(学位第３号様式)

学　位　論　文　要　旨

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題　目	Studies on early development and spawning ecology in Japanese sardine *Sardinops melanostictus* (日本産マイワシの初期発育と産卵生態に関する研究)

In the most resource period and decrease one of Japanese sardine *Sardinops melanostictus*, the early development and spawning ecology of the western Kyushu population were investigated, from biological aspects.

Artificial fertilization was undertaken and developmental process was observed until 1.5 day-old larvae. Wild eggs were incubated at 7.3-26.7℃. At 7.3, 10.8 and 23.5℃, total and viable hatching ratios, survival ratio at first-feeding stage and ratio of first-feeding success were lower than at 13.8-21.0℃. Viable hatching ratio at salinity 17.4 was considerably low. Total length of just hatched larvae was 3.44 mm. Fourth-day old larvae (about 5.7 mm TL) began to eat S Type rotifers. 17th day-old larvae reached 9.87 mm TL and 29th ones did 15.37 mm TL (maximum, 20.0 mm TL). In groups deprived of food after first-feeding stage, eighth day-old, 12th day-old and 17th day-old, they become to be moribund after three or four days. Developmental process of all cartilages and bones was described, and a developmental steps forming four periods and eight phases was prescribed by osteological development. Differential sequence of red, pink and white muscles and tonic-like fibers in the lateral muscle as an important locomotive organ was investigated. Formative process of eye, olfactory organ, taste buds, lateral line system and inner ear was examined. Changes in feeding and swimming functions were syntheticly examined from formation process of lateral muscle and sense organs including osteological development.

The most spawning period was in March and the most GSI rate of females was over 20. From the ratio of specimens with hydrated eggs or postovulatory follicles at regressing stage 0 (spawning day), the average spawning interval was calculated to be from 4 to 6 days. Spawning of sardine occurred mainly at about 20:00. On the other hand, spawning of Japanese anchovy *Engraulis japonicus* occurred during 00:00-01:00. The spawning depth of sardine was approximately 40-60 m. That of Japanese anchovy was about 0-20 m. Unfertilized eggs included a normal perivitelline-space type. They formed also a blastodisc and disintegrated gradually after stripping. Some of wild eggs were very similar in their morphological characteristics to disintegrated sardine eggs. These facts suggest that unfertilized sardine eggs may be commonly present in natural spawning, especially in the area of the south from Kyushu. Short term (from 1 hour to 1 week) variations at 9 stations in the number of collected sardine eggs were investigated. Wide variations were detected and they indicate that the total egg production calculated from spawning survey include wide variations. Egg abundance and distributional changes of sardine were studied in waters around Kyushu from 1979 to 1995. The calculation was done for 30′×30′ square and grouped into three large areas from north to south (Area Ⅰ, Area Ⅱ, Area Ⅲ). The total egg number considerably fluctuated from 47×10^{12} in 1995 to $2{,}873\times10^{12}$ in 1987. The spawning month showed secular change by the level of sardine resource. When the sardine resource was low, spawning ground was formed in the northern area of the western Kyushu (Areas Ⅰ and Ⅱ), and when the resource was high, it was formed in the south of Kyushu (Areas Ⅲ). With the transformation of spawning ground, spawning temperature was particularly changed.

Although the sardine resource is very low in present, the basic study may be required to be clarified its fluctuation mechanism.