MARINE FISHERIES

Overfishing leads to loss of genetic diversity in Tasman Bay snapper

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A collaborative study of Tasman Bay snapper suggests that there has been a loss of genetic diversity in this heavily fished stock over the past 50 years.

Teachers: this article can be used for Biology L7 A.O. 7.2 and 7.3(a), and NCEA AS 2.3, 2.9 and 3.2. See other curriculum connections at www.niwa.co.nz/pubs/wa/resources

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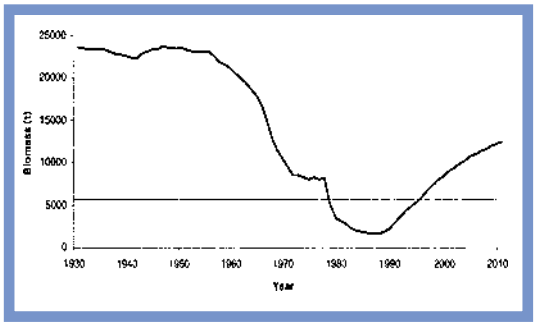
Genetic diversity in a population is critical to a species' ability to adapt to environmental changes, and to the continued productivity of a fish stock. The diversity is due to genetic differences between individuals. Rare genetic types, which are of little importance today, could be the key to adaptability in the future. Usually genetic diversity begins to decline only when populations fall to very small numbers. Because even overexploited fish stocks have several million fish, it has been assumed that they were protected from loss of genetic diversity.

We measured levels of genetic diversity over the past 50 years from snapper scale samples collected during the 1950s, 1960s, and 1970s from populations in Tasman Bay and the Hauraki Gulf. Recent developments in technology mean that it is possible to measure genetic diversity by extracting DNA from preserved and dried material. These archived scale samples, originally collected for routine ageing purposes, provide a rare opportunity to recover genetic data from old populations.

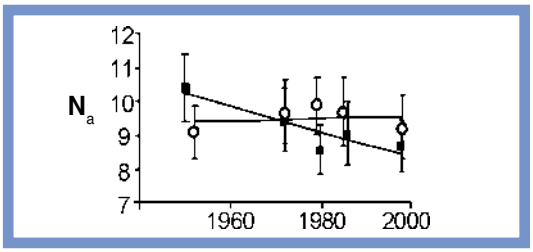
Snapper in Tasman Bay form a small, isolated population that was first exploited in the 1950s. Annual catches during the 1960s and 1970s were often more than 1000 t, and peaked at 2720 t in 1979. But by the late 1980s the total biomass had declined from an estimated 23,000 t to less than 1600 t. The current total allowable commercial catch (TACC) is 200 t.



Estimated biomass and trajectory for snapper in Tasman Bay–Golden Bay. The horizontal line shows the estimated biomass that supports the maximum sustainable yield.

In contrast, the biomass of the much larger population of snapper in the Hauraki Gulf and Bay of Plenty has remained above 40,000 t, despite being fished for more than 100 years. The current TACC for those regions is 4500 t.

The DNA study showed that the Tasman Bay snapper population lost genetic variation in several DNA markers between 1950 and 1998, but the Hauraki Gulf population showed no such decline over the same period.



Temporal changes in the genetic diversity of snapper populations in Tasman Bay (■) and the Hauraki Gulf (o) measured as a mean number of alleles, N_a.

This suggests that the number of fish in a population may be significantly greater than the number of fish that are reproducing and helping to maintain genetic diversity. Some heavily overfished local stocks may have already lost genetic diversity, which puts their long-term survival and productivity at risk. The current total allowable catch (including all removals – TAC) for snapper in Tasman Bay is set at a level that is allowing the stock to rebuild. However, it will take very much longer for the genetic diversity to recover. ■