

A Summary of Biological Data Collected During the 1998 Bristol Bay
Red King Crab Test Fishery

By

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INTRODUCTION

In 1990, the Alaska Department of Fish and Game (ADF&G) implemented the Bering Sea Crab Test Fish Project under authority of the State of Alaska's Test Fishery Program. Annual research surveys are a major component of the project, and each year the department stages these activities through the use of chartered fishing vessels. Revenues generated from the sale of crabs caught during the surveys are used to cover ADF&G's operating costs. This unique program has allowed the department to conduct research that otherwise would not be possible.

An initial objective of the test fish project included developing an internal tag application using Passive Integrated Transponder (PIT) tags to implement a large-scale tagging study for assessing Bristol Bay red king crab stocks. However, the test fishery program has also supported other research projects and activities aimed at collecting and analyzing data on critical commercial crab fisheries in the Bering Sea. Project goals, objectives and results from previous test fishery surveys are documented in Byersdorfer and Watson (1992,1993), Watson and Pengilly (1992,1993, 1994a, 1994b), Byersdorfer et al. (1994, 1995), Byersdorfer (1995), Watson et al. (1996), Tracy and Pengilly (1996, 1997), and Moore (1998).

The primary objectives of the 1998 test fishery were to: 1) conduct cost recovery fishing to fund the test fishery program in FY99; 2) test the rates at which sublegal male and female red king crabs are captured in a standardized king crab pot under three different pot soak time scenarios; and 3) collect time lapsed videos of the interaction of legal, sublegal and female red king crabs in a standardized crab pot under each soak time scenario (Tracy et al. 1998).

The purpose of this report is to document and summarize the catch composition of crabs and other related biological data from the test fishery charter.

METHODS AND PROCEDURES

Terms

Terms related to the sampling of red king and Tanner 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; the biological size measurement of red king crab.

Carapace Width (CW)- The greatest 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 not including the spines; the biological size measurement of *C. bairdi* and *C. opilio*.

Legal Size- male red king crabs ≥ 165 mm (6.5 in) in carapace width including lateral spines.

	male Tanner crabs ≥ 140 mm (5.5 in) in carapace width, including lateral spines.
<i>Pre-recruit Males-</i>	male red king crabs between 132-164 mm (5.2-6.4 in) in carapace width.
<i>Mature Males-</i>	male red king crabs ≥ 120 mm CL.
<i>Immature Males-</i>	red king crab males < 120 mm CL.
<i>Soft Shell-</i>	crabs that have molted within the previous two months.
<i>New-Shell-</i>	crabs that have molted within the preceding three to twelve months.
<i>Old-Shell-</i>	crabs that have molted within the preceding thirteen to twenty-four months.
<i>Very old Shell-</i>	crabs that have not molted within the preceding twenty-four months.

Fishing Itinerary

Fishing took place during a 26 d period from August 1 to August 26, 1998 aboard the 36.6-m (110 ft) chartered crabber, FV *Viking Queen*. Due to weather and other extenuating circumstances 21 days were needed to complete cost recovery fishing. With so little time remaining in the 28 d charter the proposed gear study was not done. Instead, the last days of the charter were utilized to acquire additional underwater video footage of red king crab.

Fishing Area

Cost recovery fishing was conducted in a 4,726 km² (1,381 nm²) area encompassing a portion of the red king crab population located in Bristol Bay. The area chosen in 1998 was based on preliminary results from the 1998 National Marine Fisheries Eastern Bering Sea crab survey (R. MacIntosh, National Marine Fisheries Service, Kodiak, personal communication). The general cost recovery and study area was between 56° 21' and 56° 54' N latitude and between 161° 25' and 162° 3' W longitude (Figure 1).

Random Pot Sampling

During cost recovery fishing five to ten randomly selected pots were chosen each day for catch composition sampling. 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. Pots were set in strings that varied in orientation, length and pots per string. Pots were baited with 1.9

L (2.0 qt) of frozen herring, chum salmon, squid and when available, Pacific cod was used as hanging bait.

Catch Sampling

The contents of each randomly sampled pot were unloaded on a sorting table where crabs were divided by species and sex. Each crab was measured to the nearest millimeter (CL for red king crab; CW for Tanner and snow crabs). A commercial measure of carapace width was also determined for male crabs to classify them as either legal or sublegal. Shell age of king, Tanner and snow crabs was also assessed.

All sampled crabs were grossly examined for disease, and handling induced injury or mortality. Females were examined for the presence or absence of eggs, and for the determination of maturity and mating activity. Complete catch sampling instructions are detailed in Tracy and Byersdorfer (1998).

Ancillary Data Collections

At the request of the Department of Environmental Conservation (DEC), red king, Tanner, Tanner hybrids and snow crabs were collected from each ADF&G statistical area fished and frozen whole. These specimens were turned over to DEC upon completion of the cost recovery portion of the charter for subsequent analysis to determine the baseline level of paralytic shellfish poison (PSP) and domoic acid present in the viscera.

Male and female red king crabs and Tanner crabs of various size classes were collected (up to 150 individuals/sex/species) and brought back to Dutch Harbor after cost recovery to determine their live weights.

The autonomous underwater video system was to be deployed during cost recovery fishing and the soak time study. The purpose of cost recovery deployments was to test the operational aspects of the camera in the field and to develop successful deployment techniques. Deployment of the system during directed research fishing was intended to provide visual documentation of red king crab behavior in and around pots under various soak time scenarios.

Instructions for all ancillary data collections are described in Tracy and Byersdorfer (1998).

RESULTS AND DISCUSSION

A total of 35 strings of gear with 7 to 25 pots per string were fished for cost recovery. A total of 801 pots were set and pulled over a 24 d period; of these 39 were randomly sampled. The number of pots pulled each day varied from 52 to 97 and the number of pots randomly sampled per day varied from 0 to 5. Soak time averaged 43 h per pot and ranged from 12 h to 204 h.

A total of 26,284 legal male red king crabs were captured in 749 pots; due to poor weather and the projected attainment of cost recovery fishing goals the contents of the remaining 52 pots were dumped over the side of the boat and the number of legal crabs were not counted.

Cost Recovery

Approximately 21,627 legal sized male red king crabs from two deliveries were sold to Westward Seafoods to offset the cost of the 1998 Bering Sea crab test fishery program. The first delivery on August 13 contained an excessive amount of deadloss of approximately 33,000 pounds. Due to this initial deadloss, a change of fishing strategy was implemented (crabs were not captured during extremely rough weather or held in the tanks for long periods). The second delivery on August 21 contained only 50 pounds of dead loss. The average weight of crabs from the combined deliveries as calculated from fish ticket receipts was 2.67 kg (7.2 lb).

Catch Composition

A total of 4,579 crabs were captured in the 39 random pot samples. Red king crabs predominated sample catches (99.4%), followed by Tanner crabs (0.5%) and snow crabs (0.1%). No Tanner hybrids or Korean hair crabs *Erimacrus isenbeckii* were found in the sampled pots although several non-sampled pots contained a small number of these animals.

Red King Crab

Sex Composition and Catch Per Unit Effort

Of the 4,552 red king crabs caught in sampled pots, 81% were males and 19% were females. Catch per pot (CPP) of legal male red king crabs in the randomly sampled pots ranged from 10 to 76 with an average of 35 crabs (Appendix A). The overall CPP of legal male red king crabs was similar to that of last year's test fishery and double that of the commercial fishery. Table 1 compares the average CPP of legal male red king crabs in test fisheries and commercial fisheries from 1991 to 1998. However, since survey dates, areas fished and pot types used have varied from year to year in the test fishery, the data may not be directly comparable.

The catch per pot of female red king crabs in the 39 randomly sampled pots ranged from 5 to 43 and averaged 20 crabs (Appendix A). Ninety percent of the total females in the random sample pots were mature.

Length Distribution and Shell Age

Length frequency distributions for male and female red king crabs in random pot samples are shown in Figure 2. Male red king crab size modes were noted around 120, and 150 mm CL. The average size of legal male crabs was 155 mm. Of the 2,580 mature males (≥ 120 mm CL) in random pot samples, 53% were legal-sized.

Among all males in random pot samples, 65% were new-shell and 35% were old-shell crabs (Figure 3). However, of the 1,366 legal-size males caught, 78% were old-shell. The large number of old-shell legal crabs far surpassed what was seen during previous years. In fact, in the past 7 years the percentage of old shell legal males has only ranged from 15 to 25 % (Byersdorfer and Watson 1992, 1993); Byersdorfer et al. 1994, 1995; Byersdorfer 1995, 1996; Moore 1998).

Tanner Crab

A total of 21 Tanner crabs *C. bairdi* were captured in the 39 random sample pots. The width distribution of male Tanner crabs in random pot samples is shown in Table 2. Of the 21 Tanner crabs captured, all were males, and 95% were old-shelled (Table 2).

Ancillary Data Collections

A total of 5 Tanner, 5 snow and 3 red king crabs were collected from one statistical area for PSP and domoic acid analysis. Due to decomposition of samples no analysis was done on the Tanner and snow crabs. PSP was not detected and no domoic acid analysis was done on the red king crab samples (M. Ostasz, Alaska Department of Environmental Conservation, Anchorage, personal communication).

The live weights of 96 sublegal male and 98 female red king crabs were taken after offloading cost recovery crabs in Dutch Harbor. Due to time constraints no live weights of legal red king or Tanner crabs were taken.

The autonomous underwater video system was deployed 7 times during cost recovery fishing. The cost recovery deployments successfully served the purpose of testing the operational aspects of the camera in the field and developing an understanding of successful deployment techniques.

LITERATURE CITED

- Byersdorfer, S. 1995. A summary of biological data collected during the 1995 Bristol Bay red king crab test fishery charter. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report 4K95-47, Kodiak.
- Byersdorfer, S. 1996. A summary of biological data collected during the 1996 Bristol Bay red king crab test fishery. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report 4K96-55, Kodiak.
- Byersdorfer, S. and L.J. Watson. 1992. A summary of biological data collected during the 1991 Bristol Bay red king crab tagging study. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Fishery Report 92-14, Juneau.
- Byersdorfer, S. and L.J. Watson. 1993. A summary of biological data collected during the 1992 Bristol Bay red king crab test fishery charter. Alaska Department of Fish and Game, Commercial Fisheries Management and Development, Regional Information Report 4K93-24, Kodiak.
- Byersdorfer, S., L.J. Watson and D. Tracy. 1994. A summary of biological data collected during the 1993 Bristol Bay red king crab tagging study. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report 4K94-32, Kodiak.
- Byersdorfer, S., L.J. Watson and D. Tracy. 1995. A summary of biological data collected during the 1994 Bristol Bay red king crab test fishery charter. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report 4K95-33, Kodiak.
- Moore, H. 1998. Bristol Bay test fish project data summary report, 1997. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report 4K98-6, Kodiak.
- Morrison, R., R.K. Gish, M. Ruccio, and M. Schwenzfeier. 1998. Annual management report for the shellfish fisheries of the Bering Sea. Page 169 *in* Annual management report for the shellfish fisheries of the Westward Region. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report 4K98-39, Kodiak.
- Tracy, D. and S. Byersdorfer. 1998. Shipboard instructions for the 1998 Bristol Bay red king crab test fishery charter. Alaska Department of Fish and Game, Division of Commercial Fisheries, (Region IV unpublished document), Kodiak.
- Tracy, D. and D. Pengilly. 1996. Project operational plan for the 1996 Bristol Bay red king crab test fishery project. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report 4K96-48, Kodiak.

LITERATURE CITED (Cont.)

- Tracy, D. and D. Pengilly. 1997. Project operational plan Bering Sea test fishery program: 1997 Bristol Bay red king crab project. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report 4K97-40, Kodiak.
- Tracy, D., Byersdorfer, S. and D. Pengilly. 1998. Project operational plan for the 1998 Bristol Bay red king crab test fishery charter. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. XXXXX, Kodiak.
- Watson, L.J., and D. Pengilly. 1992. Project operational plan for the 1991 Bristol Bay red king crab test fishery project. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 4K92-31, Kodiak.
- Watson, L.J., and D. Pengilly. 1993. Project operational plan for the 1992 Bristol Bay red king crab test fishery project. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 4K93-5, Kodiak.
- Watson, L.J., and D. Pengilly. 1994a. Project operational plan for the 1993 Bristol Bay red king crab test fishery project. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report No. 4K94-27, Kodiak.
- Watson, L.J., and D. Pengilly. 1994b. Effects of release method on recovery rates of tagged red king crabs *Paralithodes camtschaticus* in the 1993 Bristol Bay commercial fishery. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report No. 4K94-40, Kodiak.
- Watson, L.J., D. Tracy and D. Pengilly. 1996. Project operational plan for the 1995 Bristol Bay red king crab test fishery project. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report No. 4K96-2, Kodiak.

Table 1. Catch per pot (CPP) of legal male red king crabs from the Bristol Bay red king crab test and commercial fisheries, 1991-1998.^a

YEAR	CPP RED KING CRAB COMMERCIAL FISHERY	CPP RED KING CRAB TEST FISHERY
1991	12.0	16.7
1992	6.0	12.3
1993	9.0	30.0
1994	Fishery closed	35.5
1995	Fishery closed	16.6
1996	16.0	16.0
1997	15.0	36.1
1998	15.1 ^b	35.0

^a Data source: Morrison et al. 1998

^b Data source: Preliminary data as of 11/23/98.

Table 2. Width distribution of male Tanner crabs caught in randomly sampled cost recovery pots during the Bristol Bay red king crab test fishery, by shell age.

Carapace Width (mm)	Number of Crabs	
	New Shell	Old Shell
120	1	0
136	0	1
138	0	1
139	0	1
140	0	1
142	0	2
144	0	1
145	0	1
152	0	3
153	0	1
157	0	1
160	0	2
162	0	4
167	0	1
Totals	1	20

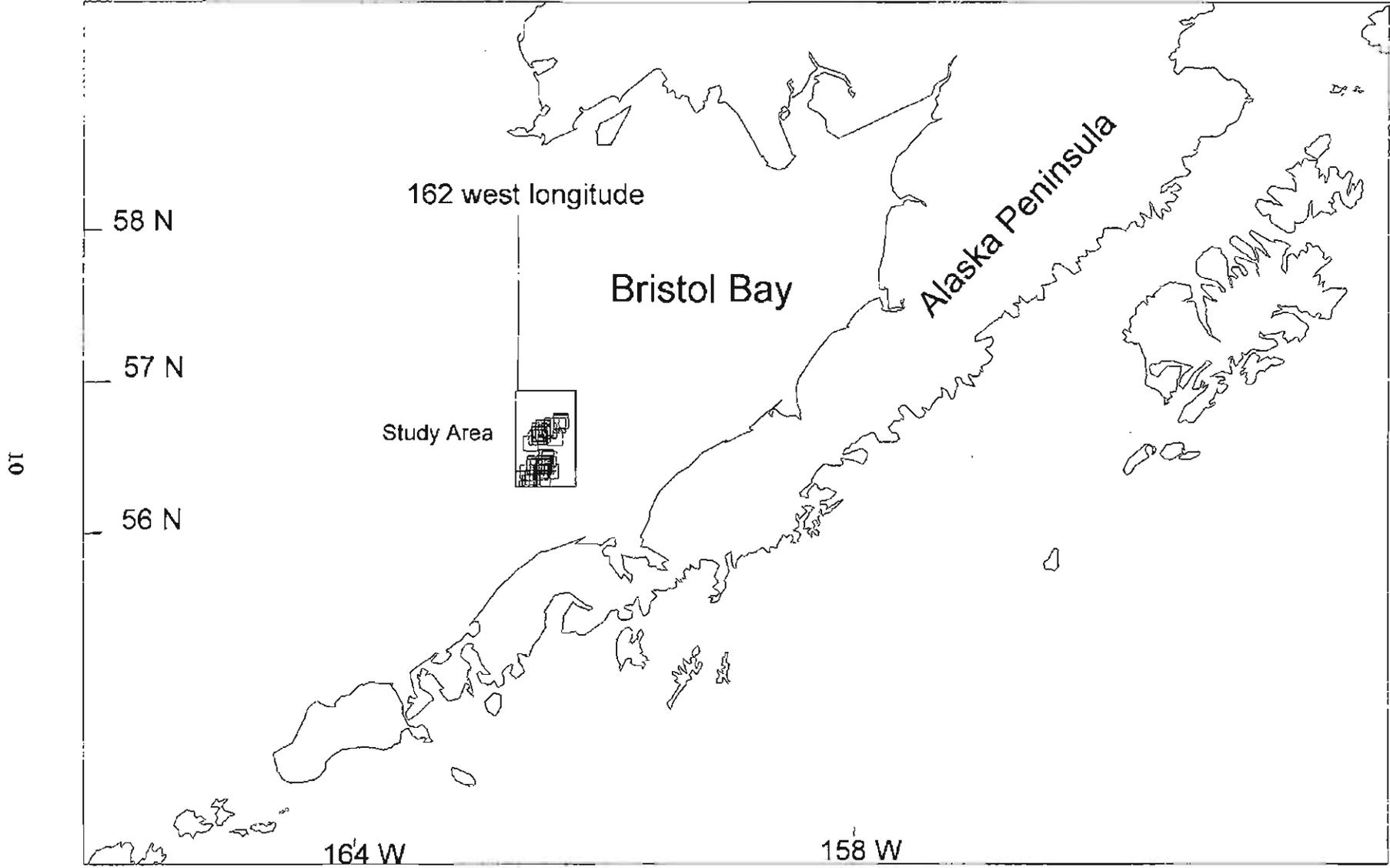


Figure 1. Location of the 1998 Bristol Bay red king crab test fishery pot samples.

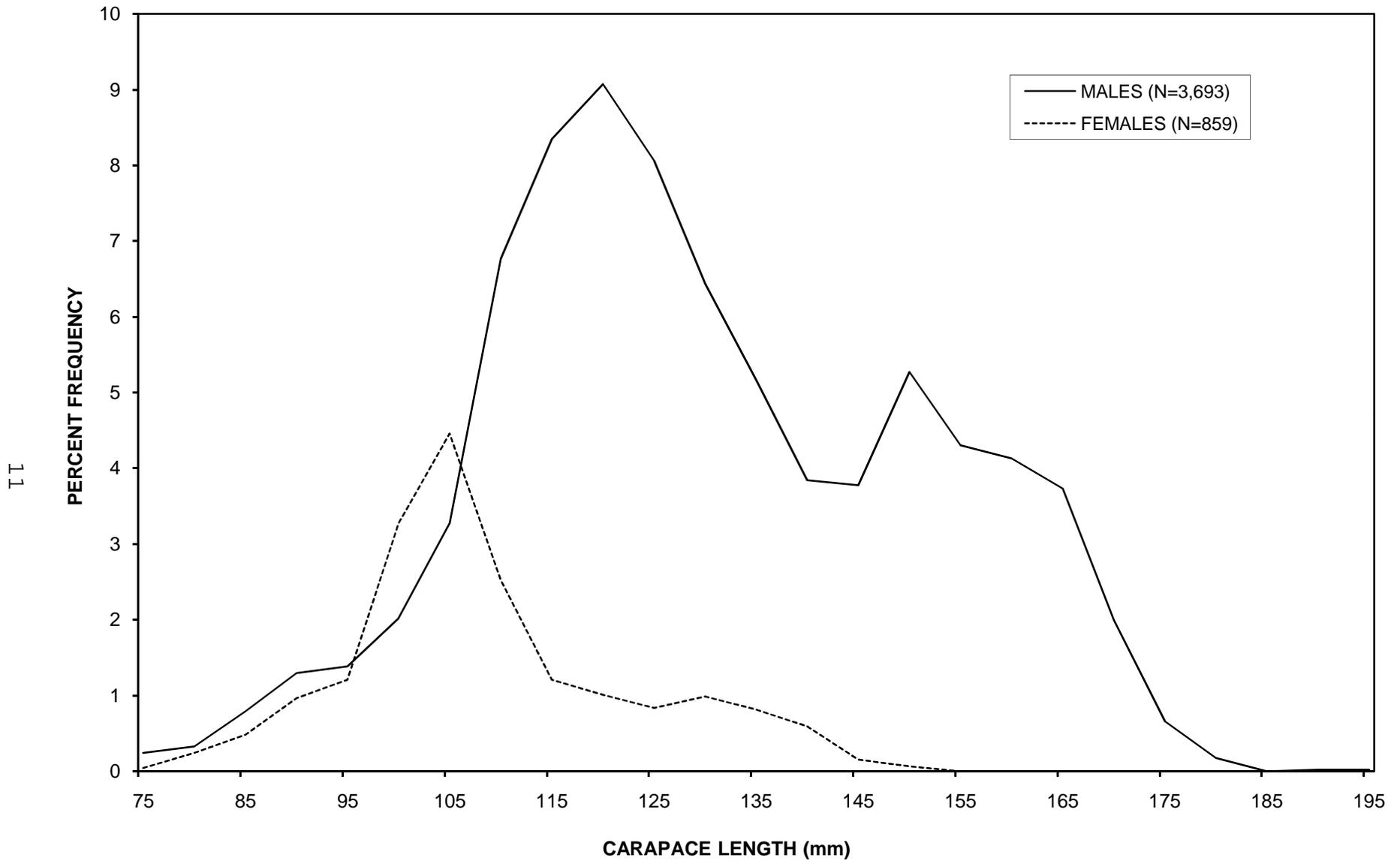


Figure 2. Length frequency of male and female red king crabs caught in randomly sampled cost recovery pots during the 1998 Bristol Bay red king crab test fishery, by 5-mm length classes.

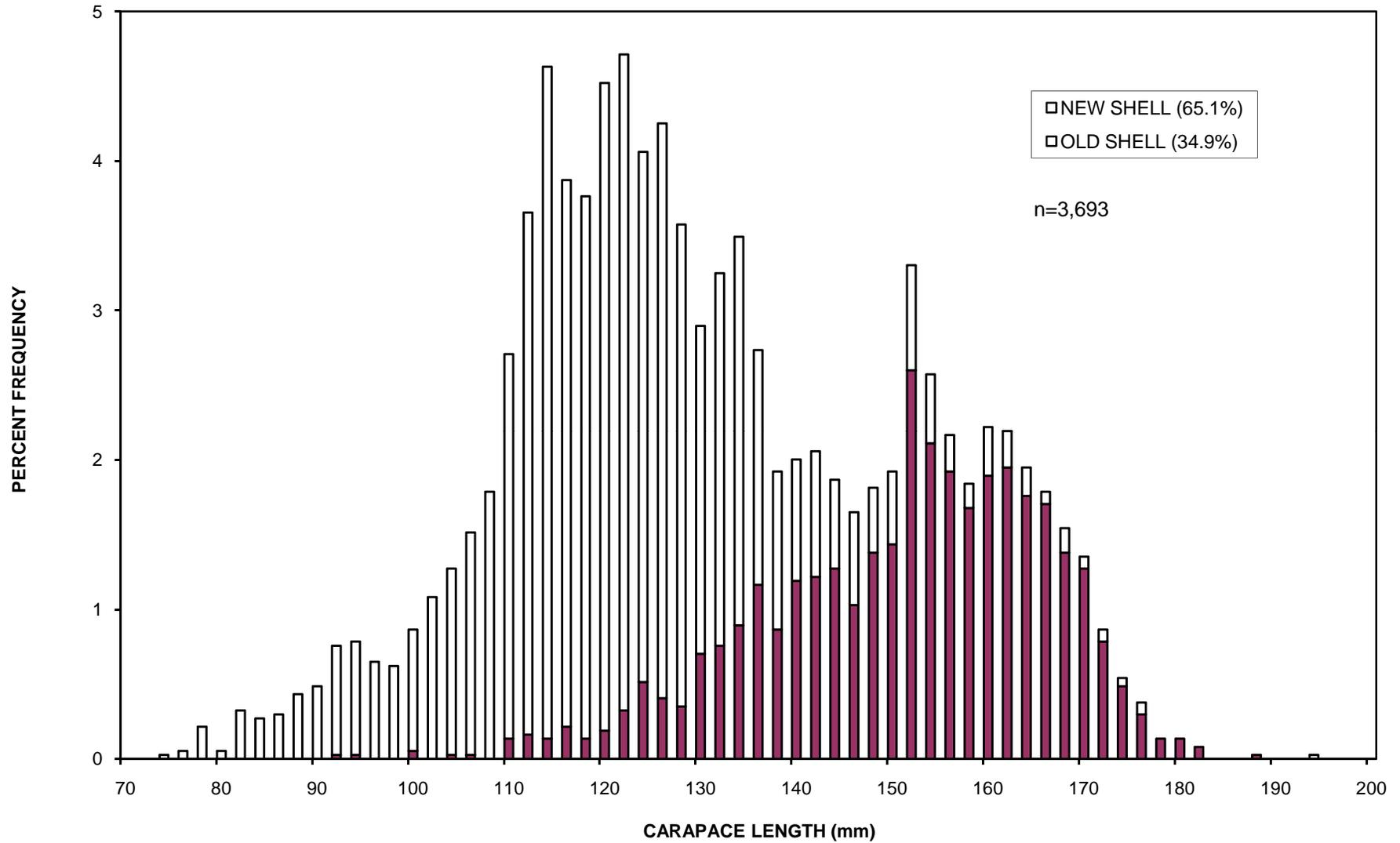


Figure 3. Shell age of male red king crabs caught in randomly sampled cost recovery pots during the 1998 Bristol Bay red king crab test fishery, by 2-mm length classes.

APPENDIX

Appendix A. Summary of red king crab fishing and catch data from 39 random sample pots in the 1998 Bristol Bay red king crab test fishery.

Pot #	Date	North Latitude		West Longitude		Depth (m)	Catch Per Pot (CPUE)				
							Females	Males		Legal No.	
								Sublegal <120mm	Sublegal ≥120mm		
9	8/2/1998	56	23.71	161	45.85	43	51	52	70	22	
26	8/2/1998	56	25.76	161	53.75	46	33	60	55	41	
49	8/2/1998	56	31.42	161	44.49	51	12	20	27	28	
53	8/2/1998	56	32.1	161	43.66	50	14	23	48	43	
58	8/2/1998	56	33.05	161	42.47	49	14	39	40	36	
102	8/2/1998	56	29.1	161	42.99	50	15	11	30	39	
130	8/3/1998	56	34.74	161	48.85	44	18	36	23	16	
156	8/3/1998	56	27.76	161	51.97	45	18	42	36	24	
166	8/3/1998	56	29.72	161	49.99	45	11	20	11	10	
178	8/3/1998	56	33.85	161	41.72	48	12	20	38	29	
189	8/3/1998	56	36.38	161	38.95	47	5	14	36	28	
204	8/3/1998	56	37.02	161	40.92	47	30	17	30	38	
220	8/4/1998	56	44.05	161	47.63	43	17	19	10	34	
233	8/4/1998	56	41.98	161	51.16	40	30	17	21	34	
252	8/4/1998	56	33.57	161	48.76	44	15	34	37	38	
273	8/4/1998	56	33.7	161	46.6	46	23	31	35	42	
326	8/5/1998	56	33.5	161	40.59	50	30	29	52	41	
352	8/5/1998	56	46.14	161	43.62	45	10	19	31	37	
361	8/5/1998	56	47.34	161	41.18	45	38	26	47	76	
362	8/6/1998	56	31.58	161	53.27	44	55	113	65	39	
377	8/6/1998	56	29.11	161	56.81	44	20	49	51	32	
387	8/6/1998	56	35.18	161	42.13	46	9	21	39	41	
390	8/6/1998	56	34.74	161	42.85	47	6	31	44	37	
428	8/6/1998	56	43.85	161	35.04	37	34	20	24	41	
452	8/7/1998	56	34.59	161	39.25	49	15	39	31	36	
467	8/7/1998	56	31.87	161	37.53	42	35	32	29	24	
487	8/7/1998	56	45.38	161	46.33	45	15	20	26	37	
493	8/7/1998	56	44.39	161	45.86	44	24	29	14	31	
503	8/8/1998	56	45.69	161	43.11	46	20	25	33	39	
527	8/8/1998	56	46.75	161	45.33	45	30	23	19	33	
536	8/8/1998	56	47.79	161	42.98	44	46	37	20	39	
563	8/8/1998	56	49.83	161	31.25	41	13	25	19	50	
579	8/8/1998	56	48.55	161	32.91	43	12	19	13	36	
588	8/8/1998	56	49.7	161	30.95	42	17	17	26	38	
592	8/9/1998	56	44.27	161	44.77	41	38	23	10	15	
599	8/9/1998	56	45.1	161	42.79	43	19	21	13	15	
652	8/9/1998	56	46.57	161	38.87	44	8	14	34	71	
663	#####	56	50.41	161	31.4	44	25	11	13	35	
681	#####	56	48.58	161	37.22	45	22	15	14	21	
TOTALS								859	1113	1214	1366

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