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Some Biological Observations on the Galaxiid Fish, *Galaxias platei*, Collected in Southern Chile

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The galaxiid fishes (Salmoniformes) are characterized by having no scales on the body, a single dorsal fin positioned in the posterior part of the body opposite to the anal fin and no adipose fin. All species are confined to the southern hemisphere; the genus *Galaxias* is the largest group in the family, showing a circumantarctic distribution (Scott *et al.*, 1974; Nelson, 1976; McDowall, 1978). *Galaxias* species, as well as other members of the family, usually occur in rivers, lakes and marshes, but diadromous populations of some species spend an earlier part of their life in the sea or estuarine waters and migrate into freshwater as transparent juveniles, which are important for the commercial fisheries in New Zealand and Chile (McDowall, 1968, 1972; Campos, 1973; McDowall *et al.*, 1975; Andrews, 1976).

Galaxias platei Steindachner is found in the Patagonian region of Chile and Argentina, between 40° and 53°S, and the Falkland Islands (Eigenmann, 1927; Fowler, 1945; Ringuelet *et al.*, 1967; McDowall, 1971; Arratia *et al.*, 1981). In Chile Patagonia, records of this species were concentrated in the part north of Puerto Montt (41°30′S) and the southernmost part around Punta Arenas (53°10′S), but the occurrence of the species in the intermediate area has been confirmed by Zama and Cárdenas (1984). A detailed taxonomic account of *G. platei* was given by McDowall (1971). Campos (1972) showed the karyotype of *G. platei*. However, nothing is known of the life history of this galaxiid, except very little information noted by Campos (1970b, 1979) and McDowall (1971). During the course of investigation for salmon propagation, the staff of the Coyhaique Salmon Hatchery collected specimens of *G. platei* in a small lake in southern Chile. I had an opportunity to examine these specimens through their courtesy. Because of the scantiness of biological observations of the species, I will report herein on length-weight relationship, gonad index, fecundity and stomach contents of the fish collected.

Material and methods

Fifteen specimens examined in this study were caught at depths between surface and 6.5 m, near the shore of Lake Don Poli (46°15′S, 71°57′W) on January 6, 1984, using a surface gill net of 60 mm stretched mesh. Water temperature on shore was 14.5°C at 11: 00 a.m. This lake, 1.5 km long and 0.5 km wide, has no substantial tributary and flows out to Lake General Carrera (Lake Buenos Aires) only when there is much rain (Fig. 1). Steep cliffs surround the lake and there is in part a sandy area with rushes where the gill net was set.

Standard length (SL), total length (TL), body weight and gonad weight of the fish were measured after refrigeration. Approximate diameter of ovarian eggs was also taken. Gonad index was calculated as follows: (gonad weight(g)/body weight(g)) × 100. Maturity phases of the gonads were determined by their macroscopic appearance, following the outline given by Pollard (1972) for *G. maculatus* (Jenyns). For convenience, ovaries of each female were fixed in 10% formalin and the

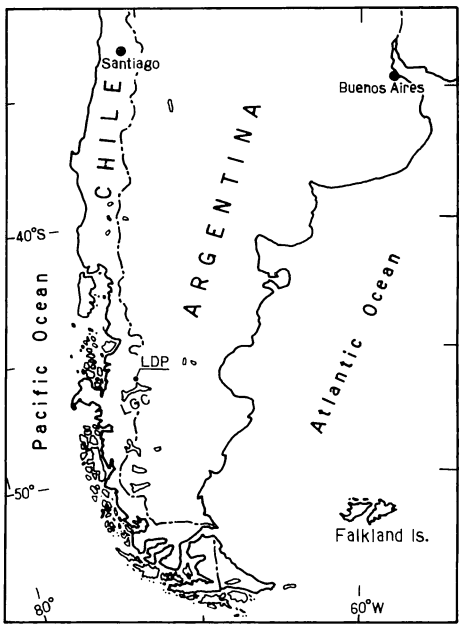

Fig. 1. Map of southern South America, showing the sampling locality of *Galaxias platei*. LDP, Lake Don Poli; LGC, Lake General Carrera.

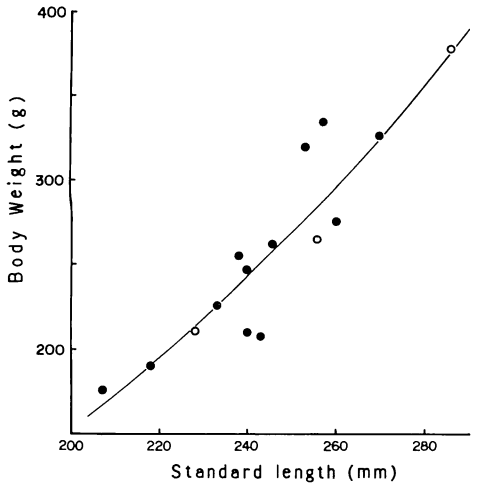

Fig. 2. Relationship between standard length and body weight of *Galaxias platei* from Lake Don Poli. Black circles, males; white circles, females.

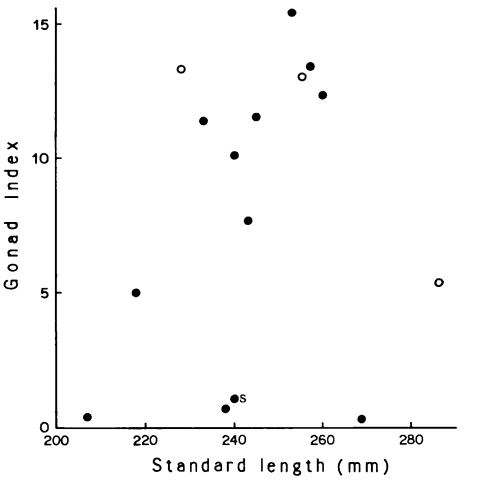

Fig. 3. Relationship between standard length and gonad index of *Galaxias platei* from Lake Don Poli. "s" indicates spent fish. Black circles, males; white circles, females.

total number of ovarian eggs was estimated by the gravimetric method, counting the actual number of eggs per 10 g. Stomach contents of each fish were examined under a binocular microscope, but identification of the organisms eaten was made only to familial or higher taxonomic level.

Results and discussion

The standard length (and total length) of the fish examined in this study ranged from 207(240) to 286(330) mm and the body weight from 176 to 378 g (Fig. 2). The relationship between standard length (X) and body weight (Y) is given by the following equation: $Y=2.483\times10^{-4}\times X^{2.516}$ ($r=0.913$). Among galaxiid species, *G. platei* is next to *G. argenteus* (Gmelin) in size, reaching more than 300 mm TL (McDowall, 1971). Eigenmann (1927) observed a *G. platei* specimen of 340 mm TL, probably the largest that has been recorded. The present specimens seem to belong to a large sized category of the species. Although there is no study on the relationship between age and growth of *G. platei, G. brevipinnis* Günther which reaches a maximum size of 270 mm in fork length is suspected to survive for six to eight years or longer (McDowall, 1978).

There were 12 males and three females in the present collection. In Fig. 3, the gonad index for each fish is plotted against standard length. Eight males had ripe testes which were partially fluid, showing gonad indices between 5.0 and 15.4. The testes of one male were spent with a gonad index of 1.1 and those of the remaining three males immature with gonad indices between 0.3 and 0.7. The spent testes were flaccid, becoming darker. The three males with immature testes ranged in length from the smallest to the largest in all the males examined and appeared not to be spawners, judging from the very low gonad indices. The three females, measuring 228 to 286 mm SL, all contained ripe ovaries. The largest female showed a much lower gonad index (5.3) than the other two (13.0 and 13.3). It is likely

Table 1. Measurements and fecundity in three females of *Galaxias platei* from Lake Don Poli.

Standard length (mm)	Body weight (g)	Gonad weight (g)	Egg diameter (mm)	Total no. of eggs
228	210	28.0	1.8–1.9	16,500
256	265	34.5	1.7–1.8	21,700
286	378	20.0	1.8–1.9	10,900

that this female had spawned partially or was forced to discharge part of ovarian eggs by stress when the fish was netted. All ovarian eggs observed macroscopically in each female were at a similar ripe stage of development and they were considered to be synchronous in maturation. The diameter of the ovarian eggs ranged from 1.7 to 1.9 mm (Table 1). The eggs were demersal, but it was not observed whether they were adhesive or not. Table 1 also shows the estimated total number of ovarian eggs in each female, which varied from 10,900 to 21,700. Apart from the case of the largest female, for a reason mentioned above, this species is presumed to yield more or less 20,000 eggs at the size of 230 to 260 mm SL in a breeding season.

According to McDowall (1971), *G. platei* is commonly a lacustrine species, inhabiting abundantly small landlocked lakes like Lake Don Poli, although sea-going juveniles may also exist. McDowall (1971) found juveniles of the species in a small stream entering a lake and in a small pool near the mouth of the stream. Campos (1970b, 1979) mentioned that adults of *G. platei* shift their benthic habitat from shallow to deeper water. On the basis of collecting recently spent fish in the southern autumn, McDowall (1971) suspected that a late summer-early autumn breeding period of *G. platei* is likely, and then found a few mature males on the shores of a landlocked lake. Zama and Cárdenas (1984) included a specimen (295 mm SL) of the species from Lake Pollux (45°40′S, 71°51′W) in their faunal study. This specimen, with well-developed ovaries, was caught at the shore in mid-summer (January). The staff of the Coyhaique Salmon Hatchery observed that numbers of adult fish were schooling on the sandy shore of Lake Don Poli when the present specimens were collected. Similar observations during summer have also been made in other lakes by local residents. It seems that inshore migration and schooling on the shore in summer are followed by spawning. The present study confirms that the spawning of *G. platei* occurs at least in the southern summer, although where and how eggs are laid along the shore remain unknown.

Diadromous populations of *G. maculatus* are known to have a unique reproductive biology as follows: During the highest spring tides, shoals of ripe adults swim among vegetation of estuarine banks and spawn there, and then eggs are left out of water; when the next cycle of spring tides comes, the eggs quickly hatch and larvae are washed out into the sea (McDowall, 1968; Andrews, 1976). McDowall (1968) reported that whereas the fertilized eggs of *G. maculatus* lose stickiness after spawning, the unfertilized ones retain it.

Of the 15 fish of *G. platei* examined in this study, eight had empty stomachs. As shown in Table 2, the stomach contents of the remaining seven, six ripe males and one ripe female, were classified into nine taxonomic categories. Cladocerans were most dominant in both number and fre-

Table 2. Stomach contents of *Galaxias platei* from Lake Don Poli, showing the number (No) of food organisms and frequency of occurrence (Oc). Vegetable fragments are excluded from count.

No. of fish examined	15	
No. of empty stomachs (%)	8 (53.3)	
Food item	No (%)	Oc (%)
Plant seed	1 (0.0)	1 (5.3)
Vegetable fragments	—	2 (10.5)
Gastropoda	130 (5.4)	3 (15.8)
Bivalvia	4 (0.2)	2 (10.5)
Crustacea		
Cladocera	1,638 (68.6)	5 (26.3)
Gammaridae	37 (1.5)	2 (10.5)
Insecta		
Aquatic insects (larvae)	1 (0.0)	1 (5.3)
Terrestrial insects (adults)	1 (0.0)	1 (5.3)
Fish eggs	576 (24.1)	2 (10.5)
Total number of preys	2,388 (100)	
Total occurrence of preys		19 (100)

quency of occurrence as food, followed by fish eggs and gastropods. Rotting vegetable fragments and a seed were also found in a few stomachs. The fish eggs eaten seemed to be those of the same species, judging from the size and appearance of the eggs. Campos (1970a) reported a similar observation in *G. maculatus*: Immature males eat eggs as soon as they are spawned and females also probably eat their own eggs. There is no further information on fish inhabiting Lake Don Poli other than *G. platei*. Planktonic and small benthic animals may be the main food sources for the present galaxiid in this lake.

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***Galaxias platei* についてのいくつかの生物学的観察**

座間　彰

1984 年 1 月（夏）にチリ南部の小湖で採集された Galaxiidae 科魚類 *Galaxias platei* 15 個体について，いくつかの生物学的観察を行なった．標本の体長範囲は 207–286 nm，体重範囲は 176–378 g であった．雄 12 個体のうち 8 個体は完熟精巣（生殖腺熟度指数 5.0–15.4）を有していた．雌 3 個体はすべて直径 1.7–1.9 mm の熟卵を持っており，一部放卵後と思われる個体を除くと生殖腺熟度指数は約 13 で，抱卵数は体長 230–260 mm の魚で 20,000 粒前後と推定された．本種の産卵は少くとも夏期に行なわれることが確認された．枝角類，魚卵および巻貝が主要餌料を構成していたが，食べられていた魚卵はサイズおよび外観から同じ *G. platei* のものと判断された．

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