



North Pacific Research Board *Project Synopsis*

**PROJECT
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FUNDING SUMMARY

Principal Investigators

William Sydeman,
Farallon Institute for
Advanced Ecosystem
Research

David Hyrenbach,
Duke University

Years funded
2002–2004

Research period
August 2002–May 2006

Budget
\$315,699
(through 2006)

Integrating marine bird and mammal observations with the Continuous Plankton Recorder Program

WINGED OCEANOGRAPHERS MONITOR NORTH PACIFIC ECOSYSTEMS

Surveys of top-level marine predators tell us how the productivity of the ocean and the availability of their prey change over time. This “top-down” perspective complements the traditional “bottom-up” approach, which focuses on surveying changes in plankton populations.

We developed an integrated program of coordinated surveys designed to sample both the “top” and “bottom” ecosystem constituents concurrently. In 2002, we began the Continuous Plankton Recorder-Marine Bird and Mammal (CPR-MBM) program, a large-scale monitoring effort to collect plankton/marine predator samples seasonally along a 7,500 km transect across the North Pacific.

WHY WE DID IT

We wanted to develop a monitoring program for the North Pacific that would involve plankton as well as marine birds and mammals. The CPR projects (302, 536, 601) quantify the abundance of plankton, which form the base of the marine food web; visual surveys of marine birds and mammals tell us about changes in ocean productivity and the abundance and distribution of prey. Because marine birds and mammals use prey not sampled by the CPR program (i.e., forage fish, squid), these observations provide novel information on the abundance and distribution of other important ecosystem constituents.

These two complementary perspectives will help us document ecosystem-wide fluctuations, which may shed light on future responses of the North Pacific to yearly (e.g., El Niño), decadal (e.g., the Pacific Decadal Oscillation) and longer-term oceanographic variability.

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Bird observer Mike Henry on board the Skaubryn, in the Aleutians.

The Big Picture

Fluctuations in the oceanography and the ecosystem of the North Pacific highlight its dynamic nature. Despite this temporal variability, we documented ten different “meso-marine ecosystems,” which underscore the need to recognize the spatial structure of the marine environment when devising ecosystem-wide monitoring and management approaches.

NPRB Research Interest

We need to know more about North Pacific marine ecosystem dynamics to improve the long-term management of fish and wildlife populations. A critical step involves developing an enhanced ability to forecast ecosystem responses to environmental change, through integration of various research activities, including long-term monitoring.



RESEARCH THEME
Ecosystems

HOW WE DID IT

Because oceanographic surveys are extremely expensive, we relied on the cargo carrier *Skaubryn* to survey a vast swath of the North Pacific across seasons (spring, summer, fall) and over many years. Repeat surveys are critical to quantify the temporal variability in the marine ecosystem, which responds to seasonal and year-to-year changes.

We surveyed a 7,500 km swath of ocean spanning from British Columbia to Japan 12 times, and used the time series to investigate the spatial and temporal distributions of plankton, marine birds, and mammals.

After developing and refining appropriate survey methods in the first two pilot cruises, we conducted standardized 400-m strip transect surveys of marine birds and mammals. We then quantified spatial patterns of planktonic populations and marine birds in the NE Pacific, southern Bering Sea, and NW Pacific.

WHAT WE DISCOVERED

We documented “hotspots”—dense concentrations of marine birds and mammals—at La Perouse Bank (Canada), Unimak Pass (Western Aleutians), and off the coast of Honshu (Japan). We characterized seasonal and year-to-year changes in marine bird species distributions across the North Pacific and related these patterns to large-scale oceanographic conditions. Our analysis of spring-time plankton and marine bird communities revealed that the sub-arctic North Pacific can be subdivided into about 10 “meso-marine ecosystems”, each with distinct physical and biological attributes.

OUTREACH

Selected Conference Presentations

- © Hyrenbach, D., Henry M., Rintoul, C., Morgan, K., Sydeman, W.J. 2006. Monitoring marine bird distributions across the sub-arctic North Pacific using platform of opportunity vessels (2002-2005): Seasonal and Inter-annual Variability. Alaska Marine Science Symposium, Anchorage, AK, 21-25 January, 2006.
- © Sydeman, W.J., Hyrenbach, K.D., Morgan, K.H., Yen, P.P., Henry, M.P., Batten, S., Welch, D.W., 2006. Meso-marine ecosystems of the North Pacific: application to ecosystem-based management. PICES XV Workshop on Ecosystem-Based Management, Yokohama, Japan.

Scientific Publications

- © Batten, S.D., Hyrenbach, K.D., Sydeman, W.J., Morgan, K.H., Henry, M.F., Yen, P.P.J., Welch, D.W. 2006. Characterising meso-marine ecosystems of the North Pacific. *Deep Sea Research II* 53: 270-290.
- © Hyrenbach, K.D., Henry, M.F., Morgan, K.H., Welch, D.W., Sydeman, W.J. 2007. Optimizing the width of strip transects for seabird surveys from vessels of opportunity. *Marine Ornithology*, 35: 29-37.

Popular Articles

- © “Bering Sea Bird Bonanza,” by Mike Henry. *The Observer*, Quarterly Journal of PRBO Conservation Science, Number 137, Summer 2004.

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MISSION OF THE NPRB

Building a clear understanding of the North Pacific, Bering Sea and Arctic Ocean ecosystems that enables effective management and sustainable use of marine resources



“Vessels of opportunity” such as the Skaubryn (left) ease some of the expense of long-term monitoring projects in the North Pacific.



Above: a “hotspot” in the Bering Sea, with whales and seabirds converging on an especially rich area of the ocean. (Chris Kenaly)

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