SPOTLIGHT 7 | Graveyard Seamounts

42°45.00'S, 180°00.00'W

By Malcolm R. Clark, Ashley A. Rowden, Ian Wright, and Mireille Consalvey

The "Graveyard seamounts" comprise a complex of 28 small volcanic edifices covering about 140 km^2 (Figure 1) on the northern flank of the Chatham Rise, an oceanic plateau that extends several hundred kilometers east of New Zealand. The features are associated with widely distributed Late Cenozoic volcanism (Gamble et al. 1986; Hoernle et al., 2006) that created a number of clusters of small intraplate volcanoes in the area. They have various volcanic forms, including cones, summit craters, and lateral dike ridges. Typically, each seamount is between 100 and 400 m high, rising from basal water depths of 1050–1200 m to summit depths of 750–1000 m. Bottom-current flows of 10–20 cm s^{-1} (Nodder and Northcote, 2001) produce basal scour moats at all the seamounts.

The Graveyard seamounts are home to over 50 fish species, but are dominated by orange roughy (*Hoplostethus atlanticus*), oreos (*Allocyttus niger*), various deepwater sharks, and cardinalfish (*Epigonus telescopus*). Orange roughy aggregate on several of the features for spawning or feeding, and these fish have supported a commercial trawl fishery since the mid 1990s (Clark, 1999).

A number of unfished seamounts have extensive areas of reeflike coral habitat comprised of *Solenosmilia variabilis* and *Madrepora oculata*, predominantly on the summits and upper flanks. These corals were not well known in New Zealand waters until a camera survey of the Graveyard seamounts in 2001 revealed their size and extent. They offer an open lattice-like structure that is home to a diverse invertebrate community, including squat lobsters, seastars, brittlestars, polychaete worms, and crabs. In contrast, seamounts affected by bottom trawling have few coral, and different assemblage composition (Clark and Rowden, 2009).

In 2001, 19 New Zealand seamounts were closed to all bottom trawling and dredging, and three of them were in the Graveyard complex (Morgue, Pyre, and Gothic) (Brodie and Clark 2003; Pitcher et al., 2010). This closure provided a contrast in fishing states on various seamounts that is currently being monitored. Graveyard, Zombie, and Scroll are

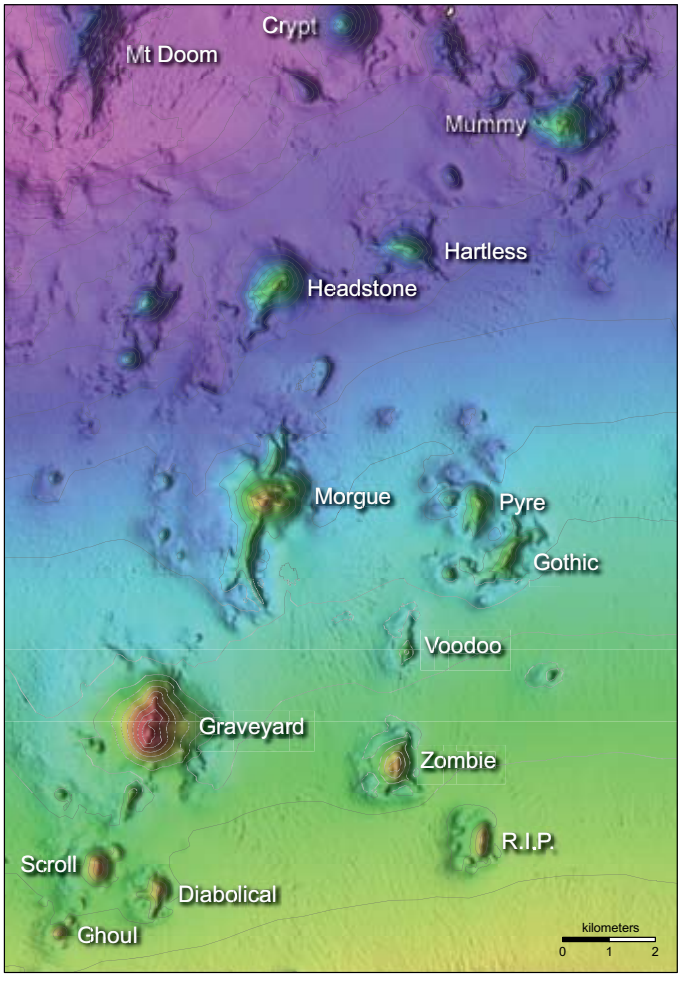

Figure 1. The Graveyard seamounts are a cluster of small volcanic peaks on the northern flanks of the Chatham Rise. Several of the seamounts are being monitored over time to determine changes in benthic fauna between fished and unfished features. *Figure prepared by A. Pallentin, NIWA*

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open to fishing; Morgue was fished, but is closed, enabling recovery to be evaluated; Pyre and Gothic were unfished, and are closed to protect benthic biodiversity. A time series of data on benthic faunal distributions has been developed, with photographic surveys in 2001, 2006, and 2009, that allows comparison of fished and unfished seamounts (a "natural experiment") and changes over time. Research has therefore provided information to support the initial protection of deepwater habitat, as well as the ability to monitor the effects of the closures and the efficacy of management. The combination of open and closed seamounts (with enforcement being carried out by all trawlers having a Vessel Monitoring System) appears to be an effective management strategy that balances exploitation of fish stocks with habitat protection.

Figure 2. An aggregation of orange roughy (*Hoplostethus atlanticus*) at 890-m water depth on the summit of Morgue. This small seamount had been heavily fished, but in 2001 was closed to trawling. Orange roughy therefore find a refuge from exploitation on this seamount. The image is taken 3 m above the seafloor. Each fish is about 35-cm long. *Photo courtesy of NIWA*

Figure 3. The summit and upper flanks of unfished seamounts in the Graveyard complex have extensive areas of cold-water corals, like the *Solenosmilia variabilis* pictured at 1000-m water depth on Gothic seamount. The corals support a diverse array of invertebrates such as brisingid starfish (orange), sponges, and other corals. The image size is about 2 m x 1 m. *Photo courtesy of NIWA*

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