Introduction to the Biogeographic Assessment

Matthew S. Kendall[1]

This report provides an assessment of the marine biogeography of the Samoan Archipelago with a focus on oceanography, reef fish, and coral communities. Biogeography examines the distribution of biota and their habitats as well as the environmental factors that have shaped them. Biogeographic characterizations are among the basic information inputs required not only for making informed management decisions but also building public support for them.

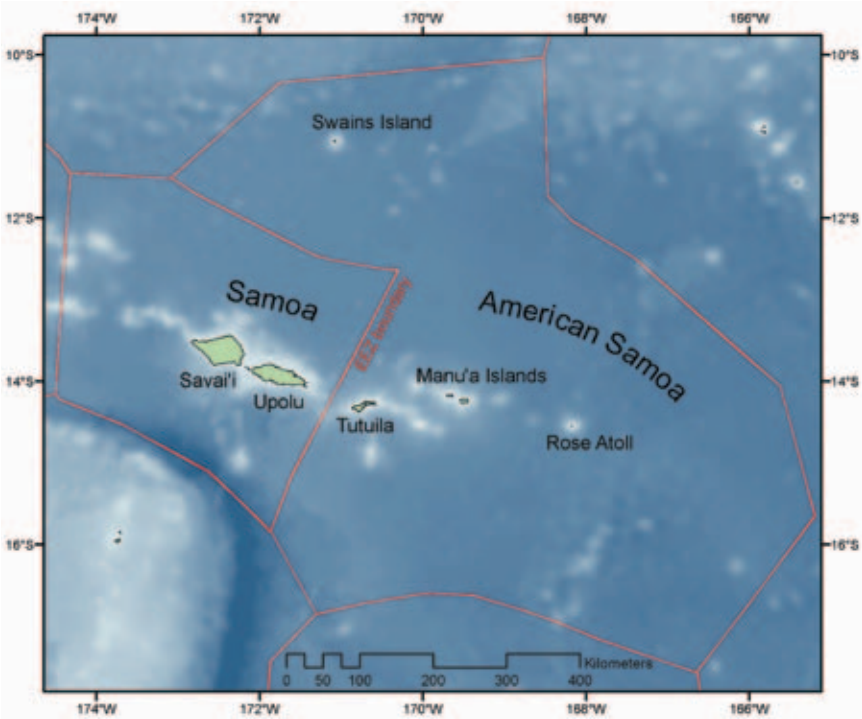

Figure 1.1. Samoan Archipelago study region.

The Samoan Archipelago lies in the South Pacific Ocean along ~14º S latitude at the international date-line (Figure 1). The archipelago is comprised of a chain of volcanic islands, seamounts, and coral atolls and is divided into two countries: Samoa and American Samoa. The much larger islands of Savai'i and Upolu comprise most of the independent nation of Samoa, formerly called Western Samoa. American Samoa (a Territory of the United States) is made up of the comparatively medium sized island of Tutuila, the smaller islands of the Manu'a group, and the two small, remote coral atolls of Swains Island and Rose Atoll that are not derived from the same volcanic hotspot as the rest of the island chain.

Many prior assessments have touched on the biogeography of either Samoa or American Samoa and are cited throughout this document. The present report builds upon these earlier assessments by combining and re-analyzing their original datasets, adding more recent biogeographic data sources, and by combining and re-interpreting their individual findings into a multidisciplinary summary of marine biogeography.

Despite their close proximity and shared resources, management decisions and prior assessments in the region have typically been split along the international political boundary between Samoa and American Samoa. In contrast, a key goal in this assessment was to compile data from both areas and to conduct the characterization across the entire archipelago. Results of the assessment are intended partly to support the "2 Samoa's Initiative", a recent cooperative agreement between the two jurisdictions that seeks to foster improved collaboration, coordination, and information exchange on natural resource management and other topics. The Governments of Samoa and American Samoa should be contacted directly for more information on the current status of this unfolding initiative.

Of note, much of the data used in this assessment was collected prior to the September 2009 tsunami that devastated some shallow water and low lying segments of the archipelago. Most parts of this assessment however, were conducted at a broad analysis scale and the types of data used were not highly sensitive to this significant and anomalous natural disturbance. For more information on tsunami impacts, interested readers are directed to specific studies that were conducted to evaluate the extent and severity of damage due to that event.

[1] NOAA/NOS/NCCOS/CCMA Biogeography Branch

A key application intended for the report is to provide guidance in the ongoing development of a network of Marine Protected Areas (MPA) in the Samoan Archipelago. The region is already home to a diversity of MPAs implemented at various levels of government from individual villages and communities to federally protected areas of international significance. Many of the different MPAs in the network were created through independent processes for different objectives but each contributes to the mosaic of marine resource management in the region. Understanding what fish, coral, and habitat resources this diverse network of MPAs collectively encompasses is a key objective of this work and is critical for understanding the scope of current protection and thoughtfully designing additional network elements.

Image 2. Reef fish sold in a local grocery.
Photo: Matt Kendall, NOAA Biogeography.

As a result of discussions with project partners in the design phase of the assessment, this report focuses on corals and reef fish, transport of their larvae, and the reef habitats where they live. Additional aspects of biogeography that are not included in this assessment but are important to the region and Samoan culture include sea birds, cetaceans, deep coral habitats, and pelagic fish communities to name but a few. Including these resources was beyond the scope of our assessment although they have been investigated in several individual studies that should be consulted for more information.

The assessment is divided into 5 chapters with supporting appendices. Each chapter was based on compilation of multiple pre-existing datasets, original analysis, and discussion that has not been previously published. Each chapter was written or reviewed in collaboration with subject matter specialists and local experts. Here in Chapter 1, the overall scope and approach of the report is introduced. In Chapter 2, regional ocean climate is characterized including wind and wave climate, sea surface temperature, primary productivity, and sea level fluctuations. The focus is on the spatial and temporal patterns and trends in ocean climate that may affect marine biogeography. In Chapter 3, regional ocean currents and transport of coral and fish larvae are investigated among the islands of the archipelago as well as the surrounding island nations. The degree of self seeding versus dependency on outside sources of fish and coral larvae for maintaining each islands reef ecosystem is quantified. Major and secondary sources of larvae for each island are discussed in terms of resilience of reefs to disturbance. In Chapter 4, the reef fish and coral communities of the archipelago are quantified on the basis of overall biodiversity, abundance, and community structure. Biogeographic trends, breakpoints, and hotspots are identified among and within each of the islands in the archipelago. In Chapter 5, we summarize the existing network of MPAs in American Samoa based on their habitats, reef fish, and coral communities. Presently protected features are compared to regional resources, and remaining gaps in resource protection are highlighted. Appendices include analytical details omitted from some chapters for brevity as well as important secondary analytical products needed as inputs for the main chapters in the assessment. This includes an inventory and summary of regional seamounts needed for the larval connectivity chapter (Chapter 3), analytical details of the reef fish and coral datasets (Chapter 4), a description of the shore to shelf edge benthic maps created and used for the MPA network analysis (Chapter 5), and supplemental information on the many marine protected areas in American Samoa (Chapter 5).