



Reproductive Potential of Nearshore Rockfish and Impact of Environmental Conditions

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Background

After more than a decade of studying rockfish reproduction, growth and development, biologists in 2006 successfully reared brown rockfish (*Sebastes auriculatus*) from birth through their critical life stages. The achievement is significant because rockfish, more than other fish, have fragile and complicated early life histories. They are also prone to overfishing and hence have been a priority for fisheries management.

The ability to raise the fish in captivity, scientists say, adds significantly to what is known about this commercial species' early growth and development. It also opens the door to the possibility of rearing rockfish for stock enhancement. Eventually, it may even be possible to farm native California rockfish for human consumption, as is currently done with native Asian species (which are easier to grow) in Japan and Korea.

Endocrinology professor Peter Collins and research biologist Wai Ning Tsang, both at the University of California, Santa Barbara, attribute the lab's rare success in rearing brown rockfish to two factors. One was the ability to carefully control environmental conditions, such as temperature, water quality and light. Another was switching to a natural diet for larval rockfish.

"We shifted from feeding larval rockfish 'convenience foods,' that is micro-organisms that can be readily raised in the laboratory, to a natural diet, which more closely resembles the diet larval rockfish would encounter in the wild and which was nutritionally optimized to enrich growth," said Collins, whose graduate student, Hisaya Fukui, a former Sea Grant Trainee, made the discovery.

Brown rockfish are one of more than 100 nearshore rockfish species (most of which are in the genus *Sebastes*) that inhabit the various rocky and sandy habitats associated with kelp forests and reefs.

Brown rockfish, commonly referred to as bolina by fishers, live in shallow, subtidal waters and bays associated with the interface of rocky and sand areas. Like most rockfish, they are prone to overfishing and slow to recover once depleted.

Project

Collins originally received California Sea Grant funding in response to the enactment of the Nearshore Fisheries Act, which called for better management of nearshore fisheries stocks and identified the need to gather essential fishery information on targeted species to do this.

The goal of their Sea Grant project was to establish protocols to identify periods of oocyte and embryo development that are susceptible to losses (atresia), leading to a reduction in potential rockfish fecundity. To this end, the normal time course of embryonic development was examined and by reference to this chronology changes in potential fecundity at specific stages of oocyte development and pregnancy were monitored.

Rockfish habitats are vulnerable to environmental disturbances (e.g., changes in maternal food availability and temperature) and contamination. This research adds to what is known about the effects of environmental conditions on reproductive output in nearshore rockfish.

"This research is a starting point for establishing a complete picture of the way brown rockfish grow and the effects a suite of environmental changes could have on their growth," he said. "We are just in the early stages of understanding rockfish culture."

Applications

With the Collins lab's success in rearing rockfish, their attention has turned to investigating whether some California rockfish might be candidates for aquaculture.

California Sea Grant College Program

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Among the group of nine brown rockfish that recently celebrated their first birthday, the biggest fish is 12.6 centimeters and weighs 33 grams. This contrasts starkly with the aquaculture star cobia, which bends the scales at six kilograms after a year of culture.

Innovative husbandry techniques might spur growth rates and thus make rockfish aquaculture or stock enhancement feasible.

Mike Rust, the team leader of a marine enhancement program at NOAA's Northwest Fisheries Science Center in Seattle, whose group has reared several species of rockfish, including browns, agreed: "We don't know whether the fish are slow growing because of inherent biology or because they don't eat often in the wild. If we knew what to feed them, they might grow a lot faster."

The growth rates of black rockfish cultured in Asia offer a promising example. Black rockfish growth has been increased 250 percent through diet.

Former Sea Grant Trainee Peter Chaillé, a graduate student working in the Collins lab, is also optimistic about the potential for culture.

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Presentations

Chaillé, P.M., Invited Speaker, 2007. Lecture titled: Rockfish – a fish of global importance for understanding our changing marine environment and as an aquaculture resource. Sapporo Guest House, City Government of Sapporo, Japan. (February 2007).

Chaillé, P.M., Delegate, 2007. International Conference on Ecophysiology of Marine Organisms (ICEMO); Coping with change: physiological responses of marine organisms. The Swire Institute of Marine Science, Department of Ecology & Biodiversity, The University of Hong Kong, Hong Kong SAR, China.

Collins P.M., Chaillé, P.M., Tsang, W.N. 2006. The maternal and hormonal environment during embryonic development and adaptation in nearshore rockfish (*Sebastes* spp.). III International Symposium on Viviparous Fishes. Universidad Michoacana de San Nicolas de Hidalgo, Facultad de Biología, Morelia, Michoacán, México, 8-11 November, 2006.

Effects of Salinity on larval growth and development in oviparous white seabass (*Atractoscion nobilis*) and viviparous teleost grass rockfish (*Sebastes rastrelliger*). 2003 Undergraduate Research Colloquium, UC Santa Barbara.

Early development patterns in cultured viviparous *Sebastes rastrelliger* and oviparous *Sparus sarba* teleosts. World Aquaculture 2002, International Aquaculture Conference and Exposition of the World Aquaculture Society and China Society of Fisheries, Beijing, PRC.

Potential Fecundity and Realized Reproductive Output in Nearshore Rockfish. Sea Grant Graduate Researcher Symposium, held in conjunction with California and the World Ocean 2002.

Reproductive Function in the Viviparous Rockfish, *Sebastes rastrelliger*, a candidate species for Mariculture. International UNESCO Training Course for graduate students, UNESCO Chinese Center of Marine Biotechnology, Ocean University of China, Qingdao, PRC.

Publication

Tsang, W.N., Chaillé, P.M., and Collins, P.M. 2007. Growth and reproductive performance of cultured nearshore rockfish. Aquaculture (accepted).

Delo, L.J, Moore, R.K, Tsang, W.N, Woo, N.Y.S, Collins, P.M., 2002. Early development patterns in cultured viviparous *Sebastes rastrelliger* and oviparous *Sparus sarba* teleosts. Proceedings of World Aquaculture 2002, Beijing, China, p. 178

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Peter Collins (left) and Hisaya Fukui

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