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Occurrence of Stream-Resident Females in Miyabe Charr

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It is well known that there are two types of mature males in the land-locked Miyabe charr, *Salvelinus malma miyabei*, the lake-run type (hereafter "lake") that migrate downstream to mature in the lake and then upstream to their native grounds to spawn, and the stream-resident types (hereafter "stream") which live their entire life in either streams or rivers (Maekawa, 1977, 1984). In contrast to males, few stream females occur (Maekawa, 1983). We, however, came across several stream females in the course of our study concerning the spawning habits of Miyabe charr conducted between 1972 and 1986. Little is known about the life cycle of stream-resident female Miyabe charr or other anadromous salmonid fish, since it is very difficult to observe or collect female fish, except for those of the land-locked populations which live in streams throughout their life (Blackett, 1973; Maekawa, 1984).

We briefly report the growth pattern and the maturation stages of stream females.

Materials and methods

From 1981 to 1986, 6 stream female specimens were collected during the breeding period, August through October, from the Yambetsu Creek inlet of Shikaribetsu Lake, Hokkaido, Japan. Portions of these samples were preserved in formalin after the removal of the otolith. In addition, 7 specimens collected from 1972 to 1975 and 22 lake-run female specimens collected in a weir across Yambetsu Creek in 1983 were used.

The age of each individual fish was determined by using their fresh otoliths, while the length and width of each individual otolith were measured in order to estimate the growth rate from the first winter to that of the next year.

Results and discussion

It is easy to distinguish stream females from either lake females or stream males because the former has a smaller body size that lacks the usual silver color and stripe, a body shape which resembles that of younger fish, and a relatively small lower jaw without any black colouration.

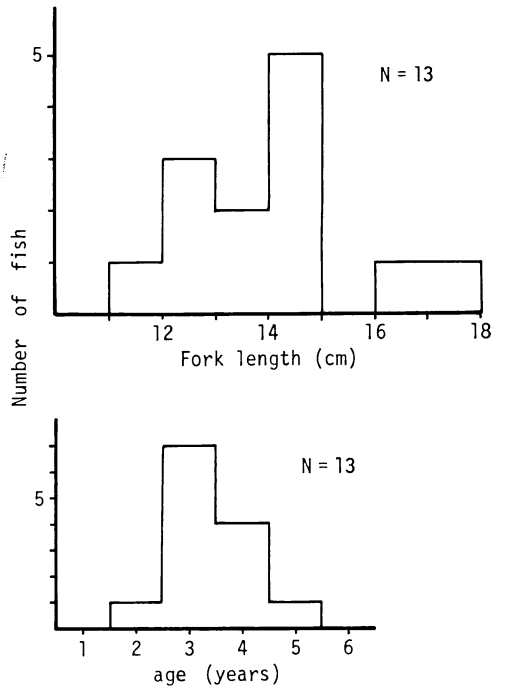

Fig. 1. Fork length and age distributions of mature stream-resident type females.

Fork length and age distribution of mature stream females are shown in Fig. 1. The average body size and age are 139.9 mm (±17.0 s.d., range 114–174, n=13) and 3.4$^+$ (±0.8 s.d., range 2–5, n=13), respectively. It has been shown that the average body size and age of lake females are about 224 mm in fork length and 3.8 years, respectively (Maekawa and Onozato, 1986). Stream males are much smaller and somewhat younger on the average than lake females. However, most lake females (Maekawa and Onozato, 1986) and stream females tend to reach maturity at three years of age, suggesting that the latter ones do not necessarily mature at a younger age than the former ones. Unlike the lake and stream females, most stream males mature at age 2$^+$, whereas a limited number mature at age 1$^+$ (Maekawa and Onozato, 1986). On the other hand, lake males mature at age 4$^+$.

Growth rates of the otolith radius were compared for stream and lake females (Fig. 2). Since otolith growth proceeds at a constant rate relative

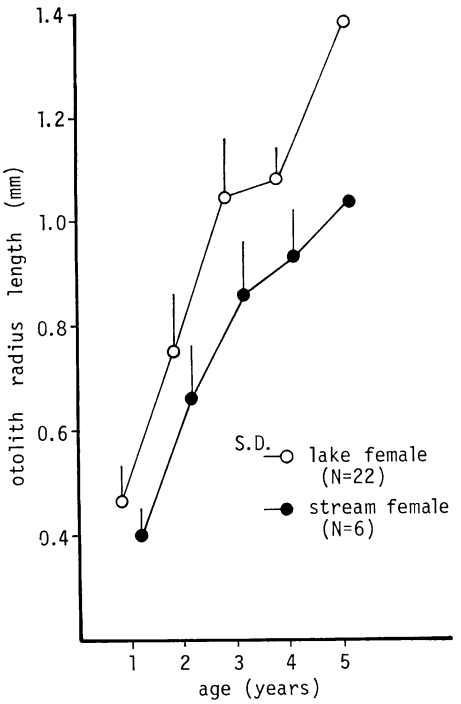

Fig. 2. Estimated growth of stream-resident and lake-run female, as shown by the average otolith width from the winter of one year to that of the next year. The final age is shown on the basis of the calendar year.

to fish growth (Maekawa and Onozato, 1986), the data shows that the average body size of stream females is significantly smaller at each age than that of lake females ($p<0.01$). Although it is not possible to compare the average growth at each cohort because of the small sample size, preliminary data comparing 3-year cohorts suggest that the average otolith size of stream females is always smaller than that of lake females [1^+; St(stream)=0.427 mm, L(lake)=0.478, 2^+; St=0.720, L=0.786, 3^+; St=0.907, L=1.089, 4^+; St=1.027, L=1.346, No. of St=3, No. of L=17]. Therefore, the mechanism of divergence between the two types of females appears to differ from that of the males because there seems to be no clear difference in the growth rate and average body size between lake and stream males (Maekawa and Onozato, 1986), except for the 1-year cohort that has the most rapid growth rate. A portion of the Miyabe charr juveniles with two modes of about 65 mm and 90 mm in fork length appears to migrate downstream to Shikaribetsu Lake between July and November, with a peak in October (Maekawa, 1977, 1984). Those remaining in the stream become smolts (age 2^+ or over) or turn silvery. A possible explanation is that stream females may mature before silvering or becoming smolt at age 3^+. This is similiar to the maturation of lake females.

The average fecundity of stream females was 116.5 eggs (±47.1 s.d., range 69–199 in fork length (124–174 mm) examined, N=6), which is far less than that of lake females (Maekawa, 1984). Therefore, unlike the case of males (Maekawa and Onozato, 1986), the average lifetime fecundity of the former appears to be much lower than that of the latter because the average age of maturation of stream females is not different from that of lake females.

If stream females and males were pioneers in the early process of land-locking as hypothesized in Sockeye salmon by Ricker (1940), the biological characteristics of the two types, especially of the stream female in anadromous fish, may come to be very important in understanding the origins of variability of land-locked populations.

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ミヤベイワナの河川残留型雌の出現について

前川光司

然別湖注入河川ヤンベツ川において，1972 年から 1986 年にかけての産卵期にミヤベイワナ，*Salivelinus malma miyabei* を調査中に偶然 13 尾の河川残留型雌が採集された．これらの成長様式と成熟年齢について残留型と降湖型を比較した．その結果，体長および成長率は全ての齢において降湖型より残留型が有意に小さいが，両者の成熟年齢 (3^+) に顕著な違いが認められなかった．抱卵数は残留型が明らかに少なかった．オショロコマを含む回遊型サケ科魚類には，この型の雌の出現が極めて稀なことを重視して，河川陸封型の変異出現について若干論議した．

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