

Session Summaries-2012

List of papers

Oral presentations

Masakazu Hori (Invited)

Effect of coastal seascape diversity on associated fish production

Nam-II Won, Hideki Takami, Yutaka Kurita, Daisuke Muraoka and Tomohiko Kawamura

Trophic structure of the rocky shore ecosystem in Otsuchi Bay, Japan: Implications for benthic–pelagic coupling

Tsutomu Noda, Yoshitomo Nagakura, Daisuke Shimizu, Hideaki Aono, Hiroyuki Okouchi, Masami Hamaguchi, Atsushi Fukuta, Yasuhiro Kamimura and Jun Shoji

Impact of the tsunami from the Great East Japan Earthquake on seagrass beds and fish assemblages in Miyako Bay

Shiori Sonoki, Yuka Morita, Jun Syoji and Kazushi Miyashita

Monitoring seasonal variations in a seagrass bed by an acoustics method

Katsumasa Yamada (Invited)

Functional diversity and functional redundancy of a faunal community in a seagrass ecosystem of northern Japan

Sang Rul Park, Joseph Stachelek and Kenneth H. Dunton

The role of salt marsh plants as a net sink or source for carbon dioxide in the southwestern Gulf of Mexico

Ekaterina V. Golovashchenko

The economic value of ecosystem services in Kievka Bay (Japan Sea)

Seokjin Yoon, Michio J. Kishi, Satoshi Nakada, Yoichi Ishikawa, Tomonori Isada and Sei-Ichi Saitoh

Ecological functions of a kelp community as an indicator of anthropogenic nutrient stressors

Poster presentations

Chunjiang Guan, Jie Na, Meng Xu and Xiutang Yuan

Studies on carbon, nitrogen, and phosphorus uptake fluxes by *Suaeda salsa* around the Bohai Sea District

Ivan I. Cherbady and Ludmila I. Sabitova

Influence of environmental factors on ammonium and phosphate uptake rates by a red alga (*Ahnfeltia tobuchiensis*) population in Izmena Bay (Kunashir Island)

Yun Hee Kang, Chang Jae Choi and Sang Rul Park

Effects of intensity and season of disturbance on the marine benthic community of a rocky intertidal shore with a periodic green tide occurrence in Korea

Chang Geun Choi and Seok Jin Oh

Development of artificial seaweed bed for ecological restoration

BIO/MEQ/FUTURE Topic Session (S10)

Ecosystem responses to multiple stressors in the North Pacific

Co-sponsored by: *SOLAS*

Co-convenors: *Vladimir Kulik (Russia), Ian Perry (Canada) and Motomitsu Takahashi (Japan)*

Background

Marine ecosystems of the North Pacific, both coastal and offshore, are influenced by multiple stressors, such as increased temperature, change in iron supply, harmful algal blooms, invasive species, hypoxia/eutrophication, ocean acidification, and intensive fishing. These multiple stressors can (but do not always) act synergistically to change ecosystem structure, function, and dynamics in unexpected ways that can differ from responses to single stressors. Further, these stressors can be expected to vary by region and over time. This session seeks to understand the responses of various marine ecosystems to multiple stressors and to identify appropriate indicators of these effects. Contributions were invited which reviewed and defined categories of indicators to document the status and trends of ecosystem change at a variety of spatial scales (*e.g.*, coastal, regional, basin) in response to multiple stressors. Emphasis was placed on empirical and theoretical approaches that forge links between ecosystem change and the intensities of multiple stressors. This session was a contribution to the work of PICES WG 28 on [*Development of Ecosystem Indicators to Characterize Ecosystem Responses to Multiple Stressors*](#).

Summary of presentations

Session S10 was held on Friday, October 19, 2012 (half day). It was launched with an invited speaker, Natalie Ban (Australian Research Council Centre of Excellence for Coral Reef Studies, Australia) and included 5 other oral presentations, 8 poster presentations, and time for discussion.

Dr. Ban discussed issues related to mapping cumulative impacts, including advances, relevance and limitations to marine management. She began by noting there is global concern about multiple stressors and currently a lot of interest in mapping where multiple stressors might be interacting. She identified the purpose of her presentation as providing examples of methods and data for mapping multiple stressors in a given region. She concluded that such approaches do provide informative uses of existing data and information, baselines for future mapping, new opportunities to improve mapping approaches, but cautioned that there is a need to ground-truth these mapping efforts. She also recommended caution when scores for the vulnerabilities of different habitats to different stressors developed in one region (*e.g.*, the California Current system) are applied to a different region (*e.g.*, the coast of British Columbia) without critical consideration of their “transferability”. An important next step in these types of habitat vulnerability analyses is the use of Bayesian methods to assess multiple stressors, which are now being investigated in some coral reef regions. Discussion following her presentation included how to move from GIS analyses of multiple stressors to impacts; it was noted that some of this needs to come from directed studies of impacts. However, such studies currently often examine only one stressor at a time.

Dr. Ian Perry, with co-author Dr. Jennifer Boldt, provided an example of a study to identify multiple stressors on multiple habitats in a specific region, the Strait of Georgia, British Columbia, featuring the early work of Working Group 28. The objectives of his study were to develop a structured process to identifying multiple stressors in the Strait of Georgia, and the responses of selected (key) habitats to these stressors, to identify which habitats might be more vulnerable to which stressors, and to provide base information that is needed to develop indicators of ecosystem responses to multiple stressors in this area. He described a GIS-based approach to identify which stressors occur in the Strait of Georgia and how they might impinge upon various habitats, and then described an expert-based project to identify the potential vulnerabilities of these habitats to which stressors. He concluded that considerable (but not complete) information is available for the Strait of Georgia on spatial patterns of important marine habitat features and human stressors, that we are beginning to understand the knowledge gaps concerning measures of habitat vulnerability and resilience, and that expert surveys are one method to obtain information but they need to be cross-linked with empirical data. Ecosystem models may provide useful “platforms” to understand ecosystem responses to multiple stressors, but they also need to be supported and cross-checked with empirical data and expert surveys. This type of analysis does not permit inclusion of temporal trends in stressors, which can be important in assessing current conditions when the information base is from past conditions.

Mr. Vladimir Kulik provided a detailed and thorough statistical analysis of mapping cumulative human and natural impacts in the Sea of Okhotsk, based on the monitoring of energy emissions from fishing activities. He derived time series of this information and applied statistical analyses to extract the dominant underlying features and trends. Planned activities include additional stressors such as SST and sea ice, adding nearshore human activities (specifically small-scale fishing), involving experts in a survey to get weights for ecosystem vulnerability, clustering the bottom area by ground type and depth, and summarizing impact scores by clusters.

Dr. Motomitsu Takahashi and co-authors provided an initial comparative study of ecosystem responses to anthropogenic activities and natural stressors among inland, shelf and oceanic waters around Japan. They used the expert-based screening method developed by Working Group 28 to identify the impacts of human activities and natural stressors in each of these regions. They then compared the outcomes from the expert-based approach with observed data. They concluded that increasing sea temperatures affect all three ecosystems, that coastal development and engineering have strong impacts on the East China Sea and the Seto Inland Sea, that demersal and pelagic fishing impacts the East China Sea and the Kuroshio/Oyashio region, respectively, and that nutrient inputs have synergistic impacts to Harmful Algal Blooms and hypoxia. They also identified

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problems with the expert-based scoring method, including that the certainty of the experts on the impacts differ among ecosystems because of the quality and quantity of information available, that the evaluation of impacts can differ among experts with different experience and expertise, that more information in the intertidal and coastal waters along China are needed for the East China Sea region, and that for oceanic waters, a lack of information may preclude appropriate evaluation of ecosystem responses.

Dr. Mingyuan Zhu and co-authors examined ecosystem changes under multiple stressors in the Yellow Sea, including the natural environment of Yellow Sea and East China Sea, their multiple stressors, the resulting changes in pelagic and benthic communities, and the consequent response of the ecosystems. They concluded that multiple stressors on the ecosystems of these Chinese seas occur from both climate change and anthropogenic activities and that they are increasingly severe, that there are clear ecosystem changes as evidenced by loss of biodiversity, declines in living marine resources, increasing HABs, “green tides”, jellyfish blooms, *etc.*, and that further studies and management actions to reduce environmental stresses are urgently needed.

The presentation by Mr. Kyung-Su Kim and co-authors received the Best Paper award from the MEQ Committee (see the end of Session Summaries for the list of recipients). They examined the combined effects of elevated carbon dioxide concentrations and temperature on the development of olive flounder, the most important aquaculture species in Korea. It provided an example of the type of directed study that is needed to begin to understand the joint effects of more than one stressor. They concluded that larval growth was similar at the two lower CO₂ concentrations examined and within the range of seawater temperature range of 18–22°C, but that growth was enhanced at the highest CO₂ concentration at both temperatures. They also noted that the calcium component in larval bone was significantly increased at the highest CO₂ concentration. This study provided a nice example of the (often) non-linear relationships that can occur with multiple stressors interact.

General discussion considered whether these expert-based survey approaches should be done with a regional or global focus, *i.e.*, whether the respondents should be asked to consider just the range of values and experiences in a particular geographic region or on a global comparison. No consensus was reached other than to note this question can be important and should be considered in such surveys and their questions. In addition, how can the impacts of multiple stressors on habitats be examined when more than two stressors are occurring? For example, Perry and Boldt found that the mode number of stressors on any 4 km² region in the Strait of Georgia was between 20 and 25. When developing indices for multiple stressors, they need to be “simple” but at the same time allow for users to “drill down” to obtain more details about how particular sets of stressors might be driving particular responses in habitats. An important shortcoming in these approaches was noted regarding temporal changes, and how to update the analyses. A stepwise process was recommended, involving identification of habitats, stressors, and their vulnerabilities, noting that these vulnerabilities of specific habitats to different stressors likely do not need to be updated on a regular basis. Updates for new time periods would then use the established vulnerabilities and simply update the stressor information.

List of papers

Oral presentations

Natalie C. Ban, Stephen S. Ban and Hussein M. Alidina (Invited)

Mapping cumulative impact: Advances, relevance and limitations to marine management and conservation in Pacific Canada, and emerging Bayesian approaches

R. Ian Perry and Jennifer Boldt

Identifying multiple stressors and potential habitat responses in marine ecosystems of Pacific Canada

Vladimir V. Kulik

Mapping cumulative human and natural impacts in the Sea of Okhotsk

Motomitsu Takahashi, Sachihiko Itoh, Naoki Yoshie, Kazuhiko Mochida, Masakazu Hori and Shigeru Itakura

Comparative study on ecosystem responses to anthropogenic activities and natural stressors among inland, shelf and oceanic waters around Japan

Mingyuan Zhu, Ruixiang Li and Zongling Wang

Ecosystem Changes under multi-stressors in the Yellow Sea

Kyung-Su Kim, JeongHee Shim and Suam Kim

The combined effects of elevated carbon dioxide concentration and temperature on the early development stage of olive flounder *Paralichthys olivaceus*

Poster presentations

Evgeniya Tikhomirova

Typical distributions of primary production at the surfaces of Peter the Great Bay (Japan Sea)

Kanako Naito, Setsuko Sakamoto, Mineo Yamaguchi, Ichiro Imai and Ken-ichi Nakamura

Iron as a triggering factor for harmful dinoflagellate blooms

Aya Morinaga and Kazumi Matsuoka

Eutrophication suggested by the heterotrophic signal of dinoflagellate cyst assemblages; Case of Omura Bay, West Japan

Yuta Inagaki, Tetsuya Takatsu, Masafumi Kimura, Yota Kano, Toyomi Takahashi, Yoshihiko Kamei, Naoto Kobayashi and Tatsuaki Maeda

Effects of hypoxia on annual changes in growth and somatic condition of flathead flounder *Hippoglossoides dubius* in Funaka Bay, Japan

Tetsuya Takatsu, Koji Shinoda, Shoichi Inoue, Tomofumi Seta and Yuta Inagaki

Drastic reduction of demersal fish abundance by hypoxia in Mutsu Bay Japan in the fall of 2011

Stephani Zador and Kirstin Holsman

Identifying and comparing ecosystem stressors in the eastern Bering Sea and Gulf of Alaska

Yumiko Yara, Meike Vogt, Masahiko Fujii, Hiroya Yamano, Claudine Hauri, Marco Steinacher, Nicolas Gruber and Yasuhiro Yamanaka

Ocean acidification limits temperature-induced poleward expansion of coral habitats

Anastasiia Strobykina

Spatial and temporal variability of nutrients in the Okhotsk Sea shelf zone

MONITOR/POC Topic Session (S11)

Effects of natural and artificial calamities on marine ecosystems and the scheme for their mitigation

Co-sponsored by: *JSFO and FRA*

Co-convenors: *Michael Foreman (Canada), Toyomitsu Horii (Japan), Vladimir Kulik (Russia), Phillip Mundy (USA), Sei-ichi Saitoh (Japan), Hiroya Sugisaki (Japan) and Tokio Wada (Japan)*

Background

From ancient times, we have been discussing and taking countermeasures on revival of fisheries and social infrastructures of waterside from natural disasters such as tsunamis and floods. The earthquake (Magnitude 9.0) that occurred in northeastern Japan on the 11th of March, 2011, was beyond our imagination. The earthquake and the subsequent gigantic tsunami destroyed the regional fisheries and surrounding society, and impacted marine ecosystems in eastern Japan. The tsunami also damaged the nuclear power plant of Fukushima, posing a serious threat to the North Pacific ecosystems due to the radioactive contamination of the ocean. Other recent examples of disasters which caused serious problems of environmental pollution for the marine ecosystems are hurricane Katrina in 2005, and the oil spill of the Gulf of Mexico in 2010. The magnitude of climatic disasters such as storms and floods may have been enhanced due to global warming. Since oil refineries, factories, power plants and other industrial infrastructures are often built in the coastal areas of the world, coastal ecosystems are vulnerable to natural and artificial disasters. For the wise use of ecosystem services, it is urgent and important to reveal the effects of natural and artificial disasters on marine ecosystems, to document their restoration processes, and to promote effective measures for restoration and mitigation of disaster impacts. The purposes of this session were to discuss: (1) the effect on the marine ecosystem by disasters, (2) the effect on the marine industries and societies by disasters, (3) schemes for the