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Job Report

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Project Name: Studies of Blue Crab Populations of the Texas Coast

Period Covered: January 1, 1963 to December 31, 1963 Job No. 2

Population Studies of the Blue Crabs of the Galveston Bay System

Abstract: A major peak of apparent abundance of small blue crabs occurred in tertiary bays in the fall of 1963. Sampling indicated that sex ratios of juveniles were stable at each salinity level, while adults showed greater variation. All but nine of 118 Gulf crabs (Calinectes danae) were collected in salinities over 20 ppt. Tagging results are discussed and suggestions to improve the experiments are offered.

Objectives: To sample the blue crab population with various collecting devices in an attempt to determine seasonal abundance, migrational patterns and growth rates as related to environmental conditions.

Procedures: All blue crabs (Callinectes sapidus) and Gulf crabs (C. danae) caught, incidental to routine shrimp and fin-fish sampling, were measured in carapace width in millimeters (distance between the tips of the lateral spines) and sexed. Additional notes were kept on maturity stages.

Sampling gears included: A six-foot bar seine of one-fourth inch bar mesh; a ten-foot trawl of 1 1/4 inch stretch mesh with a one-fourth inch mesh cod end; a 1200 foot drag-seine with 2 1/2 inch mesh wings and two inch mesh bag; a sixty foot beach-seine of 1/2 inch bar mesh. During late summer and throughout the fall, additional samples were collected by towing a 20 foot trawl of 1 1/2 inch stretch mesh.

The bar-seine was used semi-monthly in tertiary bays. A sample was collected by dragging the seine for 500 feet. Ten-foot trawl samples were collected semi monthly in secondary and primary bay areas. The duration of each trawl was 15 minutes. Drag-seine sets enclosed a 1200 foot circle; while the sixty foot beach-seine was pulled 100 feet, but covered roughly 5000 square feet. All but 20 foot trawl stations were predesignated (Figure 1). Routine stations are described in Table 4.

Adult crabs, for tagging, were caught by trawl, beach seine, drag-seine and occasionally by crab pot. The tags were similar to the Nesbit-Fiedler tag described by Cronin (1949), however, Petersen discs were substituted for the Nesbit plastic tag.

Findings:

Commercial Landings

From January 1963 through October 1963, 430,000 pounds* of blue crabs were landed at Galveston. Landings (Table 1) increased sharply in March and declined

* Production from monthly reports of the Bureau of Commercial Fisheries, Division of Resource Development, Market News Service Jan. - Dec. 1963.

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slightly in June. A second production peak occurred in July when 81,000 pounds were reported. September catches fell off abruptly.* Production for November and December was not available.

Table 1 Blue Crab Production at Galveston (1963)

Month	Pounds Landed	Month	Pounds Landed
January	5,000	July	81,000
February	7,000	August	52,000
March	42,000	September	34,000
April	55,000	October	49,000
May	57,000	November	No data
June	48,000	December	No data
		TOTAL	430,000

Seasonal Occurrence

Bar-seines are used in small tertiary bays and catch young individuals of the crab population. Drag-seines catch large crabs; while trawls and beach seines are less selective. The width-frequency distribution of blue crabs by sampling gear is shown in Figure 2. The data were smoothed by 3's to eliminate minor fluctuations. The accompanying graphs (to the right) show the average monthly blue crab catches by sampling gear. Areas above the broken lines represent above average peaks of availability.

Because the bar-seine catches small crabs, these data were used to detect changes in apparent abundance which may reflect periods of spawning success. Small peaks appeared in February and August. These were followed by a huge peak in the fall (Figure 2). Although the drag-seine data are weak, above average peaks in adult crab availability occurred in July and September. The July peak corresponds with the July commercial production peak (Table 1).

Salinity Tolerance and Sex Ratios

Table 2 shows the average number of juvenile and adult blue crabs caught per sample, sex ratios, and occurrence of C. danae at certain salinity levels. Because it is impossible to determine maturity of male blue crabs by observation (Fischler and Walburg, 1962), all crabs over five inches in width were considered adult. Sex ratios of juvenile blue crabs were fairly stable at each salinity level while adults show greater variation.

All but nine of 118 specimens of C. danae were collected in salinities over 20 part per thousand (Table 2). Daugherty (1952) did not find this species in salinities less than 23.7 ppt; however, Gunter (1950)

* In September roughly 20 percent of the commercial catches in lower Galveston Bay were of poor quality. The shells were pitted and the individuals died soon after capture. Biologists at Texas A & M University were able to isolate two chitin destroying bacteria from a sample of adult crabs collected in Galveston Bay. The authors believe this may be partilly responsible for the low production in September. Results of the experiments at Texas A & M University will be reported at a later date.

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collected this species in salinities between 15 and 19.9 ppt. The three specimens collected in salinity less than 15 parts per thousand were caught in a single sample at Lone Oak Bayou in Trinity Bay.

Tagging

Blue crab tagging methods were described by Cronin (1949) and evaluated by Webster (1962). Fischler and Walburg (1962) state that female blue crabs in Chesapeake Bay move to more saline waters while males tend to remain in brackish waters. These authors also state that:

> "Studies in Delaware Bay (Porter, 1956), in Texas (Daugherty, 1952), and in Louisiana (Darnell, 1959) at various times of the year indicate movement of adult crabs in these areas similar to that in Chesapeake Bay."

The same authors cite Pearson (1951) who postulates that movement may be similar in all sections of the coast. Similar movements, based on biological samples, were assumed by Pullen (1962-63) in Galveston Bay and Moffett (1962-63) in Matagorda Bay.

To determine blue crab movements in Galveston Bay, 398 adult crabs were tagged. Of these 239 were males. The overall recovery rate was 8.8 percent. Numbers tagged and recovery rates are shown in table 3. Tags returned with catch information are summarized in table 4. Although the seining of adult crabs from the Gulf surf at Galveston offered evidence that a spawning movement had occurred, sufficient numbers were not tagged in the bay to demonstrate movement to or from the Gulf. The longest movement by an individual tagged female crab was about 8 miles west along Galveston beach. The longest movement by a tagged male crab was about 10 miles from Clear Lake to Eagle Point.

Discussion: Examination of blue crab tagging studies conducted elswhere and the lack of long term tag returns in the current study (table 4) indicate that time of tagging should be considered before blue crab movements can be determined. Fischler and Walburg (1962) released 1,488 tagged blue crabs in South Carolina in January 1958. Most returns from this experiment were received from July of the same year. Cargo (1958) tagged 392 adult female crabs in Virginia on July 31, August 10, September 11 and September 17, 1953. Thirty-five of 117 recaptures from the Virginia study were at liberty over 200 days. The most logical explanation for the lack of long-term recaptures in the Galveston Bay study appears to be natural mortality of tagged crabs since the average life-span of blue crabs, at least in some areas, may be less than 1 year (Van Engle, 1958). All crabs tagged in Galveston Bay were adult and hence subject to heavy mortality. If these observations hold true for the Galveston Bay blue crab population, tagging efforts should be increased from late summer through early spring. At that time, special attempts should be made to tag adult female crabs prior to the so-called Gulf migration. Summer tagging experiments should be concentrated in the Gulf surf when adult female crabs are available.* Increased tagging publicity and a reward for returning tags are needed.

Figure 3 shows the percent width-frequency distribution of the tagged portion of the blue crab population and the distribution of sizes returned. An abrupt drop-off occurred at 178 mm. Crabs less than 133 mm in width were not returned (probably due to shedding). This shows that the present tagging method should be limited to crabs over five inches wide.

* The blue crab spawning population in the Gulf is exposed to shrimp trawling and sport trot-line fishing during summer.

More effective methods of sampling adult crabs should be used in future work. This would offer more reliable information on sizes and sex ratios of commercial size crabs. Such information would shed light on movements, since blue crab migrations are reflected in the sex ratios of the commercial catch (Rees, 1963). A solution would be to establish permanent 20 foot trawl stations or sample commercial catches from different bay areas. Gill-net, trammel-net or crab pot stations would offer the same information.

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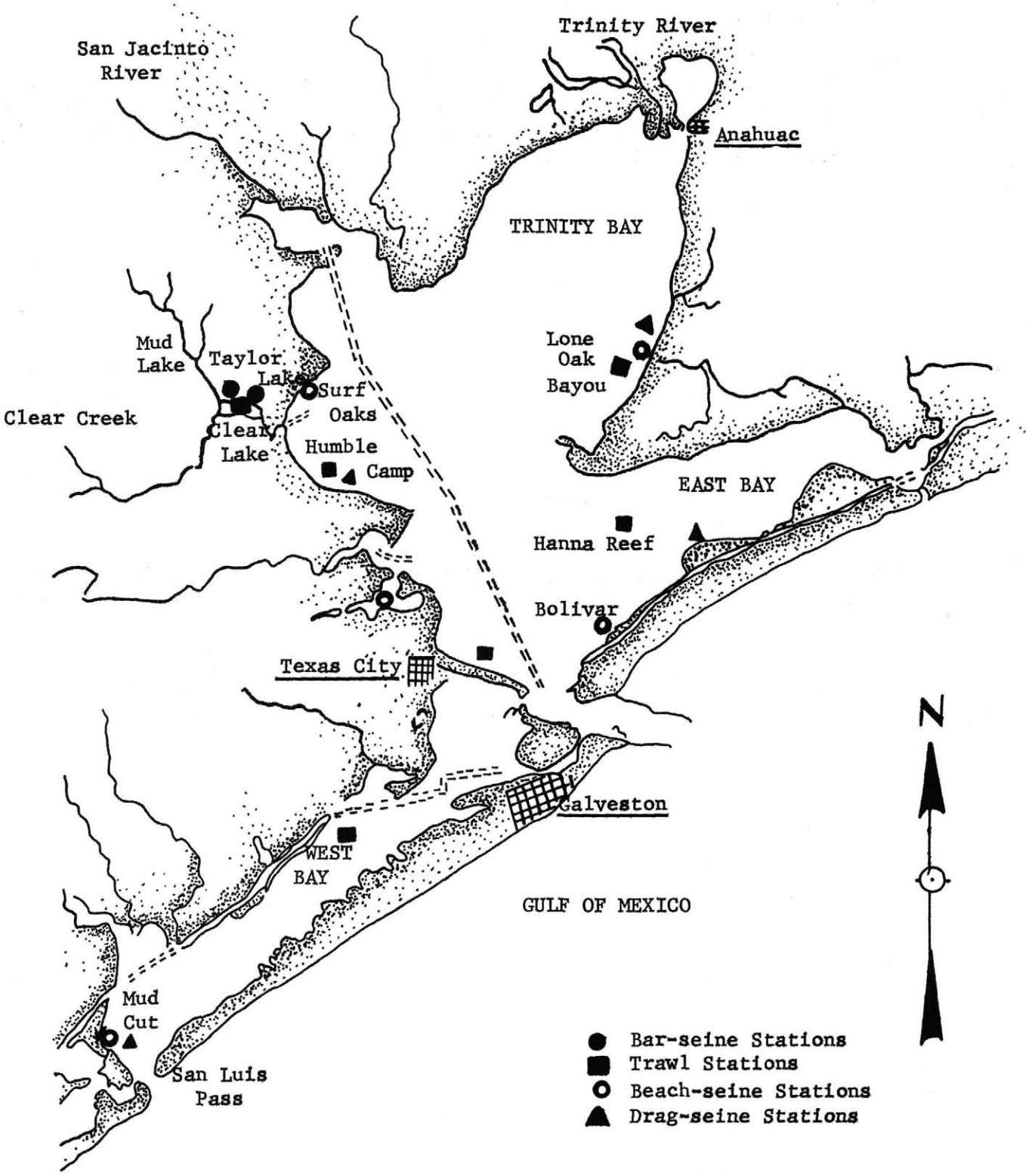

Figure 1. Blue Crab Sampling Stations (1963)

Table 2. Occurrence of C. sapidus, sex ratios, and occurrence of C. danae at graduated salinity levels.

Salinity Interval (ppt)	No. Samples	< 5 Inches Wide			> 5 Inches Wide			No. C. danae
		No. Blue Crabs	No./ Sample	♂ : ♀	No. Blue Crabs	No./ Sample	♂ : ♀	
0-4.99	3	24	8.0	1 : 1.2	0	0.0	0 : 0	0
5-9.99	6	61	10.0	1 : 1	1	0.01	1 : 0	0
10-14.99	28	124	4.4	1 : 1	20	0.71	1 : 0.5	3
15-19.99	58	270	4.7	1 : 1	35	0.60	1 : 0.2	6
20-24.99	50	171	3.4	1 : 0.4	44	0.58	1 : 0.4	42
over 25.00	46	88	1.9	1 : 1.2	23	0.50	1 : 0.4	67
TOTAL	191	738	3.9	1 : 1	123	0.64	1 : 0.38	118

Table 3. Numbers of blue crabs tagged and recovered in Galveston Bay (1963)

Month	Number Tagged		Number Recovered		% Recovered
	♂	♀	♂	♀	
April	1	0	0	0	0
May	15	0	4	0	19.0
June	53	23	9	0	11.8
July	41	84	3	5	6.4
Aug.	26	14	3	0	7.5
Sept.	26	7	1	0	3.0
Oct.	33	3	7	0	19.4
Nov.	44	22	2	1	4.5
Dec.	0	0	0	0	0
TOTALS	239	159	29	6	8.8

Table 4. Record of blue crab tag returns with catch data (1963)

No.	Tag Number	Width (mm)	Sex	Release Site	Release Date	No. Days Free	Distance Moved	Direction Moved
1	19702	181	♂	Clear Lake	5-16-63	4	1-2 mi.	E
2	19703	190	♂	"	"	19	1-2 mi.	E
3	19706	155	♂	"	"	22	0	-
4	19711	170	♂	Seabrook	5-20-63	31	10 mi.	NE
5	19733	185	♂	"	6-10-63	3	0	-
6	19744	202	♂	Humble Camp	6-12-63	15	4-5	N
7	19748	190	♂	"	"	9	9-10	S
8	19752	195	♂	San Leon	"	20	7-8	E
9	19763	193	♂	Humble Camp	6-19-63	14	?	?
10	19767	187	♂	Seabrook	"	13	2 mi.	W
11	19786	195	♂	"	6-20-63	9	5 mi.	?
12	19788	182	♂	"	"	17	7 mi.	S
13	2214	155	♂	"	6-28-63	8	5 mi.	NE
14	19025	155	♂	Clear Creek	7-12-63	32	8 mi.	S
15	19040	180	♂	5 Mi. Pass	7-19-63	12	0	-
16	19042	195	♂	"	"	7	0	-
17	19050	183	♀	Gulf Surf	7-24-64	?	?	?
18	19052	151	♀	"	"	4	0	-
19	19074	151	♀	"	"	3	0	-
20	19082	145	♀	"	"	19	8 mi.	W
21	19092	170	♀	Seabrook	"	5	0	-
22	19115	167	♂	Clear Lake	8-29-63	47	?	?
23	19118	160	♂	"	"	13	?	E
24	19126	140	♂	Seabrook	"	42	?	?
25	19194	162	♂	Chocolate Bay	9-27-63	20	0	-
26	19191	184	♂	Humble Camp	10-7-63	9	2 mi.	E
27	5405	185	♂	Upper Galveston Bay	10-17-63	5	?	?
28	5408	170	♂	"	"	7	0	-
29	19141	175	♂	Clear Lake	10-29-63	3	0	-
30	5464	182	♂	"	"	5	0	-
31	5470	184	♂	"	"	5	9-10	S
32	5471	169	♂	"	"	21	?	?
33	5318	172	♂	"	11-4-63	3	0	-
34	5347	188	♂	"	11-14-63	1	0	-
35	5499	189	♀	"	11-4-63	22	7 mi.	SE

Table 4 Description of Stations (1963)

Station Name	Habitat	Annual Salinity Range ‰	No. Samples	Gear Used	Av./Sample	Comment
Mud Lake	Tertiary Bay Receives runoff from series of bayous Bottom - soft mud Vegetation - none Depth - 2-3 feet Turbidity - high	1.5 - 23.1	18	6 foot bar seine	14.8	Important nursery
Taylor Lake	Tertiary Bay Receives runoff from Taylor Bayou Bottom - soft mud with large silt deposits Vegetation - none Depth - 2-3 feet Turbidity - moderate	4.7 - 22.1	19	6 foot bar seine	11.6	Important nursery
Lone Oak Bayou	Shoreline station Under influence of Trinity River discharge Bottom - mud-mixed *Rangia* shell Vegetation - none Depth - 1-2 feet	10.1 - 21.5	11	60 foot seine	3.0	-
Surf Oaks	Shore line station conditions fluctuate with tide - receives large amount of runoff during rains Bottom - sand and mud Vegetation - *Spartina sp.* Depth - 2-3 feet	2.1 - 24.7	10	60 foot seine	13.8	Good nursery area

Table 4 (Continued)

Station Name	Habitat	Annual Salinity Range ‰	No. Samples	Gear Used	Av./Sample	Comment
Mud Cut	Shore line station Near Gulf Pass Salinity seldom drops below 20 ppt. Bottom - mud and sand Vegetation - Ruppia sp. good cover Depth - 1-3 feet	21.9 - 37.9	9	60 foot	8	Important nursery area - Rupia sp. cover offers good protection
Bolivar	Shoreline station Near Gulf pass Bottom - hard sand Vegetation - none Depth - 1-3 feet Current usually strong on slack tide	22.0 - 33.9	10	60 foot seine	2.6	-
Humble Camp	Primary Bay Bottom - sandy mud Vegetation - none Depth - 6 feet	16.0 - 25.9	23	10 foot trawl	1.1	-
Texas City Dike	Primary Bay Salinities usually above 20 ‰ Bottom - mud Vegetation - none Depth - 9-10 feet	18.7 - 35.1	18	10 foot trawl	.6	-

Figure 4 (Continued)

Station Name	Habitat	Annual Salinity Range ‰	No. Samples	Gear Used	Av./Sample	Comment
Clear Lake	Secondary Bay Receives drainage of Clear Creek, Mud and Taylor Lakes. Bottom - mud Vegetation - none Turbidity - moderate Depth - 5-7 feet	7.0 - 24.3	20	10 foot trawl	8.1	Appears to be area of transitio of juveniles to adults
Lone Oak Bayou	Primary Bay Under Under influence of Trinity River discharge Bottom - mud with mixed shell Vegetation - none Depth - 5-6 feet	10.1 - 21.5	11	10 foot trawl	2.8	-
Hanna's Reef	Primary (East Bay) Moderate salinities Bottom - mud, sand and shell Vegetation - none Depth - 7-8 feet	15.0 - 28.0	11	10 foot trawl	.28	-
West Bay	Primary (West Bay Salinities usually high Bottom - sand Vegetation - none Depth - 4-5 feet	25.8 - 35.0	6	10 foot trawl	.17	-

Figure 2. Width-frequency distribution of the catch of blue crabs and month progression of average sample sizes.

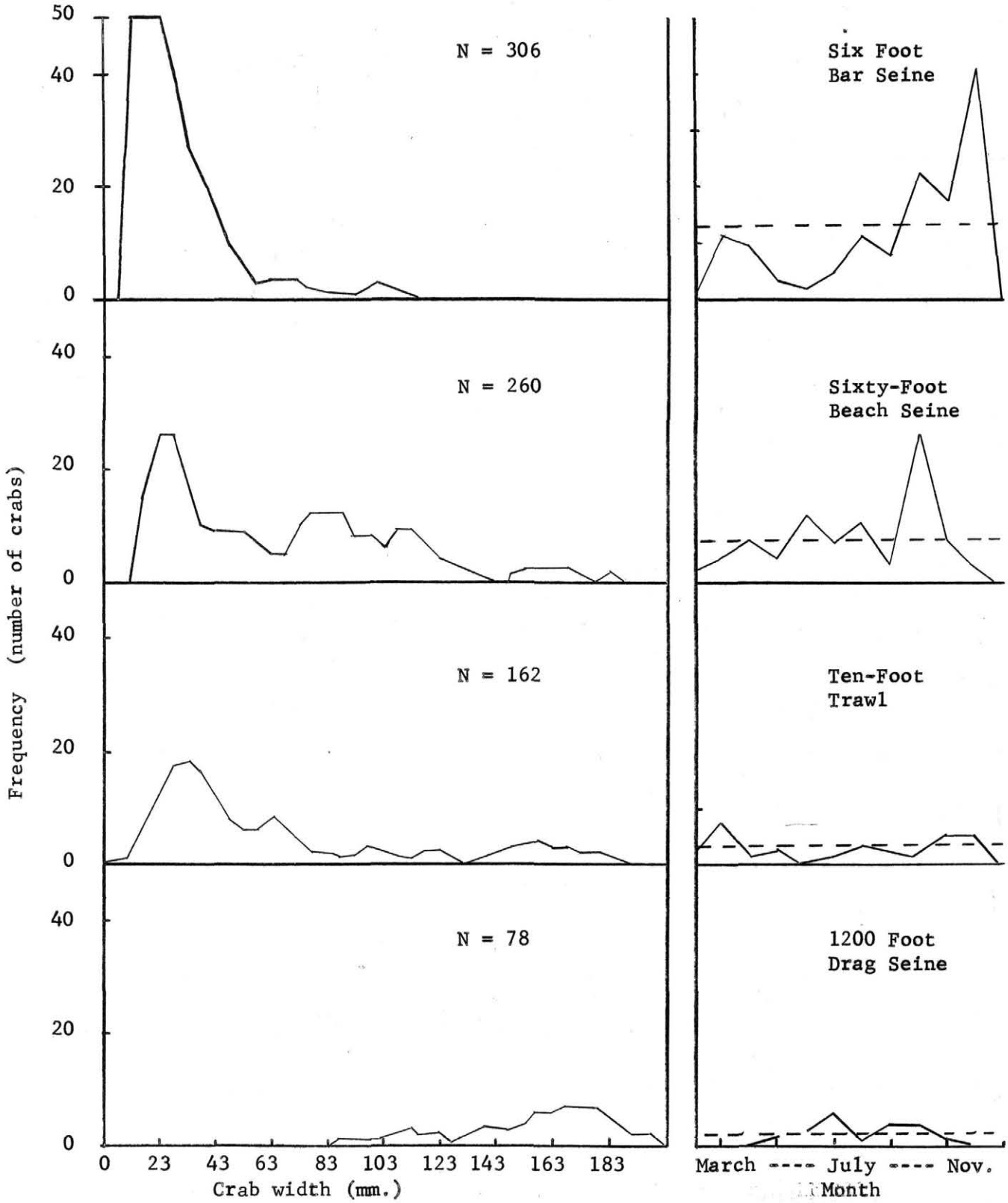

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Figure 3. Percent width-frequency distribution of tagged and returned blue crabs (1963)