



# Life History of California Sheephead: Historical Comparisons and Fishing Effects

Jennifer Caselle, UC Santa Barbara  
Christopher Lowe, CSU Long Beach  
Kelly Young, CSU Long Beach

## BACKGROUND

California sheephead (*Semicossyphus pulcher*) are among nature's true gender benders. As protogynous hermaphrodites, all fish are born female and turn into males as they age and grow. The exact timing of this metamorphosis is socially cued: It is suppressed by aggressive interactions with dominant males and triggered by the removal of alpha males.

## SUMMARY

In this project, researchers investigated possible causes for the observed decline in the average sizes of both male and female sheephead in Southern California.

The leading theory, borne out in this study, is that sportfishing, because it selectively removes large territorial males, is probably the main reason individuals in heavily fished areas are smaller than their counterparts in more remote regions. Because the fish are socially cued protogynous hermaphrodites, the removal of large territorial males triggers sex change in the largest females. As a result, paradoxically, the removal of large males has the effect of dramatically reducing the number of eggs produced, and hence the total reproductive output of a population. The findings suggest that the usual fisheries management techniques (size limits) don't work for a species that changes sex during its life. In particular, scientists report that, at popular sportfishing destinations such as Catalina Island, the entire male population could be legally fished out. The scientists are recommending that state biologists implement slot limits, which would establish upper and lower bounds on legal-size sheephead, to ensure that both males and females are present to reproduce.

## MAIN OBJECTIVE

The California Department of Fish and Game is re-considering its stock assessment of California sheephead because of deficiencies in essential fisheries data. The overarching goal of this project was to collect information that might help improve the species' management.

## FINDINGS

The main finding of this California Ocean Protection Council-funded project: Sportfishing is hammering large male sheephead. Off Catalina Island, the most visited of the Channel Islands, for example, there is a virtual absence of large, territorial males.

"We see lots of tiny, midget males, which is not the case historically," says UC Santa Barbara postdoctoral researcher Scott Hamilton.

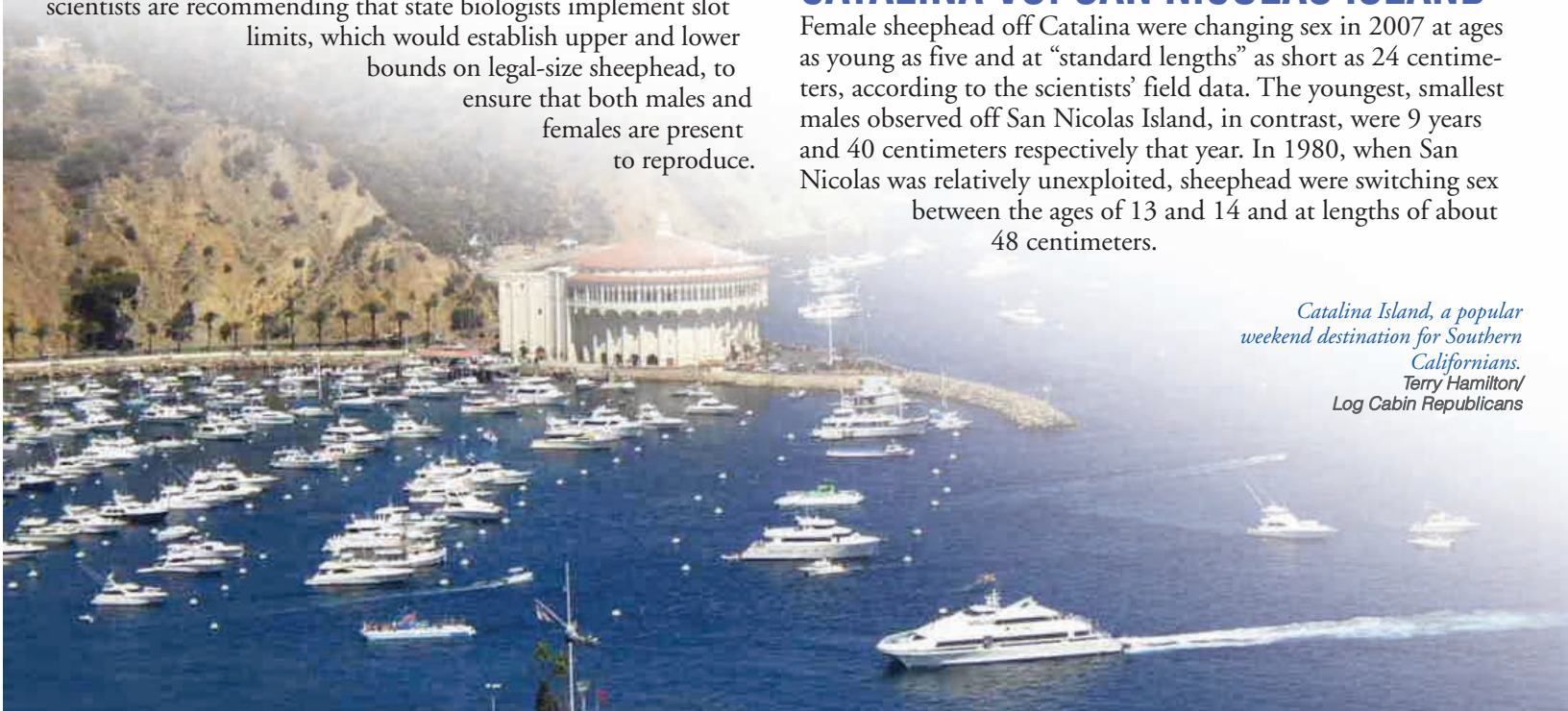
"We believe sportfishing has selectively removed "trophy" fish, which for sheephead means the males almost exclusively," says UC Santa Barbara researcher Jennifer Caselle, whose co-investigators on the grant were CSU Long Beach biologists Chris Lowe and Kelly Young.

By contrast, commercial fishing targets smaller, solid-red females that command the highest prices in the live Asian finfish markets.

## CATALINA VS. SAN NICOLAS ISLAND

Female sheephead off Catalina were changing sex in 2007 at ages as young as five and at "standard lengths" as short as 24 centimeters, according to the scientists' field data. The youngest, smallest males observed off San Nicolas Island, in contrast, were 9 years and 40 centimeters respectively that year. In 1980, when San Nicolas was relatively unexploited, sheephead were switching sex between the ages of 13 and 14 and at lengths of about 48 centimeters.

*Catalina Island, a popular weekend destination for Southern Californians.*  
Terry Hamilton/  
Log Cabin Republicans





Tomás Castelazo/Wikipedia

A male California sheephead at the fishmarket in Ensenada, Baja California, México.

“The fish keep getting smaller and they are changing sex earlier,” Hamilton says. “The bright spot is that we are seeing a recovery off San Nicolas.”

San Nicolas, besides being the most remote of the Channel Islands, is a Navy weapons-testing facility. Reduced

Caselle, J.; Hamilton, S.; Malone, D.; Kushner, D. and Carr, M. February 2008. Spatial differences in trophic ecology and life histories of California sheephead have fisheries management implications. California Islands Symposia: special session on first 5 years of monitoring the Channel Islands marine reserves. Ventura, CA.

Hamilton, S.; Caselle, J.; Egloff, T.; Kondo, K.; Loke, K. and Lowe, C. November 2008. How do patterns of abundance, size structure and biomass differ between fished and unfished waters in the Channel Islands? Results from SCUBA surveys. Western Society of Naturalists. Vancouver, B.C., Canada.

Loke, K.; Caselle, J.; Hamilton, S.; Lowe, C. and Young, K. July 2008. Reproductive parameters of California Sheephead across the Channel Islands. American Society of Ichthyologists and Herpetologists. Montreal, Canada.

access to the island post 9-11, rising fuel prices and new regulations on commercial fishing have sharply reduced local sheephead landings in the last decade.

In 1998, at the peak of the commercial sheephead fishery off San Nicolas, sex change was occurring at 7 and 8 years and at lengths of 30 centimeters. “What we see is that the fish do come back once the fishing pressure is reduced,” Hamilton says.

## IMPLICATIONS FOR MANAGEMENT

At popular sportfishing destinations such as Catalina, size limits on legal sheephead may be an ineffective and inappropriate strategy for managing the sport fishery, since a single size limit does not protect both males and females. “We think in some places you could literally fish out the entire male population legally,” Hamilton says.

The scientists are recommending that state biologists implement slot limits, which would establish upper and lower bounds on legal-size sheephead. The usual fisheries management techniques don’t work for a species that switches sex midway through life, Hamilton adds.

## PUBLICATIONS, PROCEEDINGS AND SYMPOSIA

Hamilton, S.; Caselle, J.; Love, M.; Schroeder, D.; Loke, K.; Young, K. and Lowe, C. November 2007. Selective harvesting alters life histories of a temperate sex-changing fish: historical comparisons and current status of California sheephead. Western Society of Naturalists. Ventura, CA.

Caselle, J. and Hamilton, S. September 2007. Size-selective harvesting alters the life history of California sheephead across its biogeographic range. American Fisheries Society. San Francisco, CA.

PISCO: Coastal Connections (an annual publication of the Partnership for Interdisciplinary Studies of Coastal Oceans). Fish Data Give Managers New Insights. 2007, Vol. 6.

## COLLABORATING ORGANIZATIONS

National Park Service  
NOAA Channel Islands National Marine Sanctuary

## STUDENTS

Kerri A. Loke, Master’s  
Tiana Egloff, Bachelor’s

## CONTACTS

**Jennifer Caselle**  
Marine Science Institute  
University of California, Santa Barbara  
(805) 893-5144  
caselle@msi.ucsb.edu

**Scott Hamilton**  
Marine Science Institute  
University of California, Santa Barbara  
(805) 893-7397  
s\_hamilt@lifesci.ucsb.edu

**Christopher Lowe**  
Dept. of Biological Sciences  
California State University, Long Beach  
(562) 985-4918  
clowe@csulb.edu  
www.csulb.edu/web/labs/sharklab



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California Sea Grant, University of California, San Diego, 9500 Gilman Drive, Dept. 0232, La Jolla, CA 92093-0232  
Communications Phone: (858) 534-4446