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A SUMMARY OF BIOLOGICAL DATA COLLECTED DURING THE 1992 BRISTOL BAY RED KING CRAB TEST FISHERY CHARTER

By

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INTRODUCTION

In 1990 the Alaska Department of Fish and Game (ADF&G) initiated passive integrated transponder (PIT) tagging studies of red king crabs *Paralithodes camtschaticus* in Bristol Bay (Watson et al. 1991). A second ADF&G tagging study was conducted in the summer of 1991 for the primary purpose of externally tagging mature male red king crabs using polyvinyl isthmus tags (see Gray 1965). The overall purpose of ADF&G tagging studies conducted on Bristol Bay red king crabs has been extensively explained (Watson et al. 1991; Pengilly and Watson 1992). The main objective of the 1992 test fishery charter was cost recovery fishing however, several other projects were carried out during fishing. Biological data were collected on all commercially important crab species in sampled catches. Additionally, crabs were collected for aquarium studies, shellfish observer training and paralytic shellfish poison (PSP) testing. Other tasks included morphometric measurements of select king crab body parts and photographic/video documentation of fishing activities and crab species of interest. The purpose of this report is to document the catch composition of crabs and other related data from the cost recovery charter.

METHODS AND PROCEDURES

For purposes of this report, terms related to the classification of sampled red king crabs are as follows:

Carapace Length (CL)-the straight line distance across the carapace from the posterior margin of the right eye orbit to the medial-posterior margin of the carapace.
Legal Size-male crabs $\geq$ 165 mm (6.5 in) in width including lateral spines.
Pre-Recruit Males-male crabs between 132-164 mm (5.2-6.4in) in width.
Mature Males-male crabs $\geq$ 120 mm CL.
Immature Males-male crabs < 120 mm CL.
New-Shell Males-individuals that molted during the last molting season.
Old-Shell Males-individuals that failed to molt during the last molting season.

Tanner *Chionoecetes bairdi* and snow *Chionoecetes opilio* crabs were classified as follows:

Carapace Width (CW)-the straight line distance across the carapace at a right angle to a line midway between the eyes to the medial-posterior margin of the carapace.
Legal Size-male Tanner crabs $\geq$ 138 mm in width, not including lateral spines.
New-Shell Males-individuals that molted during the last molting season.
Old-Shell Males-individuals that failed to molt during the last molting season.

Fishing Itinerary

Fishing took place in a 16 d period from October 8-23 aboard the 39-m (128-ft) chartered crabber, FV *Kristen Gail* just prior to the 1992 Bristol Bay red king crab fishery. Biological data collection and collection of crabs was conducted concomitant with cost recovery fishing.

Fishing Area

The fishing area was chosen by the captain from review of the station summaries of the last two ADF&G tagging charters (Watson et al. 1991; Byersdorfer and Watson 1992) and the 1991 and 1992 National Marine Fisheries Service (NMFS) eastern Bering Sea crab surveys (Stevens et al. 1991, 1992). From this information an initial fishing area was chosen and prospect pots deployed. If few crabs were found, additional prospect gear was deployed; if significant numbers of crabs were found, pots were concentrated in that area. The general fishing area was similar to the area fished during the 1990 and 1991 charters; between 56° and 57° N latitude and 162° and 165° W longitude (Figure 1). In 1990 and 1991, large concentrations of legal red king crabs were found in this area.

Sampling Design

Five randomly selected pots were chosen each day to sample for catch composition. Once the number of pots to be pulled that day was known, the pot numbers were chosen by using a table of random digits. Fishing was done using 2.1-m x 2.1-m (7.0-ft x 7.0-ft) commercial side-loading king crab pots with 12.7-cm (5.0-in) stretch mesh. The pots were set out in strings of varying length with varying distances between the pots depending on whether the string was a prospect or fishing string. Prospect pots were set approximately 3.2 km (2.0 nm) apart, with the exact distance dependent upon the amount of ground to cover and the time frame in which to do it. The purpose of prospect pots was to cover large areas in an attempt to locate commercial concentrations of red king crab. In contrast, fishing strings were put out in areas after concentrations of crabs were located. Fishing strings contained 6-8 pots per 1.6 km (1.0 nm) fished. The itinerary for setting and picking pots was at the discretion of the captain, with the primary objective of catching approximately 11,600 red king crabs for cost recovery. Pots were baited with 1.9 L (2.0 qt) of frozen herring and when available, Pacific cod *Gadus macrocephalus* was used as hanging bait.

Catch Sampling

The contents of each sampled pot were unloaded to a sorting table where all crabs were separated by species and then transferred to another table for measuring. Each sampled crab was measured to the nearest millimeter (carapace length or CL for red king crab; carapace width or CW for

Tanner and snow crabs). An additional, commercial measure of carapace width was made for male red king crabs to classify them as either legal or sublegal.
Shell age of king, Tanner and snow crabs was also assessed.

All red king and snow crabs were measured from each sampled pot. However, Tanner crabs were sometimes subsampled; a minimum of 5 crabs of each sex were measured for carapace width. A sampling fraction was obtained by dividing the total crabs in the pot by the crabs sampled, thus it was always greater than or equal to one. The sampling fraction was determined for each sampled group and recorded with each crab. Expansions of data using the sampling fraction were done for each crab. Thus, for a pot with 20 crabs, five of which were sampled, the fraction was 4.0 and each crab counted for four crabs in summaries (eg. size, shell age).

Additionally, all sampled crabs were carefully examined for any handling-induced injury or mortality. This examination consisted of a thorough inspection of the dorsal and ventral aspects of the carapace and inspection of each leg. A NMFS biologist who was aboard the boat conducting a survival experiment for crabs discarded from commercial pots did the examination. An injury was defined as any break, crack, or hole in the carapace or legs caused by the pot, handling, or other crabs (Richard MacIntosh, National Marine Fisheries Service, Kodiak, personal communication). Red king crabs were grossly examined for the microsporidian infestation commonly known as cottage cheese disease and the parasitic barnacle *Briarosaccus callosum.* Tanner crabs were grossly examined for black mat and bitter crab syndromes.

All sampled females were examined for the presence of eggs, empty egg cases, and egg stalks for determination of maturity.

Ancillary Data Collections

A collection of 210 live male and 210 live female red king crabs was obtained for passive integrated transponder (PIT) tag studies to be conducted by ADF&G at the Seward Marine Center (Watson and Pengilly 1993). The collection consisted of approximately 70 crabs of each sex in each of three size classes; 120-124, 125-129, and 130-134 mm CL. These crabs were collected during the last few days of the charter and were placed in a separate live tank so they could be easily removed upon landing in Dutch Harbor and packed for shipment to Seward. Attendant to the crab collection for the PIT tag study, proximal leg segment measurements were taken on male and female red king crabs to determine whether or not females and males of equal carapace length had similar sized proximal leg segments. Results from these studies will be reported at a later date.

Crabs were collected opportunistically throughout the charter for the fall shellfish observer practicum scheduled to take place aboard the vessel following the completion of the test fishery charter. In particular, crabs of commercial value were retained for this test.

At the request of the Department of Environmental Conservation (DEC) three red king crabs and three Tanner crabs were collected and frozen whole from each statistical area fished. These specimens were turned over to DEC upon completion of the charter for subsequent analysis to determine the baseline level of paralytic shellfish poison (PSP) present in the viscera of commercially-important Bering Sea crabs.

RESULTS AND DISCUSSION

A total of 38 strings of gear were fished with 5-36 pots in a string. A total of 646 pots were set and pulled over a 16 d period; 50 pots were sampled. The number of pots pulled each day varied from 10-85 but the number of pots sampled per day was five. Soak time averaged 41 h per pot and ranged from 6.8 h to 74.0 h. A total of 11,420 pre-recruit and legal male red king crabs were captured in the 646-pot fishing effort.

Catch Composition

A total of 2,002 crabs were captured in the 50-pot sample. Red king crabs predominated sample catches (56.4%), followed by Tanner crabs (39.6%), snow crabs (3.2%), and Tanner hybrids (0.8%). No Korean hair *Erimacrus isenbeckii* crabs were found in the sampled pots. In contrast, during the 1991 survey red king crabs predominated the catches by a greater percentage (80.4%) with Tanner crabs contributing a smaller percentage (16.7%). However, 1991 catches of snow crabs (2.6%) and Tanner hybrids (0.4%) were similar to 1992 catches. Since the 1992 charter was not a systematic crab survey but a test fishery charter these data are not directly comparable to results from previous surveys. However, it is worth noting that there is an apparent decline in red king crab catches within the area shown in Figure 1. For the remainder of this report only results related to red king crab and Tanner crab will be reported.

Red King Crab

All data reported on red king crabs represents the real numbers of crabs caught or examined in the 50-pot sample.

Sex Composition and Catch Per Unit Effort

A total of 977 red king crabs were caught in the 50 sampled pots; 99.6% were males and 0.4% were females. Catch per pot (C/P) of legal male red king crabs ranged from 0 to 46 crabs, with an average of 12.3 crabs (Appendix A). Overall catch-per-pot of legal male red king crabs declined from 1991 to 1992 in both test fishery and commercial fishery pots. For example, the average C/P of legal male red king crabs in the 1991 survey was 16.7 crabs (versus 12.3 crabs per pot in 1992)(Byersdorfer and Watson 1992). Similarly, the average catch-per-pot of legal

male red king crabs from the past two commercial fisheries indicates a decline, from 12 crabs per pot in 1991 to 6 crabs per pot in 1992 (ADF&G 1993). Male and female red king crab catch per pot is summarized in Appendix A.

Length Distribution and Shell Age

Length frequency distributions for male and female red king crabs are shown in Figure 2. Male red king crab size modes were noted around 115, 130, and 150 mm CL. The average size of legal male crabs in the sampled pots was 151 mm, similar to the average size in the 1991 survey (150 mm) (Byersdorfer and Watson 1992) and the 1992 Bristol Bay red king crab fishery (153 mm) (ADF&G 1993). Of the 781 mature males ($\geq$ 120 mm CL) 79% were of legal size.

Among all males, 82.7% were new-shell and 17.3% were old-shell crabs (Figure 3). However, of the 617 legal-size males caught, 22% were old-shell crabs. This is similar to the percentage of old-shell crabs (22.3%) caught in the 1992 Bristol Bay red king crab fishery (ADF&G 1993).

Incidence of Handling-Induced Injury and Disease

The overall rate of handling-induced injury was quite high relative to the previous year: 11.4% had injuries to the body, 4.1% had leg injuries and 0.6% had both body and leg injuries (Table 1). The rate of handling-induced injury is greater than the 1991 rate where 2.0% were assessed as having body or leg injuries (Byersdorfer and Watson 1992). We believe this difference to be a result of the more rigorous examination afforded the crabs on the 1992 charter. No red king crabs examined were infected with cottage cheese disease or parasitic barnacles.

Cost Recovery

Approximately 11,213 male red king crabs $\geq$ 152 mm (6 in) CW were sold to offset the cost of the 1992 Bristol Bay test fishery program. An additional 473 male red king crabs were landed as dead loss. The average weight per crab as calculated from the fish ticket was 2.8 kg (6.3 lb), slightly less than the average weight of 2.9 kg (6.4 lb) from the 1991 test fishery charter (Byersdorfer and Watson 1992).

Tanner Crab

A total of 959 Tanner crabs were caught in the 50-pot sample; however, only 686 crabs were sampled. Tanner crab data presented hereafter has been expanded to reflect the 959 crabs caught in the 50-pot sample.

Sex Composition And Catch Per Unit Effort

Of the 959 Tanner crabs caught, 86% were males. The catch of legal male Tanner crabs in the sampled pots ranged from 1 to 56 crabs, with an average of 6.1 crabs. Male and female Tanner crab catch by pot is summarized in Appendix B.

Width Distribution And Shell Age

Width frequency distributions for male and female Tanner crabs are shown in Figure 4. Prominent size modes for males were noted around 105, 135, 145 and 160 mm CW. Size modes for females were noted around 75 and 100 mm CW. Among all males, 83.2% were new-shell and 16.8% were old-shell (Figure 5). Of the 307 legal males caught, 97% were new-shell crabs. Because the vessel targeted on locating and catching recruit and legal male red king crabs, the sex and size composition data presented here for Tanner crabs should not be considered representative of the Bering Sea population.

Incidence Of Handling-Induced Injury And Disease

As with red king crabs, the overall rate of injury was high: 4.8% had body injuries, 16.8% had leg injuries and 1.9% had both body and leg injuries (Table 1). The rate of handling-induced injury is greater than the 1991 rate where 3.0% were assessed as having body or leg injuries (Byersdorfer and Watson 1992). Again, we believe this difference to be a result of the more rigorous examination afforded the crabs on the 1992 charter. No Tanner crabs examined were infected with black mat or bitter crab syndromes.

Ancillary Data Collections

Male and female red king crabs, Tanner, snow and hybrid Tanner crabs and Korean hair crabs were retained throughout the charter for the observer test. Observer candidates identified, measured, counted and examined all retained crabs during offloading on October 24, 1993.

A total of 9 Tanner crabs and 11 red king crabs were collected for analysis by DEC for the presence of PSP. Tanner and king crabs from the northeastern part of the survey area (statistical area 635700) had trace amounts of PSP in their viscera while specimens from the southwestern areas had no PSP (Mike Ostasz, Department of Environmental Conservation, Dutch Harbor, personal communication).

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Table 1. Incidence of disease and handling-induced injury for red king and Tanner crabs caught during the 1992 Bristol Bay test fishery.

Injury[a] and Disease[b] Category	Red King Crab				Tanner Crab			
			Total				Total	
	Male	Female	No.	%	Male	Female	No.	%
Body injury	108	1	109	11.2	40	6	46	4.8
Leg injury	39	1	40	4.1	153	8	161	16.8
Both body & leg injuries	6	0	6	0.6	18	0	18	1.9
No apparent injury or disease	820	2	822	84.1	610	124	734	76.5
Total	973	4	977	100.0	821	138	959	100.0

[a] Injury is any damage by pot, handling or other crabs (hole, smash, break or tear).

[b] Disease is any externally observed macroscopic malady (black mat and bitter crab syndromes, "cottage cheese" disease).

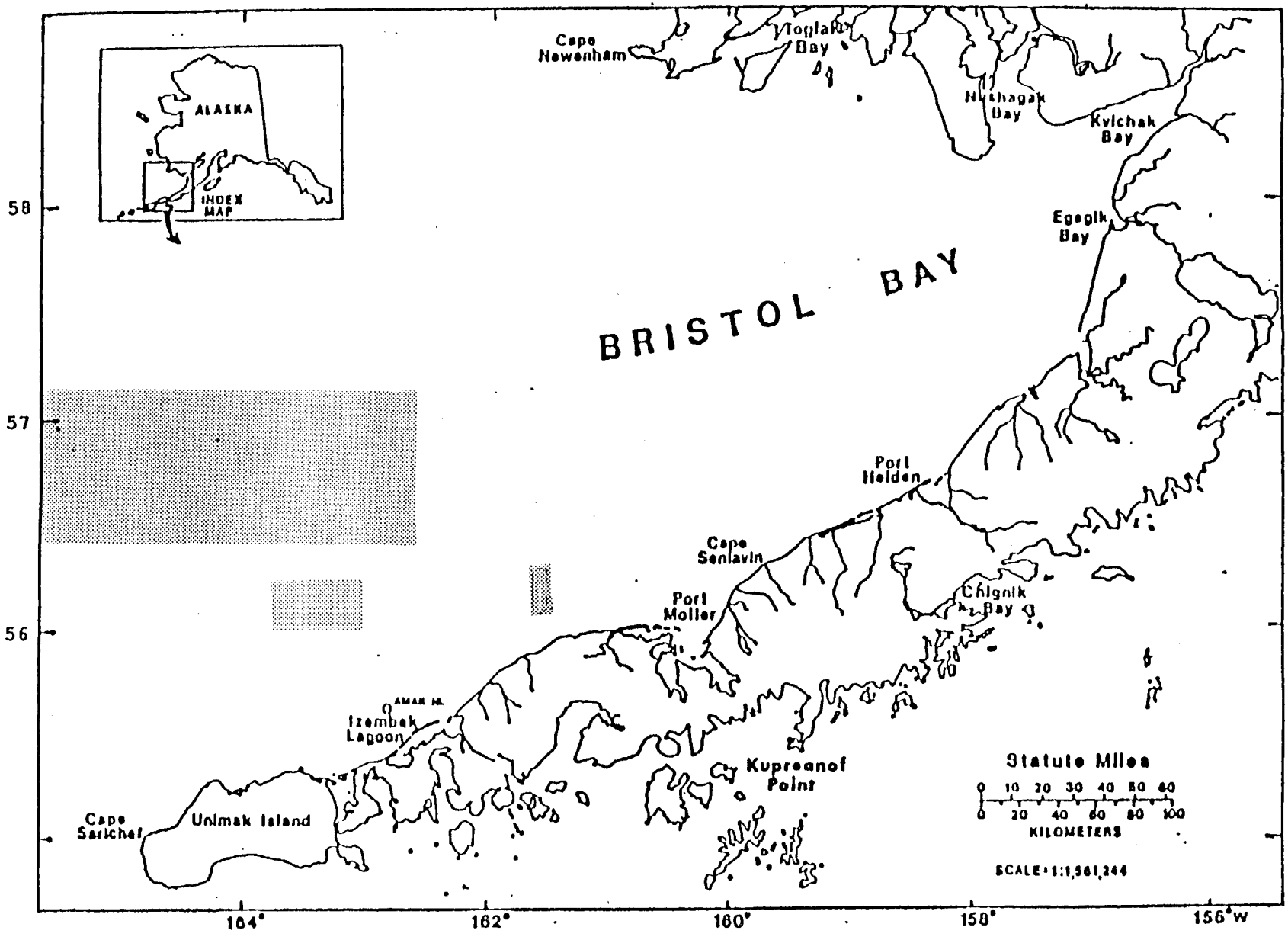

Figure 1. Location of the 1992 Bristol Bay test fishery (all shaded areas).

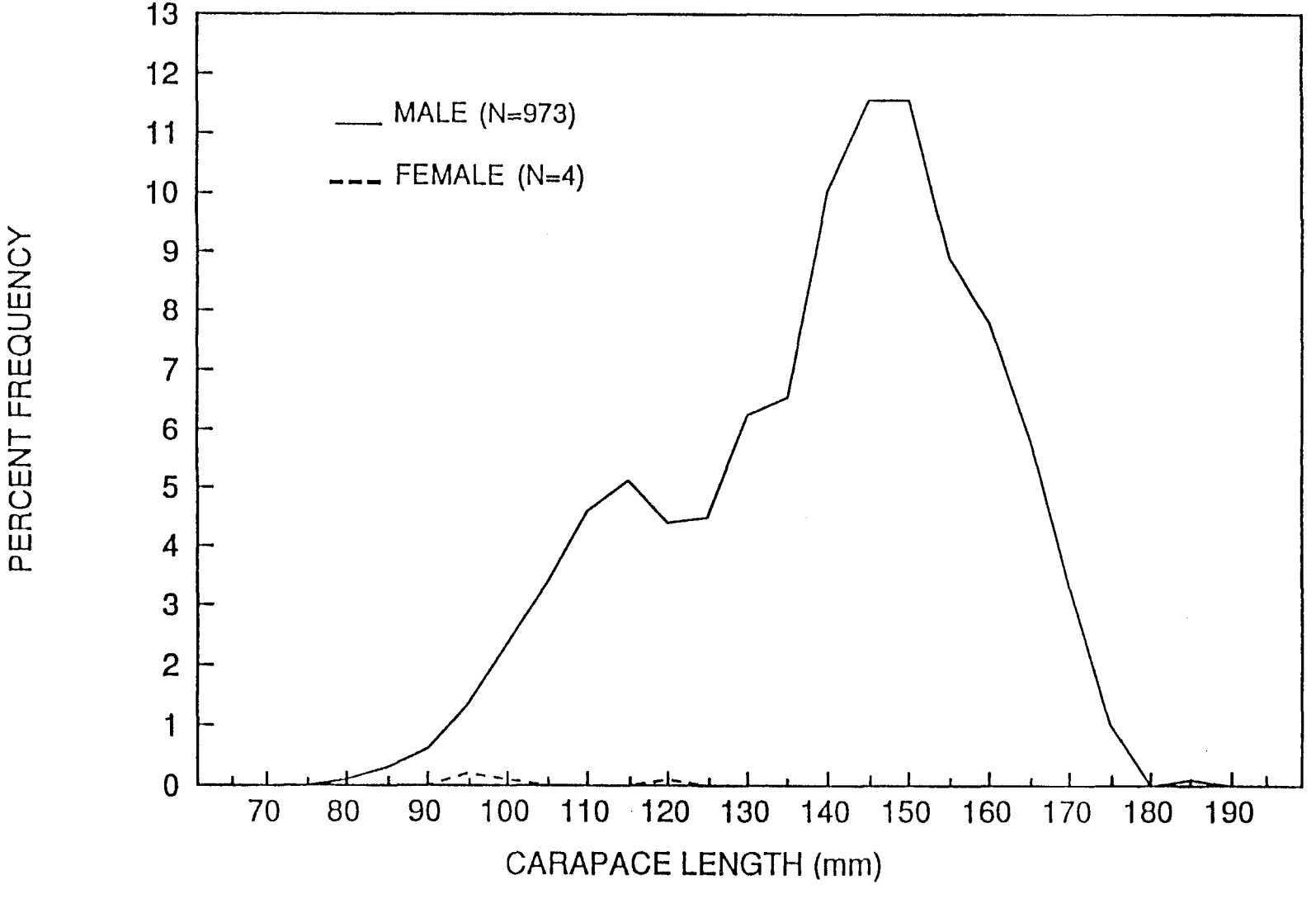

Figure 2. Length frequency of male and female red king crabs caught during the 1992 Bristol Bay test fishery, by 5-mm length classes.

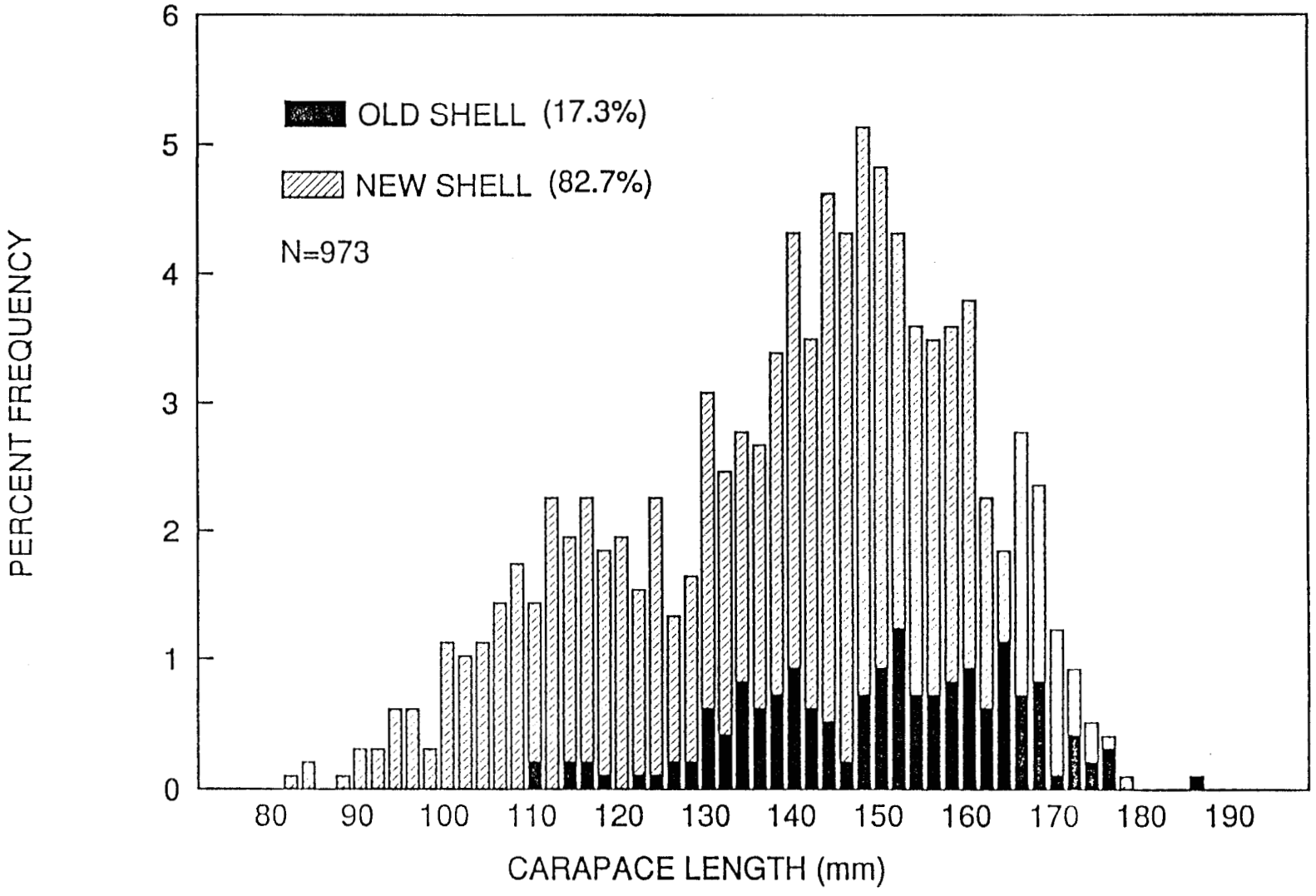

Figure 3. Shell age of male red king crabs caught during the 1992 Bristol Bay test fishery, by 2-mm length classes.

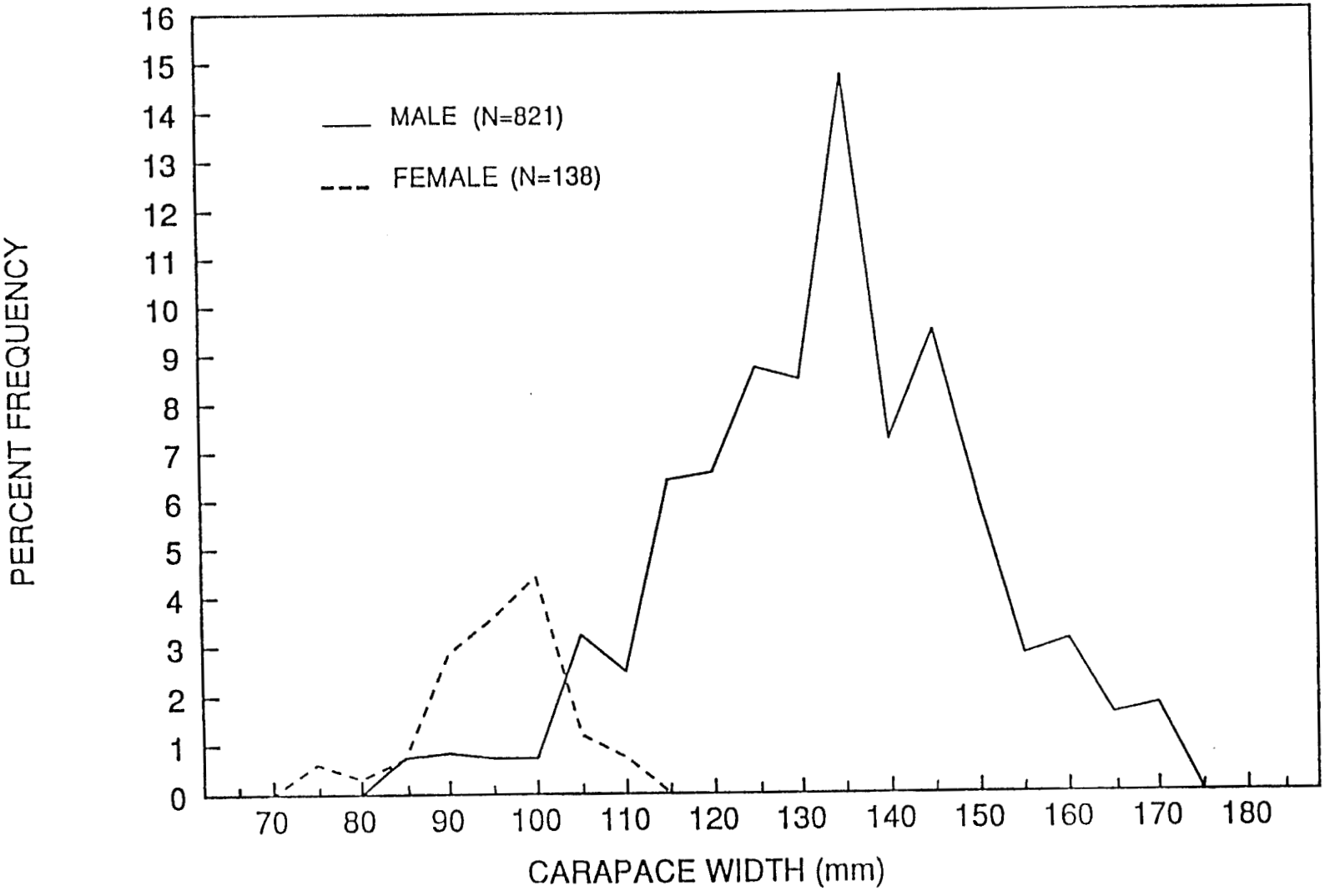

Figure 4. Width frequency of male and female Tanner crabs caught during the 1992 Bristol Bay test fishery, by 5-mm width classes.

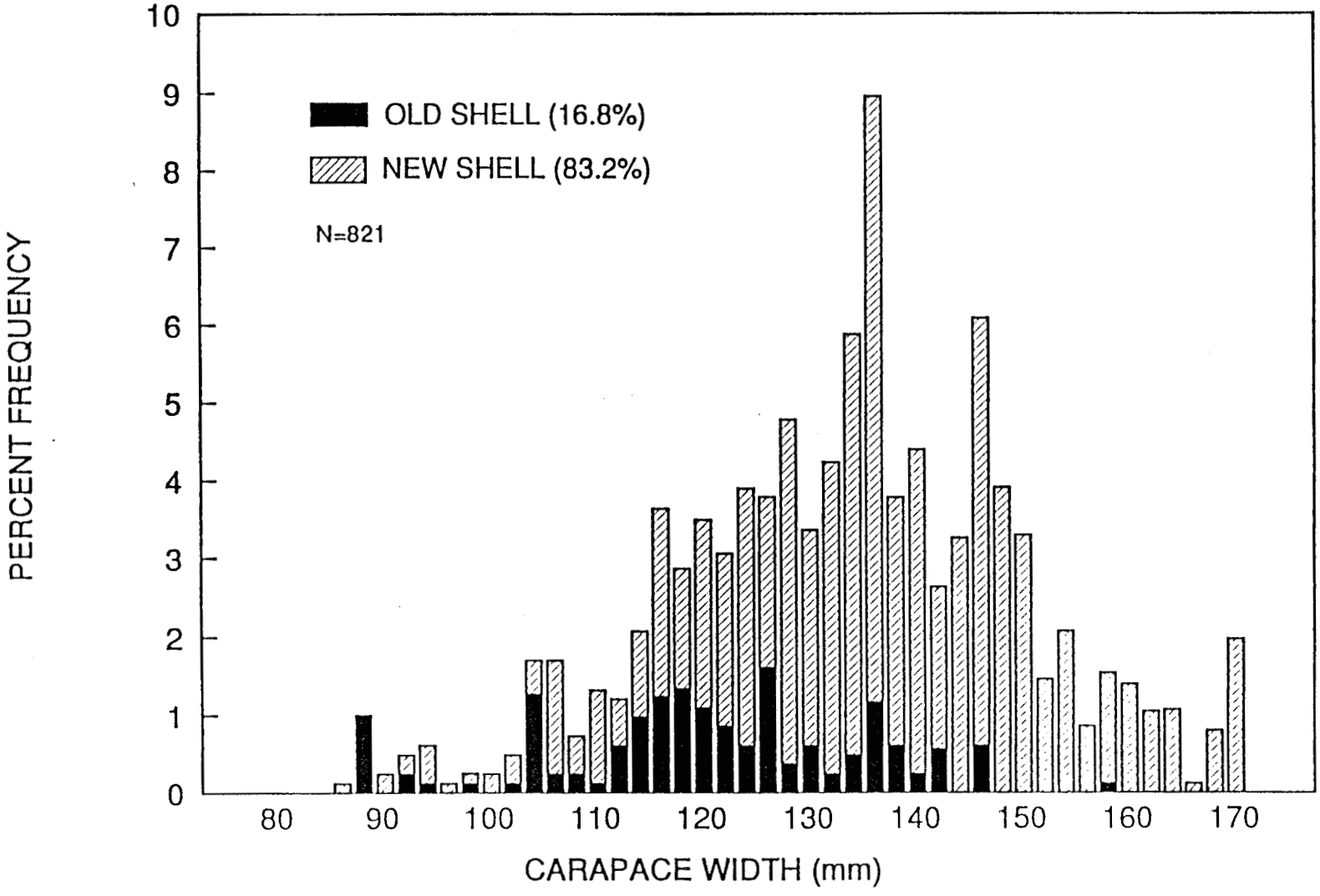

Figure 5. Shell age of male Tanner crabs caught during the 1992 Bristol Bay test fishery, by 2-mm width classes.

APPENDIX

Appendix A. Summary of red king crab fishing and catch data in sampled pots in the 1992 Bristol Bay test fishery.

Pot #	Date	North Latitude	West Longitude	Depth (m)	Females	Catch Per Pot (CPUE) Males Sublegal <120mm	Sublegal ≥120mm	Legal No.
1	10/10	56 36.90	164 45.18	75	0	0	0	0
20	10/10	56 43.40	164 14.25	73	0	0	0	0
21	10/10	56 41.90	164 16.95	73	0	0	0	0
23	10/10	56 38.84	164 21.84	75	0	0	0	4
17	10/10	56 48.08	164 7.09	73	0	0	0	5
107	10/11	56 4.40	163 24.13	64	0	0	1	9
75	10/11	56 35.56	163 18.48	75	0	19	8	12
58	10/11	56 40.70	163 27.28	71	0	4	2	11
37	10/11	56 52.72	164 41.04	70	0	1	1	6
39	10/11	56 56.31	164 36.74	70	0	1	4	19
118	10/12	56 27.55	163 11.60	82	0	1	0	2
113	10/12	56 32.58	163 28.73	79	1	0	4	7
132	10/12	56 38.29	163 5.51	75	1	3	3	12
89	10/12	56 40.95	163 18.14	75	0	12	3	7
97	10/12	56 43.50	163 22.62	73	0	13	9	16
9064	10/13	56 39.04	163 23.95	75	0	4	4	14
9058	10/13	56 40.70	163 27.28	71	0	1	1	6
9054	10/13	56 41.90	163 29.86	71	0	0	3	6
9053	10/13	56 42.25	163 30.59	71	0	1	2	11
159	10/13	56 57.79	163 24.11	66	0	3	7	33
9094	10/14	56 42.50	163 20.95	73	0	4	3	17
178	10/14	56 46.27	163 29.09	71	0	1	0	3
182	10/14	56 47.20	163 29.04	71	0	1	2	5
206	10/14	56 56.91	163 5.38	64	0	1	0	9
211	10/14	56 58.33	163 44.59	62	0	4	4	4
9189	10/15	56 49.00	163 28.95	70	0	1	0	5
9194	10/15	56 50.34	163 29.03	70	0	1	1	1
9198	10/15	56 51.49	163 29.02	70	0	0	0	5
9158	10/15	56 57.68	163 24.67	66	0	1	0	12
222	10/15	56 59.02	163 26.37	66	0	0	1	7
228	10/15	56 59.56	163 29.62	66	0	0	0	14
8079	10/16	56 37.29	163 11.22	77	0	2	4	9
7069	10/16	56 37.61	163 21.25	75	0	0	0	3
8088	10/16	56 40.63	163 17.55	73	0	25	4	11
8160	10/16	56 57.86	163 23.73	66	0	0	1	4
245	10/17	56 50.88	162 57.59	66	0	8	7	39
296	10/17	56 51.27	162 45.15	66	0	7	3	23
255	10/17	56 52.33	162 55.06	64	0	11	8	46
263	10/17	56 53.40	162 53.15	62	1	3	4	21
274	10/17	56 54.15	162 46.00	62	0	2	9	27
367	10/18	56 43.70	162 46.81	70	0	1	0	11
9241	10/18	56 50.29	162 58.50	66	0	6	7	23
9257	10/18	56 52.59	162 54.56	64	0	2	10	32
361	10/18	56 54.38	162 32.61	66	0	3	7	11
354	10/18	56 54.90	162 42.90	64	1	22	13	24

-Continued-

Appendix A. (page 2 of 2)

Pot #	Date	North Latitude	West Longitude	Depth (m)	Females	Catch Per Pot (CPUE) Males Sublegal <120mm	Sublegal ≥120mm	Legal No.
337	10/18	56 57.13	162 48.06	60	0	2	2	7
9273	10/19	56 54.15	162 46.31	62	0	4	7	21
9291	10/19	56 50.41	162 46.83	64	0	8	10	24
9299	10/19	56 51.74	162 43.97	66	0	0	1	3
9266	10/19	56 53.91	162 52.40	62	0	9	4	16
Total					4	192	164	617

Appendix B. Summary of Tanner crab fishing and catch data in sampled pots in the 1992 Bristol Bay test fishery.

Pot #	Date	North Latitude	West Longitude	Depth (m)	Females	Catch Per Pot (CPUE) Males Sublegal <138mm	Catch Per Pot (CPUE) Males Legal ≥138mm
1	10/10	56 36.90	164 45.18	75	0	4	2
20	10/10	56 43.40	164 14.25	73	3	19	2
21	10/10	56 41.90	164 16.95	73	28	33	5
23	10/10	56 38.84	164 21.84	75	1	4	4
17	10/10	56 48.08	164 7.09	73	1	12	1
107	10/11	56 4.40	163 24.13	64	0	10	4
75	10/11	56 35.56	163 18.48	75	0	29	7
58	10/11	56 40.70	163 27.28	71	0	4	4
37	10/11	56 52.72	164 41.04	70	0	12	5
39	10/11	56 56.31	164 36.74	70	2	7	3
118	10/12	56 27.55	163 11.60	82	7	5	4
113	10/12	56 32.58	163 28.73	79	16	4	7
132	10/12	56 38.29	163 5.51	75	0	14	10
89	10/12	56 40.95	163 18.14	75	0	2	8
97	10/12	56 43.50	163 22.62	73	0	3	3
9064	10/13	56 39.04	163 23.95	75	0	7	11
9058	10/13	56 40.70	163 27.28	71	0	10	9
9054	10/13	56 41.90	163 29.86	71	1	3	6
9053	10/13	56 42.25	163 30.59	71	0	7	8
159	10/13	56 57.79	163 24.11	66	0	9	14
9094	10/14	56 42.50	163 20.95	73	2	9	4
178	10/14	56 46.27	163 29.09	71	5	20	5
182	10/14	56 47.20	163 29.04	71	1	9	3
206	10/14	56 56.91	163 5.38	64	0	4	0
211	10/14	56 58.33	163 44.59	62	1	7	1
9189	10/15	56 49.00	163 28.95	70	0	2	2
9194	10/15	56 50.34	163 29.03	70	2	8	8
9198	10/15	56 51.49	163 29.02	70	0	7	1
9158	10/15	56 57.68	163 24.67	66	3	28	8
222	10/15	56 59.02	163 26.37	66	3	26	5
228	10/15	56 59.56	163 29.62	66	2	12	4
8079	10/16	56 37.29	163 11.22	77	28	14	56
7069	10/16	56 37.61	163 21.25	75	1	11	6
8088	10/16	56 40.63	163 17.55	75	1	4	1
8160	10/16	56 57.86	163 23.73	66	2	24	6
245	10/17	56 50.88	162 57.59	66	0	8	5
296	10/17	56 51.27	162 45.15	66	0	5	18
255	10/17	56 52.33	162 55.06	64	0	7	4
263	10/17	56 53.40	162 53.15	62	0	5	2
274	10/17	56 54.15	162 46.00	62	1	8	0
367	10/18	56 43.70	162 46.81	70	2	4	9
9241	10/18	56 50.29	162 58.50	66	2	15	8
9257	10/18	56 52.59	162 54.56	64	0	6	2
361	10/18	56 54.38	162 32.61	66	1	12	6

-Continued-

Appendix B. (page 2 of 2)

Pot #	Date	North Latitude	West Longitude	Depth (m)	Females	Catch Per Pot (CPUE) Males Sublegal <138mm	Catch Per Pot (CPUE) Males Legal ≥138mm
354	10/18	56 54.90	162 42.90	64	12	19	12
337	10/18	56 57.13	162 48.06	60	6	13	3
9273	10/19	56 54.15	162 46.31	62	3	4	1
9291	10/19	56 50.41	162 46.83	64	1	10	2
9299	10/19	56 51.74	162 43.97	66	0	8	6
9266	10/19	56 53.91	162 52.40	62	0	8	1
TOTALS					138	514	307