

NEW ZEALAND'S LARGEST AND MOST ISOLATED MARINE RESERVE: the subtropical Kermadec Islands



FIGURE 3. Diversity of echinoderms: crown-of-thorns starfish (*Acanthaster planci*) and feather star (Photograph courtesy of Pete Mesley).

The volcanic Kermadec Islands are home to New Zealand's northernmost land mass, located between 29 and 32° south latitudes and 177 and 179° west longitudes. The archipelago is composed of four island groups, located 750 km north-east of New Zealand along the Kermadec Trench which extends from the East Cape. The Kermadec Islands are found approximately halfway between temperate New Zealand waters and tropical Tonga Island waters. Raoul Island belongs to the northernmost group, is the largest of all the islands in the archipelago at 2938 ha and is surrounded by the smaller Meyer Islands and Herald Islets. The next island group to the south-west is the Macauley and Haszard Island group, followed by the Curtis and Cheeseman Island group with L'Esperance Rock and Havre Rock as the most southerly group in the Kermadec Island chain (figure 1).

MARINE RESERVES IN NEW ZEALAND

The first marine reserve (MR) in New Zealand was created at Leigh in 1975, located north of Auckland in the Hauraki Gulf and was named the Cape Rodney–Okakari Point MR (also known as the Goat Island MR). Within 10 years of protection, major changes in community structure within the reserve were noted as the area had previously been exploited by over-fishing. Prior

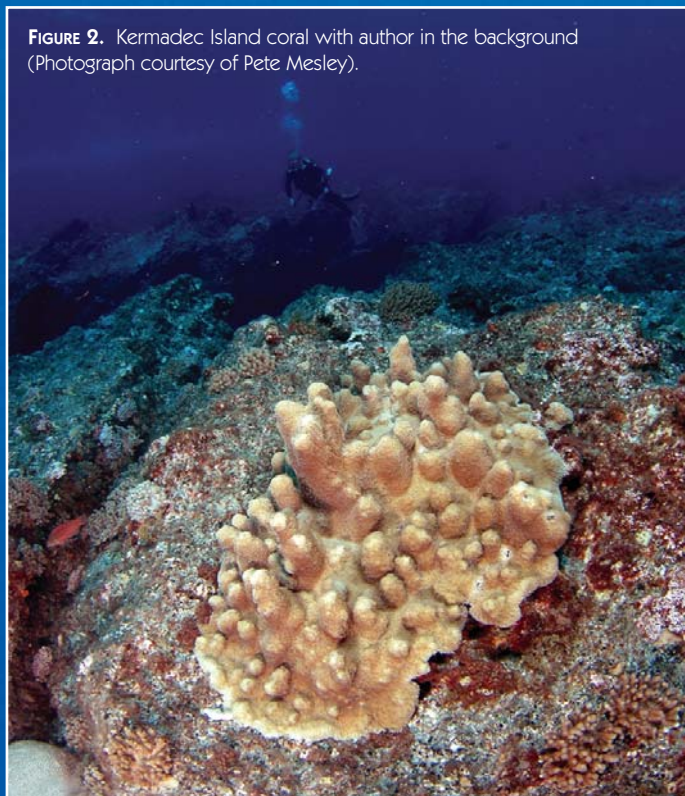


FIGURE 2. Kermadec Island coral with author in the background (Photograph courtesy of Pete Mesley).

to protection, the benthic community was largely dominated by urchin (*Evechinus chloroticus*) barrens, a grazer of macroalgal species. After the area was protected from fishing, abundance of the highly targeted snapper (*Pagrus auratus*) increased, which is a natural predator of sea urchins. The growth of the snapper population decreased urchin abundance, which allowed previously highly-grazed macroalgae species to return in larger numbers. Macroalgae stands provide habitat and structure for many invertebrate and fish species, thus resulting in a large increase in biodiversity and major changes in biomass within the MR. Trophic cascades such as this have been documented at other MRs in New Zealand, often occurring within a few years of protection (Shears & Babcock, 2002, 2003).

The Kermadec MR was created in 1990 and is New Zealand's largest at 748,000 ha. The MR protects the four main island groups, extending to 12 nautical miles seaward. Protected marine habitat ranges from the high intertidal zone to the shallow coastal waters surrounding the islands dropping to 40 m, to deeper waters of depths greater than 3000 m. Marine reserve law in New Zealand prohibits fishing, removal of any living matter or disturbing marine communities within the reserve.

The Kermadec MR (figure 1) protects New Zealand's only true subtropical reef habitat with sea-surface temperatures that range from 18° to 24°C annually. The marine community is a unique mix of tropical, subtropical and temperate species. Benthic primary producers are represented by scleractinian corals (figure 2) which are found at shallow depths as well as foliose, filamentous and encrusting red algae. Notably absent are fuclean and laminarian algae. Grazing invertebrates are represented by echinoderms such as the crown-of-thorns (*Acanthaster planci*, figure 3) and gastropods such as the endemic giant limpet (*Patella kermadecensis*). Herbivorous fish are represented by the grey and caramel drummer (*Kyphosus bigibbus* and *Girella fimbriata*) and the Pacific gregory (*Stegastes fasciolatus*). Demoiselle (*Chromis dispilus*; figure 4), blue maomao (*Scorpius violaceus*), orange wrasse (*Pseudolabrus luculentus*) and mimic blenny (*Plagiotremus tapeinosoma*) make up the balance for the most observed species. Larger fish species are represented by the spotted-black grouper (*Epinephelus daemeli*), kingfish (*Seriola lalandi*), northern kahawai (*Arripis xylabion*) and Galapagos shark (*Carcharhinus galapagensis*; figure 5 background). It has been determined that the fish fauna of the Kermadec Islands is more similar to Lord Howe Island than to northern New Zealand.

CONDUCTING RESEARCH AT THE KERMADEC ISLANDS

On 22 March 2008, I joined the vessel 'Spirit of Enderby' operated by Heritage Expeditions in Auckland, New Zealand destined for the Kermadec Islands. Research expeditions to these islands are infrequent due to their isolation and narrow weather windows with regular cyclone activity. I was fortunate to have been awarded a scholarship by the Enderby Trust to join the cruise with tourists interested in different facets of the Island's history, birdlife and underwater environs. The research that I conducted while at the islands will be used for my PhD thesis at Victoria University of Wellington titled: 'Marine Reserves as Conservation and Management Tools in New Zealand,' supervised by Dr Jonathan Gardner and Dr James Bell.

Survey sites were highly determined by the prevailing wind, which was from the east for most of our time and meant that Denham Bay was the most dived site during the trip (figure 1). The physical structure of Denham Bay is gently sloping from the intertidal to subtidal zone and characterized by large boulders, rocks, cobble and sand. One survey was conducted at the Meyer Islands, characterized by more vertical walls with habitat features such as caves, overhangs and crevices.

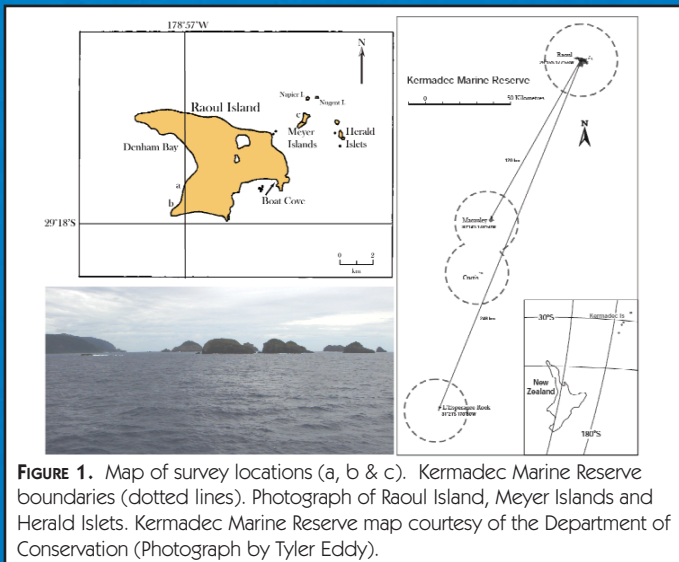


FIGURE 1. Map of survey locations (a, b & c). Kermadec Marine Reserve boundaries (dotted lines). Photograph of Raoul Island, Meyer Islands and Herald Islets. Kermadec Marine Reserve map courtesy of the Department of Conservation (Photograph by Tyler Eddy).

Surveys of benthic and pelagic fish species for size and abundance were conducted using a two minute timed count technique. The survey was designed to sample a range of depths and habitats in order to better understand how much variability in the fish distribution size and abundance can be explained by these factors. The body of research pertaining to the unique fish community found at the Kermadec Islands is relatively small, with few published studies (see Schiel *et al.*, 1986; Francis *et al.*, 1987; Cole *et al.*, 1992, 2001; Francis *et al.*, 1999). This research represents the first survey conducted for all species of fish since the opening of the Kermadec MR in 1990 and one more snapshot of the distribution of fish in this isolated location.

During the five surveys 38 species of fish were recorded for size and abundance and three further species were sighted for a total of 41 observed fish species. There have been more than 100 species of fish described at the Kermadec Islands and it has been determined that greater sampling effort and more survey sites throughout the archipelago are required in order to increase the number of species observed. Preliminary results indicate that fish assemblages are significantly different between Denham Bay and Meyer sites. Further analysis is underway to determine the driving factors that are responsible for differences.

CONSERVATION IMPLICATIONS

Based on estimates of population sizes and densities of marine communities at the Kermadec Islands, it has been suggested that recruitment may be a limiting factor in a region that is highly isolated, subject to strong wave and storm energy manifested through cyclones as well as the relatively small amount of suitable rocky-reef habitat available due to water depths dropping to as deep as 3000 m within the marine reserve. It has also been noted that there are no major currents flowing to the Kermadec Islands, which may explain why major coral and macroalgal groups that are expected to be able to survive in such conditions are absent.

For these reasons, this ecosystem is exceptionally fragile to anthropogenic factors such as invasive species introduced from boat hulls or bilge water as well as fishing. If the population does in fact rely on self-recruitment, fishing pressure could have dramatic impacts on the community structure of fish throughout the archipelago. Particularly susceptible is the spotted black grouper (*Epinephelus daemeli*) which is female until it grows to 100–110 cm and changes sex. Fishing of larger individuals could potentially remove all the males from the population. There are also endemic invertebrate (giant limpet; *Patella kermadecensis*) and fish species (Kermadec scalyfin; *Parma kermadecensis*, *Ocosia apia* and possibly *Gymnothorax griffini*) which merit special conservation priorities.

The Kermadec MR protects a unique marine community that appears to be extremely susceptible to human influence. A

major reason why the Kermadec Islands are still home to spotted black grouper, Galapagos reef sharks, endemic giant limpet and Kermadec scalyfin is the geographical isolation of the islands which were for a large part of history not regular fishing grounds. The MR that is in place today protects a unique biological community not found elsewhere in the world.

FURTHER READING

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BACKGROUND: FIGURE 5 Galapagos reef sharks (*Carcharhinus galapagensis*) (Photograph by Tyler Eddy).



FIGURE 4. Demoiselle (*Chromis dispilus*), feather stars and gorgonians at Meyer Islands (Photograph by Tyler Eddy).