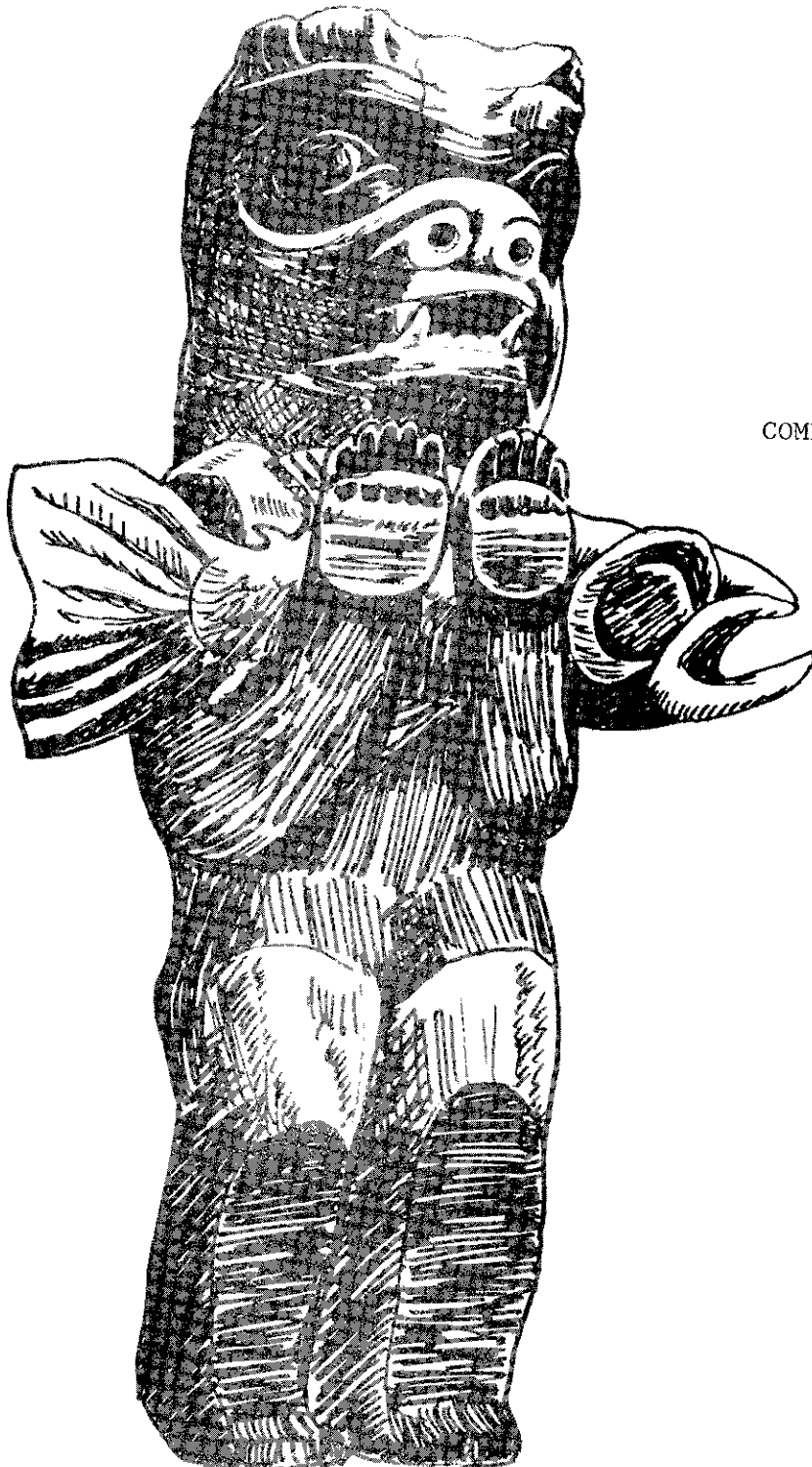


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THE LIFE HISTORY OF ADULT STEELHEAD
SAMPLED IN THE TYEE TEST FISHERY
IN THE SKEENA RIVER ESTUARY AND
COMPARISONS WITH OTHER STEELHEAD STOCKS
IN BRITISH COLUMBIA

W.E. CHUDYK

DECEMBER, 1976

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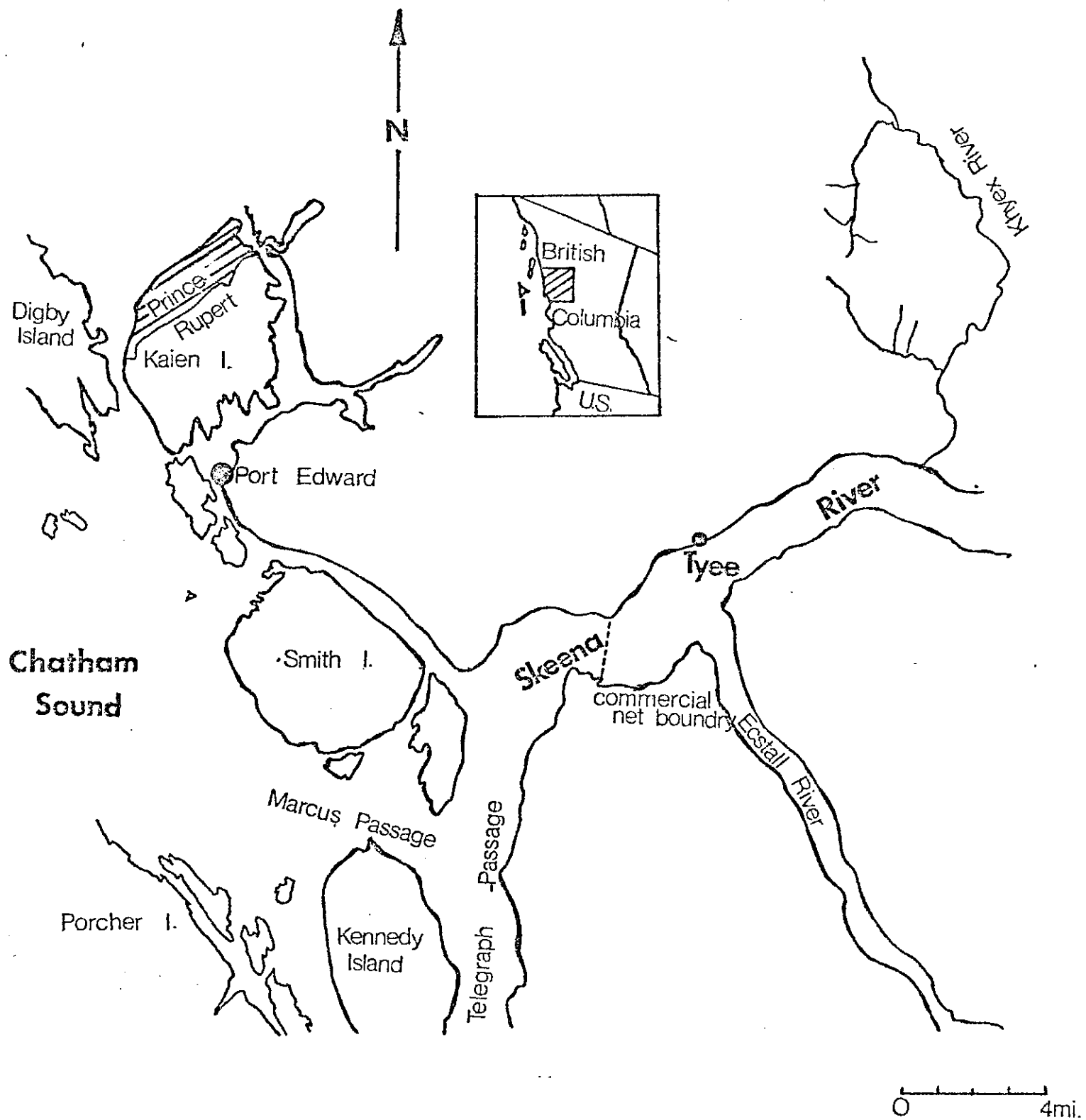
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INTRODUCTION

Summer steelhead trout (Salmo gairdneri) in the Skeena River are captured incidental to salmon in a gill net test fishery at Tyee. The Tyee test fishery, located four miles above the fishing boundary (Fig. 1), monitors sockeye and pink salmon escapement upstream from the commercial fishery. Fisheries and Marine Service operate the Tyee fishery as a major regulatory technique for estimating required salmon escapement. This report summarizes age, size, and sex for the steelhead sampled at Tyee in four years (1973 - 1976) of test fishing. Comparisons are made with similar information on specific Skeena stocks, the Kispiox and Babine Rivers.

The identification of a life history (scale) pattern unique to a specific tributary of the Skeena together with continued analysis of steelhead age groups at Tyee, would provide a good marker for time of entry/time of passage through the gill net fishery. Specific time of entry into the lower river is not presently known for any Skeena steelhead stock, but it is information that is basic to managing the commercial net and indian fisheries for increased steelhead escapement.



Figure; 1 The Skeena River estuary showing Tyee

METHODS

Steelhead scale samples, lengths, weights and sex were collected at Tyee by Fisheries and Marine Service personnel from 1973 to 1976. All steelhead killed in the Tyee test net fishery (approximately 90%) were sampled. The scale samples were cleaned and acetate impressions made of the two best scales using heat and pressure. These imprints were then read with a Microcom 1600 microfiche viewer. The 1973 and 1974 scales were checked by D.W. Narver to assure continuity in reading technique. The age formula used is as described in Narver & Withler (1974) and has the following features: a decimal separates the freshwater from salt water age; an "S" represents the complete year associated with spawning, and a "+" represents both freshwater and salt water growth following the last respective annulus (an incomplete year). An example of the notation is 4.2S1+ indicating a steelhead that spent four years in freshwater before smolting in its 5th year (4.); resided in the ocean for two years (.2) before returning to spawn in its seventh year(s); spent a complete year in the ocean (1) before returning in its ninth year (+) where it was captured.

Life History Categories

Two hundred and ninety-four steelhead samples with readable scales were collected in the Tyee test fishery from 1973 to 1976 (two hundred and sixty-nine scales with complete life histories). Nineteen age groups were identified in the sample, eleven for maiden fish and eight for repeat spawners (Table 1). The dominant age groups for maiden fish were 4.2+ (37.5%), 3.2+ (25.7%), 4.3+ (8.6%), and 3.3+ (6.7%) while 4.2S1+ (4.8%) and 3.2S1+ (4.5%) were dominant groups for repeat spawners. Males occurred in ten of eleven maiden age groups but females occurred in only eight maiden age groups. Of the total sample, maiden fish comprised 87.1% and repeat spawners 12.9%.

The most common freshwater age groups for two hundred and thirty-five maiden fish were 4. (57.9%) and 3. (40.4%) (Table 2). The proportion of age 3. and 4. do not appear to be different between sexes.

Table 1. Steelhead Trout age groups from the Skeena River at Tye for 1973 to 1976. (No scales with regenerated freshwater zone are included.)

| Age Group | Number of Steelhead | Number Male | Number Female | Percent Total |
|-----------|---------------------|-------------|---------------|---------------|
| 2.3+ | 1 | 1 | 0 | .4 |
| 3.1+ | 8 | 7 | 1 | 3.0 |
| 3.2+ | 69 | 26 | 43 | 25.7 |
| 3.3+ | 18 | 14 | 4 | 6.7 |
| 3.1S1+ | 3 | 3 | 0 | 1.1 |
| 3.2S1+ | 12 | 5 | 7 | 4.5 |
| 3.1S1S1+ | 1 | 0 | 1 | .4 |
| 3.3S1S1+ | 1 | 0 | 1 | .4 |
| 4.1+ | 10 | 8 | 2 | 3.7 |
| 4.2+ | 101 | 31 | 70 | 37.5 |
| 4.3+ | 23 | 19 | 4 | 8.6 |
| 4.4+ | 1 | 1 | 0 | .4 |
| 4.5+ | 1 | 1 | 0 | .4 |
| 4.1S1+ | 2 | 1 | 1 | .7 |
| 4.2S1+ | 13 | 2 | 11 | 4.8 |
| 4.2S1S1+ | 1 | 0 | 1 | .4 |
| 5.2+ | 2 | 1 | 1 | .7 |
| 6.2+ | 1 | 0 | 1 | .4 |
| 19 | 269 | 120 | 149 | 100 |

Table 2. Numbers and percentages of male and female steelhead of different freshwater ages from the Skeena River at Tye for 1973 to 1976.

| | | Freshwater Age | | | | | Total |
|--------|---|----------------|------|------|----|----|-------|
| | | 2. | 3. | 4. | 5. | 6. | |
| Male | n | 1 | 47 | 60 | 1 | 0 | 109 |
| | % | .9 | 43 | 55 | .9 | - | |
| Female | n | 0 | 48 | 76 | 1 | 1 | 126 |
| | % | - | 38.1 | 60.3 | .8 | .8 | |
| Total | n | 1 | 95 | 136 | 2 | 1 | 235 |
| | % | .4 | 40.4 | 57.9 | .9 | .4 | |

A distinct sex-age difference is shown for ocean age groups (Table 3). The dominant ocean age group (.2+) forms 73.1% of the total (253). This is 53.8% of the total male sample and 90.3% of the total female sample or about two females per male. The younger and older age groups, .1+ (14.3%) and .3+ (30.3%) were composed primarily of males (4 males:1 female).

Table 3. Numbers and percentages of male and female steelhead of different ocean age from the Skeena River at Tye for 1973 to 1976. (Scales with regenerated freshwater zones included. Repeat spawners excluded.)

| | | Ocean Age | | | | | Total |
|--------|---|-----------|------|------|-----|-----|-------|
| | | .1+ | .2+ | .3+ | .4+ | .5+ | |
| Male | n | 17 | 64 | 36 | 1 | 1 | 119 |
| | % | 14.3 | 53.8 | 30.3 | .8 | .8 | 100 |
| Female | n | 4 | 121 | 9 | 0 | 0 | 134 |
| | % | 3.0 | 90.3 | 6.7 | - | - | 100 |
| Total | n | 21 | 185 | 45 | 1 | 1 | 253 |
| | % | 8.3 | 73.1 | 17.8 | .4 | .4 | 100% |

Repeat Spawners

Numbers and percentages of repeat spawning steelhead of different ocean ages are shown in Table 4. The incidence of repeat spawning steelhead sampled at Tye is 12.9% of which females outnumbered males two to one. Interestingly 3 out of 38 repeat spawners

were returning for the third time.

Table 4. Numbers and percentages of different ocean ages of repeat spawning steelhead sampled at Tyee for 1973 to 1976 (sample size 294 including scales with regenerated freshwater zones).

| | | .1S1+ | .2S+ | .2S1+ | .1S2+ | .1S1S1+ | .2S1S1+ | .3S1S1+ | Total | % Total Sample |
|--------|---|-------|------|-------|-------|---------|---------|---------|-------|----------------|
| Male | n | 4 | 0 | 9 | 0 | 0 | 0 | 0 | 13 | |
| | % | 31 | - | 69 | - | - | - | - | 100 | 4.4 |
| Female | n | 1 | 1 | 19 | 1 | 1 | 1 | 1 | 25 | |
| | % | 4 | 4 | 76 | 4 | 4 | 4 | 4 | 100 | 8.5 |
| Total | n | 5 | 1 | 28 | 1 | 1 | 1 | 1 | 38 | |
| | % | 13 | 3 | 74 | 3 | 3 | 3 | 3 | 100 | 12.9 |

Sex Ratio

The overall sex ratio for Tyee steelhead is 1:1.16 males to females.

Length-Weight Relationships

Adult steelhead sex, length and weight relationships are summarized for all Tyee sample collected from 1973 to 1976 (Table 5). In general, males are longer and heavier than females of the same ocean age group. For example, on average, a 4.2+ male is longer (79.8 cm.) than a 4.2+ female (75.0 cm.) and the 4.2+ male is on

the average heavier (5.6 kg.) than the female (5.2 kg.).

Among fish of a given freshwater age and sex, those with the older ocean age are larger. Similarly for fish of a given ocean age and sex, those with older freshwater age are larger. The latter has not been commonly documented before, a common assumption being that ocean growth strongly masked any possible influence at smolt age/size. In the Tyee sample an additional year of freshwater growth meant .4 to 6 kg. or 1.9 to 2.7 cm. increase in length for either .2+ or .3+ fish.

DISCUSSION

Freshwater Age

Percentages of summer steelhead in various life history categories from the lower Skeena River and its Babine and Kispiox tributaries are compared in Table 6 along with Dean River summer steelhead (Hemus 1973 and Leggett 1974). The Kispiox and Tyee samples were dominantly 4.2+ steelhead (30.3% and 37.5%) while Babine and Dean Rivers were mostly 3.2+ steelhead (62% and 65%). The dominance of age 3. steelhead smolts in the Babine River is likely related to the productive rearing area below Babine Lake. The age 3. smolts dominance in the Dean River may also relate to stream productivity. The Dean River originates in the fertile

Chilcotin Plateau country (Leggett pers. com.). The high proportion of age 4. smolts in the Kispiox sample suggests waters of low productivity (Table 6). The high proportion of age 4. smolts in the Tyee sample suggests that most steelhead tributaries of the Skeena are unproductive.

Table 5. Average lengths (cm.), weights (kg.), and ranges of lengths and weights by sex for Tyee steelhead age groups from 1973 to 1976 (sample size). Numbers of fish in each category parenthesized.

| Age Group | Average Weight | | Range | | Average Length | | Range | |
|-----------|----------------|---------|----------|---------|----------------|----------|------------|-----------|
| | Male | Female | Male | Female | Male | Female | Male | Female |
| 2.3+ | 4.2(1) | | | | 89.6(1) | | | |
| 3.1+ | 1.8(7) | 2.0(1) | 1.6-2.0 | | 53.7(7) | 56.3(1) | 50.7-56.3 | |
| 3.2+ | 5.2(24) | 4.6(43) | 2.3-7.5 | 3.2-6.4 | 77.9(26) | 73.9(43) | 68.0-90.0 | 66.0-81.0 |
| 3.3+ | 8.7(14) | 7.2(4) | 6.4-11.3 | 5.9-8.4 | 90.7(14) | 84.6(4) | 83.3-95.5 | 82.6-88.5 |
| 4.1+ | 2.4(7) | 1.8(1) | 1.4-4.5 | | 56.8(7) | 77.9(2) | 47.5-58.2 | 72.5-81.9 |
| 4.2+ | 5.6(28) | 5.2(68) | 4.1-7.3 | 3.2-8.2 | 79.8(31) | 75.0(68) | 69.7-89.5 | 66.0-82.2 |
| 4.3+ | 9.1(17) | 7.6(4) | 5.4-12.7 | 7.3-8.2 | 93.2(19) | 87.3(4) | 80.0-100.0 | 78.0-97.1 |
| 4.4+ | 9.5(1) | | | | 90.4(1) | | | |
| 4.5+ | 16.3(1) | | | | 111.0(1) | | | |
| 5.2+ | 5.7(1) | 6.8(1) | | | 83.0(1) | 80.7(1) | | |
| 6.2+ | | 5.9(1) | | | | 79.0(1) | | |

Table 6. Percentages and numbers of steelhead in various life history categories from the Skeena River, Dean River.

| Age Group | 1973-1976 Tyee (n) | 1975 Kispiox ⁴ (n) | 1967-1968 Babine ³ (n) | 1973 Dean ¹ (n) | 1974 Dean ² (n) |
|-----------|--------------------------|-------------------------------------|---|----------------------------------|----------------------------------|
| 2.1 | | .5(1) | 1(1) | .8(3) | 1.1(1) |
| 2.2 | | 1(2) | 1(1) | 7.3(27) | 22.5(20) |
| 2.3 | .4(1) | | | 6.8(25) | 5.0(4) |
| 3.1 | 3.0(8) | 2.1(4) | 3(3) | 6.5(24) | 5.0(4) |
| 3.2 | 25.7(69) | 14.9(29) | 62(62) | 65.8(242) | 58.4(52) |
| 3.3 | 6.7(18) | 14.9(29) | 18(18) | 10.3(58) | 7.9(7) |
| 3.4 | | | | | |
| 4.1 | 3.7(10) | 2.1(4) | 5(5) | 1.9(7) | |
| 4.2 | 37.5(101) | 30.3(59) | 9(9) | .5(2) | 1.1(1) |
| 4.3 | 8.6(23) | 10.3(20) | 1(1) | | |
| 4.4 | .4(1) | 2.5(5) | | | |
| 4.5 | .4(1) | .5(1) | | | |
| 5.1 | | | 1(1) | | |
| 5.2 | .7(2) | 1.5(3) | | | |
| 5.3 | | 1.0(2) | | | |
| 6.2 | .4(1) | | | | |
| Total n | | | | | |

1. Hemus (1974)
2. Leggett & Westover (1976)
3. Narver (1969)
4. Whately (1976)

The Skeena River, at Tyee, has primarily .2+ ocean steelhead (73.1%) of which 53.8% of the total male sample and 90.3% of the female sample belong to this age group (Table 7). Females in this age group outnumber males about 2:1. Conversely, males dominate in the .1+ and .3+ age groups (4:1) over females.

Repeat Spawners

The preponderance of repeat spawners among females in the Tyee sample is confirmed in other studies. For example, repeat spawning steelhead in the Kispiox (a Skeena tributary) were 17.6% of the total sample with a male to female ratio of 1:5 (Whately 1976). However, the percentage of repeat spawners (3.3%) for another Skeena tributary, the Babine, (Narver 1969) is very different. The Babine repeat spawners were all (4) females. Narver's total sample size (100) may have been too small to show a true incidence of repeat spawners. The percentage of repeat spawning steelhead on the Dean, not in the Skeena system, was 17.9%, with a male to female ratio of 1:5.1 (Hemus 1974). Tyee Kispiox and Dean fit in the range of repeat spawners (9.5 - 36.3%) reported by Withler (1966) for winter steelhead (89% females). Withler (1966) suggests that the reason for more female repeat spawners than males is not known precisely but may relate to male early stream entry or to males remaining on spawning grounds longer

or to more aggressive behaviour by males in defending spawning territory.

Sex Ratio

The sex ratio of 1:1.16 for Tyee is lower than for Babine River stocks (1:1.33 Narver 1969) and other coast stocks (Withler 1966), however, if the sample was collected by angling as on the Babine, then a bias toward females is thought to occur (Withler 1966). The Tyee sample was strictly collected by gill net and should not be biased towards females in the same way that a sports fishery is biased. The sampling is probably biased - perhaps to larger fish, allowing the smaller, .1+ fish to escape. These are mainly males.

FUTURE ACTION

Present data collections, except for Babine and Kispiox, for the Skeena River tributaries are inadequate for comparison with the Tyee sample. The information deficit on the Skeena should be satisfied by 1978. This will allow a more in-depth comparison with age analysis of steelhead at Tyee.

SUMMARY

- 1) The dominant maiden steelhead age groups for Tyee were 4.2+ (37.5%), 3.2+ (25.7%), 4.3+ (8.6%) and 3.3+ (6.7%).
- 2) The dominant freshwater age groups for maiden Tyee steelhead were 4. (57.9%) and 3. (40.4%).
- 3) The most common ocean age group for maiden Tyee steelhead was .2+ (73.1%) (of the total sample (253)). The .2+ age group has 53.8% of the total male sample and 90.3% of the total female sample or about two females per male. The odd numbered ocean age groups, .1+ (14.3%) and .3+ (30.3%) were dominantly male (4:1).
- 4) The incidence of repeat spawning steelhead in the Tyee sample was 12.9% for a total sample of two hundred and sixty-nine steelhead. The male to female ratio for repeat spawning steelhead at Tyee was 1:2.
- 5) The overall sex ratio for Tyee steelhead was 1:1.16, males to females.
- 6) Male maiden steelhead were longer and heavier than female steelhead of the same age group. Male and female length-weight relationships are closely related to ocean growth.

7) The sample steelhead from Tyee were dominantly 4.2+ while Babine steelhead were mostly 3.2+ steelhead. This age difference is because of variations in stream productivity as it relates to the time required to produce a smolt sized steelhead.

8) The Tyee sample is dominantly .2+ ocean steelhead (73.1%) of which 53.8% of the total male sample and 90.3% of the total female sample belong to this age group. Females in this (.2+) age group outnumber males 2:1. Conversely males dominate in the .1+ and .3+ age groups (4:1) over females. Sex ratios for the Dean, Kispiox and Babine Rivers are comparable to those of the Tyee sample.

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