

## Preface

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In 2011, the Tohoku Earthquake took place off the Pacific coast, and the subsequent tsunami hit the Pacific coast of northern Japan on 11 March 2011. The moment magnitude of the earthquake was 9.0, and the maximum height of the tsunami exceeded 15 m in many places on the Pacific coast of northern Japan. This disaster brought serious damages to humans, urban infrastructures, and fisheries facilities, including fishing boats, aquaculture facilities, and ports. Economical losses related to this disaster were estimated at 1400 billion US dollars at present. The damages also extended to ecosystems from the shore to deep canyons from the tsunami, subsidence, and the earthquake itself. Damages from the tsunami on marine ecosystems and recovering processes have been studied in the 2004 Indian Ocean Earthquake and 2015 Illapel (Chile) earthquake; however, the covered types of ecosystems were limited in these studies. More importantly, monitoring data before the earthquake were scarce.

The tsunami also hit the Fukushima Daiichi Nuclear Power Plant and caused a meltdown of reactors by the loss of electric power supply. A large amount of radioactive substances including <sup>130</sup>I, <sup>134</sup>Ce, and <sup>137</sup>Ce were released to atmosphere and aquatic environments.

Just after the earthquake, the Oceanographic Society of Japan organized a task force on earthquake-related issues under President Kimio Hanawa. The task force engaged

in the collection of information, making recommendations on monitoring and research, and public announcements. The final report was published in August 2013 on the website of the society ([http://kaiyo-gakkai.jp/jos/archives/geje2011\\_artcl/3279](http://kaiyo-gakkai.jp/jos/archives/geje2011_artcl/3279)).

After the earthquake, a number of research projects were established under various funding agencies, including the Ministry of Education, Science, Culture, and Sports (MEXT), the Ministry of Environment, and the Ministry of Agriculture. Tohoku Ecosystem-Associated Marine Science (TEAMS, funded by MEXT) started in January 2012 focusing on the research of damages and recovering processes of the ecosystems on the coast and offshore of northern Japan. Over 150 researchers from 15 universities and institutions joined to this project. Then, the Interdisciplinary Study on Environmental Transfer of Radionuclides from the Fukushima Daiichi NPP Accident (ISET-R) was started in June 2012.

This special section of the Journal of Oceanography mainly consists of results from TEAMS and also includes the results from other projects. The editors believe that we have a responsibility to describe what happened after the earthquake and tsunami in the marine environments. Fortunately, a considerable amount of data before the disaster was available in various places. This section will significantly contribute to the comprehensive understanding of the damages and recovery processes of the ecosystems from the earthquake and tsunami. Moreover, we hope these studies have deepened the understanding of basic mechanisms supporting the high biological productivity in this area and ecosystem resilience to stressors.

Five years have passed since the disaster. The aquatic ecosystems seem more resilient than human architecture, and a certain amount of fishery activities have already recovered. However, it seems that the recovery process of

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organisms and ecosystems has not stopped in most habitats, and the landscape of the urban area is going to change for several years by the re-colonization of people and construction of large-scale seawalls. We have to monitor the environment and ecosystems and clarify the mechanisms of biological production to contribute to the sustainable development in this area. We also believe these contributing papers are precious records of the description of a quite rare natural disturbance.

Over 2500 people have not been found yet, and 68,000 people are still living in temporary housing in northern Japan. Sixty thousand people have evacuated from their home towns, and fishery activities are still in moratorium in Fukushima Prefecture. We hope these interruptions to daily life will settle down as soon as possible.