

# Observer

▼ A new wave of marine ecosystem research at PRBO

## Sea Change

William J. Sydeman, Ph.D. and K. David Hyrenbach, Ph.D.

In the 19th century, when canaries were carried into coal mines to test the air for human health hazards, no one could have predicted the current widespread use of birds and other organisms as environmental indicators. As the science of ecology now enters the 21st century, the value of seabirds as indicators for marine ecosystems is becoming crystal clear.

This *Observer* presents a review of prbo's work to develop novel management approaches for the California Current marine ecosystem. Specifically, we share information obtained from long-term studies of breeding seabird populations on the Farallon Islands National

Wildlife Refuge (in cooperation with the refuge managers, U.S. Fish and Wildlife Service) and shipboard surveys of seabirds in southern and central California (conducted with Scripps Institution of Oceanography, California Department of Fish and Game, National Marine Fisheries Service, and the College of Staten Island.) We focus on three facets of this ongoing research: assessing the effects of climatic variability; determining the location of ocean productivity "hot spots"; and (in a companion article on page 9) using seabird data in the management of fisheries.

These three avenues are linked by a unifying theme: marine birds serve as sensitive indicators of change in marine ecosystems. Numerous and conspicuous predators, seabirds provide valuable information on the state of the environments they inhabit and the food chains that sustain their populations. On a more global scale, seabird studies may highlight long-term changes in

marine ecosystem response to rising ocean temperatures, or climate change. Along with a few other species at the top of marine food chains, seabirds can be used to help identify ocean hot spots, areas of high productivity that could be set aside as biological reserves.

Herein we provide specific examples of information available from seabird research that we believe provides great value for wildlife conservation and resource management. This information contributes to a necessary understanding of both natural and human-related changes in marine ecosystems. Through this work, we hope to promote a new management ethos, wherein human uses of ocean resources are balanced with the needs of seabirds and other marine organisms.

### Climate Variability

*El Niño and seabirds: the top of the food chain is the tip of the iceberg*

Nearly constant rains during the winter of 1998 firmly etched in our minds the phenomenon of El Niño and its little-recognized sister, La Niña. Such terms refer to a flip-flop of wind patterns and ocean conditions in the Pacific Ocean—

*continued on page 2*



Common Murre foraging.

Humpback whale breaching.



## PRBO bird conservation plans are catalyzing new efforts across the West.

▼ PRBO on the move

# Conservation Momentum

Ellie M. Cohen

Prbo is gaining conservation momentum, thanks to your ongoing support! A number of highlight events have occurred since our last *Observer* appeared.

We completed extensive renovations of our Visitor Center and Banding Lab at Palomarin Field Station. In December, our Wetlands Program relocated up the road to their new home in the Point Reyes National Seashore, thanks to the Park and to a generous donation from the Foundation grant.

As part of prbo's San Francisco Bay Habitat Project, we are developing a first-ever "Habitat Conversion Model." Based on prbo field work over the past two decades, the initial model will help habitat managers predict how converting artificial salt ponds to tidal marsh will affect bird populations. Prbo's growing Wetlands team is off and running to implement the U.S. Shorebird Conservation Plan in California and is also playing a lead role in a multinational shorebird migration mon-



Ellie Cohen

itoring program from Mexico to Canada.

The Terrestrial Program is hosting the Third International Partners in Flight (pif) conference in Monterey, California, in March, expecting 700 participants from all over the world. The conference will focus on integrating songbird, shorebird, and water bird conservation efforts in the

Western Hemisphere (for information, see [www.prbo.org/pif/npif2002.htm](http://www.prbo.org/pif/npif2002.htm)).

Prbo co-chairs California pif and has been the catalyst for bird habitat conservation plans that are being implemented across the West. On-the-ground prbo research efforts have been spawned by these plans. For example, our Terrestrial Program is embarking on a new multiyear monitoring project with the usda Forest Service to assess long-term effects of forest management practices in the Sierra Nevada. Prbo is also partnering with the Bureau of Reclamation on state-of-the-art conservation in the San Joaquin River watershed (Central Valley, California), includ-

ing riparian habitat restoration and bird population assessments in grasslands and vernal pools.

Prbo's Marine Sciences Division launched a new, science-based project to examine the feasibility of establishing offshore "national parks" in the California Current system (ccs), which extends from British Columbia to Baja California, Mexico (see "The First pppp Workshop," page 6). The Marine Program is also drafting the first-ever CCS Marine Bird Conservation Plan.

The new year is seeing prbo make some great progress towards achieving our vision. Bird conservation science is increasingly guiding habitat management to promote biodiversity.

With all this momentum, our top organizational priority is to ensure prbo's financial security for the long haul. We are committed to building a major endowment fund through planned giving, including real estate transfers, stock gifts, retirement and insurance plan designations, and charitable bequests, to ensure that prbo's uniquely effective conservation-through-science efforts continue for decades to come!



Ellie M. Cohen is PRBO's Executive Director.

## Sea Change, from page 1

the periodic oscillation between a warm-water phase, El Niño, and a cold-water phase, La Niña. This form of climate variability has given rise to widespread weather variability and to biological responses, such as warm-water albacore tuna migrating north into the Gulf of Alaska. El Niño also perturbs the marine food webs of the California Current, with consequences for the seabirds that make their living in this highly variable marine environment.

During El Niño conditions, certain physical processes in the ocean are severely altered. Upwelling—the movement of cold, nutrient-rich waters

from ocean depths up to the surface, stimulating production of microscopic marine plants at the base of the food chain—is suppressed. In addition to lower overall ocean productivity, low nutrient levels cause a shift in the flora of the California Current, from large-celled taxa such as diatoms to small-celled species such as dinoflagellates.<sup>1</sup> This change in the flora is thought to cascade up the food web. Small plant-

<sup>1</sup>Diatoms and dinoflagellates, groups of microscopic, photosynthetic organisms, are abundant primary producers in food webs of the oceans.



Rockfish of the genus *Sebastes*

plankton cells support small zooplankton grazers, instead of the larger ones that eventually feed fish, whales, and seabirds. Warmer surface waters may also push fish and zooplankton deeper in the water column, where they are less accessible to diving seabirds and cetaceans (dolphins and whales).

Seabirds respond to these shifts in the food web in various ways: they may not attempt to reproduce at all; for those that do breed, the numbers of eggs laid is greatly reduced, as is their success in rearing offspring; and,

## These links illustrate a climatic mechanism responsible for year-to-year variability in seabird productivity.

for some species, the death rate of breeding-aged adults may increase.

PrBO's exceptionally long-term research program on the Farallon Islands has enabled us to discern mechanisms that link climate variability and seabird reproductive success. Examples of the effects of multiple El Niño events on the California Current ecosystem over the past 30 years are presented in the four graphs on this page.

Figure 1a shows changes in the average January-to-March sea surface temperature, taken daily by prbo biologists stationed on Southeast Farallon Island. While warm-water winters occurred in many years, the largest deviations from average conditions occurred during the El Niño winters of 1983, 1992, and 1998.

Figure 1b illustrates an effect of climate variability on Common Murres, the most abundant breeding seabird on the Farallones. In most years, the murres fledge about 0.8 chicks per breeding pair—not bad considering that each pair lays only one egg per year. During the major El Niño events, murre breeding success was drastically reduced. This pattern of change on a year-by-year time scale is apparent for many other Farallon species, as well.

Figure 1c focuses on a primary prey species that murres feed their chicks—young-of-the-year rockfish of the genus *Sebastes*. As underscored by earlier prbo studies, rockfish availability is a significant determinant of seabird breeding success on the Farallon Islands. In years of *Sebastes* shortage, when seabirds are forced to rely upon other prey species, such as anchovies and squid, they fledge fewer young. Figure 1c shows deviations from the long-term average use of rockfish by Common Murres on Southeast Farallon Island, a pattern that echoes those in 1a and 1b. In years of warm-water conditions and poor reproductive success, rockfish comprise a lesser proportion of the chick diet.

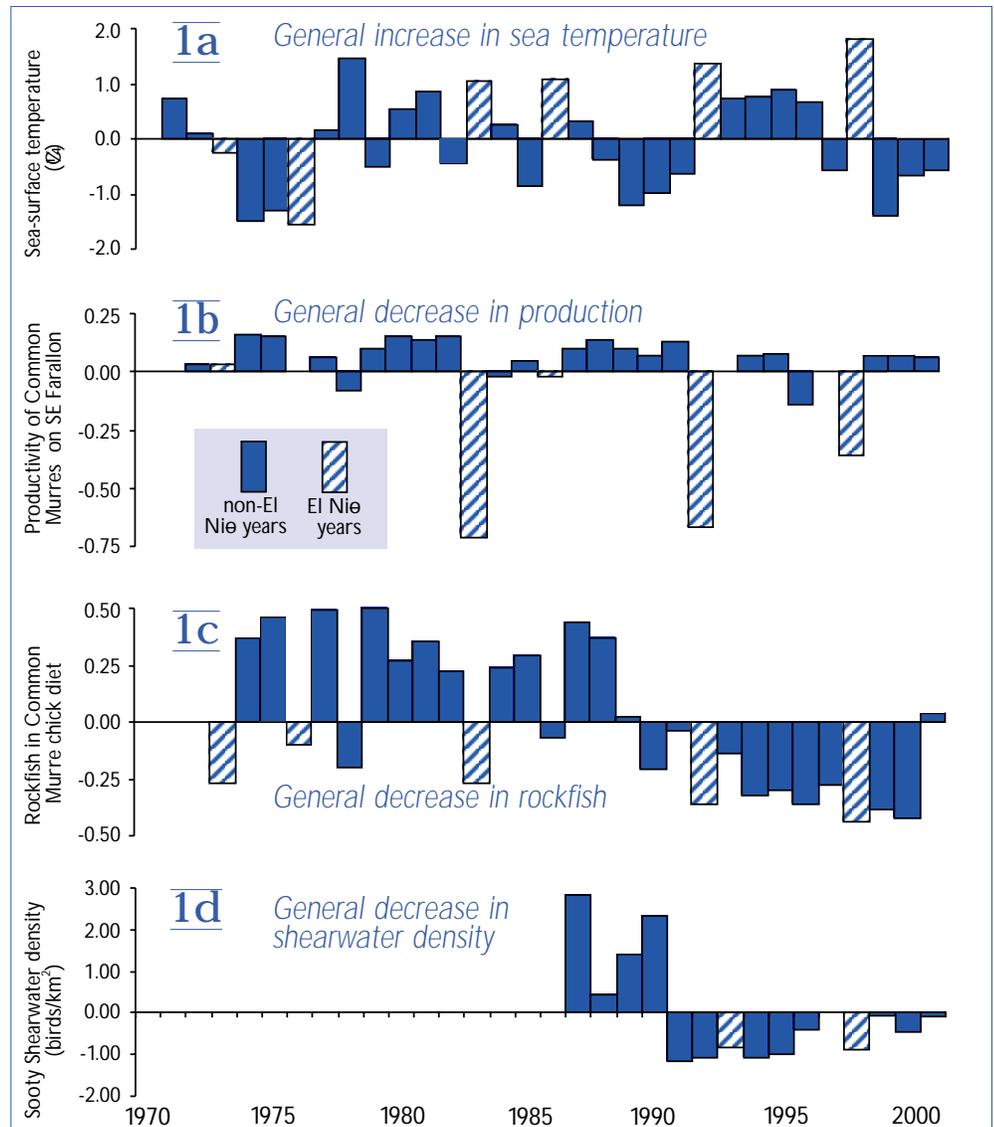


Figure 1. Standardized anomalies—annual values relative to the long-term mean—for four indicators of marine ecosystem change.

These links, between ocean temperature, murre reproductive success, and changing prey use, illustrate a climatic mechanism responsible for year-to-year variability in seabird productivity.

Does this same variability affect migratory species, which visit the California Current seasonally? We are beginning to answer this question through our studies in southern California, with the California Cooperative of Oceanic Fisheries Investigation (Calcofi). Conducting seabird surveys

aboard Calcofi offshore cruises enables us to contrast the responses of visiting seabirds with those of locally breeding species like the Common Murre. One limitation in this approach is the much shorter time-series involved (time-series are standardized measurements made over the same geographic area at consistent intervals through time). Our at-sea surveys began much more recently than our Farallon-based colony studies. Some interesting patterns emerge nonetheless.

*continued on page 4*

If we zoom out in time, from the scale of years to that of decades, we can ask whether longer-term patterns are evident in our seabird data sets.

## Sea Change, *from page 3*

Figure 1d spotlights the Sooty Shearwater, a spring-to-fall visitor that breeds in New Zealand and Chile and exemplifies the response of highly mobile species. Similar to the murre example, shearwater springtime abundance varied considerably between years and was low during El Niño events.

Additionally, the shearwater time-series, despite its short duration, contains a signal of ecosystem change in response to a recently documented shift in the ocean/climate.

### *Opening the lens: decade-to-decade change in the ecosystem*

The beauty of long time-series is that, in addition to short-term fluctua-

tions from year to year, they can be used to characterize longer-term variability associated with climate change from decade to decade. If we zoom out in time, from the scale of years to that of decades, we can ask whether longer-term patterns are evident in our seabird data sets. For instance, has the frequency or intensity of warm-water years changed through time? Have

## Pelagic Predators, Prey, and Processes

Gazing at the setting sun over the Pacific Ocean, we may ponder the miles of open ocean beyond the horizon and ask, "How do we protect this vast wilderness, which goes deeper than sunlight and contains organisms that we still have not seen?" The prosaic yet challenging answer is through collaboration between science and management.

One way to protect important habitats and populations, and to maintain viable ecosystems, is through the establishment of Marine Protected Areas (MPAs). These are delimited zones that provide some level of protection to marine living resources. Marine Reserves (MRVs) go one step further, restricting extractive activities such as fishing. In February 2001, 160 marine scientists and conservation biologists signed a landmark consensus statement declaring that "existing scientific data justify the immediate application of fully protected marine reserves as a central management tool."<sup>1</sup>

The potential for MPAs as management tools is rapidly becoming apparent, especially along the Pacific Coast of North America. Data are revealing the threatened status of ecologically, culturally, economically, and recreationally valuable marine resources, from microorganisms to 100-ton mammals. The California Marine Life Protection Act was passed in 1999 to incorporate MRVs and MPAs into the management of state waters (referred to in the marine policy world as "nearshore"—from high tide to three nautical miles out). The Pacific Fisheries Management Council is currently considering the use of MPAs for fisheries management in federal waters, from three to 200 miles offshore.

In May 2000, U.S. Presidential Executive Order 13158 established within the National Oceanographic & Atmospheric Administration (NOAA) a Marine Protected Areas Center and Institute for MPA Science, in Santa Cruz, California. The mandate is: collaborate with agency and nongovernmental partners to develop the science-based framework and tools to design and effectively manage MPAs.

Approximately 0.01% of the world's oceans lie in protected areas. NOAA's 14 National Marine Sanctuaries, representing

0.6% of marine waters under U.S. jurisdiction, encompass mostly shallow waters that harbor intertidal and subtidal organisms living on rocky substrates, corals, and sea grasses. The sanctuaries' purpose is to protect these resources from degradation. An even smaller fraction of coastal waters is fully protected from extractive or harmful uses.

What about those special places beyond the horizon, teeming with marine vertebrates—seabirds, sea turtles, large predatory fish (including great white sharks), pinnipeds (seals and sea lions), and cetaceans (whales and dolphins)—many of which migrate thousands of miles biannually between feeding and birthing grounds? Pelagic species live primarily in the open ocean and are subject to a wide range of anthropogenic threats, including fishing, bycatch, marine debris, ship strikes, and military operations.

Because these far-ranging pelagic predators occupy highly dynamic and ephemeral habitats, the design of offshore MPAs to protect them represents a major challenge. Yet oceanic surveys and research have revealed a valuable clue for protecting large aggregations of pelagic predators, as explained in this PRBO *Observer*—"hot spots" of primary production, foraging, and predator-prey interactions that involve a complex array of organisms at all levels of marine food webs. The question is whether protecting highly productive offshore areas with MPAs (which would complement existing and planned nearshore MPAs) would protect pelagic species from the impacts of human activities.

A recent workshop (see sidebar on page 6) has focused new scientific attention on research and management priorities for "Pelagic Predators, Prey, and Processes"—vital and often threatened components of healthy marine ecosystems. We anticipate a continuing series of collaborative meetings that will join scientists, management agencies, funding sources, resource users, conservation groups, and other stakeholders to promote pilot projects. Among these will likely be assessment of the efficacy of MPA designs and management plans, which could mark a new horizon for marine conservation.

—*Kaya Pederson, Marine Policy Analyst/Researcher, PRBO and NOAA's MPA Center (a cooperative position)*

<sup>1</sup>February 2001 meeting in San Francisco of American Association for Advancement of Science.

## We have initiated a new research project to collect ecosystem-wide information.

there been corresponding long-term changes in reproductive success, diet composition, or at-sea abundance of seabird populations?

Ocean temperatures off the west coast of North America—and in the global ocean, for that matter—have increased over time, though this pattern resembles an abrupt step function rather than gradual and constant change. In particular, there appears to have been a general increase in temperature in 1976–1977. While punctuated with annual fluctuations, some of which were negative, it continued at least through 1998.

Corresponding patterns have been documented in a wide variety of physical and biological time-series spanning the North Pacific Ocean. These include precipitation, storm tracks, the flowering date of terrestrial plants, and salmon catches in California-Oregon and the Gulf of Alaska.

Recently, atmospheric and fisheries scientists from the University of Washington (uw) documented “an El Niño-like warm-water phenomenon, persisting on a scale of several decades, (that) was responsible for widespread ecosystem and fisheries changes over much of the northern hemisphere.” They called this series of 20- to 30-year shifts in Pacific Ocean temperature the “Pacific Decadal Oscillation” and identified a number of warm and cool regimes over the past 100 years.

Prbo’s localized perspective corroborates the uw scientists’ global view of long-term variability in ocean conditions. Our time-series on bird productivity, diet, and population abundance, from the Farallones and from southern California, show similar decadal patterns of change—with some notable differences. While production of young by Farallon murres has remained relatively constant, there is a trend for increasing reproductive failure in the 1980s and 1990s,



Sooty Shearwater

following the 1976–1977 regime shift. Prior to 1983, these reproductive failure events were smaller in magnitude. Then, during the 1980s and 1990s, intense reproductive failures were associ-

ated with strong El Niños. This pattern suggests that the intensity of food-web collapse during the 1980s and 1990s was greater than during the preceding decade.

Information on the use of rockfish prey by breeding murres also supports the concept of long-term changes in the ecosystem, and here 1989 emerges as a pivotal year. Before 1989, juvenile rockfish were the predominant food item fed to young murres in all years except during El Niño events. After 1989, use of this prey item decreased in a relatively constant manner, as the waters of the California Current continued warming.

The Sooty Shearwater time-series from our Calcofi surveys echoes this pattern of long-term changes in the ecosystem. As shown in Figure 1d on page 3, shearwater abundance in the waters off southern California declined markedly after 1990. Though the late 1980s is also the period when the decline in use of juvenile rockfish by Farallon murres began, we do not consider a direct link between rockfish and shearwaters likely. Instead, we believe that the same climatic factors that caused the decline in juvenile rockfish abundance are probably responsible for the decrease in shearwater numbers. The underlying phenomenon is

Pacific white-sided dolphin



likely related to ocean warming and a regime shift in 1977 (possibly accentuated in 1989).

The Sooty Shearwater, still extremely numerous, is a dominant species in California’s marine avifauna. Its impressive aggregations, in fact, are helping us pinpoint ocean areas of vital interest for management and conservation.

### Biological hot spots and marine protected areas

#### *Beyond breeding colonies: conservation in the open ocean*

When we monitor seabirds breeding on the Farallones, how large is our perspective on the ocean? The insights we gain encompass a region equal to the foraging range of the birds. Murres, which may forage up to 60 kilometers away from Southeast Farallon, provide information on oceanographic conditions and prey availability for a total area of about 11,000 square kilometers. Our conservation interests, however, are much larger in scope. While the Farallon project represents the backbone of prbo’s Marine Sciences program, we are now moving beyond the confines of our backyard in the Gulf of the Farallones to focus our attention on the entire California Current system.

We have initiated a new research project to collect ecosystem-wide information on physical oceanography, prey dispersion, and top predator distributions, to determine whether and why seabirds and cetaceans occur at specific, predictable locations.

For the design of pelagic reserves—protected areas in the open ocean—birds and cetaceans are ideal focal organisms. They are predators that can be readily used to monitor the food webs exploited by economically important fish, which rely on similar resources but are inherently more difficult or expensive to study since their movements

*continued on page 6*

## Pelagic mpas could serve as key components of innovative marine conservation efforts on a very large geographic scale.

### Sea Change, *from page 5*

remain largely hidden beneath the ocean surface.

Our first working hypothesis is as follows: predators aggregate in areas of elevated marine productivity—hot spots—to feed on dense prey aggregations. Predator and prey populations co-occur, because nonswimming prey (plankton) are physically aggregated and retained in areas where water masses converge. Swimming prey, such

#### The First PPPP Workshop

On January 17, 2002, at U.C. Santa Cruz, PRBO and NOAA's Institute for MPA Science, in collaboration with the National Fish and Wildlife Foundation, co-sponsored a "Pelagic Predators, Prey, and Processes" workshop, to discuss conservation issues facing far-ranging organisms that spend most of their time in the open ocean. In a sunlit room facing the sea, more than 25 scientists from diverse disciplines met to exchange perspectives on everything from currents and eddies within the California Current system to how these affect zooplankton, fish, sea turtles, marine birds, and whales. The central question facing the group was the extent to which such open-ocean organisms could benefit from the potential establishment of pelagic Marine Protected Areas (MPAs). Some of the specifics addressed included: To what extent are movements of both water masses and organisms predictable, in a geographic sense and from season to season? Can we identify processes that support predictable predator-prey associations? Can we develop a consensus about where pelagic Marine Reserves might be placed? What tangible metrics could we use to assess their effectiveness? Many interesting ideas and a surprising degree of agreement surfaced over the course of the day. The group, informally calling itself the Pelagic Science Working Group on Marine Protected Areas, will issue a summary of workshop results in the coming months.

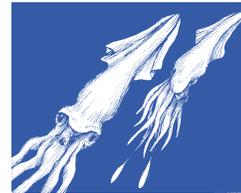
—Gregg Elliott, PRBO Conservation Policy Analyst

as forage fishes and squid, select these areas due to their high levels of plankton prey. Finally, regions with predictable gradients in water flow—convergence zones, for example, where water masses meet downstream from upwelling centers—promote highly productive food webs, exploited by seabirds and cetaceans.

If we can demonstrate recurrence, or "predictability," between seasons and from year to year in the locations of such strong food web interactions, we may be able to use them to establish Marine Protected Areas (mpas; see sidebar on page 4). Exploitation and human impacts on seabirds and cetaceans could be eliminated or reduced in these regions of the ocean.

Our conceptual model concerns the oceanic habitats and food webs exploited by many marine top predators: commercially valuable fish stocks such as salmonids and tunas, sharks, marine birds, sea turtles, and whales and dolphins. Pelagic, or open-ocean, habitats such as those in the California Current system have been considered too dynamic and unpredictable for the establishment of pelagic mpas. We believe, though, that persistent ocean productivity patterns and predictable wildlife habitat associations could guide the design of mpa networks for the open ocean. If so, pelagic mpas could serve as key components of innovative marine conservation efforts on a very large geographic scale.<sup>2</sup>

Outreach to scientists, marine managers, and other stakeholders will be key to exploring the feasibility and potential



Squid

benefits of mpa concepts for pelagic habitats. We have begun by developing the "Pelagic Predators, Prey, and Processes (pppp) Initiative," a collaborative process to assess the scientific basis for establishing open-ocean mpas in the

California Current system. To advance this new initiative, we co-hosted the first pppp workshop (described in the sidebar on this page). Its main objective was to characterize the areas and habitats where top predators (marine turtles, seabirds, and whales) and their prey (forage fish and zooplankton) aggregate, and to assess whether food webs supporting these aggregations are predictable enough in time and space to warrant mpa designation. Certain of our research results to date strongly suggest that this is the case.

#### *A promising hot spot in the California Current system*

The California Current ecosystem is very large and heterogeneous, with three physically and biologically distinct domains: 1) Washington and Oregon; 2) central and northern California; and 3) southern California and Baja

California. Figure 2 shows these as regions 1, 2, and 3. Important differences in physical properties, such as intensity of coastal upwelling, and biological properties, such as food web structure,

differentiate these domains. Disparate reserve designs will likely be required to accommodate these differences.

Recognizing this, our research integrates two distinct viewpoints, one regional and the other local. The larger-scale perspective includes surveys of the

*continued on page 6*

dynamic northern and southern limits of the California Current system. In the north, off British Columbia, our research cruises extend to an offshore weather station, as shown in Figure 2. In the south, off southern California



Euphausiid shrimp (krill)

<sup>2</sup> Examples of a new, large-scale approach to marine conservation include the Baja to Bering Sea Initiative, designed to protect key elements of the marine system in that vast geographic area; and U.S. Executive Order 13158 (see sidebar by Kaya Pederson on page 4), which mandates an expanded and strengthened comprehensive system of mpas for the nation.

Our results suggest the presence of a predictable area of high ocean productivity, with seabirds the key indicator.

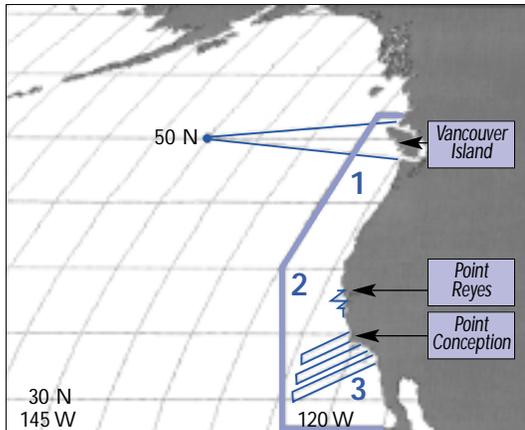


Figure 2. The northeastern Pacific Ocean, showing the extent of the three surveys in our study. The California Current system, delineated in light blue, has been divided into three physically and biologically distinct regions (see text).

and Baja California, our cruises with Calcofi are plotted within region 3.

Our smaller-scale, or local, perspective focuses on important areas of seabird-cetacean aggregation—the Santa Barbara Channel, Gulf of the Farallones, and, in British Columbia, La Perouse Bank. Each of these is associated with a predictable upwelling center—offshore of southern California (Point Conception), central California (Point Reyes), and Vancouver Island's southwest coast, respectively.

Figure 3 illustrates some of the insights we have gained from this research. Sooty Shearwaters in the vicinity of Point Conception more commonly occupy waters of higher chlorophyll concentration. The presence of chlorophyll, readily seen in satellite images, indicates an abundance of phytoplankton, the tiny plants at the base of marine food webs. It helps scientists detect areas of high ocean productivity. Large plumes of high-chlorophyll water that appear during spring and summer provide evidence that upwelling enhances ocean productivity downstream from coastal promontories. The one at the Point Conception upwelling center is delineated in Figure 3. Despite year-to-year

changes in the extent of this plume, Sooty Shearwaters are predictably found in higher densities within the highly productive, recently upwelled water than within waters of intermediate productivity associated with the southerly-flowing California Current. Notice that no shearwaters were sighted within low-productivity, subtropical waters farther offshore and to the south of the study area. Even during the 1998 El Niño, a warm-water period, there was high ocean productivity in the vicinity of Point Conception.

Though preliminary, these results suggest the presence of a predictable area of high ocean productivity, with seabirds (in this case foraging Sooty Shearwaters year after year) the key indicator. Firmly identifying such areas, we believe, holds tremendous promise

for conservation measures encompassing entire marine food webs.

### New concepts in marine ecosystem management

Over the next few years, we will face the major challenge of synthesizing information gained from our continuing studies at the Farallones and from new research programs at sea. Our task is daunting but by no means insurmountable.

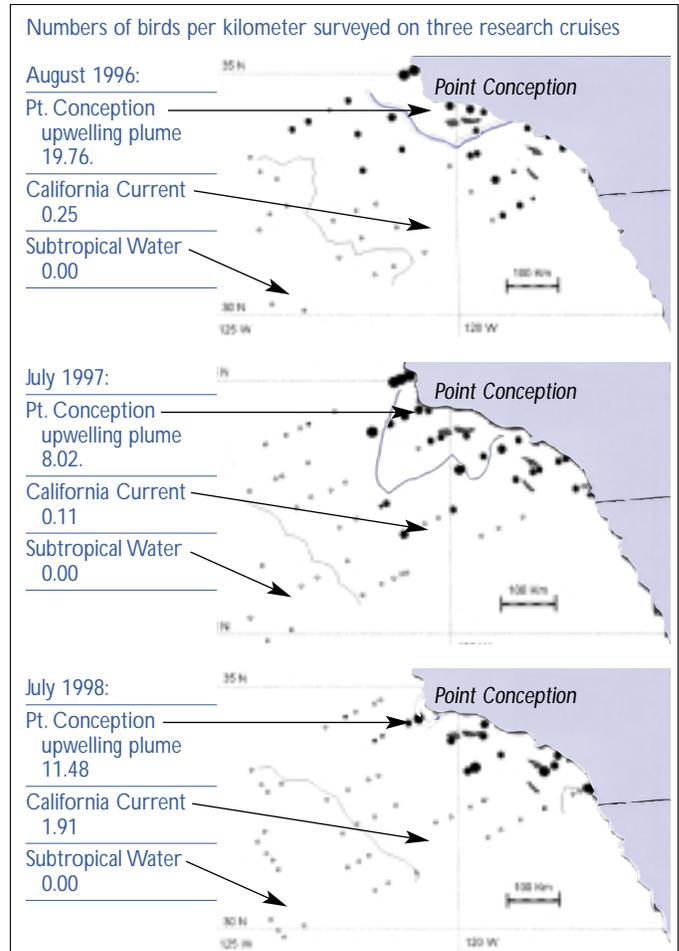


Figure 3. Sooty Shearwater summertime distributions off of southern California. Circles depict locations where shearwaters were present (black) or absent (white). The diameter of black circles is proportional to the birds' abundance. The bold blue line is a contour of high chlorophyll concentration; narrow gray lines are contours of moderate concentration. Higher chlorophyll concentrations indicate higher ocean productivity.

## Understanding seabirds' feeding interactions pinpoints important foraging habitats for a range of marine predators.

### Sea Change, from page 7

Recognizing the need for understanding patterns and mechanisms on multiple spatial scales, from tens to thousands of kilometers, and temporal scales, from seasons to decades, represents a tremendous advantage. A deeper knowledge of the way climate variability influences population dynamics of marine predators will emerge from this synthesis. The knowledge will enhance our ability to manage marine populations and to protect ocean resources.



Silver (coho) salmon

It is well known that fish populations frequently fluctuate in relation to ocean temperature: some like it hot while others prefer colder conditions. Likewise, some changes in marine bird and mammal populations are driven by natural environmental variability. In addition, human activities—fisheries exploitation, bycatch, chronic oil spills, and other pollution—affect marine populations. It is essential that we assess the impacts from natural environmental variability in conjunction with those from human activities in the ocean. Learning about

mechanisms that promote strong ecological interactions will also strengthen future conservation efforts. Understanding seabirds' feeding interactions, for example, pinpoints important foraging habitats for a range of marine predators.

Prbo has an impressive history of contributing valuable insights into the management and conservation of a variety of ecosystems. We now see this aspect of the Marine Sciences program as critical to the health of ocean predators and their ecosystems—and as a focal point for our work over the coming decades.

*Major support for the research and goals discussed in this article is provided by the National Fish and Wildlife Foundation (NFWF), David & Lucile Packard Foundation, and U.S. Fish & Wildlife Service (USFWS). PRBO, in partnership with a dozen governmental, nonprofit, and academic organizations, is working to synthesize and disseminate the critical information needed to ensure healthy, diverse marine bird communities in the California Current system. Future Observer articles will report on related work in our Marine Sciences Division, such as developing a California Current System Marine Bird Conservation Plan with specific management recommendations. PRBO greatly appreciates the commitment of NFWF, the Packard Foundation, and USFWS to science-based conservation in the California Current.*

### Shark Update

Results of prbo's quest to understand the white shark's ocean migration (*Observer* 126, Fall 2001) appeared in the January 3, 2002, issue of the journal *Nature* and then made newspaper headlines. The sharks' whereabouts at sea have remained a mystery until now, but satellite "pop-up" tags enabled prbo researcher Peter Pyle and colleague Scot Anderson, along with researchers from Stanford University and U.C. Santa Cruz, to track four animals across vast stretches of open ocean for the first time. One male, named Tipfin by prbo researchers, migrated from the Farallones to the Hawaiian archipela-



go, some 2,280 miles to the west, where he stayed the entire winter and spring.

Three other tagged sharks migrated to a subtropical region of the eastern Pacific hundreds of miles west of Baja California, where they remained in the open ocean for several months.

Satellite telemetry also revealed the sharks' intriguing diving patterns during their transit across the open sea. While the four animals sometimes dove as deep as 2,040 feet below sea level, they seemed to prefer swimming at two discrete depths—one within 15 feet of the surface, the other 900 to 1,500 feet down. All four sharks spent

up to 90 percent of the day in these two diving zones and little time at intermediate depths.

Such electronic tracking should continue to provide insights into the white shark's movement patterns and life cycle. "We see the same sharks return to the Farallones again and again," says Peter Pyle. "Males come back yearly, but females return every other year: they may be going farther afield than males as part of a two-year breeding cycle. Long-range data on females will be of particular interest."

In November 2001, Tipfin returned to the Farallones, giving prbo researchers the chance to attach another pop-up tag on his back—this one programmed to record data for nine months. Nine other sharks were tagged at the Farallones in 2001.



The Cassin's Auklet has very similar food habits to adult herring at sea.

▼ Using seabird studies in fisheries management

## The Secret Life of Pacific Herring

Kyra Mills and Diana Watters

Diana Watters, a California Department of Fish and Game biologist cooperating with PRBO, is also co-author of a paper on these findings that Kyra Mills presented at the April 2001 International Symposium on Interactions between Fish and Birds / Implications for Management, in England.

Are there clues to the status of commercially valuable fish to be found in more visible marine organisms—in studies of seabirds? Can seabird responses to changing ocean conditions help a management agency set annual quotas for harvesting fish?

To answer such questions, prbo and the California Department of Fish and Game (cdfg) began a project two years ago, focused on the Pacific herring. We set out to investigate how Farallon Island seabirds' success in raising chicks each spring/summer relates to the status of herring stock the following winter, when the fish appear in San Francisco Bay to spawn.

This project is not based on the usual premise that, because seabirds eat fish, low fish abundance causes low chick production. In fact, seabirds on the Farallones eat very *little* herring. Instead, our study assumes that Farallon seabirds and Pacific herring that spawn in San Francisco Bay are affected by the same ocean variables. They both depend on the ocean for their food; plankton is the common denominator for the marine food web; and plankton abundance depends upon oceanographic conditions (it is low during warm-water years). If ocean conditions are favorable, abundant plankton will provide ample food for seabirds (in the form of plankton *and* fish) as well as for herring and other fish. Our study uses seabirds to predict fish stocks, rather than the other way around.

The herring fishery largely takes place within San Francisco Bay, where herring spawn beginning at two or three years of age (they live eight years

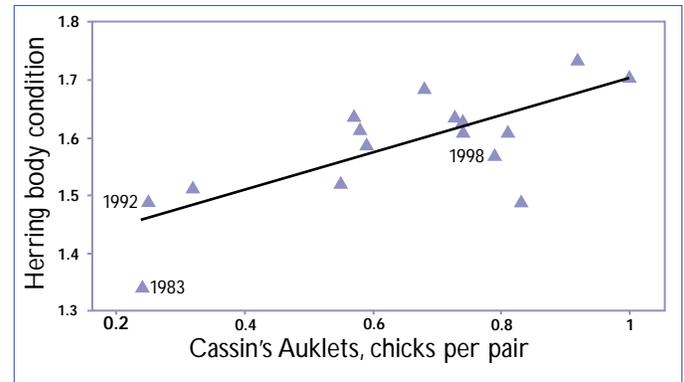
on average). After depositing their eggs on marine vegetation in the shallow water, they return to the open ocean to feed for the next seven to nine months. Despite the crucial importance of this at-sea period for determining herring survival and condition, little is known about it. Fortunately, the main months when herring feed at sea coincide with the period when Farallon seabirds lay eggs and raise chicks.

To assess the status of the herring population and establish fishing quotas, cdfg collects data in the Bay. They use information such as age composition, young-of-the-year abundance, and the previous season's biomass. Given the variability of ocean conditions that affect herring at sea, estimates of spawning biomass from one year may not accurately predict the following year's. Cdfg also uses information on the current season's ocean conditions.

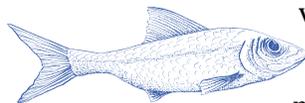
Prbo, in our ongoing seabird research on the Farallon Islands, derives annual estimates of chick productivity—the average number of chicks fledged per breeding pair. For a seabird pair to be successful at raising chicks, the food supply must be adequate to meet the energetic demands of both adults and growing chicks.

We hypothesize that seabird productivity on Southeast Farallon Island can serve as a basis for understanding the biomass and condition of herring when they enter San Francisco Bay to spawn the following winter. If ocean feeding conditions are good for seabirds, indicated by high chick productivity, they will also be good for herring, indicated by high spawning biomass and good body condition.

The figure above summarizes one of our analyses to date. During warm-



A Farallon seabird's breeding success corresponds with the condition of spawning herring (as gauged by CDFG) in San Francisco Bay the following winter.



Pacific herring

water El Niño years, when coastal upwelling was reduced and ocean production was low (especially in 1983 and 1992), both seabird chick production and the indicators of herring spawning biomass were generally low. For Cassin's Auklets, Western Gulls, and Common Murres—seabirds that feed largely on plankton and have very similar food habits to adult herring at sea—we found the strongest association between their chick production and herring body weight and condition.

If we can prove that such associations are predictable, then this information can be incorporated into models used by cdfg to set fishing quotas, adding to their accuracy. Use of information from seabirds and other “non-target species” is vital for predicting and monitoring ecosystem health.

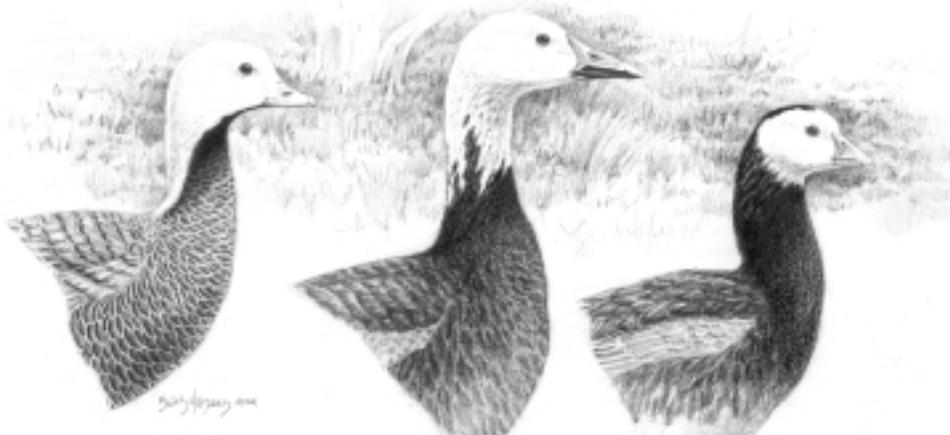
It is also required by state and federal laws calling for management based on an ecosystem perspective. California's Marine Life Management Act (see *Observer* 118, Fall 1999) is designed to conserve the health and diversity of marine ecosystems and resources, and to encourage sustainable activities and uses of these resources. Collaborations between managers from cdfg and biologists from prbo are important for helping reach these goals.

Kyra Mills is a PRBO Farallon Biologist, and Diana Watters is a CDFG Pacific Herring Biologist.

Make your gandering more enjoyable.

▼ From "Focus" to field trips

## Birding with PRBO



### Wild Geese

**Rich Stallcup**

Probably ever since there were humans to dream, wild geese have been synonymous with freedom and wanderlust in our songs and poems. Once there were many millions more waterfowl than now. In the times when deafening choruses of spadefoot toads drove the river otters crazy, the flocks of geese and swans overhead could blacken out the day. Mostly they are gone now—but not all! While the wild geese used to come to everyone, we now pilgrim to their strongholds.

Thus begins an updated "Focus" column on this suite of wintering birds. The original essay appeared here in 1989. Along with the four races of Canada Goose

Above: Rare look-alikes are the adult Emperor Goose (left); the Blue Goose or dark-morph Snow Goose (center), and the dark-morph Ross' Goose (right).

found in California, the full text covers the light and dark forms of Snow Goose and Ross' Goose. A new illustration by Keith Hansen, featured here, is also included. To obtain this entire "Focus," visit our website—[www.prbo.org](http://www.prbo.org)—or contact PRBO at (415) 868-1221, extension 307.

As Rich Stallcup writes:

Knowing more about birds than simply their common names will surely make your gandering more enjoyable.



### PRBO Members' Events with Rich Stallcup

For more information, contact Melissa Pitkin at (415) 868-1221, extension 307, or [mpitkin@prbo.org](mailto:mpitkin@prbo.org).

**WEEKEND** ■ July 13–14—**Lassen National Park**. Join us as we explore the Park and visit with prbo biologists studying songbirds. \$150, not including lodging and food. Complete information sent upon registration. Limited to 15 participants.

**DAY TRIPS** 9:00 AM–3:00 PM. \$25/person. Call for detailed information. Trips limited to 15 participants.

■ May 25—**Año Nuevo State Reserve**. On the San Mateo coast; a hike to search for elephant seals and special birds.

■ August 25—**Abbotts Lagoon**. On the Point Reyes coast, a haven for shorebirds and waterfowl.

■ September 22—**Bodega Bay**. Starting at Doran Beach County Park; exploring habitats filled with autumn birds.

■ October 12—**The Outer Point of Point Reyes**. A search for fall migrants (and vagrants!) and seabirds.

■ November 3—**San Francisco Urban Birding**. From the Cliff House to Golden Gate Park to Lake Merced.

We hope you can join us for one of these exciting field days.

#### bird bio

#### Dunlin (*Calidris alpina*)



**Characteristics:** Sandpiper. 20–23 cm. Fall and winter: grayish above and whitish below, buffy gray chest and neck.

Spring and summer: reddish brown marked with blackish, giving a scaly appearance; undersides whitish with a black patch across the belly. The bill, decurved and longer than head, is blackish. Legs and feet are grayish or blackish.

**Distribution:** Winter migrant, fairly common. Arctic, circumpolar. Winters along coasts of U.S. to Mexico and southern Eurasia to northern Africa and India.

**Habitat:** In summer, wet tundra, alpine mountain tops. During fall, tidal flats, beaches, mudflats, and pools.

**Feeding:** Probes for small mollusks, crustaceans, and marine worms; in spring, for seeds.

**Song:** Flight call distinctive, loud *purre* or *pjeer*. Display song (often heard on migration) a series of rolling harsh trills—*jrrre-jree-jrrrrjjjjjjjj jrrrr jrrr jrrr*.

**Life Span:** Average 3–4 years.

**Behavior Notes:** Monogamous; strong fidelity to breeding territory leads to renewal of pair bonds in successive years. Female and male construct scrape (nest depression) in fairly dry ground of tundra or alpine meadow, usually near water, often concealed in vegetation; nest lined with withered willow leaves and lichen. Female incubates mostly at night, male in day. Female often leaves chicks well before they fledge.

—Melissa Pitkin, PRBO Education Coordinator

“I have no doubt that this contribution will benefit the lives of many species.”

▼ *Include PRBO in your estate planning*

## A Legacy of Giving

*How, and why, does someone choose to make a lasting gift in support of PRBO's conservation through science? Recently we sat down with Geoff Geupel, Terrestrial Program Director, to talk about his reasons for joining the Tern Society and including PRBO in his estate planning.*

**Observer:** Why did you become a member of the Tern Society?

**Geoff:** There are many reasons. First and foremost is a personal sense of indebtedness that I feel toward prbo. The opportunity provided to me and hundreds of other budding biologists, through our internship program, is like no other. Where else can you live and breathe birds and conservation for months or even years, surrounded by some of the best field biologists, ornithologists, and scientists in the world? An internship at the Palomarin Field Station in 1980 changed the course my life. Prbo allowed me the freedom to pursue a childhood dream to continually hone and practice my field skills, revel in the never-ending puzzles of the natural world, and help make the Earth a healthier place. I have



Geoff Geupel near the Palomarin Field Station.

witnessed many others make similar choices and transformations. These people are now all over the world making important decisions that are changing the art and science of conservation. I want to make sure this opportunity exists for future generations of biologists, not only for their sake but for the future of the birds and all the creatures with whom we share the planet.

**Observer:** Were there other reasons you incorporated charitable giving into your estate planning?

**Geoff:** Of course, all the funds I leave to prbo are exempt from federal estate taxes. Instead of being used for taxes, the money will be “on the ground”: I have requested it to be used to fund interns in the field. I have no doubt that this contribution will benefit the lives of many species (including *Homo sapiens* and *Chamaea fasciata*—the Wrentit). I hope a legacy of giving will set examples for my children and future biologist who have been touched by birds and prbo.

**Observer:** Any final thoughts on investing in prbo's future?

**Geoff:** Prbo's core programs and projects like Palomarin, the Farallones, Mono Basin, Sacramento River, and, I hope, many more in the near future are vitally important to conservation. These long-term projects and data sets (some over 30 years old!) can be described as fingers on the pulse of the environment. They are also the hardest projects to maintain over the long term and can only survive through the sacrifices of dedicated staff and the generosity of individuals who understand their importance.



## Ways that you can provide a lasting gift to PRBO

### ☞ **BEQUESTS**

These are gifts through your will, including gifts of securities, property, and cash. Your estate receives a deduction for the value of the gift.

### ☞ **LIFE INCOME GIFTS**

These gifts allow your beneficiary to receive income now, with the benefits passing on to prbo in the future.

### ☞ **GIFTS OF LIFE INSURANCE**

Designate prbo to receive all or part of the proceeds of your life insurance policy.

### ☞ **RETIREMENT PLANS**

Transferring the remains of a retirement plan to prbo can be a tax-efficient way to make a gift. Retirement plan principal left to individuals may be significantly reduced by estate tax and income tax, both of which are avoided if the plan passes to prbo.

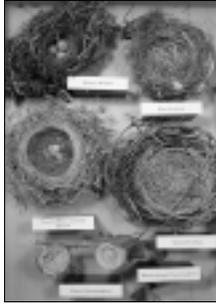
Many more options are available. If you are interested in securing prbo's future through a planned gift, we encourage you to consult with your personal financial planner or attorney. If you would like more information, please contact Sarah Huard, Manager of Individual Giving, at (415) 868-1221, extension 324, or via email at [shuard@prbo.org](mailto:shuard@prbo.org).

## New interactive exhibits focus on the breadth of prbo's programs.

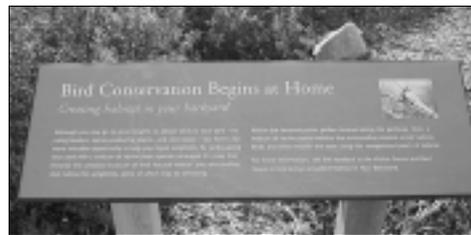
▼ *PRBO Visitor Center—beautifully remodeled*

# Welcome to Palomarin

October 27, 2001, was the official grand reopening of prbo's Visitor Center at the Palomarin Field Station. The new center features interactive exhibits focusing on the breadth of prbo's research and education



programs, accompanied by "flipbooks" that contain descriptions and maps of prbo projects; bird biographies of



some common local species; and student artwork contributed by schools participating in our education programs.

Mist netting and bird banding still occur in the newly renovated bird banding lab, and visitors are encouraged to join our biologists as they check the mist nets for birds (call for seasonal hours).

Please come and explore our new Visitor Center. Sign the register, and let us know what you think! For directions to the Palomarin Field Station, visit



Examples of the new exhibits, panels, and interpretive signs at PRBO's remodeled Palomarin Visitor Center.

www.prbo.org, or contact Melissa Pitkin at (415) 868-1221, extension 307, or mpitkin@prbo.org.



### We are deeply grateful to the following for making this project possible:

#### Visitor Center

'Pathways to Nature'  
Conservation Fund  
Wild Birds Unlimited  
National Fish and  
Wildlife Foundation  
Bothin Foundation

#### Bird Banding Lab

Stuart Jacobson  
Jack W. Ladd  
A. Ewan Macdonald  
Stephen A. Thal

#### Mist Net Trail

Marcia, Richard &  
Cindy Grand

#### Farallon Display

Compton Foundation,  
Inc.

#### Deck and Benches

John L. Jones

#### Nature Trail

Dorothy B. Hunt

#### Visitor Center Displays

Beth Barker  
In loving memory of  
Dorothy E. Rintels, a  
lifelong friend of  
birds

#### Banding Lab Displays

In memory of Dorothy  
Brownold

#### Outdoor Signs

Benjamin D. Parmeter,  
MD

#### Special Gifts

Point Reyes National  
Seashore  
California Coastal  
Conservancy  
Will and Gloria Price  
Anonymous  
Pacific Gas & Electric

#### Additional Support

Dr. Howard Cogswell  
Preston Cook  
Theodore Eliot, Jr.

Jack Guggolz  
Totton P. Heffelfinger  
Sarah Jones  
Robin L. C. Leong  
Gerald Maisel  
Bruce Merchant  
Ann Stone  
Jean Stallcup

#### Project Coordinator

Melissa Pitkin,  
Education Director

#### Design and Construction

Edutracks  
Edward Pohlman  
Construction  
The Sibbett Group  
Thingmaker  
Urban Design

#### Special Thanks

PRBO Staff  
PRBO Board of  
Directors

## Grand List

The Grand List highlights some prbo priority projects that are in need of funds. If you can help in any way to support these projects, please contact Sarah Huard at (415) 868-1221, extension 24. We are, of course, always appreciative of general operational support that allows us to fund priority needs at any particular time. Thanks!

- ▶ **Farallon Islands Research:** Funds a graduate-level biologist to assist in seabird, marine mammal, and/or white shark research for three months. *Cost:* \$3,000
- ▶ **Effects of Restoration on Birds:** Funds a Geographic Information Systems intern to assist in the development of a computer model that will predict how converting salt ponds to tidal marsh will affect birds that use these habitats. The model will help San Francisco Bay habitat managers evaluate restoration alternatives to promote the greatest biodiversity. *Cost:* \$9,000
- ▶ **Translating Science into Conservation Action:** Funds promotion of prbo's science-based conservation recommendations to habitat managers and policy makers regionally and nationally. *Cost:* \$16,500
- ▶ **Palomarin Field Station Research:** Seed money for a new, long-term research initiative to evaluate the effects of Douglas fir succession on coastal scrub habitat and dependent birds. *Cost:* \$30,000

## Findings: scientific questions, methods, results

▼ Since spring of 2001

# Science Achievements: a Sampling

► At the April meeting of the Cooper Society in New Mexico, Nadav Nur presented "Conservation biology of tidal marsh dependent songbirds in the San Francisco Estuary: distribution and abundance in relation to significant habitat features," co-authored with Hildie Spautz, Yvonne Chan, and Diana Stralberg. Dan Barton and Aaron Holmes presented two poster papers co-authored with Geoff Geupel: "Nesting biology of Black-billed Magpie in shrubsteppe" and "The relationship between nestling weight and first-year survival in the Nuttall's White-crowned Sparrow."

► At the April 2001 International Symposium on Interaction between Fish and Birds (Implications for Management), in Hull, England, Kyra Mills presented "Long-term population studies of seabirds on the Farallon Islands, California: three decades of change in demographic and prey harvest attributes," co-authored with Bill Sydeman, Michelle Hester, Peter Pyle, and Kyra Mills.

► At the national meeting of the Wildlife Society, in Reno, Nevada, in September, Aaron Holmes, Diana Humple, and Geoff Geupel presented a paper on wildlife-induced changes to a shrubsteppe bird community and a related poster paper on Loggerhead Shrike reproductive success. See figure at right.

► At the July 2001 meeting in Hawaii of the Society for Conservation Biology, Nils Warnock presented "Population dynamics of endangered wild and reintroduced San Clemente Loggerhead Shrikes," co-authored by A. Blackford, H. Carlisle, D. Garcelon, J. Opdycke, and K. Brock.

► "Climate change, reproductive performance and diet composition of marine birds in the southern California Current system, 1969–1997," a major paper authored by Bill Sydeman, Michelle Hester, Julie Thayer, F. Gress, P. Martin and Joelle Buffa, was published in the journal *Progress in Oceanography*.

► "Patterns of abundance of migratory shorebirds in the Intermountain West of the United States," a paper by Dave Shuford, Gary Page, and

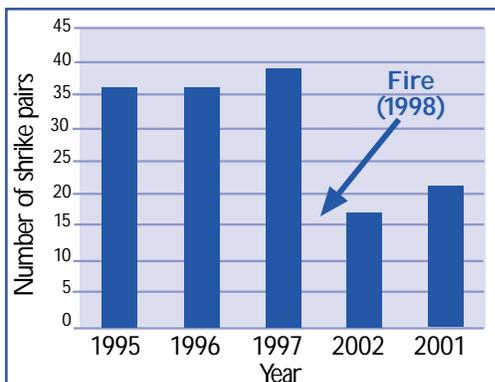
Lynn Stenzel, was completed for *Western Birds*, where it is in press.

► "Sandpipers, phalaropes, and allies" is a chapter authored by Nils and Sarah Warnock in *The Sibley Guide to Bird Life and Behavior*. Nadav Nur and Geoff Geupel authored the chapter on Wrentits.

► "First North American record of Greater Sandplover," by Sue Abbott, Steve N.G. Howell, and Peter Pyle, was published in *North American Birds*.

► At a June workshop on wetlands for the the National Resource Conservation Service in Spokane, Washington, Viola Toniolo gave a presentation entitled "Restoring riparian habitat to benefit songbirds."

► At the February 2001 meeting of the Wildlife Society, Western Section, in Sacramento, PRBO staff gave the following papers: "U.S. shorebird conservation: status and implementation of regional and national plans" (Nils Warnock, co-authors Catherine Hickey, Gary Page, Dave Shuford, and S. Brown);



In 1998, a large wildfire fueled by cheatgrass, an introduced annual grass species, burned approximately half the sagebrush habitat at our study site in Boardman, Oregon. PRBO monitoring of the Loggerhead Shrike population there revealed a corresponding decrease in the number of breeding birds.

"Climate change, seabird populations, and fisheries management in Central California" (Kyra Mills, co-authors Julie Thayer and Bill Sydeman); "Eastern Sierra riparian songbird conservation project: a case study in Partners in Flight Riparian Bird Conservation Plan Implementation" (Sacha Heath, co-authors Grant Ballard and Geoff Geupel); and "The Coastal Scrub

and Chaparral Bird Conservation Plan" (Mary Chase); and "Trends in abundance and distribution of the tidal marsh Song Sparrows, Salt Marsh Yellowthroat and California Black Rail in the S.F. Bay region, 1996–2000 (co-authors Nadav Nur, Yvonne Chan, Diana Stralberg, Elizabeth Brusati, and Jules Evens).

► PRBO received the "Pacific West Region Partnership Achievement Award" from the National Park Service for our work in partnering with Lassen Volcanic National Park as well as the Lassen National Forest over the past five years.

► At the November meeting of California Cooperative Oceanic Fisheries Investigations (CalCOFI), in San Diego, David Hyrenbach presented "Seabirds and ecosystem management in the southern California Current system: response to oceanographic variability over multiple temporal scales," co-authored with Bill Sydeman, and Kyra Mills.

► Dave Shuford, Grant Ballard, Geoff Geupel, and Tom Gardali contributed to California Department of Fish and Game's (CDFG) Bird Species of Special Concern (BSSC) list, an important part of CDFG's regulatory toolbox to ensure protection of species in decline. The draft list is posted on PRBO's website, [www.prbo.org](http://www.prbo.org).

► At a joint meeting in June of the California Riparian Habitat Joint Venture and Partners in Flight, Sacha Heath, Aaron Holmes, Violo Toniolo, and Grant Ballard presented papers, and several PRBO staff led discussions focused on synthesizing bird data and sharing recommendations with land managers.

► On behalf of the California Department of Fish and Game's Office of Spill Prevention and Response, and with invaluable support from the Oiled Wildlife Care Network, PRBO's Marine Science Division conducted an all-day training session in September on oiled wildlife processing protocols. We

now have a larger, more diverse team (32 individuals) prepared to respond to an oil spill event in California.

► At the Fifth Biennial State of the Estuary Conference in October 2001, PRBO's San Francisco Bay Habitat Project staff presented four posters, including: "California Black Rail distribution, abundance and nest site characteristics in the San Francisco Bay Estuary," by Hildie Spautz, Nadav Nur, Jules Evens, Elizabeth Brusati, and Yvonne Chan; and "Landscape-level predictors of songbird abundance in San Francisco Bay tidal marshes" by Diana Stralberg, Nadav Nur, and Hildie Spautz. Nils Warnock presented a paper, "Bird populations in San Francisco Bay: what does the future hold?" co-authored by Gary Page, Nadav Nur, John Takekawa, and J. Hanson.

► At the Riparian Habitat and Floodplains Conference in Sacramento in March, 2001, Geoff Geupel chaired sessions on songbird response to restoration in riparian habitat. Staff presented 11 papers and two posters on diverse topics including outreach programs and studies of bird reproductive success, habitat relationships, and responses to invasive plants and wildfire. Gregg Elliott chaired two sessions exploring ways to make habitat restoration and flood protection more compatible from regulatory and public perspectives.

► Terrestrial Program staff conducted two Landbird Monitoring Training courses, teaching over 30 agency, academic and private individuals in various landbird monitoring methods. In addition, Peter Pyle conducted two Advanced Identification Workshops, focused on techniques used in ageing and sexing passerines and near-passerines.

► In 2001, a record 38 new and 13 returning intern field biologists were trained through the Terrestrial and Education Programs. This was the first year of our Parkflight Program, a partnership with the National Park Service and American Airlines, through which an international intern from Mexico participates in fall migration monitoring in the Point Reyes National Seashore and Golden Gate National Recreation Area.

Our study of tidal marsh songbirds will be featured in a special spring issue.

▼ People and events at PRBO

## News Updates

New to prbo's staff as of October 2001 is John Baker, Manager of Foundation and Corporate Relations. In the past, John worked for the MacArthur Foundation and was associated with major conservation efforts in Southeast Asia. In Thailand, for example, he directed a non-governmental organization devoted to community development and the environment. Says John, "I'm excited about working at prbo with the leaders in conservation science and helping to address major conservation challenges." Adds Executive Director Ellie Cohen, "John is already proving to be a wonderful addition to prbo's fundraising team! I am delighted that he is on board during such an exciting time for prbo."



John Baker

In other highlights: Catherine Hickey, now a master's candidate at U.C. Davis, has rejoined prbo as a staff biologist in our Wetlands Program. Catherine has also been appointed vice-chair of the U.S. Shorebird Conservation Plan council.

Nils Warnock has become the leader of our San Francisco Bay Habitat Project, which was launched by Gary Page and led by Gary for the past 15 years.

Bill Sydeman accepted a seat on the Scientific Steering Committee for the North American Waterbird Conservation Plan. Russ Bradley, who studied Marbled Murrelets and earned his master's degree at Simon Fraser University in British Columbia, is our newest Farallon biologist.

Noah Eiger is our new Manager of Information Technology, providing

invaluable assistance to prbo staff and coordinating improvements in our computer systems. Dan Barton, a computer systems specialist and biologist, recently joined our Terrestrial Program staff after serving as a prbo intern.

Sue Abbott, recently a Wetlands Program biologist, now works full-time in our Education Program. Missy Wipf, an intern in prbo's Education Program, joined the Terrestrial Program staff to help Sandy Scoggin coordinate the March 2002 Partners In Flight conference, which prbo is hosting.

Abra Brayman joined our administrative staff as Membership Assistant, and Adam Blue is our interim Office Manager.

Congratulations to all.



**Welcome to three new members of PRBO's Board of Directors—Leslie M. Browne, Lokelani Devone, and Matthew Stone. We will introduce all three in our next full *Observer* issue.**

## Tidal Marsh Sparrows

How do contaminant levels in the eggs of San Pablo Bay birds, including songbirds that nest in tidal marsh habitats, affect their reproductive success?

Three subspecies of Song Sparrow are endemic to San Francisco Bay and are highly threatened: what is the genetic relationship among them?

How does our growing understanding of the population ecology of these tidal marsh specialists shed light on their status and conservation needs?

These and other results from prbo's study of tidal marshes, a major component of our San Francisco Bay Habitat Project, will be featured in the Spring 2002 prbo *Observer*, a special issue.



## Farallon Patrol Log

Through winter, volunteer skip-pers of the Farallon Patrol kept prbo's Farallon Island Research Station supplied. Jim and Petra Reed (*Melange*) were foiled twice by rough seas in late December, and Sam Lavanaway on 5 January could transfer only people (not supplies) to and from the island. Many thanks from prbo.

Oct 6	Rodney Malouf	<i>Surf Six</i>
Oct 13	Sam Lavanaway	<i>La Adriana</i>
Nov 3	Dick Sponholtz	<i>Kielia</i>
Nov 10	Al DiVittorio	<i>Solbritt</i>
Nov 17	Rod Macfarlane	<i>Tiger Beetle</i>
Nov 18	Mick Meningoz	<i>New Superfish</i>
Dec 8	Alex Pop-Lazaic	<i>Tamo Daleko</i>
Jan 5	Sam Lavanaway	<i>La Adriana</i>
Jan 19	Bill Foss	<i>Detente</i>
Feb 9	Sam Lavanaway	<i>La Adriana</i>

## PRBO Field Biologists

Tia Adams, Scot Anderson, Andrew Campomizzi, Dara Cantor, Phil Capitolo, Roy Churchwell, Marta Curti, Aaron Englander, David Figueroa, Robin Hirsch-Jacobson, Justin Hite, Dennis Jongsomjit, Alison King, Kirsten Lindquist, Liz Macley, Chris McCreedy, Ladne Miller, Heriberto Munguia, Kristie Nelson, Daniela Roemer, Jim Tietz, Bob Wilkerson, Aja Woodrow.

## Wish List

For the library at prbo's Palomarin Field Station: Funding to purchase a complete set of the *Journal of Wildlife Management*, 1940s to the present (\$750).

For the Wood Duck nest-box project: stepladders, 12- to 20-foot; call Rich Stallcup, (415) 663-8660.

## Contributions

We are grateful to the following contributors of gifts of \$250 or more (September–December 2001, exclusive of Bird-A-Thon):

Louise Abbott	Theodore Eliot, Jr.	Dr. & Mrs. Benjamin D. Parmeter
Janet W. Allen	Mr. & Mrs. Russell B. Faucett	Dr. & Mrs. Lawrence Petz
Gayle A. Anderson	Senator Dianne Feinstein & Mr. Richard Blum	George S. Peyton, Jr.
Anonymous	Myriam & Joel Fontaine	Mr. & Mrs. Jay Pierrepont
Anonymous 2	Bill & Karen Foss	Frances B. Pope
Anonymous 3	Marcia, Richard & Cindy Grand	Helen Pratt
Anonymous 4	Ms. Patricia D. Gunther	Mr. & Mrs. Willis J. Price
Anonymous 5	Totton & Joanne Heffelfinger	John C. Robinson
Richard Bachenheimer	Mr. & Mrs. F. Warren Hellman	Dr. & Mrs. Benson Roe
Peter Barnes	Ann Heurlin	Ivan Samuels
Helene Belz	Doris B. Hughes	Barbara E. Schilling
Hope Millholland Bernstein	Dorothy B. Hunt	Robert Schonholtz
Dix & Didi Boring	Elliott Conway Insley	Maggie & Contee Seely
Robert & Jeanne Bradford	Mr. & Mrs. John Jacobs	Keith Smeltzer
Mr. & Mrs. Robert I. Branick	Dwight L. Johnson	Dick Spight & Judith Fortney
Mr. & Mrs. Richard Breisch	Mr. & Mrs. John Kalivoda	Langdon Stevenson
Alice Buckles Brown	Kevin & Karen Kennedy	Ann Stone
Arden Bucklin-Sporer & Dr. Karl Sporer	Arthur H. & Susan Kern	Marilyn M. Strand
Lisa Buttrey & David Cothran	Jack & Adrienne Ladd	Mary Stroh-Twicheil & Charles Twicheil, Jr.
Rigdon Currie and Trish Johnson	Philip A. Lathrap	Carter & Mary Thacher
Dr. Chester F. Chapin	Belina Lee Lazzar	Mr. & Mrs. Stephen A. Thal
Henry Corning & Glenda Griffith	Robin L. C. Leong	Richard & Martha Thayer
Mary J. Decker	Ronald Lezell	Leslie & Roland Tognazzini
Carla & Gary DeCrona	Mr. & Mrs. Ewan Macdonald	Carol Schussler Van Wijnen
David Earp	Don McCarthy	Marshall & Jennifer White
Christopher Eberly	Beverly Merrill	Mr. & Mrs. James Wintersteen
		Mary P. Wright.

## Institutional Giving

We deeply appreciate the corporate and foundation grants that support prbo's increasingly successful conservation-through-science efforts.

The **Richard and Rhoda Goldman Fund** has provided significant seed funds for prbo's "Birds Across Borders" project. Building upon previous collaborative efforts in Mexico and Central America, our goal is to understand and conserve migratory bird species and their habitats through cooperative, locally based training and research projects.

The **Giles W. and Elise G. Mead Foundation** along with the **Frank A. Campini Foundation** and **ExxonMobil Corporation** renewed generous support for prbo's seabird, marine mammal, and white shark research and conservation program based on the Farallon Islands, in cooperation with the U.S. Fish and Wildlife Service.

Many thanks to the **Oracle Corporation** for extending support for prbo's cavity-nesting seabird conservation program on Año Nuevo Island.

We are grateful to the **Richard A. Grand Foundation** for sponsoring four intern field biologists to work in prbo's Tidal Marsh Project this past year. The Spring 2002 *Observer* will feature an in-depth report on these studies.

The **David and Lucile Packard Foundation** is providing the second year of support for the Riparian Habitat Joint Venture (rhjv) Coordinator, who works under the auspices of prbo and reports to the 18-member rhjv board. The rhjv includes governmental, nonprofit, and private interests working to restore and conserve streamside habitat for birds and other wildlife throughout California.

Many thanks also to: Dorothy and Jonathan Rintels Charitable Trust, Tides Foundation, Seacology, Clean Bay, Inc., Bushnell Corporation, Kowa Optics, Carl Zeiss Optical, Inc., Ivmh Selective Distribution Group, Inc., Farallon Restaurant, the Page Foundation, and Ibis Environmental Services. 

## Memberships

Our thanks to the following new members who have joined prbo (September–December 2001, exclusive of Bird-A-Thon):

Louise Abbott, Marion G. Behn, Mr. & Mrs. Edmund D. Chew, Judith Clayton, Carol L. Dienger, Mr. & Mrs. Wilbur Dong, Judith J. Dugan, David Earp, Linda Edelstein, John B. & Cynthia A. Ford, Carla G. Galloway, M.D., Lynn & Nancy Higbee, Suzanne Himmelwright, Coleman W. Kennedy, George C. Millikan, Maura Naughton, Darryl D. Ott, Joseph N. Rogoff, Mr. & Mrs. Mike Saenz, Kari Ann Schafer, Robert Schwartz, Douglas Steele, Jerry W. Stengel & Sarah G. Lane, Thanh Van Tran, Mr. & Mrs. Robert A. Traverso, Mr. & Mrs. Stephen M. Vial, Rosilyn White.

## Gifts Honoring

Prbo is grateful for the following memorial gifts (September–December 2001):

In memory of Clayton R. Coler: Carole L. Feasel.

In loving memory of Leslie Grelia: Rich Stallcup; Janet Wessel.

In memory of Jack Guggolz: Marianne R. Shepard.

In memory of Kathleen Schweiger; in memory of Virginia Stella; and in memory of Paul Wagner: Gayle A. Anderson.

In memory of Bill Wilson: Marion G. Behn; Mr. & Mrs. Richard W. Maes; Mr. & Mrs. Stephen M. Vial.

*As always, PRBO is deeply grateful to Audubon Canyon Ranch, Point Reyes National Seashore, and the U.S. Fish & Wildlife Service for providing facilities and field stations where we work.*

**CALENDAR OF EVENTS**

*You are invited to celebrate PRBO's Conservation Through Science at our*  
**2002 Annual Meeting**  
*Saturday, May 18<sup>a</sup> 12:00 noon to 3:00 PM*  
*At Susie Tompkins-Buell's beautiful, historic barn on Bolinas Lagoon*  
*Special Guest Speaker: Graham Chisholm, Executive Director,*  
*The Nature Conservancy, California, and Co-Founder, Great Basin Bird Observatory*  
*A morning Open House & Banding Demonstration will take place at Palomarin Field Station.*  
*Please join us! More information will be mailed soon.*

**PRBO BIRD WALKS** are morning outings, often in Point Reyes National Seashore, free to PRBO members, \$5 donation for non-members • Call 415/868-1221, extension 307, for information.

Sunday, April 7 ■ **Birding Five Brooks** Spring birding at a great spot for migrants, woodpeckers, and wood ducks!

Saturday, May 4 ■ **Return to the Burn** On a half-day hike, learn about the remarkable recovery, and prbo research discoveries, since the 1995 Mount Vision Fire.

Sunday June 9 ■ **Tidal Marsh** A visit to one of prbo's tidal marsh study sites on northern San Francisco Bay.

Sunday July 9 ■ **Birds of Redwood Creek.** Join us as we explore a riparian zone with a prbo landbird biologist who monitors the nesting birds of this habitat.

**MEMBERS' EVENTS WITH RICH STALLCUP** ■ *Again in 2002, PRBO invites members to participate in all-day outings—plus a June weekend at beautiful Lassen National Park—with outstanding birder and educator Rich Stallcup. Trips are limited to 15 participants and require advance registration. See page 10 of this Observer for a full schedule.*

**For complete information about PRBO Bird Walks and Members' Events with Rich Stallcup, call (415) 868-1221, extension 307, or e-mail mpitkin@prbo.org.**

PRBO online :: WEB SITE [www.prbo.org](http://www.prbo.org) :: E-MAIL [prbo@prbo.org](mailto:prbo@prbo.org)

**PRBO — working to conserve birds, other wildlife and their ecosystems through objective, innovative scientific research and outreach.**

C Printed on recycled paper using soy-based inks

The PRBO Observer is published quarterly by the PRBO Board of Directors. Edited and designed by Claire Peaslee, assisted by members of PRBO's staff and, for this issue, by Joyce Schnobrich and Kate St. Clair. Copyright © 2002 PRBO.

Point Reyes Bird Observatory is a non-profit 501(c)3 organization with headquarters at Stinson Beach, California. All memberships and contributions are tax-deductible to the extent allowed by law. Annual memberships are as follows:

Benefactor: \$1,000 & more	Family: \$50
Sponsor: \$500	Regular: \$35
Sustaining: \$250	Student & Senior: \$20
Contributing: \$100	

**Board of Directors**

William S. Foss, *Chairman*  
 Benjamin D. Parmeter, MD, *Vice-Chair*  
 Langdon R. Stevenson, *Secretary*  
 F. Rigdon Currie, *Treasurer*  
 Jack W. Ladd, *Immediate Past Chair*  
 Leslie M. Browne  
 Arden Bucklin-Spore  
 Preston Cook  
 Christina Desser  
 Lokelani Devone  
 Totton P. Heffelfinger  
 John H. Jacobs  
 Stuart Jacobson  
 Robin L. C. Leong  
 A. Ewan Macdonald  
 Harold C. Nathan, PhD  
 James F. Quinn, PhD  
 Thomas B. Smith, PhD  
 Matthew D. Stone  
 Stephen A. Thal

**Executive Director**

Ellie M. Cohen

**Marine Sciences**

William J. Sydeman, PhD, *Director*  
 Christine Abraham  
 Adam Brown  
 Russell Bradley  
 Natalia Collier  
 Meredith Elliott  
 David Hyrenbach, PhD  
 Kyra Mills  
 Jerry Nusbaum  
 Cornelia Oedecoven  
 Peter Pyle  
 Dan Robinette  
 Jennifer Roth  
 Ben Saenz  
 Julie Thayer  
 Peter Warzybok

**Population Ecology**

Nadav Nur, PhD, *Director*  
 Yvonne Chan  
 Hildie Spautz  
 Diana Stralberg  
 Julian Wood

**Terrestrial**

Geoffrey R. Geupel, *Director*  
 Grant Ballard  
 Dan Barton  
 Ryan Burnett  
 Mary Chase, PhD  
 Jim DeStaebler  
 Katie Fehring  
 Moe Flannery  
 Tom Gardali  
 Jeanne Hammond  
 Sacha Heath  
 Aaron Holmes  
 Diana Humple  
 Sandy Scoggin  
 Viola Toniolo  
 Missy Wipf

**Wetlands**

Gary W. Page, *Co-Director*  
 Nils Warnock, PhD, *Co-Director*  
 Carleton Eyster  
 Doug George  
 Catherine Hickey  
 Diana Humple  
 Kriss Neumann  
 Kate Peterlein  
 Chris Rintoul  
 Miko Ruhlen  
 Eric (Zed) Ruhlen  
 W. David Shuford  
 Lynne E. Stenzel  
 Sarah Warnock  
*San Clemente Island:*  
 Jon Plissner, PhD, Ashley  
 Blackford, Heather  
 Carlisle, Carrie Hisaoka,  
 Robbie Kohley, Julie  
 Lambert

**Conservation Policy**

Gregg Elliott

**RHJV Coordinator**

Ann Chrisney

**Education & Outreach**

Melissa Pitkin, *Director*  
 Sue Abbott  
 Rich Stallcup,

*PRBO Naturalist*

**Development & Communications**

John Baker, *Foundation/Corporate Relations*  
 Sarah Huard, *Individual Giving*  
 Abra Brayman  
 Matt Leffert  
 Claire Peaslee

**Finance & Administration**

Bob Hunter, *Director*  
 Judi Black  
 Noah Eiger  
 Melissa Frakes  
 Gareth Penn

**Research Associates**

Sarah Allen, PhD  
 Frances Bidstrup  
 Anne Black, PhD  
 Malcolm C. Coulter, PhD  
 Jules G. Evens  
 Steve N. G. Howell  
 Jon King  
 A. Peter Klimley, PhD  
 Borja Mila  
 Scott Newman, DVM  
 Helen M. Pratt  
 Mark Rauzon  
 Jane C. Warriner  
 John S. Warriner  
 Sophie Webb  
 David W. Winkler, PhD  
 Jon Winter  
 Steve Zack, PhD