

## TRACING THE IMPACT OF A YELLOWTAIL (*SERIOLA QUINQUERADIATA*) CAGE FARM ON THE WATER QUALITY IN THE SETO INLAND SEA, JAPAN

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Farming of food fish in the Seto Inland Sea, Japan is totally dominated by the net-pen rearing along the coastal areas. The annual production has increased dramatically from 7500 t in 1970 to 45000 t in 1979, and nearly leveled off in recent year (Okaichi and Yanagi 1997). About 75% of the production is a yellowtail (*Seriola quinqueradiata*). Moreover, a significant proportion of the yellowtail feed is lost from the production system through feed wastage, faeces and dissolved waste into the surrounding environment. Ultimately, these wastes provided nutrients for marine life, but it can cause localized problems because of its concentrated nature. The present study was carried out in order to understand the effect of dissolved waste loading from yellowtail cage farm on the water quality as a basic knowledge on the regional planning.

The present study was conducted to investigate fluctuations in different physical, chemical and biological parameters from fish net-pens with production of yellowtail in a coastal area of the Seto Inland Sea, Japan. The experimental design involved the establishment of surrounding sites (10 m from the net-pens) and a transect extending away from the net-pens at 0, 10, 50 and 100 m. At each station, sampling was done at three different depths, i.e. the surface (0 m), the middle (7 m) and the bottom (14 m). Physico-chemical data (including oxygen, nutrients and particulate organic matters) and phytoplankton biomass (as chlorophylla) were determined on May 23, 2002 (low feeding) and September 2, 2002 (high feeding). There were significant differences ( $p < 0.01$ ) in  $\text{NH}_4^+$  and  $\text{PO}_4^{3-}$  at the edge of net-pen and the surrounding sites in the high feeding period. At a transect line,  $\text{NH}_4^+$  and  $\text{PO}_4^{3-}$  were also significant difference ( $p < 0.01$ ), which the highest concentration at the edge of net-pen and decreased with distance from the net-pen to 100 m. This pattern was inversely related with  $\text{NO}_3^- + \text{NO}_2^-$  concentrations. Moreover, an analysis of variance indicated that in the high feeding period was significantly increased of  $\text{PO}_4^{3-}$  concentrations ( $p < 0.01$ ) at each site. The nitrogen ( $\text{NH}_4^+$  and  $\text{NO}_3^- + \text{NO}_2^-$ ) to phosphorus ( $\text{PO}_4^{3-}$ ) ratio was significantly decreased from  $29.7 \pm 5.8$  (low feeding) to  $9.5 \pm 1.4$  (high feeding). Although no significant differences were observed comparing particulate C, N and P concentrations at the surrounding sites and a transect line, the biomass of phytoplankton was greatest with highest quality and quantity of  $\text{PO}_4^{3-}$  concentrations during the high feeding period. The increased  $\text{PO}_4^{3-}$  concentrations determined a response of phytoplankton, proven by the relationships with the N:P ratio ( $r = -0.70$ ,  $p < 0.001$ ) and  $\text{PO}_4^{3-}$  ( $r = 0.61$ ,  $p < 0.001$ ) concentrations in the water column. The present study indicates that high organic loading from yellowtail cage farms could cause deterioration of the water quality in the cage culture system and in the surrounding environment. The additional nutrient sources of dissolved waste from yellowtail production create an internal load that leads to increase  $\text{PO}_4^{3-}$  and decrease in the N:P ratio of the water column, apparently contributed to an increased biomass of phytoplankton.