

## Validating Age Estimates for Bocaccio Rockfish with Radiometric Dating

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### Summary

**B**ocaccio (*Sebastes paucispinis*), also known as red snapper, rockcod, grouper or salmon grouper, were the dominant rockfish in California's early longline fishery and the most abundant rockfish in the bottom-trawl fishery from Morro Bay to Fort Bragg until the mid-1980s, according to a 2001 report published by the California Department of Fish and Game. Annual landings of bocaccio are now about a hundredth of what they were in the early-1970s. The National Marine Fisheries Service estimates that the stock's spawning biomass has been reduced by about 98 percent.

As with other long-lived fish, bocaccio are especially vulnerable to overexploitation: they reach sexual maturity late in life, and their reproductive success rate is highly variable from year to year. Another factor contributing to their decline has been the absence of accurate age statistics, which fisheries managers may use to compute sustainable catch limits.

### The Project

In this project, California Sea Grant funded Dr. Gregor Cailliet and colleagues at California State University to evaluate the accuracy of aging bocaccio by counting calcified layers in the fish's bone-like ear structures, called otoliths. Otoliths are assumed to grow in annual bands.

Their work suggests that otolith-based age estimates tend to underestimate ages of older fish, compared to age estimates based on radiometric analyses. In younger fish, whose otolith layers are more distinct and easy to count, both



An otolith is a bone-like structure in a fish's ear, assumed to calcify in annual layers. The number of layers is thus a proxy for a fish's age. The otolith on top is estimated to be from a 3-year-old bocaccio while the one on the bottom is estimated to be from a 28-year-old. Photo: Allen Andrews.

methods provide similar age estimates.

The scientists' findings are based on measurements of the ratios of radium 226 and lead 210 in more than 370 pairs of otoliths from bocaccio caught in Central California in 1983-84. In addition to aging specimens, they also computed life expectancies. Their analysis suggests that the life expectancy of a female bocaccio is at least 39 years while that of a male is at least 25 years. Previous estimates for females and males ranged from 20 to 50 years.

### Applications

Dr. Cailliet's work rigorously documents the longevity of the bocaccio and suggests that the fish are more vulnerable to overfishing than previously thought. As a result, the stock probably requires a longer recovery period than originally thought. The techniques developed for this project are being applied to

other species of management concern. Dr. Cailliet currently is funded to validate age statistics for the blackgill rockfish. He plans to study age statistics for the orange roughy in New Zealand and the Patagonian toothfish (Chilean seabass) in the Southern Ocean, two other long-lived species whose numbers have declined dramatically in recent years. Some of his previous Sea Grant research showed that the yelloweye rockfish can live for more than 100 years.

### Cooperating Organizations

Monterey Bay Aquarium  
National Marine Fisheries Service  
University of California, Santa Barbara

### Publications

Cailliet, G.M., A.H. Andrews, E.J. Burton, D.L. Watters, D.E. Kline, and L.A. Ferry-Graham. 2001. Age determination and validation studies

of marine fishes: Do deep-dwellers live longer? *Exp. Gerontol.* 36:739–764.  
Andrews, A.H., G.M. Cailliet, K.H. Coale, et al. 2002. Radiometric age validation of the yelloweye rockfish from southeastern Alaska. *Mar. Freshw. Res.* 53:1-8.

#### **Trainee and Thesis**

Burton, Erica, M.S. in Marine Science, California State University, 1999, "Radiometric Age Determination of the Giant Grenadier."

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