Quarterly Journal of PRBO Conservation Science. Number 130, Fall 2002. $2.50

seabirds & krill, p. 6

Biotic response to global warming, p. 3

Observer

An unparalleled opportunity for PRBO in the 21st century

Climate and Ecology

How will global warming affect wildlife, such as these dowitchers foraging in intertidal habitat?

William J. Sydeman, PhD

For at least half a century, it has been well known that ecological processes and animal populations are affected by local climatic conditions, such as rainfall, temperature, wind events, and other daily weather. It was not until the mid 1990s, however —when "El Niño" became a household word—that scientists, resource managers, and the public truly appreciated the importance and holistic nature of the *global-scale* climate system, and the corresponding weather and biological regimes. Within the past decade, global climatic fluctuations of longer time duration than the 6- to 18-month El Niño have been identified for the first time; these include the 10- to 30-year-long Pacific Decadal Oscillation (see page 4 of this *Observer*) and others of similar magnitude.

The ecological consequences of these long-term climate fluctuations are gaining recognition, but we still have much to learn about how naturally occurring long- and short-term climatic variations interact to affect ecosystems and wildlife. A heightened quest for such knowledge is taking place today after 100 years of accelerated warming across the globe. Birds, arguably the most conspicuous of all organisms, provide a model focus for investigating how climate change influences ecosystems.

PRBO has a remarkable history in many ways, but one aspect that stands out is our commitment to long-term studies. As a volunteer intern at the Palomarin Field Station in the early 1980s, I routinely explained to visitors that PRBO's mission was to conduct long-term research on birds. In retrospect, I hardly knew the implications of my words. Today, PRBO is one of few organizations forging an understanding of climate cycles, climate change, and their effects on ecosystems and wildlife.

Consider several examples:

♦ Our extensive dataset from the Farallon Islands provides one of only three 30-plus-year studies of seabird communities worldwide (the others are British and French studies in the Antarctic). And it is the only study of its type in an upwelling ecosystem—the California Current System, one of the five highly productive eastern boundary currents of the world.

♦ Our 20-plus-year community study of terrestrial birds at Palomarin represents another uncommonly valuable database in PRBO's arsenal of long-term research.

♦ Relatively "young" PRBO studies—ten years of research on riparian birds in California's Central Valley, a unique and growing database on tidal marsh birds in the San Francisco Bay Estuary, multiple shorebird surveys in the Pacific Flyway, and at-sea research on marine birds, among others—hold great potential for evaluating climate change (see page 5).

The importance of the insights we are gaining into climate cycles and ecosystem response on varying time scales, from within a single breeding season to within and between decades, cannot be overemphasized. Virtually all

continued on page 2

photo by Kenneth W. Gardiner

...perhaps one of the most urgent environmental issues of our time

Thinking globally, conserving regionally

Birds and Climate Change

Ellie M. Cohen

By 1974, prbo biologists were proud: four years of seabird studies on the Farallones, four years of shorebird studies on Bolinas Lagoon, and three years of winter songbird censuses at Palomarin—groundbreaking and comprehensive for the time!

In prbo's Tenth Annual Report (1974), David Ainley reported: "In 1971 we launched a program aimed at describing the basic breeding biology, marine ecology, and interrelationships of the 12 seabird species that call the Farallones their home; 1974 saw the completion of the bulk of that project... the information gathered will be none too early in this era of increasing marine pollution and of decisions on how humans will or will not destroy the dwindling resources of the sea."

In that same annual report, Gary Page and Lynne Stenzel wrote: "As a result of the rainfall patterns over the last four years, we now have two years of shorebird censuses from very wet winters and two years from relatively dry ones... data for the entire four-year period in which Bolinas Lagoon has been quarantined and relatively free of human activity... we are ready to examine the impact of increased human activity on birds."

David, Gary and Lynne knew their research would help reveal human-caused changes in the environments they were studying. What they might not have predicted was that they and other prbo biologists were building some of the longest-term datasets on seabirds, shorebirds, and songbirds in the world—datasets that would help reveal not only human impacts but also natural changes to ecosystems over time.

Ellie M. Cohen

This issue of the *Observer* focuses on climate change, perhaps one of the most urgent and controversial environmental issues of our time. Regardless of its causes—human and/or natural—scientists from across the spectrum agree that global warming is occurring, with potentially huge economic and biological consequences.

From four years of data back in 1974, Gary and Lynne deduced that rainfall amounts significantly affect how waterbirds use estuaries. Today, prbo's Marine Science Division, under the leadership of Bill Sydeman, is analyzing our more than three decades of seabird data to understand climate fluctuations over various time periods.

If we hope to prevent collapses of wildlife populations and even entire food webs, we must incorporate the most current findings about climate change in our research—and in our recommendations to habitat and wildlife managers.

While David reported in 1974 that the seabird studies were almost complete, today we know differently. It is incumbent upon us to continue and expand our long-term studies of birds, to successfully conserve biodiversity in the 21st century.

Ellie M. Cohen is PRBO's Executive Director.

Climate & Ecology, *from page 1*

long-term strategies for both conservation (such as wetlands restoration) and resource management (of fisheries and forests, for example) must embrace a growing scientific understanding of the natural climate system, its periodicities, amplitudes, and corresponding ecological consequences.

With new knowledge will come new practices. Much of today's fisheries management, for example, is based upon the notion that the organization of ecosystems (such as the distribution and abundance of the constituent organisms) is *stable* through time. No one imagined that fish or bird communities could fundamentally change from decade to decade—from a group dominated by cold-water (subarctic) species, such as the anchovy, to one dominated by warm-water (subtropical) species, such as the sardine. Yet this is what we and others have recently observed in the California Current marine ecosystem. The implications for managing the nation's fisheries are considerable.

Understanding the influence of climatic cycles on wildlife populations forms the ecological backdrop for conservation. One example: Cassin's Auklets on the Farallones have declined by more than 80% over the past 30 years, during a period of ocean warming. If changes in their prey base have also occurred (see page 6), this change could well be of greater importance than other factors, including mortality in oil spills.

With our long-term studies of climate-driven changes to ecosystems and birds, prbo will be able to make stronger scientific recommendations to wildlife, land, and ocean managers, and to develop more effective conservation strategies. This is something that few other organizations can do, and something we should be proud to contribute.

William J. Sydeman, PhD, is Director of PRBO's Marine Science Division.

prbo photo

The loss of species may pose a major threat to human existence in the next 100 years.

Possible ecological changes due to global warming

Broken Biological Connections

Terry L. Root, PhD

The average global temperature has increased about 0.6˚C in the past century. Although organisms have responded to climatic changes throughout their evolutionary history, a primary concern about wild species and their ecosystems today is the current *accelerated* rate at which the temperature is rising. When changes in climate are gradual, species that have the genetic ability to adapt may be able to survive under different climate regimes. Others may relocate into new areas that have climatic conditions similar to their previous habitats. In today's world, however, dispersal of species may not be possible, due either to widespread habitat fragmentation or to the growing scarcity of appropriate habitats.

The combined effects of rapid temperature rise and other stresses are likely to become one of our most serious global-change problems. Two possible consequences are 1) numerous extinctions of populations and even entire species, and 2) "decoupling" of interdependent species that are ecologically linked in communities—when some species shift and others do not.

It is generally believed that large numbers of species are currently going extinct. In 1999, the American Museum of Natural History commissioned Louis Harris and Associates to perform a nationwide survey titled "Biodiversity in the New Millennium." Seventy percent of the biologists polled in the survey believe the world is currently undergoing a mass extinction event. These biologists also think this loss of species poses a major threat to human existence in the next 100 years, due to the likely disruption of ecosystems that we rely on for supplying and cleaning water.

If interdependent species respond differently to climate change, then both will likely face decreases in population size and possible extinction. The following are just two examples.

Climate change may be causing mismatching in timing between the breeding of Great Tits in the United Kingdom and other key species, such as caterpillars, in their communities. While the tits are apparently slightly shifting the time that they lay their eggs, the hatching of caterpillars, which the birds feed to their chicks, is already occurring quite a bit earlier. If prey species such as caterpillars, which have historically been used by adult tits to feed chicks, are tracking temperature closely, while the timing of laying is not tracking temperature as quickly, then as the globe warms, a mismatch between the predators and prey will likely occur. Indeed, the date when caterpillars are at high abundance will likely continue to shift earlier, possibly to the point where they will be unavailable in the numbers needed for parent birds to feed their rapidly growing chicks.

Regional and global effects

Another example of decoupling centers on the role of birds as effective predators of insect pests. In pecan orchards of the southeastern United States, a single Tufted Titmouse is estimated to save nut growers 52,000 pecans annually by feeding on insects that feed on the nuts. If a decoupling occurs, separating the presence of birds from their insect prey, bird density could fall and pest density could multiply. This scenario could easily result in an increased use of pesticides, which has many costs, both monetarily and biologically.

Shifts in timing have been noted in locations from around the globe—Asia, Australia, Europe, North America, Russia, and elsewhere—for all major groups of animals, including invertebrates, amphibians, birds, and mammals. Changes have been observed in the timing of calling by frogs (which reflects timing of breeding) in North America, migration arrival and departure of birds in Europe and North America, peak insect abundance (which reflects the time of emergence from dormant life stages) in Europe and New Zealand, and bud burst and blooming by trees in North America and Asia—and these are just a few examples.

For the Great Tit in the U.K., warming climate is weakening ecological links between nesting birds and the insects they feed their chicks.

Rapid climate change could soon become the greatest challenge to animal and plant conservation in the 21st century. The recent temperature change has apparently already had a major influence on many species. Clearly, if such climatic and ecological changes are now being detected—when the globe has warmed by an average of only 1˚F (0.6˚C)— it is likely that many more far-reaching impacts on species and ecosystems will occur in response to temperature increases predicted by the Intergovernmental Panel on Climate Change (www.ipcc.ch/). These run as high as a 10˚F global average temperature increase by 2100.

Scientific understanding of the ecological consequences of global warming—and actions human can take to help mitigate the effects—will become increasingly important, not only for our sake but for the sheer existence of many wild animals and plants.

Terry L. Root, PhD, is a Senior Fellow in the Institute for International Studies, Center for Environmental Science and Policy, at Stanford University. She was also the featured speaker at PRBO's 2002 Osher Symposium.

photo by Arthur Morris / vireo

This year an exciting natural experiment is unfolding in the North Pacific.

When climate forces collide

Warming Event in a Cold Ocean

K. David Hyrenbach, PhD

The patterns of ocean currents and atmospheric winds that transfer the Earth's heat energy *fluctuate*—ultimately with consequences for fish, seabird, and marine mammal populations. Marine scientists are assembling a growing understanding of these ocean climate changes; prbo contributes through our long-term study of the marine ecosystem (see *Observer* 127, winter 2002).

This year, an exciting natural experiment is unfolding in the North Pacific: a short-term warm-water event is developing against the backdrop of a longer-term cold-water phase. The climate forces involved have come to light through analyses of global ocean temperature since the beginning of the 20th century. First, there has been a progressive temperature increase associated with global warming. We have also seen 20- to 30-year regimes of alternating warm and cold water conditions, termed the Pacific Decadal Oscillation (pdo), and shorter one- to two-year warm-water (El Niño) and cold-water (La Niña) periods linked to the El Niño Southern Oscillation (enso).

While pdo regimes persist for decades, typical enso events occur about every 4–7 years and persist for 6–18 months. The pdo affects the North Pacific Ocean primarily and the tropics secondarily, while the converse is true for enso. Researchers have documented two full pdo cycles: cool regimes prevailed from 1890 to 1924 and again from 1947 to 1976, while warm regimes dominated from 1925 to 1946 and from 1977 through the late 1990s.

To picture the relationship between enso and pdo, consider two widely used indices (Figure 1). The Southern Oscillation Index (soi) is a measure of the difference in sea-level atmospheric pressure across the tropical Pacific—between the high-pressure region over Tahiti (to the east) and the low-pressure region over Darwin, Australia (to the west). *Weakly positive* soi values indicate "normal" conditions: easterly trade winds along the tropics, warm water piling up along the western equatorial Pacific, and cold water along the eastern side of the basin near Peru. *Strong positive* values indicate La Niña conditions: stronger trade winds, water to the east even cooler, and water to the west warmer. *Negative* soi values indicate El Niño conditions: weaker or even reversing trade winds, warmer water along the eastern side of the tropical Pacific, and cooler water to the west.

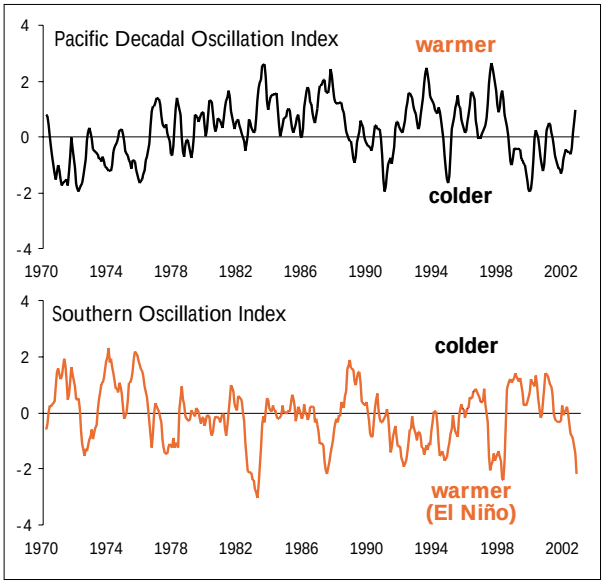


Figure 1. Monthly time series of Pacific Ocean climatic indices, January 1970–August 2002.

The second part of this picture, the pdo index, quantifies sea surface temperature in the North Pacific basin, poleward of 20˚N. Positive values indicate warmer water than normal; negative values, colder.

2002: ENSO meets PDO

Shorter-term enso events are superimposed on long-term pdo regimes, but little is understood about how these climatic phenomena interact with each other. Now, though, an El Niño is taking shape in the midst of a cold-water pdo regime. The last time an El Niño event occurred during a cold phase of the pdo was in 1973, when prbo's Farallon Island research program was in its infancy. Today we are in a position to evaluate how these two climate phenomena will interact to alter the California Current marine ecosystem and its seabird inhabitants.

The pdo index reversed signs in fall 1998–winter 1999, when the North Pacific transitioned from a warm-water to a cold-water regime. It has remained negative since then despite short-lived warming fluctuations in 2000 and 2001 and a spike in August 2002.

Meanwhile, enso warming materialized by July, and warm-water conditions prevailed throughout the central equatorial Pacific during summer 2002. Easterly equatorial winds are weaker than average, and the soi is negative, indicating a resurgence of El Niño warm-water conditions in the tropics.

Though likely to intensify through the end of 2002 and into 2003, this El Niño is expected to remain weak to moderate—not surprising given that a cold-water pdo is now aligned with the warm-water enso event.

Uncertainties surrounding these forecasts are compounded by the unknown contribution of Pacific-wide warming over the past 100 years.

Questions about climate-related changes in marine ecosystems underscore the value of prbo's research. Our long-term dataset on seabird reproductive success suggests that a changing ocean climate influences marine bird populations in the California Current. While continuing to monitor this "biological index," we will try to determine some of the mechanisms that link seabirds' ability to forage successfully with the ocean climate.

David Hyrenbach, PhD, is a Biologist in PRBO's Marine Science Division for part of the year and also a Research Scientist at Duke University.

Prbo studies: understanding the consequences of climate change

Documented and predicted effects

Habitat, Migration, Reproduction

Global climate change and sea level rise: Potential losses of intertidal habitat for shorebirds

Gary W. Page

Two predicted consequences of global warming are an accelerated rate of sea level rise and inundation of many low-lying coastal intertidal areas. Shorebirds rely on coastal habitats during migration and in winter, foraging on intertidal mud and sand flats. Their numbers depend on the extent of these flats and density of accessible prey. Rising sea levels will likely cause intertidal habitat to become less available.

Prbo has collaborated in research to model potential effects of sea level rise on tidal flats used by shorebirds. We provided data from Willapa Bay in Washington, and Humboldt and San Francisco bays in California. During shorebird surveys of 66 coastal sites in the Pacific Flyway, these three collectively held 40–90% of the 13 most abundant shorebird species.

Modeling results projected an 18% loss of tidal flat habitat in Willapa Bay by the year 2100; a 29% loss in Humboldt Bay; and 39% and 70% losses for the north and south portions of San Francisco Bay, respectively. Subsidence of the Earth's crust and constraints on the estuary to move inland contributed to the high estimates for South San Francisco Bay.

Major adverse effects, difficult to quantify, are implicated for shorebirds. While sea level rise may create new sites, the potential for this on the Pacific coast, with its generally steep coastline, may be limited. More research is needed to elucidate potential effects of climate change and sea level rise on North American shorebird populations.

Gary Page is Co-Director of PRBO's Wetland Program. He is co-author of a paper reporting on these results in Waterbirds 25(2), 2002.

■ Assistance editing the climate change section of this *Observer* was provided by Bill Sydeman.

Climate change and migration timing of a temperate-wintering songbird

Thomas Gardali and Ryan DiGaudio

Mean wintertime temperatures at prbo's Palomarin Field Station, in coastal California, have increased approximately 2˚C since 1979. During the period 1979-2000, the Ruby-crowned Kinglet, a migratory songbird that winters here, has had progressively earlier spring departure dates. Climate change may well be a factor in this. An increase in temperature, which alters the timing of life-cycle events in plants and arthropods, could in turn affect the timing of birds' migration. At Palomarin, warmer December temperatures and larger insect populations could enable overwintering migrants to obtain the fat they need more quickly and initiate migration sooner. This hypothesis may apply especially to small insectivorous songbirds, which have high metabolic rates. Also between 1979 and 2000, fall arrival dates for Ruby-crowned Kinglets at Palomarin became later. Though kinglets may be staying on their breeding grounds longer—and benefiting from a longer time period for rearing young—their overwintering numbers at Palomarin have declined significantly since 1992. Documenting changes in migration schedules is just one step in understanding the consequences of climate change for avian populations.

Tom Gardali is a Biologist in PRBO's Terrestrial Program. Former staff Biologist **Ryan DeGaudio** prepared this data analysis for his Master's thesis.

Other Notes:

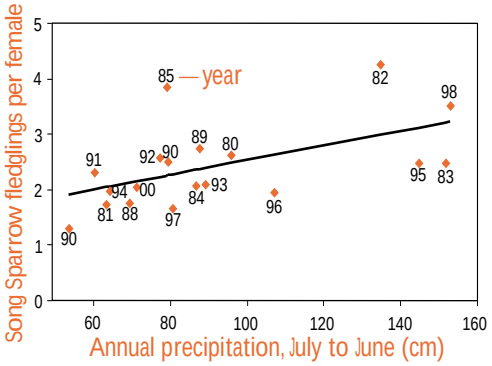
■ A pivotal paper linking long-term songbird productivity to annual rainfall, authored by prbo Terrestrial Program biologists, appeared in 1987.

■ Biologists from the Institute for Bird Populations, with Peter Pyle as a co-author, have shown that climate affects reproductive success of birds breeding in the forests of the Pacific Northwest. Read more online at www:birdpop.org.

Weather, reproductive success, and population dynamics in a Song Sparrow population

Mary K. Chase, PhD

Prbo's long-term study of Song Sparrows breeding near the Palomarin Field Station has found that year-to-year variation in weather has a strong effect on reproductive success and population size. Between 1980 and 2000, Song Sparrows produced more young in years with higher rainfall; peaks in their productivity coincided with above-average rainfall levels. Several very wet El Niño events (e.g., in 1998) contributed to high reproductive success. An eight-year period of below-average rainfall was associated with low success. In wetter years, Song Sparrows continued nesting later into the summer, which allowed them to produce more broods of young. Also, their eggs were less likely to be lost to nest predators in wetter years. Cool summers, too, promoted a longer breeding season and the production of more young per successful nest, possibly because the coastal scrub habitat stays moist longer into the summer in cool weather. These results suggest that if early-summer temperatures increase in the future, due to global warming, there could be negative effects on the reproductive success of Song Sparrows breeding in coastal scrub habitats.



Mary Chase, PhD, is a PRBO Terrestrial Program Biologist. A paper based on her research reported here was co-authored by Nadav Nur, PhD, and Geoff Geupel.

Understanding the ecological implications of ocean climate change

Farallon seabirds and a variable marine ecosystem

Weathering Long- and Short-term Change

Christine L. Abraham

Cassin's Auklet chick.

Cassin's Auklets are small seabirds that breed on Southeast Farallon Island (sefi), 27 miles west of San Francisco. Prbo findings on this species illustrate the ways in which our long-term research contributes to understanding the relationship between seabird populations and changing ocean climate.

The Farallon Islands lie within the California Current System (ccs), one of the most productive yet variable marine ecosystems in the world. In some years, the ccs is characterized by relatively high upwelling and cool ocean temperatures, both of which result in plentiful marine food resources. During other years, such as during El Niño Southern Oscillation (enso) events, upwelling subsides in magnitude and duration, and ocean temperatures warm considerably.

The ccs is also subject to long-term changes in oceanographic conditions (see page 4). It is widely accepted that ecosystem regime shifts transpired in the North Pacific Ocean in 1976-77 and 1989-90 (both shifts generally resulting in warmer ocean temperatures). Preliminary evidence also suggests that a regime shift occurred in 1998-99 (resulting in cooler ocean temperatures).

Prbo biologists have been studying the Farallon Cassin's Auklets and the surrounding oceanic environment since the early 1970s. During this period, there has been an overall increase in spring (March) ocean temperature at sefi of approximately 0.5°C. Corresponding to this warming, the size of the auklet breeding population has declined by approximately 80%.

To understand in more detail the links between Farallon auklets and marine ecosystem conditions, we have studied various aspects of the birds' reproduction and ecology. Nestling growth rates, for example, directly depend on the amount of available prey that adult Cassin's Auklets are able to capture and feed to their chicks. As shown in Figure 1, nestling growth rates display trends between decades that correspond to those observed in sea-surface temperature: higher growth rates correspond with colder periods. Growth also varies widely on a year-to-year basis and is closely related to March sea temperature (Figure 2).

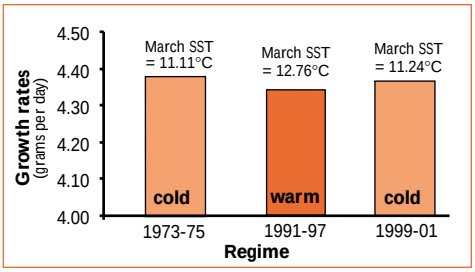


Figure 1. Auklet growth rates in two cold-water regimes (1973-75 and 1999-01) and one warm-water regime (1991-97). Note that SST=sea surface temperature.

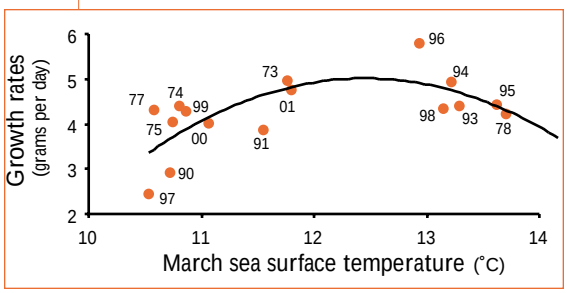


Figure 2. Relationship between March sea surface temperature and auklet growth rates. Note that two-digit numbers represent years.

The fact that growth rates are not *substantially* lower in warm-water regimes suggests that the Farallon population of Cassin's Auklets can respond adaptively to variable oceanographic conditions. The birds can alter the timing of egg-laying so that the period of peak nestling development may coincide with peak prey availability. Auklet parents may also be able to compensate for very poor food availability by increasing their foraging effort, thus ensuring relatively high rates of nestling growth and survival.

Probing the prey base

Understanding how the distribution and abundance of auklet prey change with variable ocean conditions is a critical component in understanding how auklets respond to these changes. Two species of euphausiid (among the zooplankton[1] collectively known as "krill") are the primary prey items in the diet of Farallon Cassin's Auklets. Changes in spring oceanographic conditions, such as those that occur during enso events or longer-term warm-water regimes, can have significant negative consequences on euphausiid availability, distribution, and abundance. Overall zooplankton biomass in the ccs declined by 80% between 1951 and 1995, but we do not know to what degree euphausiids have been affected.

This year prbo, in collaboration with the Cordell Bank and Gulf of the Farallones National Marine Sanctuaries, conducted zooplankton surveys near sefi (*Observer* 129, Summer 2002). Our effort was a first step toward better understanding these complex oceanographic-prey-predator relationships. We also plan to conduct a long-term study of the ecological energetics of Cassin's Auklets, which will involve monthly surveys of euphausiid distribution and abundance.

As prbo investigates seabird populations over longer time periods and in finer detail, we will continue to enhance understanding of the ecological implications of ocean climate changes.

Christine Abraham is a staff Biologist in PRBO's Marine Science Division.

[1] Zooplankton—minute, drifting animals such as the shrimp-like euphausiids—are also a primary food source for numerous whale species, as well as other seabirds. On PRBO's website, www.prbo.org, see our "Pelagic Predators, Prey, and Processes" report.

photo and graphs PRBO files

Are birds in your backyard arriving or departing at different times?

Sources and suggestions

A Climate for Learning

Melissa Pitkin

To help you decipher the complex issue of climate change, here are a few facts, ideas, and informative websites.

Did you know?

■ The globally averaged temperature of air at the Earth's surface has warmed between 0.3 and 0.6°C (about 0.5–1°F) since the late 19th century.

■ By the year 2100, the temperature at the Earth's surface, globally averaged, is expected to rise by an estimated 1–3.5°C (about 2–6°F) relative to the average in the 1990s.

■ Sea level has risen since the 19th century by 10–25 cm (about 4–10 inches).

■ By the year 2100, sea level is expected to rise a further 15–95 cm (about 6–37 inches).

■ When the Pacific Decadal Oscillation (pdo; see page 4) is in a warm phase, spring in north temperate latitudes usually arrives earlier. This might imply a longer breeding season for songbirds.

■ When the pdo is in a cold phase, seabirds such as the Cassin's Auklet have a good year because of the increased prey availability in the oceans (see page 6).

Websites on climate

Commonly asked questions:
www.gcrio.org/ipcc/qa/cover.html

Updated El Niño information:
www.pmel.noaa.gov/tao/elnino/1997.html

Pacific Decadal Oscillation (PDO):
http://tao.atmos.washington.edu/pdo/

Concerned Scientists' position:
www.ucsusa.org/index.html (click on "Common Sense on Climate Change:)

What do you see?

■ Are birds in your backyard arriving or departing at different times than you have noticed in the past?

■ Do you notice any differences in bird activities this winter, as we enter an El Niño warm-water period at the same time as a longer-term cold-water regime (see page 4)?

■ Do you observe any other changes in patterns in your backyard environment?

Let us know what you observe! We will publish some of your field notes in a future *Observer*. Send email to mpitkin@prbo.org, or post a note to Melissa Pitkin at prbo (see back page for mailing address).

Melissa Pitkin is PRBO's Education and Outreach Program Director (415/868-1221, extension 307).

What you can do

Some scientific models demonstrate that human activities contribute to the observed patterns of global warming. A precautionary approach calls for people to act now, as suggested by a contributing author to this Observer.—Editor

The U.S. contributes about 25% of the world's greenhouse gases—vastly more than any other country. A few simple suggestions to help curb the amount of greenhouse gases that are pumped into our atmosphere include:

■ Replace incandescent light bulbs with the new fluorescent bulbs that provide the same quality of light but consume far less electrical energy.

■ Buy cars that have high gas mileage, such as the new hybrid (gas plus electric) vehicles, and avoid the purchase of low-efficiency, high-emission vehicles.

■ When remodeling, replace windows with energy-efficient ones to help conserve heat in the winter and coolness in the summer.

■ Likewise, put insulation in the walls, and insulate your roof. The use of a white foam spray in the roof of my Central California house decreased its summer temperatures by about 15°F.

—Terry Root, PhD

The Grand List

The Grand List highlights prbo priority projects in need of funds. If you can help in any way to support these projects, please contact Sarah Huard at (415) 868-1221, extension 324. We are, of course, always appreciative of general operational support that allows us to fund priorities as needed.

- **Palomarin Field Station:** To expand our pioneering, multi-decadal breeding songbird research to include habitat succession and climate-change studies. Cost: $3,000 per Intern (three); $12,000 Project Manager (one, part-time)

- **San Francisco Bay Habitat Conversion Model:** For additional data collection to supplement our first-generation model that will predict the effects on different bird populations of converting salt ponds to tidal marsh. Cost: $7,500

- **Volunteer Coordinator:** To coordinate training of "citizen scientists" who will assist prbo biologists in data collection throughout California and beyond. Seed Funds: $18,000

- **Website Enhancement:** To modernize the prbo website to reach new audiences and provide real-time data exchange among staff, partners, and volunteers. Cost: $10,000

F O C U S 61

Birds and Weather

Rich Stallcup

Birds that are native to any area can be seen as "weathervanes," reflecting local climate effects. Their adaptations and activities indicate responses throughout the natural community to seasons and weather conditions.

Birds have evolved physical and behavioral strategies for dealing with *ordinary* weather within their range. They are waterproof, they know how and when to seek shelter, and because they are feathered, they can thermoregulate (stay warm in cold and cool in heat). Migratory kinds are able to depart from high latitudes before the cold season sets in.

Exceptional and *extreme* weather causes problems for birds: sometimes there are many casualties for migrants over water; sometimes results are devastating to local species with small terrestrial populations.

Many birds—organisms with unusually high metabolism—adapt better to hot conditions than very cold ones: it is much harder for them to recover body heat than to cool off. For example, many desert species do not need much water, as they derive enough fluid from their insect prey. Tropical seabirds pant and quiver their gular pouches to fan their innards.

Some birds have evolved physical designs for cold, such as extra and denser feathering, but what dictates cold-weather survival is the ability to forage. Among small songbirds in winter, bark and cone gleaners do the best: chickadees, creepers, nuthatches, and woodpeckers can always find insect or spider eggs hidden in dark crannies.

Among the victims of cold weather are population pioneers trying to open up expanded wintering opportunities to the north. Severe winters may kill the pioneers (like Carolina Wrens in the Northeast and Midwest, and Montezuma Quail in southeastern Arizona and southwestern New Mexico).

An exhausted Yellow Warbler, survivor of a storm over the Gulf of Mexico, rests on a truck fender on the Texas coast.

Wild weather

Like any living thing, birds are subject to weather extremes, and local populations may be decimated by single wild-weather events. Here a few anecdotes, some from *The Encyclopedia of North American Birds* by John K. Terres.

Hail: Dangerous hailstorms in North America happen mostly in the interior during afternoons in June and July. They can kill birds, other wildlife, domestic stock, and even humans! In 1938, two California Condor corpses found at the carcass of a horse after a hailstorm were believed killed by hail. In July 1953, two extreme hailstorms in Canada killed an estimated 150,000 waterfowl "with terrible destruction of songbirds, hawks, owls, grouse, coots...." Thousands of Sandhill Cranes and many small birds were killed by hail in 1960 near Elida, New Mexico.

Ice: During World War II many Common Loons from a flock over the Atlantic fell to the deck of a battleship, their wings encased in ice.

Lightning: There are only a few published reports of lightning strikes on birds. John James Audubon saw two nighthawks struck down by lightning during a thunderstorm at Indian Key, Florida. In April 1939, 34 of 75 flocking White Pelicans fell to the ground near Nelson, Nebraska. All were dead; some had feathers singed by the bolt.

Storms: Northbound migrants in the Atlantic Flyway leave the Yucatan Peninsula headed for the U.S. and Canada in April and May. Warblers, vireos, flycatchers, thrushes, and others take off at dusk for the 14- to 18-hour nonstop flight across the Gulf of Mexico to Alabama, Louisiana, or Texas. Except for oil rigs (which are sometimes crawling with birds), there is nowhere to stop for rest and refueling. Usually the trip is easy, and most birds fly right over the U.S. coast to find better forest and forage somewhat inland—unless, that is, a "norther" (strong wind, sometimes with rain, blowing hard against the avian travelers) develops after take-off. The trip then is much more difficult, and the birds that survive arrive exhausted, falling into the first bush they see. Birders at locations on the U.S. Gulf Coast can then see numerous individuals and species up close, right along the beach—survivors of a weather ordeal that doubtless proved fatal to a great many more songbirds.

An exceptional bird–weather event occurred in May 1998, when Bristle-thighed Curlews migrating thousands of miles nonstop over the Pacific collided with a violent storm. Tired (and some clearly injured) survivors of this El Nino-related phenomenon showed up, for the first time on record, on the West Coast of North America—a delight for birders but also cause for concern for the species' small worldwide population (see *Observer* 126, Fall 2001).

Birds do well in weather to which they have adapted over time. When the elements change too rapidly, or generate extremes, many cannot cope. Birds' responses to weather, observed and scientifically understood, are sensitive "weathervanes" of climate change.

Rich Stallcup is PRBO's Naturalist, in our Education Program.

Photo by Rich Stallcup

Prbo marks the passing of one of our dearest friends.

John H. Jacobs, 1925-2002

Tribute to a Leader

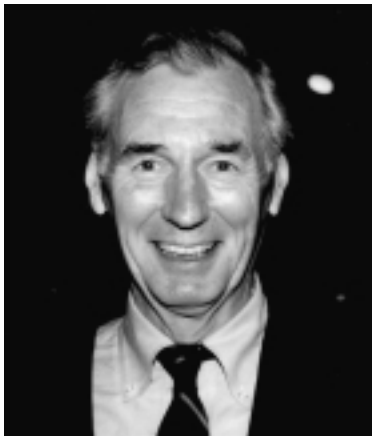
Sarah Huard

It is with deep sadness that prbo marks the passing of one of our dearest friends—a long-term supporter and member of our Board of Directors, John H. Jacobs. John died on Monday, July 15, 2002, at the age of 76.

Executive Director Ellie Cohen expresses the sentiments shared by all of us at prbo who had the good fortune to know John: "He was an exceptional and inspirational human being. I miss John enormously."

John Jacobs joined prbo's Board in 1990 and, over the past 12 years, helped lead prbo to its current status as an internationally recognized conservation science organization. In his tenure on the Board, John served as President, Vice-President, Chair of the Facilities and Development Committees, and on the Executive Committee. He was also a member of prbo's Tern Society, a group of loyal friends who have provided for prbo's future through bequests and other planned gifts.

A tribute to John's life, hosted by the San Francisco Planning and Urban Research Association (spur) and his wife Shirley Jacobs, was held in San Francisco on September 8, 2002. Prbo Board Chair Bill Foss noted John's tremendous impact on prbo and on conservation in California:



John H. Jacobs

"This is neither the time nor the place to catalog prbo's many accomplishments or extol its virtues. It is entirely fitting, however, to note that prbo is today an organization with a budget in excess of $5 million, that we are highly esteemed in the world of conservation science, and that the work we do is carried out across a broad geographical span reaching from Alaska to Latin America and Antarctica. I can stand here and say these things about prbo in no small part because of John Jacobs' enthusiasm for, and commitment to, what we do. He presided over the Board during important years of rebuilding and served the Board during the last years of his life at a time of explosive growth.

"Without a doubt, I speak for all of my colleagues in the Board and for the staff of prbo when I say that it was a genuine pleasure to have known and worked with John."

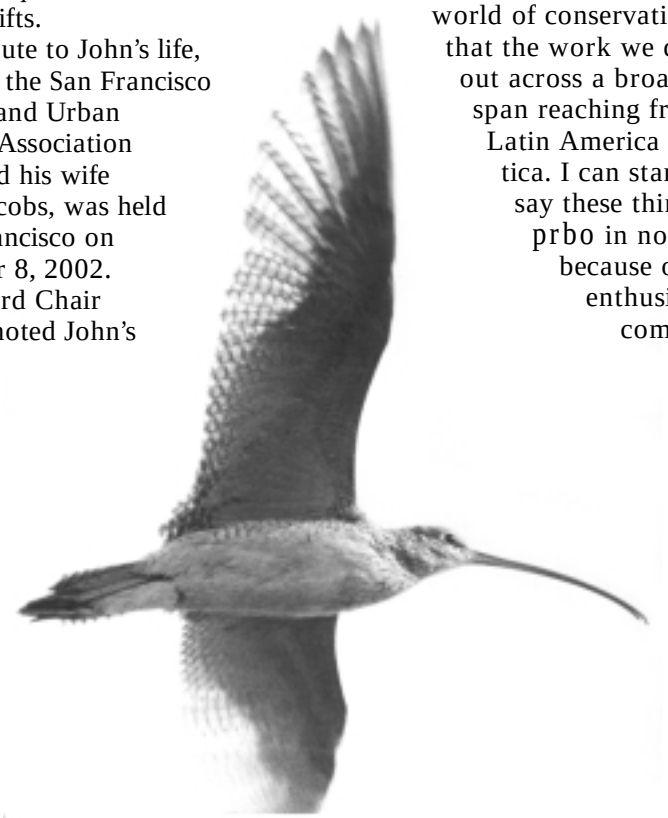
In addition to his work with prbo, throughout his career John served in many capacities: as director of the Stockton Redevelopment Agency; executive director of spur; a leader in the creation of the Golden Gate National Recreation Area; executive director of the San Francisco Chamber of Commerce; former board member of kqed, the World Affairs Council of Northern California, and the Fine Arts Museums of San Francisco; and chairman of the board of the San Francisco State University Foundation.

John was also an avid and acclaimed sailor. In recognition of John's deep love of sailing and the sea, prbo has established **The John H. Jacobs Memorial Fund**. Gifts to the Fund will support the conservation of the marine ecosystem off the California Coast. The Fund will maintain a special focus on protecting the unique resources of the Farallon Islands and San Francisco Bay.

Prbo is immeasurably grateful for John's varied and wonderful contributions. He will be sorely missed, but we look forward to building on John's vision for prbo—bringing our science to bear on conservation in California and beyond, to protect birds and biodiversity for generations to come.

Sarah Huard is PRBO's Manager of Individual Giving.

If you would like more information about the John H. Jacobs Memorial Fund or about becoming a member of the Tern Society, please contact Sarah Huard at 415.868.1221, extension 324, or via email at shuard@prbo.org.



Long-billed Curlew photo by Kenneth W. Gardiner ♦ John Jacobs Photo courtesy spur

Prbo's Latin America Program aims to develop long-term bird monitoring stations.

People and activities

Inside PRBO

Welcoming Steve Latta

Steve Latta, PhD

The new Project Director of prbo's Latin America Program is Steve Latta, PhD. His role, on our Terrestrial Program staff, involves working with cooperating institutions and scientists, especially in Mexico, to develop a series of long-term monitoring stations for the study of both resident and neotropical migratory birds. Steve will also begin implementing workshops to help train biologists from host institutions in Latin America.

Steve has spent the last ten years working in the Dominican Republic, where he has held workshops and established ongoing programs on conservation education. Steve received his PhD in 2000 at the University of Missouri, Columbia, where his dissertation on the ecology and population regulation of wintering neotropical migrants received the Distinguished Dissertation Award. Fluent in Spanish, he has published over 30 peer-reviewed scientific articles (including conservation-oriented essays). From his extensive experience in Latin America, Steve reports that there is strong interest in cooperative monitoring programs on the part of many partners.

Says Terrestrial Program Director Geoff Geupel, "I am delighted to have someone with Steve's knowledge and skills joining the staff at prbo!"

With his family—his wife and three daughters—Steve has relocated to California from Missouri, and we welcome all of them warmly.

Angela Calpestri

Office Manager Angela Calpestri

Joining prbo as Office Manager is Angela Calpestri, a birder with an aptitude for business. Angela is a long-time resident of Marin County, California, and an avid bird lover. She recently completed her Bachelor's Degree in Business at Sonoma State University. Angela also brings to prbo extensive experience helping manage nonprofit organizations, and we are fortunate to have her on our staff.

Farallon Patrol Log

Volunteer skippers of the Farallon Patrol, regularly sailing from San Francisco Bay to Southeast Farallon Island, keep prbo's Farallon Research Station provisioned with biologists and supplies. Listed here are Patrol members who sailed across the Gulf of the Farallones for prbo during the late summer and early fall 2002 seasons. Many thanks!

Jul 6	Dale Head	*Magic*
Jul 20	Dick Sponholz	*Kielia*
Aug 3	Rob MacFarlane	*Tiger Beetle*
Aug 17	Fred Babian	*Temerity*
Aug 31	Tom Camp	*Just Imagine*
Sept 8	Mick Meningoz	*Superfish*
Sept 21	Rick Boyce	*Paloma*
Sept 28	John Gratton	*Nakia*

PRBO's 2002 Bird-A-Thon took place between September 21st and October 5th. Pictured here, a group of PRBO staff and interns conducting their 24-hour count pause at one of their stops, on outer Point Reyes, to celebrate sighting a Tropical Kingbird. Watch for a full report on this year's fund-raising Bird-A-Thon in the next PRBO *Observer*.

Steve Latta photo by Aaron Holmes ♦ Angela Calpestri photo by Claire Peaslee ♦ Bird-A-Thon photo by Melissa Pitkin

Donations

Prbo is grateful to the following contributors of gifts of $250 or more (June through September 15, 2002):

Anonymous (2), Peter Barnes, Janice B. Barry, M.D., Thomas C. Benet, Maria Warton & Patrick M. Bennett, Linda Brownrigg, Mr. & Mrs. Terry Coddington, Preston & Donna Cook, Mr. & Mrs. Robert Friend, Doris B. Hughes, Dorothy B. Hunt, Robert E. Hunter, Jr., Dwight L. Johnson, Mary Ellen King, Robin L.C. Leong, Park Loughlin, Mr. & Mrs. Ewan Macdonald, Andrew K. Marckwald, Jr., Frederick & Janet Matteson, Mrs. Gladys Moore, Dr. & Mrs. Benjamin D. Parmeter, Mr. & Mrs. William J. Patterson, Marjorie & Theodore Plant, Helen Pratt, Eric W. Preston, Joyce & Jim Schnobrich, Stephen R. Schulz, Larry H. Strassburger, M.D.

In-Kind Donations

We are grateful to the following individuals for recent donations to prbo:

Bob Battagin for a 1989 Jeep Cherokee. For items for PRBO's silent auction: John Baker, Sandy Ross & Butterfly Lodge, Chris Desser, Ted Elliott, Bill Foss, Jack Ladd, Ewan Macdonald, Hal Nathan, Off the Beach, Langdon Stevenson, Steve & Britt Thal, Rig Currie & Trish Johnson.

Memberships

Our thanks to the following new members who have joined prbo (June through September 15, 2002):

Loree Angel, Slade Backer, Michael Butler, James H. Castle, Ron Enos, Langdon Faust, Elizabeth Fische, Eliot Graham, Rosalind A. Jackson, Brian Kenny, Lynn & Peter Kenny, Doris Lang, Geoff & Sarah McQuilkin, Linda Mora, Carol F. Nowick, Lauren Oliver, Patty Palmer, Michelle Paregian, Catherine Powers, Aniana U. Reyes, Linda A. Skolness, Tiburon Belvedere Library, Drs. Judith Todd & Dan Kee, Allan Weidner, F. & P. Wilcox.

Wish List

Prbo seeks donations of the following. For more information, please call (415) 868-1221.

Frequent flier miles to allow more staff to attend scientific conferences. Desktop publishing/layout services. A 35-mm camera with telephoto or zoom lens. Digital camera with close focus. Tripods, including a Bogen tripod with quick-release head. Office furnishings: filing cabinet, VCR, small desk, desk chair. For our 2003 intern housing: beds, dresser, tables, chairs, sofa, lightweight desk, lamp.

Memorial Gifts

Prbo is grateful for the following memorial gifts (June through September 15, 2002):

In Memory of Regina M. Foss: Ellie M. Cohen & Miki Goralsky; Robin L.C. Leong

In memory of Shawn Grogan: Anne & Joseph Abbott; Benson & Neff CPA; Anne Fukano

In memory of John H. Jacobs: Thomas C. Benet; Ellie M. Cohen & Miki Goralsky; Theodore L. Eliot, Jr.; Kim & Joshua Horner; Robin L.C. Leong; Bucky Mace; Calvin Malone; Amy Meyer; Dr. & Mrs. Benjamin D. Parmeter; Rita & Elvin Platti; Tina Stangio; Langdon Stevenson; Ann Stone; Mr. & Mrs. William I. Watson; Edgar Wayburn

In Memory of Kam Man Leong: Joanne Black Castro; Robin L.C. Leong; Steve & Britt Thal

In Memory of Marion Smith: Robin L.C. Leong

In Memory of Sydney Thal: Robin L.C. Leong

PRBO Field Biologists

Summer–Fall 2002

Tia Adams, Scot Anderson, Laurie Bannister, Erin Belmont, Gerick Bergsma, Christopher Berner, Brenda Blinn, Brian Burns, Sarah Campbell, Andy Campomizzi, Phil Capitolo, Sofia Arenas Castillo, Nat Collier, Ted Coriell, Renee Cormier, Jill Coumoutso, Leah Culp, Glen Davis, Miguel Demeulemeester, Ryan DiGaudio, Thomas Dodsworth, Steve Dumdei, Kristen Dybala, Shannon Farrell, Jamie Fenneman, Katie Fisk, Jennifer Foster, Sarah Foster, David Gardner, River Gates, Meghan Gilbart, Aaron Haiman, Joshua Haiman, Noah Hamm, Adam Hannuksela, Britten Harter, Kathleen Henderson, Jolie Henricks, Stacia Hetrick, Sanja Hinic, Robin Hirsch-Jacobson, Gernot Huber, Dennis Jongsomjit, Alison King, Quresh Latif, Kirsten Lindquist, Yen Luc, Blaine MacDonald, Kim Maute, Hugh McGee, Frasier Metcham, Jennifer Millard, Emily Morrison, Henry Ndithia, Allison Nelson, Kristie Nelson, Hilary Papendi, Andrea Pfeffer, Sam Rankin, Cesar Rodriguez, Tobias Rohmer, Alexander Rosenthal, David Roth, Taza Schaming, Emmi Schlicht, Justin Shew, Todd Thompson, Viola Toniolo, Chris Tonra, Fields Trimble, Aja Woodrow.

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.

Institutional Giving

Prbo would like to acknowledge the generosity of the many foundation and corporate supporters who have made recent contributions to our efforts in conservation science.

Oracle Corporation continued generous support for prbo's conservation of Rhinoceros Auklets on Año Nuevo Island, in partnership with Año Nuevo State Reserve. This small, vulnerable seabird population has now reached its highest peak since the 1800s and, with more work, should continue to stabilize.

Further support for prbo's efforts to protect cavity-nesting seabirds came from **ExxonMobil Corporation,** whose generous grant will go toward our efforts to conserve Rhinoceros Auklets, Cassin's Auklets, and Ashy Storm-petrels on the Farallon Islands and throughout California.

The Homeland Foundation's continued support for prbo's monitoring and protection on the Farallon Islands of five species of seals and sea lions is deeply appreciated. Prbo has conducted year-round monitoring of Farallon marine mammals for more than 30 years—essential to the conservation of this key ecosystem component.

Prbo's ongoing monitoring of Snowy Plover breeding populations in Point Reyes National Seashore received renewed support from **ChevronTexaco.** Our efforts provide insights about threats faced by this sensitive species and guide National Park Service management practices in an important habitat.

Educating school children and the public about conservation and ecology is an important aspect of prbo's "conservation through science" mission. Another generous grant from the **Compton Foundation** will enable us to teach more people about birds and conservation.

We are also grateful for recent support from other organizations, including the **Winifred & H.B. Allen Foundation, National Fish & Wildlife Foundation, Pentax Corporation,** and **San Francisco Foundation.**

PRBO
CONSERVATION SCIENCE

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PRBO Conservation Science
will be soon be launching a new logo and graphic design.
The next Observer – the winter 2003 issue –
will will feature an all-new look
while continuing our tradition of excellence.

CALENDAR OF EVENTS

PRBO BIRD WALKS *Morning outings in or near Point Reyes National Seashore; $5 donation, free to PRBO members. For more information, call Melissa Pitkin at (415) 868-1221, extension 307.*

Saturday, November 2 ■ **Winter Birds of Bear Valley** Walk in a lush wooded valley to encounter Ruby- and Golden-crowned kinglets, Varied Thrush, and more. Meet us at 9:00 am in the gravel parking lot at the Bear Valley Visitor Center.

Sunday, December 1 ■ **Waterbirds on Bolinas Lagoon** Join us to welcome back the wintering avian populations on this beautiful wetland. Wear rubber boots! Meet at 9:00 am at prbo headquarters, 4990 Shoreline Highway, Stinson Beach.

Sunday, January 5 ■ **Winter at Palomarin** Begin the New Year with a look into our mistnets and a hike to explore winter birds. Meet us at 9:00 am at Palomarin Field Station.

ANNUAL BIRD-A-THON DINNER & HOLIDAY PARTY

Saturday, December 7, 5:00 PM ■ Stinson Beach Community Center

A festive gathering of PRBO friends and staff to enjoy Bird-A-Thon stories and awards, music, and food. Please join us! Watch for details in the mail.

PRBO online :: WEB SITE www.prbo.org :: E-MAIL prbo@prbo.org

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

♻ Printed on recycled paper using soy-based inks

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PRBO Conservation Science (founded in 1965 as 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	