Sea Grant California

Sea Grant News

"Science Serving California's Coast"

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Sea Grant News
Marsha Gear, Editor
Joann Furse, Designer
Christina Johnson, Science Writer

California Sea Grant
Russell A. Moll, Director
Paul G. Olin, Extension Director

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Tagging Study Uncovers Hidden Movements of Sharks—Fishers Collaborate by Returning Tags

Sharks inspire fear. Yet truly, they are among the sea's more vulnerable species because they are so easily over fished. While science can help protect these awesome creatures, many sharks are difficult to study because their movements are basically invisible, and their homes so vast. As part of a broad national effort to learn more about sharks, California Sea Grant is funding researchers to tag thresher sharks—a highly migratory species that "threshes" small fish with its powerful, sickle-like tail. The tagging data is, for the first time, allowing marine biologists to learn where thresher sharks live at different stages of their life, where they go and what factors control their movements. This information has shown, among other things, that fishing regulations designed to protect marine mammals and sea turtles also alleviate pressure on sharks.

The type of tagging data being collected during this Sea Grant project is important because so much basic biological information about sharks is missing, said NOAA Fisheries biologist Suzanne Kohin, who is familiar with the project and involved in shark management. Thresher sharks are believed to migrate seasonally, but only part of their migration route is known. Nobody is sure where adults breed, either. The habitat requirements of juveniles are yet another mystery. "We know very little about their vertical and horizontal distributions," she said.

The lack of basic information on the life histories of sharks is particularly significant because historically most commercial shark fisheries have been unsustainable, said Jeffrey Graham of Scripps Institution of Oceanography, the lead researcher on the California Sea Grant project. Concerns about the sustainability of thresher sharks, a secondary target of the commercial swordfish drift gill net fishery, have been heightened recently by closures of fishing grounds in the north Pacific Ocean to reduce "takes" of endangered sea turtles. Biologists, including Graham, are concerned the regulation will shift fishing effort to the Southern California Bight, believed to be a nursery ground for thresher and mako sharks.

Tagged thresher being released wearing archival tag (shown in inset). Photos this story: Dan Cartamil, Scripps Institution of Oceanography

Graham is not at odds with fishers, however. In fact, he and Sea Grant Trainee Dan Cartamil, a doctoral student in Graham's shark laboratory, are relying on cooperation with the fishing community to retrieve "archival" tags that have been placed on the pectoral fins of about 70 thresher sharks. The pecan-sized tags record a shark's depth and the temperature of water through which it swims. Most importantly, the tags are able to collect data for periods long enough to shed light on sharks' sea-

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Thresher tagging continued from p. 3

Fishing for thresher sharks.

sonal habitat preferences. The downside: the only way to recover the data stored on the tag's tiny waterproof chip is to retrieve the tag and download its contents to a computer.

This is where fishers come in. Since they are the ones who catch sharks, and the ones to see the tags, they are the ones who are being asked to return the tags. Luckily, many fishers are willing to help. "We are as interested as the scientists in learning about sharks, but for a different reason," said Mike Garret, a sport fisher in Dana Point who recently earned a $100 reward for returning a tag. (Each tag is inscribed with instructions to call the shark lab.) "We want to target them more efficiently."

Garret said he believes better science can both help the resource and fisheries. For his part, he is interested in learning more about what threshers eat seasonally to better lure them with the right bait. "We already know they feed on bait fish, but I've also caught them on squid," he said. Steve Fosmark, a longtime gillnetter from Pebble Beach who sits on the Pacific Fisheries Management Council's Highly Migratory Species Advisory Subpanel, said he would like to know threshers' migration patterns to optimize his fishing operations and reduce fuel costs.

Although the tagging data is not yet sufficient to plot out the sharks' migration routes, Cartamil said he has been able to reconstruct their diving behaviors and to correlate these to the ocean's vertical thermal structure. His analyses show that during the day, sharks make repeated dives through the thermocline (an area where ocean water temperatures change rapidly with depth) to depths up to 1,000 feet. At night, they stay within the "mixed layer," a layer of relatively warm water at the surface, so named because the water is well mixed by waves and wind. They do not dive at night because, as visual predators, they presumably cannot see small schooling fish on which they feed. Mako sharks have similar diving patterns, though threshers may dive to greater depths, he said.

Computations based on the diving data suggest thresher sharks spend about 95 percent of their nocturnal life at depths less than 36 feet, Cartamil said. The 36-foot mark is significant because it is the minimum depth at which drift gill nets may be set in federal waters. The regulation is designed to create a safe corridor for marine mammals and sea turtles that otherwise are easily entangled in the sometimes mile-long nets. The sharks' nocturnal behavior is key because gillnetting is done at night.

The good news is that the net regulation also protects thresher sharks, Cartamil said. But, it also means that raising nets slightly could significantly increase the numbers of thresher sharks harvested.

As the research progresses, Cartamil said he hopes to learn more about where young thresher sharks live. So far, all of the sharks they have tagged have been sub-adults or adults. The absence of juveniles in deeper waters has been conspicuous. One theory is that baby thresher sharks live in nearshore waters, which if true means that beach water quality, runoff, habitat degradation, and other aspects of urban life could be impacting these animals. ■ ■ ■

New Study to Explain Cause of Seabird Die-Offs

POINT REYES—Although 2005 was not an El Niño year, oceanographic conditions off the West Coast of the United States last spring were reminiscent of the physical and biological changes that occur during El Niño events. Unusually weak winds, warmer than normal ocean temperatures, suppressed coastal upwelling, low primary productivity, and the northward migration of warm-water species such as albacore and Humboldt squid—all these occurred last year.

Of particular note were mass die-offs of several species of seabirds and the complete reproductive failure of Cassin's auklets on California's Farallon Islands. The entire colony of Cassin's auklets abandoned their nests last May, most likely because breeding pairs could not find krill, their main food.

Krill, tiny shrimp-like organisms, found at the base of the food chain. The species shown above are about a half inch in length. Photo: Benjamin L. Saenz, PRBO

A series of research cruises, being funded by California Sea Grant, will help researchers identify the physical processes that created El Niño-like conditions that ultimately led to starvation of seabirds and reduced abundances of other animals, including "young of the year" rockfishes and Coho salmon.

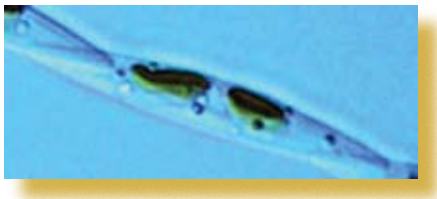
Marine biologists from Point Reyes Bird Observatory (PRBO) rinsing nets after capturing krill at the shelf-beak near the Farallon Islands. Photo: Sophie Webb, PRBO
(Inset) A Cassin's auklet that flew aboard the R/V *McArthur II*. Photo: Benjamin L. Saenz, PRBO

"We want to understand the chain of events that suppressed coastal upwelling," the process by which nutrients are brought to the surface, says lead investigator Bill Sydeman, director of the marine ecology division at the Point Reyes Bird Observatory, now called the PRBO Conservation Science. The seasonal injection of these nutrients supports the growth of small organisms at the base of the food chain, including krill. Surveys suggest that krill abundances in 2005 were about half of what they were in 2004, he said.

"How this significant but not catastrophic reduction in available food was amplified to higher trophic levels at such unprecedented scale needs to be understood," Sydeman said. This information will provide insights into climate variability and change and its relevance to ecosystem-based fisheries management.

By offering insights into the potential effects of large climatic variability, fisheries managers will be better equipped to protect seabirds and other species that may or may not be commercially targeted during times when food is scarce. ■ ■ ■

Sport Fish Found to Contain Toxin Produced During Algal Blooms—Sea Grant to Study Anglers' Exposure



(Above) Diatoms of the genus Pseudonitzschia produce domoic acid. Photo: courtesy G. Pitcher
(Right) Domoic acid causes painful seizures and even death in sea lions. Photo: Francis Gulland, Marine Mammal Center, Sausalito, California

SANTA CRUZ—A study is planned to determine the extent to which anglers in Monterey Bay are being exposed to a potent neurotoxin produced by some marine algae.

The toxin, domoic acid, responsible for die-offs of marine mammals and seabirds, was recently found in the viscera of two popular sport fish—white croaker and staghorn sculpin—caught from the Santa Cruz Municipal Wharf.

Professor Mary Silver of the Ocean Sciences Department at UC Santa Cruz (UCSC) says anglers can reduce their risk of poisoning by gutting and cleaning their catch. She does not want to over hype the public's risk from the toxin because relatively few fish have been collected and tested. Additionally, the toxin has been detected in fish only during the relatively infrequent times it is also present in seawater. It has yet to be detected in muscle tissue.

Mary Silver, professor of ocean sciences at UC Santa Cruz, is leading the study. Photo: courtesy UCSC

Nonetheless, she says, the toxin's presence does point to the need for more studies, as domoic acid was detected in white croaker four of the 13 times the fish were caught and in staghorn sculpin on one of ten sampling dates. It was not detected in surfperch or bocaccio, the only other fish sampled in numbers sufficient for analysis.

To more fully document public health risks, California Sea Grant has awarded support to Silver, Sea Grant Marine Advisor Carrie Pomeroy and mathematics professor Raquel Prado of UCSC. Besides analyzing more fish, the investigators will quantify toxin exposure rates for different sub-groups of anglers at the wharf. Motivating the study is the concern that consumption patterns and cooking methods vary significantly along socioeconomic and cultural lines. As a result, some people may be ingesting toxins in amounts exceeding federal safety limits.

"Domoic acid has been studied in the natural environment but there is no systematic understanding of people's risk from consuming contaminated fish," said Pomeroy,

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Domoic acid (continued)

Sea Grant Marine Advisor Carrie Pomeroy. Photo: California Sea Grant Archives

who will lead a survey of anglers' seafood consumption patterns.

"We want to look at what people are catching and what they are eating," she said. "There may be people who are at risk because of the way they prepare and consume what they catch."

Domoic acid is an algal toxin produced by diatoms of the genus Pseudonitzschia that has killed many hundreds of marine mammals and seabirds in California in the last five years. Frances Gulland, a veterinarian at the Marine Mammal Center in Sausalito, believes that the toxin, which attacks the brain, may partially explain bizarre, overly friendly and overly aggressive sea lion behavior in recent years.

Although commercial seafoods are tested for domoic acid, similar safeguards for protecting public health are not in place for recreationally caught fish. In fact, very little is known about how much of the toxin is consumed by anglers.

Certain culinary practices, such as eating whole fish or crab "butter" (the liver), increase chances of poisoning, Silver said. Cooking techniques are another variable. While boiling can help remove domoic acid, assuming the broth is not consumed, frying does not. Stir-frying in a wok can seal in toxins.

"Once we figure out the cultural and economic dimensions of the situation, we can work with health officials and community groups to target public education efforts," Pomeroy said. ■ ■ ■

California Sea Grant Honored by Food Technologists

Sea Grant's Pamela Tom has been named the recipient of the 2006 Calvert L. Willey Distinguished Service Award from the Institute of Food Technologists (IFT) in recognition of her "continuing, meritorious and imaginative service."

Tom, manager of California Sea Grant's seafood extension program, also directs the highly regarded Seafood Network Information Center at seafood.ucdavis.edu. She will be presented with her award at the IFT's annual meeting in Orlando, Florida in June. ■ ■ ■

Where are They Now?

Leah Akins. Photo: Matthew Schlesinger

Former Sea Grant State Fellow Now Policy Analyst for California Resources Agency

SACRAMENTO—Leah Akins, a California Sea Grant State Fellow in 2004, is now an ocean policy analyst at the California Resources Agency. In this capacity, she serves as staff to Mike Chrisman, Secretary of Resources, on ocean issues.

Akins holds a master's degree in marine ecology from UC Davis where she studied how the supply of larvae to shore affects intertidal crab populations around Point Reyes. In her present position she is helping to implement Gov. Arnold Schwarzenegger's ocean action plan, which includes fulfilling the conservation goals of the California Ocean Protection Act. ■ ■ ■

University of California San Diego
California Sea Grant College Program
9500 Gilman Drive Dept 0232
La Jolla CA 92093-0232
http://www.csgc.ucsd.edu

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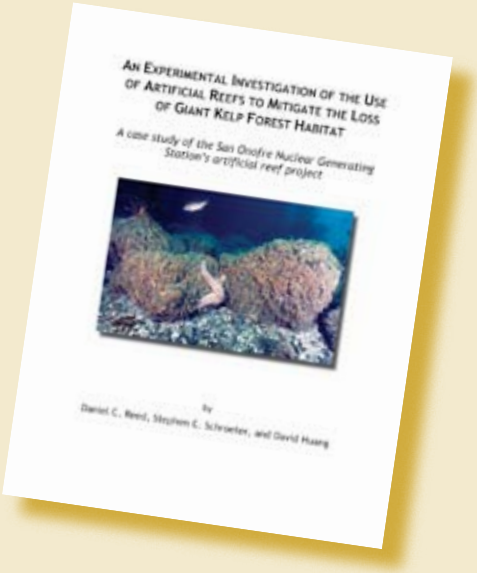
New California Sea Grant Publication

Artificial Reefs



California Sea Grant has published a 144-page case study conducted by Drs. Daniel Reed, Stephen Schroeter and David Huang that summarizes the five-year experimental phase of the San Onofre Nuclear Generating Station's artificial reef project.

The project's overall goal is compensation for the loss of kelp bed resources impacted by the station's operation. These resources include giant kelp, understory algae, invertebrates and fishes.

The book includes a brief history of the mitigation project and components, details of its administration, and artificial reef design recommendations, based on the coauthors' findings.

The publication is available for $10. The cost includes shipping, handling and any applicable sales taxes. Checks should be made payable to UC Regents with your name, mailing address, phone number and email included and sent to California Sea Grant Communications, UCSD, 9500 Gilman Drive, La Jolla, CA 92093-0232. Phone inquiries should be directed to 858.534.4446. ■■■