

An appropriate stocking size of juvenile Japanese flounder, *Paralichthys olivaceus*, in consideration of carrying capacity

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Japanese flounder *Paralichthys olivaceus* is a major coastal commercial fish. The total catch of the flounder is stable between 6,500 and 8,400 tonnes in the last decade. It is also one of the major target species of stock enhancement in Japan. A total of 30 million juveniles are released every year. Economic return rate (amount of catch / cost of stocking) can increase to 2.5 in the case appropriate releasing techniques are applied. Stocking size is one of the most important techniques to be considered as well as the size at release and the timing of release. We applied an ecophysiology model to predict the growth of juvenile Japanese flounder and to evaluate an appropriate stocking size under the criterion that released fish, as a competitor of wild one for food, do not restrict the growth of wild fish. This model consists of 5 compartments (i. e. wild flounder, released flounder from hatchery as a competitor, other competitors, mysids as a main food item, predators) and includes various physiological responses to varying environments (mainly temperature) and ecological interactions (i. e. prey-predator relationship and competition for food) among these compartments. The predicted growth of both wild and released flounders until 65 days after stocking (9 November) well agreed with the observed ones at Ohno Bay, a small shallow sandy area up to 10m deep in the northwest of Japan. Wild flounder would reach to 141mm in TL on 9 November without any released flounder, while in fact they grew only to 109mm. The model explained that the standing biomass of mysids decreased because the amount of predation on mysids by both wild and released fish exceeded the production which was controlled by temperature and abundance of mysids themselves, and that led to the restricted growth of wild flounder. An appropriate stocking level below which release of hatchery-raised flounder would not retard the growth of wild one was predicted as 49,000 individuals while actual stocking level was 76,300.

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