Southern District King & Tanner Crab Index of Abundance Survey, July 5 - 15, 1988

Regional Information Report[1] 2H88-10

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INTRODUCTION

The Department began conducting a survey for red king (Paralithodes camtschatica) and Tanner crab (Chionoecetes bairdi) in the Southern District of the Lower Cook Inlet Management Area (H) in 1974 (Figure 1). The purposes of this survey are to:

1. Establish an index of abundance for both legal and sublegal males, which in turn is utilized to generate a guideline harvest range for the ensuing commercial season.

2. Tag both legal and sublegal (king crab only) male crabs to determine movement and growth per molt (king crab only).

3. Evaluate reproductive success as measured by incidence of egg bearing mature females and relative fecundity.

METHODS

The 1988 survey was conducted from July 5 through July 15. The survey has been conducted in July since 1980.

The State research vessel Pandalus was utilized for the survey. The vessel is 66 feet in overall length and carries 12 pots. The pots were 700 pound 7' x 7' commercial king crab pots. They were covered with 3 inch stretch mesh as one of the goals of the survey is to capture and retain small crabs. The two tunnel opening dimensions were 35" x 8". Pots were baited with two 2 quart jars

three quarters filled with chopped herring. Thawing time for the bait was kept consistent. A 24 hour period was the initial soak time goal.

Station selection was based on historical survey design. Virtually the same stations have been fished for the past 10 years. Since 1986 a few stations at the periphery of the stock have been moved in order to look for potential changes in distribution. Each station was one nautical mile square. Four pots spaced one third of a nautical mile apart were fished within each square. The gear was generally set so that it bisected the square passing through the center. A Loran C and video plotter were used to record the location of each pot for further reference and replication.

Once each pot was pulled, the entire catch, crabs and fish, was dumped into totes (34"x18"x14"). King and Tanner crabs were separated by species only. All male crabs and all female king crabs were measured to the nearest millimeter of carapace length (king crabs) or width (Tanner crabs), and shell aged. Relative fecundity of all king crab females was determined. Only the first 25 Tanner females handled were measured, aged and had egg assessments made. The remaining female Tanners were counted only.

Black mat syndrome incidence, affecting Tanner crab and caused by the fungus Trichomaris invadens, was recorded.

All halibut (Hippoglossus stenolepis) were counted and returned immediately to the water. All Pacific cod (Gadus macrocephalus) were counted. Periodic sampling of cod stomachs was done to ascertain presence of shrimp or crab. Other fish were identified to a common family name only and returned to the sea.

Only pre-recruit one and those pre-recruit two male king crabs equal to or greater than 115 mm in carapace length were tagged.

The spaghetti tag was secured via a hog ring crimped into the isthmus, which connects the posterior portion of the carapace to the body. Sublegal crabs were chosen for tagging as there is a greater probability that they will live longer than legal males, therefore yielding greater opportunity to collect growth and movement data.

Tanner crab tagging consisted of applying carapace dart tags to new shell legal males. If new shell males were not captured then vigorous looking old shell males were selected. New shell males were picked as there is greater probability that they will live longer than old shells, therefore providing an increased opportunity to collect movement information. Distribution of tags was relative to the abundance of legal crabs captured per station. The tag itself was applied by inserting the anchor of the tag shaft into a hole made in the anterior portion of the right branchial region of the carapace. The hole was made with an ice pick that was of a slightly greater diameter than the shaft of the tag. The carapace dart tag will not be retained during the molt. There is currently no tag available that can be kept throughout a molt.

RESULTS

A total of 228 pots were lifted from 57 stations. No gear was lost. Fishing depths ranged from 15 to 91 fathoms with an average of 40 fathoms (Table 1). All soak times were approximately 24 hours. The average soak was 23.3 hours.

One hundred eighty four legal male king crabs were captured (Table 2). This yielded an index number of 0.8 legal crabs per pot. There were no legal males caught in 45 of the 57 stations. The range for the remaining 12 stations was 0.3 to 18.0 legals with the high catch of 18.0 coming from a station approximately two miles

north northwest of Barabara Pt. in a depth range of 59 to 60 fathoms (Figure 2).

A total of 336 sublegal male king crabs were caught. Pre-recruit ones and twos numbered 76 and 163 respectively for an average catch per pot of 0.3 and 0.7. Pre-recruit threes totalled 97 for an average catch per pot of 0.4 (Table 3). A total of 71 pre-recruit one and pre-recruit two male king crabs were tagged.

Two hundred ninety four female king crabs were taken. Matures and immatures numbered 218 and 76 respectively. All mature females were new shell. Only one was barren while 16 had full clutches (Table 4). The average clutch was 64% full.

Legal male Tanner crab catch, including all classes of recruits and post-recruits, totalled 2,591 out of the 228 pot lifts yielding an index number of 11.4 legals per pot (Table 5). True recruits averaged 8.3 per pot. Twenty one of the 57 stations had no legal crabs. The highest average catch per pot of legal males was 50.8 taken from a station approximately 1.5 miles northwest of Barabara Pt. in a depth range of 48-51 fathoms (Figure 3). A total of 175 legal male Tanner crabs were tagged. The average size of all the legal males sampled was 156 mm (6.1 inches) in carapace width.

True pre-recruit ones and twos averaged 1.5 and 0.1 per pot respectively. Pre-recruit threes and smaller averaged less than 0.1 per pot (Table 6). The catch of pre-recruit twos and smaller cannot be used to quantify abundance as these small crabs are not efficiently retained by the pots.

The female Tanner catch equalled 2,333. Of these, 2,332 were mature and one was immature. Seventy nine percent of the mature females had full clutches (Table 7). Seven percent of the new and old shell age class females had less than full clutches.

Incidental halibut and Pacific cod catches were 312 and 1,434 respectively. No black mat was observed on any Tanner crab sampled.

None of the crabs captured of either species were soft shelled.

DISCUSSION

Review of the 1988 survey catch of king crab indicates an improvement in the relative fecundity (clutch fullness) of the average female (64% in 1988 versus 52% in 1987 and 44% in 1986). Coupled with an increase in number of mature females from 1987 (218 in 1988 versus 101 in 1987) this increase in fecundity is a positive sign for long term stock improvement.

Legal male king crab showed a slight decline from 1987; however the overall count of sublegal males was up (Table 2). Interpretation of these changes in male abundance should be viewed with caution as the numbers are still relatively low, therefore a significant change in magnitude, i.e., doubling, may not yet be significant.

The king crab stock is still in a depressed condition. Not only are the numbers of crabs low, but the geographic distribution is concentrated in relatively few areas. Increased fecundity of the females is a bright spot; however, the fact remains that the eggs carried by these females will take eight years and many molts to become commercially legal crabs.

Only positive environmental changes, e.g., optimal water temperature and reduced predation, will influence significant near term king crab stock increases given the recent low fecundity. The probability of long term stock recovery can be significantly

enhanced by continued protection of all animals from controllable sources of mortality, such as fishing and pollution.

The legal male portion of the Tanner crab stock declined significantly in 1988 both in numbers and geographic distribution. The index of legal males in 1987 was 23.8 declining to an all time low of 11.4 in 1988. The previous low, since the survey was changed to a defined post molt period (moved to July in 1980), was 16.3 in 1982 (Table 5).

The potential for a meaningful decline in legal males was first identified from results of the 1987 surveys. True pre-recruit ones (those sublegal crabs which have the greatest probability of attaining legal size by the next year) averaged 4.2 per pot which was the lowest number since 1980. The number of true pre-recruits found in the Kamishak District in 1987 was also very low, thereby precluding significant recruitment into the Southern District (Kachemak Bay) via emigration from Kamishak. These low numbers of true pre-recruits in 1987 manifested themselves into an index of record low recruitment of 8.3 recruits per pot in 1988 (Table 6).

The 1988 survey once again identified a historical low number of true pre-recruit ones, 1.5 per pot. This coupled with the overall low numbers of sexually mature males indicated a reduction in the male component of the reproductive stock in both 1988 and 1989.

The near term outlook for the Southern District does not appear encouraging unless a portion of the relatively large amount of true pre-recruit ones found in the Kamishak District in 1988 emigrate into the Southern District in 1989. Data is not available to quantify the probability of this event as no permanent tag has yet been developed for the Tanner crab that can be retained throughout a molt. Thus there is no possibility of tracking post molt movement.

Of final concern is the number of old shell mature females that are bearing less than full egg clutches. Although this is only seven percent of the total number of old shells captured (Table 7), it does not compare favorably with the same age class of mature females in the Kamishak District and the Prince William Sound Management Area where relative fecundity of these animals has historically been 99 to 100 percent.

Low numbers of sexually mature males, shrinking geographic distribution and reduced fecundity of females all indicate that the Southern District Tanner crab stock is in a depressed condition. As in king crab, positive environmental factors will influence abundance of crabs. However, the probability of long term stock recovery will be greatly enhanced by protection of both male and female crabs from controllable sources of mortality, such as fishing and pollution.

Table 1. Description of stations fished during the July 1988 Southern District king and Tanner crab index of abundance survey.

Station Number[a]	Number of Pots Fished	Depth Range in Fathoms	Station Number	Number of Pots Fished	Depth Range in Fathoms
I-1	4	23 - 25	H-12	4	57 - 60
K-1	4	20 - 23	J-12	4	49 - 60
H-2	4	37 - 39	L-12	4	37 - 39
G-3	4	42 - 45	H-13	4	46 - 54
I-3	4	27 - 37	I-13	4	51 - 59
K-3	4	18 - 19	K-13	4	48 - 55
F-4	4	38 - 48	L-14	4	45 - 51
H-4	4	34 - 36	K-15	4	73 - 91
J-4	4	25 - 34	M-15	4	15 - 16
G-5	4	36 - 39	L-16	4	56 - 60
I-5	4	35 - 37	K-17	4	75 - 81
K-5	4	23 - 27	L-18	4	64 - 67
H-6	4	42 - 52	M-19	4	55 - 60
J-6	4	34 - 38	O-19	4	19 - 22
L-6	4	20 - 21	L-20	4	38 - 54
G-7	4	24 - 39	N-20	4	37 - 42
I-7	4	35 - 41	P-20	4	16 - 20
K-7	4	38 - 46	M-21	4	34 - 59
M-7	4	18 - 23	O-21	4	35 - 39
H-8	4	45 - 49	N-22	4	48 - 60
J-8	4	38 - 40	P-22	4	28 - 34
L-8	4	30 - 34	O-23	4	33 - 37
N-8	4	19	Q-23	4	22 - 30
I-9	4	49 - 55	R-24	4	28 - 30
K-9	4	46 - 50	S-25	4	27 - 29
H-10	4	48 - 51	R-26	4	18 - 23
J-10	4	44 - 45	U-27	4	25 - 28
L-10	4	34 - 37			
I-11	4	59 - 60			
K-11	4	41 - 45			

Total Stations = 57
Total pots = 228
Depth range = 15 - 91 fathoms
Average depth = 40 fathoms

[a] See Figure 1 for station location

Table 2. Total catch of king crab from the Southern District of abundance surveys, 1974-1988.

Year	Survey Dates	Pots Pulled	Number Females	Number Sublegal Males	Number Legal Males	Average Legal Males per Pot[a]	Average wt. (lbs).	Commercial Harvest (no.)	Commercial Harvest (lbs.)
1974	6/13-27	240	Not Available	494	275	1.2	7.5	242,202	1,816,512
1975	5/20-31	260	432	552	573	2.2	8.3	201,759	1,674,872
1976	6/07-19	227	981	977	225	0.9	8.2	126,258	1,035,316
1977	6/10-21	260	12,075	9,772	281	1.1	7.1	82,266	584,090
1978	6/14-21	237	2,944	5,501	807	3.4	6.6	100,665	664,388
1979[b]	5/31-6/07	255	2,555	2,853	665	2.4	6.8	125,527	853,584
1980	7/08-25	367	14,855	10,041	1,941	5.3	6.8	74,804	508,670
1981	7/10-19	238	2,711	2,130	519	2.2	7.1	25,901	183,899
1982	7/08-19	222	1,889	608	95	0.4	---	Closed	---
1983	6/28-7/15	230	696	447	123	0.5	---	Closed	---
1984	7/09-26	234	2,100	777	418	1.8	---	Closed	---
1985	7/08-18	231	941	337	273	1.2	---	Closed	---
1986	7/08-18	237	480	365	210	0.9	---	Closed	---
1987	7/14-24	237	137	188	252	1.1	---	Closed	---
1988	7/05-15	228	294	336	184	0.8	---	Closed	---

[a] Unstandardized soak times

[b] Sample stations were increased in areas containing legal size king crab, 1980 index catch per pot is not comparable to previous year's values.

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Table 3. Average catch per pot of male king crab by size class captured in the Southern District index of abundance survey, 1980-1988.

Size Class[a]	Index Year 1980	1981	1982	1983	1984	1985	1986	1987	1988
$\leq$ 90	0.8	0.2	0.2	0.2	0.1	0.02	0.004	0.08	0.0
91 - 108	8.7	2.1	0.3	0.5	9.5	0.1	0.07	0.08	0.4
109 - 126	9.4	3.4	1.0	0.4	1.5	0.5	0.6	0.2	0.7
127 - 144	8.4	3.1	1.1	0.8	0.8	0.8	0.9	0.4	0.3
145 - 163	4.6	1.8	0.3	0.4	0.9	0.3	0.6	0.7	0.3
$\geq$ 164	0.7	0.4	1.3	0.2	0.9	0.9	0.3	0.3	0.5
Pots Pulled	219	238	222	230	234	231	237	237	228

[a] Carapace length in millimeters.

Pre-recruit	4	$\leq$	90
Pre-recruit	3	=	91 to 108
Pre-recruit	2	=	109 to 126
Pre-recruit	1	=	127 to 144
Recruit		=	145 to 163
Post-recruit		$\geq$	164

Table 4. Relative fecundity by shell age for mature female king crab from the 1988 Southern District index of abundance survey.

Percent Full[a]	Number of crabs Shell Age New (%)	Old	Very Old	Total (%)
0	1 (<1)	0	0	1 (<1)
25	12 (6)	0	0	12 (6)
50	83 (38)	0	0	83 (38)
75	106 (49)	0	0	106 (49)
100	16 (7)	0	0	16 (7)
Total	218 (100)	0	0	218 (100)

[a] Percent full = relative fecundity

Table 5. Total catch of Tanner crab from the Southern District index of abundance surveys, 1974-1988

Year	Survey Dates	Pots Pulled	Number Females	Number Sublegal Males	Number Legal Males	Average Legal Males per Pot[a]	Average Weight lbs.[b]	Commercial Harvest (no.)	Commercial Harvest (lbs.)
1974	6/13-27	240	785	Not Available	3,889	16.2	2.85	339,565	967,762
1975	5/20-31	260	1,840	"	5,093	19.6	2.65	505,375	1,339,245
1976	6/07-19	227	1,757	"	5,014	22.1	2.79	722,760	2,016,501
1977	6/10-21	260	3,937	"	10,352	39.8	2.65	1,043,488	2,765,243
1978	6/14-21	237	2,617	"	8,508	35.9	2.64	880,083	2,323,420
1979	5/31-6/07	255	3,075	1,929	3,721	14.6	2.60	436,515	1,134,940
1980	7/08-25	219[c]	1,455	7,995	4,525	20.7	2.75	380,975	1,047,680
1981	7/10-19	238	1,719	3,088	4,012	16.9	2.50	219,411	548,579
1982	7/08-19	222	2,772	3,749	3,628	16.3	2.47	236,805	584,908
1983	6/28-7/15	230	2,195	3,130	5,087	22.1	2.51	397,116	996,763
1984	7/09-26	234	1,911	3,333	5,838	24.9	2.49	493,694	1,229,298
1985	7/08-18	231	3,540	7,445	8,171	35.4	2.30	506,200	1,164,261
1986	7/08-18	237	2,886	4,497	4,822	20.3	2.31	468,435	1,077,400
1987	7/14-24	237	3,097	2,753	5,649	23.8	2.46	384,050	944,763
1988	7/05-15	228	2,333	1,303	2,591	11.4	---	Closed	Closed

[a] Unstandardized soak times.

[b] Average weight of legal males taken from commercial dockside data.

[c] Number of pots pulled includes only stations previously sampled prior to 1980, 367 pots pulled, 9,680 legal crabs captured from all stations.

Table 6. Average catch per pot of male Tanner crab by size class and shell age captured in Southern District index of abundance surveys, 1980-88.

Size Class[a]	Index Year 1980 Shell Age New[b]	1980 Shell Age O&VO[c]	1981 Shell Age New	1981 Shell Age O&VO	1982 Shell Age New	1982 Shell Age O&VO	1983 Shell Age New	1983 Shell Age O&VO
51 - 87	0.1	0.0	0.1	0.0	0.03	0.0	0.0	0.0
88 - 114	0.7	0.6	2.2	0.6	2.6	1.0	0.9	1.0
115 - 139	6.5	4.1	7.8	2.2	9.9	3.4	8.4	3.4
140 - 165	24.8	4.4	12.9	0.8	13.4	1.0	19.6	1.1
≥ 166	14.1	1.0	3.0	0.1	1.8	0.1	1.3	0.4
Pots pulled	219		238		222		230	

Size Class	Index Year 1984 Shell Age New	1984 Shell Age O&VO	1985 Shell Age New	1985 Shell Age O&VO	1986 Shell Age New	1986 Shell Age O&VO	1987 Shell Age New	1987 Shell Age O&VO
51 - 87	0.08	0.0	0.1	0.0	0.02	0.01	0.01	0.0
88 - 114	2.0	0.9	2.6	1.1	0.9	0.8	0.2	0.4
115 - 139	7.2	4.2	20.8	7.4	10.0	7.3	4.2	6.7
140 - 165	17.5	3.4	27.6	5.3	17.7	2.0	21.1	1.5
≥ 166	3.9	0.2	1.6	1.0	0.5	0.1	1.2	0.03
Pots pulled	234		231		237		237	

Continued

Table 6. Continued.

Index Year

Size Class	1988 Shell Age New	O&VO
51 - 87	0.001	0.0
88 - 114	0.1	0.3
115 - 139	1.5	3.9
140 - 165	8.3	1.6
≥ 166	1.4	0.1
Pots pulled	228	

[a] Carapace width in millimeters

Pre-recruit	3	=	51	- 87
Pre-recruit	2	=	88	- 114
Pre-recruit	1	=	115	- 139
Recruit		=	140	- 165
Post-recruits				- 166

[b] New = carapace pink or light in color, minimal scratching and epifauna on exoskeleton, spines sharp.

[c] O & VO - Old Shell = carapace hard and brownish, scratches present, epifauna may be present, spines worn.

Very old shell = carapace hard, dark brown to blackish, scratches present, epifauna present, spines very worn.

Table 7. Relative fecundity by shell age for mature female Tanner crab from the 1988 Southern District index of abundance survey.

Percent Full[a]	Number of Crabs Shell Age New (%)	Old	Very Old	Total (%)
0	0	0	57 (2)	57 (2)
25	0	10 (< 1)	60 (3)	70 (3)
50	1 (<1)	5 (< 1)	102 (4)	108 (5)
75	4 (<1)	33 (1)	215 (9)	252 (11)
100	19 (1)	650 (28)	1176 (50)	1845 (79)
Total	24 (1)	698 (30)	1610 (69)	2332 (100)

[a] Percent full = relative fecundity

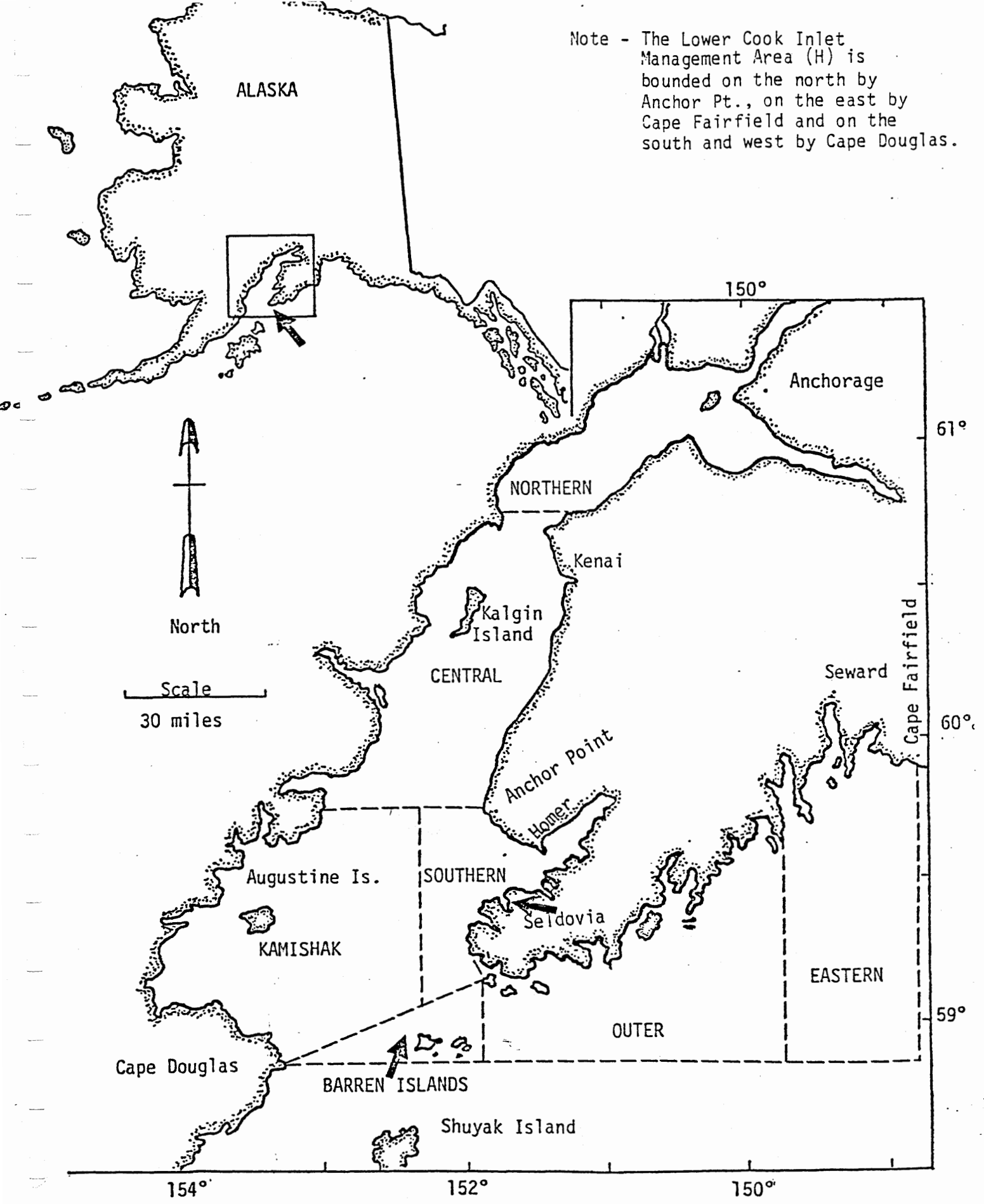

Figure 1 Cook Inlet area district location chart.

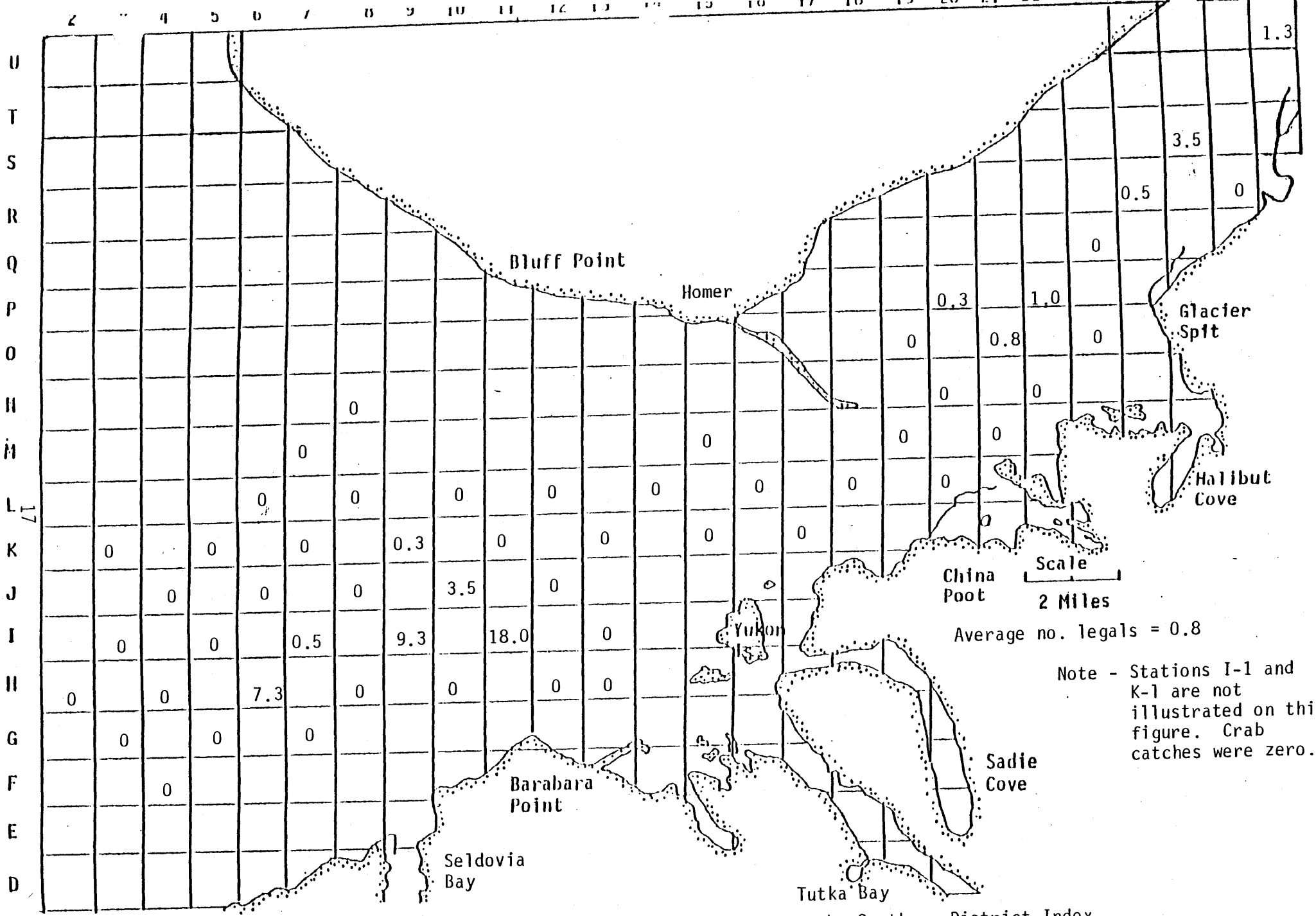

Figure 2. Average catch per pot by station of legal male king crab, Southern District Index, July 5-15, 1988.

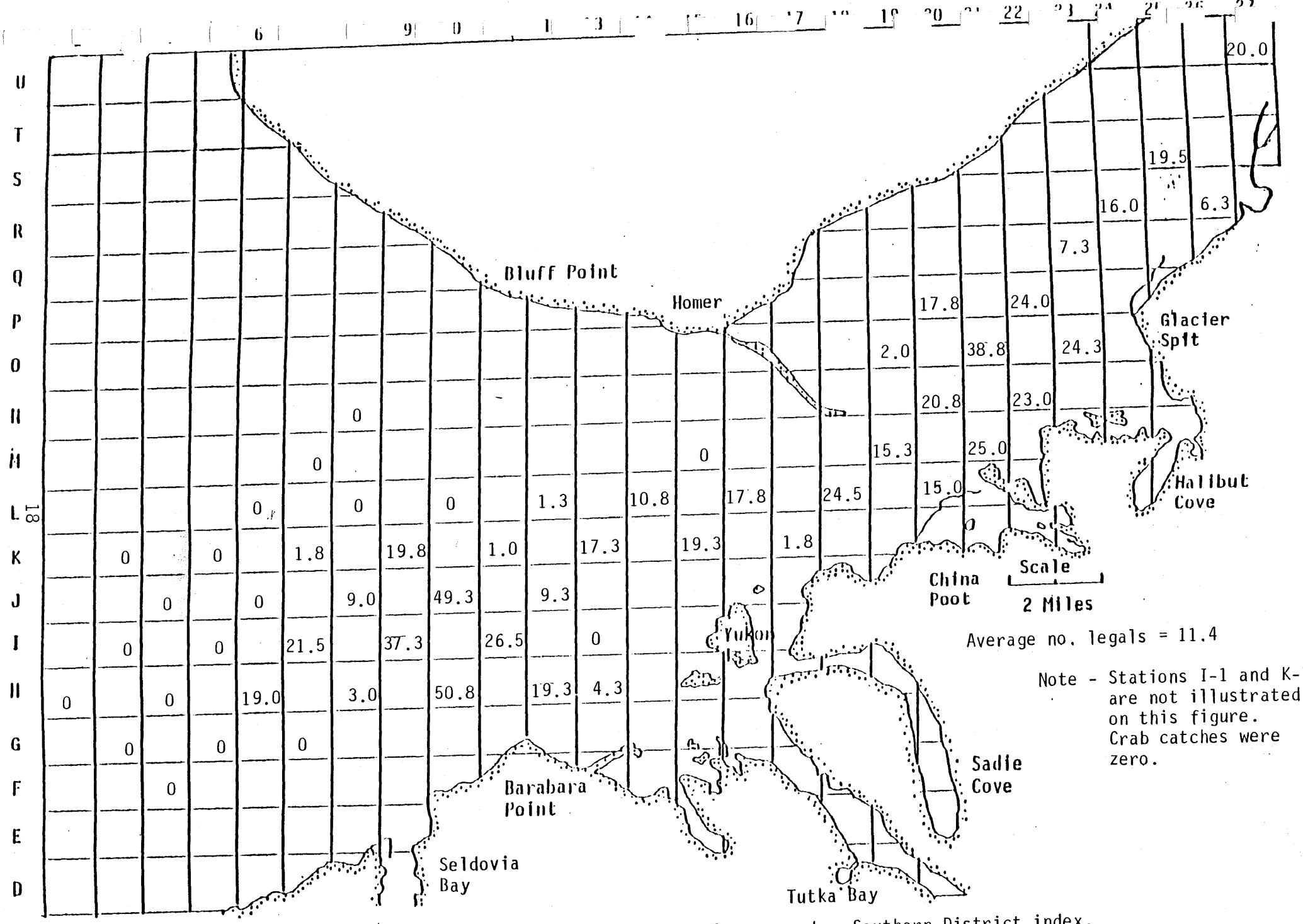

Figure 3. Average catch per pot by station of legal male Tanner crabs, Southern District index, July 5-15, 1988.