Executive Summary

Progress is being made internationally on an ecosystem approach to the management of marine systems, in particular as applied to ecosystem-based fisheries management. This concept has recently been expanded to include people in what are now called coupled marine social-ecological systems. Such concepts can provide an integrated understanding of how ecosystem changes affect human social systems, and *vice versa*. This integrated concept of understanding social-ecological systems in the coastal areas in order to achieve a sustainable balance between these two systems is called *sato-umi* (village seas) in Japanese. In 2012, PICES started an integrated social-ecological systems research project named "Marine Ecosystem Health and Human Well-Being (MarWeB)", which was funded by the Japanese Ministry of Agriculture, Forestry and Fisheries. The key questions of the project were: (a) How do marine ecosystems support human well-being? and (b) How do human communities support sustainable and productive marine ecosystems? This report is the summary of the results from the project.

In this report, various social and natural scientific tools are introduced using real data from case studies to exemplify how to conduct social-ecological systems analysis for marine-dependent communities. Section 2 provides an overview of novel research at the national level on how the member countries of PICES and one of the case study nations (Indonesia) perceive their interactions with the sea. This section sets the general concepts for how people interact with the sea, and identifies important national differences. It uses the concepts of human well-being, and involves peoples' evaluations of their lives and interactions with the sea, such as positive emotions, engagement, satisfaction, and meaning. Because marine ecosystems provide a wide-variety of ecosystem services, some kind of "weighting function" is needed in order to allocate the limited human and financial resources to protect/conserve ecosystem services in socially appropriate ways. The challenge here is that each society or country has its specific priorities based on their cultural and historical backgrounds. At the same time, in order to discuss social-ecological systems approaches at the scale of the entire North Pacific, understanding the differences and commonalities in how well-being is structured among these countries is needed.

Section 3 presents a summary of the first case study focusing on shrimp aquaculture in Indonesia. In this study, local needs were apparent from the beginning, including the prevention of land erosion by abandoned shrimp ponds after the occurrence of shrimp diseases from excessively intensive aquaculture operations. To reduce emissions of high-nutrient effluents into the coastal zone, integrated multi-trophic aquaculture (IMTA) technology was introduced to conduct multi-species aquaculture in a sustainable manner. Also, scientific techniques to monitor impacts to the local marine ecosystems were presented. Section 4 summarises the results from community needs assessments and attempts to implement oyster aquaculture in coastal communities of Guatemala. Guatemala represents a "bottom up", and Indonesia a "top down", example of different approaches to implementing *sato-umi* concepts. In Section 5, the current situation of the nation-wide introduction of marine protected areas in Palau is described.

Section 6 presents comparisons among the case studies. As the final section, Section 7 provides the conclusions, lessons learned and recommendations for how to conduct social-ecological systems (*sato-umi* type) analyses in developing countries around the North Pacific.

In response to the two key questions posed at the outset of this project, we offer the following conclusions:

(a) How do marine ecosystems support human well-being?

The "traditional" biophysical science approach to this question is often framed in terms of food supply and livelihoods. However, this narrow framing leaves out the very important psychological needs of how people relate to the sea. In reality, both psychological and physical needs are required for positive human well-being.

(b) How do human communities support sustainable and productive marine ecosystems?

This is the reciprocal question to that above. It is a more social science-centered view, with the focus on people and what they do, or can do, to ensure or improve healthy marine ecosystems. The actions of people can be detrimental or beneficial to marine ecosystems. These actions become all the more important to consider when the biophysical marine ecosystems are already under stress, for example from a changing climate. This concept of what people can do to cultivate healthy marine ecosystems is at the core of the Japanese concept of *sato-umi*.

One of the strongest lessons learned from these studies was the importance of connecting with organizations in each country which could facilitate and advance the project. In order to conduct social-ecological systems research in an effective and efficient way, close connections with these key organizations and people are needed to understand the concept of marine social-ecological systems, and to be able to translate it into the local context.