学 位 論 文 の 要 約

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学位論文の題名

題　　目　Impacts of short-term salinity and turbidity stress on the early life stages of aquatic plant and animals
(初期発育段階の海洋性動植物に与える塩分と濁度の短時間暴露の影響)

学位論文の要約

The increasing frequency and intensity of precipitation attributed to global climate change will impact heavily on many organisms that inhabit in coastal areas. During intense rainfall events, coastal waters are often turbid, and salinity is reduced, in short periods of time. These create stressful conditions for the organisms found there that may have negative in term of their growth, survival, and rate of development, especially for the early stages of their ontogeny. Therefore, the objective of this study is to evaluate the effects of short-term salinity and turbidity changes on early developmental stages of some important species in Japan.

Two series of experiments were conducted in the laboratory to estimate the stress tolerance of a brown alga *Sargassum fusiforme* germlings when exposed to low salinity or high turbidity. Results showed that the growth of germlings was significantly affected by daily salinity change according to duration of stress exposure. The lowest specific growth rate (%/day) of germlings was 1.1% at 17 psu for 6 h exposure. Survival of germlings was more tolerant compared to the influence on those of growth. From the results of turbidity tolerance test, the growth and survival of germlings were reduced by increasing turbidity levels. In comparison with conditions of turbidity from 0 and 100 NTU, high mortality was recorded when germlings were exposed to high turbidity stress of 700 NTU. The only treatment of 100 NTU combined with 2 h exposure had a specific growth rate of over 2%, whereas others were below 1%. Germlings had the lowest growth of about 0.2% when exposed daily at 700 NTU for 6 h.

Study conducted to assess the effects of short-term low salinity and turbidity stress on the embryonic and early larval stages of Japanese flounder, *Paralichthys olivaceus*. In the first

experiment, the embryos were exposed to different combinations of salinity (34, 30, 26, 22, 18, and 14 psu) and turbidity (0, 100, 300, 500, and 700 NTU) for a short period of 3 h. Experiment 2 evaluated low salinity tolerance at different developmental stages under the turbidity level of 700 NTU. The results showed that turbidity significantly influenced hatching rate, abnormality rate, total length, yolk sac volume, and survival rate, whereas low salinity only affected the percentage of abnormality. There was no interaction between salinity and turbidity on these parameters.

The effects of low salinity and turbidity on the embryonic stage of red sea bream *Pagrus major* were examined under controlled laboratory conditions. In the first experiment, eggs of the red sea bream were exposed to different salinity stresses [34 (control), 30, 26, 22, 18, and 14 psu] for 3 h. In the second experiment, eggs were exposed to higher turbidity levels of 100, 300, 500, and 700 NTU obtained by dissolving kaolin clay with fresh seawater (0 NTU: control) in the same duration as in the first experiment. The results showed that the embryos of red sea bream were tolerant to short-term exposure to low salinity stress. There were no significant differences in the hatching rate, yolk sac consumption of newly hatched larvae, or survival of larvae at 6 days post-hatching. However, the short exposure to turbidity stress reduced the hatching rate, total length and yolk sac volume of newly hatched larvae, and viability of larvae of red sea bream. Turbidity had a significant impact on the abnormality rate at hatching, with higher values observed for elevated turbidity.

The embryos of disk abalone *Haliotis discus discus* and giant abalone *Haliotis gigantea* were exposed to salinity or turbidity changes to determine the effects on subsequent hatching and larval development. The short-term low salinity stress decreased the hatching and survival rates, and increased the abnormality rate for both species. As for turbidity stress, negative effects on hatching and survival rates were observed in both species when their embryos were exposed to increased turbidity. The abnormality rates of both species at turbidities of 500 and 700 NTU were significantly higher than those at turbidities of 0 and 100 NTU.