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### Two Types of Life History Which Reflect Different Migration Strategies of Amphidromous Gobioid Fish Inhabiting Insular Streams

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Amphidromous gobioid fish dominate the fish fauna of tropical Indo-Pacific insular streams. Adults usually attach their eggs to the underside of stones in the stream. Hatched larvae flow into the sea and spend time in the pelagic marine phase. Just after they recruit into streams, they metamorphose from pelagic larvae to benthic juveniles.

During our studies of their life histories on Okinawa Island (26°04'-26°53'N, 127°38'-128°20'E), Ryukyu Archipelago, we found that they can be divided into two types; dispersal type and non-dispersal type. Here, we will discuss the life histories of typical species for these two types, taking particular note of some characters; fecundity, morphologies of egg and newly hatched larva, and morphology and age at recruitment.

The life history of *Eleotris acanthopoma* is most likely an example of the dispersal type. The eggs of *E. acanthopoma* were very small (0.4 mm in longer axis) and numerous (number of oocytes: 600-263,600). Newly hatched larvae were also very small (1.3-1.4 mm in notochord length) and without eye pigmentation, a mouth and pectoral fins. After the pelagic marine phase, well-developed larvae (9.7-13.2 mm in standard length) occurred in the surf zone of coasts and estuaries throughout the year, and soon settled in the streams at the same body size. Ages at recruitment were estimated as being from two to four months based on otolith increment numbers. The hatch dates of some recruits were estimated to be during the non-spawning season (from January to April) on Okinawa Island. It was suggested that a proportion of their larval recruits were born in regions further south and came to the streams on Okinawa Island. Their life histories were characterized by larger fecundity, smaller egg and newly hatched larva, longer pelagic larval duration, and larger body at recruitment. These characteristics were common with some gobioids such as *Stiphodon percnopterygionus* and *Awaous melanocephalus*. They showed a wider distribution among tropical Pacific islands including oceanic islands. Their relatively longer larval duration may enable greater dispersal, although there may be no assurance that they will have success in recruiting to appropriate streams. These dispersed larvae may be effective in such cases as the ruination of a stream on an island or changes in oceanic current flows. Such strategies may be advantageous to remain the descendants among tropical small island regions where unstable small streams are

sparsely distributed.

In comparison, the life history of *Luciogobius* sp. is most likely an example of the non-dispersal type. *Luciogobius* sp. spawned a smaller number (177-1,069) of relatively larger eggs (2.3 mm) from December to March. Hatched larvae were also larger (3.1 mm) and had a more developed body (with pigmented eyes, a mouth and pectoral fins) than *Eleotris*. Pelagic larvae (8.5-11.1 mm) occurred in the surf zone of coasts and estuaries just before settlement from January to April. Ages at recruitment were estimated to be about one month and the hatch dates corresponded with their spawning season. Their life histories were characterized by smaller fecundity, larger egg and newly hatched larva, a shorter pelagic larval duration and recruits with a smaller sized body. These characteristics were in common with some gobioids such as *Rhinogobius* spp. and *Tridentiger kuroiwae*. Their distribution was restricted around eastern Asia, and they have differentiated into so many species within such a small region. Their shorter pelagic larval duration may be one of the factors which prevent wider dispersals. They are found in relatively stable habitats in larger rivers and streams on relatively large islands within those regions. They were considered as being successful with a relatively safe life cycle migrating within a small area.

Both gobioids of these two types co-occur within the streams of the Ryukyu Archipelago, because they are a group of small islands with small streams, located near larger islands (such as Japan proper and Taiwan) and the continent. The Kuroshio Current may also be an important factor affecting larval migrations of dispersal type gobioids.