

Volume 8



1966-1967

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STATE OF ALASKA

Walter J. Hickel, Governor

ANNUAL REPORT OF PROGRESS, 1966 - 1967

FEDERAL AID IN FISH RESTORATION PROJECT F-5-R-8

SPORT FISH INVESTIGATIONS OF ALASKA

ALASKA DEPARTMENT OF FISH AND GAME
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INTRODUCTION

This report of progress consists of findings and work accomplished under the State of Alaska Federal Aid In Fish Restoration Project F-5-R-8, "Sport Fish Investigations of Alaska."

The project during this report period is composed of 20 separate studies. Some are specific to certain areas, species or fisheries, while others deal with a common need for information. Each job has been developed to meet the needs of various aspects of the State's recreational fishery resource. Seven jobs are designed to pursue the cataloging and inventory of the numerous State waters. These are divided into logical utilization areas and are jobs of a continuing nature. It will be many years before an index of the potential recreational fishing waters is completed. Six jobs are directed toward specific sport fish studies. These include special efforts toward the anadromous Dolly Varden of Southeastern Alaska, silver salmon in Resurrection Bay, king salmon stocks on the lower Kenai Peninsula, king and other salmon stocks in Upper Cook Inlet, and Arctic grayling and sheefish in Interior Alaska. Special reports have been prepared on specific phases of the Dolly Varden life history and appear in the Department's special "Research Report" series.

The Statewide access evaluation remains one of the most important jobs conducted under this Federal Aid Program. It provides the Department with a tool to recommend withdrawal of suitable access sites on potential recreational fisheries throughout the State.

The remaining jobs include creel census efforts on specific fisheries in high use areas of the State, an egg-take program directed toward locating suitable indigenous stocks, perfecting advanced techniques in taking, handling and rearing species that are not normally associated with standard fish cultural practices, and continuation of the evaluation of the Fire Lake System.

The material contained in this report is often fragmentary in nature. The findings, evaluations and interpretations contained herein are subject to re-evaluation as the work progresses and additional data are collected.

RESEARCH PROJECT SEGMENT

STATE: ALASKA Name: Sport Fish Investigations of Alaska.
Project No: F-5-R-8 Title: Investigation of Anadromous Dolly Varden Populations in the Hood Bay Drainages, Southeastern Alaska.
Job No: 2-B

Period Covered: June 1, 1966 through April 27, 1967.

ABSTRACT

This report presents the results of the first year's operation of the Hood Bay Creek weir and the fifth year of investigation of the life history of the Dolly Varden Salvelinus malma (Walbaum). Emphasis of study included determining the number of Dolly Varden entering Hood Bay Creek, the maturity composition of these immigrants and the migration characteristics of the potential spawner and nonspawner char entering the system.

An estimated 5,533 Dolly Varden entered Hood Bay Creek from the sea in 1966. This migration began in mid-June, peaked in late July and early August and ended in early November. The immigration was considered to consist of 2,158 (39%) potential spawners for the year, of which 988 (46%) and 1,170 (54%) were considered to be females and males, respectively. Egg size and ovary weights of the potential female spawners increased rapidly until the beginning of spawning in October. At this time their egg diameters were between 5.0 and 6.0 mm. A maturity index of 15 to 20 percent was calculated for the female Dolly Varden immediately prior to spawning in Hood Bay Creek.

The majority of the Dolly Varden which had entered Hood Bay Creek in 1966 left the system in the same year. The immature Dolly Varden left the system soon after their date of entry while char spawning in Hood Bay Creek remained in the system until spawning was completed. The length of time spent in the system was reflected in their growth because length increment of the spawning char, while in the system, was three times greater than the nonspawning char.

Dolly Varden spawning activity was first observed in Hood Bay Creek on October 21 and periodically thereafter until November 2. Hydraulic sampling of Dolly Varden eggs and pre-emergent fry resulted in estimates which may indicate an excellent survival of the char eggs during the 1966-67 winter.

Stomach analysis of immigrant char indicated that salmon eggs were the most frequently eaten food while the char were in Hood Bay Creek. Insects of the orders Plecoptera and Diptera were the most frequently found food item in rearing char.

RECOMMENDATIONS

The 1967 study should concentrate on determining the homing capabilities and strength of Dolly Varden migrants in Hood Bay Creek. Special emphasis should be placed on obtaining as complete a coverage and marking as possible of the initial outmigrant Dolly Varden from Hood Bay Creek. Since this group of char are known to have originated from Hood Bay Creek their importance in determining the homing of Dolly Varden cannot be over-emphasized.

The sampling of the migrant char at the weir should be expanded to include at least 10 percent of the enumerated migrants. The 5 percent sample in 1966 was found to be an inadequate coverage for some of the objectives. In addition, every tenth char dip netted from the trap should be sampled, rather than dip netting each day's sample consecutively as was done in 1966. This should help eliminate the sampling bias that occurred in the 1966 sampling program.

Specifically, objectives 2, 5 and 12 of the 1966 program should be eliminated from the investigation outline in 1967. Information obtained on objectives 2 and 5 are considered to be sufficient for the present. Accomplishment of objective 12 is of little future value to the project. The remaining 1966 objectives should be continued with some minor changes.

The objectives recommended for the 1967 study are as follows:

1. Determine the number and timing of Dolly Varden leaving Hood Bay Creek on their first migration to sea.
2. Determine the number and timing of Dolly Varden entering and leaving Hood Bay Creek.
3. Determine the number and timing of salmon entering Hood Bay Creek.
4. Determine the size, sex ratio and age of Dolly Varden migrating to sea for the first time from Hood Bay Creek.
5. Determine the size, sex ratio and age of Dolly Varden entering and leaving Hood Bay Creek.
6. Determine the homing tendencies, within the year, of Dolly Varden leaving Hood Bay Creek on their first migration to sea.
7. Determine the homing tendencies, within the year, of immigrant Dolly Varden displaced from Hood Bay Creek.
8. Determine the homing tendencies of Dolly Varden entering Hood Bay Creek.
9. Determine the number of mature (potential spawners for the year) and non-spawning Dolly Varden entering Hood Bay Creek.
10. Determine the frequency of spawning, by sex, of Dolly Varden spawning in Hood Bay Creek.
11. Determine if mortality of char occurs after spawning and obtain an estimation of mortality rate of spawned out char by sex.
12. To locate spawning areas of Dolly Varden in Hood Bay Creek.
13. Estimate Dolly Varden egg deposition and over-winter survival of the eggs in a selected area of Hood Bay Creek.
14. Evaluation of hydraulic sampling techniques in providing a deposition index.
15. Determine the distribution of Dolly Varden and salmon in Hood Bay Creek on a weekly basis.
16. To obtain information on the physical and chemical conditions of Hood Bay Creek.
17. Determine the food of Dolly Varden migrating to sea for the first time from Hood Bay Creek.
18. Determine a tag suitable for use on Dolly Varden less than 150 mm in fork length.
19. To evaluate the effectiveness of the Hood Bay Creek weir to stop and trap Dolly Varden on their first migration to sea.

OBJECTIVES

1. Determine the degree of usage of a non-lake system for spawning purposes.
2. Obtain supplemental data pertaining to gonad characteristics, ovary weight, egg diameters and fecundity.

3. Determine age and length of the 1966 potential spawners.
4. Determine distribution and progress of movement of Dolly Varden to the spawning sites.
5. Determine sex ratios on the spawning site and degree of intermingling or schooling of spawning fish.
6. Determine physical and chemical conditions of the spawning site.
7. Estimate total egg deposition, number of females spawning, number of redds constructed, number of eggs deposited per redd and potential egg survival.
8. Determine frequency of spawning.
9. Determine if mortality of char occurs after spawning and obtain an estimation of mortality rate of spawned-out char.
10. Determine the number of Dolly Varden entering and leaving Hood Bay Creek.
11. Instigate a program to determine the migration habits of Dolly Varden entering and leaving Hood Bay Creek.
12. To evaluate foot survey data collected in 1965 on number of Dolly Varden estimated to be in Hood Bay Creek.

Information was obtained on all objectives except number 12. Due to an incomplete enumeration of the outmigrants, the number of Dolly Varden present in the creek at the time of the foot surveys could not be accurately determined.

Objectives 8 and 9 were instigated in 1966 and are dependent on recovery of the tagged char in subsequent years. Hence, the results of the work accomplished on these two objectives will not be available for this report.

TECHNIQUES USED

An 85-foot wood weir with removable 5/8-inch mesh screens was built across Hood Bay Creek. The weir (Figure 1) contained three traps of which two were operated in the direction of major migration.

All immigrant char captured in the weir traps were measured (fork length in mm) and either released or sampled. The released char were fin clipped (right ventral) and tagged with dart tags using techniques similar to that described by Armstrong and Blackett (1966). Each char sampled was weighed (to the nearest .01 lb.) and dissected to determine sex, degree of maturity and stomach content. Otoliths were obtained from the sampled char and stored (dry) for later age analysis.

Outmigrant char captured in the weir traps were measured and examined for fin clip or tag. All unmarked char were fin clipped (right ventral) and tagged with dart tags. Spawned-out char were recorded as such and sexed by external characteristics. Initial outmigrant char which entered the traps in early summer were only enumerated.

Foot surveys were periodically conducted to count the number of Dolly Varden by section of the creek and to make observations of spawning Dolly Varden.

Hydraulic sampling of a selected Dolly Varden spawning site was conducted to determine egg deposition and overwinter survival of the eggs. The technique of sampling was identical to that described by Blackett (1967).

Certain adjustments were made on the data to obtain estimates of the total immigrant population and maturity composition of the immigrant char. These adjustments were necessary because removal of the weir screens during high water periods caused char to be missed. Also, a bias was found to occur in the sampling technique which favored the larger char. The method of obtaining these estimates is presented as follows:

1. The estimate of the total immigration of char was obtained by using the ratio of unmarked (429) to marked (552) outmigrant char captured and the number of

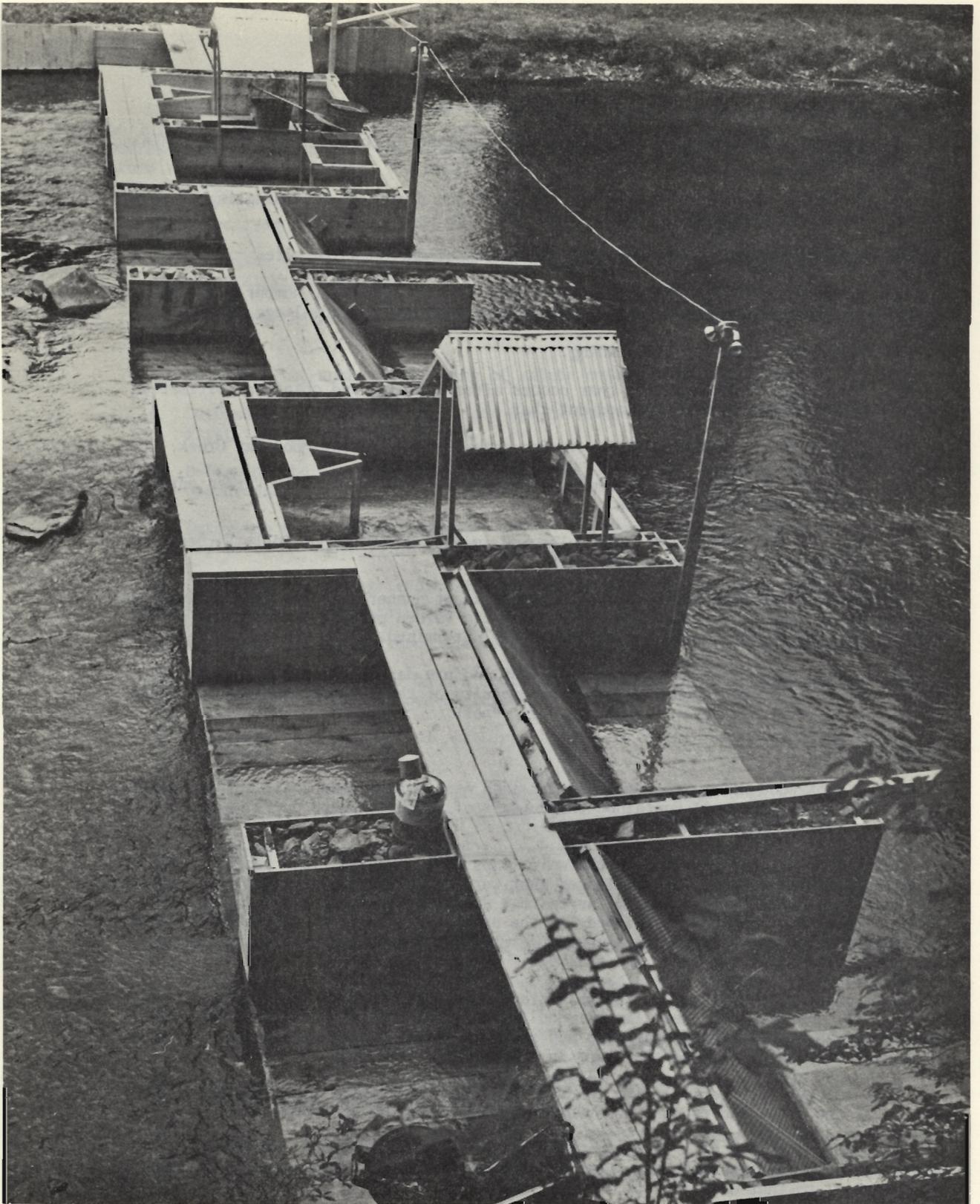


FIGURE 1. The 85-foot wooden weir at Hood Bay Creek, Admiralty Island, Southeastern Alaska.

marked immigrant char available for recapture (2,843). The number estimated to have been missed (2,209) was then added to the number sampled (138), to those found dead at the weir (343), and to those marked char available for recapture (2,843). The resulting figure (5,533) was considered to be the total number of char which entered Hood Bay Creek in 1966.

2. A correction for bias of selection among the sampled char was obtained by dividing the sample (131) and enumerated char (2,999) into four length groups, and multiplying the percentage of potential spawners found in each length group of the sample times the number of enumerated char in each length group. The calculated number of potential spawners in all of the four length groups was considered to be the number of potential spawners among the enumerated char. The percentage of potential spawners among the enumerated char was then considered to be the percentage of all the immigrants which were potential spawners in 1966.

FINDINGS

The findings presented are mostly the result of the first year's operation of the Hood Bay Creek weir. Much of this information will be re-evaluated and become more meaningful as subsequent years' data are collected. For information collected on the Dolly Varden project in previous years see Armstrong (1963, 1965a, 1965b, 1965c), Armstrong and Blackett (1966a, 1966b), Blackett (1967), Blackett and Armstrong (1965a, 1965b) and Heiser (1966).

Numbers and Timing of Out-and In-Migrant Dolly Varden

The migration of anadromous Dolly Varden in Hood Bay Creek can be separated into three, somewhat distinct, migrations termed initial outmigrants, immigrants and outmigrants.

Initial outmigrants are those char migrating to sea for the first time after rearing for usually three or four years within the creek. These char may leave the system from March through July.

Immigrants include the returning initial outmigrants and char that are entering the creek after spending the winter in some other area. This latter group comprises char which have probably originated from Hood Bay Creek as initial outmigrants in previous years. These fish are presumed to have wintered in lakes as do the Dolly Varden of the Peril Strait area (Armstrong, 1965c). Immigrants may enter the creek from June through November.

Outmigrants include the immigrants that have entered the system within the same year. The majority, if not all, of the immigrants leave the system in the same year of entry and presumably migrate to a lake for the winter. This migration may occur from July through November with very few, if any, of these char remaining in the creek later than November.

Initial Outmigrants:

Enumeration of initial outmigrant char in 1966 was limited to a period after June 1 when construction of the weir was completed. The peak of the initial outmigration probably occurred prior to this date.

Between June 2 and June 18, 365 initial outmigrant Dolly Varden were enumerated at the weir. After June 18 only 15 more were enumerated with the last one captured at the weir on July 17.

Immigrants:

An estimated 5,533 Dolly Varden entered Hood Bay Creek from the sea in 1966. The migration began in mid-June, peaked in late July and early August and ended in early November (Figure 2). Substantial numbers of Dolly Varden entered the system periodically from mid-July through mid-October. By early August, 50 percent of the total immigration had entered the system and by late September over 75 percent had entered Hood Bay Creek (Figure 3).

The peaks of Dolly Varden immigration usually occurred during high water periods (Figure 2). The migration began at a water temperature of 41° F, increased as the water temperature declined, ending at a water temperature of 38° F. (Figure 2).

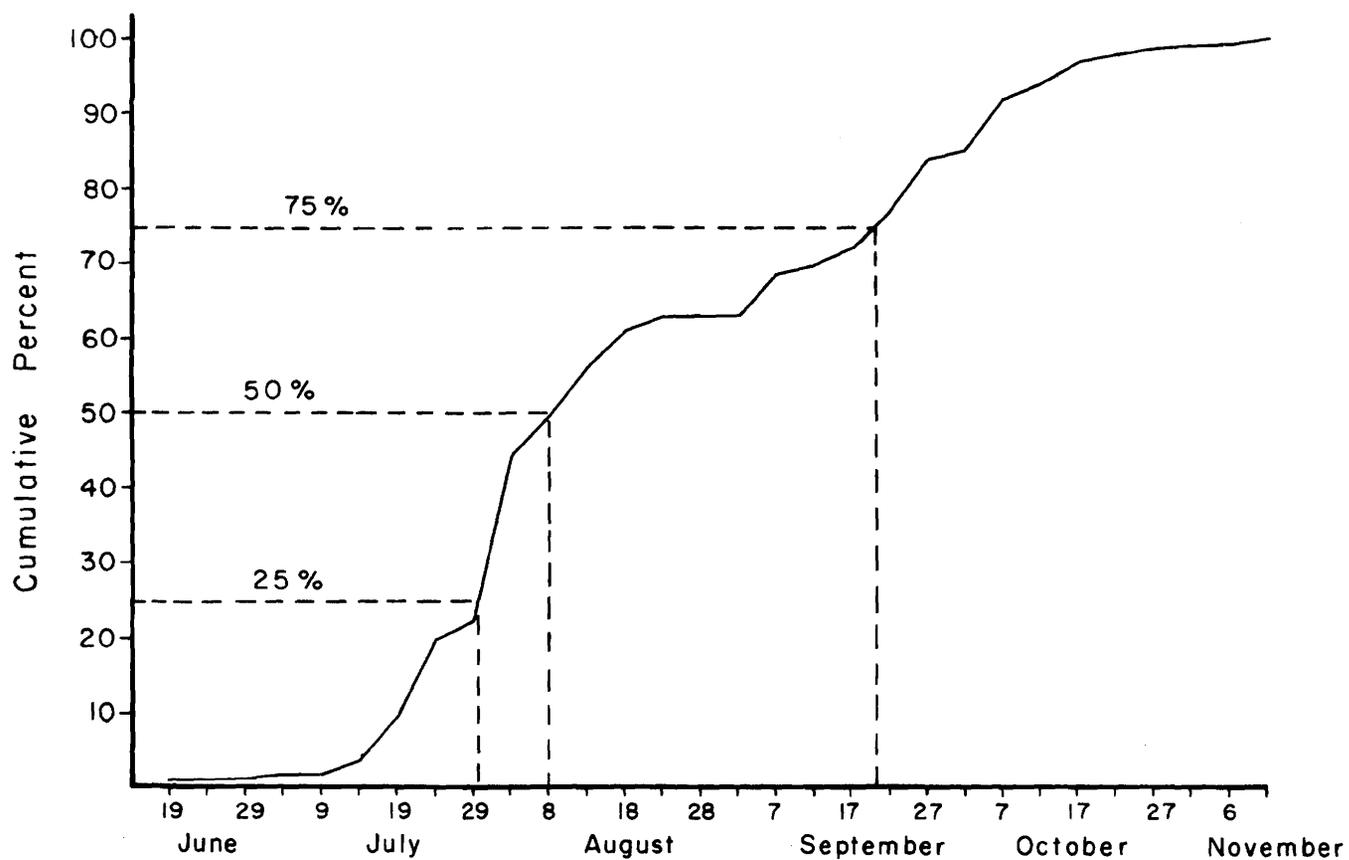


Figure 3. Cumulative Percent of Dolly Varden Entering Hood Bay Creek by Five Day Intervals, 1966 (N=5,533).

Dolly Varden began entering Hood Bay Creek before the migration of pink, chum and coho salmon began in mid-July. Both pink and chum salmon migrants peaked in mid-September when over 50 percent of the total Dolly Varden immigrants had entered the system. The last pink salmon migrant was enumerated in mid-October and the chum salmon migration was over by the end of October. A total of 20,451 pink, 15,845 chum and 85 coho salmon was enumerated at the Hood Bay weir in 1966.

There was no apparent correlation with the size of immigrant Dolly Varden and their date of entry. The mean fork length of the immigrants by five-day interval fluctuated considerably from one period to the next (Figure 4).

The timing of the entry of mature and immature Dolly Varden into Hood Bay Creek was similar. The percentage of potential spawners entering the creek by month was similar to the percentage of the total Dolly Varden captured at the weir during each month (Table 1). This indicated that in 1966 the potential spawners followed the same trend of immigration as the immature Dolly Varden.

TABLE 1. Comparison by Month of Entry of Sampled Potential Spawners, Out-migrant Spawners, Number Enumerated and Estimated In-Migrants--Hood Bay Weir, 1966.

Month of In-Migration	Sampled Potential Spawners		Tagged Out-mig. Spawners		No. Avail. for Tagging & Sampling		Estimated In-migration	
	No.	%	No.	%	No.	%	No.	%
June	1	1.7	1	0.3	45	1.4	46	0.8
July	22	37.3	167	46.6	1388	44.3	1428	25.8
August	20	33.9	103	28.8	979	31.2	1981	35.8
September	14	23.7	66	18.4	424	13.5	1245	22.5
October	2	3.4	21	5.9	296	9.4	812	14.7
November	<u>0</u>	<u>---</u>	<u>0</u>	<u>---</u>	<u>3</u>	<u>0.1</u>	<u>21</u>	<u>0.4</u>
Total	59	100.0	358	100.0	3135	99.9	5533	100.0

Outmigrants:

The number of outmigrant Dolly Varden in 1966 cannot be determined because of the high water periods when the weir was inoperable, resulting in an incomplete enumeration of these char. It is believed that the majority of the Dolly Varden which had entered the creek in 1966 left the system in the same year. On November 21, only 173 Dolly Varden could be counted within the system. On April 4, 1967 a survey of the creek indicated that all of the 1966 immigrants had left the system.

There was a distinct difference in the timing of outmigrants by maturity (Figure 5). Immature Dolly Varden left the system soon after their date of entry. The majority (over 80%) of the immature char had left the system before the spawning segment of the population began leaving (Figure 5). The tagged immature Dolly Varden spent an average of 14 days in the creek with over 74 percent leaving the system less than 12 days after their date of entry (Figure 6).

Dolly Varden spawning in Hood Bay Creek remained in the system until spawning was completed and then left the system soon thereafter. Spawners left Dolly Varden began leaving the system in mid-October and most of these char had left by the end of November (Figure 5). Dolly Varden spawners spent an average of 80 to 90 days in Hood Bay Creek in 1966 (Figure 6). Over 60 percent of the spawners left the system between 82 and 111 days after their date of entry.

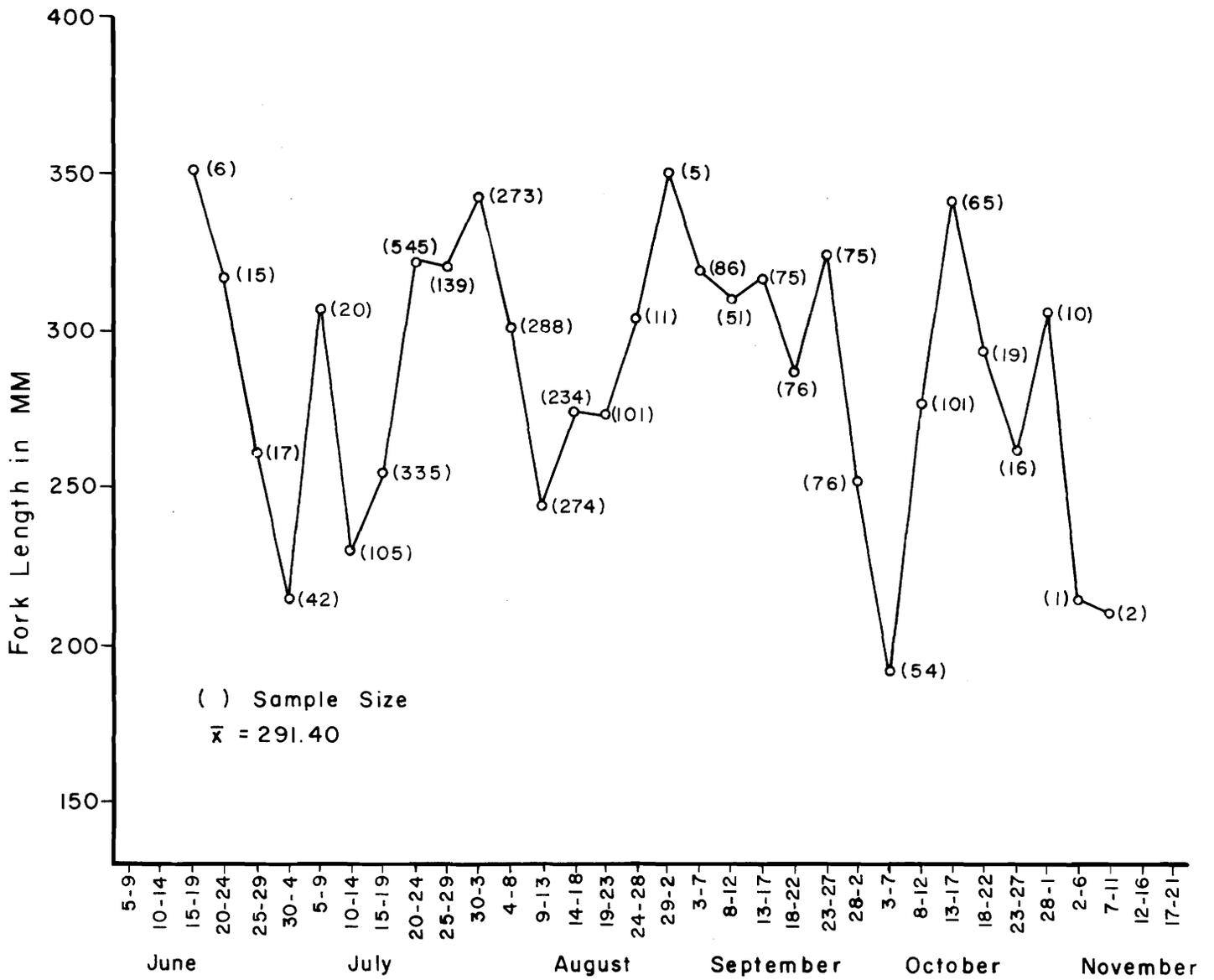


Figure 4. Mean Fork Length of In-migrant Dolly Varden Measured at the Hood Bay Weir by Five Day Intervals, 1966 (N=3,117).

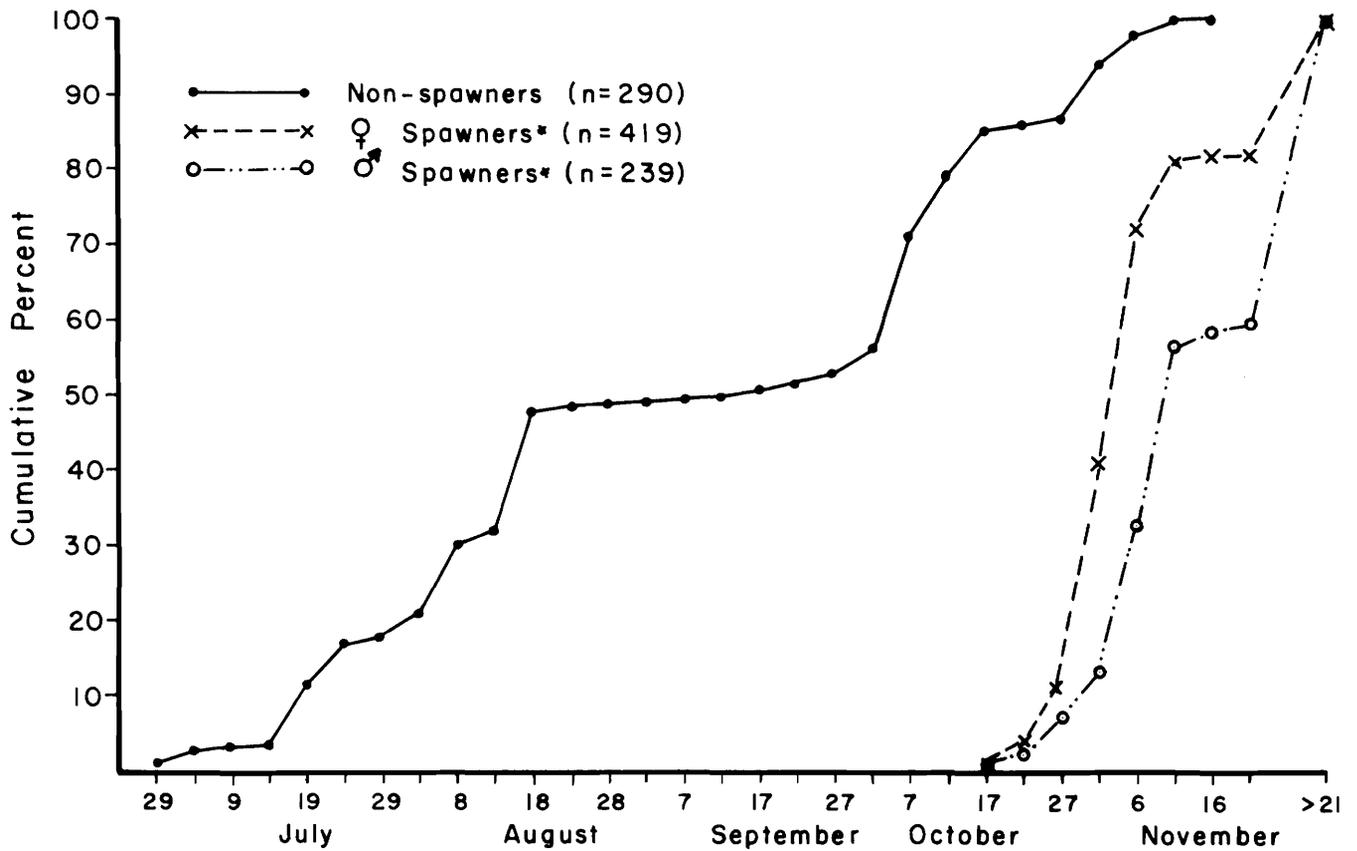


Figure 5. Cumulative Percent of Dolly Varden Spawners and Non-spawners Leaving Hood Bay Creek by Five Day Intervals, 1966.

* Char Classified as Spawned-out by External Examination.

Male spawners spent more time in Hood Bay Creek and left the system later than the females. Males spent an average of 90 days while females spent an average of 81 days in Hood Bay Creek (Figure 6). By November 21, approximately 82 percent of the female and 59 percent of the male spawners had left the system.

Maturity of the Immigrants

The immigrations of Dolly Varden into lakes and streams consist of sexually immature and mature (potential spawning) char. The percentage of the immigration which are potential spawners may not be directly related to the number of Dolly Varden entering a system. The study conducted at Lake Eva indicated that of the 82,950 immigrant char in 1964 only 2.56 percent were considered to be potential spawners (Blackett, 1967). The reason for the low percentage of potential spawners entering the lake is probably due to the large number of char which have originated from systems other than the lake. Many of these char enter the lake after spawning in their respective streams. The immature recruitment stock from these streams will also enter the lake for the winter. Hence, the immigration of char into a lake may consist of many races with the potential spawners consisting of a percentage of the race originating only from the lake system. In contrast the percentage of migrants entering a nonlake system which are potential spawners may be much higher than the lake system because these immigrants may be of a single race. The study at Hood Bay Creek was set up to determine the percentage of the immigrants that could be expected to spawn in 1966.

Of the estimated 5,533 Dolly Varden entering Hood Bay Creek, 2,158 (39.0%) were considered to be potential spawners for the year. The 3,375 other immigrants were non-spawners for the year. These char consisted of fish which had not spawned before and those which had spawned in a previous year but were sexually immature (nonconsecutive spawners).

Of the 2,158 potential spawners, 988 (45.8%) and 1,170 (54.2%) were considered to be females and males respectively. It is interesting to compare the Hood Bay Creek results with those of the Lake Eva system in 1964. The number of potential spawners calculated to have entered Lake Eva was 1,103 females and 1,040 males (Blackett, 1967). Hence, despite the fact that the Lake Eva immigration was almost 15 times greater than the Hood Bay Creek immigration, the number of potential spawners entering these two systems was approximately the same.

The average length, weight, egg diameter and ovary weight are given by month for the female potential spawners in Table 2. The nonspawners of stage V are included for comparison as this group includes those char in which the gonads are the most developed of those classified as immature. Blackett (1967) describes this group as including the char which have egg diameters greater than 0.90 mm but less than 1.75 mm. Although the potential spawners and nonspawners are easily separated by egg diameter and ovary weight in July, difficulty in separation by maturity may be experienced among char sampled prior to July.

A rapid development of the ova prior to spawning in October is evident from the September and October samples of potential spawners (Table 2). This apparent accelerated growth of the ovaries in September was also observed among the char sampled at Lake Eva by Blackett (1967). The information indicates that the egg size at maturity for the char from Hood Bay Creek may be greater than a 5.0 mm diameter and less than a 6.0 mm diameter.

A maturity index (Table 2) was calculated by sample month for the potential spawners by dividing the average ovary weight by the average body weight and expressing the quotient as a percentage of the body weight. According to Blackett (1967) the maturity index provides a better method of expressing maturity than the increase in ovary weight when there is variation in fish size and age between samples. The maturity index for the Hood Bay Creek char increased rapidly from 3.7 percent in July to 19.1 percent in October. A sample of 66 maturing char taken from Hood Bay Creek in September and the first week in October in 1965 had an average maturity index of 15.1 percent (Blackett, 1967). This indicates the maturity index for the Hood Bay Creek Dolly Varden immediately prior to spawning is probably somewhere between 15 and 20 percent.

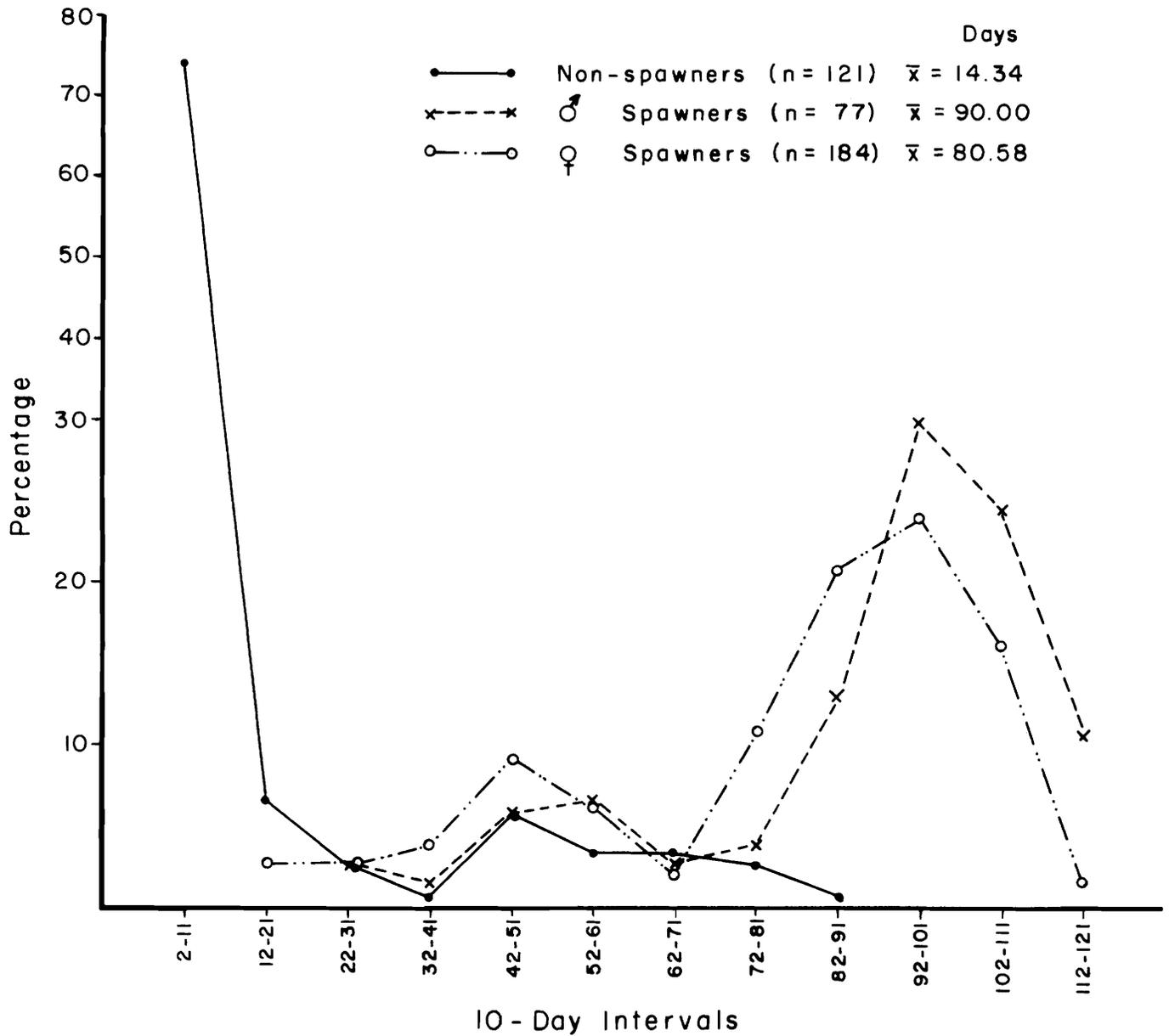


Figure 6. Percentage of Number of Days Spent in Hood Bay Creek, 1966, by Ten Day Intervals for Non-spawning and Spawning Dolly Varden.

TABLE 2. Average Measurements by Month, of Length, Weight, Egg Diameter and Ovary Weight of 58 Immigrant Dolly Varden at Hood Bay Creek, 1966.

<u>Maturity</u>	<u>Month</u>	<u>Sample Size</u>	<u>Average</u>				<u>Maturity Index</u>
			<u>Length</u>	<u>Weight</u>	<u>Egg Diameter</u>	<u>Ovary Weight</u>	
Potential Spawners	July	11	387mm (343-410)	662g (472-1,021)	2.62mm (2.25-3.28)	24.62g (12.38-41.13)	3.7%
	August	13	376 (283-440)	640 (263-939)	3.06 (2.51-3.83)	36.72 (7.30-81.73)	5.7%
	September	4	364 (334-392)	667 (508-894)	4.31 (4.05-4.57)	66.63 (58.27-76.60)	10.0%
	October	2	426 (375-477)	975 (621-1,325)	5.63 (5.22-6.03)	186.39 (123.85-248.92)	19.1%
Non-Spawners (Stage V)	July	17	333mm (235-400)	413g (136-712)	1.59mm (1.06-2.49)	6.09g (0.57-20.43)	
	August	9	276 (218-380)	249 (109-626)	1.32 (0.82-2.27)	4.07 (0.22-17.83)	
	September	1	340	467	1.27	2.50	
	October	1	341	458	1.07	2.66	

Age and Size of the Immigrants

The length frequency of 2,996 immigrant Dolly Varden measured at the Hood Bay Creek weir in 1966 is presented in Figure 7. The immigrant char ranged in fork length from 121 to 520 mm. The majority of the char in the 121 to 250 mm range are probably the recruitment stock of age III and IV char for 1966. These fish probably are returning to the system after leaving it in the spring of 1966. The majority of the char larger than 250 mm are probably entering Hood Bay Creek after spending the winter in a lake.

The size and age of the sampled immigrant char are presented in Tables 3 and 4. These figures should not be considered representative of the age composition of the immigrant char in 1966 as the larger size classes were oversampled. However, comparison of the size of nonspawners and potential spawners by age group and between age groups should be as reliable as the sample sizes will allow.

Age groups II through VIII were found among the immigrant char in 1966. The majority of the migrant char were from age groups III through VII. Similar ages and age groups were found among the Dolly Varden entering Lake Eva and Saook Creek on Baranof Island in Southeastern Alaska (Heiser, 1966).

The average size of the potential spawner immigrant was larger than the average size of the nonspawner immigrant in each age group (Tables 3 and 4). This indicates that maturity of the char may be more closely related to size than to age.

The average fork length by age increased markedly between age IV and V (Figure 8). Many of the age III and IV immigrant char are from the 1966 recruitment stock which probably spend less time at sea than do the older age groups. The age V group consists mostly of previous years' recruitment char, which has spent more time away from the system than younger age groups, hence the greatest increase in growth would be expected to occur between age IV and V. There were no obvious differences in growth rate between the male and female Dolly Varden (Figure 8).

The percentage of the char in each age group which were potential spawners increased in the older age groups (Table 5). The percentage of potential spawners increased from 8.3 percent in age group III to 83.3 percent in age group VII. The information indicates that the majority of the immigrant char spawned for the first time at age V or VI.

Size of Outmigrant Dolly Varden

Dolly Varden leaving Hood Bay Creek can be separated into two distinct size groups depending on whether or not they spawned within the system. Nonspawners consist mostly of those char less than 300 mm in fork length (Figure 9). This information indicates that nonconsecutive spawning among the Dolly Varden at Hood Bay Creek may be minimal.

The growth of the nonspawning and spawning Dolly Varden while in Hood Bay Creek is related to the length of time spent within the system. In total, 115 tagged nonspawners were captured and measured as they left the system. These char averaged a 4.34 mm length increment during their average stay of 14 days within the system. Sixty percent of the nonspawners showed no growth in length while in Hood Bay Creek (Table 6). The tagged spawners (252) captured and measured as they left the system averaged a 14.28 mm length increment. However, these char spent an average of 80-90 days or approximately six times longer in the system than the nonspawning char.

Residual Eggs

The number of residual (unspawned) eggs left in the body cavity of Dolly Varden after spawning was determined for 13 char captured at the weir as they left the system. All but one of the char contained unspawned eggs. The number of residual eggs per fish ranged from 1 to 13 and averaged 6 eggs for each of the char containing unspawned eggs.

The fork length of the char containing residual eggs ranged from 342 mm to 460 with a mean of 405.

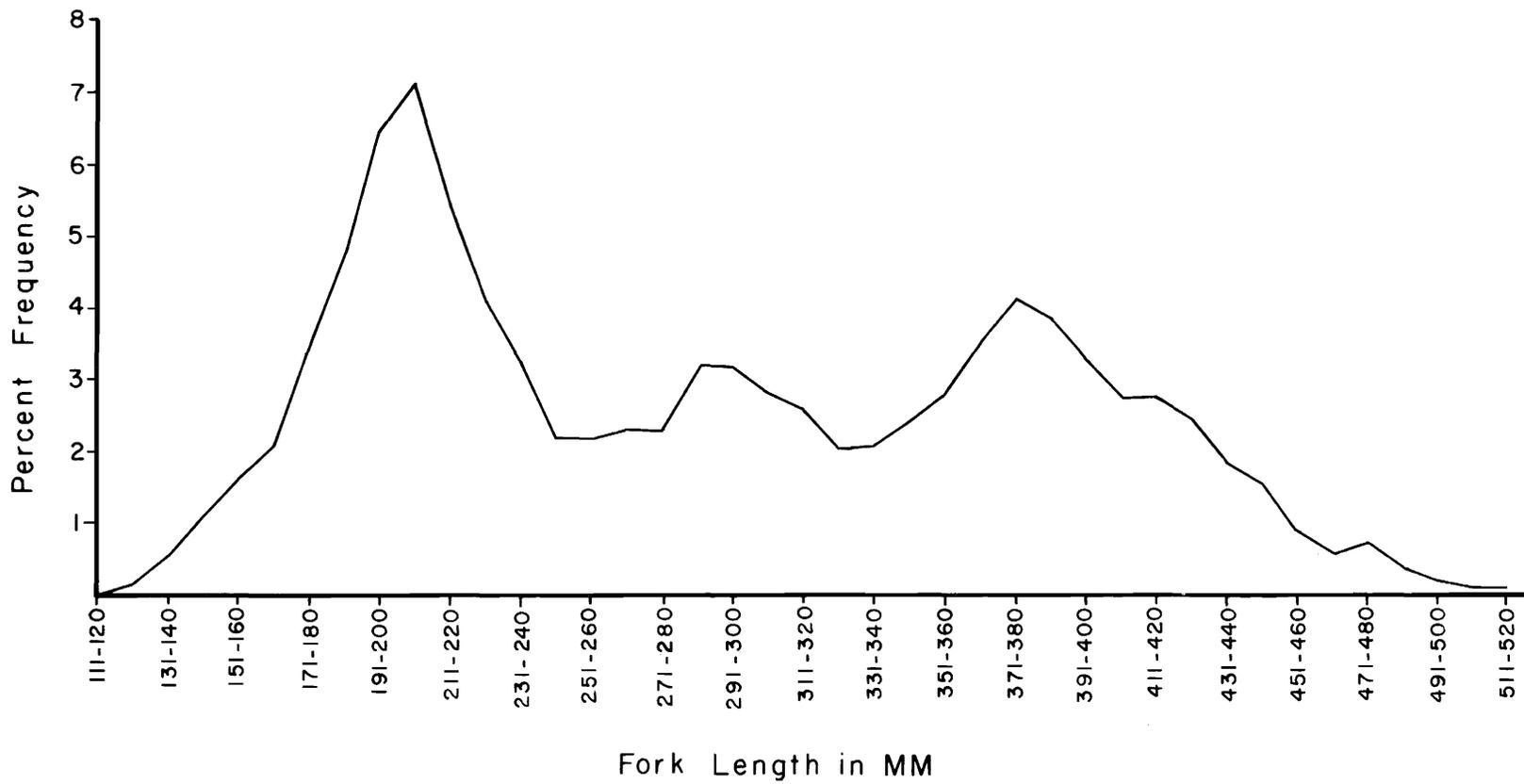


Figure 7. Length Frequency of Enumerated Dolly Varden In-migrants at the Hood Bay Creek Weir, 1966 (N=2,996).

TABLE 3. Age, Average Length and Length Range of In-migrant Dolly Varden Non-Spawners and Potential Spawners Sampled at the Hood Bay Weir, 1966.

Age Group	Non-Spawners			Potential Spawners			Totals	
	No.	Average Fork Length mm	Range mm	No.	Average Fork Length mm	Range mm	No.	Ave. Fork Length mm
II	2	182	(178-185)	0	--	--	2	182
III	11	204	(171-251)	1	214	--	12	205
IV	11	221	(166-280)	2	258	(205-310)	13	227
V	16	297	(225-389)	14	337	(235-397)	30	315
VI	6	335	(300-380)	16	378	(281-440)	22	366
VII	2	325	(295-355)	10	420	(369-477)	12	404
VIII	<u>3</u>	<u>394</u>	<u>(376-406)</u>	<u>2</u>	<u>427</u>	<u>(407-446)</u>	<u>5</u>	<u>407</u>
Total	51	267	(166-406)	45	368	(205-477)	96	314

TABLE 4. Age, Average Weight and Weight Range of In-migrant Dolly Varden Non-Spawners and Potential Spawners Sampled at the Hood Bay Weir, 1966.

Age Group	Non-Spawners			Potential Spawners			Totals	
	No.	Average Weight lbs.	Range lbs.	No.	Average Weight lbs.	Range lbs.	No.	Average Weight lbs.
II	2	0.13	---	0	--	--	2	0.13
III	11	0.20	(0.11-0.37)	1	0.24	--	12	0.20
IV	11	0.26	(0.10-0.47)	2	0.48	(0.20-0.75)	13	0.30
V	16	0.60	(0.25-1.53)	14	0.97	(0.43-1.50)	30	0.77
VI	6	0.91	(0.51-1.38)	16	1.42	(0.57-2.12)	22	1.28
VII	2	0.79	(0.52-1.05)	10	1.92	(1.15-2.92)	12	1.73
VIII	<u>3</u>	<u>1.52</u>	<u>(1.40-1.60)</u>	<u>2</u>	<u>1.89</u>	<u>(1.52-2.25)</u>	<u>5</u>	<u>1.67</u>
Total	51	0.52	(0.10-1.60)	45	1.34	(0.20-2.92)	96	0.91

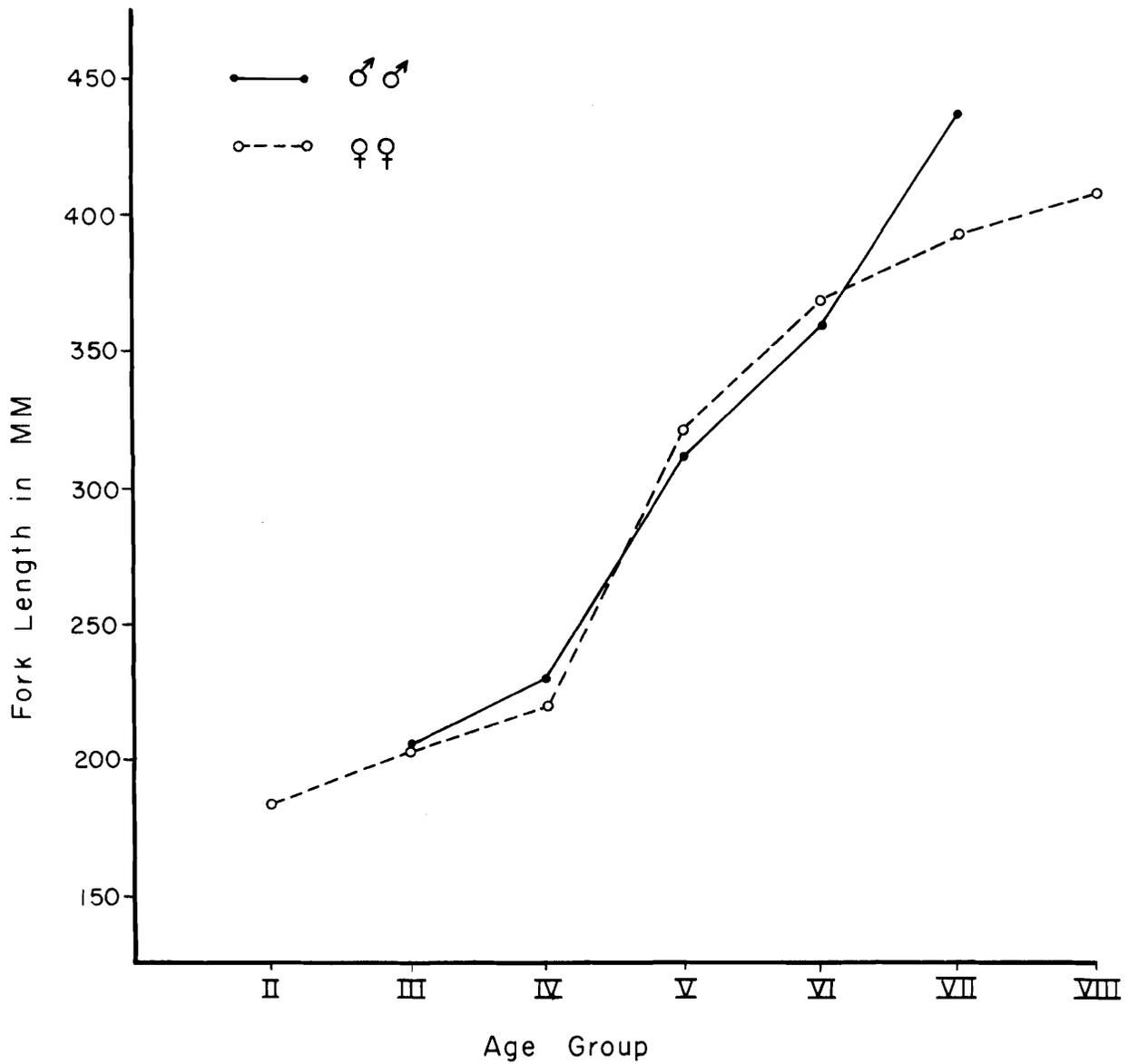


Figure 8. Growth Curves for Male and Female Dolly Varden In-migrants Sampled at the Hood Bay Creek Weir, 1966.

TABLE 5. Percent by Age Group of Non-Spawner and Potential Spawner In-migrant Dolly Varden Sampled at the Hood Bay Creek Weir, 1966.

<u>Age</u>	<u>(n)</u>	<u>Non-Spawner</u>	<u>Potential Spawner</u>
II	(2)	100.0%	0.0%
III	(12)	91.7%	8.3%
IV	(13)	84.6%	15.4%
V	(30)	53.3%	46.7%
VI	(22)	27.3%	72.7%
VII	(12)	16.7%	83.3%
VIII	(5)	60.0%	40.0%

TABLE 6. Length Increment of Non-Spawners and Spawners While in Hood Bay Creek, 1966.

<u>Length Increment in mm</u>	<u>Non-Spawners</u>	<u>Spawners</u>	
		<u>Male</u>	<u>Female</u>
0	69 (60.00%)	3 (4.05%)	19 (10.67%)
1-10	30 (26.09%)	15 (20.27%)	66 (37.08%)
11-20	5 (4.35%)	25 (33.78%)	59 (33.15%)
21-30	7 (6.09%)	20 (27.03%)	31 (17.42%)
31-40	3 (2.61%)	10 (13.51%)	2 (1.12%)
41-50	<u>1 (0.87%)</u>	<u>1 (1.35%)</u>	<u>1 (0.56%)</u>
Total	115 (\bar{X} = 4.34 mm)	74 (\bar{X} = 18.91 mm)	178 (\bar{X} = 12.36 mm)

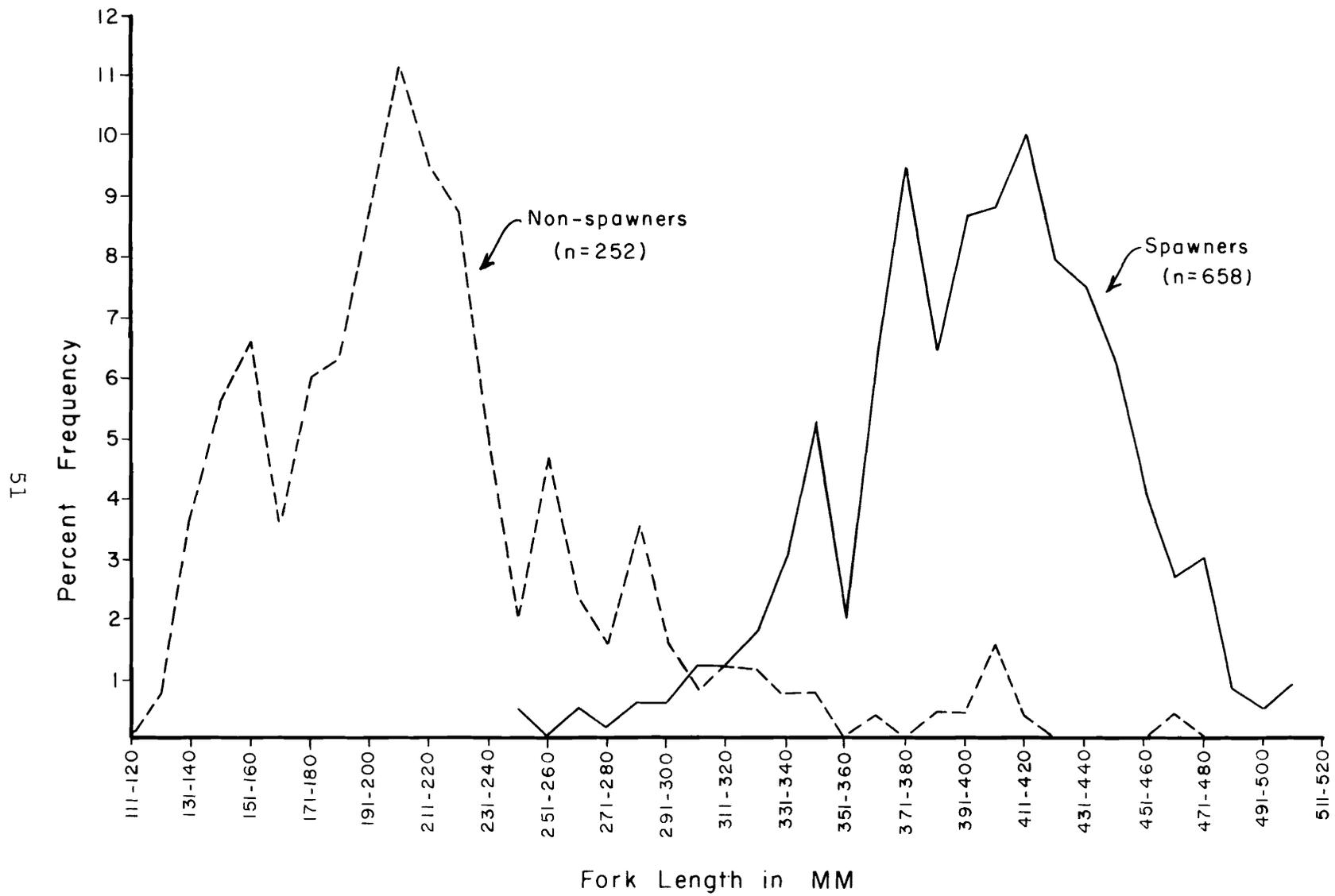


Figure 9. Dolly Varden Outmigrants Measured at the Hood Bay Creek Weir, 1966.

Distribution of Char Within the Creek

The distribution of Dolly Varden immigrants within Hood Bay Creek is indicated from periodic foot survey counts of char by creek section (Table 7). From July through September the majority of the char (over 90%) were concentrated in the lower half of the creek. In early October, Dolly Varden began moving into the upper sections in substantial numbers and by late October the greatest number of char were found in the upper quarter of the creek. On November 13, Dolly Varden could only be found in the lower sections of the creek. This pattern of distribution was also found to occur in 1965 (Blackett, 1967).

The distribution is probably related to spawning in late October and migration of the nonspawners from the creek prior to spawning. Since spawning has been observed only in the upper sections of the creek and the majority of the nonspawners have left the creek prior to spawning (Figure 5), it is understandable that Dolly Varden are concentrated mainly in the upper sections in late October. Dolly Varden found only in the lower sections on November 13 and in low numbers indicates that mature Dolly Varden leave the system after completion of spawning.

TABLE 7. Distribution of Dolly Varden Within Hood Bay Creek in 1966 as Determined from Periodic Foot Survey Counts.

<u>Date of Survey</u>	<u>Number Counted</u>	<u>Percentage Counted in Each Quarter Section of Creek*</u>			
		<u>1st</u>	<u>2nd</u>	<u>3rd</u>	<u>4th</u>
July 26	627	93.6	6.4	0.0	0.0
August 8	495	84.8	15.2	0.0	0.0
August 11	209	53.1	43.1	2.9	0.9
August 19	844	72.3	26.1	0.8	0.8
August 26	276	86.2	11.2	1.8	0.7
September 2	764	74.0	21.6	2.2	2.2
September 9	261	56.3	33.7	8.0	1.9
September 24	913	67.0	28.6	2.4	2.0
October 2	391	39.6	16.4	5.6	38.4
October 10	151	16.6	29.1	27.2	27.2
October 21	453	2.4	8.8	17.0	71.7
November 6	117	28.2	0.0	25.6	46.2
November 13	125	100.0	0.0	0.0	0.0

* The 1st quarter begins at tide water and the 4th quarter ends near the uppermost accessible (for fish) portion of the creek. Each quarter section is approximately 1,838 feet long.

Period of Spawning

Spawning activity was first observed in Hood Bay Creek in 1966 on October 21 and periodically thereafter until November 2. This period of spawning closely parallels that reported by Blackett (1967) in 1965 when spawning activity was observed in Hood Bay Creek between October 26 and November 4. Blackett (1967) believed that the spawning observations in 1965 represented the peak period of spawning rather than the inception. This is probably also true for the spawning observations made in 1966.

Egg Deposition and Overwinter Survival

Hydraulic sampling was used to determine the Dolly Varden egg deposition and overwinter survival of the eggs in a selected area of Hood Bay Creek. From 60, two-square-foot samples taken in an area of 2,379 square feet, it was determined that 17,681 + 3,306 eggs were deposited in the selected area in 1966. Sampling of the same area (60 samples) in the Spring of 1967 resulted in a pre-emergent fry estimate of 37,462 + 17,366. The data was not considered to be sufficiently reliable to attempt an overwinter survival estimate; however, the information may indicate an excellent survival of the char eggs during the 1966-67 winter.

Food

The food analysis of Dolly Varden was restricted this year to samples obtained at the weir of Dolly Varden and of rearing Dolly Varden collected in the creek by minnow trap. We have conducted studies on the food of immigrant char from streams other than Hood Bay Creek (Armstrong, 1965-66). The study was repeated at Hood Bay Creek in hopes of determining a typical pattern of feeding for char during their migration into the streams of Southeastern Alaska. The study of food of rearing char is believed to be the first study accomplished during this life history phase.

Inmigrant Char

The stomach contents of 130 inmigrant Dolly Varden captured at Hood Bay Creek weir was determined (Table 8). Of those examined, 76 (58.5%) contained food.

Salmon eggs were the most frequently occurring food item and were found in 47.4 percent of the feeding char. This same heavy feeding on salmon eggs was found to occur from samples collected in Saook Creek (non-lake system) and Eva Creek (lake system) on Baranof Island (Armstrong, 1965-66) and by other investigators working with an inmigrant population of Dolly Varden (DeLacy, 1941; Roos, 1959; Savvaitova, 1960; Savvaitova and Reshetnikov, 1961; and Reed, 1967). Most investigators have felt that salmon eggs eaten by Dolly Varden are drifting eggs washed out of the redds at the time of deposition or dug up by other spawning salmon (Savvaitova, 1960; McNeil, 1962; Armstrong, 1965b and Reed, 1967).

The percentage of char feeding on salmon eggs increased as the number of salmon entering the system increased. In July only 3.2 percent fed on salmon eggs, this percentage increased in August to 60 percent and in September and October to 100 percent.

Much of the food material was eaten in salt water prior to the char's entry in Hood Bay creek. These food items included Amphipods (17.1%), Mysids (7.9%), Decapods (3.9%), Euphausiids (2.6%) and Brachiopods (1.3%).

Food items probably picked up while the char were in the creek included Diptera (7.9%), Plecoptera (6.6%), Trichoptera (2.6%), Ephemeroptera (1.3%), Arachnids (1.3%) and Annelids (1.3%).

Rearing Char

The stomach contents were determined for 43 rearing Dolly Varden captured by minnow trap in Hood Bay Creek on July 27, 1966. Of those examined, 39 (90.7 percent) contained food.

Insects of the orders Plecoptera and Deptera were found most frequently in the feeding char and occurred in 46.0 and 41.0 percent of the fish respectively. Other food material and their frequency of occurrence were Trichoptera (12.8%), Lepidoptera (2.6%), Arachnids (2.6%) and fish (2.6%).

TABLE 8. Stomach Contents of Dolly Varden Sampled at the Hood Bay Creek Weir During Their In-migration, 1966.

Stomach Contents	July		August		September October		Total	
	*	**	*	**	*	**	*	**
Fish Material:								
Salmon eggs	1	3.2	15	60.0	20	100.0	36	47.4
Scales	1	3.2	--	----	--	----	1	1.3
Unidentified fish								
Remains	-	---	--	4.0	--	----	1	1.3
Crustaceans:								
Amphipods	12	38.7	1	4.0	--	----	13	17.1
Brachiopods	1	3.2	--	----	--	----	1	1.3
Decapods	2	6.5	--	4.0	--	----	3	3.9
Euphausiids	2	6.5	--	----	--	----	2	2.6
Mysids	5	16.1	1	4.0	--	----	6	7.9
Unidentified Crustaceans	2	6.5	--	----	--	----	2	2.6
Insects:								
Diptera	3	9.7	3	12.0	--	----	6	7.9
Ephemeroptera	-	---	1	4.0	--	----	1	1.3
Plecoptera	4	12.9	1	4.0	--	----	5	6.6
Trichoptera	1	3.2	1	4.0	--	----	2	2.6
Unidentified Insects	3	9.7	--	----	--	----	3	3.9
Miscellaneous:								
Annelids	1	3.2	--	----	--	----	1	1.3
Arachnids	1	3.2	--	----	--	----	1	1.3
Debris (wood, rocks, plant material)	10	32.3	2	8.0	--	----	12	15.8
Unidentified	<u>12</u>	<u>38.7</u>	<u>3</u>	<u>12.0</u>	<u>--</u>	<u>----</u>	<u>15</u>	<u>19.7</u>
Number Feeding	31	(56.4%)	25	(54.3%)	20	(69.0%)	76	(58.5%)
Number Empty	<u>24</u>	(43.6%)	<u>21</u>	(45.7%)	<u>9</u>	(31.0%)	<u>54</u>	(41.5%)
Total Examined	55		46		29		130	
* = Incidence of Feeding ** = Percent occurrence in feeding fish.								

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