

## TROPHIC MODELING OF A TEMPERATE MARINE ECOSYSTEM THROUGHOUT MARINE RESERVE PROTECTION IN NEW ZEALAND<sup>1</sup>

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Marine Reserves (MRs) in New Zealand are being monitored and investigated to determine implications for conservation and management strategies. This research project employs a variety of techniques to answer questions about how MRs impact biological communities and what this means for the management of coastal resources. Underwater research at three central New Zealand MRs (Kapiti MR, Long Island MR and the newly implemented Taputeranga MR; see Figure 1) conducting seasonal size and abundance surveys of reef fish, invertebrates and algae at both protected and unprotected locations is used to determine biomasses of trophic groups. Monitoring data also exists prior to and throughout MR protection, which is used to determine ecosystem response to protection in temperate central New Zealand waters. This monitoring information is used in combination with biological data from the literature to describe trophic linkages within the ecosystem.

An ecosystem model that was created for Te Tapuwae o Rongokako MR located midway up the east coast on the North Island, New Zealand has identified that the region is relatively poor in invertebrate biomass when compared to Leigh MR, which lies further north (Pinkerton *et al.*, 2008, Lundquist & Pinkerton 2007). It was determined that the diet of lobsters is composed of a large amount of macroalgae, which has not been observed in other regions of New Zealand. This ecosystem appears to be strongly influenced by lobster abundance, which has been increasing since implementation of the MR.



**Figure 1.** Map of New Zealand showing marine reserve locations with three study sites shown in red (Kupe/Kevin Smith is now known as Te Taputeranga). Image modified with permission from New Zealand Department of Conservation.

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This study is focused in the Cook Strait region located between the North and South Islands, which is characterized by colder waters in comparison to the north and is a highly dynamic area where three ocean currents converge. Temporal data is also used to evaluate ecosystem response to MR protection. This approach allows for an understanding of how MR design and placement, fisheries regulations and coastal resource use affect the dynamics of a biological community. Each of three marine reserves investigated have different designs with respect to boundaries, size and shape. Commercial, recreational and traditional fisheries for reef fish and invertebrate species are important in these regions and we wish to understand how ecosystems respond to MR protection and the impact of factors such as size, placement and design.

## REFERENCES

- Lundquist, C.J., Pinkerton, M.H., 2007. Ecosystem Modeling of Te Tapuwae o Rongokaka Marine Reserve. Department of Conservation Science for Conservation Series, Investigation # 3765.
- Pinkerton, M.H., Lundquist, C.J., Duffy, C.A.J., Freeman D.J., 2008. Trophic modelling of a New Zealand rocky reef ecosystem using simultaneous adjustment of diet, biomass and energetic parameters. *J. Exp. Mar. Biol. Ecol.* 367, 189-203.