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Sea Grant California

SEA GRANT IN BRIEF

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Teasing Apart the Physics of Rip Currents with a Satellite-Tracked Surf Drifter

Maybe you've gone to the beach, jumped in for a quick dip, paddled around and suddenly found yourself being swept out to sea. If so, you've been caught in a rip current. What causes the formation of these narrow seaward jets? A leading theory is that changes in wave height along a beach drive their formation. What does this mean? Other things being equal, if there are two areas of high surf, a rip current will form somewhere along the relatively quiet stretch of beach between surf spots.

To learn more about the physics of the surf zone, California Sea Grant has funded doctoral student Wilford Schmidt of Scripps Institution of Oceanography and his advisor Dr. Robert Guza, a professor of coastal oceanography at Scripps, to develop a satellite-tracked drifter capable of withstanding the force of breaking waves. These drifters, the first of their kind, are currently being used to track water movements within a rip current located about 400 meters south of the Scripps Pier in La Jolla.

The first deployment of the drifters in the summer of 2001 showed that eddies – circular currents – form in the surf zone over deep spots on the seafloor. The paths of the drifters also suggested that rip currents accelerate as they flow seaward, with the highest velocities occurring at the edge of the surf zone. Once past the surf, the drifters slowed dramatically, an important fact for swimmers and lifeguards. In early August, the scientists successfully completed a second deployment of the new drifters to further investigate eddies and other circulation patterns in the near shore.

With Sea Grant funding, oceanographers have built the first ever satellite-tracked drifter for the surf zone. The drifters, left, are being deployed and, right, being retrieved from the surf. Drifters are made of PVC piping and stand about 1.2 meters high.

Dr. Robert Guza, left, professor of coastal oceanography and Wilford Schmidt, right, doctoral student at Scripps Institution of Oceanography, are tracking the drifters from an observation platform close to the beach.

IN THIS ISSUE

Evaluating the Human Health Threat from Mitten Crabs

Chinese mitten crabs in the San Francisco Bay-Delta appear free of a dangerous human pathogen, but the estuary contains all the requisite hosts for an infestation in the future. That was the conclusion of a Sea Grant study in which more than 1,300 mitten crabs and crayfish were dissected and microscopically examined for evidence of Asian and North American lung fluke larvae.

People become infected with flukes by eating raw or undercooked infected crustaceans. Symptoms of infection include tuberculosis-like respiratory problems and permanent lung damage. The flukes can also migrate to the brain, causing severe brain damage. Fluke infections are common in parts of Korea and China where mitten crabs are a delicacy.

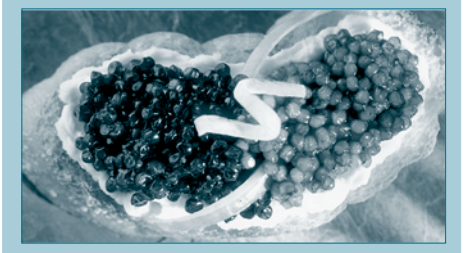
Lung flukes begin their lifecycle in freshwater gastropods, such as snails. Mitten crabs and crayfish are their main intermediate host. Flukes complete their lifecycle in mammals, including people. Health officials in California have been concerned that the highly invasive mitten crab, so-named for its furry pinchers, might be spreading flukes. Though it is illegal to sell mitten crabs in California, there is a flourishing black market in live mitten crabs in immigrant Asian communities, and it is legal to recreationally trap and eat mitten crabs.

Allaying these public health concerns, the scientists led by Jenifer Dugan of UC Santa Barbara have reported that none of the collected crustaceans showed any signs of fluke parasitism. A survey of snail populations, however, revealed that in every major geographical region of the Bay-Delta, there was at least one abundant snail species that could serve as a host for flukes. Crabs and crayfish can consume these snails, resulting in transmission of the fluke.

Chinese mitten crabs were first seen in the Bay Delta in 1992. Since then, the 3-inch crustaceans, native to China and Korea, have spread throughout the Bay-Delta, clogging fish screens and water pumping stations.
Photo: Carolynn Culver

Farming a Better Caviar, a Gourmet's Delight

With the collapse of sturgeon populations in the Caspian Sea region, farmed caviar has emerged as an alternative to wild-caught caviar from the highly overfished Caspian Sea region. Even gourmets, who compare farmed-caviar to osetra, have been won over. As the farmed-caviar industry continues to expand, there is a growing interest in selectively breeding sturgeon for enhanced caviar quality and yield. In a series of experiments funded by



Caviar from farmed white sturgeon has become a popular alternative to imported specialty caviars from the Caspian Sea region. Sea Grant has been instrumental in laying the scientific foundation for this relatively new industry.
Photo: Stoltz Sea Farm

California Sea Grant, geneticists have begun to establish the scientific foundation for developing such breeding strategies. Geneticists Bernie May of UC Davis and former graduate student and Sea Grant Trainee Jeff Rodzen have mapped the pedigree structure of a sturgeon brood stock at Stolt Sea Farm in Sacramento, the state's largest white sturgeon farm. Their work has shown that although sturgeon body size is strongly tied to genetics, the most prized caviar traits – color, grade, firmness, size – remain an elusive combination of environment and ancestry. Stolt Sea Farm has used the genetic markers developed in this project to help it guard against inbreeding its brood adults. It is currently using the scientists' work to tease apart the genetics behind superior caviar traits.

Marine Advisor Jim Waldvogel, opposite, has been counting chinook salmon and their carcasses in the Smith River in Del Norte County for more than two decades. In 2001, there were more spawning adults, about 260 individuals, than in any of the previous 22 years.
Photo: Sea Grant Extension Program

Smith River Salmon Count: Number of Spawning Adults on Rise

Sea Grant Marine Advisor Jim Waldvogel has completed this season's tally of spawning chinook on the Smith River in Del Norte County, the largest river in the state that has not been dammed. He reports that there were more spawning chinook in 2000 and 2001 than in any of the previous 22 years.

He attributes this to a shift in the phase of the Pacific Decadal Oscillation. This new phase, which could last some 30 years, is associated with cooler than normal ocean water temperatures in California, increased upwelling and enhanced coastal productivity. Though favorable to California salmon, the shift could reduce Alaska salmon numbers.

The environmental group Save-the-Redwoods League recently acquired 25,000 acres of timberland in the surrounding Mill Creek watershed for $60 million. The group has since donated the land to the California State Parks. Waldvogel's salmon count, the longest on record in the area, will be an important piece of information on fish resources as the state develops a management plan for the new park.

Sea Grant Fish Pathologist Sleuthing to Find Source of Strange Salmon Disease

In 1981, a strange bacterial disease began sweeping through fledgling salmon farms in Chile, eventually killing as much as 90 percent of salmon at some farms. The culprit, it was later learned, was a rickettsial-like pathogen, *Piscirickettsia salmonis*, once believed to infect only salmon.

New research funded by California Sea Grant has shown that the *P. salmonis* bacterium can also infect white sea bass, *Atractoscion nobilis*. The finding may help prevent the spread of disease from hatcheries to the wild. It also lends credence to a growing body of scientific evidence in support of the theory that the *P. salmonis* bacterium is broadly distributed throughout the world's oceans.

That theory was first put forth to explain the occurrence of the bacterium in farmed Chilean salmon, explained Sea Grant researcher Dr. Ron Hedrick, the fish pathologist at UC Davis who was the first to identify *P. salmonis* bacteria in white sea bass tissue samples. Salmon are native to the Northern Hemisphere. Only salmon eggs, not salmon, were imported to Chile. Because the disease is not believed to be transmitted via eggs, and because Chile has no wild salmon, outbreaks in Chile perplexed the scientific community. How were salmon becoming infected?

Researchers concluded that bacteria in seawater must be infecting farmed salmon since the fish consistently became diseased six to 12 weeks after being transferred into open-ocean net pens. Their line of thought led circuitously back to the unresolved question: Where are the bacteria coming from if there are no wild salmon off Chile?

Hedrick and others now believe that there is a reservoir of *P. salmonis* in the world's oceans and that *P. salmonis* is neither unique to salmon nor sea bass. Consistent with this, scientists have found similar bacteria in the Atlantic and South Pacific oceans and the Mediterranean Sea.

As part of his Sea Grant study, Hedrick is now developing techniques for detecting the presence of *P. salmonis* antibodies in hatchery and wild white sea bass. So far, the bacterium has been detected in only hatchery-raised white sea bass, but antibodies to the bacterium appear to be present in wild white sea bass, further supporting the conclusion that the bacterium is present in naturally occurring populations of marine fish.

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Sea Grant State Fellow Organizing Workshop on Contaminants in Bay-Delta

Three months into his California Sea Grant State Fellowship, Edward Salinas has discovered first-hand the challenges and rewards of approaching science not as a laboratory exercise but as a part of the decision-making process for managing resources as vital as drinking water for more than 25 million Californians.

Salinas is spending his nine-month fellowship with the California Resources Agency as a science advisor to the CALFED Bay-Delta Program. As such, he is organizing a workshop on the effects of endocrine-disrupting contaminants in the San Francisco Bay-Delta ecosystem. This work entails identifying appropriate session topics, selecting speakers and reading a whole lot of scientific

Continued Pg. 4

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Sea Grant Fellow Continued from Pg. 3

literature on what is already known about the effects of contaminants – heavy metals, pesticides, even by-products of hormone supplements – on marine and human health.

The workshop, titled "Endocrine and Reproductive Impacts of Contaminants in the Bay-Delta System," will be held in January in the San Francisco Bay area. Ultimately, what is learned could lead to new regulations on discharging contaminants into the Bay-Delta or to other actions that might assist resource agencies in meeting water-quality standards set forth by the federal Clean Water Act.

The workshop will help the state draw a road map for expeditiously addressing gaps in knowledge, he said. "Some key unknowns are: 'How do multiple contaminants interact? And what are the effects of restoration projects on the bioavailability of toxins?'" The CALFED Science Program will issue a call for research proposals that will be based on the workshop's findings.

"My experiences as a fellow are really different than graduate work," said Salinas, whose doctoral thesis examined the effects of pulp-mill effluent on sea urchin reproduction. "I am now asking, 'What are the big questions? Who is out there looking for answers?'" Salinas is on track to receive his doctorate from UC Davis in the fall.

For more information on the California Sea Grant State Fellowship Program, please visit the education section of our Website at http://www-csgc.ucsd.edu. The deadline for applications for the class of 2003 is Nov. 1, 2002.

California Sea Grant State Fellow Edward Salinas, above, is working as a science adviser to the CALFED Bay-Delta Program on issues that will help ensure the safety and availability of drinking water in the state.

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