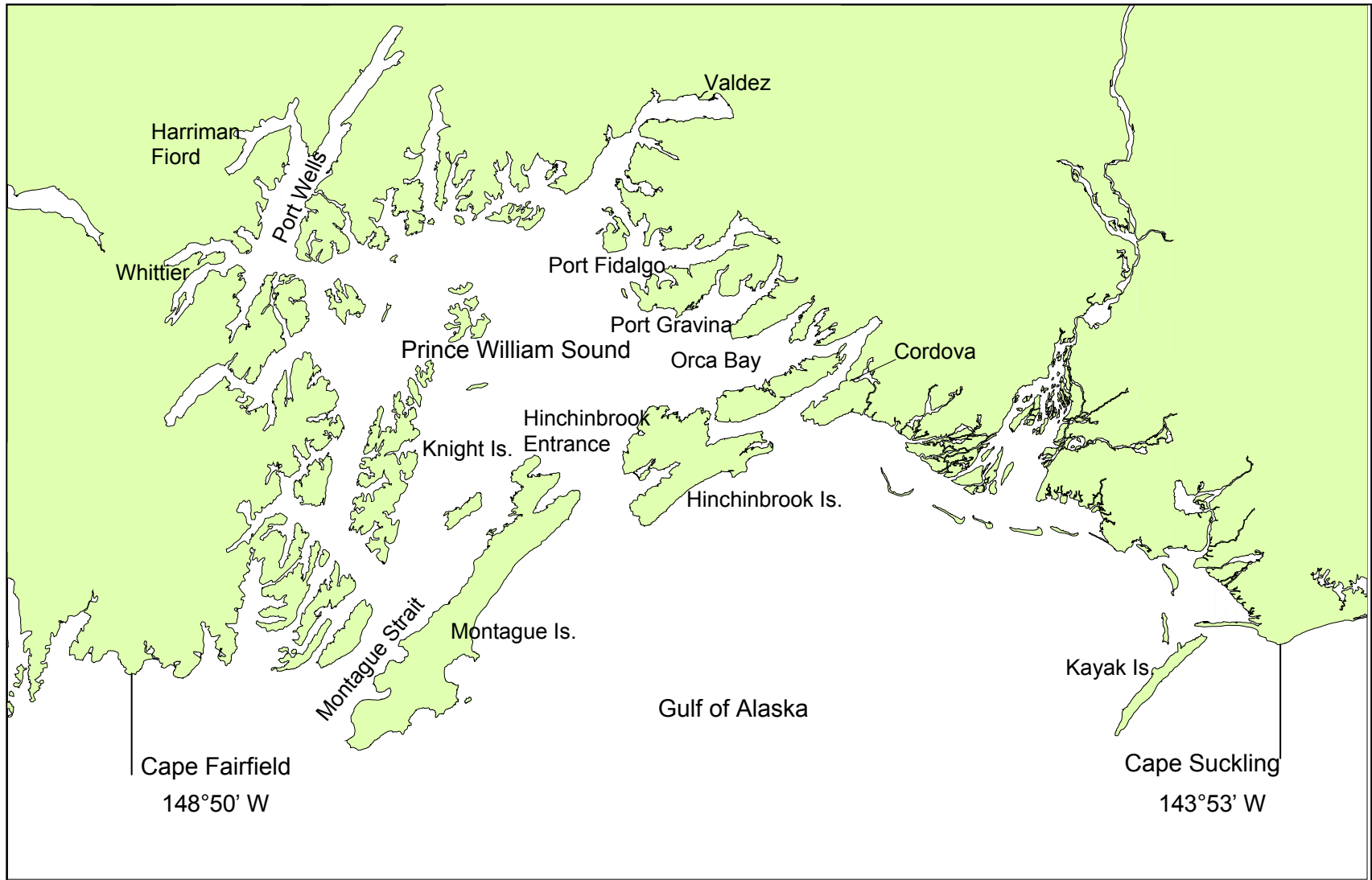


Figure 1. Prince William Sound shellfish registration area.



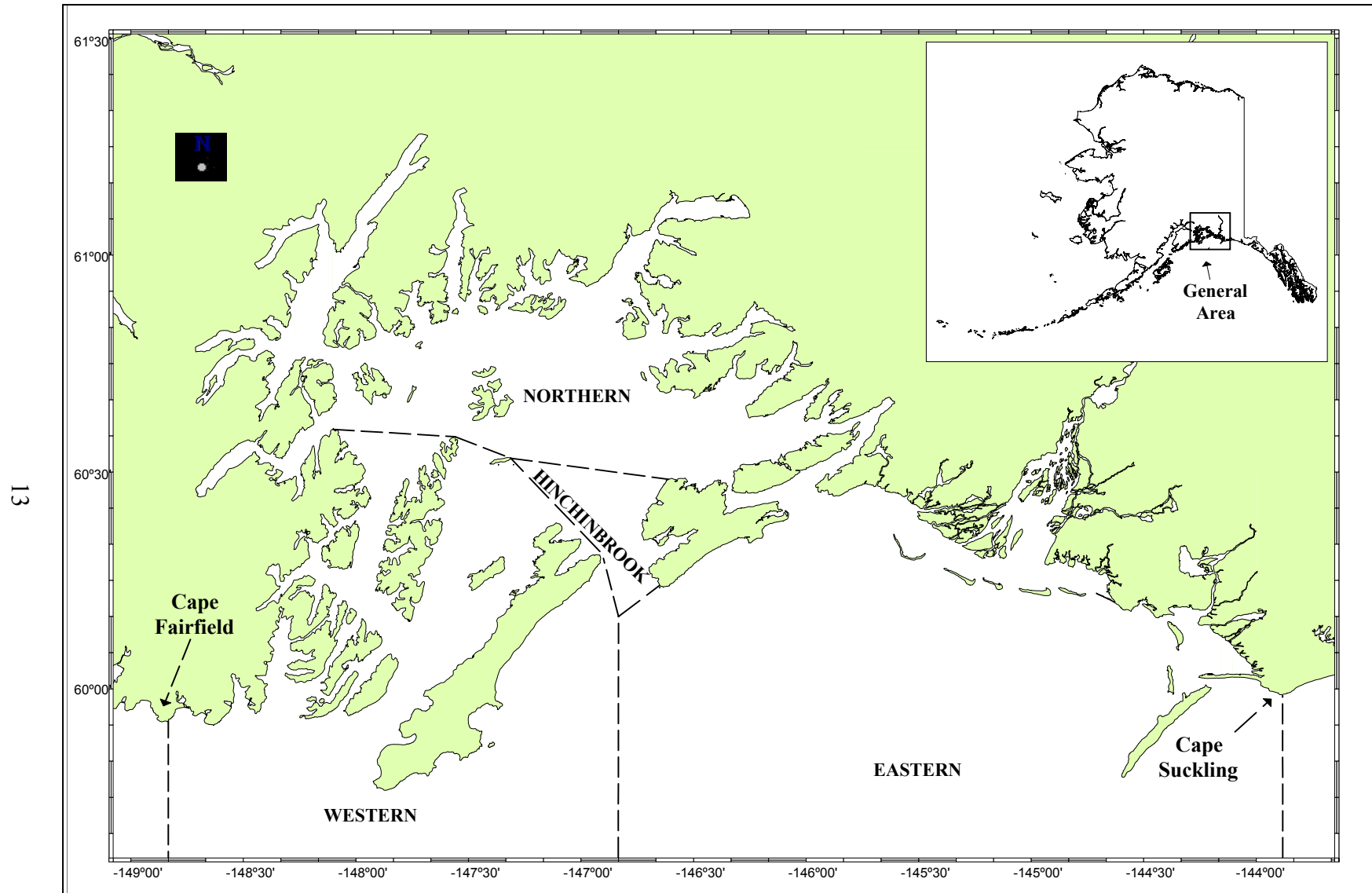


Figure 2. Prince William Sound Tanner crab fishing districts.

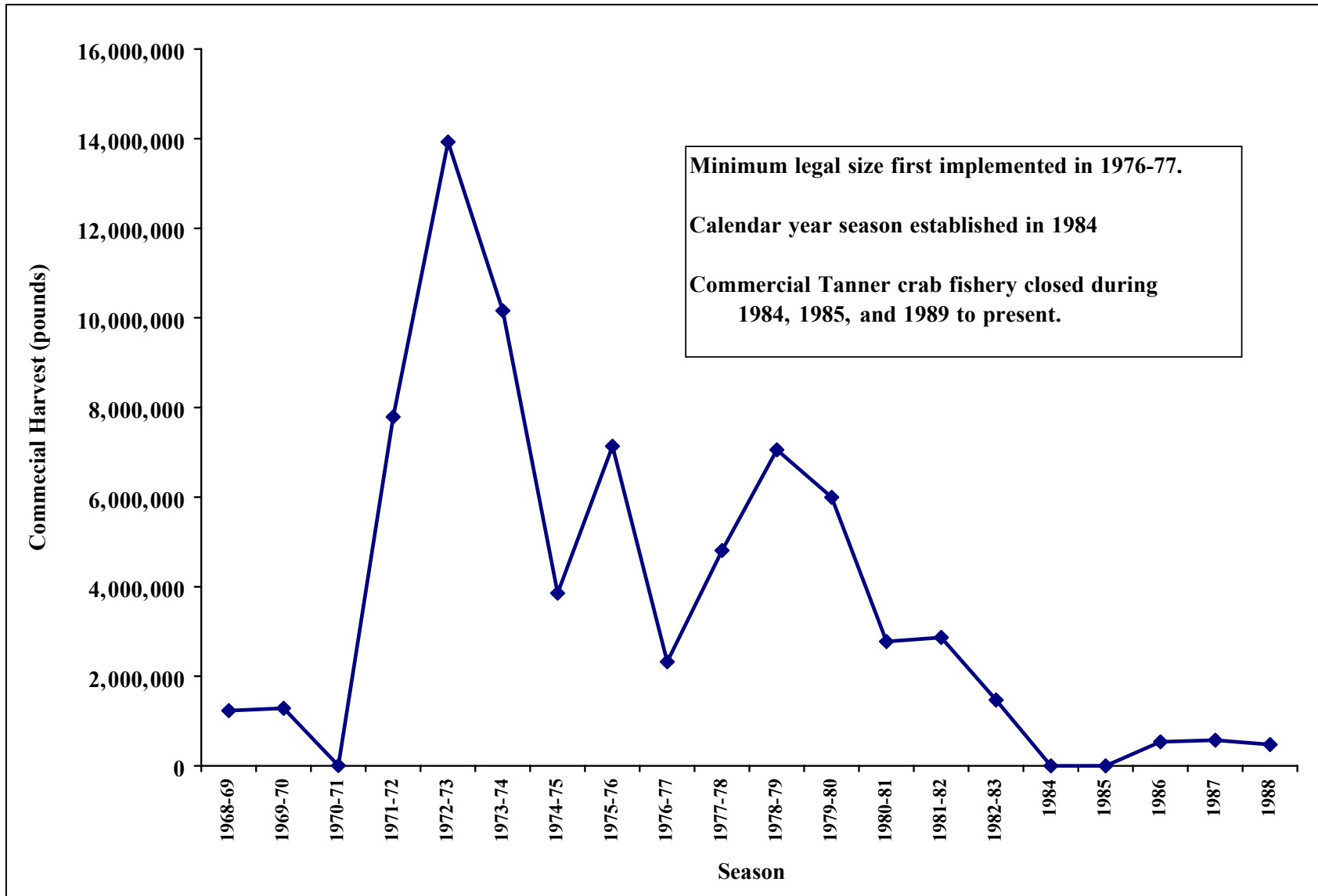


Figure 3. Tanner crab harvest from the Prince William Sound Management Area, 1968–1988.

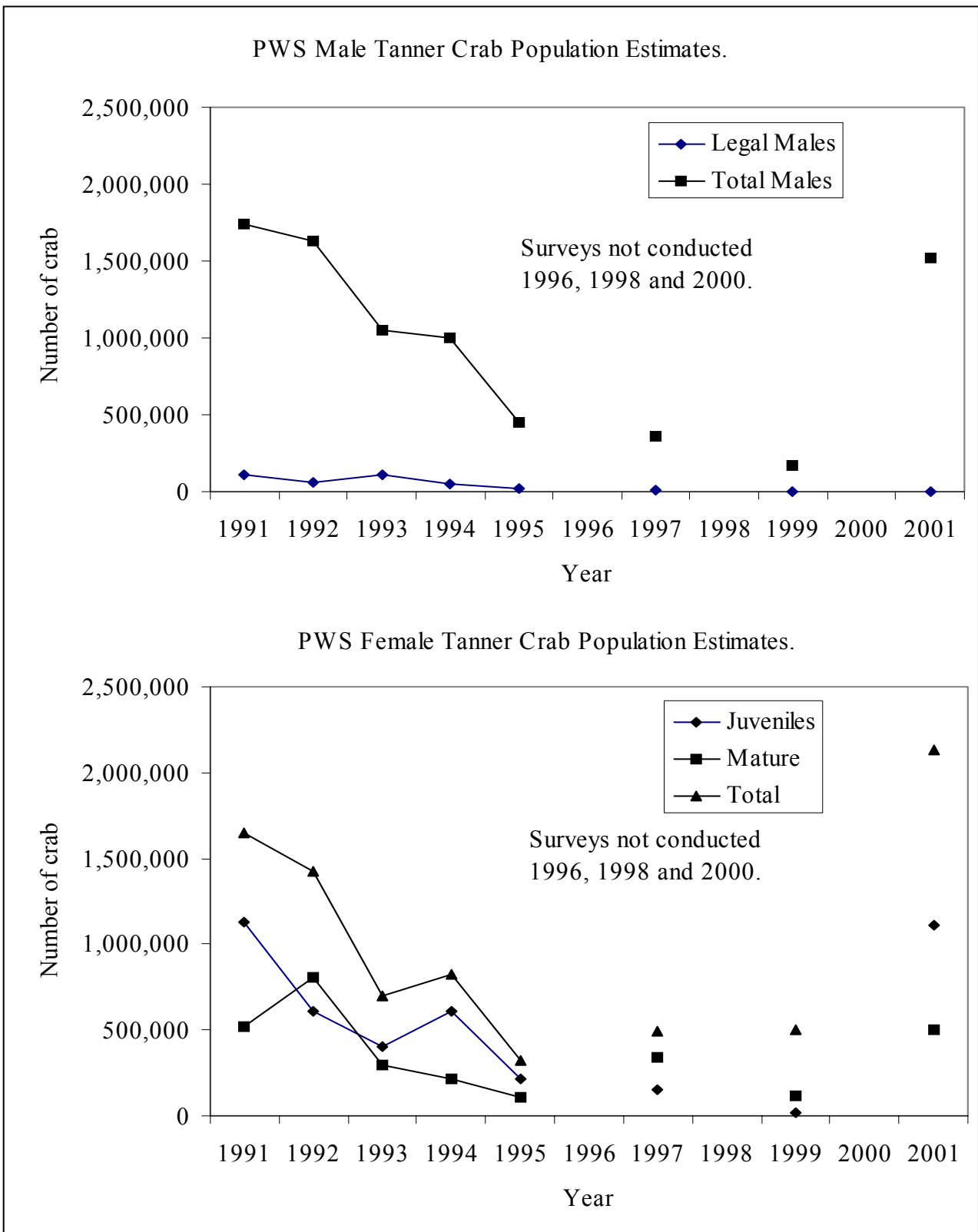


Figure 4. Tanner crab population estimates from Prince William Sound trawl surveys, 1991-2001.

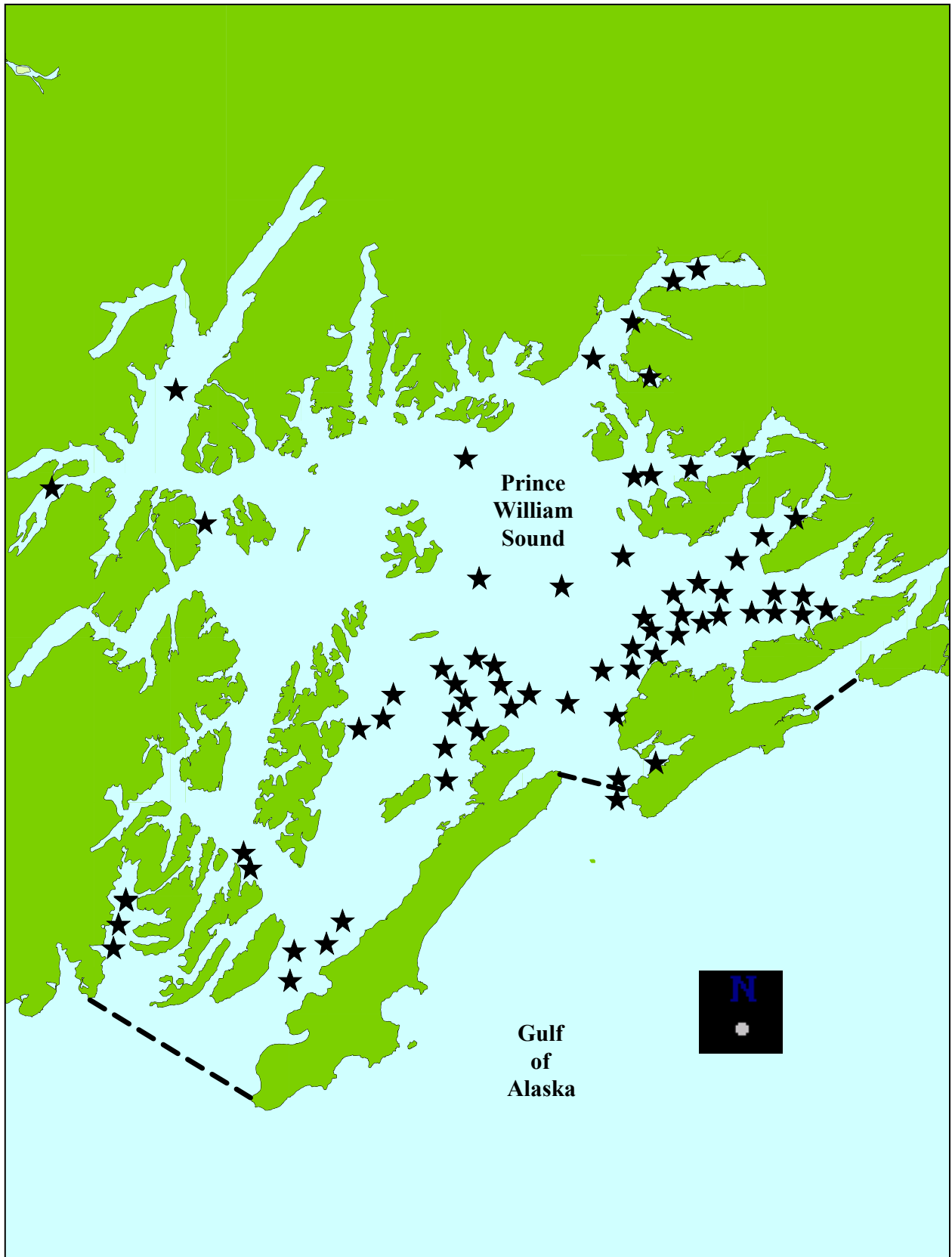


Figure 5. Bottom trawl survey locations in 1999.

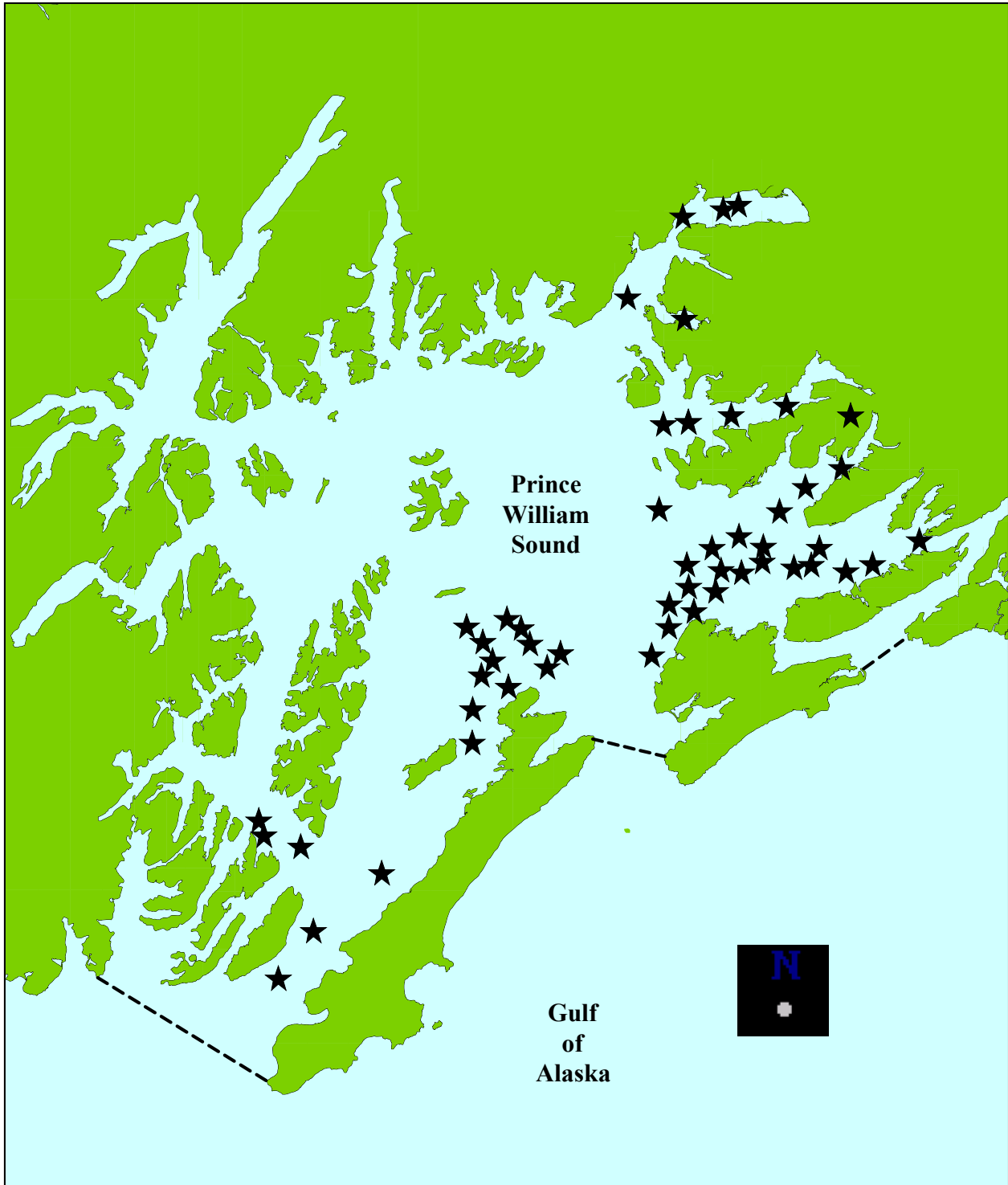


Figure 6. Bottom trawl survey locations in 2001.

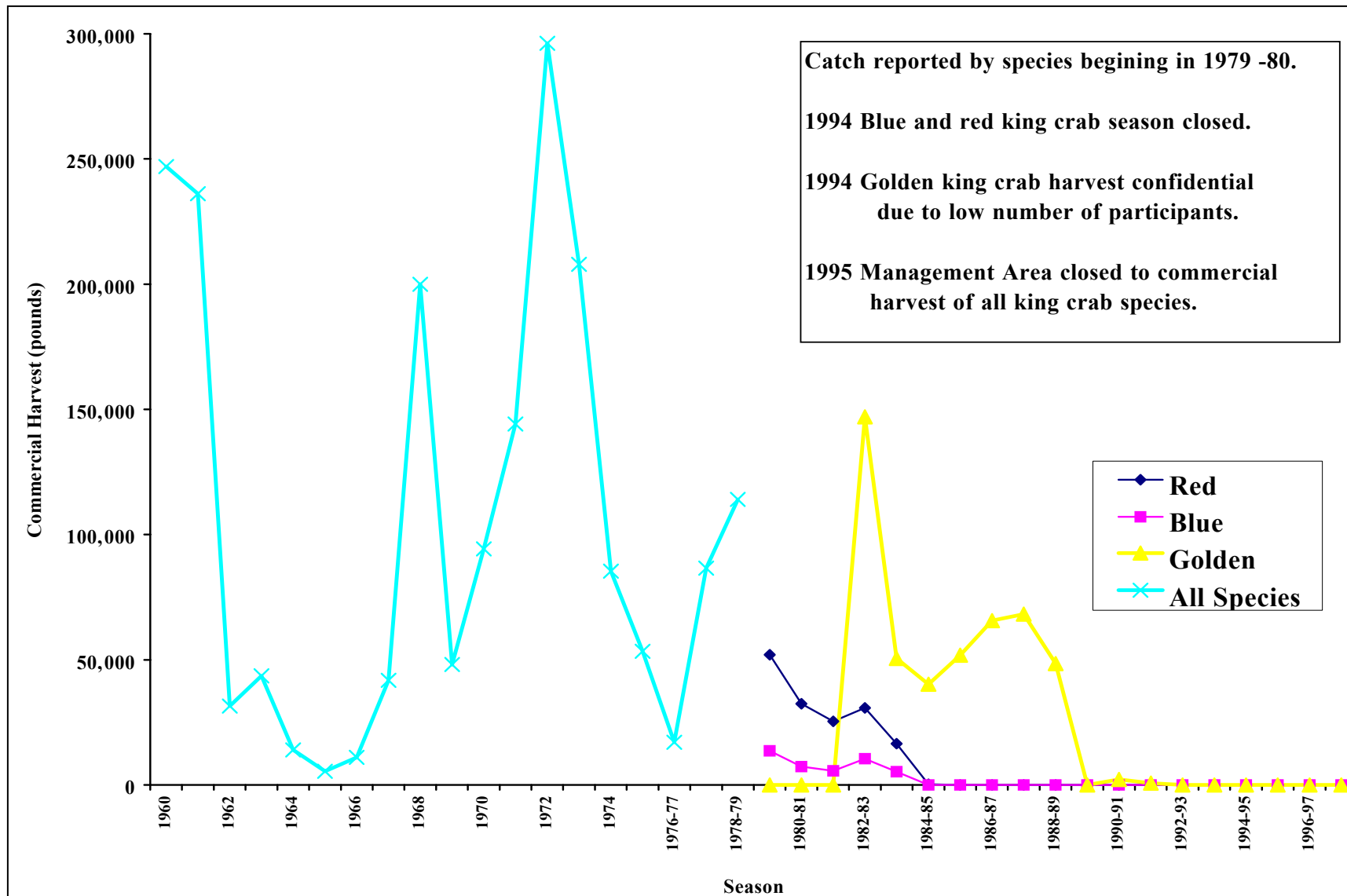


Figure 7. King crab harvests, Prince William Sound Management Area, 1960–1998.

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