Short Paper

Penetration of Microorganisms into Deposited Fish Scales in the Sediment of a Coastal Finfish Culture Grounds*¹

Farming of yellowtail *Seriola quinqueradiata* is one of the most common aquaculture activities in Japan, utilizing coastal areas which are protected from strong winds and wave action. The fish are cultured in floating or submerged net-cages and were fed small-sized, lower-priced fish, such as sardine, anchovy, saury, mackerel and sand eel.¹⁾ Uneaten foods and faeces from the farmed fish gradually sink to the sediment of the farming area. Due to high organic matter and nutrient content, accumulation of such deposited matter is considered to be one of the causes leading to eutrophication of coastal waters.^{2,3)} During our studies of the organic content of sediment in coastal waters, we found a significant amount of hard tissue from food fish, such as scales and spines, deposited along with organic matter in the sediment of the yellowtail farming grounds. In this short paper, observation on the penetrated holes by microorganisms into deposited fish scales is described.

Sediment samples were taken in February and April, 1982, with a Ekman-Birge sampler, at the yellowtail farming ground in Hamajima Inlet of Ago Bay, Mie Prefecture.

To determine the size fractions of the deposited organic matter, each sediment sample was passed through sieves of 8 different mesh sizes, 2,830, 1,000, 500, 250, 125, 63, 44 and 32 micrometers, in running water. Organic particles in the fractionated sediment samples were separated from inorganic grains by decanting the upper layer after the sediment suspension was shaken well, and were concentrated with a centrifuge.

A typical example of perforated holes spreading in every direction on the deposited fish scales is shown in Fig. 1. Broken scales of various sizes were collected from the sediment samples at the yellowtail farming ground by our method of size fractionation and decantation. Perforated holes were found on almost every deposited scale of a size up to 32 micrometers. It can be concluded from the complexity of the perforated holes around the edges of the broken fish scales, as shown in Fig. 1, that deposited fish scales are broken down to small pieces via development of such perforated holes.

Crystal violet staining was used to demonstrate if any microorganisms would be present in the perforated holes. Special care was taken to avoid washing away the attached microorganisms. Figure 2 shows that microorganisms of coccoid or short rod forms of a 1–2 micrometers were observed inside the perforated holes.

These observations might indicate that the deposited hard tissues were gradually degraded by marine microorganisms in the sediment. The chemical composition of the hard tissue of fish scales and bones varies from one fish species to another.^{4,5)} Specific chemical composition of fish scales degraded by microorganisms,

Fig. 1. Spreading of perforated holes on a broken fish scale deposited in the sediment of a yellowtail farming ground.

Fig. 2. Crystal violet staining of microorganisms present in perforated holes of a deposited fish scale.

the microorganisms responsible for such decomposition and the degradation rate in natural environment remain to be determined. Studies designed to obtain this information are in progress in our laboratory.

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