

Evaluation of values of ecosystem services of seagrass bed based on fish production: looking for an area of the highest production in Japan

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[Abstract]

In order to quantitatively estimate fish production in seagrass beds and to compare the production under a large spatial scale, fish sampling combined with biotic and abiotic surveys were conducted at an intensive sampling site (IS: Hiroshima, Seto Inland Sea, Japan) and 20 sites inside Japan (sampling sites for comparison at a large spatial scale: LS) in 2009 and 2010. In addition, data obtained at the IS from 2007–2008 were also analyzed for year-to-year comparison of fish production. Japanese black rockfish *Sebastes cheni* was most dominant in seagrass beds in the Seto Inland Sea. The larvae and early juveniles immigrate into seagrass beds in late February to early March at a total length of about 20 mm. The rockfish larvae and juveniles were collected with a round seine net (4 mm mesh) at one- or two-weeks intervals from February to May 2009. The rockfish was most abundant in late March. In order to estimate the possible effects of global warming on fish production in seagrass beds, growth of larval and juvenile rockfish was examined under a variety of temperature conditions. Rearing experiments were also conducted to examine the effect of variability in temperature and daylength on the juvenile growth rates. Otoliths of wild juveniles collected in 8 locations were processed for back-calculation of growth trajectories during larval (< 20 mm) and post-immigration (20–50 mm) periods based on the Biological Intercept Method. Mean growth rates during the larval period ranged between 0.2 and 0.8 mm/d and were higher under higher temperatures. Contrastingly, mean growth rates during the post-immigration period decreased to 0.1–0.4 mm/d in some sites. Variability in prey availability in the sampling site did not explain the variability in the growth rate. The rearing experiment revealed that gross growth efficiency of juvenile rockfish was highest at 16° C. Based on the possible increase in water temperature (about 2° C in 2095), it is plausible to expect reduction of juvenile fish production and/or northward shift of the rockfish distribution. Effect of daylength on growth was also significant with higher growth rates due to the longer daylength. Effect of shifts of spawning season and spawning ground would differ among fish species and spawning season. Comparison of early growth under

different day-length conditions between rockfish and ayu indicated that the shifts of spawning season and spawning ground would have different effects on vital rates of the fish early life stages.

Key Words: Seagrass Bed, Fish Production, Ecosystem Services, Global Warming Effects