

ALASKA DEPARTMENT OF FISH AND GAME
DIVISION OF COMMERCIAL FISHERIES

1993 SOUTHERN DISTRICT (KACHEMAK BAY) DUNGENESS CRAB POT SURVEYS



by
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INTRODUCTION

In 1990 the department began a pot survey for Dungeness crabs (Cancer magister) in Kachemak Bay, which is part of the Southern District of the Cook Inlet Management Area (Figure 1). Since its inception the survey has evolved from an assessment of softshell incidence to an index of abundance. A summary of the current objectives is as follows:

- 1) Identify the annual timing of the molt, or molts, of catchable Dungeness crabs, both male and female.
- 2) Document the percentage of soft-shell Dungeness crabs.
- 3) Document the sex, size and shellage of all Dungeness crabs and the egg condition of all female Dungeness crabs.
- 4) Establish an index of abundance of Dungeness crabs.
- 5) Document the incidental catch of king and Tanner crabs.
- 6) Document the difference in catch between pots with escape rings open and pots with escape rings closed.

The crab trawl surveys in Cook Inlet began in 1989, but were not fully implemented until 1990. The primary goal of the trawl survey was to assess Tanner (Chionoecetes bairdi) and red king crab (Paralithodes camtschaticus) stocks. Ancillary information, such as Dungeness catch, was documented. The initial survey design did not focus on Dungeness, because during likely survey months, June - August (post Tanner and king molt), a portion of the Dungeness stock would not be available to the gear, i.e., they were in waters too shallow to sample with a trawl. Trawl survey data presented in this report will allow comparison to the Dungeness pot survey catches.

METHODS

In 1993 the State chartered the F\V Lion of Judah for the entire survey. Standard Dungeness pots of two distinct weights were used for the survey: pots used east and west of Homer Spit were 60 and 100 pounds, respectively. The gear dimensions reflected those generally used by commercial fishermen. Bait types used were squid in the gear east of the Spit and razor clams in the pots west of Homer Spit. These bait types also reflect those commonly used by commercial fishermen. Initial soak time goals were 24 hours east of the Spit and 48 hours west of the Spit. The variation in soak times was the result of both fishermen comments regarding the time necessary for the pots to begin fishing and cost of the charter.

All commercial Dungeness gear are required by regulation to have two 4 3/8 inch diameter circular escape rings. The intent of the escape ring regulation is to permit the egress of female and sublegal male crabs from the pot thereby reducing the incidence of handling of non-target crabs. The escape rings were left open on two-thirds of the survey gear in order to approximate the catches of commercial fishermen. Every third pot, or one-third of the gear, was fished with the escape rings closed. This was done in order to determine the relative magnitude of small crabs that these pots were capable of capturing and retaining.

Selection of survey stations was systematic. Commercial fishermen were interviewed in order to determine specific locations for crab capture given the time of year the survey was to occur. A total of 170 stations were selected, 90 east (Appendix A) and 80 west of Homer Spit (Appendix B). The time span of the respective surveys within the year was based on fishermen input, historical catch figures, suspected, and known molt timing of catchable males and available funding for the project.

The gear was set east of Homer Spit in three 15 pot strings in the Mud Bay area and 15 three pot strings in the upper bay (Figure 2). Eight 10 pot strings were fished west of Homer Spit (Figure 3). Distance between individual pots within a string was approximately 0.25 nautical miles east of Homer Spit and 0.20 nautical miles west of the Spit.

A Global Positioning System, video plotter and echo sounder were used to record pot and station information for future reference and replication. Depths were recorded at the time the gear was set utilizing the vessel's sounder. Documented depths do not take into consideration the stage of the tide.

Once each pot was pulled, all Dungeness, king and male Tanner crabs were measured to the nearest millimeter (mm) of carapace width (Dungeness and Tanner) or length (king) and shellaged. Relative fecundity of all Dungeness and king crab females was determined. Juvenile female Dungeness were not identified since positive classification would have required destroying the animal. Female Tanners were counted only.

Speed was often essential while pulling the pots. Shallow sets coupled with running tides and currents made it necessary to move through the gear with maximum efficiency in order to retrieve all the pots before the water became too shallow for the vessel or the current pulled the buoys under. In some instances therefore the bycatch species were sampled only to species, count and sex.

RESULTS

East of Homer Spit

The dates for the five surveys east of Homer Spit were: May 17 - 19, June 15 - 17, July 20 - 22, Aug. 16 - 23 and Sept. 22 - 24. Ninety pots were lifted in four of the five surveys east of the

Spit; 86 lifts were made during the last survey in September. Fishing depths ranged from 0.7 to 8.0 fathoms, averaging 3.0 fathoms. Average soaks varied from 20 to 25 hours with a mean of 23 hours (Table 1).

Similar to past years, overall numbers of male crabs increased as the survey season progressed, beginning at 225 crabs in May, peaking in August at 907 animals and declining again in September to 428 (Figure 4). Females catch was substantially less, starting at 18 in May, peaking at 95 in July and dropping to 78 by September. Total male soft-shell numbers jumped from a level of 2 in May to 25 in July, peaking at 35 (4%) in August and declining to 5 in September (Table 2).

The monthly increase is most evident for the new-shell males (Figure 5) although it occurred with the old shells as well (Figure 6). The new-shell male portion of the catch increased from 16 percent in the May survey to a high of 51 percent in the August survey. The new shell increase was evident for legals as well as sublegals (Table 3).

The size range of males was 144 to 195 mm carapace width with a mean of 167 mm. There were no significant changes in the average sizes or ranges of size among surveys (Table 4). Only two females were ovigerous. The size range of females was 123 to 175 mm carapace width with an average of 146 mm. Only 3 of the females were in a soft-shell condition. All three were captured during the September survey (Table 5).

One male and no female Tanner crabs were caught during the Dungeness pot survey east of Homer Spit. The lone male was captured during the May survey. No king crabs were caught (Table 6)..

West of Homer Spit

The two surveys west of the Spit were conducted July 13 - 15 and August 9 - 11. Seventy and 80 pots were pulled west of the Spit in July and August, respectively. Ten pots were lost in July and none in August. Fishing depths ranged from 15.0 to 45.0 fathoms, averaging 28 fathoms. Mean soak times were 48 hours for the July survey and 49 hours for the August survey (Table 1).

The July survey west of Homer Spit resulted in a catch of 9 males and 11 females. Three of the males were legal. None of the males were in a soft-shell condition (Table 2). One of the legal and three of the sublegal males were new shells (Table 3). The males ranged in size from 156 to 180 mm with an average of 164 mm (Table 4). None of the 11 females were either ovigerous or soft-shelled (Table 5).

The survey conducted in August resulted in a catch of 43 males, 34 legals and 9 sublegals, as well as 25 females. None of the males were soft shells (Table 2). New shell percentages were 68 and 33 for legals and sublegals, respectively (Table 3). The size range of the males was 153 - 186 mm, averaging 170 mm (Table 4). Of the 25 females, none were ovigerous or soft-shelled (Table 5).

Tanner crab catch in the July survey totalled 27 males and 17 females. Thirty two males and 33 females were caught in August. No king crabs of either sex were captured (Table 6).

Escape rings

For the second consecutive survey year, retention of sublegal males was clearly greater in pots with escape rings closed versus those with escape rings open. Overall sublegal catch per pot was 3.6 with rings closed as opposed to 2.0 with rings open, an 80 percent

increase. Catch rates for legal crabs was identical in both ring open and ring closed pots at 3.6 crabs per pot. It should be noted that although pots with rings closed retained more small crabs than pots with rings open, these crabs were in the same size group; they did not catch crabs that were any smaller than the ones found in the ring open pots (Table 7).

1993 trawl survey

The trawl survey was conducted July 6 - 14, 1993. Male and female Dungeness catches from the 1993 trawl survey were 136 and 534 crabs, respectively (Table 8). Legals composed 56 percent (76 crabs) of males. New shells equalled 86 percent of the males and 71 percent of the females. Soft shell males accounted 17 percent of the total male catch. None of the 534 females were in a soft-shell condition. All of the females were non-ovigerous. Mean carapace width for males was 166 mm with a range of sizes from 136 to 188 mm (Figure 7). Average carapace width of females was 141 mm within a range of 126 to 169 mm (Figure 8).

DISCUSSION

After 11 years of substantial harvest (1978 to 1988) the commercial catch of Dungeness crabs in the Southern District declined rapidly in 1989 and 1990 to a point where the fishery was closed because of low abundance (Table 9). Beginning in 1989, department trawl and pot surveys indicated a potential for a recovery. Later surveys however showed that these crabs essentially represented a single cohort and were resident only in the waters of Kachemak Bay east of Homer Spit. Furthermore, the males exhibited a high level of skipmolting in the prerecruit one size class thereby significantly reducing potential recruitment into the legal segment of the stock.

The substantial size group of Dungeness crabs that the trawl survey first identified in 1989 eventually recruited into the adult segment of the stock in 1991. Pot and trawl surveys indicated that this group of animals maximized it's move into the legal segment of the stock in 1992. The 1992 pot survey also identified substantial skip-molting beginning in the prerecruit one size class. Pot surveys in 1993 showed that skip-molting reduced the possible recruitment from this group of animals by as much as 50 percent. Additionally pot and trawl surveys as well as personal use fishery information indicated that these crabs only inhabited that portion of Kachemak Bay east of Homer Spit leaving the area west of Homer Spit with a very small number of Dungeness.

The skip-molting that is seemingly characteristic of upper Kachemak Bay may not be a recent phenomenon. Although the data are sparse, it appears that the males east of Homer Spit may only be capable of reaching the recruit size class (165 - 189 mm). In the late 1970's and early 80's, before the fishery was fully developed, average commercial weights ranged from 2.0 to 2.25 pounds per crab. Eight inch crabs were uncommon and 9 inch crabs were not found. On the other hand catch data from commercial fisheries indicated that the Dungeness crabs found west of Homer Spit were capable of growing substantially larger than the recruit size class. It was not uncommon to find 8 and 9 inch crabs with average delivery weights ranging from 2.5 to 2.9 pounds per crab (Table 10). The males west of Homer Spit may be able to molt more frequently during their life cycle or achieve greater incremental growth per molt. This phenomenon has been identified in Tanner crabs in Cook Inlet Management Area, i. e., Southern District Tanners are capable of reaching a maximum size significantly larger than crabs from the Kamishak and Barren Islands Districts.

Pot survey catches are indicating that the large cohort of crabs is passing through its life cycle and following year classes are weaker. The male Dungeness catch from the 1993 pot survey east of

Homer Spit was down substantially from the 1992 survey. Using August survey data for both years, the month of highest catches, this decline is most evident in the prerecruit one size class where the catch dropped by more than 50 percent from 853 crabs in 1992 to 352 crabs in 1993. Although the decline in legals was less pronounced, it was still substantial, dropping 25 percent from 737 to 555 crabs. Using the August data again, skipmolting in 1993 remained very high at 56 percent of the sublegals and 45 percent of the legals (Table 3). Trawl survey data also showed a decline from 211 males in 1992 to 136 males in 1993. Also of significant concern is the absence of juvenile crabs in the trawl catch (Table 8).

Interestingly trawl survey data continue to identify substantial numbers of adult females in the deeper waters of Kachemak Bay. This is of particular note when compared to the declining numbers of males from the 1989 to 1993 survey (Table 8). Conversely pot surveys have never demonstrated numbers of females approaching those of males from the same cohort (Table 2). Comparison of these data indicates that adult males move into shallower water (sampled by pot survey) in the summer while the majority of the adult females remain in deeper water (sampled by trawl survey). This phenomenon may differ in areas such as China Poot Bay, but at least for the majority of the area and stock sampled by the surveys, varying movement by sex seems to occur.

Survey catches west of Homer Spit continued to be very low. Neither the pot nor trawl survey signified any potential for near term stock recovery. Movement of post larval crabs from either the waters east of Homer Spit or upper Cook Inlet has not occurred to this point. Personal use fisherman also report very few Dungeness west of the Spit.

Similar to previous years the pot survey did not identify a large percentage of soft shells in 1993. The largest percentage was four

which is comparable to the proportions found in the 1990 through 1992 surveys (Table 2). Once again the trawl survey captured a larger percentage of softshell males. Seventeen percent of the males were in a softshell condition in the July 1993 trawl catch (Table 11). It appears that the majority of the adult males molt in deeper water during the months of June and July then immigrate into shallower water where they are captured in increasing numbers during the pot surveys. This is based on the substantial increase in the historical pot survey catches during the months of July and August coupled with both the very low percentage of pot survey softshells and significant numbers of trawl survey soft shells.

Historical catch data also seem to indicate that recruitment and movement into shallow waters occurred in July and August. Commercial catch reached its peak in August (25.2%) with July (24.7%) and September (23.5%) following closely behind (Figure 9). Based on historical commercial catch data and anecdotal information from fishermen, it appears that a substantial molt can infrequently occur in August or even September. This was likely the case in 1987 when 40 percent of the commercial catch was taken during the months of September and October. It should be noted however that this seasonally late appearance of crabs in 1987 occurred in the fishery west of Homer Spit; July and August remained the peak catch months east of the Spit.

Once again the overall recovery of the Cook Inlet Dungeness crab population seems to hinge on the reproductive success of the stock of crabs east of Homer Spit. Although these animals do not appear to emigrate to the waters west of the Spit as adults, their larvae will likely drift into all the waters of Cook Inlet and beyond thereby providing an opportunity for recovery. Research on Dungeness larval development and distribution conducted in California, Oregon, Washington and British Columbia indicate that larvae remain in the water column for a minimum of 3 to 4 months and may be transported by water movement for substantial distances,

estimated at 100 miles or more along the coastal northwest (Jamieson et al. 1993; McConnaughey et al 1992). Although surface water circulation data indicate two small gyres within upper Kachemak Bay that may entrain larvae, the same report states that persistent to strong winds will eliminate the gyre system (ADF&G, 1978). Persistent to strong winds obviously will occur within any 3 to 4 month period thereby releasing the larvae from the gyre and transporting them via tides and general outflow from the waters of upper Kachemak Bay to the outer bay and beyond. Furthermore, gyres aside, there is general water movement out of upper Kachemak Bay thus outward larval movement potentially exists at any time (Figure 10).

The Dungeness pot and trawl surveys are scheduled again for 1994. No significant changes are planned for the survey designs. A groundfish trawl survey in the waters of central Cook Inlet will occur in 1994 for the first time. The resultant data may provide additional insight into the distribution of Dungeness crabs in Cook Inlet.

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Table 1. Station descriptive data, Kachemak Bay Dungeness crab pot survey, 1993.

Date	Location	Station	No. pots pulled	Depth range (fms)	Avg. (fms)	Avg. soak (hrs.)
5/17	East of Spit	Mud Bay	45	1.5–8.0	3.3	24
5/18			45	2.7–8.0	3.8	22
6/15			45	2.0–6.8	3.6	24
6/16			45	2.3–6.8	3.6	22
7/20			45	1.3–6.2	2.6	25
7/21			45	0.7–6.7	2.0	20
8/16			45	0.8–5.8	2.5	24
8/22			45	0.8–3.3	2.0	23
9/22			43	2.0–8.0	3.8	24
9/23			43	1.7–5.0	2.6	21
7/13	West of Spit		70	15.0–45.0	28.0	49
8/09			80	15.0–43.0	28.0	48

1 Date gear was set.

2 Depths calculated from vessels sounder at time gear was set. Not calculated from mean lower low water as used on navigational charts.

Table 2. Dungeness crab catch, in numbers, Southern District Dungeness pot surveys, 1990–93.

Year	Dates	Location	Pots pulled	Females	Sublegal males	Legal males	Total males	Soft-shell males
1990	5/15–17	East of Spit	90	53	47	17	64	8 (13)
	6/19–21		90	54	65	23	88	9 (10)
1991	6/04–06	East of Spit	89	6	116	110	226	21 (9)
	7/09–11		90	21	388	263	651	36 (6)
	8/06–08		90	85	625	475	1,100	47 (4)
	9/12–14		90	30	615	492	1,107	5 (<1)
	7/02–06	West of Spit	82	9	6	5	11	2 (18)
	8/14–16		95	9	7	11	18	0 (0)
1992	5/31–6/04	East of Spit	89	27	276	180	456	2 (1)
	6/30–7/2		89	76	583	578	1,161	31 (3)
	7/27–29		90	65	621	531	1,152	50 (4)
	8/11–13		90	47	849	792	1,641	14 (1)
	8/25–27		88	47	853	737	1,590	24 (2)
	9/10–12		89	47	621	749	1,370	4 (<1)
	10/07–09		90	19	516	349	865	2 (<1)
	7/05–07	West of Spit	96	30	7	14	21	1 (5)
	8/05–07		78	59	49	59	108	0
	1993 ¹	5/17–19	East of Spit	90	18	105	120	225
6/15–17		90		60	226	203	429	5 (1)
7/20–22		90		95	297	448	745	25 (3)
8/16–23		90		84	352	555	907	35 (4)
9/22–24		86		78	148	280	428	5 (1)
7/13–15		West of Spit	70	11	6	3	9	0
8/09–11			80	25	9	34	43	0

1 33% of escape rings closed.

Table 3. Shell age of male Dungeness crabs from the Southern District Dungeness pot survey, 1990–93.

Year	Dates	Location	Shell age														
			Number sublegals				Number legal				All males						
			New	(%)	Old	(%)	Total	New	(%)	Old	(%)	Total	New	(%)	Old	(%)	Total
1990	5/15–5/17	East of Spit	30	(64)	17	(36)	47	7	(41)	10	(59)	17	37	(58)	27	(42)	64
	6/19–6/21		52	(80)	13	(20)	65	17	(74)	6	(26)	23	69	(78)	19	(22)	88
1991	6/04–6/06	East of Spit	89	(77)	27	(23)	116	101	(92)	9	(8)	110	190	(84)	36	(16)	226
	7/09–7/11		368	(95)	20	(5)	388	262	(99)	1	(1)	263	630	(97)	21	(3)	651
	8/06–8/08		607	(97)	18	(3)	625	470	(99)	5	(1)	475	1,077	(98)	23	(2)	1,100
	9/12–9/14		596	(97)	19	(3)	615	486	(99)	6	(1)	492	1,082	(98)	25	(2)	1,107
1991	7/02–7/06	West of Spit	2	(33)	4	(67)	6	4	(80)	1	(20)	5	6	(55)	5	(45)	11
	8/14–8/16		6	(86)	1	(14)	7	7	(64)	4	(36)	11	13	(72)	5	(28)	18
1992	5/31–6/02	East of Spit	37	(13)	239	(87)	276	44	(24)	136	(76)	180	81	(18)	375	(82)	456
	6/30–7/02		153	(26)	430	(74)	583	261	(45)	317	(55)	578	414	(38)	747	(62)	1,161
	7/27–7/29		210	(34)	411	(66)	621	268	(51)	263	(49)	531	478	(41)	674	(59)	1,152
	8/11–8/13		272	(32)	577	(68)	849	328	(41)	464	(59)	792	600	(37)	1,041	(53)	1,641
	8/25–8/27		363	(43)	490	(57)	853	430	(58)	307	(42)	737	793	(50)	797	(50)	1,590
	9/10–9/12		254	(41)	367	(59)	621	436	(58)	313	(42)	749	690	(50)	680	(50)	1,370
	10/07–10/09		171	(49)	178	(51)	349	375	(73)	141	(27)	516	546	(63)	319	(37)	864
	7/05–7/07		West of Spit	3	(43)	4	(57)	7	5	(36)	9	(64)	14	8	(38)	13	(62)
8/05–8/07	33	(67)		16	(33)	49	40	(68)	19	(32)	59	73	(68)	35	(32)	108	
1993	5/15–5/19	East of Spit	7	(7)	98	(93)	105	28	(23)	92	(77)	120	35	(16)	190	(84)	225
	6/15–6/17		22	(10)	204	(90)	226	43	(21)	160	(79)	203	65	(15)	364	(85)	429
	7/20–7/22		95	(32)	202	(68)	297	208	(46)	240	(54)	448	303	(41)	442	(59)	745
	8/16–8/23		154	(44)	198	(56)	352	306	(55)	249	(45)	555	460	(51)	447	(49)	907
	9/22–9/24		52	(35)	96	(65)	148	132	(47)	148	(53)	280	184	(43)	244	(57)	428
1993	7/13–7/15	West of Spit	3	(50)	3	(50)	6	1	(33)	2	(66)	3	4	(44)	5	(56)	9
	8/09–8/11		3	(33)	6	(66)	9	23	(68)	11	(32)	34	26	(60)	17	(40)	43
1 33% of escape rings closed.																	

Table 4. Male Dungeness crab size data, Southern District Dungeness pot surveys, 1990–93.

Year	Date	Location	Average width (mm)	Range
1990	5/15–5/17	East of Spit	155	101–190
	6/19–6/21		154	102–189
	6/04–6/06	East of Spit	164	135–187
	7/09–7/11		163	114–182
	8/06–8/08		164	129–185
	9/12–9/14		164	127–189
	7/02–7/06		West of Spit	164
	8/14–8/16	172		158–197
	5/31–6/02	East of Spit	163	136–190
	6/30–7/02		165	137–191
	7/27–7/29		165	139–194
	8/11–8/13		165	142–196
	8/25–8/27		164	126–194
	9/10–9/12		166	139–193
	10/7–10/9		167	139–192
	7/05–7/07	West of Spit	171	156–202
	8/05–8/07		167	145–204
	1993	5/17–5/19	East of Spit	166
6/15–6/17		165		143–195
7/20–7/22		167		148–193
8/16–8/23		168		146–190
9/22–9/24		168		145–192
7/13–7/15		West of Spit	164	156–180
8/09–8/11			170	153–186

Table 5. Female Dungeness crab catch, Southern District Dungeness pot surveys, 1990–93.

Year	Dates	Location	Total females	Egg development (No.)		Avg. size (mm)	Size range	Soft-shells (no.)	Shellage (no.)	
				w/eggs	w/o eggs ¹				new	old
1990	5/15–5/17	East of Spit	53	3	50	149	113–165	6	45	8
	6/19–6/21		54	0	54	153	106–171	8	44	10
1991	6/04–6/06	East of Spit	6	0	6	152	120–163	0	4	2
	7/09–7/11		21	2	19	149	119–165	0	16	5
	8/06–8/08		85	0	85	150	116–173	0	66	19
	9/12–9/14		30	0	30	149	128–170	0	23	7
	7/02–7/06	West of Spit	9	0	9	155	135–163	0	3	6
	8/14–8/16		9	0	9	155	148–175	0	9	0
1992	5/31–6/02	East of Spit	27	2	25	143	126–164	0	14	13
	6/30–7/02		76	0	76	145	126–164	0	32	44
	7/27–7/29		652	0	65	144	115–172	0	32	33
	8/11–8/13		47	0	47	148	126–170	0	19	28
	8/25–8/27		47	0	47	145	126–167	0	16	31
	9/10–9/12		47	0	47	143	129–171	0	30	17
	10/7–10/9		19	0	19	147	126–169	2	10	9
	7/05–7/07	West of Spit	30	0	30	154	139–168	1	20	10
	8/05–8/07		59	0	59	156	141–167	0	50	9
1993	5/17–5/19	East of Spit	18	1	17	151	136–169	0	16	2
	6/15–6/17		60	0	60	142	123–158	0	40	20
	7/20–7/22		95	0	95	146	125–175	0	27	68
	8/16–8/23		84	1	83	146	128–165	0	29	55
	9/22–9/24		78	0	78	146	129–160	3	22	53
	7/13–7/15	West of Spit	11	0	11	151	139–165	0	7	4
	8/09–8/11		25	0	25	156	141–168	0	19	6

1 Barren adults not distinguished from juveniles.

Table 6. Tanner and king crab bycatch from the Southern District Dungeness crab pot survey, 1990–1993.

Year	Dates	Location	Tanner crabs		King crabs	
			males	females	males	females
1990	5/15–5/17	East of Spit	1	0	0	0
	6/19–6/21		0	1	0	0
1991	6/04–6/06	East of Spit	101	14	2	2
	7/09–7/11		8	0	0	0
	8/06–8/08		13	0	0	0
	9/12–9/14		2	0	0	0
1991	7/02–7/06	West of Spit	76	31	0	0
	8/14–8/16		33	29	0	0
1992	5/31–6/02	East of spit	21	0	0	0
	6/30–7/02		0	0	0	0
	7/27–7/29		0	0	0	0
	8/11–8/13		0	0	0	0
	8/25–8/27		0	0	0	0
	9/10–9/12		0	0	0	0
	10/7–10/9		0	0	0	0
	7/05–7/07	West of Spit	35	4	0	0
	8/05–8/07		40	4	0	0
	1993	5/17–5/19	East of Spit	1	0	0
6/15–6/17		0		0	0	0
7/20–7/22		0		0	0	0
8/16–8/23		0		0	0	0
9/22–9/24		0		0	0	0
7/13–7/15		West of Spit	27	17	0	0
8/09–8/11			32	33	0	0

Table 7. Average catch per pot of male Dungeness crab in pots with and without escape rings, east of Homer Spit, 1993 Southern District Dungeness crab pot survey.

Size (5 mm groups)	Rings Closed	Rings open
Sublegals		
<139	0.0	0.0
140–144	<0.1	0.0
145–149	0.1	<0.1
150–154	0.6	0.1
155–159	1.3	0.5
160–164	1.6	1.4
Total Sublegals	<u>3.6</u>	<u>2.0</u>
Legals		
165–169	1.3	1.5
170–174	1.2	1.1
175–179	0.7	0.6
180–184	0.3	0.3
>185	0.1	0.1
Total Legals	<u>3.6</u>	<u>3.6</u>

Table 8. Summary of Dungeness crab catch (number), Southern District crab trawl survey, 1989–93.

Date	Stations	Total Dungeness catch	Males	Average width (mm)	Range	Percent softshell	Females	Average width (mm)	Range	Percent softshell	Percent egg bearing
Oct., 1989	11	934	304	118	28–216	11	630	124	24–170	8	1
July, 1990	19	977	317	134	91–181	12	660	129	102–171	11	5
July, 1991	20	710	234	155	111–183	20	476	134	106–173	0	11
July, 1992	18	687	211	157	128–193	24	476	143	116–174	<1	<1
July, 1993	19	670	136	166	136–188	17	534	141	126–169	0	0

Table 9. 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	12	189
1962	530,770	0	530,770	15	269
1963	1,665,599	11,605	1,677,204	50	1,360
1964	417,005	6,036	423,041	22	341
1965	74,211	0	74,211	14	105
1966	12,523	117,037	129,560	5	28
1967	7,168	0	7,168	2	13
1968	484,452	3,407	487,859	7	224
1969	49,894	0	49,894	9	41
1970	209,819	0	209,819	10	50
1971	97,161	0	97,161	22	136
1972	38,930	0	38,930	24	206
1973	308,777	1,271	310,048	54	625
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	Season closed	0	0	0	0
1992	Season closed	Confidential ¹	Confidential ¹		
1993	Season closed	Confidential ¹	Confidential ¹		

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

¹ Two or less participants.

Table 10. Average weights of commercial Dungeness landings,
Southern District, 1975–84.

Year	June	July	West of Spit		Oct.	Weighted average
			August	Sept.		
1975			2.91	3.73		2.85
1976						3.05
1977						2.78
1978			2.29	2.20	2.20	2.23
1979		2.53	2.54	2.61	2.52	2.55
1980						
1981	2.54	2.56				
1982			2.22			2.22
1983			2.29	2.65		2.41
1984			1.97			
			East of Spit			
1978				2.08	2.01	2.04
1979				2.00	2.25	2.12
1980						
1981		1.99	1.95	2.02		1.99
1982		1.67	2.02			1.94
1983	2.06	2.15	2.15	1.97	1.80	2.05
1984	1.94	2.00	2.09	1.96	2.00	1.99

Table 11. Incidence of soft shelled Dungeness crab, Southern District crab trawl survey, 1989–1993.

Date	Total males	No. soft (%)	Legal males	No. soft (%)	Sublegal males	No. soft (%)	Females	No. soft (%)
Oct., 1989	304	33 (11)	23	1 (4)	281	32 (11)	630	48 (8)
July, 1990	317	37 (12)	6	0	311	37 (12)	660	72 (11)
July, 1991	234	47 (20)	46	11 (24)	188	36 (19)	473	0
July, 1992	211	51 (24)	66	27 (41)	145	24 (17)	476	1
July, 1993	136	23 (17)	76	15 (20)	60	8 (13)	534	0

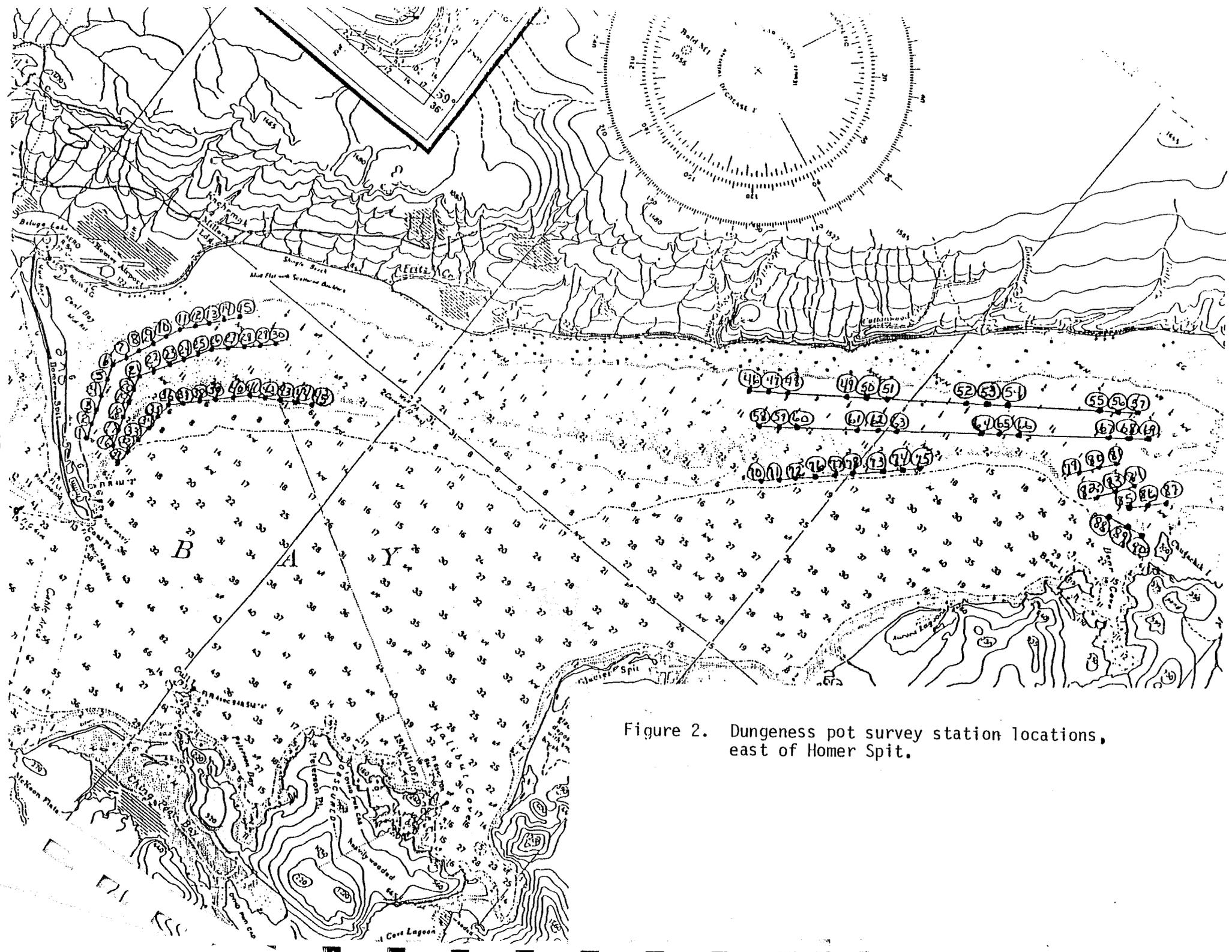


Figure 2. Dungeness pot survey station locations, east of Homer Spit.

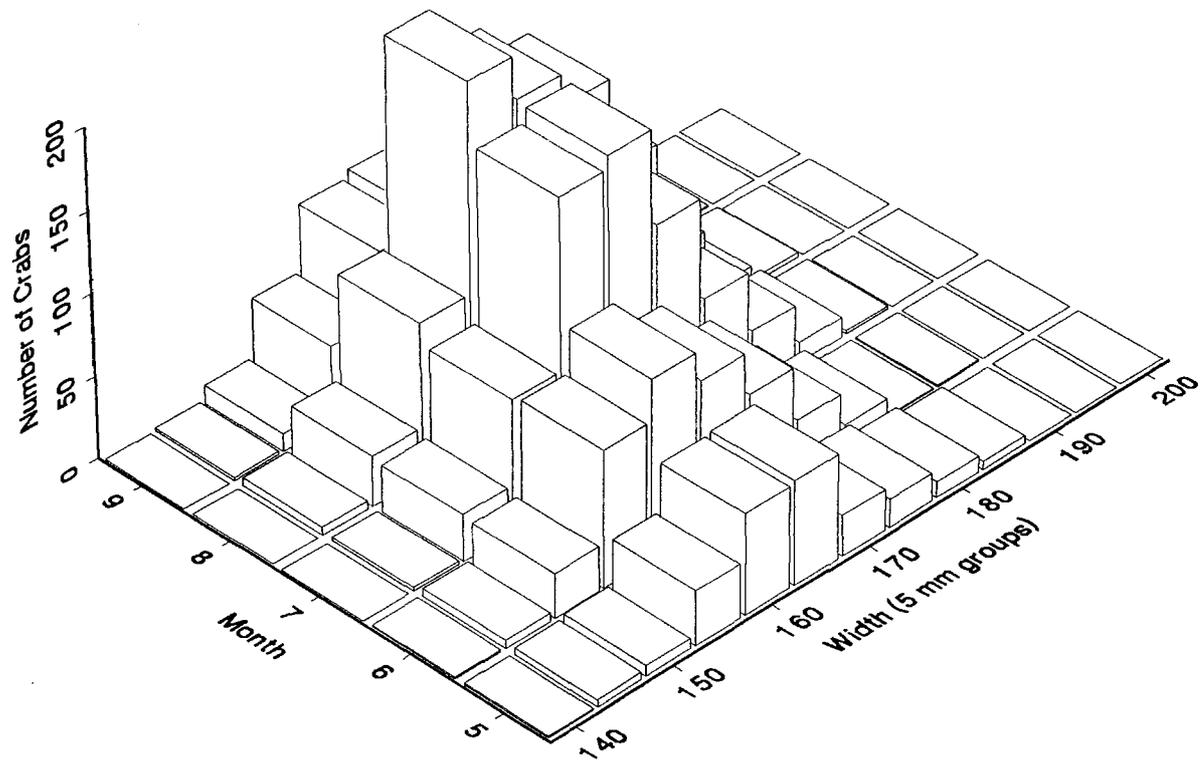


Figure 4. Total male Dungeness catch, May - Sept. 1993 Dungeness pot survey.

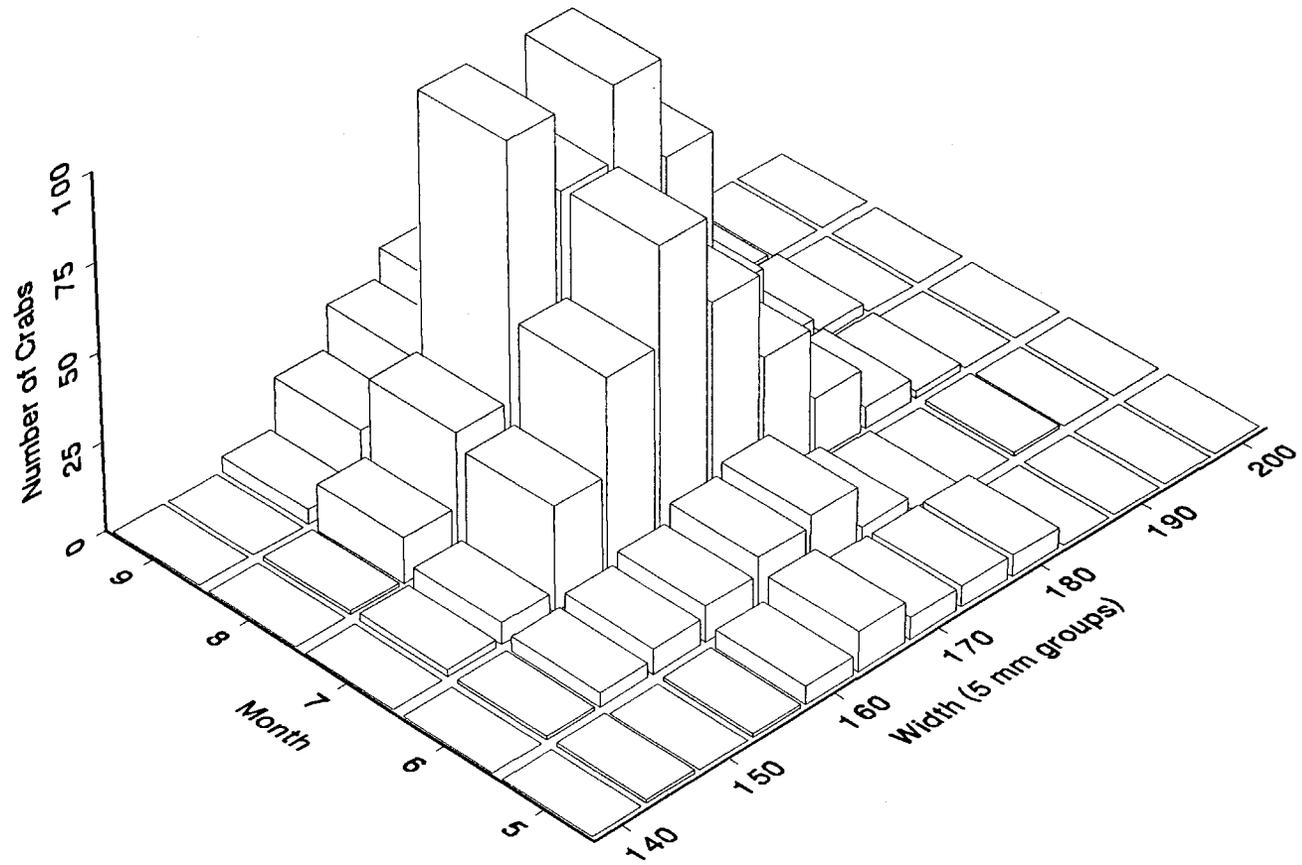


Figure 5. New shell male Dungeness catch, May - Sept., 1993 Dungeness pot survey.

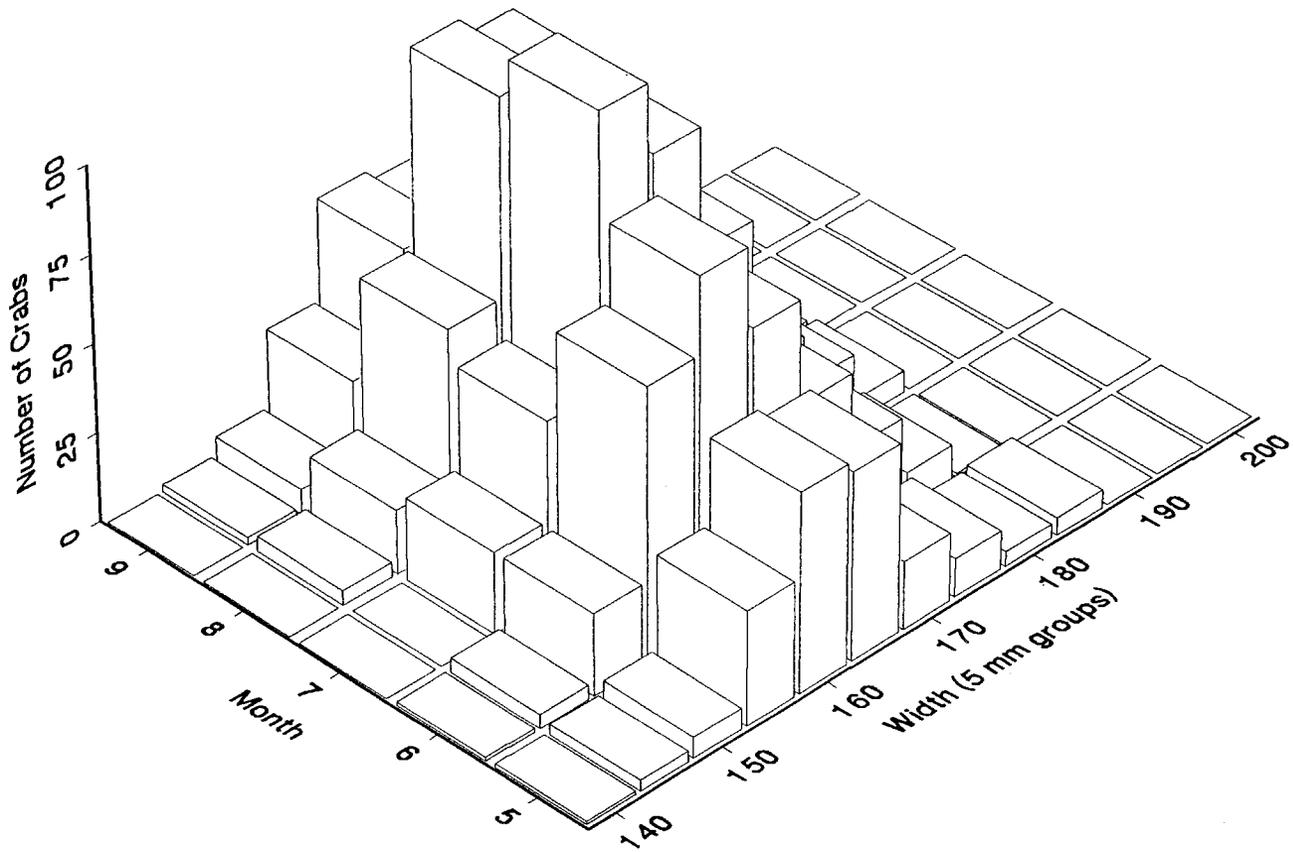


Figure 6. Old shell male Dungeness catch, May - Sept., 1993 Dungeness pot survey.

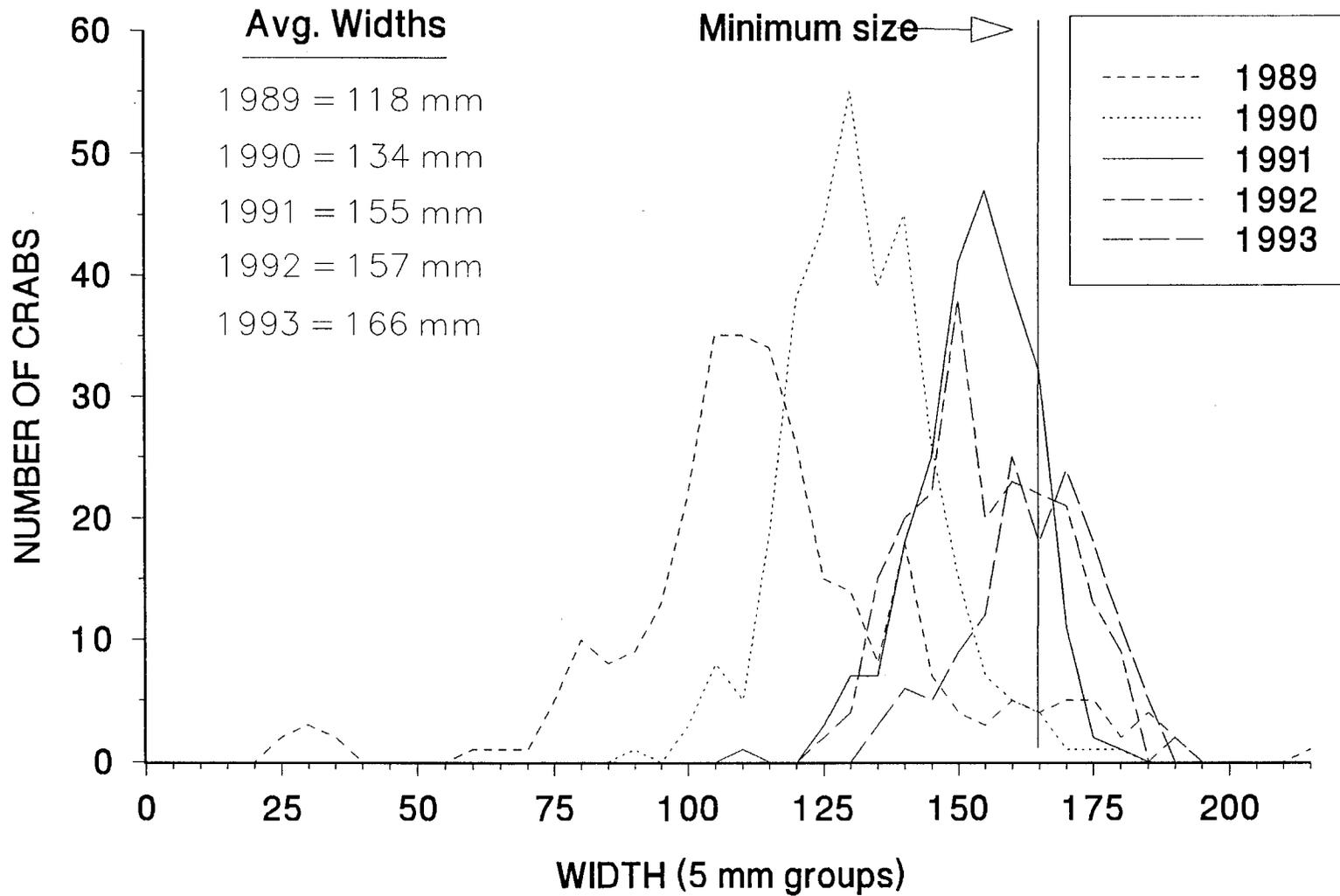


Figure 7. Male Dungeness catch, 1989 - 93, Southern Distr. trawl survey.

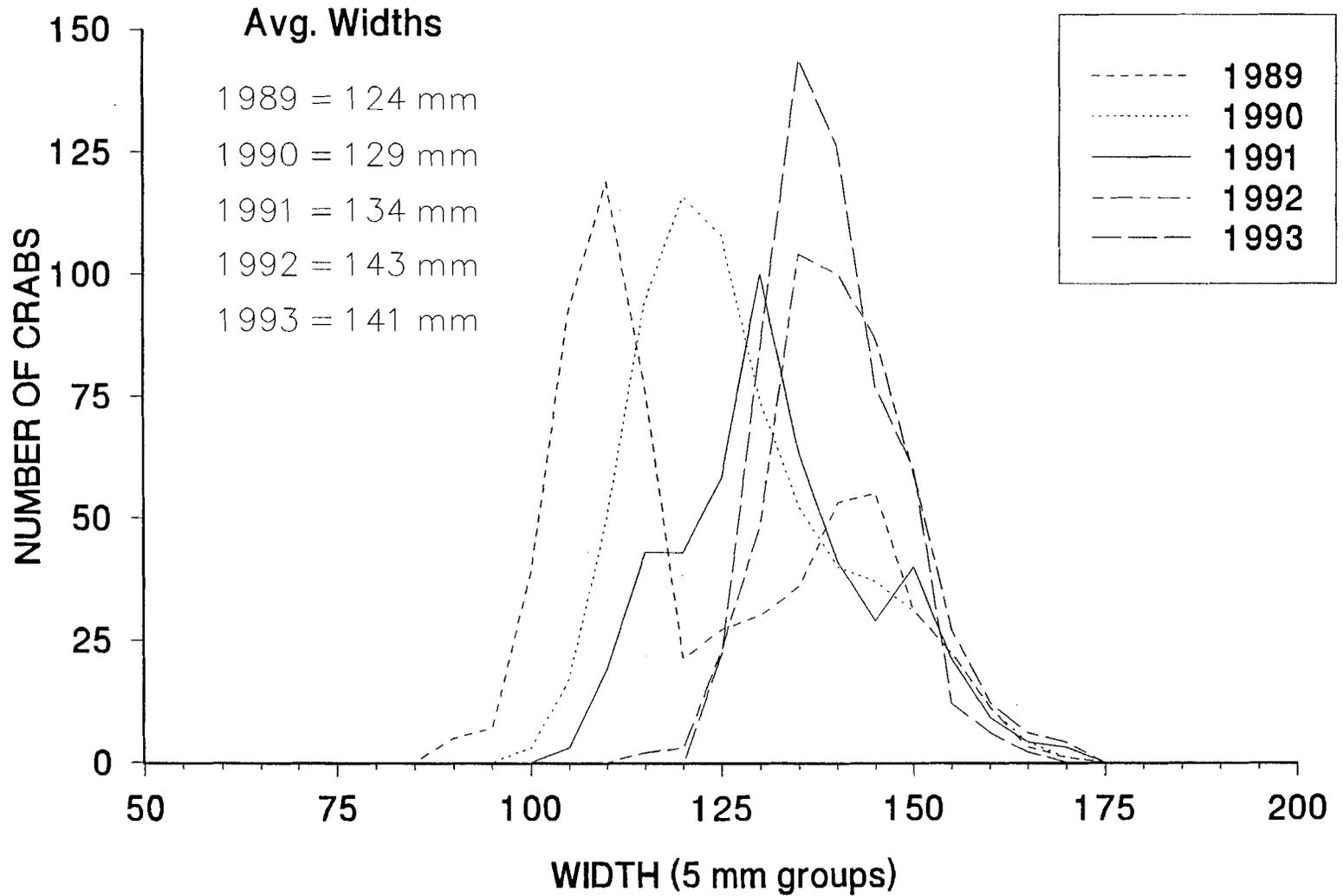


Figure 8. Female Dungeness catch, 1989 - 93, Southern Distr. trawl survey.

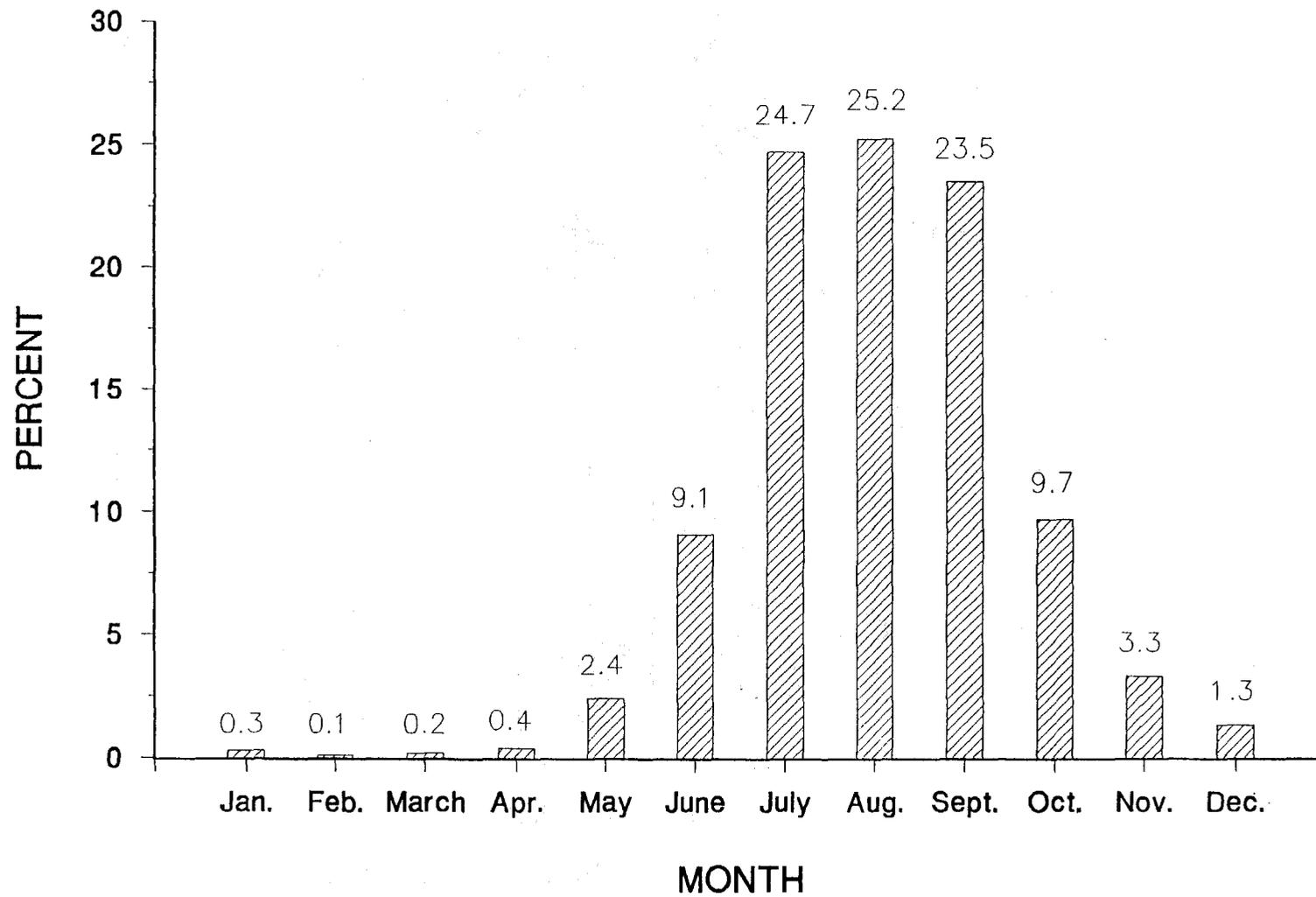


Figure 9. Dungeness crab catch (percent) by month, Cook Inlet Mgt. Area, 1978 - 1990.

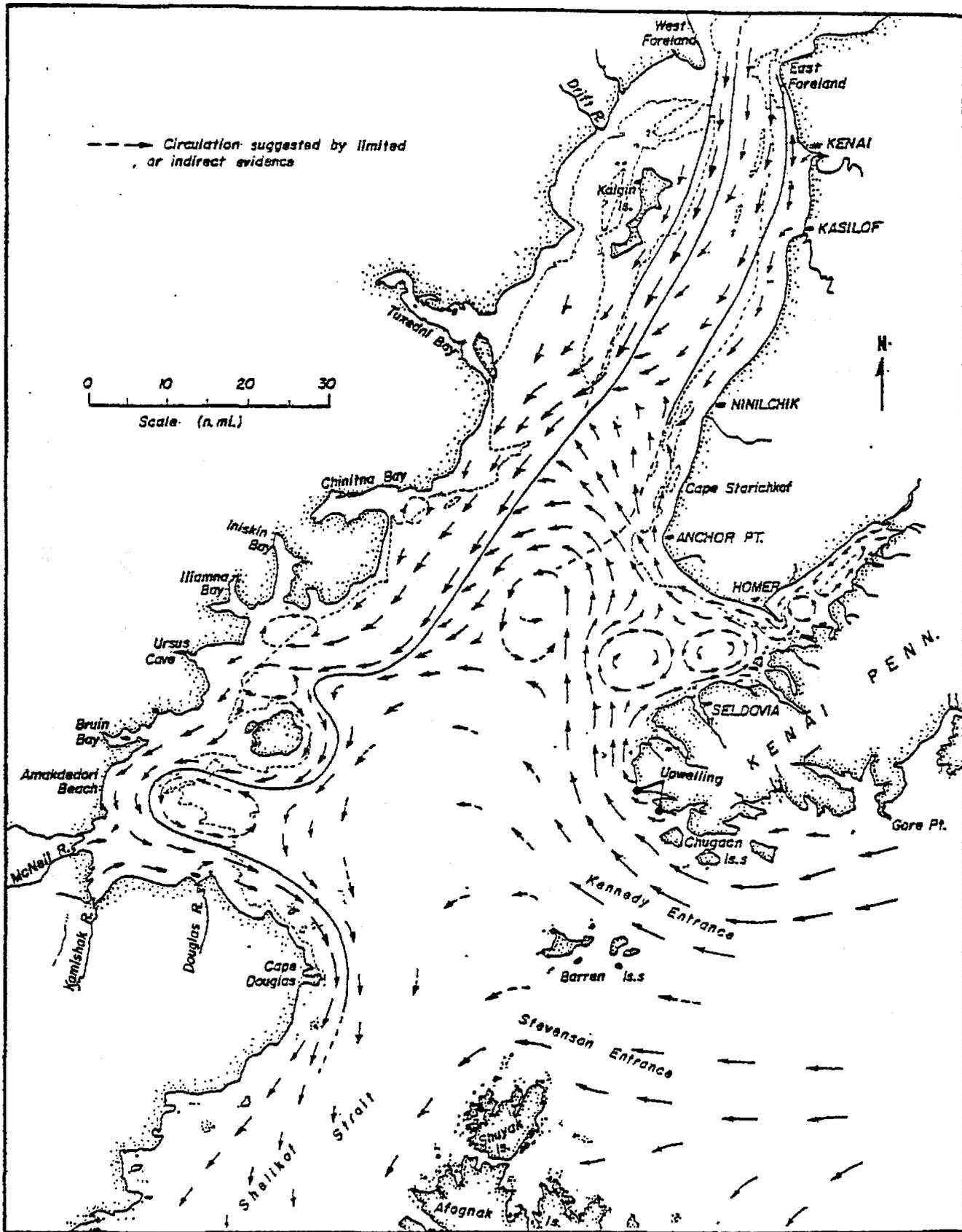


Figure 10. Net surface circulation in Lower Cook Inlet, based primarily on data collected during the spring and summer seasons (ADF&G, 1978).

Appendix A. Survey station locations, east of Homer Spit, Southern District Dungeness pot survey, 1993.

Station No.	Latitude	Longitude
1. 59° 36'.90 151° 25'.90	16. 59° 37'.03 151° 25'.39	31. 59° 36'.84 151° 25'.05
2. 59° 37'.15 151° 26'.10	17. 59° 37'.30 151° 25'.50	32. 59° 37'.07 151° 25'.00
3. 59° 37'.35 151° 26'.30	18. 59° 37'.52 151° 25'.62	33. 59° 37'.31 151° 24'.91
4. 59° 37'.60 151° 26'.50	19. 59° 37'.75 151° 25'.76	34. 59° 37'.57 151° 24'.82
5. 59° 37'.82 151° 26'.65	20. 59° 38'.03 151° 25'.95	35. 59° 37'.85 151° 24'.72
6. 59° 38'.06 151° 26'.50	21. 59° 38'.25 151° 25'.63	36. 59° 38'.10 151° 24'.35
7. 59° 38'.30 151° 26'.30	22. 59° 38'.43 151° 25'.39	37. 59° 38'.28 151° 23'.95
8. 59° 38'.52 151° 26'.10	23. 59° 38'.67 151° 25'.12	38. 59° 38'.47 151° 23'.57
9. 59° 38'.80 151° 25'.90	24. 59° 38'.89 151° 24'.78	39. 59° 38'.64 151° 23'.20
10. 59° 38'.92 151° 25'.52	25. 59° 39'.03 151° 24'.40	40. 59° 38'.80 151° 22'.70
11. 59° 39'.10 151° 25'.15	26. 59° 39'.18 151° 23'.98	41. 59° 38'.92 151° 22'.30
12. 59° 39'.28 151° 24'.75	27. 59° 39'.30 151° 23'.51	42. 59° 39'.08 151° 21'.80
13. 59° 39'.45 151° 24'.40	28. 59° 39'.45 151° 23'.11	43. 59° 39'.20 151° 21'.40
14. 59° 39'.60 151° 24'.00	29. 59° 39'.60 151° 22'.70	44. 59° 39'.32 151° 20'.96
15. 59° 39'.72 151° 23'.55	30. 59° 39'.73 151° 22'.26	45. 59° 39'.46 151° 20'.50

Appendix A. Continued.

Station No.	Latitude	Longitude
46. 59° 42'.78 151° 13'.35	58. 59° 42'.55 151° 12'.55	70. 59° 42'.15 151° 11'.90
47. 59° 42'.95 151° 12'.90	59. 59° 42'.71 151° 12'.11	71. 59° 42'.23 151° 11'.50
48. 59° 43'.11 151° 12'.45	60. 59° 42'.88 151° 11'.70	72. 59° 42'.40 151° 11'.24
49. 59° 43'.70 151° 10'.97	61. 59° 43'.45 151° 10'.30	73. 59° 43'.20 151° 09'.50
50. 59° 43'.87 151° 10'.51	62. 59° 43'.62 151° 09'.86	74. 59° 43'.35 151° 09'.35
51. 59° 44'.05 151° 10'.10	63. 59° 43'.80 151° 09'.40	75. 59° 43'.48 151° 08'.85
52. 59° 44'.58 151° 08'.70	64. 59° 44'.38 151° 08'.00	76. 59° 42'.53 151° 10'.78
53. 59° 44'.75 151° 08'.21	65. 59° 44'.55 151° 07'.53	77. 59° 42'.72 151° 10'.43
54. 59° 44'.92 151° 07'.80	66. 59° 44'.72 151° 07'.10	78. 59° 42'.92 151° 10'.04
55. 59° 45'.50 151° 06'.30	67. 59° 45'.28 151° 05'.65	79. 59° 44'.80 151° 05'.67
56. 59° 45'.67 151° 05'.89	68. 59° 45'.45 151° 05'.23	80. 59° 45'.02 151° 05'.20
57. 59° 45'.83 151° 05'.40	69. 59° 45'.65 151° 04'.80	81. 59° 45'.24 151° 04'.75

Appendix A. Continued.

Station No.	Latitude	Longitude
82. 59° 44'.62 151° 05'.10	85. 59° 44'.75 151° 04'.30	88. 59° 44'.72 151° 03'.80
83. 59° 44'.90 151° 04'.65	86. 59° 45'.00 151° 03'.90	89. 59° 44'.67 151° 03'.36
84. 59° 45'.13 151° 04'.25	87. 59° 45'.12 151° 03'.40	90. 59° 44'.72 151° 03'.10

Appendix B. Survey station locations, west of Homer Spit, Southern District Dungeness pot surveys, 1993.

Station No. ¹	Begin (lat., long.)	End (lat., long.)
91	59°32.55 151°43.50	59°31.90 151°47.10
92	59°34.40 151°45.15	59°33.00 151°48.00
93	59°31.00 151°48.80	59°30.40 151°52.70
94	59°32.20 151°51.00	59°31.20 151°54.60
97	59°33.35 151°55.00	59°34.05 151°58.80
98	59°35.10 151°48.30	59°36.35 151°51.50
99	59°36.30 151°46.50	59°37.70 151°49.40
100	59°38.75 151°45.50	59°39.75 151°48.90

¹ Ten pots were set equidistant apart in each station.

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