

Abundance and Size-Class Structure of Dungeness Crabs In or Near Frequently-Dredged Areas in the Columbia River Estuary

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INTRODUCTION

In October 1985, the National Marine Fisheries Service (NMFS) completed a 2-year study of Dungeness crabs, Cancer magister, in the Columbia River estuary (McCabe et al. 1986). The main objectives of the study, which was funded primarily by the Portland District, U.S. Army Corps of Engineers (COE), were to determine estuarine distribution, relative abundance, size-class structure, and location and timing of movements across the Columbia River bar (River Mile 0.7 to 2.8¹) of Dungeness crabs. The 2-year study demonstrated that crab densities fluctuate annually in the estuary. For example, densities on the bar in the spring and summer of 1984 were less than 115 crabs/hectare (ha), whereas during the same period in 1985, densities exceeded 1,800 crabs/ha.

Because of the large annual fluctuations in crab densities at some frequently-dredged estuarine areas, the COE requested that NMFS continue to sample at some of the established stations. The objectives of the extended study are to describe the abundance and size-class structure of Dungeness crabs in or near frequently-dredged areas in the Columbia River estuary. These observations will expand the overall data base on Dungeness crabs in the estuary, specifically in areas subject to frequent dredging, and will provide additional information for COE crab entrainment studies. Results from the first and second years of the extended study were reported in McCabe et al. (1987a, 1987b). This annual report describes research done from January through September 1988, the final year of the extended study. A final report, integrating data collected from 1983 to 1988, will be prepared and submitted to COE by April 1989.

¹ River Mile is used in this report because of its common usage in navigation charts.

METHODS AND MATERIALS

Sampling for Dungeness crabs was done at established sites (McCabe et al. 1986) in the Columbia River estuary from January through September 1988. Stations 3 (Ilwaco Channel), 6 (Chinook Channel), and 10 (Flavel Bar area) were sampled monthly (Figure 1); five of the six bar stations (Stations 1, 2, 23, 24, and 25) were usually sampled biweekly from April through September 1988 when weather and oceanographic conditions permitted. The bar stations were not sampled during winter. Station 26 on the bar was not routinely sampled due to the presence of commercial crab pots in the area.

Samples were collected with an 8-m semiballoon shrimp trawl towed for 5 minutes at each site during the flood tide. Overall mesh size in the trawl was 38.1 mm (stretched), with a 12.7-mm mesh liner placed in the cod end of the net to prevent the escape of young-of-the-year crabs. The distance traveled during a sampling effort was estimated using either a radar range-finder or Loran-C navigational equipment. By using the distance traveled and the fishing width of the trawl, which was estimated to be about 5 m by the manufacturer, we were able to estimate crab densities. Densities are reported as numbers of crabs/hectare (ha). Before each sampling effort, salinity (ppt) and temperature (°C) were measured at the surface and near the bottom using a Beckman RS5-3² salinometer and temperature probe.

All crabs collected during each sampling effort were counted, and individuals from a subsample of up to 100 crabs were measured (mm), weighed (g), and examined for eggs. Crabs were measured to the nearest mm across the carapace anterior to the tenth anterolateral spines. For data analysis, crabs were separated into four size-classes: I (<50 mm), II (50-99 mm), III (100-129 mm), and IV (>129 mm).

²Reference to trade names does not imply endorsement by the National Marine Fisheries Service, NOAA.

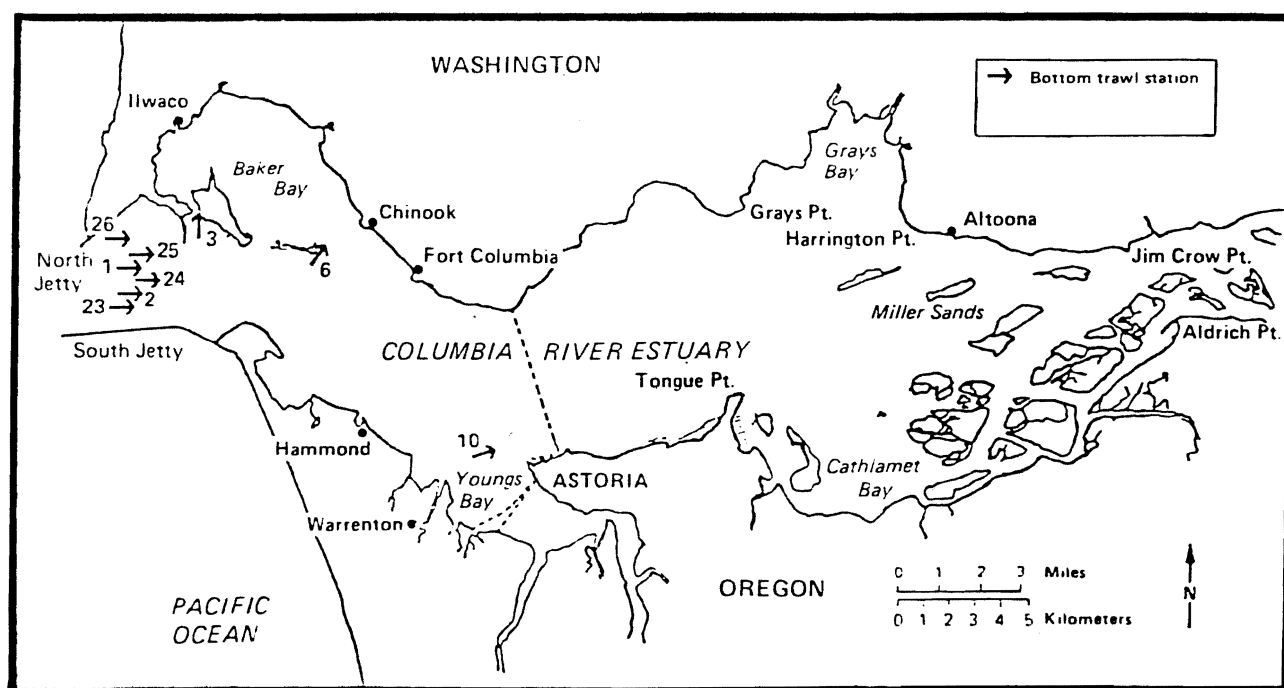


Figure 1.--Map of the Columbia River estuary, showing the Dungeness crab sampling stations.

RESULTS AND DISCUSSION

Estimated crab densities at the five bar stations varied spatially and temporally (Table 1). Data collected on 28 April are not shown, as sea conditions on the bar were poor and only two stations were sampled. Estimated densities at all bar stations were generally low, with no densities exceeding 150 crabs/ha. Mean crab density per sampling trip (all bar stations combined) was highest on 16 May (89 crabs/ha) and lowest on 8 August (2 crabs/ha). All mean biweekly densities were ≤ 25 crabs/ha, with the exception of the density on 16 May.

In 1988, densities of young-of-the-year (Y-O-Y) Dungeness crabs on the bar were relatively low. Mean monthly densities of Y-O-Y (all stations combined) were 0/ha (April), 58/ha (May), 10/ha (June), 1/ha (July), 0/ha (August), and 1/ha (September). Dungeness crab megalops larvae were first captured on the bar on 28 April, and Y-O-Y were first collected on 16 May. In April, 5 megalops were collected on the bar; in May and June, catches of megalops were 320 and 3, respectively. No Dungeness crab megalops larvae were collected on the bar after June. Most of the Y-O-Y crabs were first or second instar juveniles (Appendix Figures A1, A2).

Although the monthly size ranges of Dungeness crabs captured at the bar stations were similar from May through September 1988, the size distribution changed markedly (Table 1; Appendix Figures A1, A2). Size Class I crabs (<50 mm carapace width), primarily Y-O-Y, were present in all months, except April. No Size Class II crabs (50-99 mm) were captured on the bar. Size Classes III (100-129 mm) and IV (>129 mm) were present in all months on the bar.

At the three stations upstream from the bar, crab densities also fluctuated spatially and temporally (Table 2). At Station 3 (Ilwaco Channel), densities were highest in May (1,542 crabs/ha) and lowest in August (51 crabs/ha). Densities at Station 6 (Chinook Channel) were highest in September (2,290 crabs/ha) and lowest in

Table 1.--Dungeness crab densities (number/hectare) at six bar stations in the Columbia River estuary; crabs were collected with an 8-m shrimp trawl during April-September 1988. Crabs were separated into four size-classes: I (<50 mm), II (50-99 mm), III (100-129 mm), and IV (>129 mm).

Date	Size Class	Station					
		1	2	23	24	25	26
13 Apr	I	0	0	0	0	0	- ^{a/}
	II	0	0	0	0	0	-
	III	0	0	4	7	13	-
	IV	0	0	0	4	3	-
	Total	0	0	4	11	16	-
16 May	I	49	32	91	82	36	-
	II	0	0	0	0	0	-
	III	19	0	3	13	13	-
	IV	28	3	3	52	23	-
	Total	96	35	97	147	72	-
10 Jun	I	11	6	0	72	0	-
	II	0	0	0	0	0	-
	III	0	0	0	6	0	-
	IV	0	0	6	8	16	-
	Total	11	6	6	86	16	-
27 Jun	I	8	0	6	3	5	-
	II	0	0	0	0	0	-
	III	0	0	0	0	9	-
	IV	2	5	0	10	19	-
	Total	10	5	6	13	33	-

Table 1.--cont.

Date	Size Class	Station					
		1	2	23	24	25	26
11 Jul	I	3	0	2	7	0	-
	II	0	0	0	0	0	-
	III	0	0	0	4	3	-
	IV	35	2	0	7	3	-
	Total	38	2	2	18	6	-
25 Jul	I	0	0	0	0	0	-
	II	0	0	0	0	0	-
	III	3	0	0	3	4	-
	IV	8	0	15	20	0	-
	Total	11	0	15	23	4	-
8 Aug	I	0	0	0	0	0	-
	II	0	0	0	0	0	-
	III	0	0	0	0	0	-
	IV	0	0	5	6	0	-
	Total	0	0	5	6	0	-
24 Aug	I	0	3	0	0	0	-
	II	0	0	0	0	0	-
	III	0	0	3	3	0	-
	IV	3	10	3	3	11	-
	Total	3	13	6	6	11	-
6 Sep	I	0	4	0	0	0	7
	II	0	0	0	0	0	0
	III	0	0	7	0	7	4
	IV	11	13	11	12	3	11
	Total	11	17	18	12	10	22

a/ Indicates that station was not sampled because of crab pots in the area.

Table 2.-- Dungeness crab densities (number/hectare) at three stations in the Columbia River estuary; crabs were collected with an 8-m shrimp trawl during January-September 1988. Crabs were separated into four size-classes: I (<50 mm), II (50-99 mm), III (100-129 mm), and IV (>129 mm).

Date	Size Class	Station		
		3	6	10
5 Jan	I	11	0	0
	II	125	29	5
	III	29	21	33
	IV	23	29	11
	Total	188	79	49
1 Feb	I	0	0	0
	II	941	60	38
	III	195	144	127
	IV	26	42	9
	Total	1,162	246	174
1 Mar	I	0	0	4
	II	222	101	185
	III	34	121	41
	IV	0	38	4
	Total	256	260	234
12 Apr	I	0	6	17
	II	108	76	108
	III	18	140	43
	IV	12	108	0
	Total	138	330	168

Table 2.--cont.

Date	Size Class	Station		
		3	6	10
2 May	I	0	0	0
	II	1,311	44	556
	III	231	140	71
	IV	0	38	4
	Total	1,542	222	631
13 Jun	I	27	7	12
	II	465	452	631
	III	167	189	0
	IV	38	88	0
	Total	697	736	643
12 Jul	I	5	0	0
	II	135	241	220
	III	70	167	29
	IV	22	93	0
	Total	232	501	249
9 Aug	I	0	0	0
	II	6	30	84
	III	28	240	32
	IV	17	66	4
	Total	51	336	120
7 Sep	I	0	0	0
	II	57	365	56
	III	293	1,602	65
	IV	128	323	13
	Total	478	2,290	134

January (79 crabs/ha). At Station 10 (Flavel Bar area), densities were highest in May (643 crabs/ha) and lowest in January (49 crabs/ha).

Overall, Size Classes II and III were the dominant size classes at Stations 3, 6, and 10. Densities of Size Class I crabs were zero or very low, and Y-O-Y crabs were virtually absent at all three stations (Table 2; Appendix Figures A3-A11).

Actual crab densities in the Columbia River estuary were probably higher than those estimated from our trawl catches. The sampling efficiency of our 8-m semiballoon shrimp trawl for different size classes of Dungeness crabs in the Columbia River estuary is unknown. In Humboldt Bay, California, Gotshall (1978) estimated that his 4.9-m bottom trawl was about 50% efficient in collecting Dungeness crabs (combined age 0+ and older). Stevens and Armstrong (1984), who estimated crab populations in Grays Harbor estuary, Washington, used a sampling efficiency of 3.3% for early instar crabs collected with a 4.9-m semiballoon otter trawl.

The present study is a continuation of a previous study conducted between 1983 and 1985 in which a greater number of estuarine sites were sampled (McCabe et al. 1986). In general, data collected in 1986 (McCabe et al. 1987a), 1987 (McCabe et al. 1987b), and 1988 (this report) substantiate the spatial and temporal fluctuations in crab densities observed in the Columbia River estuary during the earlier study. A detailed analysis of crab data collected from 1983 through 1988 will be presented in a final report.

ACKNOWLEDGMENTS

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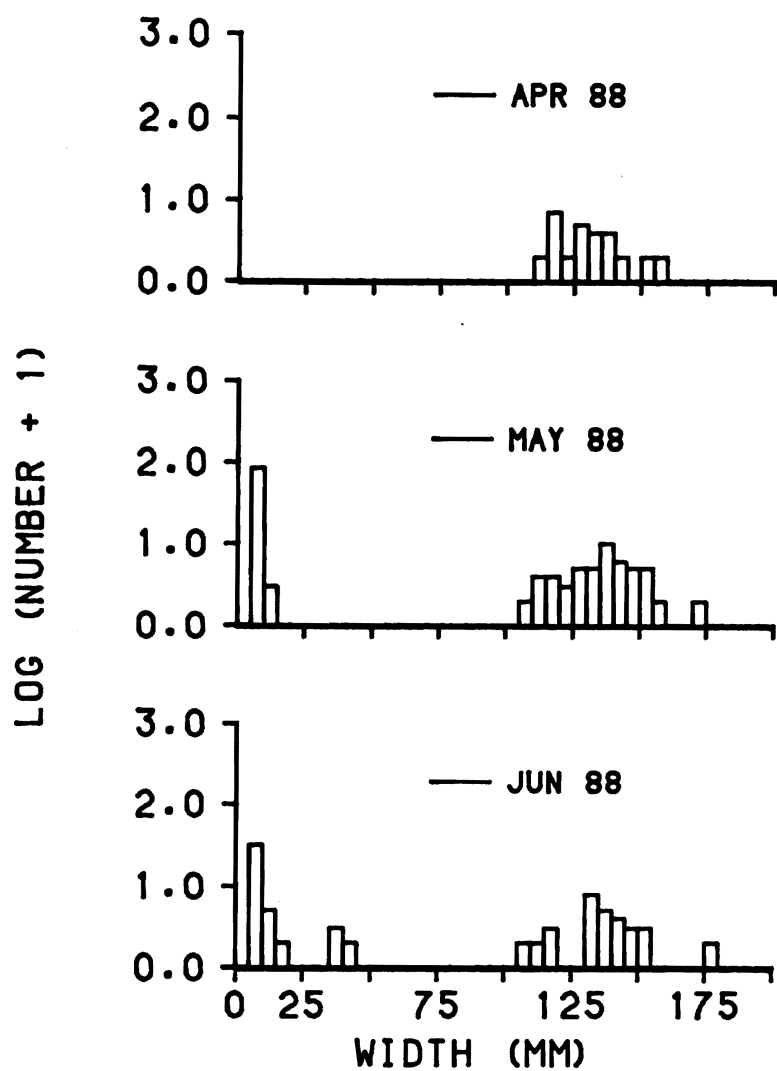
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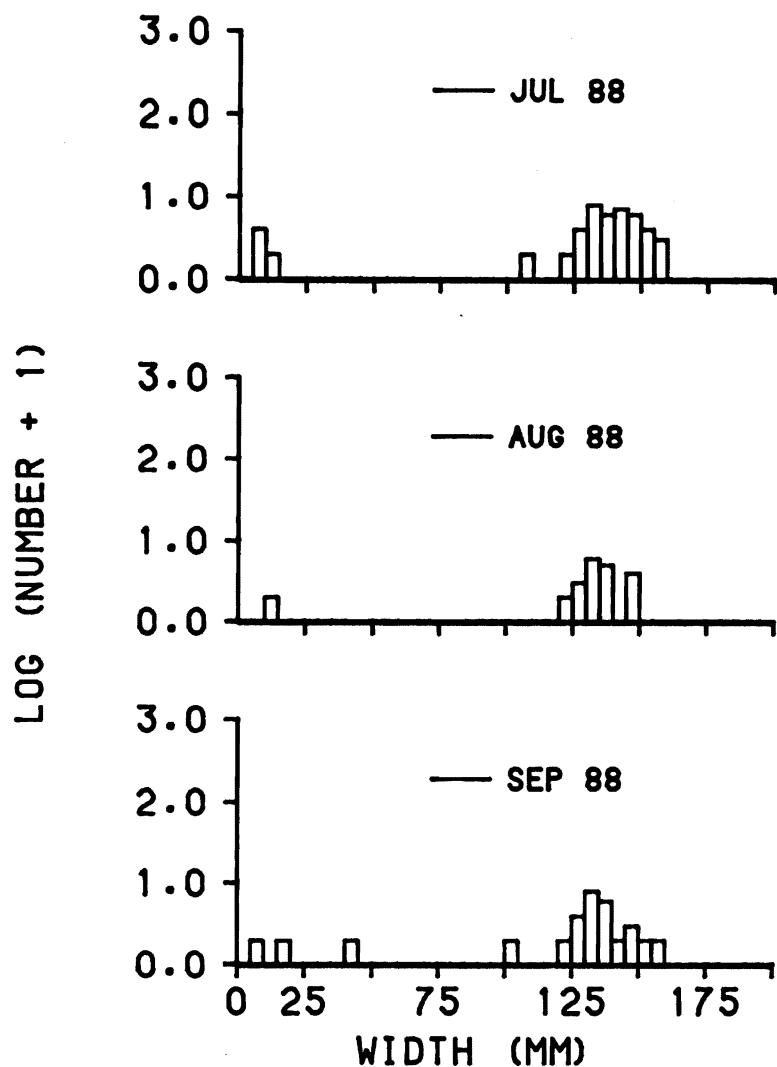
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APPENDIX.--Width-frequency histograms for Dungeness crabs collected in the Columbia River estuary from January through September 1988.



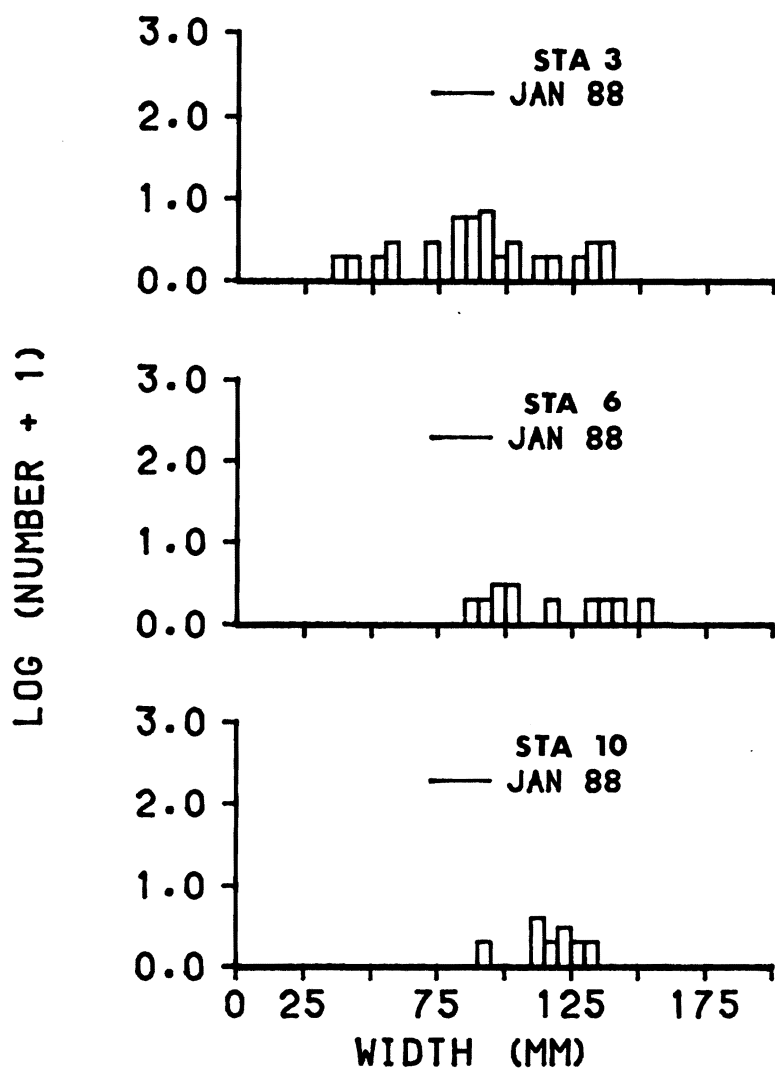
Appendix Figure A1.--Width-frequency histograms for Dungeness crabs

collected on the Columbia River bar from April through June 1988. Each histogram includes data collected from 5-10 trawling efforts.

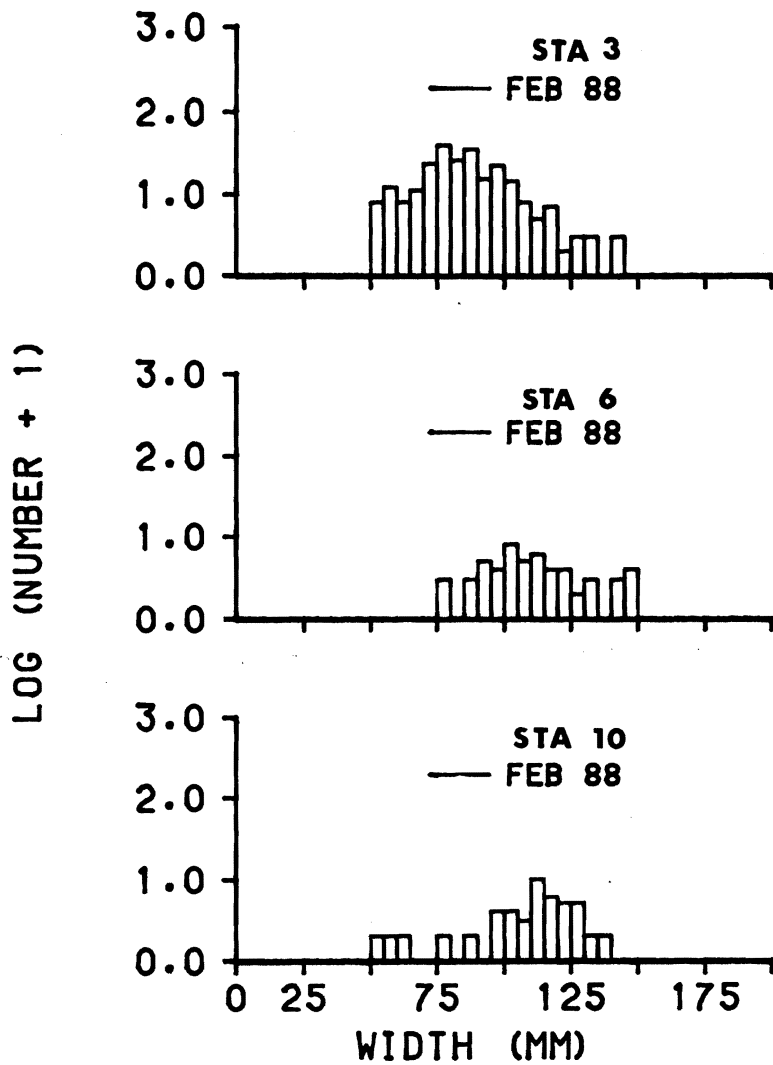


Appendix Figure A2.--Width-frequency histograms for Dungeness crabs

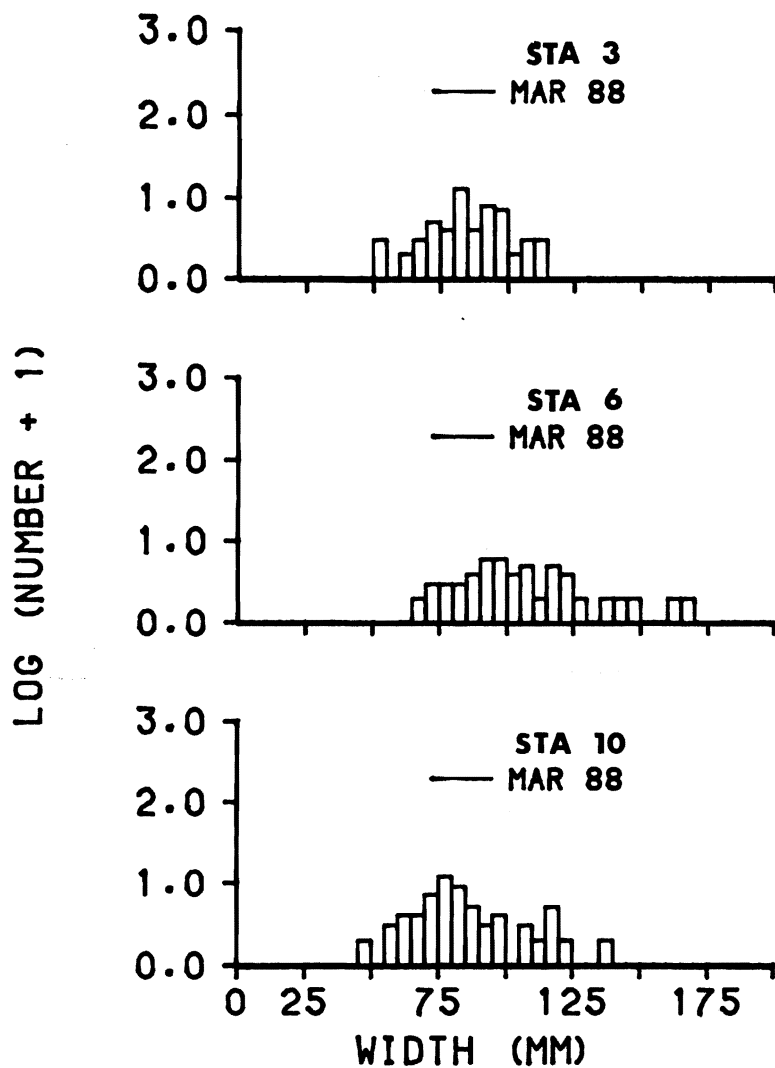
collected on the Columbia River bar from July through September 1988. Each histogram includes data collected from 6-10 trawling efforts.



Appendix Figure A3.--Width-frequency histograms for Dungeness crabs
collected at Stations 3, 6, and 10 in January 1988.
One trawling effort was done at each station.

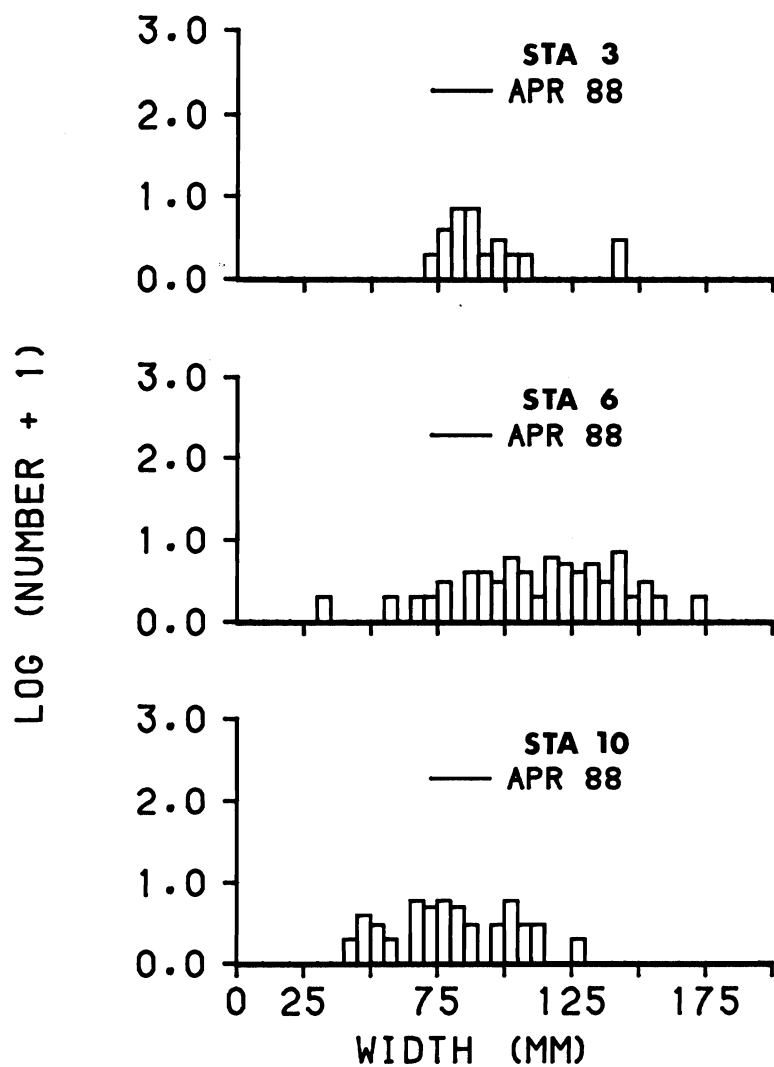


Appendix Figure A4.--Width-frequency histograms for Dungeness crabs
collected at Stations 3, 6, and 10 in February 1988.
One trawling effort was done at each station.



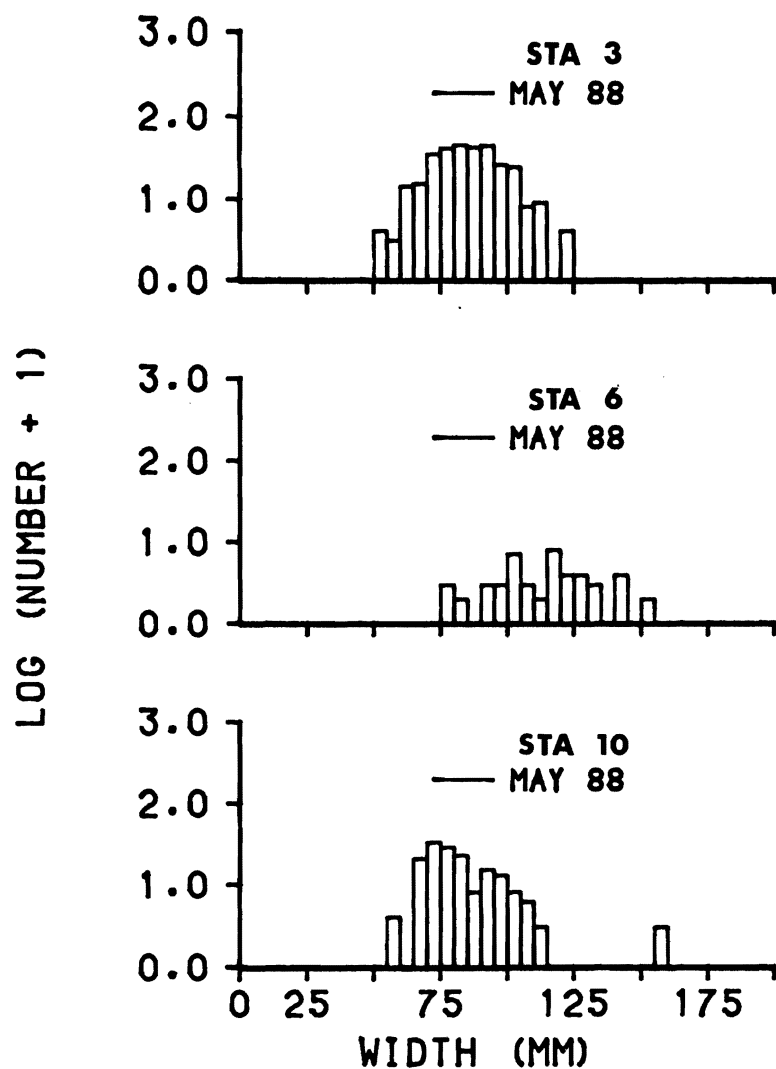
Appendix Figure A5.--Width-frequency histograms for Dungeness crabs

collected at Stations 3, 6, and 10 in March 1988. One trawling effort was done at each station.

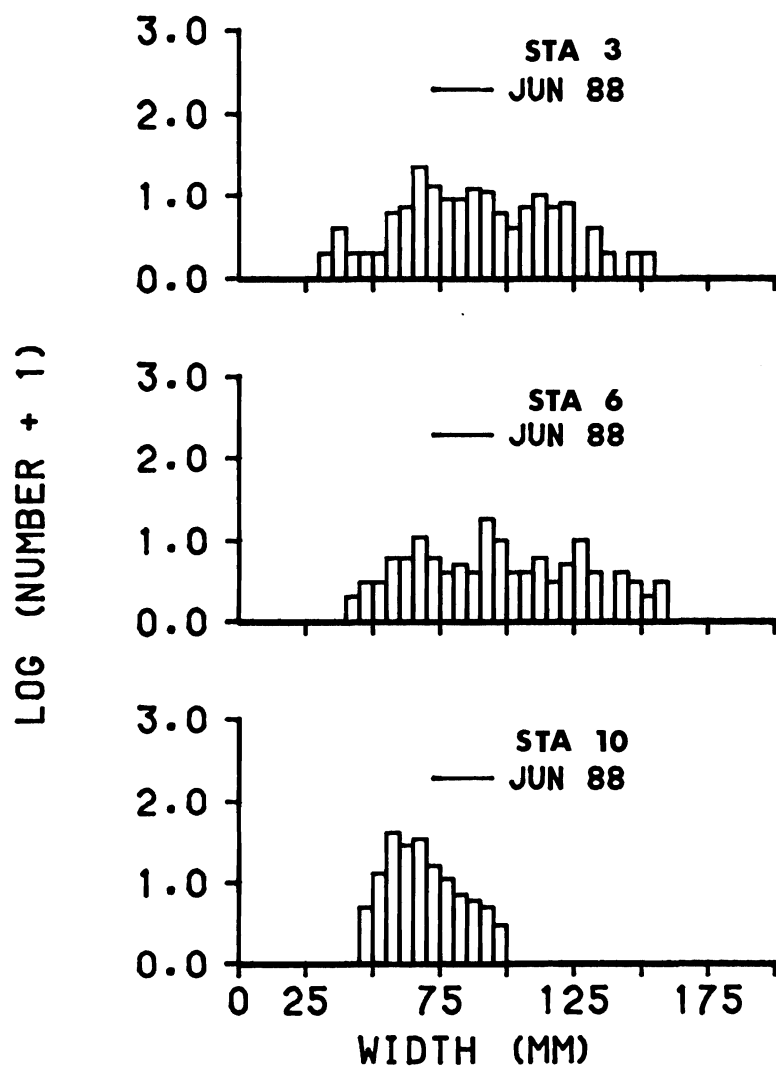


Appendix Figure A6.--Width-frequency histograms for Dungeness crabs

collected at Stations 3, 6, and 10 in April 1988. One trawling effort was done at each station.

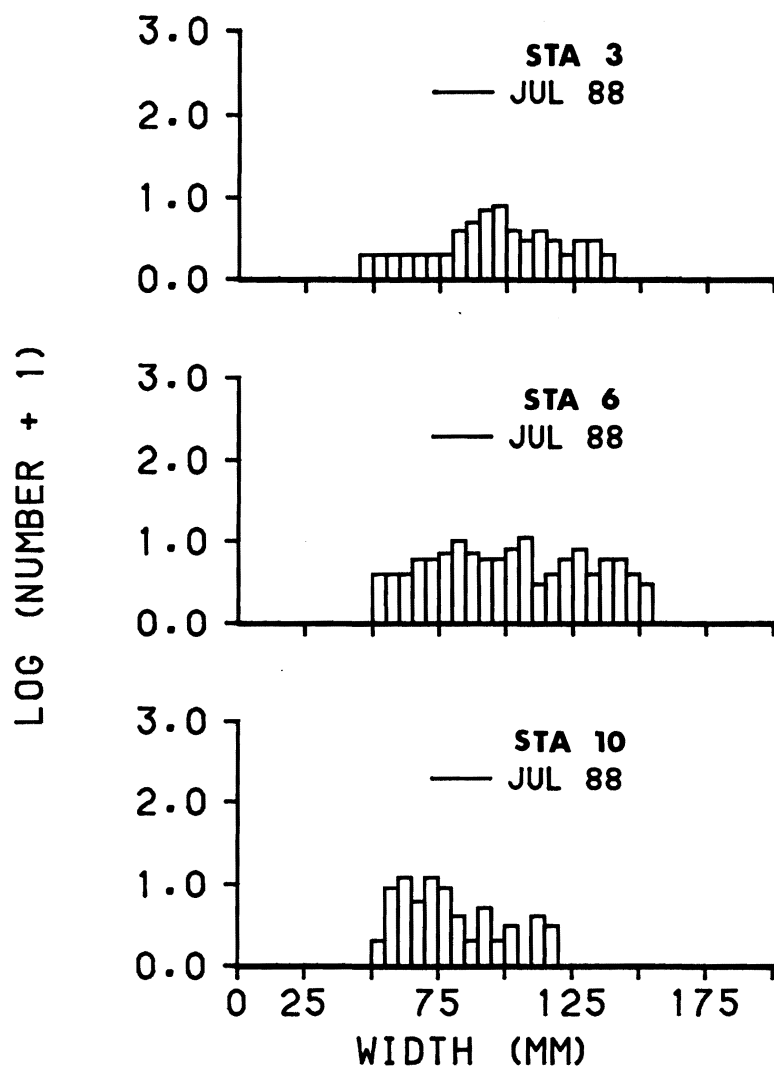


Appendix Figure A7.--Width-frequency histograms for Dungeness crabs collected at Stations 3, 6, and 10 in May 1988. One trawling effort was done at each station.

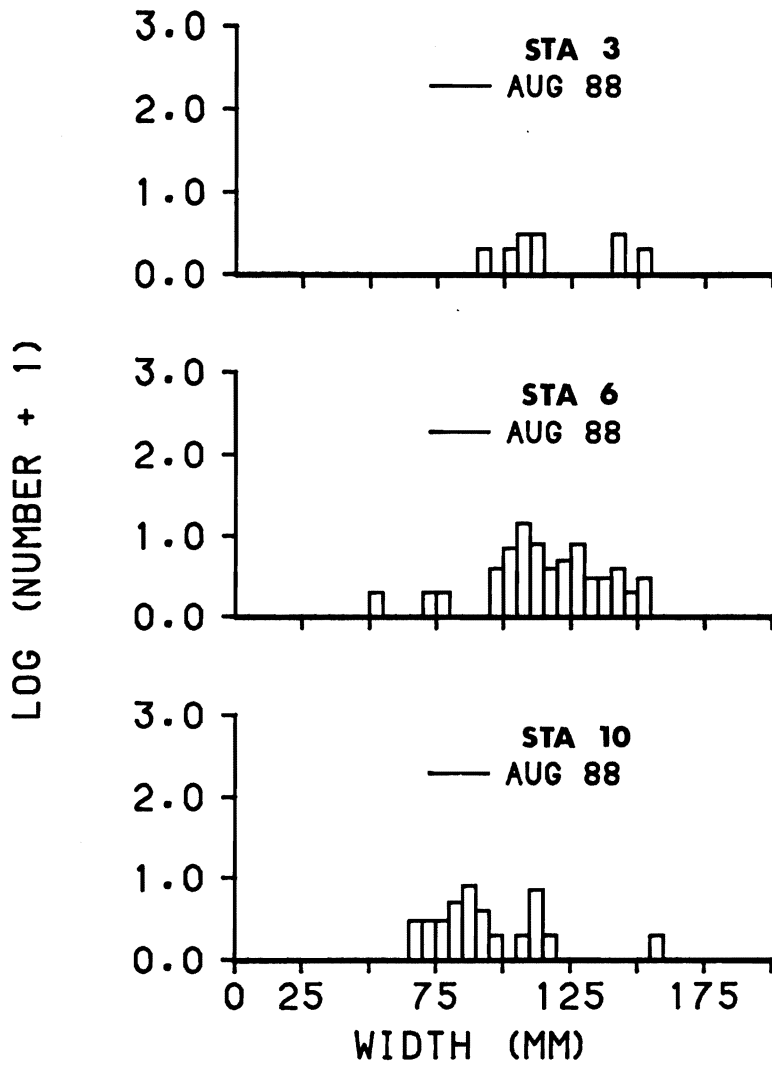


Appendix Figure A8.--Width-frequency histograms for Dungeness crabs

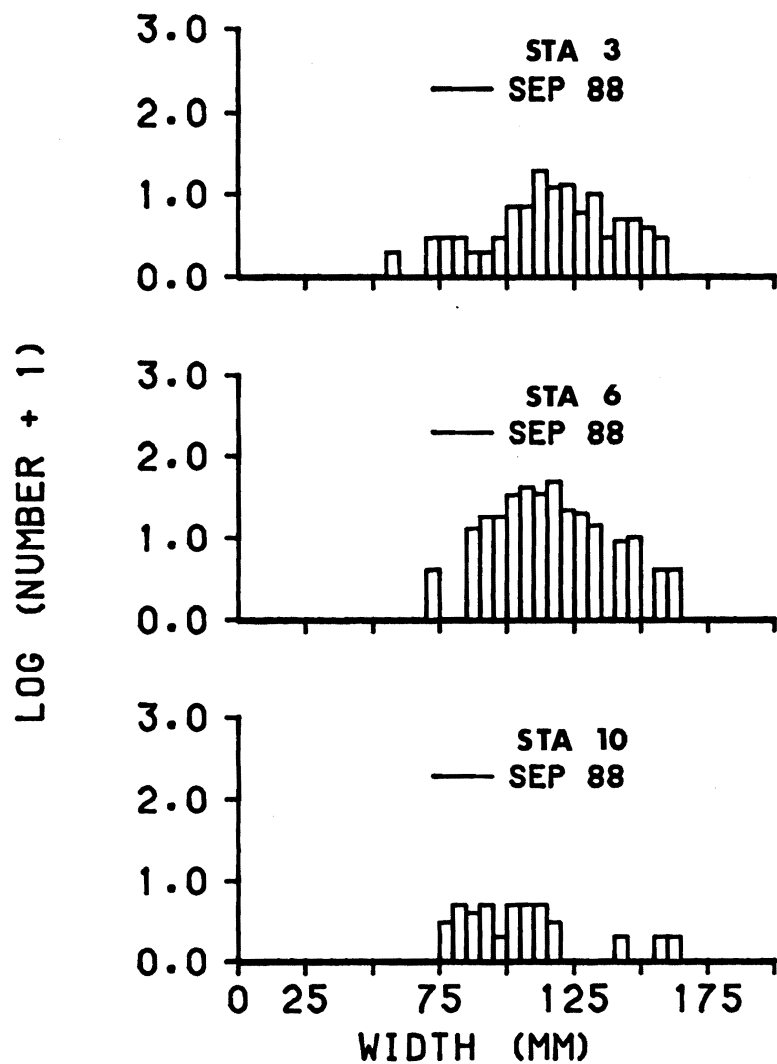
collected at Stations 3, 6, and 10 in June 1988. One trawling effort was done at each station.



Appendix Figure A9.--Width-frequency histograms for Dungeness crabs collected at Stations 3, 6, and 10 in July 1988. One trawling effort was done at each station.



Appendix Figure A10.--Width-frequency histograms for Dungeness crabs
collected at Stations 3, 6, and 10 in August 1988.
One trawling effort was done at each station.



Appendix Figure A11.--Width-frequency histograms for Dungeness crabs
collected at Stations 3, 6, and 10 in September 1988.
One trawling effort was done at each station.