

**STATUS OF STOCKS  
OF COMMERCIALLY IMPORTANT CRAB SPECIES  
IN THE EASTERN BERING SEA IN 1988**

by

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## EXECUTIVE SUMMARY

The following is a summary of conclusions presented in this report. All figures given are estimated total numbers of crabs, plus or minus 95% confidence intervals. Estimates for 1987 and 1988 were compared by t-test; values of t greater than 2.0 were defined as significant. See text for descriptions of size ranges.

### Red king crab (*Paralithodes camtschatica*) Bristol Bay and Pribilof District.

Legal males: 6.4 million  $\pm$  20%; Non-significant decrease of 20%.  
Pre-recruits: Significant decrease of 47%.  
Large Females: No significant change.  
Outlook: Fishery decreasing in 1988. Recruitment has been poor for several years.

### Pribilof Islands blue king crab (*P. platypus*) Pribilof District.

Legal males: 196,000  $\pm$  86%; significant decrease of 73%.  
Pre-recruits: Essentially absent.  
Large Females: No significant change.  
Outlook: No sign of incoming recruitment. Fishery closed for 1988.

### St. Matthew blue king crab (*P. platypus*) Northern District.

Legal males: 833,000  $\pm$  37%; No significant change.  
Pre-recruits: No significant change.  
Large Females: 270% increase; not significant due to high variance.  
Outlook: Fishery stable but poor. Recruitment and reproduction questionable due to inadequate data.

### Tanner crab (*Chionoecetes bairdi*) Southeast and Pribilof Districts.

Legal males: 14.3 million  $\pm$  88%; Non-significant increase of 144%.  
Pre-recruits: Significant increase of 200%.  
Large Females: Significant increase of 120%.  
Outlook: Fishery increasing. Increasing recruitment of juveniles into pre-recruit and legal categories.

### Tanner crab (*C. opilio*) All districts combined.

Large males: 171.0 million  $\pm$  31%; Non-significant increase of 13%.  
Small males: No significant change.  
Large Females: No significant change.  
Outlook: Population stable. Fishery increasing slightly. Recruitment of juveniles to large sizes increasing.

### Hair crab (*Erimacrus isenbeckii*)

Large males: 0.5 million  $\pm$  60%; Non-significant decline of 55%.  
Pre-recruits: Non-significant increase of 100%.  
Large Females: No significant change.  
Outlook: Declining fishery. Juvenile production showing continued improvement.

## THE SURVEY

The 1988 Eastern Bering Sea (EBS) crab survey consisted of 396 successful bottom trawl tows and covered an area of approximately 141,117 square nautical miles. The 1988 survey area was similar to that of 1987, but included slightly more area (Fig. 1). The 1988 survey covered virtually all commercial crab fishing grounds with the exception that golden king crab were not surveyed.

The survey was conducted aboard two chartered vessels, the F/V Ocean Hope 3 and the University of Washington's R/V Alaska between June 1 and August 6. Methodology was similar to that of previous surveys in that most tows were made at the centers of squares defined by a 20 x 20 nautical mile grid. Near St. Matthew Island and the Pribilofs, additional tows were made at the corners of squares. Trawl gear used was identical to that used last year, and we assumed that it behaved similarly. Procedures for estimating abundance were identical to those of previous years. Note that crab sizes are reported as carapace length (cl) for king and hair crabs, and carapace width (cw) for Tanner crabs. Biomass and numeric estimates are given  $\pm 2$  standard errors (approximately 95% confidence intervals). Districts referred to in the text conform to those described in current commercial shellfish regulations.

In addition to the regular survey, additional stations were towed at 10-mile intervals at 4 different locations in water 25-30 fm deep. Seven extra tows were made inshore along the coast of the Alaska Peninsula between 160° and 162° W. long., to assess the abundance of king crab in inshore waters. Additional tows were also made in shallow water near Togiak (7) and Kuskokwim Bay (6) where high catches of yellowfin sole have recently occurred. A group of 44 additional tows were made at stations C08 and D08 after the regular survey to compare catch rates between 2 different trawls. Those comparisons will be reported separately.

Also in 1988, an extended survey was made of Norton Sound and the Northeast Bering Sea shelf region in August and September. Results of that survey will be reported separately.

## STATUS OF STOCKS

### Red King Crab (*Paralithodes camtschatica*)

The majority of the legal ( $\geq 135$  mm cl) male crabs occurred in Bristol Bay (Area T, Fig. 2), and their overall distribution was similar to that of 1987, except that higher densities of legal crabs were found close to the Alaska Peninsula. A few red king crabs were also found near the Pribilof Islands and in the Northern District, but their contribution to overall abundance in the EBS was negligible.

The high density region of legal male crabs occurred in a narrow horseshoe-shaped band stretching from near the Alaska Peninsula to slightly northeast of mid-Bristol Bay. The highest catch of legal crabs occurred at station C08, just north of the Alaska Peninsula (although the value of 1349 shown in Fig. 2 is an average of multiple tows). King crabs were caught in all of the seven additional inshore tows, with legal males occurring at 5 of those. Average densities in those 7 tows were not significantly different from average densities for the entire area of red king crab distribution for any size or sex group except small females, none of which were caught in the 7 extra tows.

The estimated abundance of legal male red king crabs in Bristol Bay and the Pribilof District was 6.4 million crabs and showed a slight but non-significant<sup>1</sup> decrease from 1987 to 1988 (Table 1). Post-recruit crab ( $\geq 150$  mm cl), showed no significant change from 1987. Pre-recruit crab (110-134 mm cl) declined significantly to 53% of the previous level and are now at an historical low. The 1987 survey appeared to show increased recruitment below 100 mm cl. Some of those crabs, particularly females, grew into larger size groups in 1988, but the estimated abundance of larger crabs is lower than was expected. There has apparently been

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1. Significance was determined by the use of unpaired t-tests. Values of t greater than 2.0 were defined as significant with probability less than 0.05.

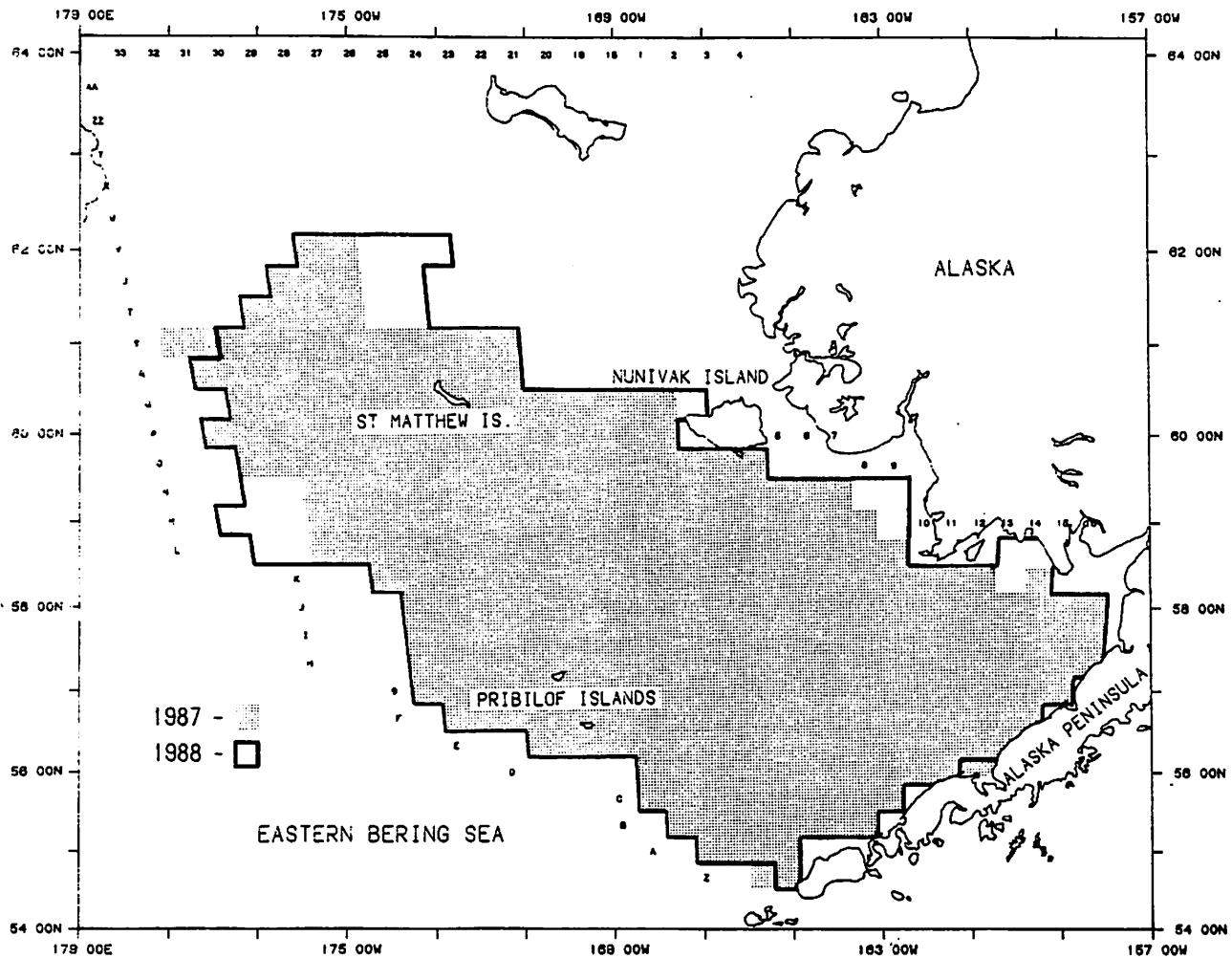


FIGURE 1. NMFS eastern Bering Sea crab survey in 1987 and 1988.

little recruitment of juveniles to this population in several years (Fig. 3). What looked like an upward trend in abundance of legal males over the past two years has either stabilized or begun to decline.

In 1988 we found fewer male crabs in molting or soft-shell condition than in 1987 (0.4 vs 2.8%), and fewer with old (skipmolt) shells (8.5 vs 12.2%). Molting of male crabs appears to have been completed prior to the survey.

The estimated abundance of large<sup>2</sup> ( $\geq 90$  mm cl) females in Bristol Bay showed no significant change from 1987 to 1988 and now stands at 15.7 million crabs. The estimated abundance of small females decreased to 17% of last years estimate, but this decrease was not significant due to high variance of the estimates. About 12.4% of all females were still molting or soft-shell; all of these

females were  $\geq 90$  mm, and 86% had extruded new eggs. Among the mature females (i.e. those carrying external embryos or cases) 94% had molted and extruded new, uneyed eggs. Thus, it appears that in 1988 female molting, mating, and extrusion had not been completed by mid-June. The proportion of mature females seen with new eggs in 1987 and 1986 was 98% and 46% respectively. Fluctuations in these data are probably due to annual variability in timing of embryo hatching and extrusion of new eggs by females.

The fishery will be opened on September 25, 1988 with a guideline harvest of 7.5 million pounds (range 5.8-9.2) relative to an estimated stock of  $35.5 \pm 7.1$  million pounds in Bristol Bay. Catch-per-unit-of-effort (CPUE) in recent years has ranged from 8-12 crabs per pot-lift (Fig. 4).

2. Throughout this report, the term "large females" refers to those females larger than the median size at maturity, i.e., the size at which 50% are mature. A small number of females above this size may actually be immature, but the majority are mature crabs which should contribute to reproduction of the population.

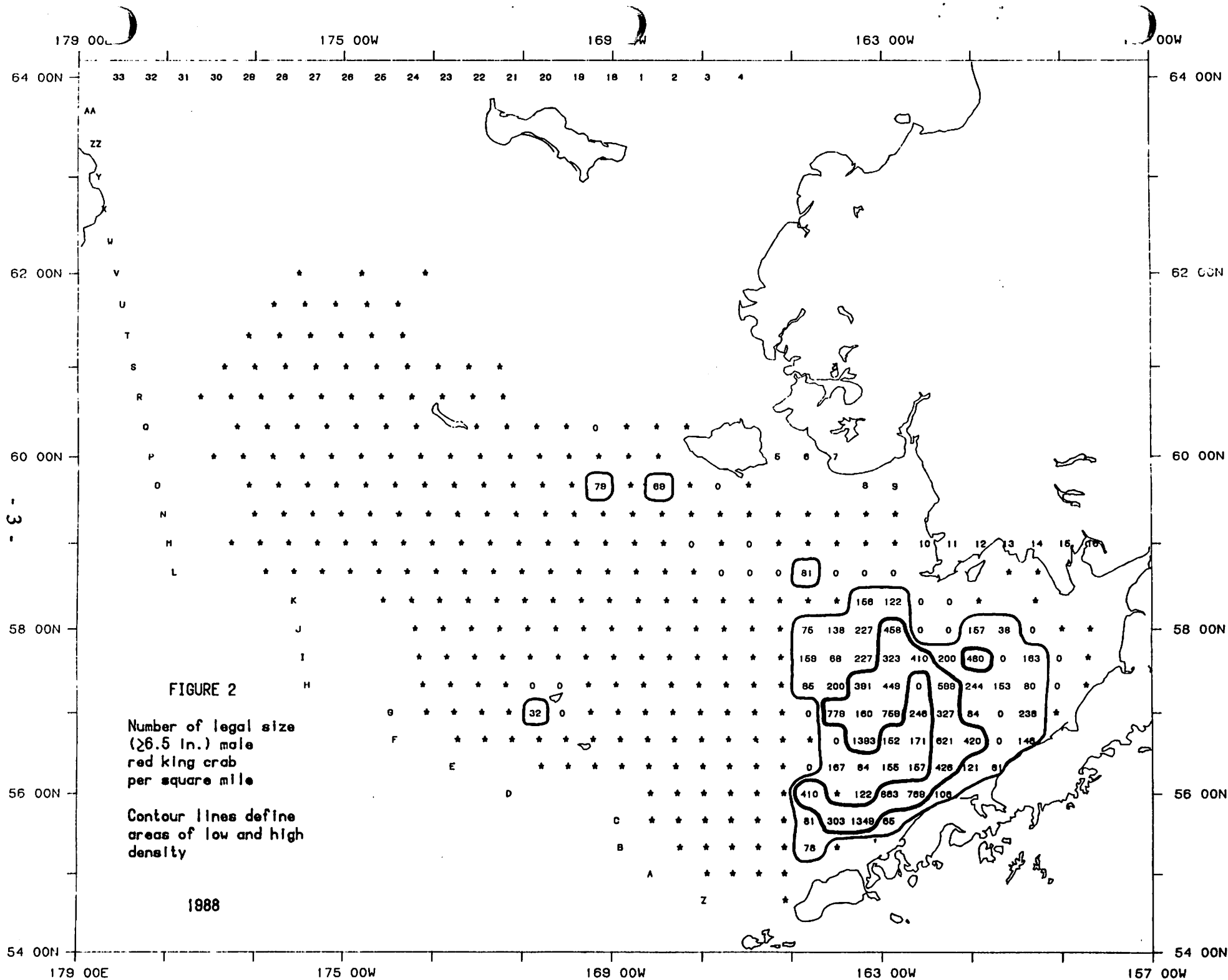


Table 1. Annual abundance estimates (millions of crabs) for red king crab (*P. camtschatica*) in Bristol Bay and the Pribilof District from NMFS surveys.

Size <sup>1</sup> (mm) Width(in)	Males				Females			Grand Total
	<110 <5.2	110-134 5.2-6.5	≥135 ≥6.5	Total	<90 <3.5	≥90 ≥3.5	Total	
1969	41.0	20.3	9.8	71.1	18.3	28.5	46.8	117.9
1970	9.5	8.4	5.3	23.2	4.9	13.0	17.9	41.1
1972 <sup>2</sup>	14.1	8.0	5.4	27.5	7.0	12.1	19.1	46.6
1973 <sup>3</sup>	50.0	25.9	10.8	86.7	24.8	76.8	101.6	188.3
1974 <sup>3</sup>	59.0	31.2	20.9	111.1	37.7	72.0	109.7	220.8
1975	84.9	31.7	21.0	137.6	70.8	58.9	129.7	267.3
1976	70.2	49.3	32.7	152.2	35.9	71.8	107.7	259.9
1977	80.2	63.9	37.6	181.7	33.5	150.1	183.6	365.3
1978	62.9	47.9	46.6	157.4	38.2	128.4	166.6	324.0
1979	48.1	37.2	43.9	129.2	45.1	110.9	156.0	285.2
1980	56.8	23.9	36.1	116.8	44.8	67.6	112.5	229.3
1981	56.6	18.4	11.3	86.3	36.3	67.3	103.6	189.9
1982	107.2	17.4	4.7	129.3	77.2	54.8	132.0	261.3
1983	43.3	10.4	1.5	55.2	24.3	9.7	34.0	89.2
1984	81.8	12.6	3.1	97.6	57.6	17.6	75.1	172.7
1985	13.7	10.1	2.5	26.3	6.9	6.8	13.7	39.9
1986	11.8	12.3	5.9	30.1	4.5	5.4	9.8	39.9
1987	20.1	12.6	7.9	40.6	16.8	18.3	35.1	75.7
1988	8.5	6.4	6.4	21.3	2.7	15.7	18.4	39.7
Limits <sup>4</sup>								
Lower	3.4	5.0	5.1	15.3	0.04	3.6	5.4	20.7
Upper	13.7	7.8	7.6	27.3	5.4	27.7	31.4	58.7
±%	60	22	20	28	98	77	71	48

1 Carapace length (mm).

2 Limited survey in 1971, not used for population estimate.

3 1973 and 1974, estimates considered unreliable.

4 Mean ± 2 standard errors for most recent year.

The target exploitation rate has been set at 20% of the legal male population, as opposed to 30% used in 1987, because the estimates of pre-recruit and small male crabs are at historical low levels.

#### Pribilof Islands Blue King Crab (*P. platypus*)

Legal (≥ 135 mm cl) males were found primarily to the northeast of the islands (Fig. 5). The estimated abundance of legal males was 196,000 crabs (Table 2), representing a significant decrease of 73% from 1987 to 1988. No pre-recruits were caught. Size-frequency data show a large spike of crabs at 50 mm, the majority of which were caught in a single tow (Fig. 6). A similar peak seen at 70 mm in 1987 was not seen at expected larger sizes in 1988. The adult portion of this stock appears to have essentially disappeared; the range of legal

males appears to have contracted, as they were captured at only 3 stations in this district as opposed to 11 last year. Juvenile recruitment may be occurring but is questionable. This population is now at an historical low level (Fig. 7), and the fishery will not be opened in 1988.

The estimated abundance of large (≥ 90 mm cl) females showed no significant change from last years level. Historically, estimates of female abundance have been imprecise due to the preference of females for rocky habitat which is not sampled well by trawls. Only 20 mature females were caught, of which 16 (75%) were carrying new, uneyed embryos. Blue king crab are biennial spawners. Only a portion of the female population spawns in a given year, while the remainder are in the non-egg-bearing phase. About 3% of males

# Red King Crab Length Frequency

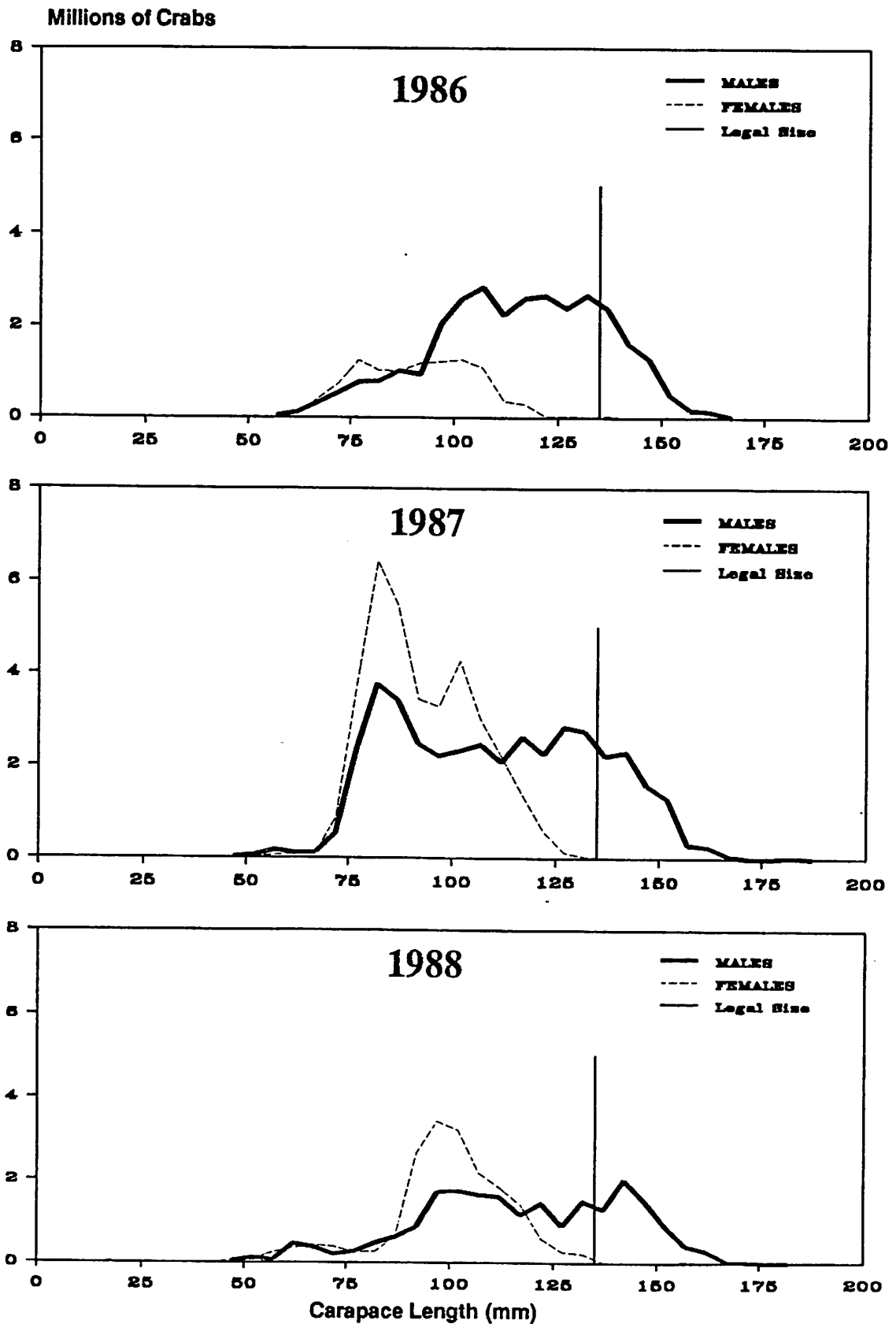


Figure 3. Estimates of abundance for red king crab (*P. camtschatica*) by 5 mm length classes, 1986-1988. Vertical line indicates lower limit of legal size.

and females were in molting or soft-shell condition indicating that molting was mostly completed for 1988.

St. Matthew Island Blue King Crab (*P. platypus*)

Legal ( $\geq 120$  mm cl) males occurred primarily southwest of the island (Fig. 5). The area over which they were distributed was similar to that of 1987. The estimated abundance of legal crabs was 833,000 crabs, and showed no significant change from the previous value (Table 3). The abundance of pre-recruits also showed no significant change. The abundance of large females ( $\geq 80$  mm cl)

increased by a factor of 3.7, but this increase was not significant due to large variance of the estimates, probably because females occur almost exclusively in rocky nearshore habitat which is difficult to sample with trawl gear. Size-frequency data indicate that the population is remaining stable (Fig. 8). Approximately 33% of males and 37% of females were in softshell or molting stages, indicating that the survey occurred just after the midpoint of the molting season. Only 4 of 9 mature females (44%) were carrying new uneyed embryo clutches, which is typical for this stock, as explained above.

**Red king crabs, Bristol Bay**

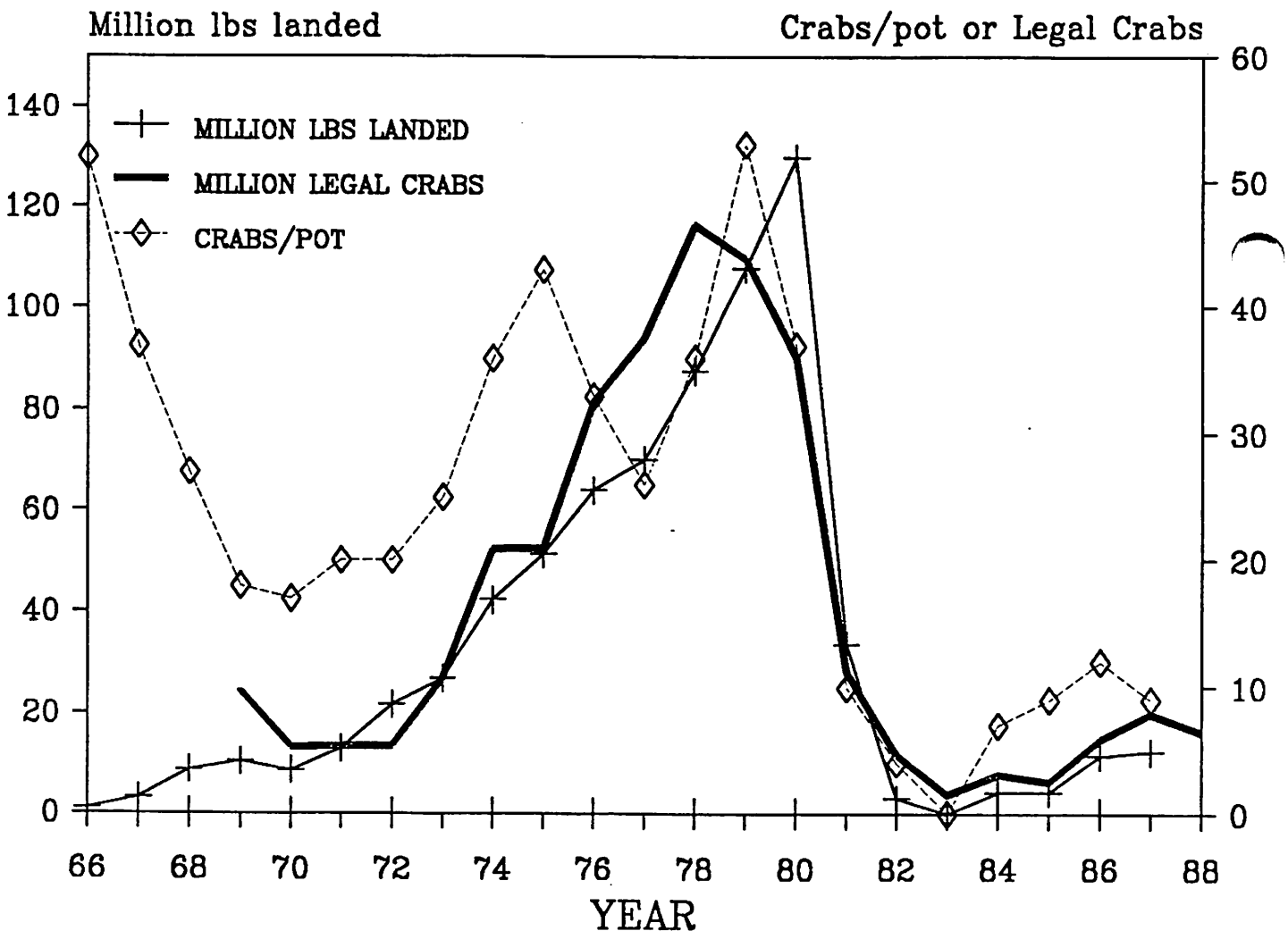


FIGURE 4. U.S. landings in millions of lbs, catch-per-unit-of-effort as crabs/pot, and the abundance of legal red king crabs (*P. camtschatica*) in millions in Bristol Bay, estimated from the NMFS trawl surveys.





Table 2. Annual abundance estimates (millions of crabs) for blue king crab (*P. platypus*) in the Pribilof District from NMFS surveys.

Pribilof District								
Size <sup>1</sup> (mm) Width(in)	Males				Females			Grand Total
	<110	110-134	≥135	Total	<90	≥90	Total	
	<5.2	5.2-6.5	≥6.5		<3.5	≥3.5		
1974	4.4	3.1	1.9	9.4	0.6	10.9	11.5	20.9
1975	4.1	8.0	7.5	19.6	0.0	8.8	8.8	28.4
1976	10.3	2.1	3.9	16.3	0.4	17.7	18.1	34.4
1977	3.2	2.2	9.4	14.8	2.2	17.5	19.7	34.5
1978	1.2	5.8	4.3	11.3	0.3	35.5	35.8	47.1
1979	6.4	1.5	4.6	12.5	5.2	2.9	8.1	20.6
1980	1.9	1.4	4.2	7.5	0.8	101.9	102.7 <sup>3</sup>	110.2
1981	4.8	1.4	4.2	10.4	3.4	11.6	15.0	25.4
1982	1.2	0.7	2.2	4.1	0.7	8.6	9.3	13.4
1983	0.6	0.8	1.3	2.8	0.2	9.2	9.4	12.2
1984	0.5	0.3	0.6	1.3	0.3	3.1	3.4	4.8
1985	0.06	0.16	0.32	0.54	0.18	0.52	0.70	1.24
1986	0.02	0.02	0.43	0.47	0.04	1.86	1.90	2.37
1987	0.57	0.08	0.73	1.38	0.39	0.58	0.97	2.35
1988	1.10	0.0	0.20	1.29	0.77	0.43	1.20	2.49
Limits <sup>2</sup>								
Lower	0.0	0.0	0.03	0.00	0.0	0.05	0.00	0.00
Upper	2.94	0.0	0.36	3.14	2.11	0.81	2.70	5.84
±%	168		86	143	174	88	125	135

1 Carapace length (mm).

2 Mean ± 2 standard errors for most recent year.

3 Female estimates considered unreliable in 1980.

The 1988 fishery opened on September 1 with a guideline harvest of 1.1 million pounds (range 0.7-1.5). Preliminary Alaska Department of Fish and Game (ADF&G) statistics indicate that about 1.4 million pounds were landed by 46 vessels during a four day opening with an average CPUE of 14 crabs per pot-lift<sup>3</sup>. The estimated exploitation rate was 41% (by weight) or about 340,000 crabs out of an estimated legal stock of 833,000 crabs. In comparison, during 1987, 63 vessels landed 1.1 million pounds or 232,000 crabs for an estimated exploitation rate of 39% and an

average CPUE of 8 crabs per pot-lift<sup>4</sup> (Fig. 9).

#### Tanner crab (*Chionoecetes bairdi*)

Although the legal minimum size of 5.5 in cw is equivalent to 140 mm cw, legal crabs are defined in this report as ≥ 138 mm cw because of the difference between scientific measure (between spines) and commercial measure (spine tip to spine tip). The data included in Table 4, however, show large crabs as males ≥ 135 mm, because this is closer to the lower limit of sizes landed, and has been used for a long-term index.

3. Ken Griffin, ADF&G, P.O. Box 508, Dutch Harbor, AK 99692, pers. comm., Sept 1988.

4. Alaska Dept. Fish and Game, 1988, Westward Region shellfish report to the Alaska Board of Fisheries. ADF&G, Div. of Commercial Fisheries, Westward Regional Office, 211 Mission Rd., Kodiak, AK 99615, 384p.

# Blue King Crab Length Frequency Pribilof District

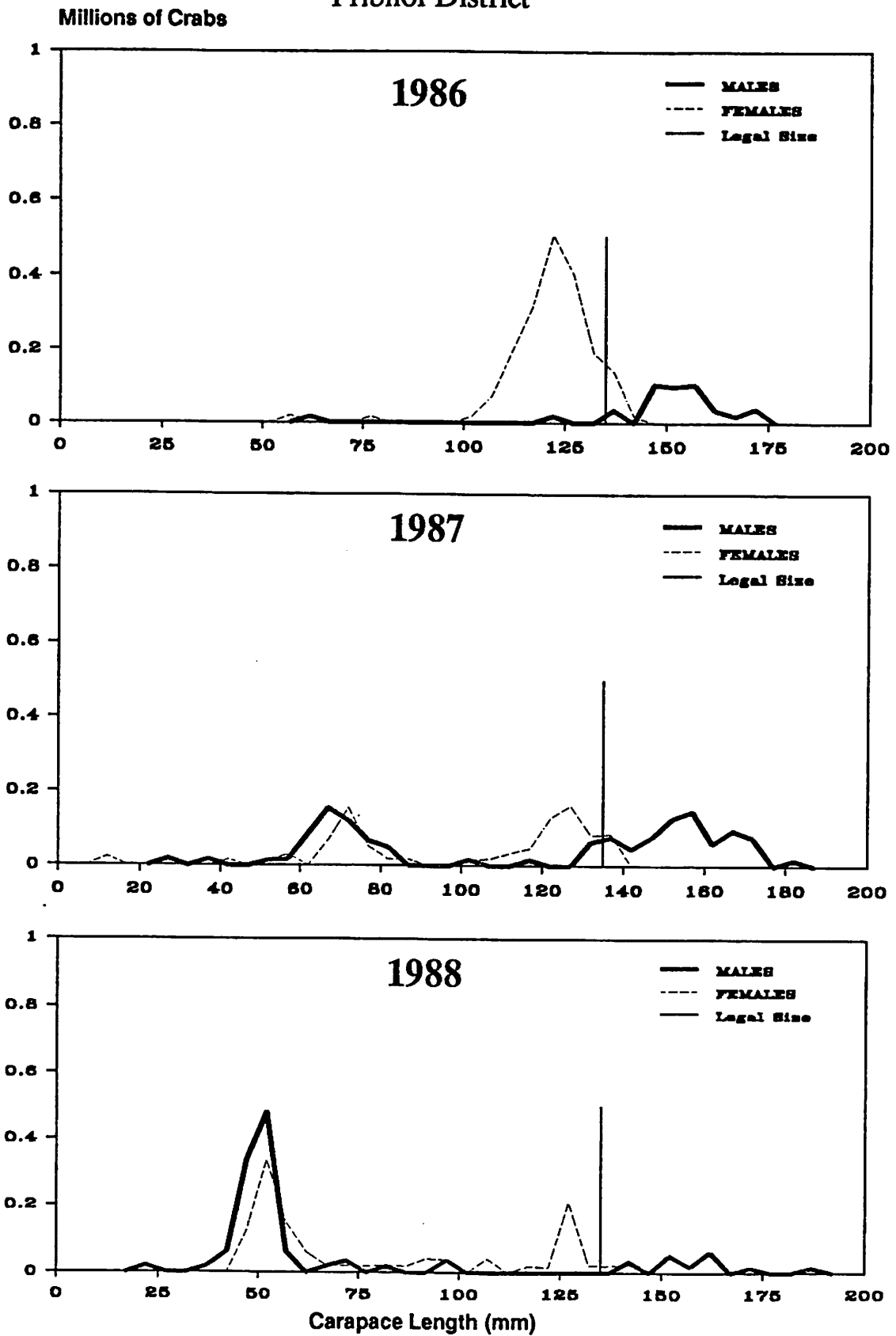


Figure 6. Estimates of abundance for Pribilof District blue king crab (*P. platypus*) by 5 mm length classes, 1986-1988. Vertical line indicates lower limit of legal size.

Legal males were sparsely distributed in Bristol Bay and continental slope areas with regions of relatively high abundance along the Alaska Peninsula and in the Pribilof Islands (Fig. 10). The area of distribution of legal males was somewhat larger than that of 1987. The estimated abundance of legal ( $\geq 138$  mm cl) male *C. bairdi* in the Southeast and Pribilof Districts is 14.4 million crabs (with 17.4 million  $\geq 135$  mm; Table 4). The estimated abundance of legal crabs increased by a factor of 2.4 from 1987 levels; although this increase was not statistically significant, associated increases in other size and sex groups indicate that it is a biologically important change. The estimated abundance of pre-recruits (110-134 mm cw)

increased significantly by a factor of 2.9, and the estimate of small males ( $\leq 109$  mm cw) showed no significant change from 1987. Size frequency (Fig. 11) show what appears to be significant recruitment of small males over the past 2-3 years.

The abundance of large ( $\geq 85$  mm cw) females (all districts) increased significantly by a factor of 2.2, but the abundance of small ( $< 85$  mm) females showed no significant change from the previous estimate. Over 97% of mature females were carrying new, uneyed embryos, suggesting that the period of larval hatching and embryo extrusion was essentially completed by the time of the survey. Only 6.4% of male crabs and 4.4% of females were molting or softshell.

### Blue king crabs, Pribilof District

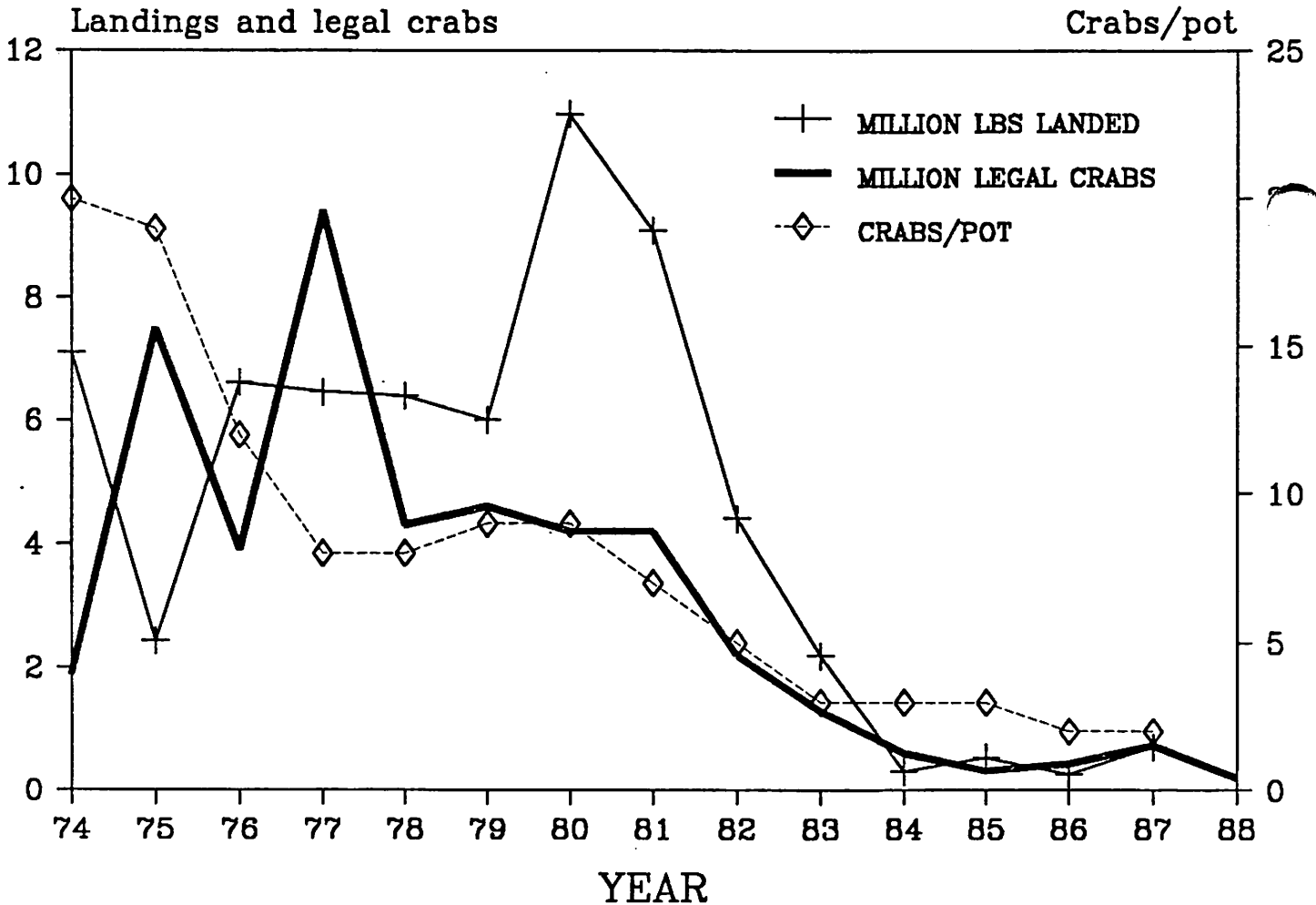


FIGURE 7. U. S. landings in millions of lbs, catch-per-unit-of-effort as crabs/pot, and the abundance of legal blue blue king crabs (*P. platypus*) in the Pribilof District in millions, estimated from the NMFS trawl surveys.

Table 3. Annual abundance estimates (millions of crabs) for blue king crab (*P. platypus*) in the Northern District from NMFS surveys.

Northern District								
Size <sup>1</sup> (mm)	Males				Females			Grand Total
	<105	105-119	≥120	Total	<80	≥80	Total	
Width(in)	<4.3	4.3-5.5	≥5.5		<3.2	≥3.2		
1978	5.6	2.4	1.8	9.8	0.8	0.4	1.2	11.0
1979	4.9	2.3	2.2	9.4	1.7	0.9	2.6	12.0
1980	3.4	2.2	2.5	8.1	0.8	2.2	3.0	11.1
1981	1.2	1.8	3.1	6.3	0.0	0.5	0.5	6.8
1982	3.2	2.6	6.8	12.5	0.4	0.7	1.1	13.7
1983	1.8	1.6	3.5	6.9	0.2	2.4	2.7	9.6
1984	1.4	0.6	1.6	3.6	0.2	0.5	0.7	4.3
1985	0.46	0.35	1.08	1.89	0.08	0.13	0.21	2.10
1986	0.56	0.40	0.38	1.34	0.25	0.06	0.31	1.65
1987	1.07	0.73	0.74	2.53	0.46	0.22	0.68	3.21
1988	1.44	0.65	0.83	2.92	0.90	0.79	1.70	4.62
Limits <sup>2</sup>								
Lower	0.17	0.32	0.52	1.27	0.14	0.18	0.37	1.64
Upper	2.71	0.97	1.14	4.58	1.67	1.41	3.00	7.58
±%	88	50	37	57	85	78	78	65

1 Carapace length (mm), categories reflect smaller average size in the Northern District; 80 mm is the median size at maturity for females.

2 Mean ± 2 standard errors for most recent year.

Due to low estimated abundance of *C. bairdi* the Bristol Bay fishery was not opened in 1986 or 1987, but was re-opened in 1988 and about 2.2 million pounds were harvested (Fig. 12). Current estimates show that the population of legal males is increasing and is currently estimated at  $33.8 \pm 30.0$  million lbs, virtually all of which is located in the Pribilof and Southeast Districts. Catch rates in recent years have been about 8-10 crabs per pot-lift (Fig. 12).

#### Tanner Crab (*C. opilio*)

Although the legal minimum size limit for this species is 78 mm cw, crabs smaller than 110 mm cw were not usually landed prior to 1983. However, market conditions affect the sizes at which crabs are landed and processors currently prefer a minimum size of 102 mm cw (4.0 in). The size ranges for male *C. opilio* used in this report are defined as follows: sublegal (< 78 mm cw); small (78-101 mm cw); large (≥ 102 mm cw); and very large (≥ 110 mm).

The distribution of large males showed an area of high concentration north of the Pribilof Islands (Fig. 13). There were also areas of high abundance in the extreme northwestern portion of the survey area south and west of St. Matthew Island. Prior to 1986, there was little fishing north of 58° N, and estimates of abundance (Table 5) probably included all portions of the stock which were subject to fishing even though an unknown portion of the commercially exploitable stock may have been north of the survey area. In 1986, substantial catches were reported from areas N of 58° lat. In addition, the 1987 survey showed that there were substantial quantities of large crab north of 59° N lat. and west of 171° W long. During the early 1980's the high density regions of *C. opilio* distribution have moved in a northwestern direction and split into two centers of abundance. For this reason, new district boundaries were devised in 1987 creating an Eastern and Western District for *C. opilio*, with the dividing line at 173° W long. Because of this change in District definitions and

# Blue King Crab Length Frequency

## Northern District

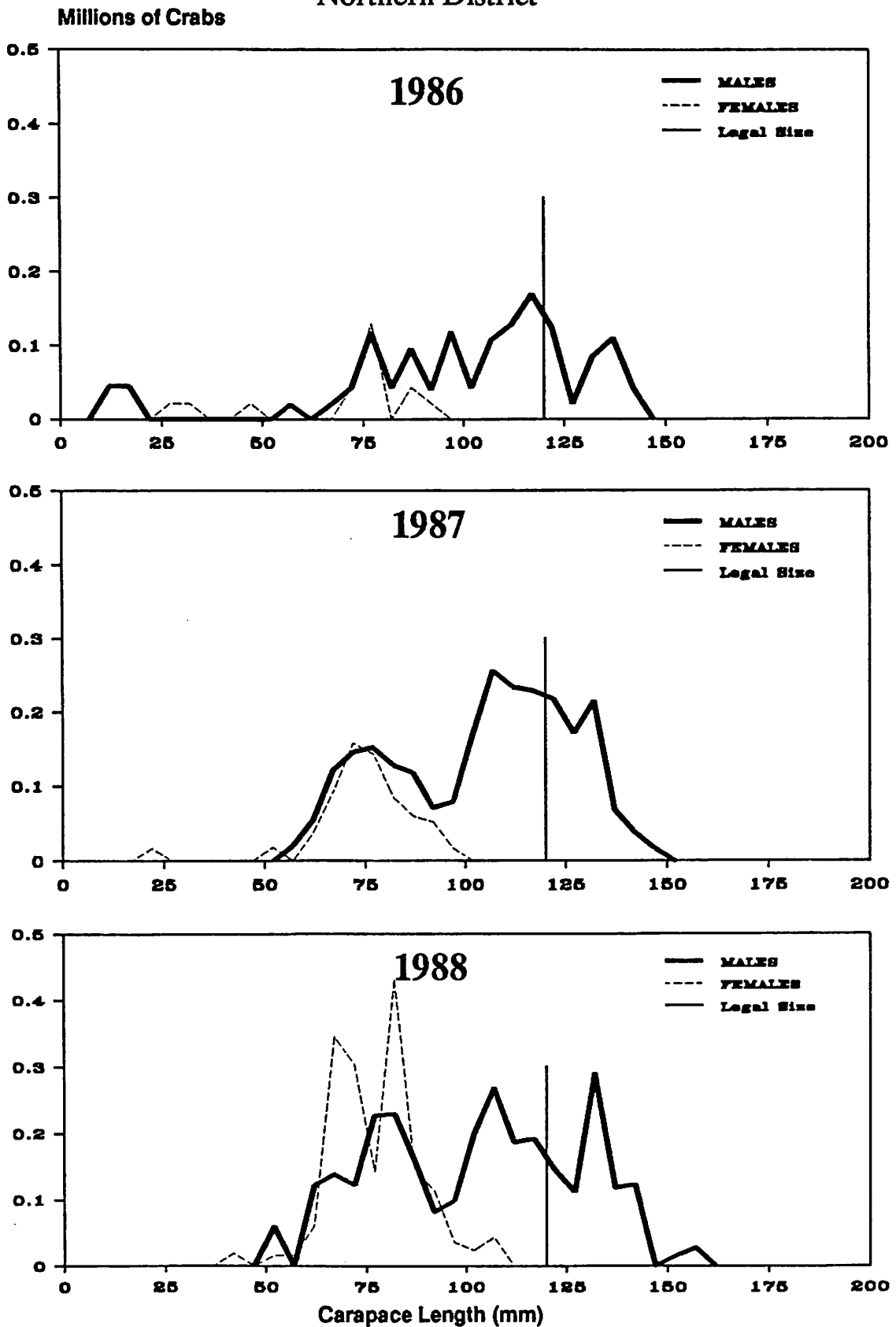


Figure 8. Estimates of abundance for St. Matthew Island (northern District) blue king crab (*P. platypus*) by 5 mm length classes, 1986-1988. Vertical line indicates lower limit of legal size.

because this species appears to be a single stock, values in Table 5 reflect the entire surveyed population of *C. opilio*. Although this species has been surveyed since 1978, the area surveyed prior to 1982 was sufficiently different from the currently surveyed areas that previous estimates probably covered a much smaller portion of the exploitable crab distribution. Furthermore, the 4-inch (102 mm) size limit was not in use prior to 1984. For these reasons estimates of abundance of large males are not shown for years prior to 1984 (Table 5; Fig. 15).

The estimated number of large ( $\geq 102$  mm cw) males (Eastern and Western Districts combined) is 171.0 million crabs, a non-significant

increase of 13% over the previous level. Other size groups of male crabs increased also; small males (78-101 mm cl) by 16% (non-significant), and very large males ( $\geq 110$  mm cl) by 29% (non-significant). A non-significant decline of 25% occurred among sublegal males. Overall, total males showed no significant change from the previous level. The estimated abundance of large female ( $\geq 50$  mm cl) crabs showed no significant change, but small females decreased significantly by 58%. Size frequency data (Fig. 14) indicate that recruitment to the fishery may continue to improve in the near-term. However, in the past, large populations of juveniles have been estimated which subsequently failed to recruit (e.g. 1984-1985), so any predictions must be

### Blue king crabs, Northern District

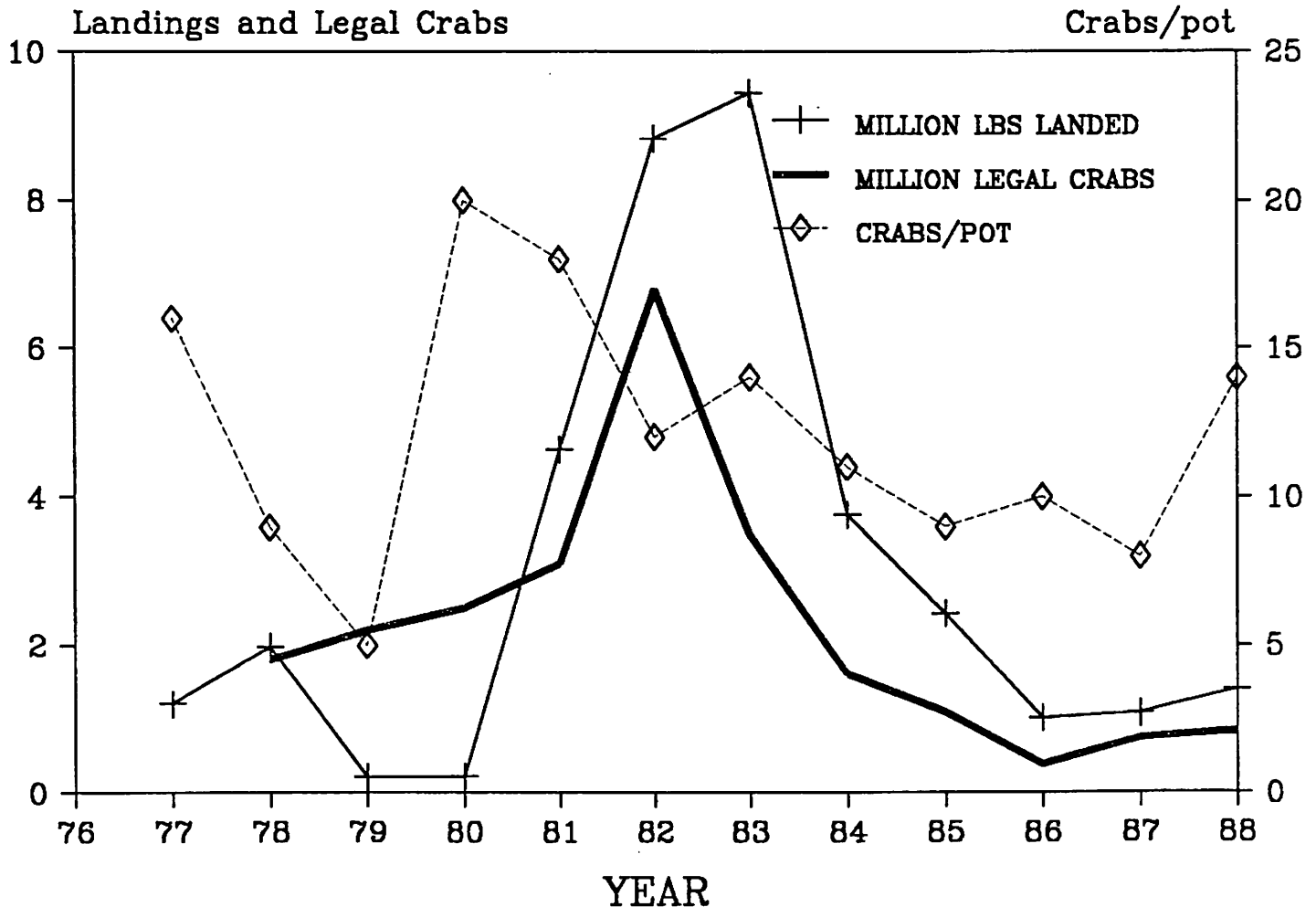


FIGURE 9. U.S. landings in millions of lbs, catch-per-unit-of-effort as crabs/pot, and the abundance of legal blue king crabs (*P. platypus*) in the Northern District in millions, estimated from the NMFS trawl surveys.

Table 4. Annual abundance estimates (millions of crabs) for Tanner crabs (*C. bairdi*) in Bristol Bay and the Pribilof District from NMFS surveys.

Size <sup>1</sup> (mm) Width(in)	Males				Females			Grand Total
	<110	110-134	≥135	Total	<84	≥85	Total	
	<4.3	4.3-5.3	>5.3		<3.4	≥3.4		
1976	180.2	136.6	109.5	426.3	174.7	220.4	395.1	821.4
1977	255.0	116.3	92.1	463.4	328.4	215.8	544.2	1,007.6
1978	124.2	81.2	45.6	251.0	116.1	73.3	189.4	440.4
1979	133.1	47.7	31.5	212.3	122.6	42.1	164.7	377.0
1980	453.3	65.0	31.0	549.3	326.9	106.8	433.7	983.0
1981	303.8	24.0	14.0	341.8	324.2	79.1	403.3	745.1
1982	88.8	46.9	10.1	145.8	126.4	83.6	210.0	355.8
1983	146.3	32.0	6.7	185.0	180.1	45.4	225.5	410.5
1984	85.1	21.2	5.8	112.1	107.0	33.4	140.4	252.5
1985	31.1	9.4	4.4	44.9	24.2	15.6	39.8	84.7
1986	110.4	12.9	3.1	126.4	68.2	13.7	81.9	208.3
1987	230.1	19.7	8.3	258.0	193.3	35.5	228.8	486.8
1988	287.3	59.7	17.4	364.4	184.8	81.0	265.8	630.2
Limits <sup>2</sup>								
Lower	189.4	30.3	2.8	248.5	119.6	42.3	181.8	430.3
Upper	385.1	89.1	32.0	480.3	249.9	119.8	349.8	830.1
± %	34	49	84	32	35	48	32	32

1 Carapace length (mm).

2 Mean ± 2 standard errors for most recent year.

viewed cautiously. Recruitment patterns in this stock are not entirely clear since recruitment evidently occurs both through localized production and by immigration from unsurveyed areas.

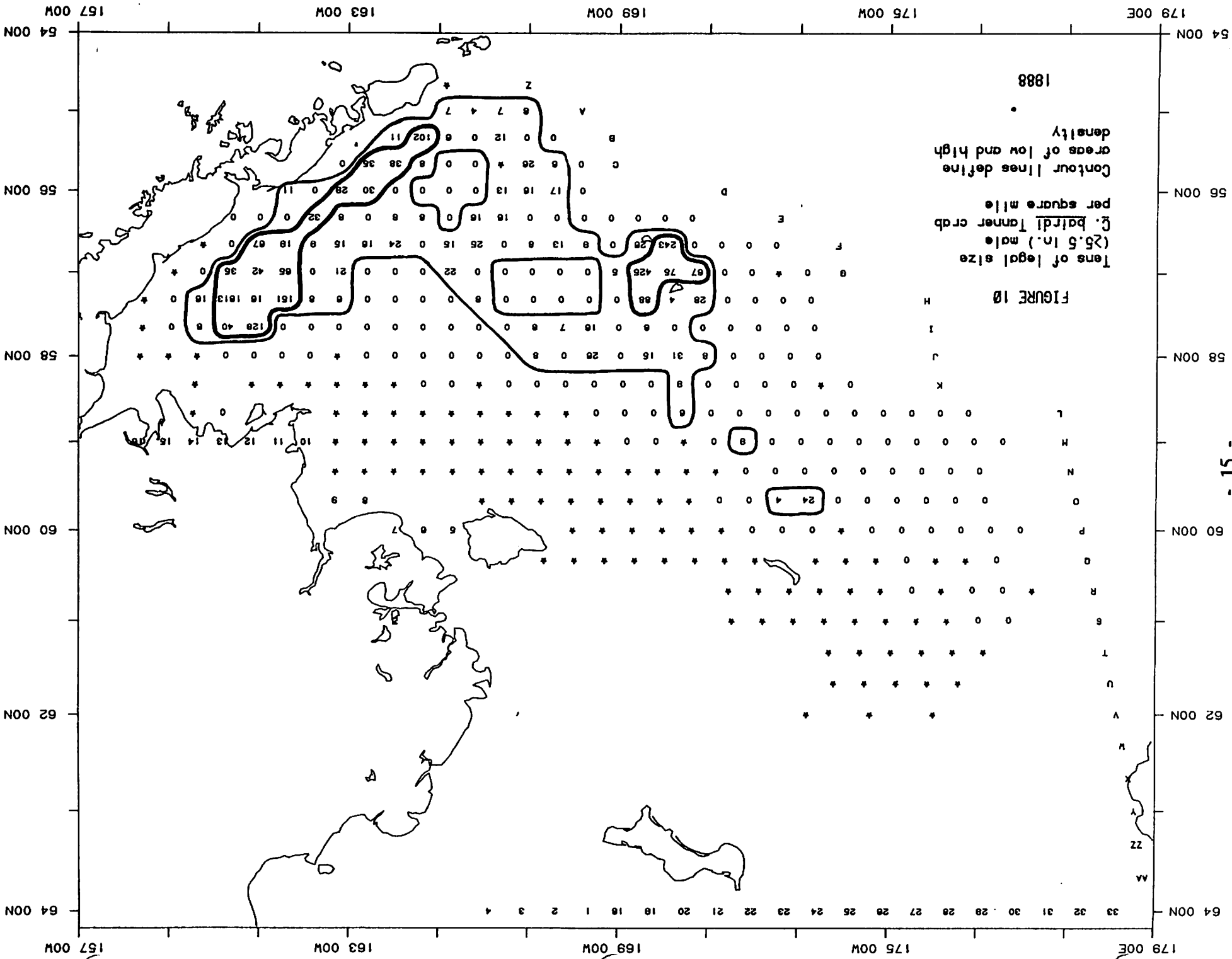
Approximately 7% of all male crabs ≥100 mm cw, i.e. the exploited stock, were found to be in molting or softshell condition; comparable figures were 16% in 1987, and 46% in 1986. Only 0.2% of females were molting or softshell, indicating that the female molting period was completed, but some males were still undergoing molting during the survey. Apparently the molting period is quite variable from year to year. Considering only mature female crabs, about 99% carried new uneyed embryos indicating that hatching and extrusion were completed by the time of the survey.

The 1988 fishery was closed on June 30. Preliminary 1988 ADF&G statistics indicate that over 135 million lbs were landed with CPUE around 144 crabs/pot (Fig. 15). Currently there is an estimated 227.5 (± 70.0) million pounds of large males (≥102 mm cw) within the survey area of which about 70% by number (72% by weight) exist

east of 173° W long.

Recent fishery landings have been large compared to the estimated biomass. This inconsistency was partially due to increased fishing pressure in the Northern District, much of which lay outside the region covered by the NMFS trawl surveys prior to 1987. Thus, our estimates did not include the entire stock that was being exploited in 1985-1986. In addition, there is reason to believe that the catchability of *C. opilio* (and perhaps *C. bairdi* as well) in the survey is less than 1.0, i.e. that population densities are routinely underestimated by trawl catches. At present, the fishery appears to have expanded about as far as possible in U.S. waters; recent increases in landings are apparently due to population growth, although high densities of large males exist near the U.S.-Soviet convention line, and there may be some immigration from Soviet waters. Despite the high landings and expanding grounds, these factors do not appear to have caused adverse impacts to the Bering Sea stock of *C. opilio*.





# C. bairdi Width Frequency

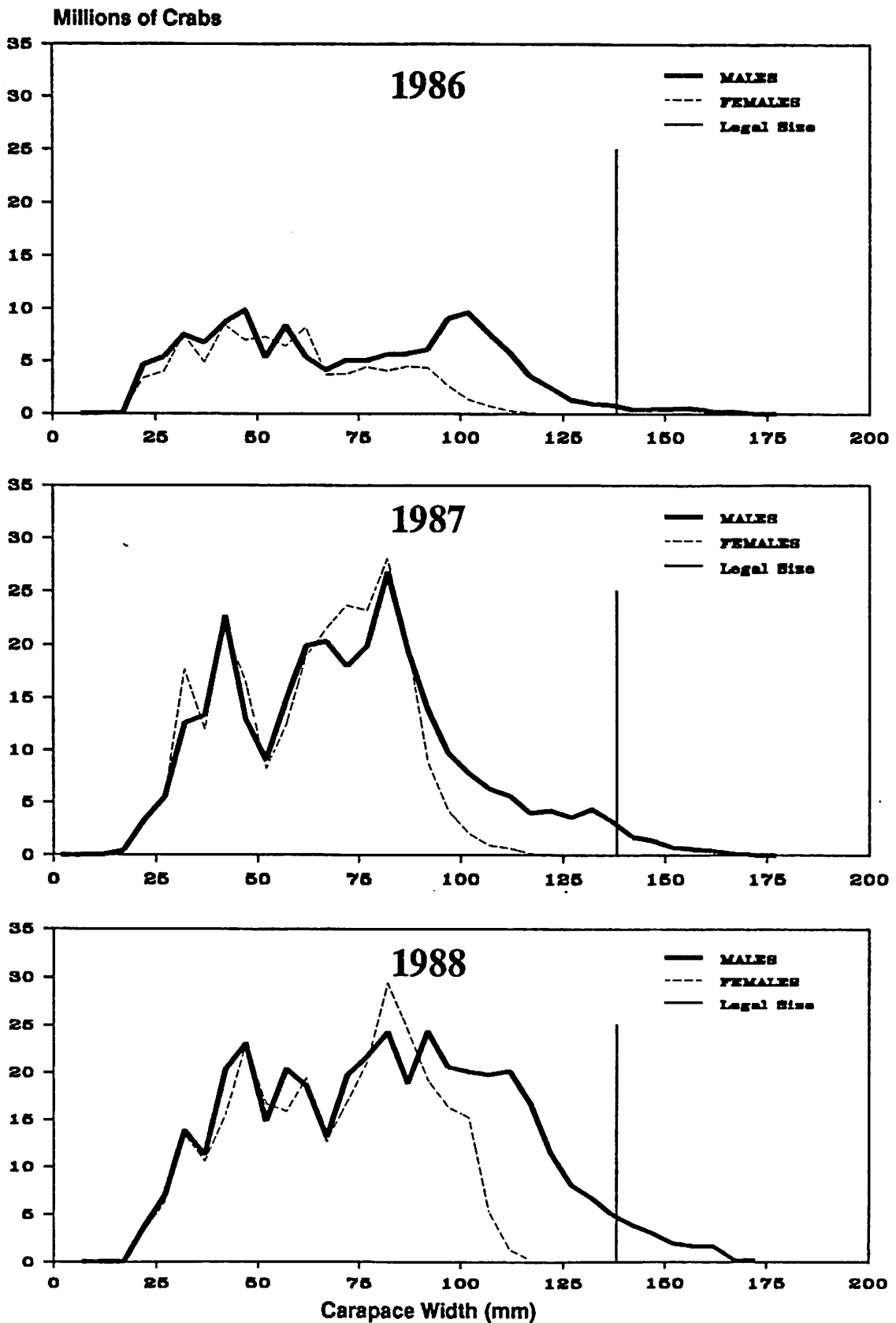


Figure 11. Estimates of abundance for *C. bairdi* in Bristol Bay and the Pribilof District by 5 mm width classes, 1986-1988. Vertical line indicates lower limit of legal size.

**Hair Crab (*Erimacrus isenbeckii*)**

Hair crab are widely scattered across the EBS. A single area of high abundance exists immediately north of the Alaska Peninsula (Fig. 16). In previous years, high densities were also found near the Pribilof Islands. Because of their patchy distribution and low densities, estimates of abundance of hair crab are imprecise. No changes in population levels from 1987 to 1988 were statistically significant. The abundance of large male ( $\geq 90$  mm) hair crabs has been declining since 1981 (Table 6); the 1988 estimate of 550,000 shows a decrease of 55% over the past year. In contrast, the estimated abundance of small ( $< 90$  mm cl) males shows an increase of 100% from 1987. The estimated abundance of total females shows no signifi-

cant change from 1987 or 1986. Size-frequency data (Fig. 17) show improved recruitment of small male crabs in the past 2 years, but again, these data are questionable.

Landings have been largely incidental to Tanner crabbing although there is occasionally some directed effort. Preliminary ADF&G statistics for 1988 were not available as of this writing, but  $< 2000$  lbs were landed in 1987. Currently there are an estimated 1.1 ( $\pm 0.6$ ) million pounds of large male crabs. The fishery and markets have both been intermittent and probably will remain so during 1988. There are no guideline harvest levels, closed seasons or size limits for hair crab. CPUE has not been predictable due to low effort (Fig. 18).

**C. bairdi, Bristol Bay and Pribilofs**

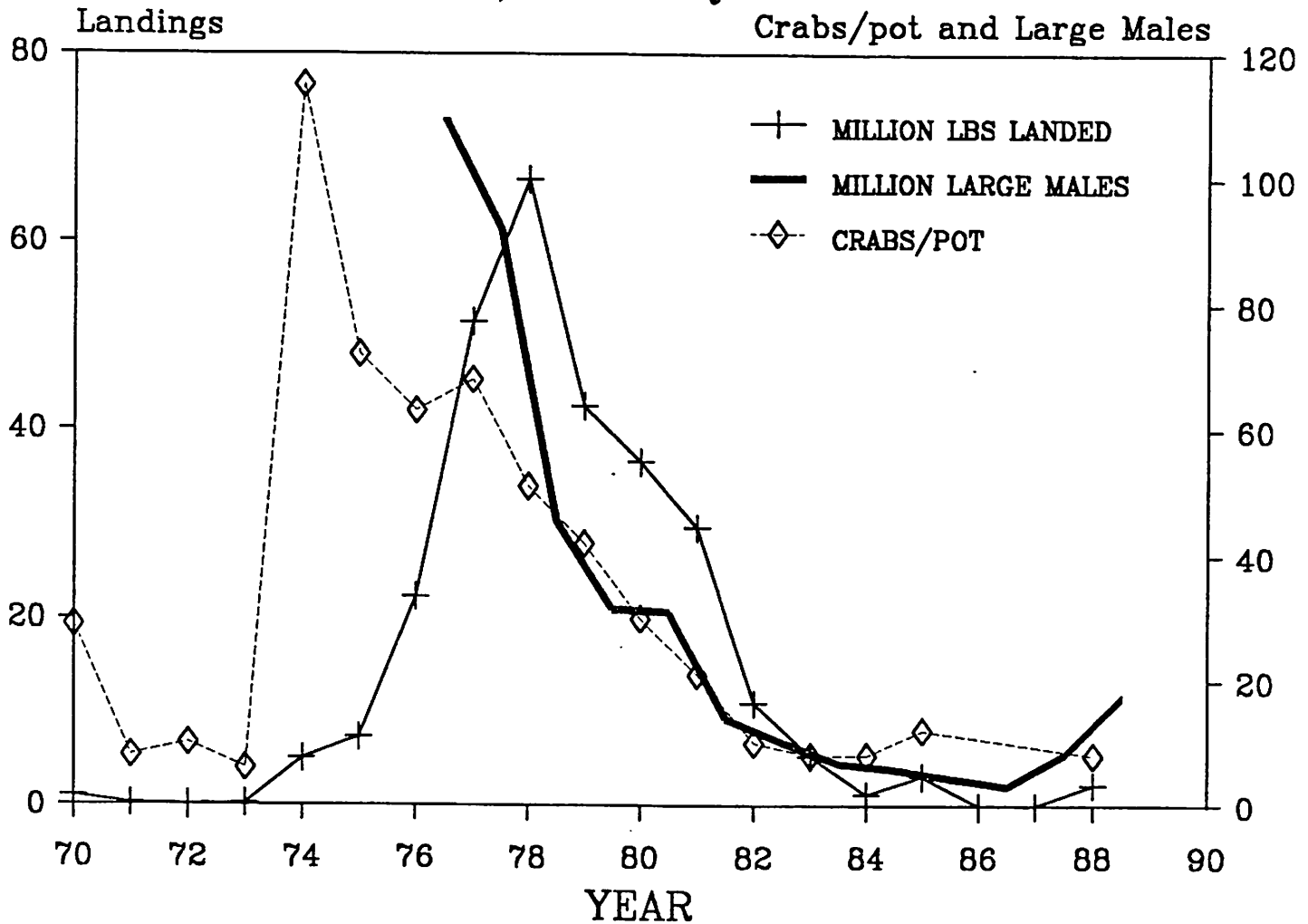


FIGURE 12. U.S. landings in millions of lbs, catch-per-unit-of-effort as crabs/pot, and the abundance of large *C. bairdi* in Bristol Bay and the Pribilof District in millions, estimated from the NMFS trawl surveys.



Table 5. Annual abundance estimates for eastern Bering Sea Tanner crabs (*C. opilio*) from NMFS surveys (millions of crab).

Size <sup>1</sup> (mm) Width(in)	Males				Females			
	<102 <3.7	≥102 ≥4.0	≥110 ≥4.3	Total	<50 <2.0	≥50 ≥2.0	Total	Grand Total
1982	*	*	21.7	2073.2	402.6	2255.8	2658.4	4731.7
1983	*	*	22.1	1858.1	673.1	1228.4	1912.6	3759.7
1984	1237.4	153.2	73.9	1390.7	610.5	581.7	1192.2	2582.9
1985	547.8	74.9	40.7	622.6	258.2	123.5	381.7	1004.3
1986	1179.0	83.1	45.9	1262.0	790.6	422.0	1212.5	2474.5
1987	4438.9	150.8	70.0	4589.8	2919.3	2929.3	5848.6	10438.4
1988	3467.2	171.0	90.1	3638.2	1235.3	2322.7	3556.0	7194.2
East(%) <sup>2</sup>	59.1	70.1	75.3	59.7	40.8	70.4	60.2	59.9
Limits <sup>3</sup>								
Lower	2598.7	118.5	53.3	2768.3	772.4	1600.1	2597.7	5366.0
Upper	4335.7	223.5	126.9	4508.2	1698.1	3045.2	4518.2	9026.4
±	25	31	41	24	37	31	27	25

1 Carapace width in mm.

2 Proportion of size group in Eastern District.

3 Mean ± 2 standard errors for most recent year.

\* Estimates not available at present time.

Table 6. Annual abundance estimates (millions of crabs) for hair crabs (*Erimacrus isenbeckii*) from NMFS surveys. The size at entry to the U. S. fishery is approximately 90 mm (3.5 in) carapace length.

Size <sup>1</sup> (mm) Length(in)	Males			Females		Grand Total
	<90 <3.5	≥90 ≥3.5	Total	Total		
1979	6.4	16.1	22.5	1.6		24.1
1980	6.0	13.7	19.7	3.1		22.8
1981	6.1	15.9	22.0	0.8		22.8
1982	1.4	7.7	9.1	0.4		9.5
1983	0.9	4.8	5.7	0.9		6.6
1984	1.1	2.9	4.0	0.4		4.4
1985	0.53	2.22	2.75	0.22		2.97
1986	0.71	1.46	2.17	0.37		2.54
1987	1.95	1.19	3.14	0.91		4.05
1988	3.98	0.55	4.52	0.85		5.37
Limits <sup>2</sup>						
Lower	0.00	0.22	0.00	0.17		0.17
Upper	10.0	0.87	10.55	1.54		12.09
±%	151	60	133	80		125

# C. opilio Width Frequency

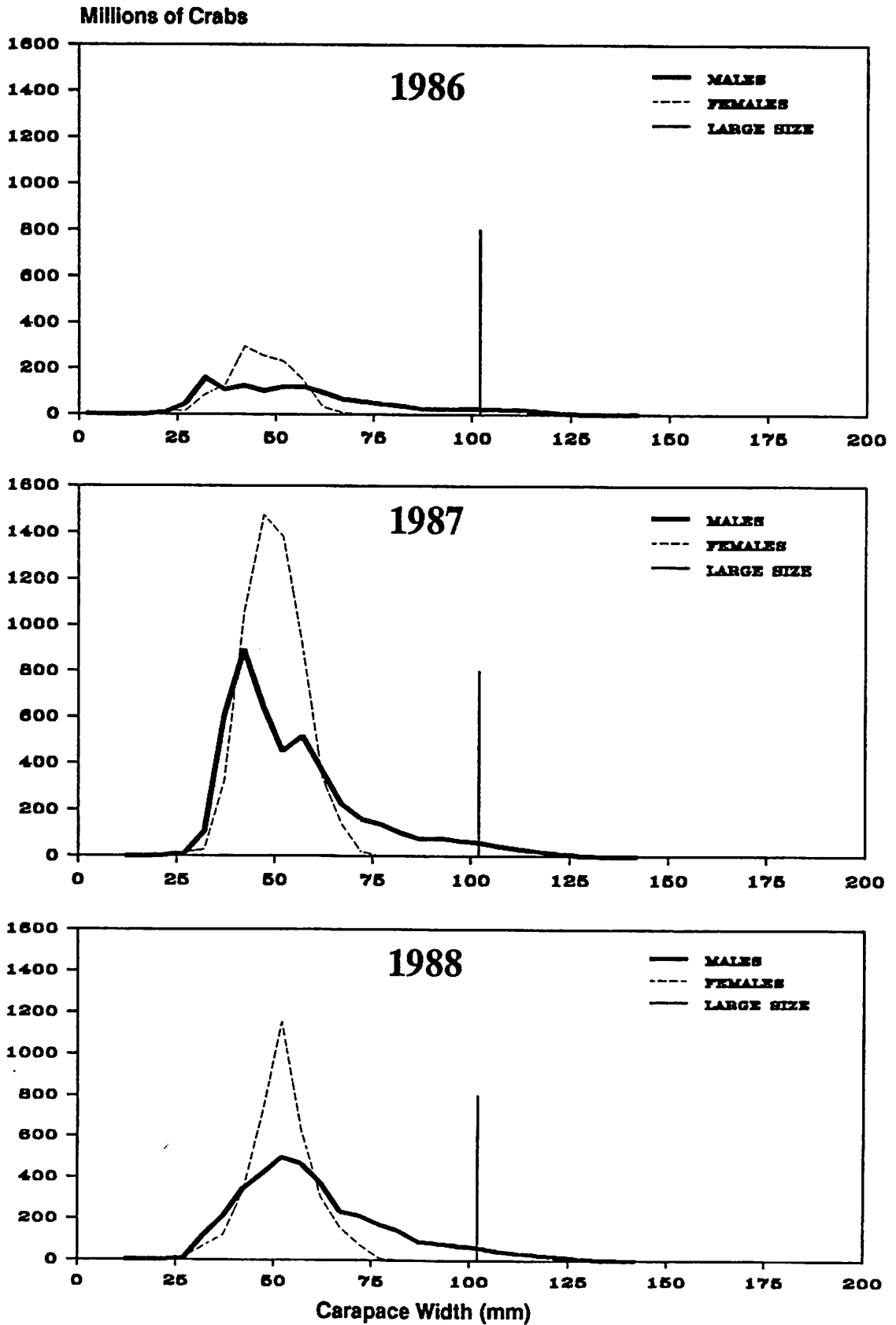


Figure 14. Estimates of abundance for *C. opilio*, all districts combined by 5 mm width classes, 1986-1988. Vertical line indicates minimum size preferred by industry.

### C. opilio, all districts

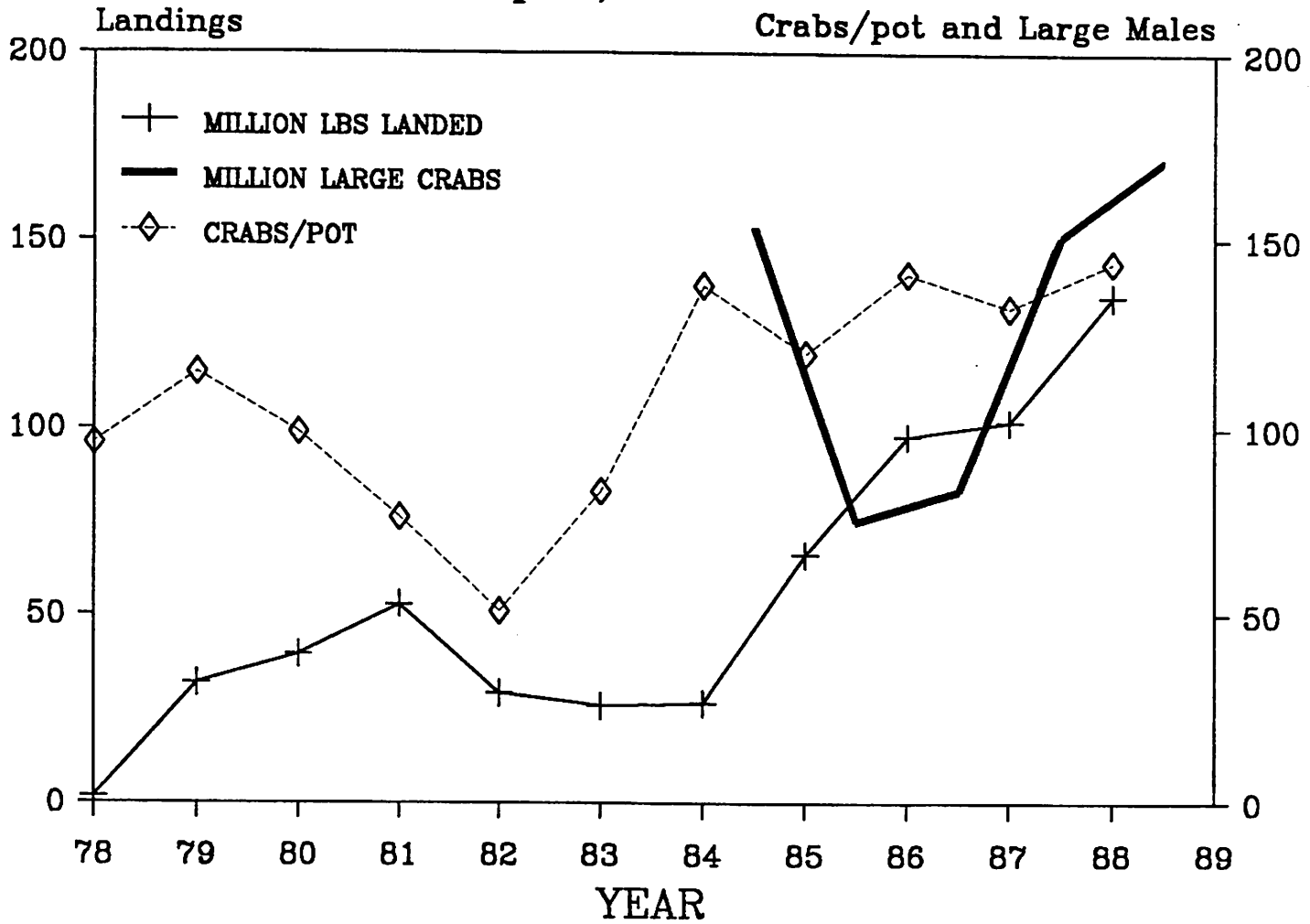


FIGURE 15. U.S landings in millions of lbs, catch-per-unit-of-effort as crabs/pot, and the abundance of large male *C. opilio* in millions (all districts combined), estimated from the NMFS trawl surveys. Large crabs defined as  $\geq 102$  mm carapace width.





# Hair Crab Length Frequency

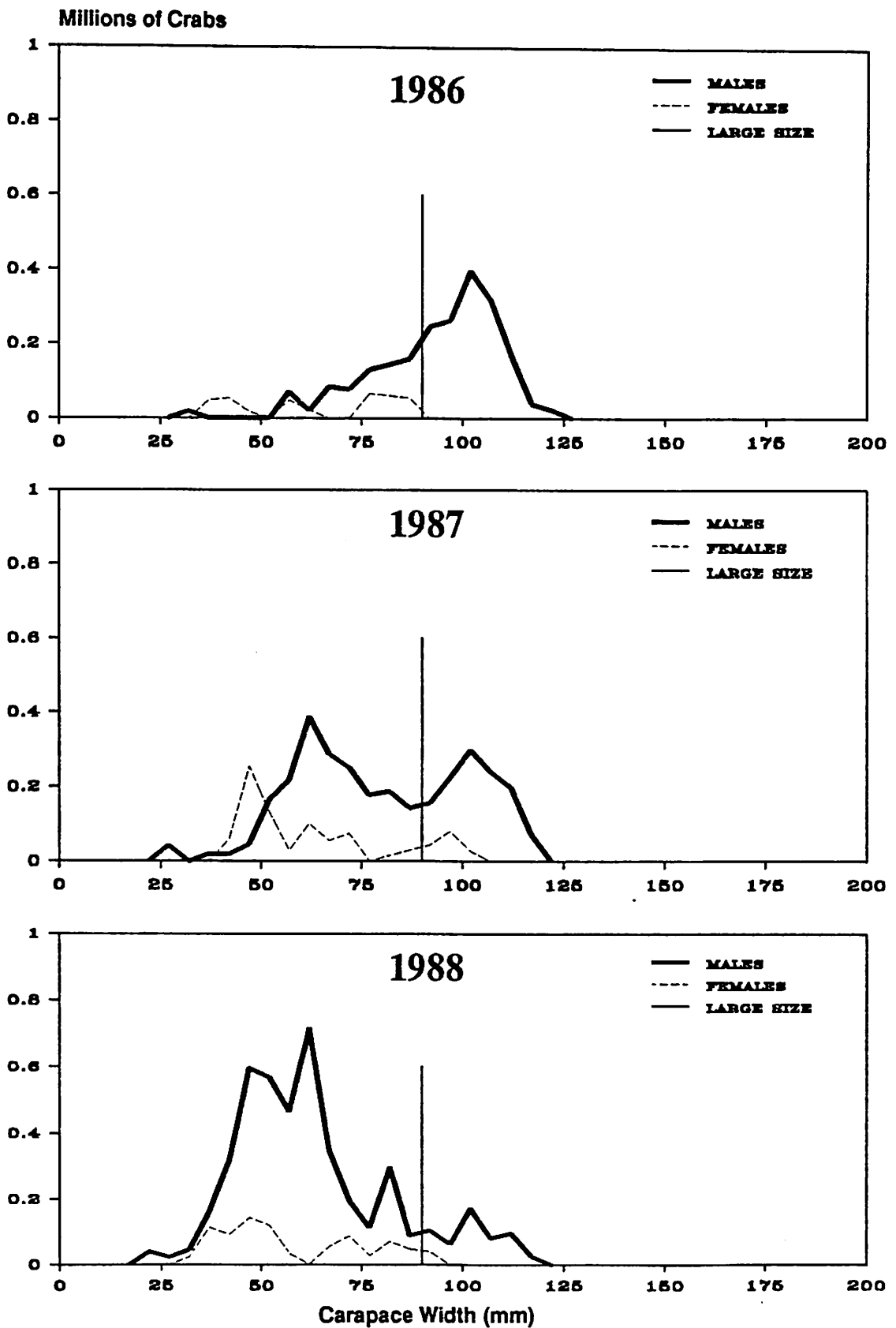


Figure 17. Estimates of abundance for hair crab (*E. isenbeckii*) by 5 mm width classes, 1986-1988. Vertical line indicates lower limit of large size group.

# Hair crab

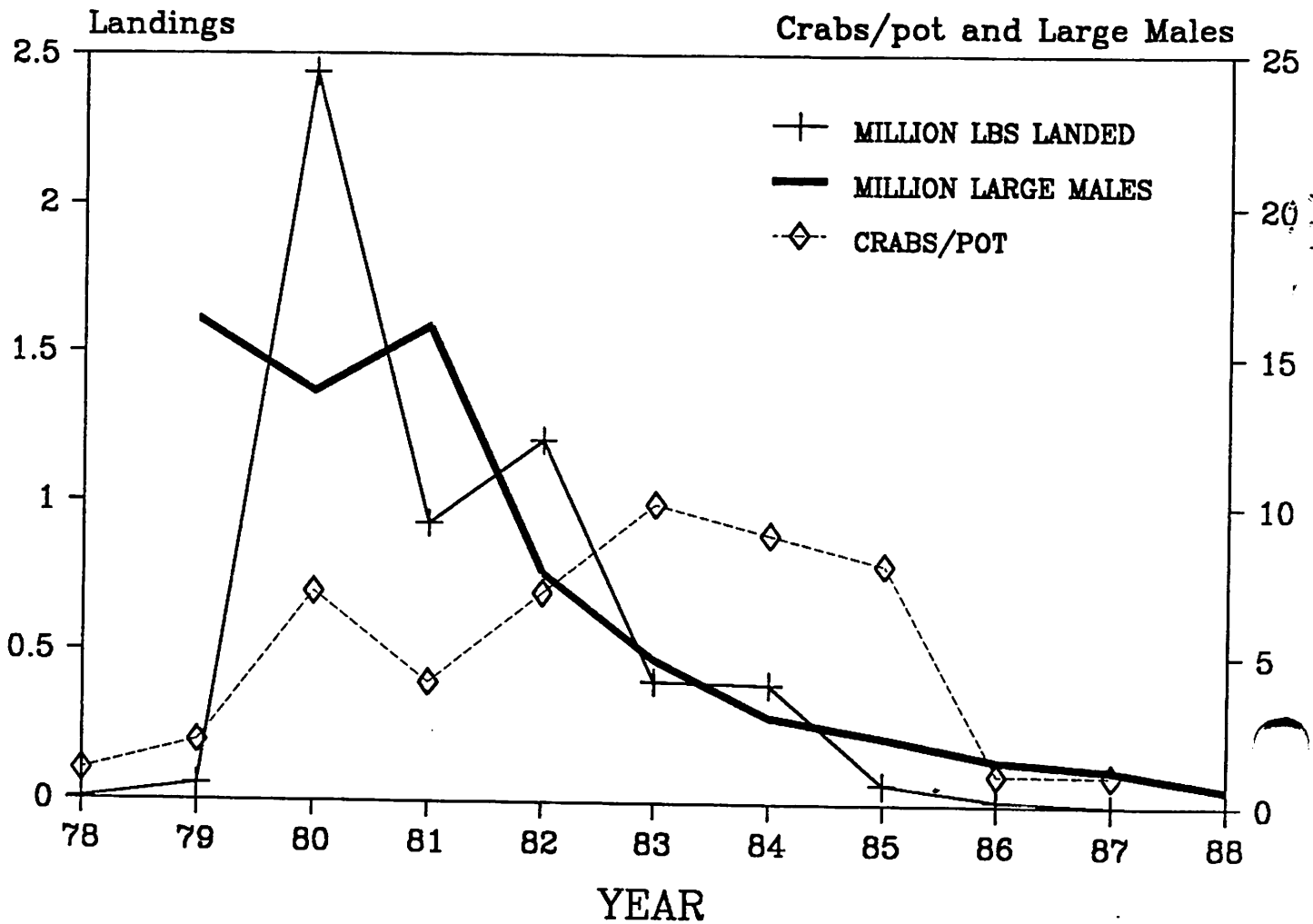


FIGURE 18. U. S. landings in millions of lbs, catch-per-unit-of-effort as crabs/pot, and the abundance of large male hair crab (*E. isenbeckii*) in millions, estimated from the NMFS trawl surveys. Large crabs defined as  $\geq 90$  mm carapace length.