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Effect of the 2011 Tohoku Earthquake on meiofauna inhabiting the landward slope of the Japan Trench off Sanriku

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Deep-sea floors contain high levels of biodiversity, which is sometimes comparable to tropical rain forests, despite the apparent uniformity of its environment (Hessler & Sanders 1967; Grassle 1989). It is explained that small-scale disturbances, such as predation and near-bottom currents, frequently occur and cause a patchy distribution of different successional stages across an area (Rex 1981; Levin et al. 2001). The effect of small-scale disturbance on deep-sea assemblages has been studied for several taxa (Kaminski 1985; Hall 1994; Paterson & Lambshead 1995; Thistle 1998). On the other hand, turbidity current, which is a bottom-flowing current laden with suspended sediments generated by tsunamis and earthquake-induced landslides, is an example of a catastrophic disturbance (cf. Harris 2014) and expected to cause a large effect on meiofaunal assemblages. However, little is known how the deep-sea benthic meiofauna respond to such a catastrophic disturbance.

On 11 March 2011, an earthquake of Mw9.0 known as the 2011 off the Pacific coast of Tohoku Earthquake occurred off the coast of Miyagi Prefecture. Sedimentation caused by the turbidity current was documented over an extensive area (Ikehara et al. 2011; Arai et al. 2013). Therefore, the 2011 Tohoku Earthquake probably impacted not only the shallow-water (e.g. Kanaya et al. 2012; Seike et al. 2013) but also the deep-sea ecosystems. This study evaluated the effect of large-scale disturbance on the deep-sea benthic assemblages inhabiting the landward slope of the Japan Trench using meiofauna, which is most abundant metazoan in deep sea, especially on benthic copepods (harpacticoid copepods).

Sediment samples were collected on the landward slope of the Japan Trench off Sanriku during 3 cruises. Two cruises were conducted from late July to early August 2011 (4.5 months after the 2011 Tohoku Earthquake); specifically the KT11-17 cruise of the R.V. Tansei Maru and the YK11-E06 cruise of the R.V. Yokosuka. The third cruise, KT12-18 of the R.V. Tansei Maru, was conducted in late July 2012 (1.5 years after the earthquake). Meiofaunal specimens were extracted from sediments and they were then sorted into higher taxa and counted. We compared the total meiofaunal densities obtained from this study to those before the earthquake in the study area (Shirayama & Kojima 1994). Benthic copepod (harpacticoid) specimens were further identified at the genus level.

During the present study, it is indicated that major disturbances to deep-sea sediments mainly influenced the vertical distribution, but meiofaunal densities remained similar through the earthquake or quickly recovered within 4.5 months of the event. In addition, harpacticoid community structure did not change in 1 year after the earthquake even between before and after the earthquake. These results suggest that the strong resilience of meiofauna inhabiting the landward slope of the Japan Trench, where high-magnitude earthquakes frequently occur, against disturbance. In the presentation, we will explain the results and background of this study in more detail.

Keywords: earthquake, disturbance, meiofauna, harpacticoid, community structure