

UC San Diego

Research Summaries

Title

Does Beach Grooming Harm Grunion Eggs?

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Background

The grunion is one of only a few fish species in the world to reproduce on land. Using the tides to guide them, these slender, butter knife-shaped fish brave land with near clockwork precision.

When the time is right, grunion “body surf” onto sandy beaches, purposefully stranding themselves at high tide. Females dig themselves tail first in liquid water-sand mix, while males curl themselves around the females and deposit milt. Their tiny, tangerine-colored eggs remain buried, developing in the warmth of the sun, until the progression in the tidal cycles scours away sand. Newly hatched grunion ride the swash out to sea.



A spawning female grunion digs tail first into the sand to deposit her eggs. The male wraps himself around her, depositing milt. Photo: Alan Pitcairn, Project Pacific

Beach communities such as San Diego aggressively rake beaches to remove paper cups, plastic bags and other rubbish left by visitors, especially during busy summer months. Raking also removes the rubbery piles of kelp washed ashore by tides and waves.

To groom a beach, “sanitizing” tractors drag large metal rakes through the top foot or two of sand.

Because of concerns that rakes crush, remove or expose eggs, the City of San Diego curtails its grooming practices during grunion spawning season, avoiding sandy areas below the high-tide line where the grunion spawn.

Project

The purpose of this project was to determine whether grooming does in fact damage grunion eggs and whether San Diego’s modified beach grooming practices protect eggs.

To do this, Dr. Karen Martin, the Frank R. Seaver Chair of Natural Science at Pepperdine University in Malibu, collected and monitored grunion eggs along five miles of popular sandy beaches in San Diego: Ocean Beach, Mission Beach, Pacific Beach, and La Jolla Shores. All these beaches are regularly groomed.

Following a run, Martin collected grunion eggs, called clutches, and marked their location via global positioning satellites. City workers were then directed to groom a small experimental area where there were known to be grunion eggs. Other areas were left untouched. The eggs were later dug up and visually compared for damage. Egg viability was tested at Martin’s laboratory.

Her work showed that grooming does harm eggs, not a surprising find. She also determined, however, that a significant number of eggs are destroyed even when beaches are only raked, fluffing up the sand, but nothing removed. When kelp is removed, nearly all the eggs in the area are lost.

Grunion eggs can be protected, however, if tractors do not rake



Professor Karen Martin sets up a study site at Ocean Beach with the help of a city beach maintenance crew member. Under Martin’s direction, workers groomed over some eggs, while leaving others undisturbed. Photo: Don Longacre, grunion greeter volunteer

below the bimonthly high-tide line during grunion season. No eggs are deposited above this mark, so grooming dry sand has no effect on eggs. Therefore, the City of San Diego’s modified grooming practices do protect grunion eggs.

Impacts

Martin presented her findings to San Diego City Council members in the fall of 2002. The city has since agreed to continue with their curtailed grooming practices during grunion season. They also agreed to hold workshops for beach maintenance workers and lifeguards to teach them about grunion, to remind them of the importance of the modified protocol, and why it is necessary.

Collaborations

This project would have been impossible without the support of Project Pacific, a San Diego-based environmental group that organized “grunion schools” for citizen volunteers.

Volunteers called “grunion greeters” monitored the locations of grunion runs and other data on an

interactive Web questionnaire. Large runs were reported to the "Grunion Hot Line."

Through the work of the volunteers, Martin was continuously apprised of the locations of recent grunion runs, making egg monitoring possible.

During the course of the project, nearly 14 tons of sand were moved. The City of San Diego assisted with the heavy sand-moving work, and modified its raking practices to facilitate the experiments.

This project, Martin said, shows that "the public, the government, environmental groups, scientists and city workers can all collaborate for the benefit of one of the world's most amazing animals."

Collaborators

Birch Aquarium at Scripps Institution of Oceanography
California Department of Fish and Game
City of San Diego Department of Park and Recreation
National Fish and Wildlife Foundation (provided additional funding)
National Science Foundation
Pepperdine University
Project Pacific
Qualcomm Incorporated
San Diego State University
Science Applications International Corporation
SeaCamp
University of California, San Diego
University of San Diego
U.S. Fish and Wildlife Service
Volunteer Match

Presentations

American Physiological Society Annual Meeting, San Diego, poster, August 28, 2002.
San Diego City Council, Natural Resources and Culture Committee, presentation of grunion study, November 13, 2002.
University of California, Irvine, Department of Ecology and Evolutionary Biology, research seminar, November 15, 2002.

Society of Integrative and Comparative Physiology annual meeting, Toronto, Ontario, Canada, poster, January 8, 2003.
Sixth International Congress of Comparative Physiology and Biochemistry, LaTrobe University, Victoria, Australia, symposium talk, February 7, 2003.
Pt. Mugu Whale Festival, public program for California State Parks, March 9, 2003.
Pepperdine University Natural Science Division, research seminar, March 5, 2003.
City of San Diego Shoreline Parks, Workshop for beach maintenance staff, March 14, 2003.
Birch Aquarium at Scripps Institution of Oceanography, Workshop for Grunion Greeter volunteers, March 26, 2003.
Southern California Academy of Sciences Annual Meeting, California State University at Northridge, research talk and poster, May 9–10, 2003.
Cabrillo Marine Aquarium, City of Los Angeles Department of Recreation and Parks, talk for "Friends" event, May 17, 2003.
Western Snowy Plover Working Group, U.S. Fish and Wildlife Service, Carlsbad, California, October 2003.
California State University at Northridge, Department of Biological Sciences seminar, October 2003.
84th Annual Meeting, Western Society of Naturalists, Long Beach, California, November 2003.

Publications

Flannery, J.A. and K.L.M. Martin. 2002. Temperature sensitivity and stages of grunion egg development. *Integr. Comp. Biol.* 42:171.
Martin, K.L.M., E.A. Smyder, and A.J. Walker. 2002. Plasticity and constraints of grunion developmental timing. *The Physiologist* 45: 369.
Smyder, E.A. and K.L.M. Martin. 2002. Temperature effects on egg survival and hatching during the extended incubation period of California grunion, *Leuresthes tenuis*. *Copeia* 2002:313–320.

Published Abstracts 2002–03

Martin, K., T. Speer, R. Pommerening, J. Flannery, and K. Carpenter. 2003. "Grunion Greeters: Volunteer Monitoring of Grunion Runs in San Diego." *Bulletin of the Southern California Academy of Sciences* 102(2):S43.

Carpenter, K.A., J.R. Pommerening, T. Speer, J. Flannery, and K. Martin. 2003. "Does Beach Grooming Harm Grunion Eggs?" *Bulletin of the Southern California Academy of Sciences* 102(2):S29.
Martin, K.L.M. 2003. Beach Spawning Fishes and the Evolution of Air-Breathing. *Comparative Physiology and Biochemistry Part A: Molec. Integr. Physiol.* 134:S116.

Popular Media

Newspapers: *San Diego Union-Tribune*, April 10, 2002, and August 29, 2002; *Los Angeles Times*, April 27, 2002; *La Jolla Light*, September 5, 2002; *Ventura County Star*, *Orange County Register*, *Malibu Times*, *Malibu Surfside News*, *San Diego Beach and Bay Press*, Summer 2003.
Radio: KNX News radio, Los Angeles; KPBS, public radio, San Diego, News 89.5, Eric Anderson, April 4, 2002, and August 30, 2002.
Magazines: *Currents*, *Pepperdine Voice*, *Universum* (Austrian science magazine, in press), *Westways*.
Television: KFMB, Channel 8, CBS affiliate, San Diego, April 18, 2002, and April 28, 2002; KGTV, Channel 10, ABC affiliate, San Diego; The Learning Channel (in production); Animal Planet, July 2003; Pepperdine's TV-26.
Newsletters: Sea Grant in Brief, May–June 2002; Pfizer, September 2002; Birch Aquarium at Scripps Institution of Oceanography, Spring 2003; Cabrillo Marine Aquarium, Summer 2003.
Web sites: <http://www.grunion.org>, <http://www.projectpacific.org>

Awards

"Best Poster in Fishery Biology" presented to Carpenter, et al. by the American Institute of Fishery Research Biologists at the meeting of the Southern California Academy of Sciences, May 2003.

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