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INVESTIGATION OF THE ABUNDANCE AND  
DISTRIBUTION OF SHRIMP OFF OREGON

ANNUAL REPORT

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## INTRODUCTION

On July 1, 1969, the Oregon Fish Commission began a one-year study to assess the movements and abundance of pink shrimp (*P. jordani*) in a specific area off Oregon.

The principal objectives of the study were as follows:

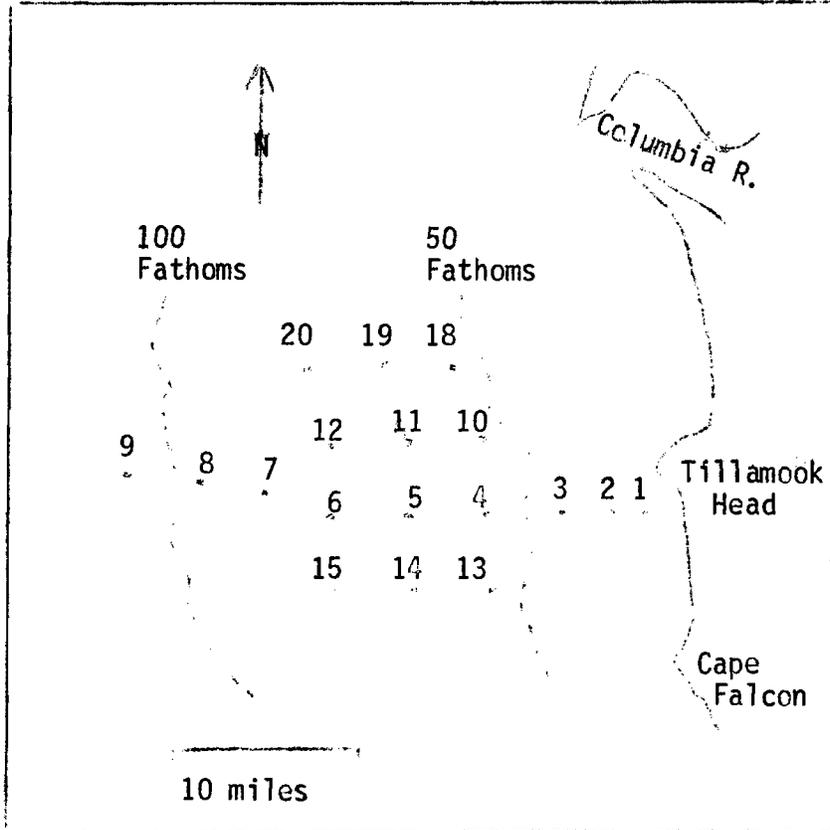
- 1) Determine the benthic movements of pink shrimp in the area off Tillamook Head, Oregon by sampling, at approximately monthly intervals, at stations arranged in a grid pattern. Analyze the age and sex composition of the samples and abundance of shrimp to determine if there is movement north-south and/or inshore -offshore within the study area.
- 2) Determine the location of 1969-year class shrimp (young-of-the-year) to establish if they move into the study area from any specific area, perhaps indicating a nursery ground.

## METHODS

The study area incorporated 18 stations off Tillamook head (Figure 1). The stations are 4 nautical miles apart except stations 1-3 and range from 3-30 miles off shore. Depth range at the stations is from 31-159 fathoms.

We used a 41-foot headrope gulf semi-balloon trawl made of 1-1/8-inch stretch mesh netting with a cod end of 1-1/2-inch mesh. An innerliner in the cod end was made of 1/2-inch mesh. Plastic rollers were attached to the 52-foot footrope. A 50-foot 5/16 inch steel tickler chain was used. Each end was attached to the ends of the footrope. Seventeen-inch dropper chains along the length of the tickler connected it to the footrope. Fifteen feet of cable bridle connected the net to the otter boards. The bridle was extended to 15 fathoms for cruise 70-2 and subsequent cruises.

Figure 1. Locations of Trawl Stations, Pink Shrimp Benthic Distribution Study.



During the first cruise, 69-2, we towed only at stations 1-15. Tows at stations 1-3 and 7-9 were 30 minutes duration and at stations 4-6 and 10-15 we made two 15 minute replicate tows.

After the first cruise we added stations 18-20 and changed the procedure. Single 1/2 mile tows were made at each station. During the last two cruises, 70-7 and 70-9, replicate 1/2 mile tows were made at each station and we eliminated stations 1-3 and 7-9.

The catch from each tow was weighed to determine gross weight. A 20-pound subsample was sorted to determine the percentage, by weight, of shrimp and incidental species. The calculated percentage of shrimp was applied to the total weight of the remaining catch to determine pounds of shrimp caught. A random sample of approximately 400 shrimp was taken from the catch when a single tow was made at a station and approximately 200 shrimp were sampled from the catch of the replicate tows. These samples were worked up in the laboratory to determine sex and age composition.

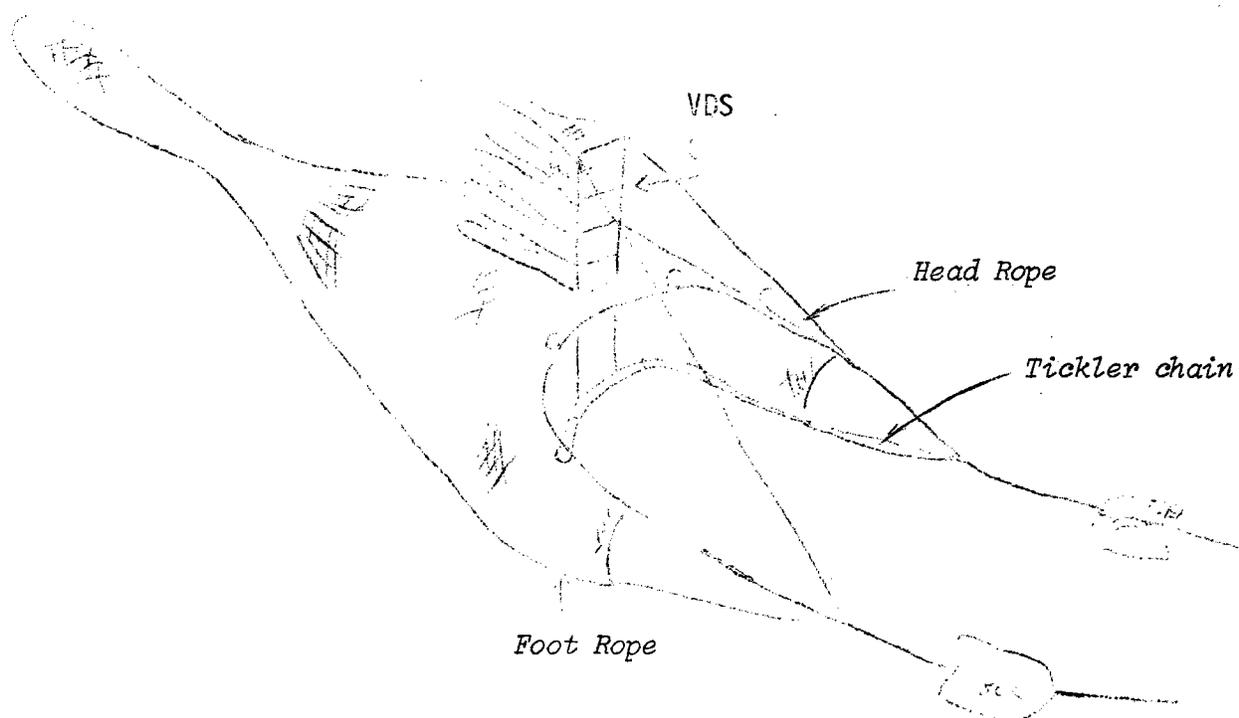
To evaluate the distribution of shrimp from 4 to 10 feet off the bottom during day time towing, we attached a vertical distribution sampler (VDS) to our net (Figure 2.). The VDS is similar in design to a VDS used by the Bureau of Commercial Fisheries Exploratory Fishing and Gear Research Base in Seattle, Washington.

The VDS has a frame of 2½-inch aluminum tubing and is 2 feet wide by 10 feet high. There are five openings in the upper 6 feet, each measuring 1 foot vertically by 2 feet horizontally. Crosspieces of 2½-inch aluminum tubing separate the openings. Knotless nylon, ½-inch mesh bags, 7 feet in length, were attached to each opening.

## RESULTS

A summary of the average sex and age composition of the shrimp samples is presented in Table 1. The changes in the sex composition reflect the increase in abundance of 1969-year class males as they increase in size and become more vulnerable to the gear. Also indicated, during the first four cruises, is the decrease in transitionals as they complete their sex change and become females. The percent composition of transitionals increases during the first half of the calendar year (cruises 70-2 through 70-9) as the males begin their sex change. The most notable change in the age composition is the increase of zero-age shrimp (1969-year class) as they become vulnerable to the gear.

Figure 2. Placement of Vertical Distribution Sampler in Semiballoon Trawl.

Table 1. A Summary of Average Trawl Catch Per  $\frac{1}{2}$  Mile and Sex and Age Composition of Samples Taken During Pink Shrimp Distribution Study <sup>1/</sup>.

Cruise	Date	Avg. Catch Per $\frac{1}{2}$ -Mile lbs.	Sex Composition - %			Age Composition - %			
			Male	Trans.	Female	0	I	II	III+
69-2	7/16-19/69	3/	59.1	15.9	25.0	0.4	61.9	9.2	28.5
69-4	9/ 8-10/69	92	53.5	12.6	33.9	1.1	61.3	9.0	28.6
69-6	10/11-12/69	52	63.7	6.4	29.9	2.9	64.9	6.1	26.1
	10/ 17/69								
69-7	11/11-13/69	39	64.5	1.1	34.4	3.6	66.4	5.3	24.7
70-2	2/10-12/70	17 <sup>4/</sup>	78.6	2.4	19.0	31.2	54.8	2.5	11.5
70-4	3/18-20/70	56	58.6	16.8	24.6	-	45.4	38.5	16.1
70-7	4/27-30/70	93	55.1	19.2	25.7	-	45.5	37.4	17.1
70-9	6/ 3 /70	116	56.2	23.8	20.0	0.1	51.7	36.8	11.4
	6/ 6- 8/70								

<sup>1/</sup> Data is from 12 stations (4-5, 10-15, 18-20) with the exception of cruise 69-2 which represents 9 stations, excluding stations 18-20.

2/ For cruise 69-2 through 70-2, age designations refer to the following year classes:

<u>Age</u>	<u>Year Class</u>
0	1969
I	1968
II	1967
III+	1966 and earlier

For cruise 70-4 through 70-9:

<u>Age</u>	<u>Year Class</u>
0	1970
I	1969
II	1968
III+	1967 and earlier

3/ Tows were made on a time interval, rather than a distance interval therefore, are not comparable.

4/ No tow at Station 18, average is of 11 stations.

The average catch per  $\frac{1}{2}$  mile in the study area decreased from 92 pounds in September, 1969 (cruise 69-4) to only 17 pounds per  $\frac{1}{2}$  mile in February, 1970 (cruise 70-2). The average catch then increased to 116 pounds by June, 1970 (cruise 70-9).

Stations 1-3 and 7-9 were established to determine if these areas were nursery grounds for the 1969-year class (young-of-the-year). Numbers of shrimp caught at these stations are presented in Table 2.

Table 2. Catches of 1969-Year Class Shrimp in Numbers at Stations 1-3 and 7-9, Pink Shrimp Distribution Study.

Cruise	Station					
	1	2	3	7	8	9
69-2	0	0	0	49 (12,284) <u>1/</u>	NT <u>2/</u>	NT
69-4	NT	NT	0	24 (4,189)	72 (3,547)	0 (960)
69-6	NT	NT	0 (20)	144 (191)	147 (12,891)	2 (66)
69-7	NT	NT	0	714 (5,666)	816 (27,566)	1 (12)
70-2	NT	NT	0 (28)	152 (284)	(388)	(34)
70-4	NT	NT	0	277 (286)	16,921 (18,001)	1 (3)

1/ The numbers in parenthesis represent total number shrimp caught by station.

2/ No Tow

Station 3 at 50 fathoms never yielded more than 0.2 pounds of shrimp. After the first cruise we decided that if station 3 yielded little or no shrimp no tows would be attempted at stations 1 and 2.

Stations 7-9, west of the main study area, yielded good catches of shrimp, especially station 8. Poor catches were experienced at station 7 from time to time. A large shale pile was located near station 7 and the poor catches may have been the result of towing over unsuitable bottom or strong bottom currents in the area or a combination of both. Station 9, at 150+ fathoms, probably was near the maximum depth limit of pink shrimp distribution.

Tows at these inshore and offshore stations did not yield significant concentrations of 1969-year class shrimp when they were 0-age. A few stations did have high percentages of the 1969-year class shrimp, but the total numbers caught were low or nearly similar to catches made in the main study area. These inshore and offshore stations were eliminated after cruise 70-4 because they did not appear to be nursery areas.

During the course of the study we learned of Dr. Alan Beardsley's work with a vertical distribution sampler. He found that during the day pink shrimp can be caught up to 12 feet off the bottom. This led to some concern that our net, with an opening of four feet, may have been missing quantities of shrimp. With the cooperation of Dr. Beardsley and the BCF in Seattle, we were able to design and install a VDS suitable for our net. We tested the net with the VDS installed in 7-10 fathoms of water and divers observed that the configuration of the shrimp net was not greatly altered. We used the VDS during the last four cruises of the study (cruises 70-2, 4, 7, and 9).

A summary of the total number of shrimp caught in the VDS and the average number caught per tow is presented in Table 3. During the cruise 70-2 and 70-4 catches in the VDS were poor. The catches then increased substantially during

cruises 70-7 and 70-9. These increased catches may be related to the increased density of shrimp on the bottom as reflected by the larger trawl catches (see Table 1). Another apparent change during the last two cruises was a noticeable decrease in water clarity. The Columbia River plume had shifted southward over the study area during cruises 70-7 and 9. Photometer readings taken to 90 feet below the surface after each tow indicated a decrease in the amount of light as compared with cruise 70-2 and 4. We suspect that the decreased amount of light reaching the bottom affected a slight change in the shrimp's daily habits in that they more readily rose off the bottom. The data needs further analysis to substantiate this supposition.

The field work for the shrimp abundance and distribution study has been completed. The data is being analyzed and the writing of the final report is underway.

Table 3. Summary of VDS Catches in Numbers of Pink Shrimp Caught Per Trip and Average Catch Per Tow, Shrimp Distribution Study.

Cruise	Number of Tows	Total Number Caught	Avg. Catch Per Tow
70-2	15	1	0.07
70-4	16	9	0.7
70-7	24	642	26.8
70-9	24	3423	142.6