

Volume 9



1967-1968

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STATE OF ALASKA
 Walter J. Hickel, Governor

ANNUAL REPORT OF PROGRESS, 1967 - 1968

FEDERAL AID IN FISH RESTORATION PROJECT F-5-R-9

SPORT FISH INVESTIGATIONS OF ALASKA

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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-9, "Sport Fish Investigations of Alaska."

The project during this reporting period was composed of 21 separate studies. Of these, seven jobs continued the inventorying and cataloging of the numerous waters, providing a comprehensive index of the State's recreational waters. Nine jobs accomplished special studies involving Dolly Varden, grayling, silver salmon, king salmon and sheefish, among others. The remaining five jobs are designed to accomplish creel census, migration, access and silver salmon egg-take studies. The egg-take study, Job 7-F, was inactive because egg-takes were accomplished under other projects.

Special reports on specific phases of the Dolly Varden Life History Study have been published in the Department's Research Report series.

The information gathered from all of these studies provides the background necessary for better management and assists in development of future investigational studies.

The subject matter contained within these reports is often fragmentary in nature. The findings may not be conclusive and the interpretations contained therein are subject to re-evaluation as the work progresses.

RESEARCH PROJECT SEGMENT

STATE: ALASKA Name: Sport Fish Investigations of Alaska.
Project No: F-5-R-9 Title: Investigation of Anadromous Dolly Varden Populations in Hood Bay Drainages, Southeastern Alaska.
Job No: 2-B

Period Covered: April 1, 1967 through December 1, 1967.

ABSTRACT

This report presents the results of the second year's operation of the Hood Bay Creek weir and the sixth year of investigation of the life history of the Dolly Varden, Salvelinus malma (Walbaum). Emphasis of study included determining the number of Dolly Varden smolts leaving the system, the age composition of these outmigrants and their migration characteristics, the number of immigrant Dolly Varden and their homing tendencies, and the frequency of Dolly Varden spawning in Hood Bay Creek and their mortality after spawning.

A total of 9,277 Dolly Varden smolts left Hood Bay Creek in 1967. Of these 6,735 left during a spring outmigration from mid-May to mid-June and 2,545 during a fall outmigration from late September through October. The age composition was mostly age III and IV for the spring outmigrants and mostly age II and III for the fall outmigrants. Salmon young and insects were the principal food items found in these migrating smolts. Of the number of char smolts marked, 8.7 percent returned to the system the same year.

An estimated 5,954 Dolly Varden entered Hood Bay Creek from the sea in 1967. This migration began in early July, peaked in early August and again in mid-September, and ended in early November. The immigration was considered to consist of 1,799 (30 percent) potential spawners for the year, of which 1,115 (62 percent) and 684 (38 percent) were considered to be females and males respectively. Most of the immigrant char were from age groups III (36.7 percent), IV (24.4 percent), V (16.3 percent) and VI (12.2 percent). By maturity, the majority of the nonspawners were in age groups III (53.0 percent) and IV (30.8 percent) and the majority of the potential spawners were from age groups V (30.2 percent) and VI (32.3 percent).

Dolly Varden that had entered Hood Bay Creek in 1967 left the system in the same year. The immature Dolly Varden left the system soon after their date of entry while mature char remained in the system until spawning was completed.

An overall mortality, occurring between spawning in Hood Bay Creek and outmigration, was computed to be 26.0 percent. The mortality of the male and female Dolly Varden spawning in Hood Bay Creek was computed to be 61.4 and 4.3 percent respectively. The mortality (male and female spawners combined) between leaving Hood Bay Creek in 1966 and entering into the system in 1967 was computed to be 32.0 percent. The majority of the 1966 marked char that returned to Hood Bay Creek in 1967 spawned in the system both years.

The returns to Hood Bay Creek after displacement to three locations in Hood Bay indicated that homing to Hood Bay Creek was much stronger among the displaced mature char and that most of the fish returning did so for the purpose of spawning.

The following "new" hypothesis is proposed for the migration and homing of Dolly Varden entering and leaving nonlake stream systems: "Dolly Varden originating from a given nonlake stream after their initial migration to sea, may enter several other nonlake streams in their search for a lake to winter in. At maturity, these fish return to their home stream to spawn."

RECOMMENDATIONS

Research

The major emphasis of research should be directed toward the study of the migration habits of Dolly Varden with special emphasis on their homing capabilities as related to their maturity. This study should test the hypothesis that "Dolly Varden originating from a given nonlake stream, after their initial migration to sea, may enter several other nonlake streams in their search for a lake to winter in. At maturity, these fish return to their home stream to spawn" (see the discussion section, page 78).

To test this hypothesis it is recommended that all char smolts leaving Hood Bay Creek be marked as was done in 1967. If the home-stream part of the hypothesis is true, then the majority of the 1969 immigrant potential spawners should be the 1967 and 1968 marked smolts. The hypothesis that Dolly Varden smolts move from one nonlake system to another should be tested by weiring the two streams in the North Arm of Hood Bay. All char captured at these weirs should be examined for marks from Hood Bay Creek. In addition, random samples of Hood Bay Creek marked fish entering the North Arm streams should be taken to determine if any of these char are entering the North Arm streams to spawn and if any have previously spawned in Hood Bay Creek.

Research should also be instigated to determine the amount of competition for food and space between coho salmon and Dolly Varden rearing in Hood Bay Creek, and how this competition (if any) may affect the rearing capacity of Hood Bay Creek for each species. To study the competition for food between the two species, periodic samples of the rearing fish should be taken throughout the length of Hood Bay Creek from April through November. Stomach contents of Dolly Varden and coho smolts should also be examined from random samples taken at the weir during their outmigration. Competition for space should be investigated on an experimental basis using procedures similar to those used by Chapman (1962) in his study of the aggressive behavior of juvenile coho.

Management

The recommendations presented in this section are some of the more obvious management implications of our research to date and may be subject to revision as more information is gathered.

The unique migration habits of the anadromous Dolly Varden probably poses one of the most difficult management problems. Management of fisheries on lake streams and lakes should receive special emphasis, as most lakes appear to serve as wintering areas for Dolly Varden originating from nonlake streams. Depletion of char in a lake system may also seriously deplete the populations of Dolly Varden in many of the surrounding nonlake systems. It is possible that a lake system fishery could be seriously depleting a nonlake system char population with no apparent depletion of the lake's population. Some management practices which may be employed on lake systems are:

1. In an area where several nonlake fisheries exist, the management biologist may want to close the lake system to fishing during the major spring and fall out- and in migrations or restrict the fishery through reduced bag limits or partial closures.
2. Closure of a fishery on a lake outlet stream during October and November might be employed to protect the spawned-out char entering the lake after spawning in their respective nonlake streams. Although it is unlikely much fishing pressure would be exhibited during these months, if a fishery develops it should be carefully monitored.

3. Closure or restriction of a fishery on a lake outlet stream from April through June would protect the spawners destined for their respective nonlake streams.
4. The race of char belonging to a given lake system may be subjected to abnormal fishing pressure during its period of spawning. A fishery on lake inlet streams should be carefully monitored for the maturity composition of the catch. Sexually mature char will probably be from the race originating from the lake system. Of the total number of char entering the lake system, less than five percent of these fish may have originated from the system.
5. Minimum size restrictions during the spring outmigration of Dolly Varden from a lake system could protect the smolts originating from the lake.

Management of Dolly Varden in nonlake systems also presents some unique problems. Since immature Dolly Varden apparently move from one nonlake stream to another in their search for a lake, a fishery on a nonlake stream may affect the char from other nonlake streams. These immature fish spend little time in the nonlake stream but, since char from other systems are continually moving into and out of a given nonlake stream throughout the summer, they give the impression that the population of char belonging to a system is greater than actually exists. Mature char belonging to a nonlake stream, after entering the system, stay until completion of spawning. These mature fish may stay in the system for 2 - 4 months; hence, they are more subjected to fishing in a given stream than the immature char.

Careful creel census of a nonlake Dolly Varden fishery would provide an indication of a population decline. Probably a decrease in the length frequency of the catch would be a better indicator than catch per unit of effort. Since the larger, sexually mature char are available over a longer period of time, a decrease of these fish should show in the length frequency of the catch. It is possible that the population of char belonging to a given system could be seriously depleted without greatly affecting the catch per unit effort. The fishery may shift to the immature fish entering a given system from other nonlake systems.

Care should be taken in the interpretation of creel census information from a lake system. The lake system fishery could be seriously depleting other fisheries without greatly affecting the catch per unit effort or length frequency of the lake system catch. For instance, a reduction of 100,000 char to 50,000 in a lake system may not greatly affect the catch per unit effort in that system. However, depending on the races caught, it could seriously deplete populations in nearby nonlake streams which may only have populations of 5,000 to 10,000 char.

The rearing habits of Dolly Varden should be considered by the management biologist. During their rearing period, the young char are extremely mobile and may be found in small tributary streams, muskeg areas, and bodies of water in which access to the main stream may be possible only during flood periods. This should be taken into consideration when logging, road building, herbicide and pesticide spraying, pollution, etc., encroach on these rearing areas.

These rearing habits should be considered when it is desirable to eliminate nonanadromous Dolly Varden during lake rehabilitation. Usually, nonanadromous Dolly Varden young of lake systems spend the first three or four years of their life in areas tributary to the lake but not in the lake itself. An incomplete rehabilitation of a lake may not become evident until 3 - 4 years after rehabilitation when the young char move into the lake environment. Special care should be taken to treat all water areas in a lake watershed, especially if there could be a connection between the lake and these areas during periods of flooding. Also, partial eradication of a Dolly Varden population could be done by using rotenone in the inlet streams of landlocked lakes at the time of spawning (probably October), thereby reducing or eliminating the rearing as well as the spawning population of char in the areas treated.

Re-establishing a population of char that is beyond regulatory help may be difficult. This may be accomplished through smolt transplants or stocking of premigratory young. Some aspects which should be considered are:

1. It may be possible to transplant smolts from one system to another. It would be feasible to capture several thousand smolts during their outmigration (probably in May) from a nonlake system and transfer these smolts to another system. Whether or not these smolts would home to the receiving system at maturity is not known.
2. Under natural conditions, anadromous Dolly Varden usually require a three- to four-year rearing period before migrating to sea. They usually are not of sufficient size for a fishery until their fourth or fifth year. Survival of Dolly Varden from fry to smolt is low and may be less than one-tenth of one percent. Survival from smolt to adult is moderately high and may exceed 20 percent. The percent return of a hatchery plant would be highest if the char were stocked as smolts. Hatchery techniques should be developed which would cause smoltification of Dolly Varden to occur at an earlier age than under natural conditions. Rearing char young under higher water temperatures and selective feeding may help.
3. The optimum time of release of hatchery reared char smolts would probably be in the spring during the spring outmigration of smolts (probably May). In nonlake streams a smaller, although significant, smolt outmigration occurs in the fall (usually October). This does not appear to occur in lake systems. Release of hatchery-reared smolts in nonlake streams at this time may also be advantageous.
4. In stocking lakes with premigratory or nonanadromous Dolly Varden young, the best area of release would probably be in the inlet streams as most of the rearing appears to be occurring in these areas.

Successful management of Dolly Varden will require careful and systematic creel census programs designed to evaluate the fisheries on the many water systems entered by these char. Careful regulation of these fisheries will be especially important since replenishment of stocks through artificial means may be difficult.

OBJECTIVES

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.

No information was gathered on objectives 12, 13, 14, and 15. These objectives were discontinued as the previous information gathered was considered adequate for our present needs. For information collected on these objectives see Armstrong (1967) and Blackett (1968).

TECHNIQUES USED

An 85-foot wood weir with removable 1/2- or 5/8-inch mesh screens was used to capture immigrant and outmigrant Dolly Varden at Hood Bay Creek. The weir contained three traps of which two were operated in the direction of major migration.

All Dolly Varden smolts captured at the weir were measured (fork length in mm) and fin-clipped (left ventral) or sampled. Each char smolt sampled was measured and dissected to determine sex and stomach content. Otoliths were obtained from the sampled char and stored (dry) for later age analysis.

Immigrant Dolly Varden captured in the weir traps were measured and examined for fin clip or tag. Unmarked char were fin clipped (adipose) and tagged with dart tags using techniques similar to that described by Armstrong and Blackett (1966). Samples of the immigrant Dolly Varden were taken to determine age and degree of maturity.

Outmigrant char captured in the weir traps were measured and examined for fin clip or tag. All unmarked char were fin clipped (adipose) and tagged with dart tags. Spawned-out char were recorded as such and sexed by external characteristics.

An estimate was made to determine the total number of immigrant char because removal of weir screens during high water periods caused some char to be missed. This estimate was obtained by using the ratio of unmarked (1,389) to marked (1,794) outmigrant char captured and the number of marked immigrant char available for recapture (2,894). The number estimated to have been missed (2,241) was then added to the number sampled (338) to those found dead at the weir (116), to the number used in the displacement experiment (365) and to those marked char available for recapture (2,894). The resulting figure (5,954) was considered to be the total number of char entering Hood Bay Creek in 1967.

Validity of Sample

The samples of Dolly Varden smolts and immigrants were obtained by sampling every tenth char enumerated. The length frequencies of these samples were compared to the length frequencies of the enumerated smolts (Figure 1), and immigrants (Figure 2) to determine if the samples were representative of the populations.

The length frequency of the smolt sample was found to be smaller than the length frequency of the enumerated smolts. Although the differences appear to be slight (less than 5 percent difference in any size interval), the bias was consistent. One possible explanation for this difference could be the care in which the two groups were measured. Enumerated fish are measured rather quickly, which could cause a consistent over measurement. If this were true, then the bias would be occurring in the measurement of enumerated char rather than in the sample. The differences between the two groups should not significantly alter the conclusions drawn from the sample, and the sample should be representative of the population.

Comparing the length frequency of the immigrant char sample to the length frequency of the enumerated char (Figure 2) indicates that the sample is representative of the population.

FINDINGS

The findings presented are mostly the result of the second 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, 1967), Armstrong and Blackett (1966a, 1966b), Blackett (1968), Blackett and Armstrong (1965a, 1965b), and Heiser (1966).

The 1967 Outmigration of Dolly Varden Smolts

The 1967 study of the Dolly Varden smolt migration at Hood Bay Creek is believed to be the first study conducted on Dolly Varden smolts from a nonlake system. Additional information will be obtained from the future returns of the smolts marked in 1967 to Hood Bay Creek. Of special importance will be to determine if these char will "home" to Hood Bay Creek to spawn, and the percentage of marked smolts returning.

The information presented in this section should be reliable, as a nearly complete coverage of the smolt migration was obtained and the sample appeared to be representative of the population.

Numbers and Timing of Dolly Varden Smolts:

A total of 9,277 Dolly Varden smolts left Hood Bay Creek in 1967. Of these, 6,735 left during a spring outmigration and 2,542 during a fall outmigration.

Most of the spring outmigration occurred from mid-May to mid-June and peaked in late May (Figure 3). The fall outmigration occurred from late September through October with a peak during the second week in October (Figure 3). Each migration of smolts occurred in a short period of time, approximately one month, with few char smolts leaving the system from early July to late September (Figure 4).

The spring smolt migration began at a water temperature of 38°F. and was mostly over at 44° (Figure 3). The fall smolt migration began at 48°F. and was mostly over at a water temperature of 44° (Figure 3). Water height of the creek did not appear to be a contributing factor to the Dolly Varden smolt outmigration (Figure 3). Both the spring and fall outmigrant smolts migrated primarily during the hours of darkness.

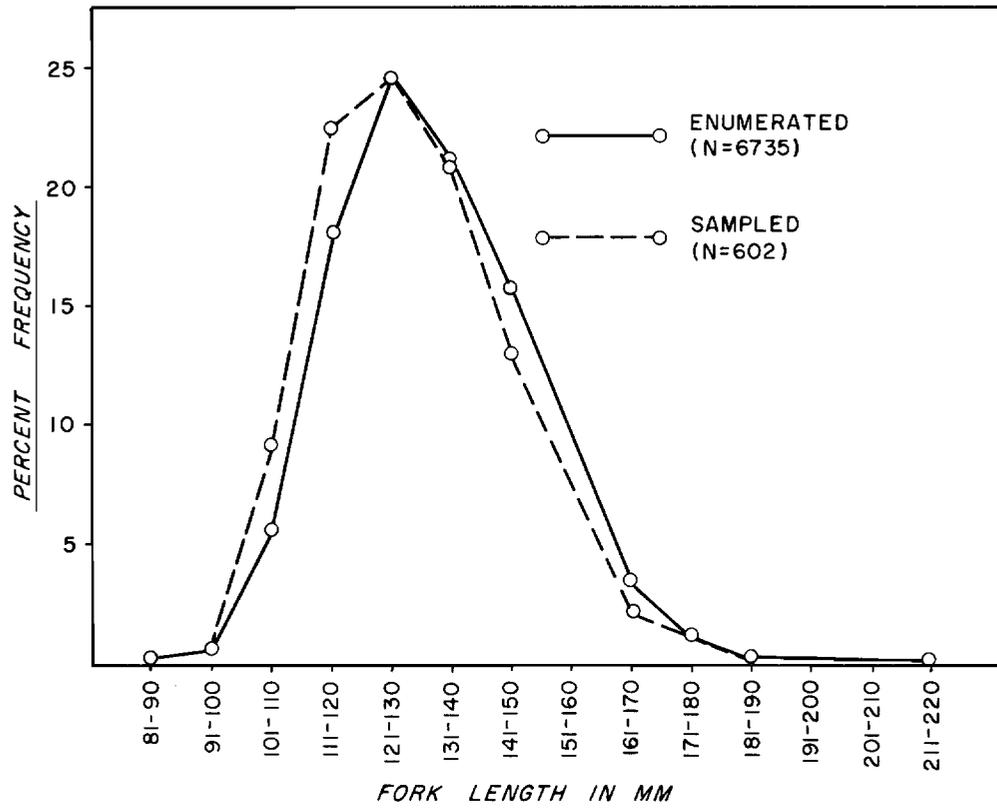


FIGURE 1. LENGTH FREQUENCY OF DOLLY VARDEN SMOLTS ENUMERATED AND SAMPLED AT THE HOOD BAY CREEK WEIR DURING THE SPRING OUTMIGRATION, 1967.

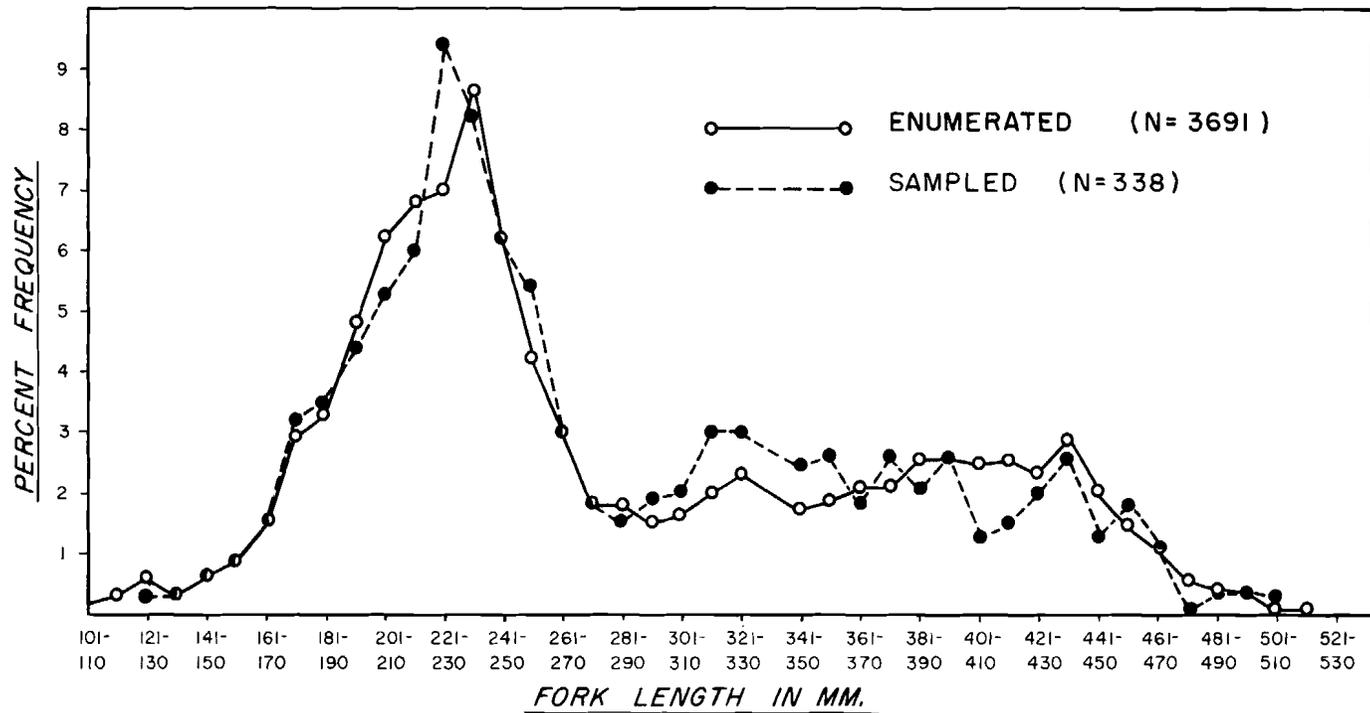


FIGURE 2. LENGTH FREQUENCY OF IMMIGRANT DOLLY VARDEN ENUMERATED AND SAMPLED AT THE HOOD BAY CREEK WEIR, 1967.

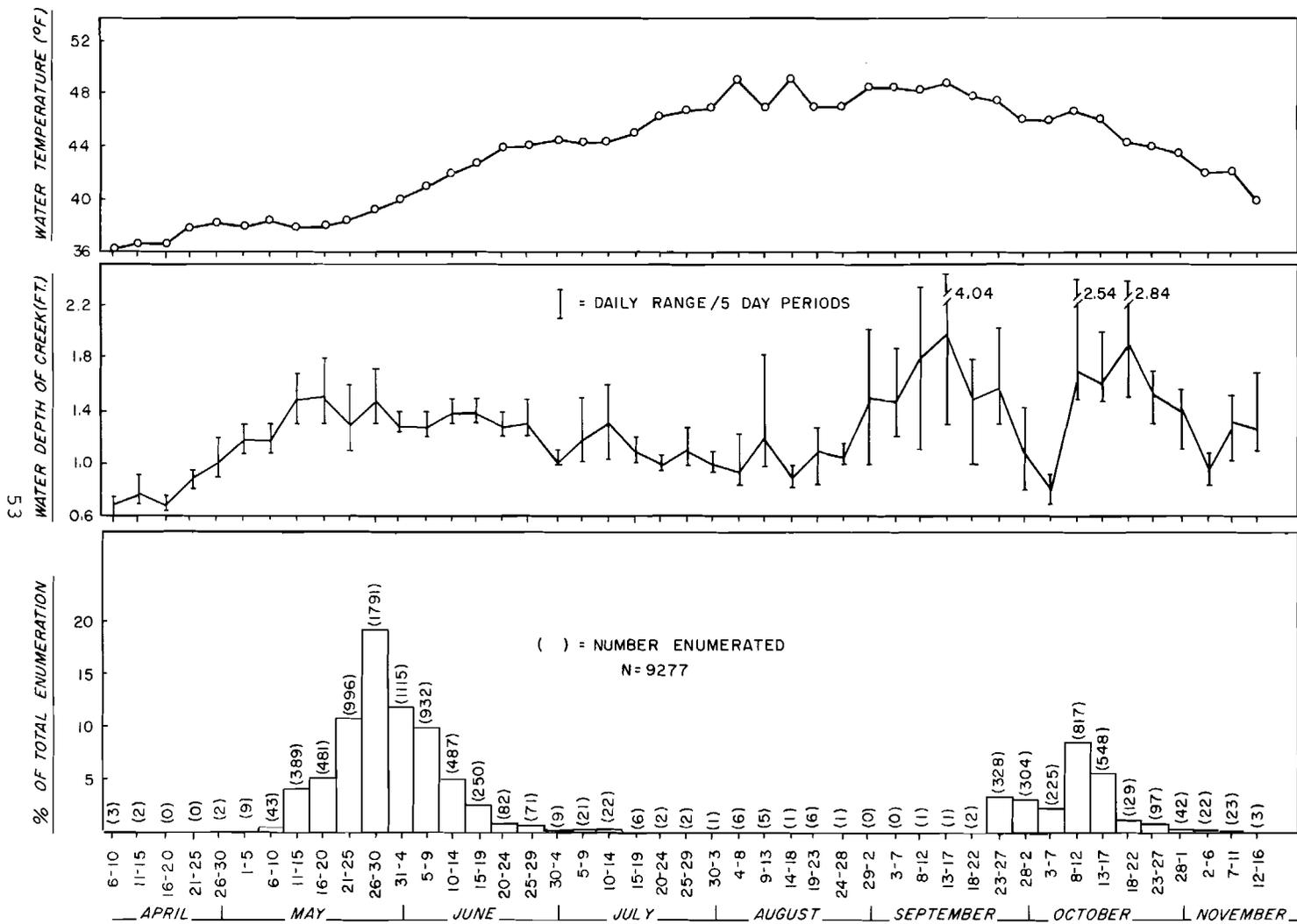


FIGURE 3. PERCENT AND NUMBERS OF DOLLY VARDEN SMOLTS LEAVING HOOD BAY CREEK AND MEAN WATER DEPTH AND TEMPERATURE OF THE CREEK BY FIVE-DAY INTERVALS, 1967.

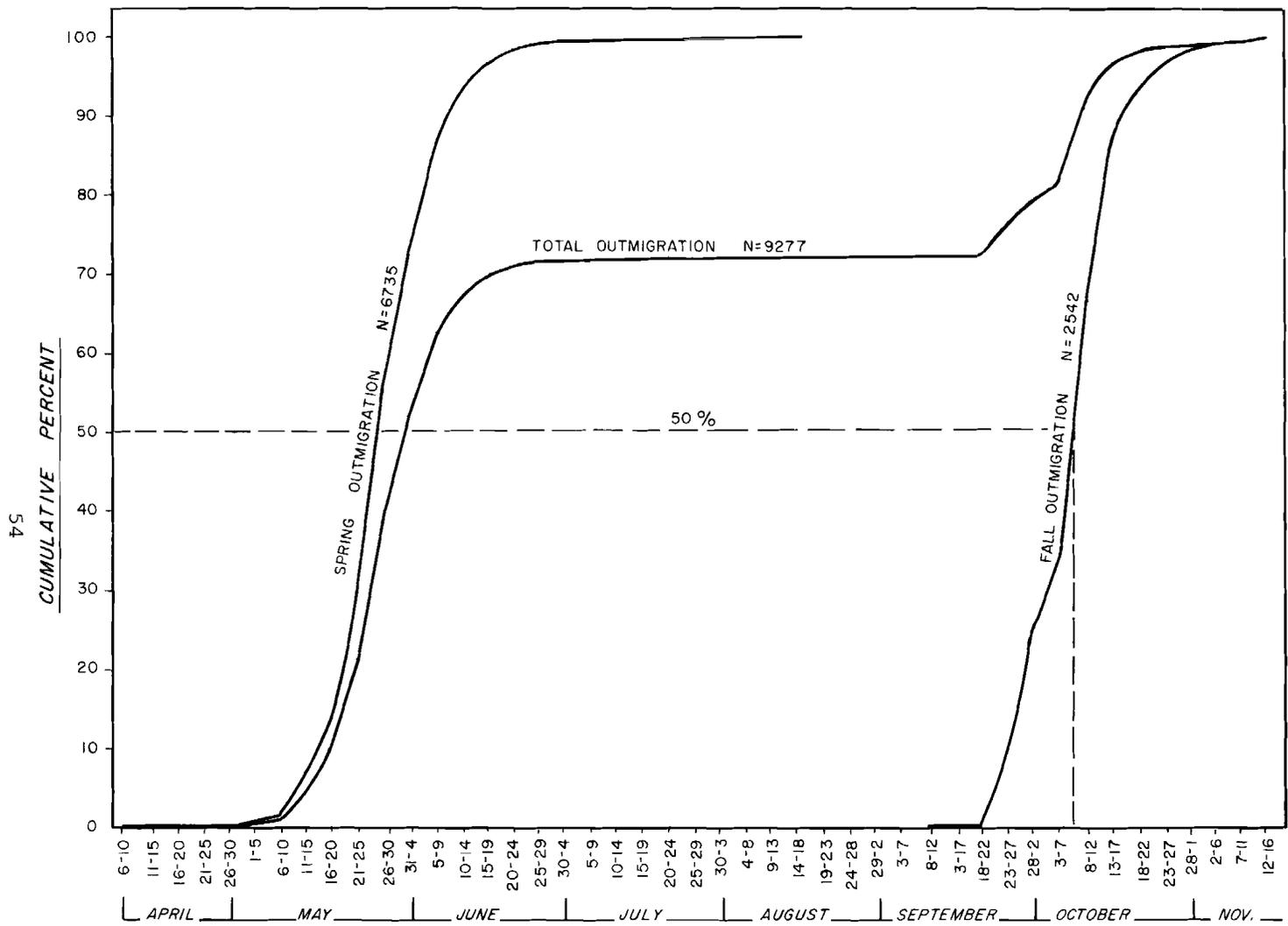


FIGURE 4. CUMULATIVE PERCENT OF DOLLY VARDEN SMOLTS LEAVING HOOD BAY CREEK BY FIVE-DAY INTERVALS, 1967. (N=9277)

The timing of the spring smolt migration of Dolly Varden was similar to the timing of pink and chum salmon outmigrants with a few exceptions (Figure 5). The peak of the pink salmon outmigration was in mid-May, approximately two weeks earlier than the peak of the spring outmigration of Dolly Varden smolts. Two peaks occurred in the chum salmon outmigration, one in mid-May and another during the second week in June, approximately two weeks before and after the peak of the spring outmigration of Dolly Varden smolts. This bi-modal peaking in chum salmon outmigration may be related to the early summer and late fall spawning of chum salmon which has been observed at Hood Bay Creek.

Size and Age of Dolly Varden Smolts:

Most of the Dolly Varden smolts were between 100 mm and 180 mm in fork length with a mean length of 136.2 mm (Figure 6). The spring outmigrants averaged slightly smaller (\bar{x} =132.8 mm) than the fall outmigrants (\bar{x} =146.4 mm) and the mode of spring outmigrants (121-130 mm) was less than the mode of the fall outmigrants (151-160 mm).

Age groups II through VI were found among the migrating smolts with the majority of the Dolly Varden migrating at age III (57.5 percent), and IV (32.0 percent) (Table 1). The spring outmigrants were mostly age III (53.6 percent) and IV (42.5 percent) char. The fall outmigrant smolts were mostly age II (27.9 percent) and III (67.9 percent) char (Table 1).

TABLE 1 - Age Composition of 589 Dolly Varden Smolts Sampled at the Hood Bay Creek Weir, 1967.

	Age Groups					Sample Size
	II	III	IV	V	VI	
Spring	0.4%	53.6%	42.5%	3.4%	0.2%	532
Fall	27.9%	67.9%	4.2%	0.0%	0.0%	57
Total (weighted)	7.9%	57.5%	32.0%	2.5%	0.1%	589

Among the spring Dolly Varden smolts sampled, the mean fork length of age group IV (\bar{x} =134.8 mm) was larger than that of age group III (\bar{x} =125.3 mm). However, the length frequencies showed considerable overlap and were similar enough to indicate that outmigration of Dolly Varden smolts may be a factor of size and not age (Figure 7). The sex ratio of the sampled smolts was nearly equal with 52 percent female and 48 percent male. Age groups III and IV had similar sex ratios among the smolts sampled.

Food of Dolly Varden Smolts:

The stomach contents of 602 Dolly Varden smolts were determined from samples taken at the weir during their outmigration from May 2 to June 28 (Table 2). Of the number examined 318 (52.8 percent) were empty and 284 (47.2 percent) had food in their stomachs.

TABLE 2 - Stomach Content of Dolly Varden Smolts Sampled at the Hood Bay Creek Weir, 1967.

Stomach Content	Incidence of Feeding	Percent Occurrence in Feeding Fish
Salmon young	163	57.4
Unidentifiable fish remains	9	3.2

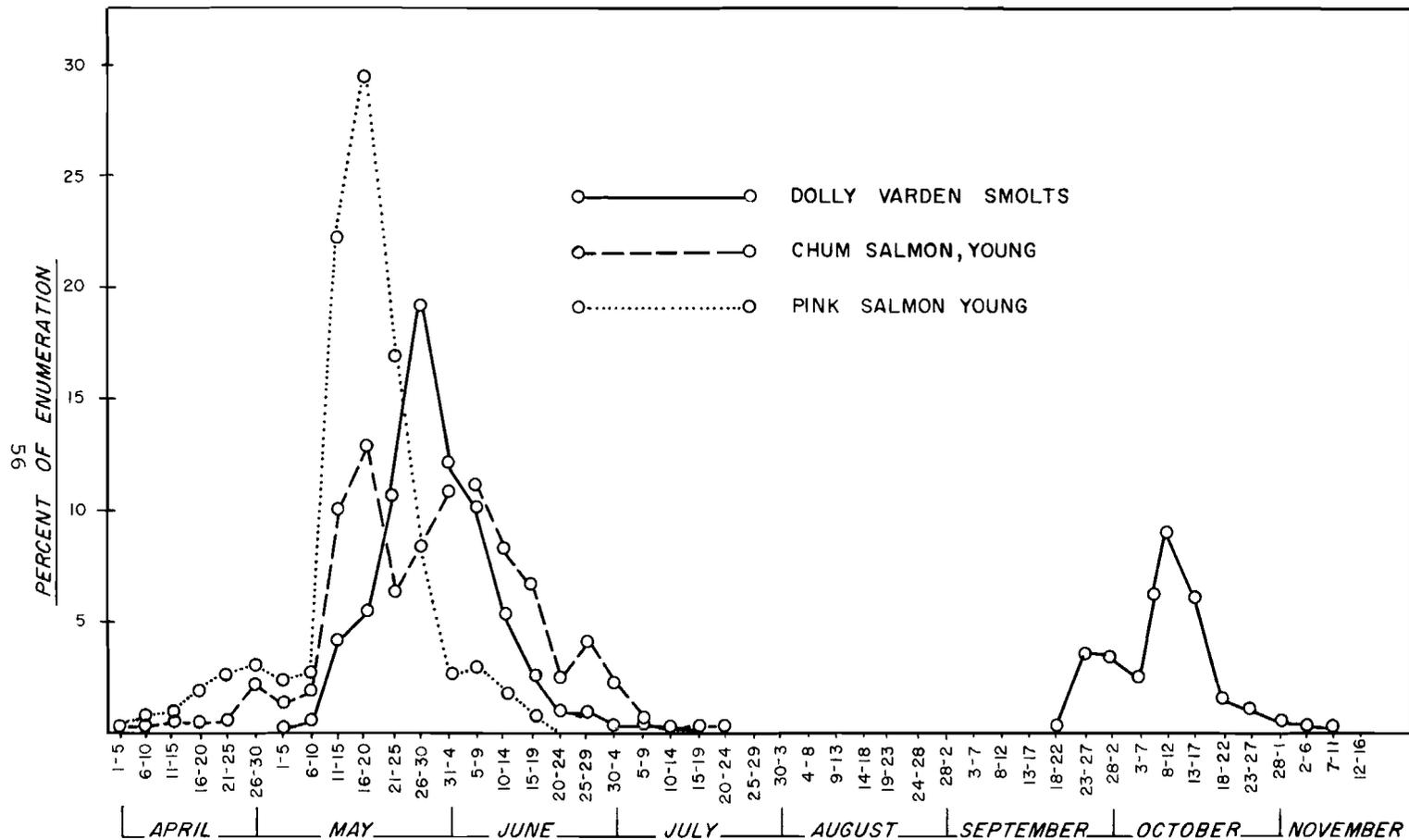


FIGURE 5. THE TIMING OF DOLLY VARDEN SMOLTS COMPARED TO THE TIMING OF PINK AND CHUM SALMON YOUNG LEAVING HOOD BAY CREEK, 1967.

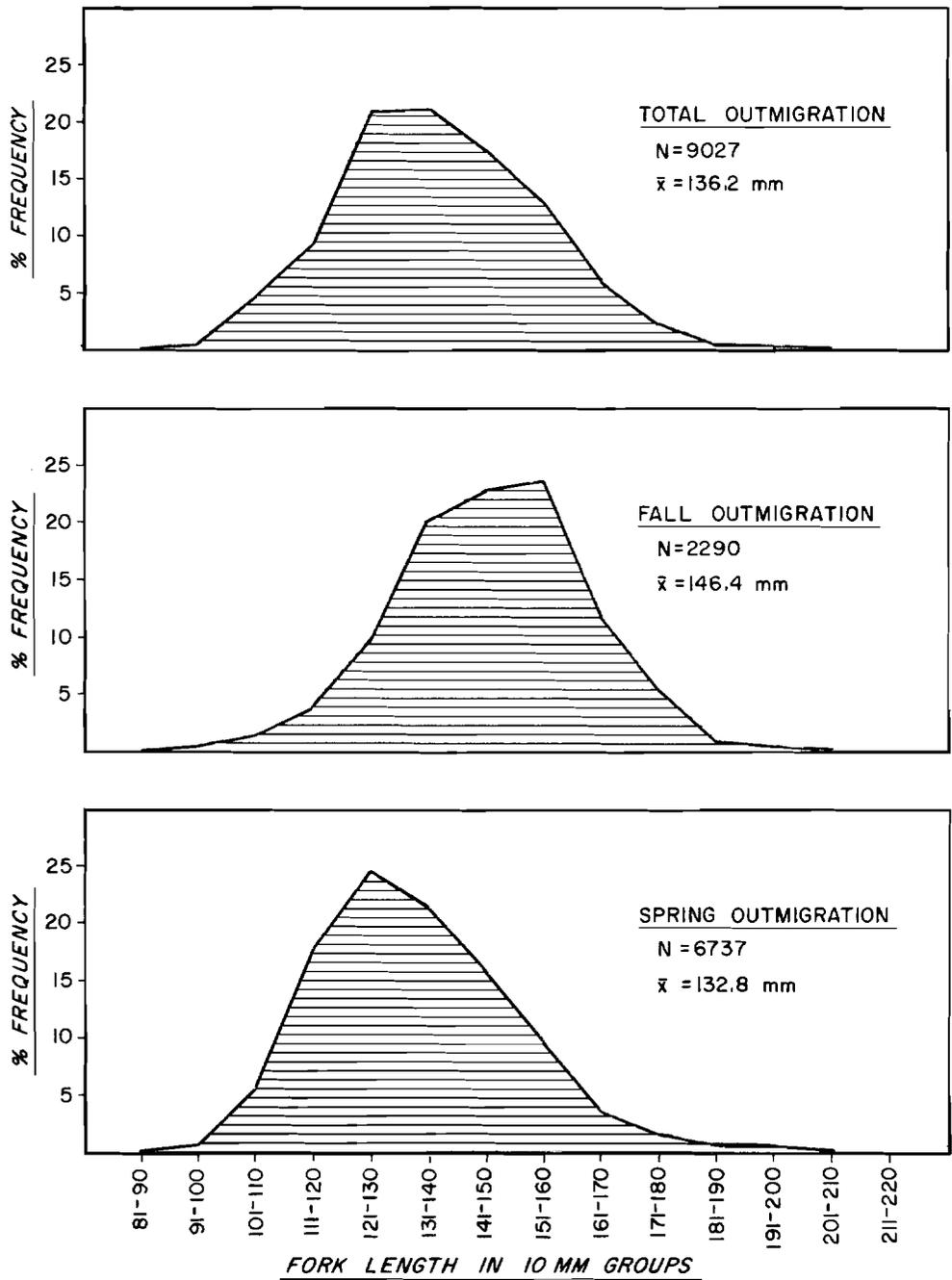


FIGURE 6. LENGTH FREQUENCY OF DOLLY VARDEN SMOLTS MEASURED AT THE HOOD BAY CREEK WEIR, 1967, (N=9027).

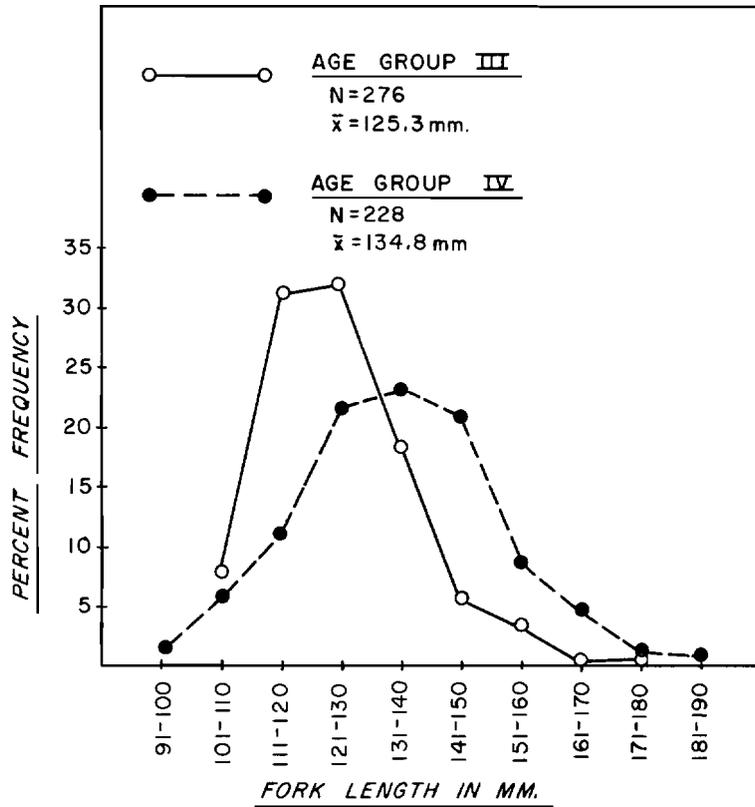


FIGURE 7. LENGTH FREQUENCY OF AGE III AND IV DOLLY VARDEN SMOLTS SAMPLED DURING THE SPRING OUTMIGRATION AT THE HOOD BAY CREEK WEIR, 1967.

TABLE 2 (Cont.) - Stomach Content of Dolly Varden Smolts Sampled at the Hood Bay Creek Weir, 1967.

<u>Stomach Content</u>	<u>Incidence of Feeding</u>	<u>Percent Occurrence in Feeding Fish</u>
Salmon eggs	1	0.3
Cottid eggs	2	0.7
Insects	115	40.5
Earthworm	3	1.1
Debris	11	3.9
Number empty = 318		
Number feeding = 284		
Number examined = 602		

Salmon young was the principal food item and they occurred in 57.4 percent of the feeding char smolts. Pink and chum salmon young were the only identifiable fish found in the stomachs of the Dolly Varden smolts. An average of 2.1 salmon young per stomach was found for the Dolly Varden feeding on salmon young.

It is unlikely that the Dolly Varden were feeding on an unnatural concentration of salmon young. The one-half-inch mesh weir screens allowed easy passage to the pink and chum salmon fry and no concentrations of these fry were observed immediately above the weir. Dolly Varden smolts were unable to maintain themselves in the strong current near the weir and were either swept into the traps or onto the inclined screens. This is also true for pink and chum salmon fry which were swept through the weir once they reached the upstream face of the weir. Also, most of the salmon young were in a state of digestion, which would indicate they had been ingested prior to the char smolts reaching the weir.

Return of Marked Dolly Varden Smolts:

Of the 6,735 Dolly Varden smolts enumerated during the spring outmigration 5,793 were marked (left ventral) and released. Of the number marked and released 398 (6.9 percent) returned the same year. Most of these fish returned in July and August after spending 30-60 days away from Hood Bay Creek. Whether these fish spent all this time in salt water or entered other stream systems is not known. Most of these returning smolts again left the system in September. Only nine of the returning smolts were recorded as having spawned in Hood Bay Creek in 1967.

Of the 2,542 Dolly Varden smolts enumerated during the fall outmigration 2,000 were marked (adipose) and released. Of the number marked and released 281 (14.0 percent) returned the same year. Most of these fish returned shortly after their release, and were again recorded leaving the system soon after their date of entry. The in-and-out type of migration observed for the fall smolts may be due to some confusion among the returning smolts by high water conditions encountered during the migration period.

Interpretation of this information on returning smolts will depend on the results of succeeding years return of the smolts marked in 1967. Information gathered on spawning Dolly Varden in Hood Bay Creek indicates that the majority of the Dolly Varden smolts will return to the system, when they are sexually mature, for spawning.

The 1967 Immigration of Dolly Varden

The information presented in this section was collected during the second year of operation of the Hood Bay Creek weir. Information on the 1966 immigration at Hood Bay Creek is presented by Armstrong (1967), and information on the 1965 immigration at Hood Bay Creek is presented by Blackett (1968).

A good coverage of the 1967 immigration was obtained and the sample appeared to be representative of the population.

Numbers and Timing of Immigrant Dolly Varden:

An estimated 5,954 Dolly Varden entered Hood Bay Creek from the sea in 1967. The migration began in early July, peaked in early August and again in mid-September, and ended in early November (Figure 8). Substantial numbers of Dolly Varden entered the system periodically from mid-July through mid-October. Approximately 50 percent of the total immigration had entered Hood Bay Creek by early September (Figure 9).

The peaks of Dolly Varden immigration usually occurred during high water periods (Figure 8). The migration began at a water temperature of 44°F., peaked when the water temperature was between 46° and 50°, and ended at a temperature of 40°. The majority of the Dolly Varden entered Hood Bay Creek during the hours of darkness.

Both mature and immature Dolly Varden entered Hood Bay Creek in greatest numbers in August and September (Table 3). The greatest number of spawners (961) entered the system in August, while the greatest number of nonspawners (2,862) entered the system in September.

TABLE 3 - Month of Immigration for Potential Spawner and Nonspawner Dolly Varden at Hood Bay Creek, 1967.

<u>Month of Immigration</u>	<u>Total Sample</u>	<u>Spawners in Sample</u>		<u>Estimated Immigration</u>	<u>Estimated Number of Spawners</u>	<u>Estimated Number of Nonspawners</u>
		<u>N</u>	<u>%</u>			
June	0	0	0.0	0	0	0
July	57	22	38.6	561	217	344
August	114	67	58.8	1,634	961	673
September	135	22	16.3	3,408	556	2,852
October	31	6	19.3	338	65	273
November	<u>1</u>	<u>0</u>	<u>0.0</u>	<u>13</u>	<u>0</u>	<u>13</u>
TOTALS	338	117	30.2 (weighted)	5,954	1,799	4,155

Chum salmon began entering Hood Bay Creek at about the same time as Dolly Varden during early July. Peaks of chum salmon migration were similar in timing to the peaks of Dolly Varden immigration. Pink salmon began entering the system in late July, peaked in late August and early September, and ended in late September. Coho entered the system from late September through mid-November. A total of 17,815 chum, 5,396 pink and 115 coho salmon was enumerated at the Hood Bay Creek weir in 1967.

Maturity of Immigrant Dolly Varden:

Of the estimated 5,954 Dolly Varden entering Hood Bay Creek, 1,799 (30 percent) were considered to be potential spawners for the year. The 4,155 other immigrants were nonspawners and consisted of char that had not spawned

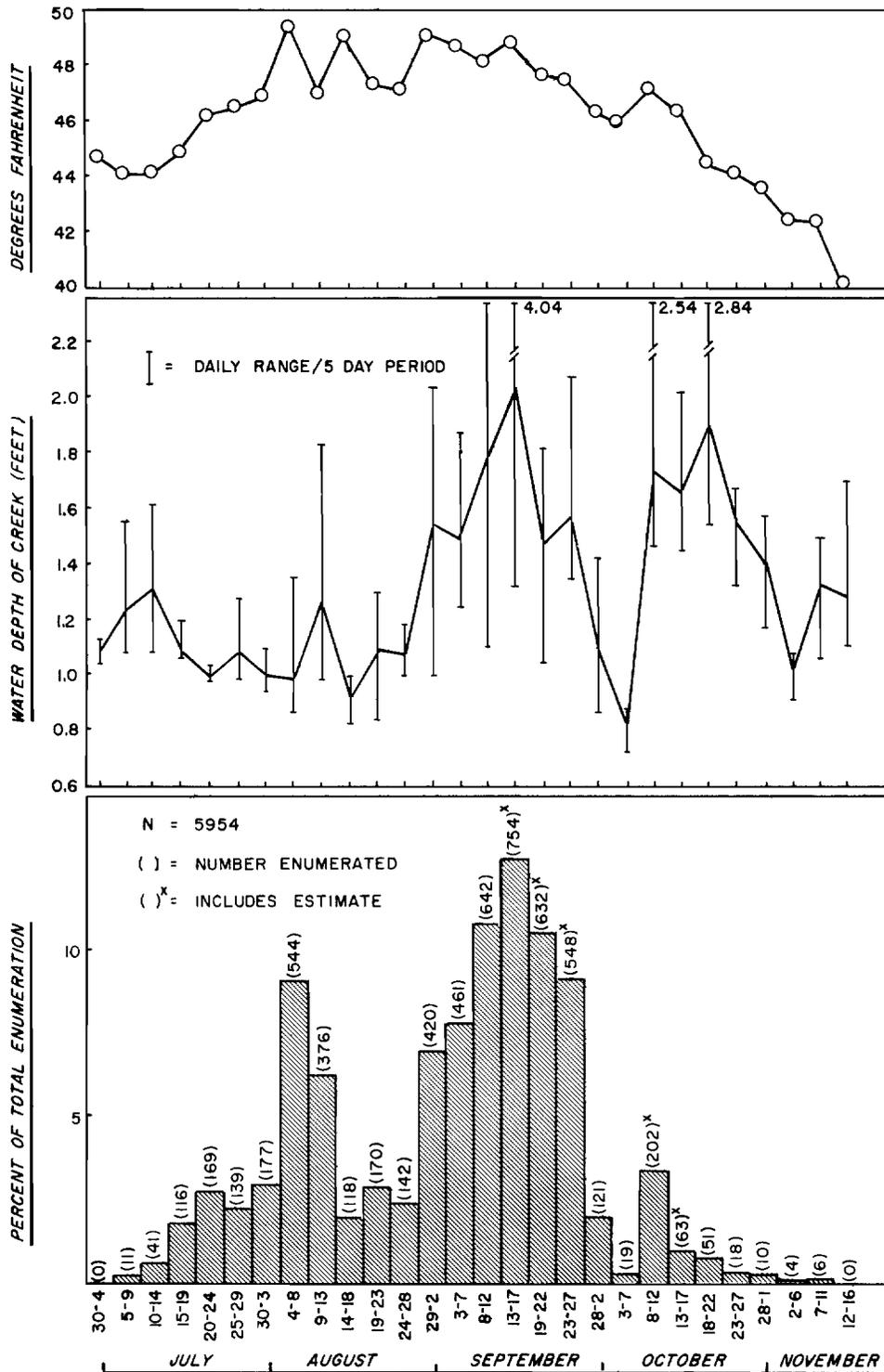


FIGURE 8. PERCENT AND NUMBER OF DOLLY VARDEN ENTERING HOOD BAY CREEK AND MEAN WATER DEPTH AND TEMPERATURE OF THE CREEK BY FIVE-DAY INTERVALS, 1967.

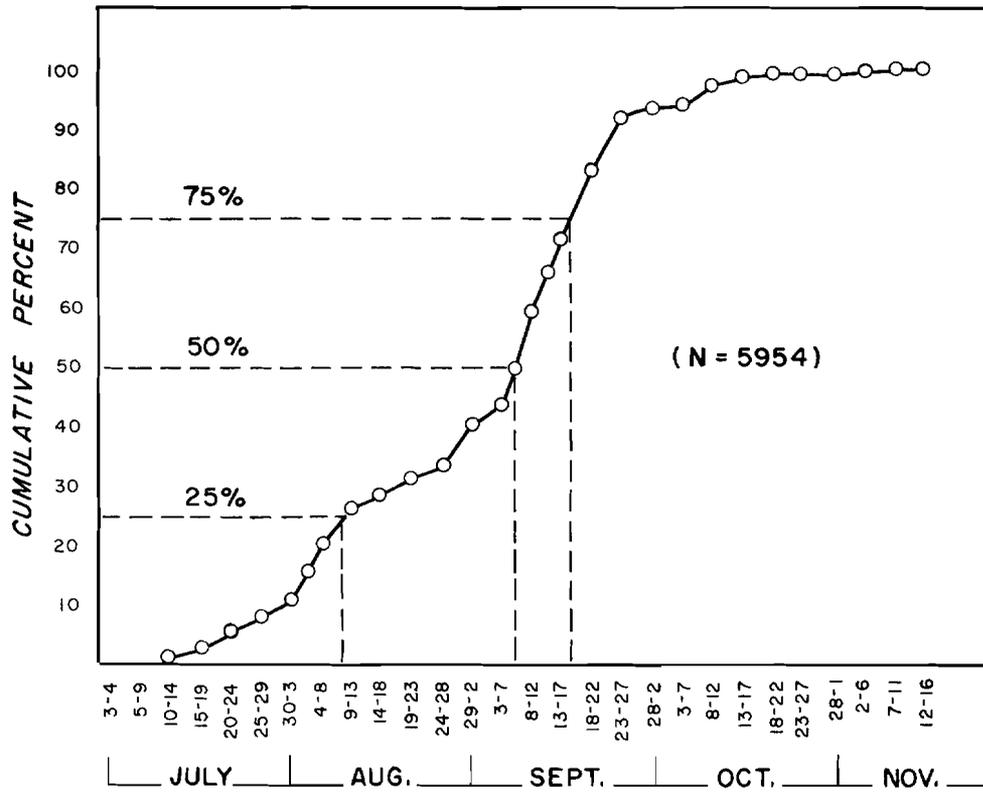


FIGURE 9. CUMULATIVE PERCENT OF DOLLY VARDEN ENTERING HOOD BAY CREEK BY 5-DAY INTERVALS, 1967.

before and those that had spawned in a previous year but were sexually immature (nonconsecutive spawners). Of the 1,799 potential spawners, 1,115 (62 percent) and 684 (38 percent) were considered to be females and males respectively.

The average length, weight, egg diameter and ovary weight are given by month for the female potential spawners sampled at the Hood Bay Creek weir in Table 4. A rapid development of the ova prior to spawning in October is evident from the September and October samples of potential spawners. A similar accelerated growth of the ovaries in September was reported for the char sampled at the Lake Eva weir by Blackett (1968) and at Hood Bay Creek in 1966 by Armstrong (1967). Egg size at maturity for the Hood Bay Creek char is probably between 5.0 and 6.0 mm in diameter.

TABLE 4 - Average Measurements by Month, of Length, Weight, Egg Diameter and Ovary Weight of 72 Immigrant Dolly Varden Potential Spawners at Hood Bay Creek, 1967.

Month	Sample Size	Average				Maturity Index
		Length	Weight	Egg Diameter	Combined Ovary Weight	
July	13	366 mm 306-437	671 gms 376-1020	2.67 mm 2.33-3.44	22.37 gms 2.82-28.65	$\frac{22.37}{671} = 3.3\%$
August	42	363 211-445	626 113-1134	3.38 2.13-4.65	39.50 0.87-51.19	$\frac{39.50}{626} = 6.3\%$
September	12	388 225-483	762 422-1261	4.51 3.45-5.37	103.00 3.85-109.85	$\frac{103.00}{762} = 13.5\%$
October	5	378 336-415	680 467-866	5.30 5.00-5.64	114.16 49.08-165.85	$\frac{114.16}{680} = 16.8\%$

A maturity index (Table 4) was calculated by sample month for the female potential spawners by dividing the average ovary weight by the average body weight and expressing the quotient as a percentage of the body weight. The maturity index for the Hood Bay Creek char increased rapidly from 3.3 percent in July to 16.8 percent in October. In 1965, a maturity index of 15.1 percent (Blackett, 1968) and in 1966 a maturity index of 19.1 percent (Armstrong, 1967) was calculated for the Hood Bay Creek Dolly Varden immediately prior to spawning. This indicates the maturity index for the Hood Bay Creek Dolly Varden immediately prior to spawning is between 15 and 20 percent.

Size and Age of Immigrant Dolly Varden:

The length frequency of 3,691 immigrant Dolly Varden measured at the Hood Bay Creek weir in 1967 is presented in Figure 10. The length frequency consists of a very distinct group of char between 150 and 300 mm with a mode of 213-240 mm, which are mostly nonspawners of age groups III and IV. Most of the char greater than 330 mm in length are potential spawners from age groups V and VI.

Age groups II through IX were found among the immigrant char in 1967 (Table 5). Most of the char were from age groups III (36.7 percent), IV (24.4 percent), V (16.3 percent) and VI (12.2 percent). By maturity, the majority of the nonspawners were in age groups III (53.0 percent) and IV (30.8 percent) and the majority of the potential spawners were from age groups V (30.2 percent) and VI (32.3 percent).

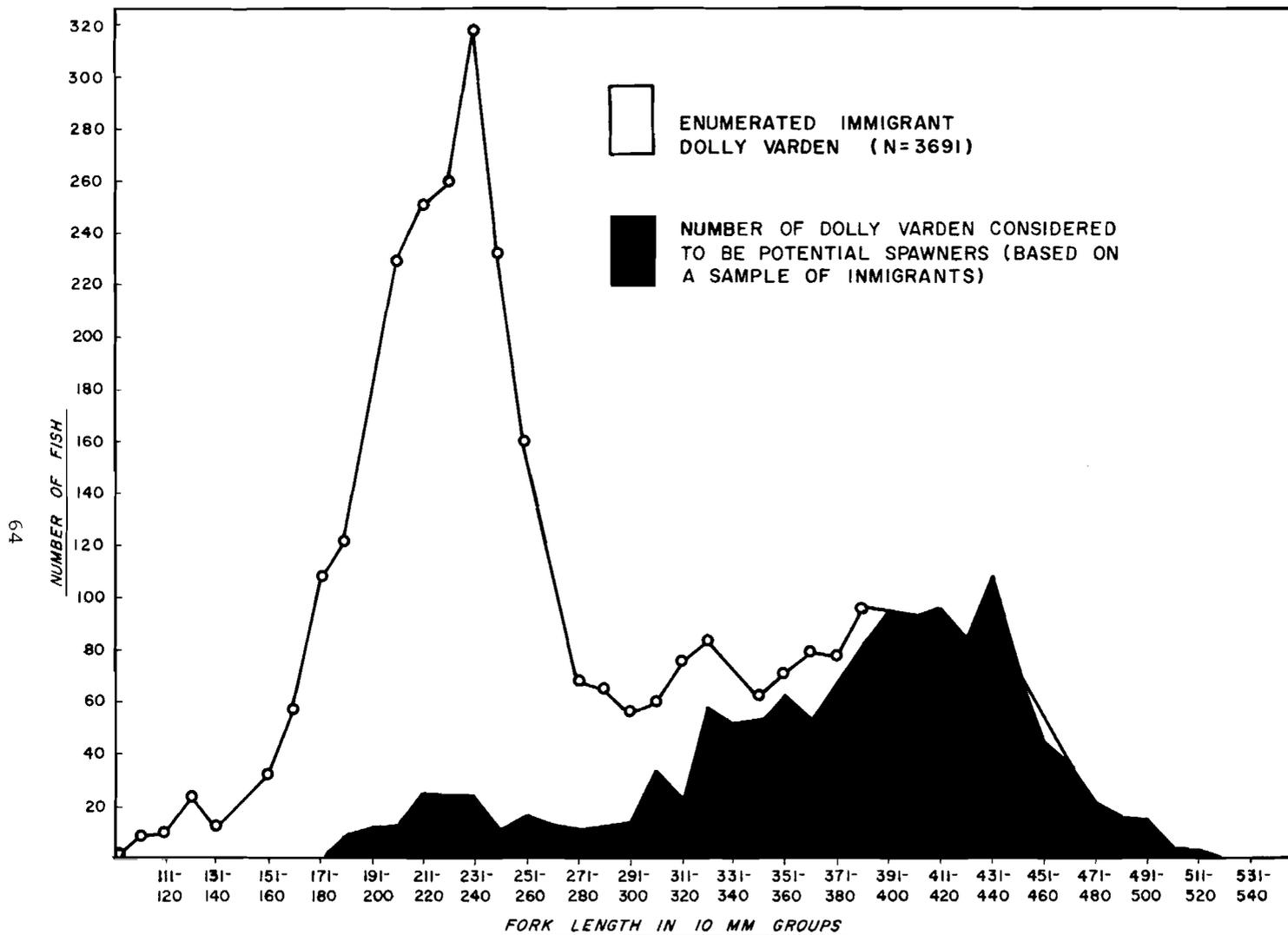


FIGURE 10. LENGTH FREQUENCY OF DOLLY VARDEN IMMIGRANTS ENUMERATED AT THE HOOD BAY CREEK WEIR, 1967, SHOWING THE NUMBER OF THESE CHAR CONSIDERED TO BE POTENTIAL SPAWNERS FOR THE YEAR.

TABLE 5 - Age Composition by Maturity of Immigrant Dolly Varden Sampled at the Hood Bay Creek Weir, 1967.

Age Group	Nonspawner		Potential Spawner		Total	
	N	%	N	%	N	%
II	4	2.0	0	0	4	1.3
III	105	53.0	3	3.1	108	36.7
IV	61	30.8	11	11.5	72	24.4
V	19	9.6	29	30.2	48	16.3
VI	5	2.5	31	32.3	36	12.2
VII	2	1.0	14	14.6	16	5.4
VIII	2	1.0	7	7.3	9	3.4
IX	<u>0</u>	<u>0</u>	<u>1</u>	<u>1.0</u>	<u>1</u>	<u>0.3</u>
TOTAL	198	99.9	96	100.0	294	100.0

The percentage of nonspawners decreased as the char became older and the percentage of spawners increased with age (Table 6). The percentage of potential spawners by age groups III, IV, V and VI were 2.7 percent, 15.3 percent, 60.4 percent and 86.1 percent respectively (Table 6).

TABLE 6 - Percent by Age Group of Nonspawner and Potential Spawner Immigrant Dolly Varden Sampled at Hood Bay Creek Weir, 1967.

Age	(N)	Nonspawner	Potential Spawner
II	4	100%	0.0%
III	108	97.3	2.7
IV	72	84.7	15.3
V	48	39.6	60.4
VI	36	13.9	86.1
VII	16	12.5	87.5
VIII	9	22.2	77.8
IX	1	0.0	100.0

The immigrant Dolly Varden ranged in fork length from 128 to 508 mm with a mean of 276 and they ranged in weight from 0.06 to 3.41 lbs with a mean of 0.71 (Tables 7 and 8). The greatest increase in growth occurred between age groups IV and V. The potential spawners were larger in both length and weight than the nonspawners in most age groups.

The 1967 Outmigration of Dolly Varden (exclusive of smolts)

Dolly Varden immigrants leave Hood Bay Creek the same year of entry. A portion of these immigrants spawn in Hood Bay Creek and leave the system spawned out. This section discusses only the immigrant fish which leave the system. Dolly Varden smolts are covered in a separate section. Some information on the outmigrant Dolly Varden at Hood Bay Creek in previous years is presented by Armstrong (1967) and Blackett (1968).

TABLE 7 - Age, Average Length and Length Range of Immigrant Dolly Varden Nonspawners and Potential Spawners
 Sampled at Hood Bay Creek, 1967.

Age Group	Nonspawners			Potential Spawners			Total	
	No.	Average Length (mm)	Range (mm)	No.	Average Length (mm)	Range (mm)	No.	Average Length (mm)
II	4	169	(128-255)	0	---	---	4	169
III	105	217	(154-295)	3	252	(211-301)	108	218
IV	61	234	(146-317)	11	240	(184-326)	72	235
V	19	281	(223-338)	29	354	(285-454)	48	325
VI	5	305	(218-341)	31	393	(269-496)	36	381
VII	2	415	(378-452)	14	413	(306-508)	16	413
VIII	2	378	(362-394)	7	430	(373-460)	9	418
IX	<u>0</u>	<u>---</u>	<u>---</u>	<u>1</u>	<u>432</u>	<u>---</u>	<u>1</u>	<u>432</u>
Totals	198	233	(128-452)	96	365	(184-508)	294	276

TABLE 8 - Age, Average Weight and Weight Range of Immigrant Dolly Varden Nonspawners and Potential Spawners
 Sampled at Hood Bay Creek Weir, 1967.

Age Group	Nonspawners			Potential Spawners			Total	
	No.	Average Weight (lbs)	Range (lbs)	No.	Average Weight (lbs)	Range (lbs)	No.	Average Weight (lbs)
II	4	0.17	0.06-0.44	0	---	---	4	0.17
III	105	0.28	0.10-0.65	3	0.53	0.28-0.85	108	0.29
IV	61	0.34	0.11-1.00	11	0.38	0.14-0.94	72	0.35
V	19	0.58	0.25-0.98	29	1.34	0.62-2.58	48	1.03
VI	5	0.86	0.27-1.33	31	1.65	0.53-2.78	36	1.54
VII	2	1.60	---	14	1.90	0.85-3.41	16	1.86
VIII	2	1.44	---	7	2.02	1.39-2.50	9	1.89
IX	<u>0</u>	<u>--</u>	<u>---</u>	<u>1</u>	<u>2.08</u>	<u>---</u>	<u>1</u>	<u>2.08</u>
Totals	198	0.36	0.06-1.33	96	1.44	0.28-3.41	294	0.71

Numbers and Timing of Outmigrant Dolly Varden:

Dolly Varden began leaving Hood Bay Creek in early July, peaked in late September and late October, and completed their outmigration by mid-November (Figure 11). Surveys of the entire creek after the last Dolly Varden had been captured at the weir indicated that all of the Dolly Varden which entered Hood Bay Creek had left the system by late November.

Most of the outmigration occurred during a fall in the water temperatures from 48° to 40°F. Water height of the creek appeared to have some effect on outmigration, although it was probably not a major factor. Most of the spawned-out char left the system during relatively low water conditions.

Nonspawners averaged 14 days in Hood Bay Creek and spawners averaged 72 days in the system in 1967 (Figure 12). Over 50 percent of the nonspawners left the system within 9 days after their date of entry. Over 80 percent of the nonspawners had left the system before the outmigration of spawned-out char had begun (Figure 13).

Size of Outmigrant Dolly Varden:

The length frequency of the enumerated outmigrant Dolly Varden (Figure 14) was similar to the length frequency of the immigrant Dolly Varden (Figure 10). The information is presented to give further support for the discussion of size differences between nonspawners and spawners entering Hood Bay Creek. Most of the char greater than 330 mm in fork length spawned in Hood Bay Creek.

While in Hood Bay Creek, the length increment of nonspawners was 6 mm and of spawners was 10 mm (Table 9). No length increment was found for 38.8 percent of the nonspawners and 14.0 percent of the spawners.

TABLE 9 - Length Increment of Nonspawners and Spawners while in Hood Bay Creek, 1967.

Length Increment (mm)	Nonspawners	Spawners		
		Male	Female	Male & Female
0	204 (38.8%)	6 (7.2%)	52 (15.7%)	58 (14.0%)
1 - 10	219 (41.7%)	22 (26.5%)	144 (43.4%)	166 (40.0%)
11 - 20	51 (9.7%)	35 (42.2%)	104 (31.3%)	139 (33.5%)
21 - 30	31 (5.9%)	17 (20.5%)	30 (9.0%)	47 (11.3%)
31 - 40	13 (2.5%)	3 (3.6%)	2 (0.6%)	5 (1.2%)
41 - 50	6 (1.1%)	---	---	---
51 - 60	1 (0.2%)	---	---	---
Total	525 (\bar{x} =5.88 mm)	83 (\bar{x} =14.0 mm)	332 (\bar{x} =9.4 mm)	415 (\bar{x} =10.3 mm)

Mortality of Spawners:

An overall mortality between spawning in Hood Bay Creek and outmigration was computed to be 26.0 percent (Table 10). The mortality of the male and female Dolly Varden spawning in Hood Bay Creek was computed to be 61.4 and 4.3 percent respectively. The higher mortality among the males is probably due to their aggressiveness and fighting on the spawning sites and their development of extreme sexual dimorphism. Blackett (1968) reported that only male Dolly Varden participated in aggression.

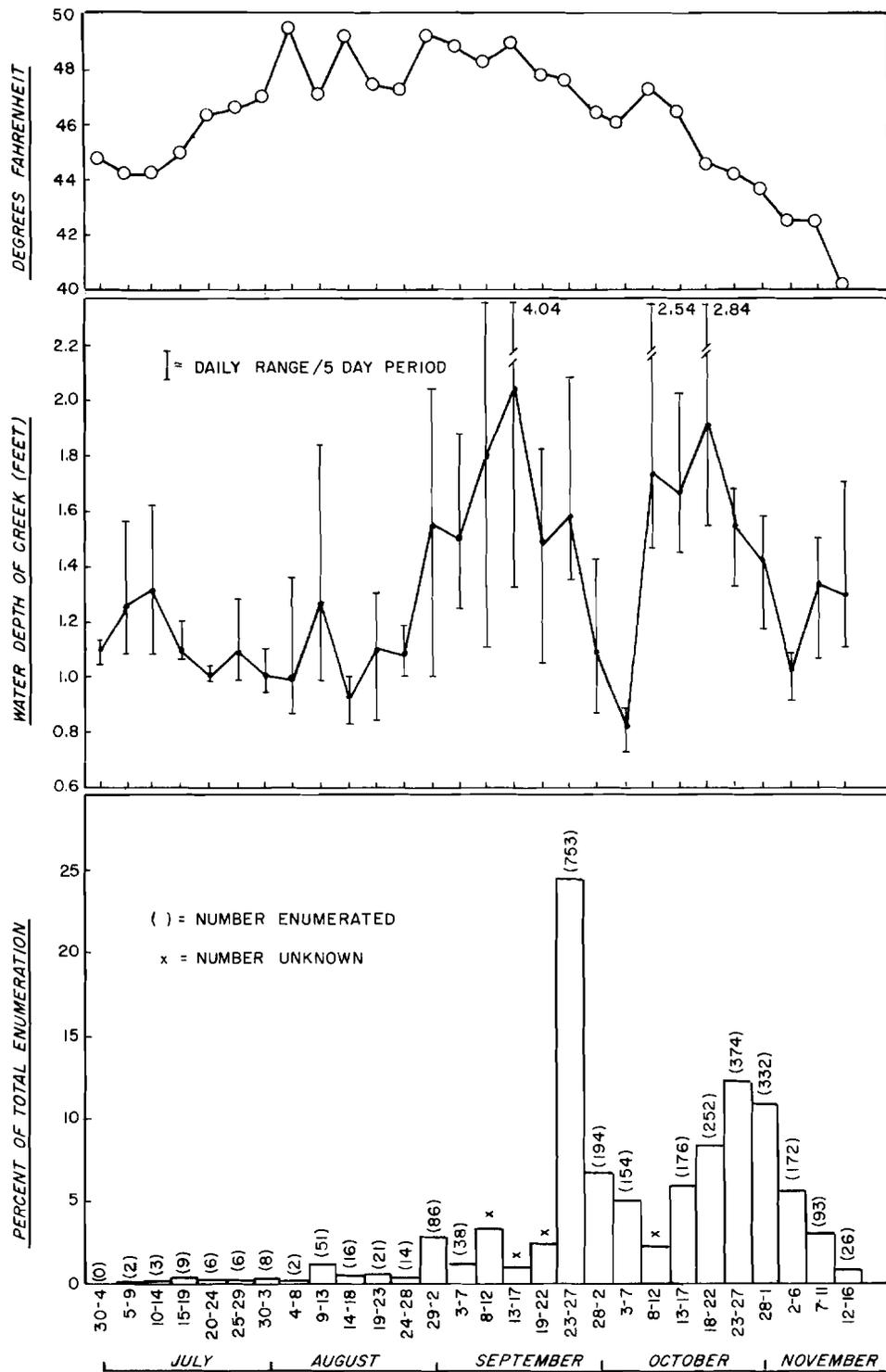


FIGURE II. PERCENT AND NUMBER OF DOLLY VARDEN LEAVING HOOD BAY CREEK AND MEAN WATER DEPTH AND TEMPERATURE OF THE CREEK BY FIVE-DAY INTERVALS, 1967.

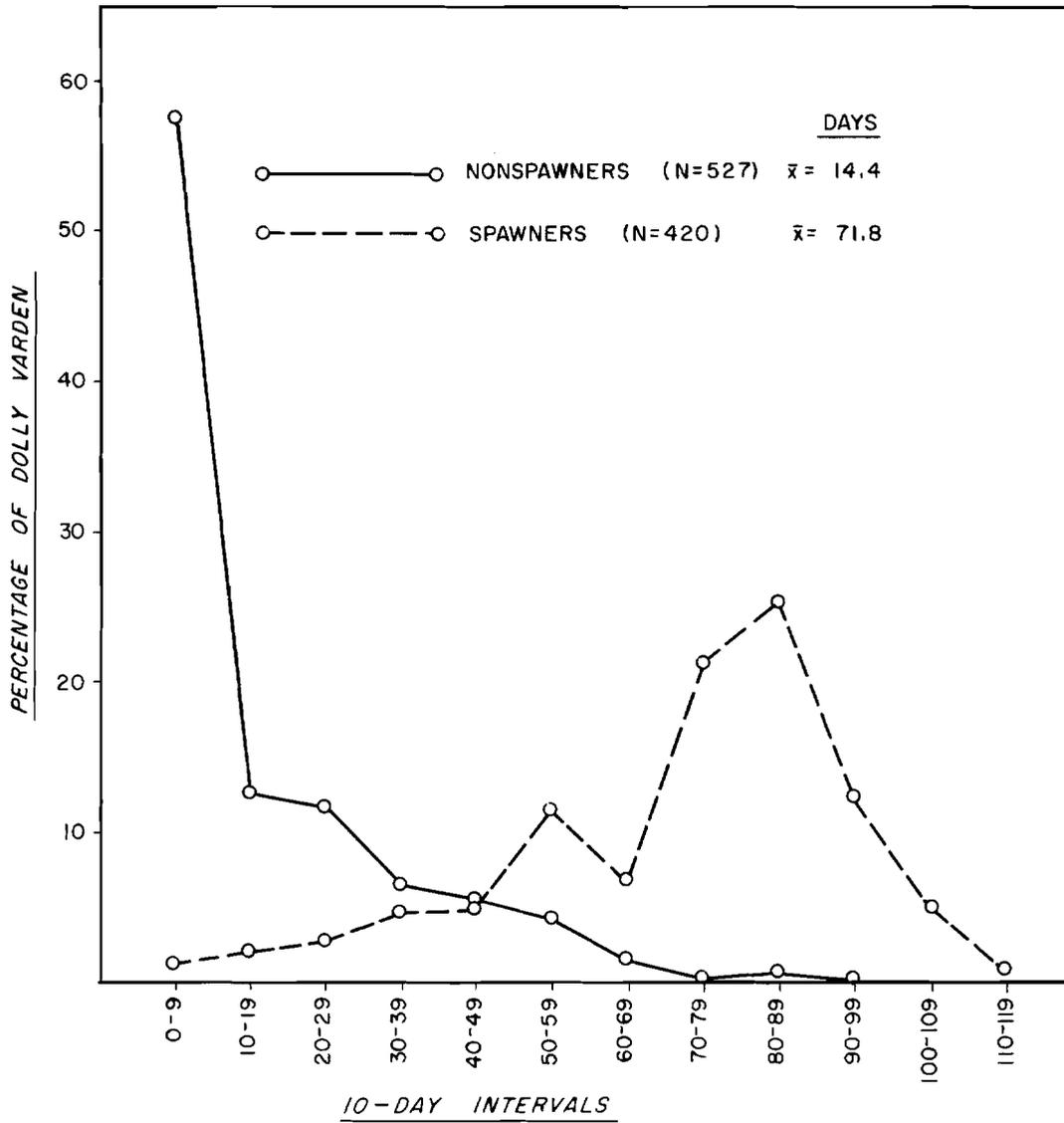


FIGURE 12. THE NUMBER OF DAYS, BY TEN-DAY INTERVALS, THAT SPAWNING AND NON-SPAWNING DOLLY VARDEN SPENT IN HOOD BAY CREEK, 1967.

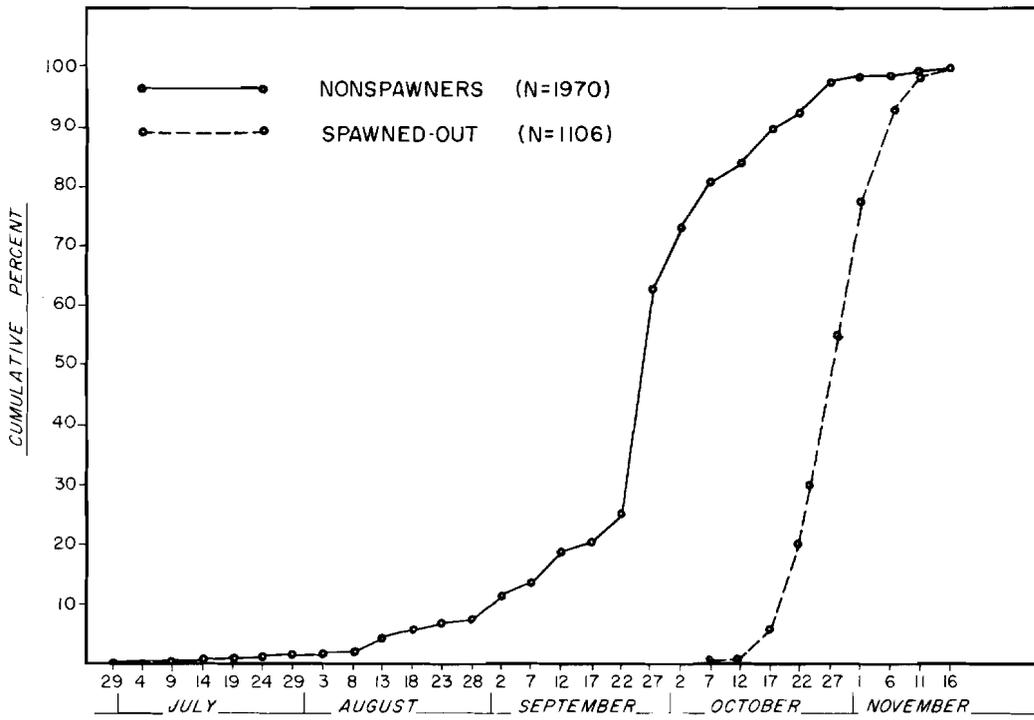


FIGURE 13. CUMULATIVE PERCENT OF NONSPAWNER AND SPAWNED-OUT DOLLY VARDEN LEAVING HOOD BAY CREEK BY FIVE-DAY INTERVALS, 1967.

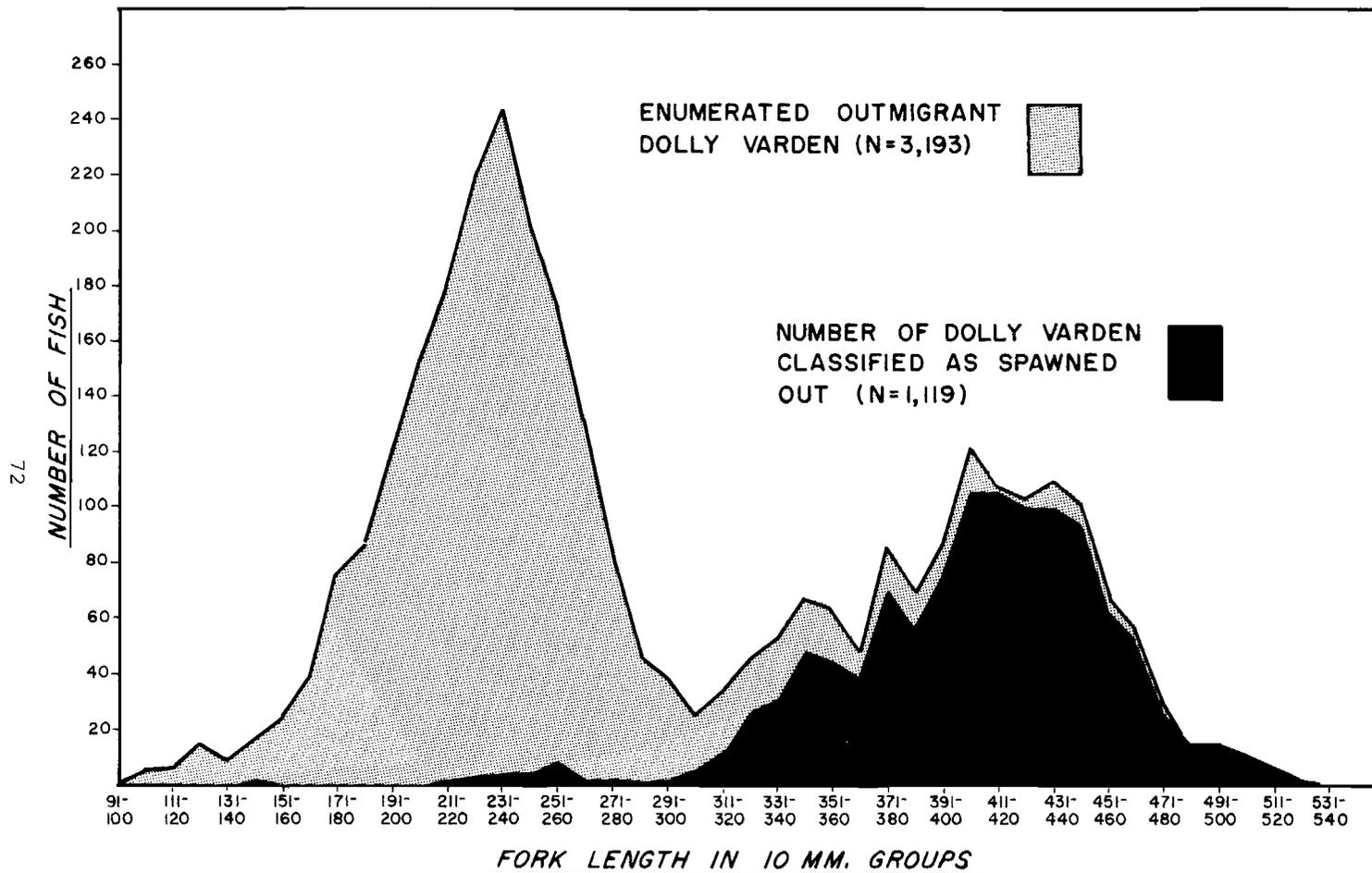


FIGURE 14. LENGTH FREQUENCY OF DOLLY VARDEN OUTMIGRANTS ENUMERATED AT THE HOOD BAY CREEK WEIR IN 1967, SHOWING THE NUMBER OF THESE CHAR CLASSIFIED AS SPAWNED OUT.

TABLE 10 - Mortality of Dolly Varden After Spawning and Before Outmigration in Hood Bay Creek, 1967.

	<u>Number Available</u>	<u>Number Enumerated</u>	<u>Difference</u>	<u>Percent Mortality</u>
Female	937	897	40	4.3
Male	<u>575</u>	<u>222</u>	<u>353</u>	<u>61.4</u>
Total	1,512	1,119	393	26.0

Return of Dolly Varden Marked in 1966

In 1966, 3,404 Dolly Varden were fin clipped, tagged, measured and released at the Hood Bay Creek weir. An estimated 748 (22.0 percent) of these marked char returned to Hood Bay Creek in 1967. The estimate was derived by multiplying the percentage (12.57) of 1966 marked char (464) among the total immigrants enumerated (3,691) times the total estimated 1967 immigration (5,954).

A total of 460 of the 1966 marked char was captured as they left Hood Bay Creek in 1967. Of these, 93.5 percent (430) were spawned out. Also, among the 1967 immigrant random sample (34) of the char marked in 1966, 91.2 percent were classified as potential spawners. These high percentages of spawners found among the 1966 marked char returning in 1967 clearly indicate that the majority of these fish returned to Hood Bay Creek for the purpose of spawning.

The length frequency of the total number tagged and released in 1966 and the length frequency, at tagging in 1966, of the char returning to Hood Bay Creek in 1967 are presented in Figure 15. It is apparent from Figure 15 that the majority of the 1966 marked char returning to Hood Bay Creek in 1967 were from the larger size classes at the time of tagging.

We believe that the majority of these char also spawned in 1966 for the following reasons:

1. Most of the char in 1966 (Armstrong, 1968) and 1967 (Figures 10 and 14) from the size classes represented by the returning char, spawned in Hood Bay Creek.
2. A total of 292 Dolly Varden tagged in 1966 left Hood Bay Creek spawned out in 1967. Of these, 45.5 percent (133) had been captured as they left Hood Bay Creek and were recorded as spawned out in 1966. Over 50 percent of the tagged char which spawned in Hood Bay Creek in 1966 were missed during their outmigration (Armstrong, 1968). Therefore, the majority of these char may have spawned in the system in 1966 and were missed during their outmigration after spawning. Also, of the remaining 159 char, for which no record of spawning was recorded in 1966, only two had been captured and recorded as immature out-migrants in 1966.

From the preceding discussion we can derive the necessary assumptions to make an estimate of the percentage mortality of Dolly Varden between spawnings. These assumptions are:

1. That all Dolly Varden which spawned in Hood Bay Creek in 1966 and were capable of returning in 1967 did so.
2. That the mortality after spawning and before migration in 1966 was the same as was determined for 1967.

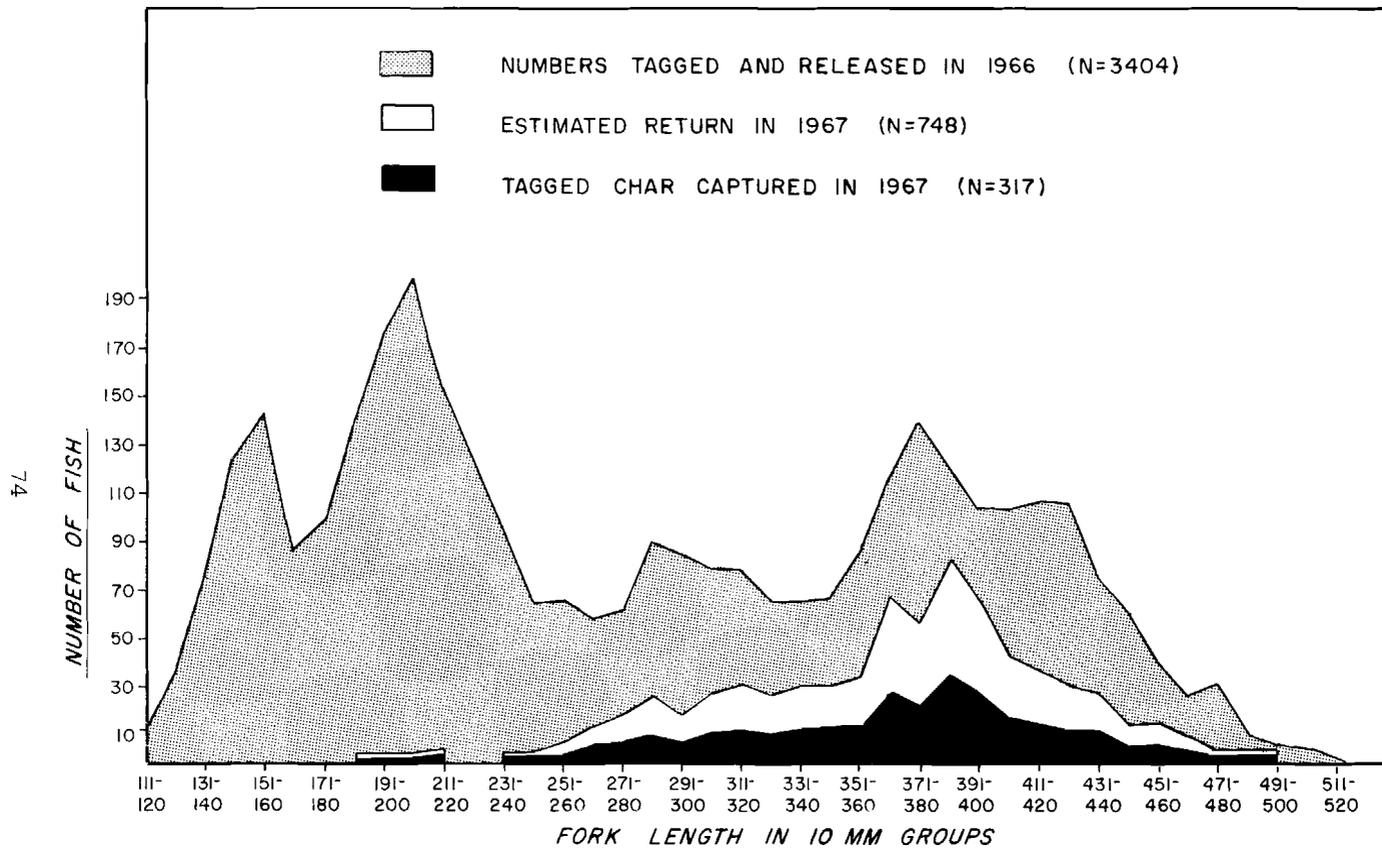


FIGURE 15. LENGTH FREQUENCY OF DOLLY VARDEN TAGGED AND RELEASED IN 1966 COMPARED TO THE LENGTH FREQUENCIES, AT TAGGING, OF THOSE CAPTURED IN 1967 AND THE ESTIMATED RETURN OF THESE CHAR IN 1967.

Based on these assumptions an estimate of the mortality of Dolly Varden from immediately after spawning in 1966 to their entry into Hood Bay Creek in 1967 may be made as follows:

Number of potential spawners marked in 1966	=	1,103
minus a 26.0 percent mortality before outmigration in 1966	=	<u>- 287</u>
Number of marked spawners entering the sea in 1966	=	816
plus the spawned-out char marked during their outmigration in 1966	=	<u>+ 284</u>
Total number of 1966 marked spawners available for entering Hood Bay Creek in 1967	=	1,100
minus estimated number of these char entering in 1967	=	<u>- 748</u>
Number of 1966 spawners not returning in 1967	=	352 (32.0%)
Mortality within Hood Bay Creek	=	26.0%
Mortality after leaving Hood Bay Creek	=	32.0%
Total 1966 spawners marked (1,103 + 284)	=	1,387
Total 1966 marked spawners entering Hood Bay in 1967	=	<u>748</u>
Total estimated mortality between immigrations	=	639 (46.1%)

The percentage survival of Dolly Varden spawners between their 1966 and 1967 immigrations at Hood Bay Creek would be 53.9 percent.

Return of Dolly Varden Displaced from Hood Bay Creek

A total of 286 Dolly Varden captured during their immigration at the Hood Bay Creek weir was tagged, marked by punching a hole in one of the fins, measured and displaced on 6 and 7, September 1967 to three locations in Hood Bay (Figure 16). The release points were at the junction of the North and South Arms of Hood Bay, off the mouths of streams entering the head of the North Arm of Hood Bay and off the mouth of Hood Bay Creek. Recovery of these displaced char was made at the Hood Bay Creek weir as they entered or left the system. All displaced char captured at the weir were dissected to determine their degree of maturity (spawned-out outmigrant char were examined externally). Some of the returning char were missed because of high water conditions so the returning catch figures would be minimal.

Of the 286 char displaced, 65 (22.7 percent) were captured at the Hood Bay Creek weir. Of these, 57 (87.7 percent) were either classed as potential spawners during immigration or as spawned out during their outmigration. The remaining eight fish captured were considered to be nonspawners for the year.

The results by point of release and size are presented in Table 11. The size breakdown was chosen to indicate percentage return by maturity. Most of the immigrant Dolly Varden at Hood Bay Creek over 301 mm in fork length are spawners and most under this length are nonspawners.

The results indicated that homing to Hood Bay Creek was much stronger among the mature char released than the immature char and that most of the fish returning did so for the purpose of spawning.

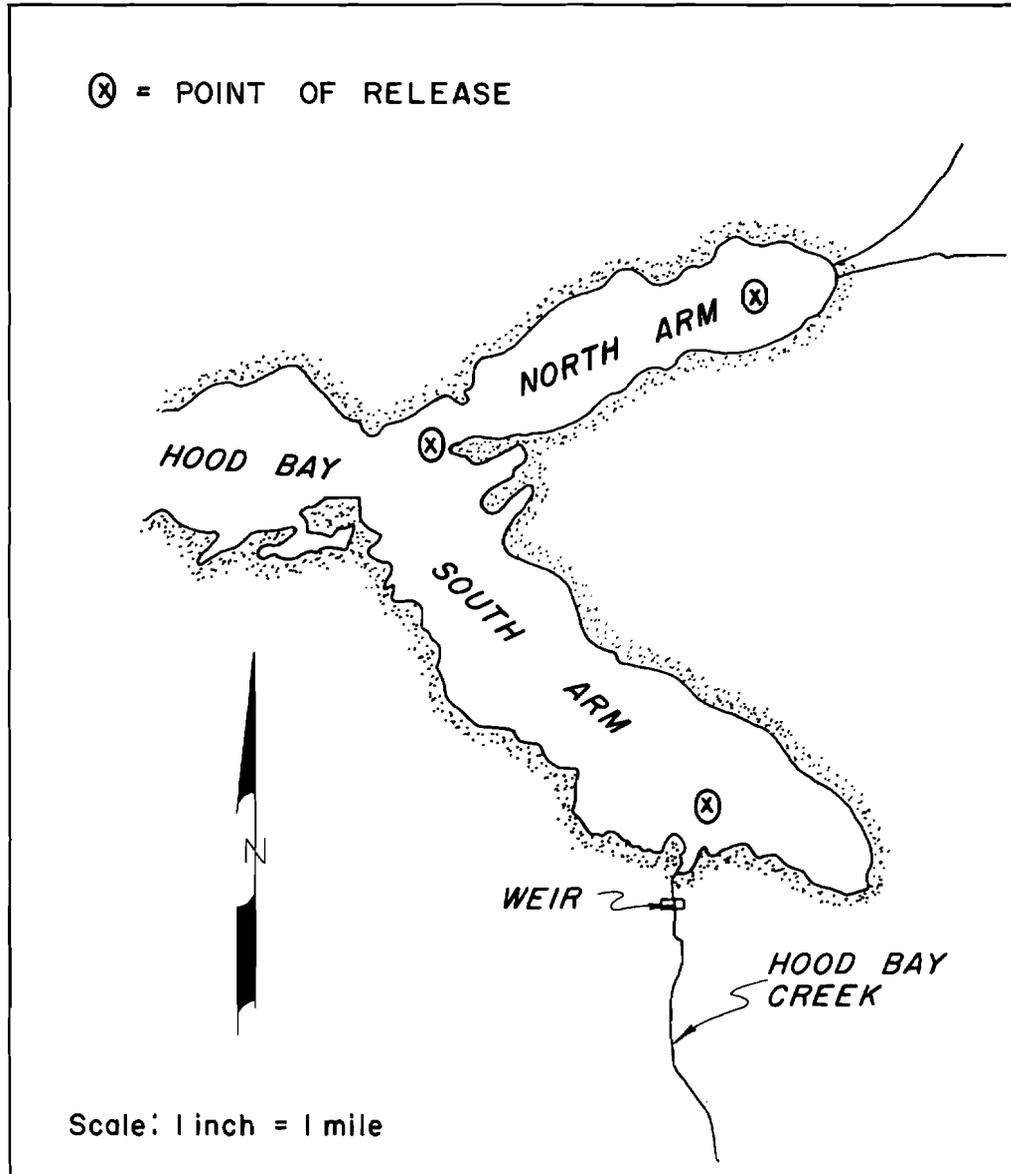


FIGURE 16. SKETCH MAP OF HOOD BAY SHOWING THE RELEASE POINTS FOR DOLLY VARDEN DISPLACED FROM HOOD BAY CREEK.

TABLE 11 - Percentage Recovery of Dolly Varden Displaced from Hood Bay Creek by Area of Release and Size.

<u>Area of Release</u>	<u>Size</u>	<u>Number Released</u>	<u>Number Recovered</u>	<u>Percentage Recovered</u>
Junction	> 301 mm	19	9	47.4
"	< 300 mm	81	5	6.2
North Arm	> 301 mm	40	17	42.5
" "	< 300 mm	58	3	4.2
South Arm	> 301 mm	45	24	53.3
" "	< 300 mm	43	7	16.3
All Areas	> 301 mm	104	50	48.0
" "	< 300 mm	<u>182</u>	<u>15</u>	<u>8.2</u>
Total		286	65	22.7

Food of Rearing Dolly Varden and Coho

The stomach contents of 9 Dolly Varden and 24 coho salmon young were examined from fish obtained by electroshocking in Hood Bay Creek on July 12, 1967 (Table 12). The purpose of the study was to determine the feasibility of using electro-fishing gear to obtain young Dolly Varden and coho and to obtain an indication of the possibility of competition for food between the two species.

TABLE 12 - Stomach Content of Dolly Varden and Coho Young Captured by Electroshocking in Hood Bay, July 12, 1967.

<u>Stomach Content</u>	<u>Dolly Varden</u>		<u>Coho</u>	
	<u>Incidence of Feeding</u>	<u>Percent Occurrence in Feeding Fish</u>	<u>Incidence of Feeding</u>	<u>Percent Occurrence in Feeding Fish</u>
Insects:				
Ephemeroptera	8	100.0	12	54.5
Plecoptera	1	12.5	10	45.4
Diptera	5	62.5	19	86.4
Hemiptera	1	12.5	0	0.0
Unidentifiable remains	5	62.5	11	50.0
Arachnids:				
Spider	0	0.0	4	18.2
Water Mite	0	0.0	1	4.5
Fish Remains	1	12.5	2	9.0
Number Empty		1		2
Number Feeding		8		22
Total Examined		9		24

It was concluded that competition for food by Dolly Varden and coho salmon young while rearing in Hood Bay Creek may exist and that the subject is worthy of further investigation. Electroshocking was found to be effective in capturing the young Dolly Varden and coho.

Tagging Experiments on Young Char

The purpose of this study was to find a tag suitable for use on rearing Dolly Varden between 40 and 100 mm in length. Although several types of tags were considered, only one appeared to be worthy of testing. This was a small lightweight aluminum staple that could be applied just under the dorsal fin.

These tags were applied to twenty young Dolly Varden in the 40 - 100 mm size range. The char were held in a small pen within the creek for about two months. There were no mortalities, one tag loss, and the char appeared to support the tag quite well. The tag was found to be a useful means of marking rearing Dolly Varden for short-term experiments of less than one year.

Effectiveness of the Hood Bay Creek Weir

To evaluate the effectiveness of the Hood Bay Creek weir to stop and trap Dolly Varden smolts during their outmigration, three outmigrant fry traps were installed adjacent to the weir decking on the downstream side of the weir. These traps were operated from April 4 to August 8. Although over 700,000 salmon fry were captured only six Dolly Varden young entered the traps. The six char captured were young-of-the-year and were captured during early April, approximately during the time of emergence of the Dolly Varden young from the gravel. These results indicate that the weir was an effective barrier to the migration of Dolly Varden smolts.

DISCUSSION

It was originally thought that Dolly Varden originating from nonlake streams, after leaving the system on their initial seaward migration in the spring, returned to the system the same year before migrating to a lake for the winter (Armstrong, 1965). Also, it was thought that the majority of Dolly Varden entering nonlake streams had originated from the system they were entering (Ibid.). However, the results of the 1967 study at Hood Bay Creek indicate that these statements may not be true.

Based on the 1967 study the following "new" hypothesis is proposed for the migration and homing of Dolly Varden entering and leaving nonlake stream systems:

Dolly Varden originating from a given nonlake stream, after their initial migration to sea, may enter several other nonlake streams in their search for a lake to winter in. At maturity, these fish return to their home stream to spawn.

This theory is based on the following information collected at Hood Bay in 1967:

1. The majority of nonspawners that entered Hood Bay Creek are from the same age groups (III and IV) and are in the same size range (150 - 280 mm) as the 1967 smolts that returned to Hood Bay Creek. However, 82.5 percent of these nonspawners had not originated from Hood Bay Creek in 1967. It is unlikely that the nonspawners entering Hood Bay Creek in 1967 had originated from the system in a previous year because if they had, their age composition would be mostly IV and V and the additional growing season would make them larger than the size range of the 1967 nonspawners. Also, as illustrated in Figure 15, very few of the 1966 immigrant char, in the small size classes, entered Hood Bay Creek in 1967. Hence, it is believed that the majority of the nonspawners entering Hood Bay Creek in 1967 have originated from stream systems other than Hood Bay Creek.

2. The low return (8.7 percent) of the 1967 smolts originating from Hood Bay Creek indicates that the majority of these char do not return to Hood Bay Creek in the same year as their outmigration. It is unlikely that the mortality of these smolts would be 91.3 percent. At Lake Eva, 47.1 percent of the char 150 mm and less returned the same year, and 94.9 percent of those returning left the lake the following year (Armstrong, 1965). This indicates a high survival rate among Dolly Varden smolts after their initial outmigration.
3. Of the 1966 marked char returning in 1967, 93.5 percent spawned in Hood Bay Creek in 1967. The evidence also indicates that these char spawned both in 1966 and 1967. Hence, it appears that Dolly Varden return to Hood Bay Creek for the purpose of spawning.
4. The maturity of the Dolly Varden returning after displacement from Hood Bay Creek indicates sexually mature char home to the system more readily than immature char.
5. Mature char entering Hood Bay Creek remain in the system until completion of spawning whereas immature char leave the system soon after their date of entry.

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