Studies on the Reproductive Biology of the Yellowfin Porgy, *Acanthopagrus latus* (Houttuyn)

キチヌ (*Acanthopagrus latus*) の繁殖生物学的研究

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STUDIES ON THE REPRODUCTIVE BIOLOGY OF THE YELLOWFIN PORGY *Acanthopagrus latus* (HOUTTUYN)

By

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Title: STUDIES ON THE REPRODUCTIVE BIOLOGY OF THE YELLOWFIN PORGY, Acanthopagrus latus (HOUTTUYN)

Abstract approved: ----------
Prof. Dr. Nobuhiko Taniguchi

The yellowfin porgy, Acanthopagrus latus (Houttuyn) locally known as 'kichinu' or 'kibire' inhabits a wide geographical range, from the coast of the Pacific Ocean in Southern Japan to the Indian Ocean and the Gulf region. This species is rarely studied and its culture is carried out on a limited scale. However, the recent high demand and market value of this fish will make its culture important. This study was conducted to describe the reproductive biology, the development of the eggs and spawning of the captive broodstock, and the development of artificially-produced larvae and juveniles of this species.

Matured fishes were taken from the batch that were cultured in the floating net cage at Uranouchi Inlet, Kochi Prefecture. Artificially-produced larvae and juveniles were used in the studies on the development of particular organs. Samples were preserved in 10% buffered formalin for morphological observation or fixed in Bouin's or Gender solution and embedded in paraffin after dehydration in ethyl alcohol series. Serial sections of

5-6 μm thick were cut and stained with Haematoxylin and Eosin (HE) or Periodic Acid Schiff (PAS) reagent for Bouin's and Gender solution, respectively for the light microscopic studies. For the electron microscopic study, samples were prefixed in glutaraldehyde + formaldehyde solution then postfixed in 1% osmium tetraoxide. The tissues were embedded either in Epon-812 or quetol 653, ultrathin sections were stained in uranyl acetate and lead citrate before studying under JEOL JEM-100U electron microscope.

This species is a protandric hermaphrodite. The functional male ranged from 14 cm to 33 cm SL with gonads having both testicular and ovarian regions. The ovarian region of functional males consisted of oocytes arrested at the perinucleolus stage throughout the annual cycle. Sex-transition to functional female occurred at about 33 cm SL. The sperm and oocytes developed rapidly from early October to November as the gonadosomatic index (GSI) of functional male and functional female increased and seawater temperature decreased. Vitellogenic oocytes occurred in the ovary in early October, mature oocytes from late October to mid-November, and atretic oocytes in November. Resorption of unspawned oocytes occurred from December to January. Estimates of absolute fecundity was 6×10^6 to 14×10^6 eggs/fish (26.4-35.0 cm SL).

Great changes in the structure and thickness of the chorion and follicular layers occurred during the development as observed under the electron microscope. The diame-

ter of the oocytes increased rapidly 24h after injection with HCG (10000 IU/fish). Ovulation occurred at 32 h after the injection at a seawater temperature of 23° C.

The spawning season of this species in Tosa Bay is from late October to mid-November. In artificial insemination experiments, the number of eggs spawned varied in each spawning trial. The highest number of eggs obtained was 4.31×10^5 eggs/fish, the highest fertilization rate was 95% and the highest hatching rate was 51.7%. Fishes that were induced with one injection of LHRHa (50μg/fish) spawned every night for 2-4 nights. An average of 2.33×10^5 eggs/fish/day was obtained with fertilization rates from 0 to 47.5%. Results of induced spawning and histological study of the distribution of the oocytes gave strong evidence that this species is a multi-spawner.

The development and differentiation of the digestive system, skin, sensory organs and the fins in relation to growth were examined. Newly hatched larvae measured 2.4 mm mean TL, were covered by a thin epidermis and with a few developed free neuromasts around the head and along the body. The pectoral fin, eye, otic vesicle and digestive organs started to differentiate the first day after hatching and rapidly developed. First feeding occurred on the fourth day, after these organs were basically formed and were functional. At the end of the postlarval stage, the olfactory cavity and the fins were formed and the skin already consisted of the epidermal and dermal layers. Internally, serration-like teeth, rudimentary

taste buds and mucous cells, and pharyngeal teeth appeared at the mouth ridge, oral cavity and pharynx, respectively and increased in number. Formation of scales, pigment pattern and appearance of rod cells occurred after the larvae entered the juvenile stage at 10 mm TL. At about 19 mm TL, the functional stomach formed and the formation of molariform teeth began, and was completed at 50 mm TL.

The growth and survival rates of artificially-produced larvae from first feeding until 7 days after hatching were investigated as to tolerance to temperature, light intensity, salinity and delayed initial feeding. High growth rate of 0.069 $\pm$ 0.050 mm/day (mean $\pm$ SD) with survival rate of 73.8 $\pm$ 7.3% was obtained for the larvae fed at 3 days after hatching, reared at 23° C, under normal seawater salinity and normal daylight intensity. Rearing at higher than 23° C or lower than 20° C gave lower mean daily growth and survival rates. At 23° C only 1.8 $\pm$ 0.6% of the starving larvae survived up to 6 days after hatching with no increase in the total length. Initial feeding at 4 days after hatching or after resulted in a decrease in both survival and growth rates. Rearing under a light intensity of 0 to 30 lx reduced the mean total length and decreased the survival rate. Only those larvae treated at 400 lx showed an increase in total length and survival rate. The larvae exposed to 10 % to 100 % seawater did not show much difference in mean daily growth but the survival rate declined as salinity decreased.

The present studies show the possibility of mass culture of this species. This is particularly because of the high fecundity and the ease with which the species can reproduce under artificial conditions. However, information such as management of the broodstock fish, growth and feeding from the juvenile stage to market size are needed for viable commercial applications.