

AITUTAKI & MANUAE

NEARSHORE MARINE ASSESSMENT

2019



Ministry of Marine Resources

TU'ANGA O TE PAE MOANA

COOK ISLANDS

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Prepared for the Aitutaki Island Council and Community

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This book is an abbreviated form of the 2017, Aitutaki and Manuae
Nearshore Invertebrate and Finfish Assessment

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Inside Rear Cover: Green Sea Turtle (*Chelonia mydas*) in Aitutaki Photo: Kirby Morejohn
Rear Cover: Humphead Wrasse (*Cheilinus undulatus*) in Aitutaki Photo: Kirby Morejohn

Avarua, Rarotonga, Cook Islands, 2019

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The globally endangered *maratea* (*Cheilinus undulatus*) are common on Aitutaki reefs. Photo: Kirby Morejohn

INTRODUCTION

Aitutaki

Aitutaki is the second most populated island of the Cook Islands, located 250 km north of Rarotonga. The island is geologically classified as an 'almost atoll' due to exposed volcanic remnants within a fringing coral reef.¹ Aitutaki has a total land area of 1,800 ha and lagoon area of 8,000 ha.

Aitutaki has legal regulations for its inshore marine species. Implemented in November of 1990, the Aitutaki Fisheries Protection By-Laws in part regulate harvest of *Tridacna* spp., *Arca* spp. and *Turbo* spp. in lagoon waters and to a distance of 200 m beyond the outer reef edge on the islands of Aitutaki and Manuae (Aitutaki By-Laws, 1990). The By-Laws include harvest limits where no more than 20 animals per genus may be harvested per day. Minimum size limits are also in place and prohibit harvest of *Tridacna* spp. less than 75 mm, *Arca* spp. less than 50 mm and *Turbo* spp. less than 38 mm. The By-Laws prohibit sale and removal of these species from their respective islands, however, permits issued by the Aitutaki Island Council may be obtained which allow harvests greater than the daily bag limit and/or less than the minimum size limit as well as export.

In 2010, the Ministry of Marine Resources and Cook Islands Government implemented the Aitutaki and Manuae Bonefish Management Plan. The purpose was to establish an ecologically sustainable bonefish fishery on both islands. Spawning and nursery sites for bonefish (*Albula glossodonta*) were identified and bonefish fishing was restricted to other designated areas. Fishing licencing and fishing guide requirements were imposed as well as fishing gear restrictions and a ban on bonefish export.

Manuae

Manuae is an uninhabited island, approximately 100 km south-east of Aitutaki. The island is a true atoll composed of two islets (Manuae and Te Au O Tu) situated within a 1,375 ha lagoon. On the western side, the islet of Manuae with a land mass of 235 ha. To the east, the islet of Te Au O Tu with a land mass of 430 ha.

Entrance into the lagoon is made through a modified reef passage at the northern end of the Manuae islet. The passage is narrow and shallow, restricting the size of boats that can enter the lagoon and constraining entrances to be made on higher tides.

Aitutakian fishermen generally visit Manuae on artisanal fishing trips. They primarily target pelagic fish outside the reef, spiny lobsters on the reef crest and coconut crabs on land with the goal of transporting these species back to Aitutaki for later consumption. Giant clams (*Tridacna* spp.) are also targeted by Aitutakian fishermen but as per the Aitutaki Fisheries Protection By-Laws, giant clam export from

¹Wood, B. L. and Hay, R. F. 1970. The Geology of the Cook Islands. NZ DSIR, Geological Survey, Bulletin 82.

Manuae is prohibited which presumably motivates fishermen to consume their clam harvest before departing.

Catch and release fishing for bonefish within the lagoon and for giant trevally from a boat outside the reef are the main attractions for tourists on fishing charters. When camping, tourists may harvest and consume giant clams (*Tridacna* spp.) and coconut crabs (*Birgus latro*) but infrequently transport species back to Aitutaki².



Aerial photo of Manuae from the north. Manuae motu on the right and Te Au O Tu on the left. Photo: Kirby Morejohn

²Quinton Schofield, Wet & Wild Aitutaki personal communication, 7th November 2017

METHODOLOGY

Surveying of finfish, invertebrates and substrate was conducted within areas of interest on the islands of Aitutaki (Fig. 1) and Manuae (Fig. 2) from September to November 2017. Areas of interest included all active *rā'ui*, legally regulated areas (marine reserves) and control areas (unregulated areas open to harvest). Within each area of interest, sampling sites were selected. In Manuae, to make comparisons with historic data, sites were placed in the same locations as Ponia (1998b³) and additional sites were added with their locations selected to capture a representative sample of the island. Within each site, surveys were conducted outside the reef in 10 m of water with SCUBA and within the lagoon and on the reef flat with snorkel and walk sampling.

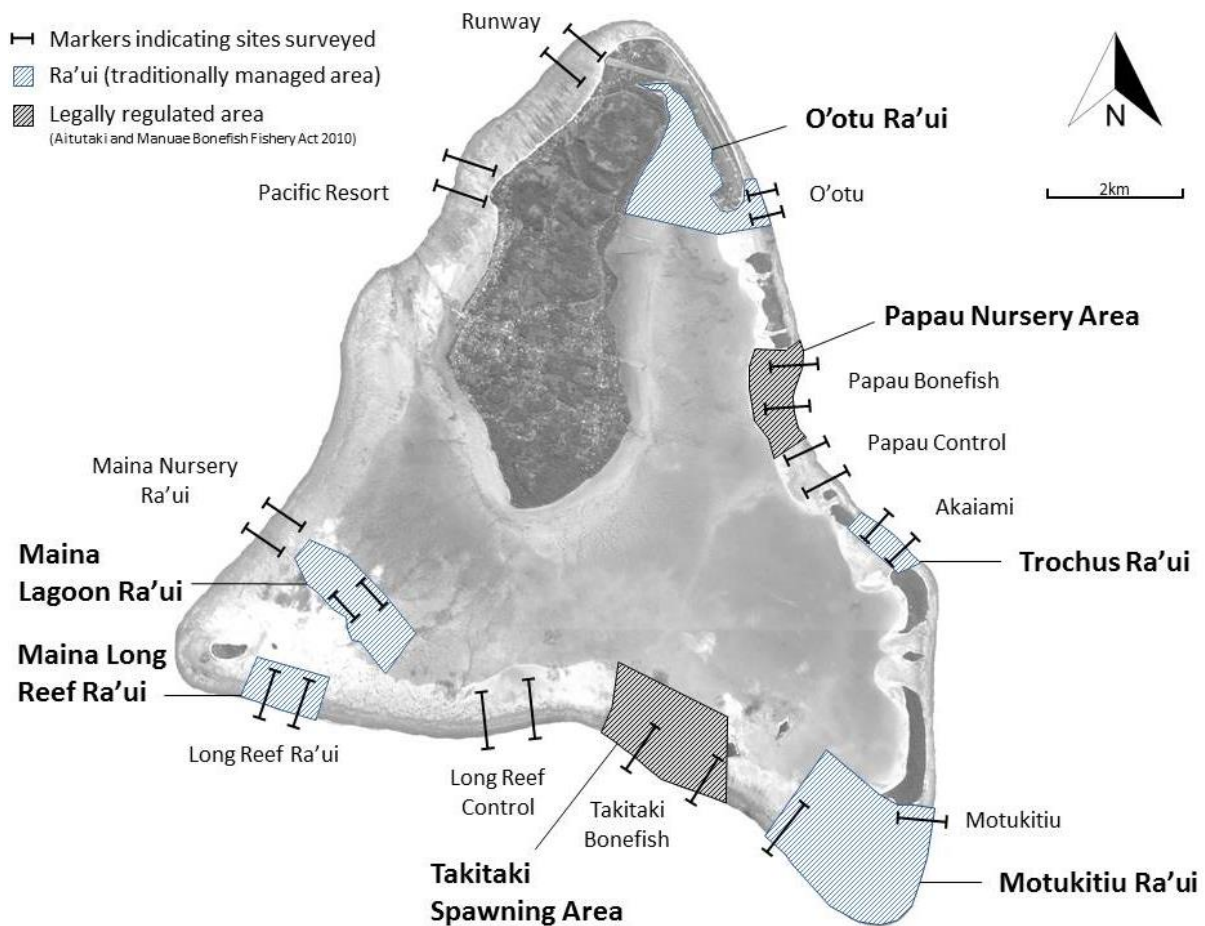


Fig. 1. Aitutaki survey sites. Map source: Google DigitalGlobe.

³Ponia, B. 1998b. Manuae Island Marine Baseline Assessment. Ministry of Marine Resources. Report No. 98/04

Data collection of all species included identification to the lowest possible taxonomic classification, counts and measurements when applicable. For finfish, fork length measurements were visually estimated. For invertebrates, length measurements were gathered (mm) for the first ten individuals of species of interest as defined by the community and local fisheries managers.

In Manuae, turtle nest surveys were used to locate preferential nesting beaches. GPS waypoints were recorded for each set of turtle tracks (up and down the beach slope) leading to an active nest. Confirmation of active nesting was made by careful excavation of randomly selected nests.

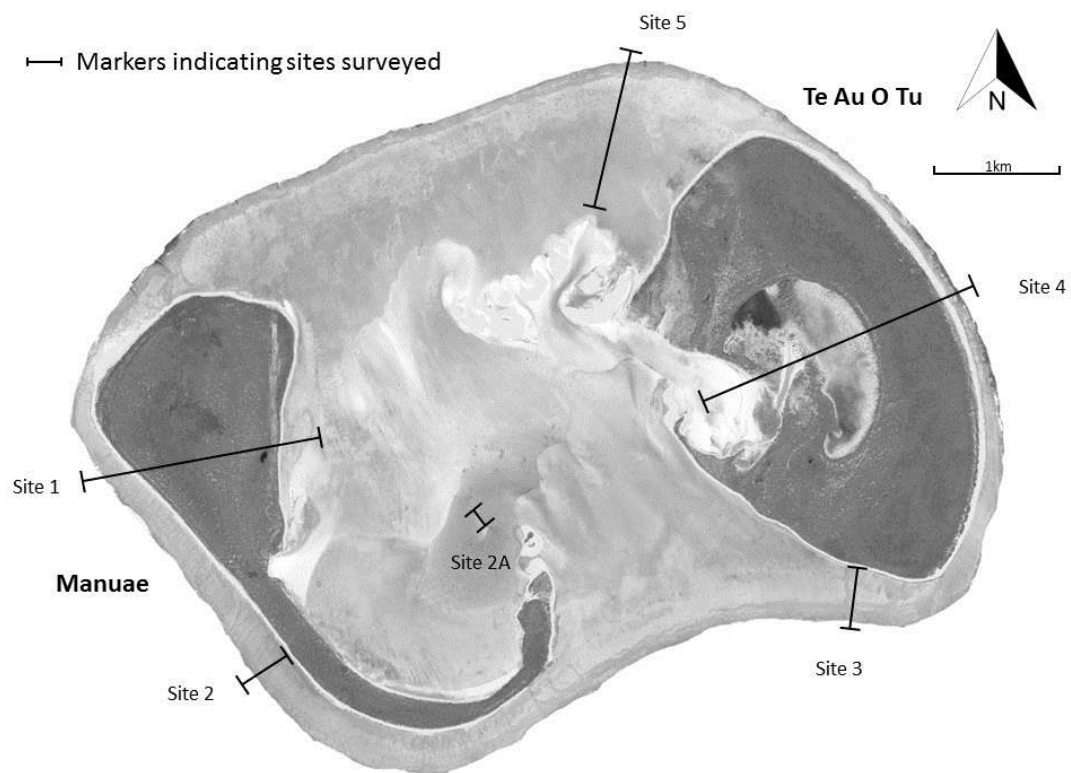


Fig. 2. Manuae survey sites. Map source: Google Digital Globe.

RESULTS

Invertebrates

Aitutaki

A total of 31,959 individual invertebrates were observed across 272 transects, representing 41 different taxa. The most frequently observed species of invertebrate was the *rori toto* (*Holothuria atra*) where a total of 15,953 individuals were recorded across all transects. The *kina*, (*Echinometra mathei*) was also common across all transects (n = 6,490).

Invertebrate densities ranged from 73 ind./100 m² at Takitaki Bonefish Reserve to 773 ind./100 m² at O'otu Rā'ui, a ten-fold difference. Invertebrate densities at O'otu Rā'ui were significantly greater than 9 of the 10 other survey sites in Aitutaki, including the regulated survey sites of Papau and Takitaki Bonefish Reserves.

Average *paua* (*Tridacna maxima*) densities were greatest in both the Long Reef Rā'ui and Long Reef Control survey areas (Fig. 3) where densities were approximately 8.5 times greater compared to other sites. Within the *rā'ui* designation, Long Reef Rā'ui had significantly greater *paua* densities than Akaiami Rā'ui, Maina Nursery Rā'ui, Motukituu Rā'ui and O'otu Rā'ui.

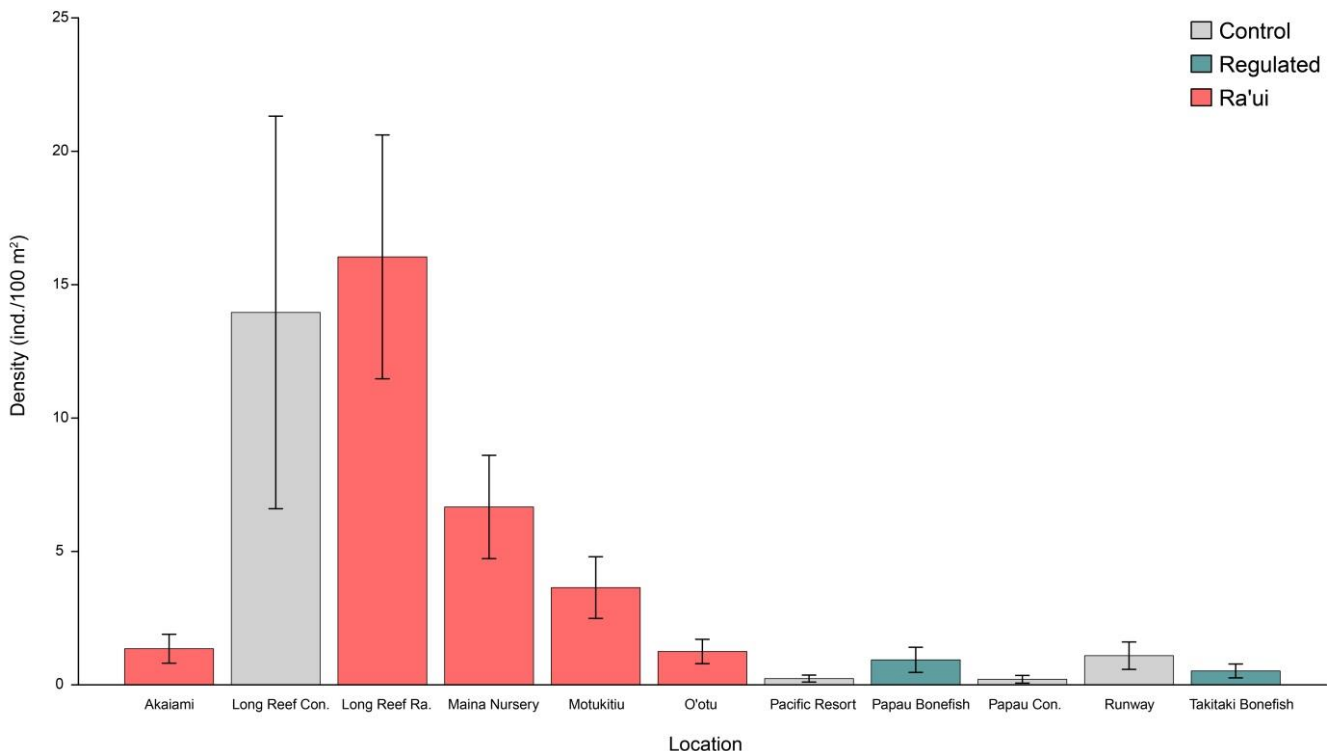


Figure 3. *Paua* densities on inner reef survey sites.

In terms of length, *paua* were largest in the Papua Bonefish Reserve (mean = 96 mm) and smallest in Runway Control (mean = 71mm), but no significant difference were detected amongst survey sites and designations. The majority of lengths recorded weresmaller than the 75 mm minimum harvest size limit (Fig. 4).

The greatest trochus densities were observed at the Akaiami Rā’ui, concentrated within the back reef (mean = 114ind./100 m²) and reef front (mean = 110ind./100 m²) habitats (Fig. 5). The density of trochus within Akaiami Rā’ui was significantly greater than all other Aitutaki sites.

Trochus lengths were significantly different between sites. The largest trochus were found in the Maina Nursery Rā’ui (mean = 111 mm) and were on average 1.13 times larger than trochus measured in the Akaiami Rā’ui (mean = 98 mm). The majority of surveyed trochus fell within the harvest size limits (80-110mm).

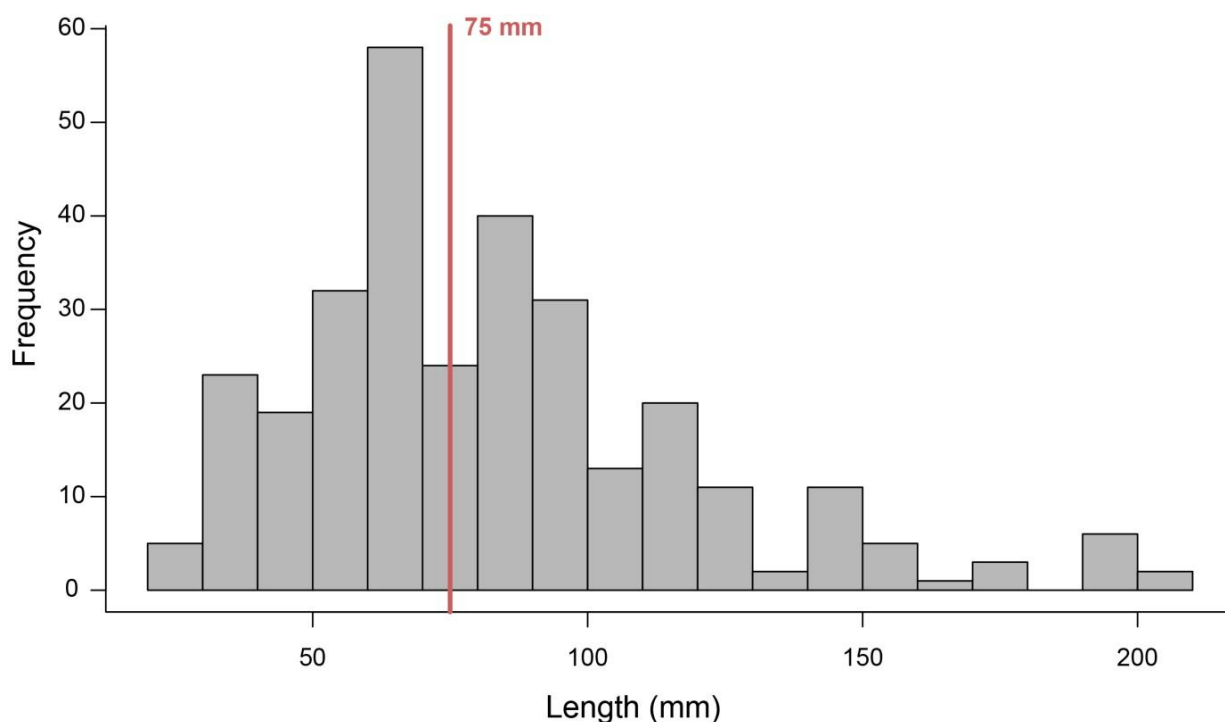


Figure 4. Length-frequency histogram of *paua* within Aitutaki with the 75 mm minimum size limit indicated.

Manuae

A total of 15,021 individual invertebrates were observed across 84 transects, representing 22 different taxa. The most frequently observed invertebrates were *rori toto* (*Holothuria atra*) and *paua* (*Tridacna* spp.), where a total of 7,218 and 5,763 individuals were recorded across all transects, respectively.

The highest invertebrate densities were within Site 2 (mean = 950 ind./100 m²). These values were 10 times greater than the lowest values found in Site 2A (mean = 94 ind./100 m²) and accounted for significant variation between survey sites.

Overall, densities of *paua* were relatively high, particularly compared to Aitutaki, and were greatest in Site 2 and Site 3 (mean = 488 and 283 ind./100 m² respectively), specifically in the mid-lagoon and back reef habitats.

Paua were largest within Site 2A (mean = 177 mm), despite having lower overall densities. The smallest *paua* were recorded in Site 4 (mean = 102 mm). The majority of lengths were above the 75 mm minimum size allowable for harvest (Fig. 5).

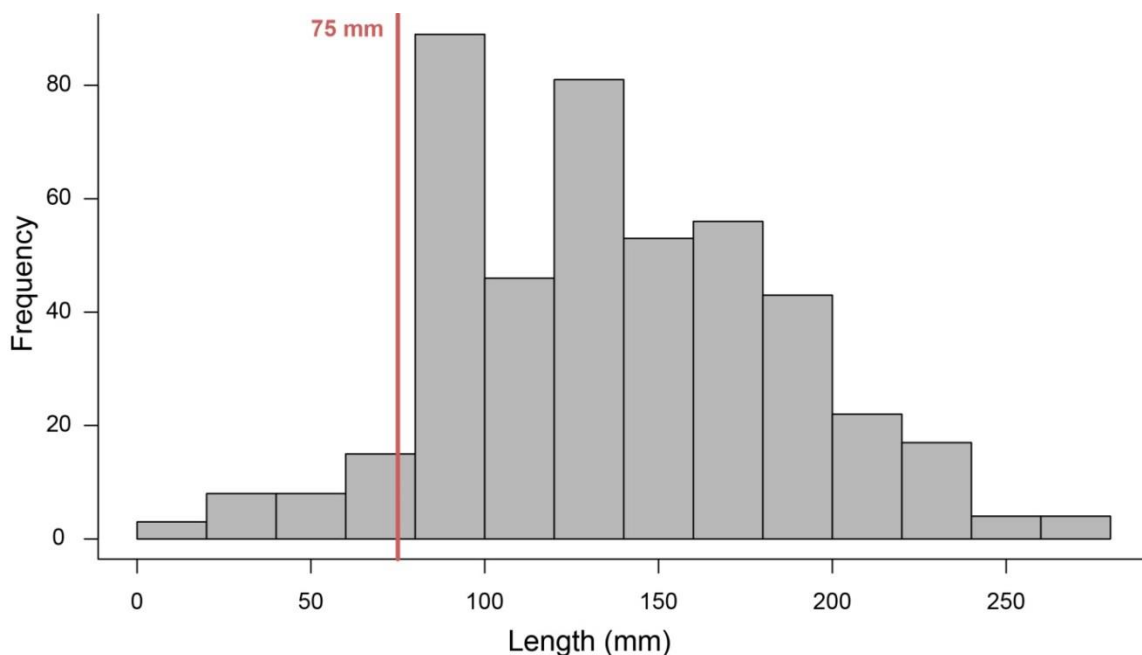


Figure 5. Length-frequency histogram of *paua* within Manuae with the 75 mm harvest size limit indicated.



MMR Fisheries Officer Tua Matepi recording *paua* densities in the Manuae lagoon. Photo: Kirby Morejohn



The Manuae lagoon holds the last remaining high density *paua* stock in the southern Cook Islands. Photo: Kirby Morejohn

Finfish



A school of *tapa'uru* (*Carangoides ferdau*- foreground) and *Troa* (*Lethrinus xanthochilus*-background) near the Papau Passage of Aitutaki. Photo: Kirby Morejohn

Aitutaki

A total of 13,710 individual finfish were observed across 42 transects, representing 169 different taxa. The most frequently observed species of finfish was *Chromis acares*, where a total of 4,782 individuals were recorded.

Finfish densities were greater in outer reef habitats than in lagoon habitats, particularly for sites on the western side of Aitutaki. Finfish densities were not found to be correlated with site designation (*rā'ui*, reserve, or areas open to fishing).

Maratea (*Cheilinus undulatus*) were only observed in outer reef habitats, particularly within Motukitiu Rā'ui (n = 6), Papau Bonefish Reserve (n = 8), Papau Control (n = 4) and Takitaki Bonefish Reserve (n = 2).

Manuae

A total of 3,759 individual finfish were observed across 10 transects, representing 84 different taxa. Like Aitutaki, the most frequently observed species was *Chromis acares* where a total of 2,140 individuals were recorded.

Finfish densities were greater in outer reef habitats than in lagoon habitats, particularly for Site 1 and Site 2 on the leeward side (mean = 2,220 and 1,862 ind./100 m² respectively).

Coral and Substrate

Within outer reef sites in Aitutaki, hard substrates including those covered in crustose coralline algae (CCA) were dominant and greater than those seen on other southern group islands. Soft corals in Aitutaki were also abundant and were much more prevalent than any of the other southern group islands (Fig. 6). Manuae substrate in outer reef sites was mainly composed of hard coral, dead coral, crustose coralline algae, macroalgae and hard pavement. Coral cover in Manuae was the second highest in surveyed southern group islands (22.8%) and was just over the 22.1% estimates for Indo-Pacific coral cover average.⁴

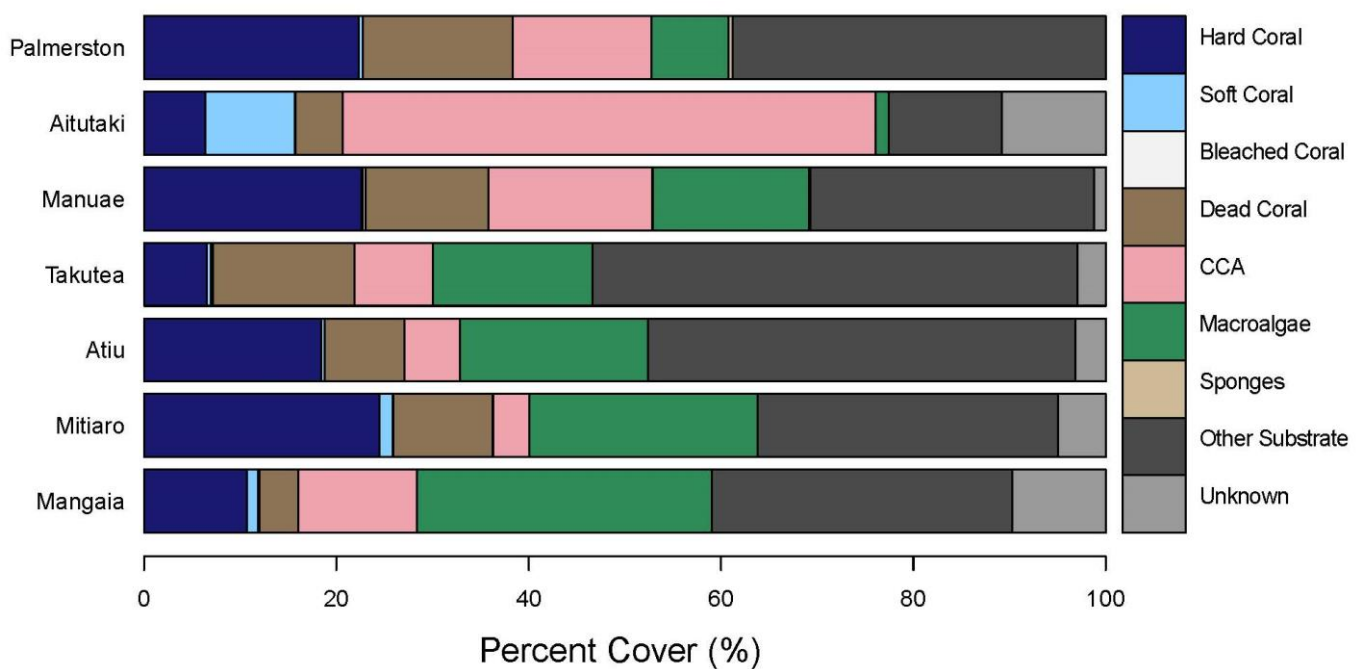


Figure 6. Substrate types and average percentage cover from outer reef sites in surveyed southern group islands.

⁴Bruno, J.F. and Selig, E.R. 2007. Regional decline of coral cover in the Indo-Pacific: timing, extent, and subregional comparisons. *PLoS ONE* 8 e711, 2 – 8.

Manuae Turtle Nest Survey

Turtle tracks leading to nests were observed on both Manuae and Te Au O Tu islets. On the Manuae islet, 7.7 kilometres of beach were surveyed and 26 nests were recorded (Fig. 7). Nests were concentrated on southwest, ocean facing beaches. No nests were found along surveyed lagoon facing beaches on Manuae. Two randomly chosen nests on the southwest side of Manuae islet were excavated revealing unhatched eggs.

On Te Au O Tu, 5.8 kilometres of beach were surveyed and 31 turtle nests were recorded. Nests were concentrated on east, south and southwest, ocean and lagoon facing beaches.

Multiple turtles were observed off transect in lagoon waters and along the outer reef slope. All turtles observed were identified as endangered (IUCN) green sea turtles (*Chelonia mydas*).

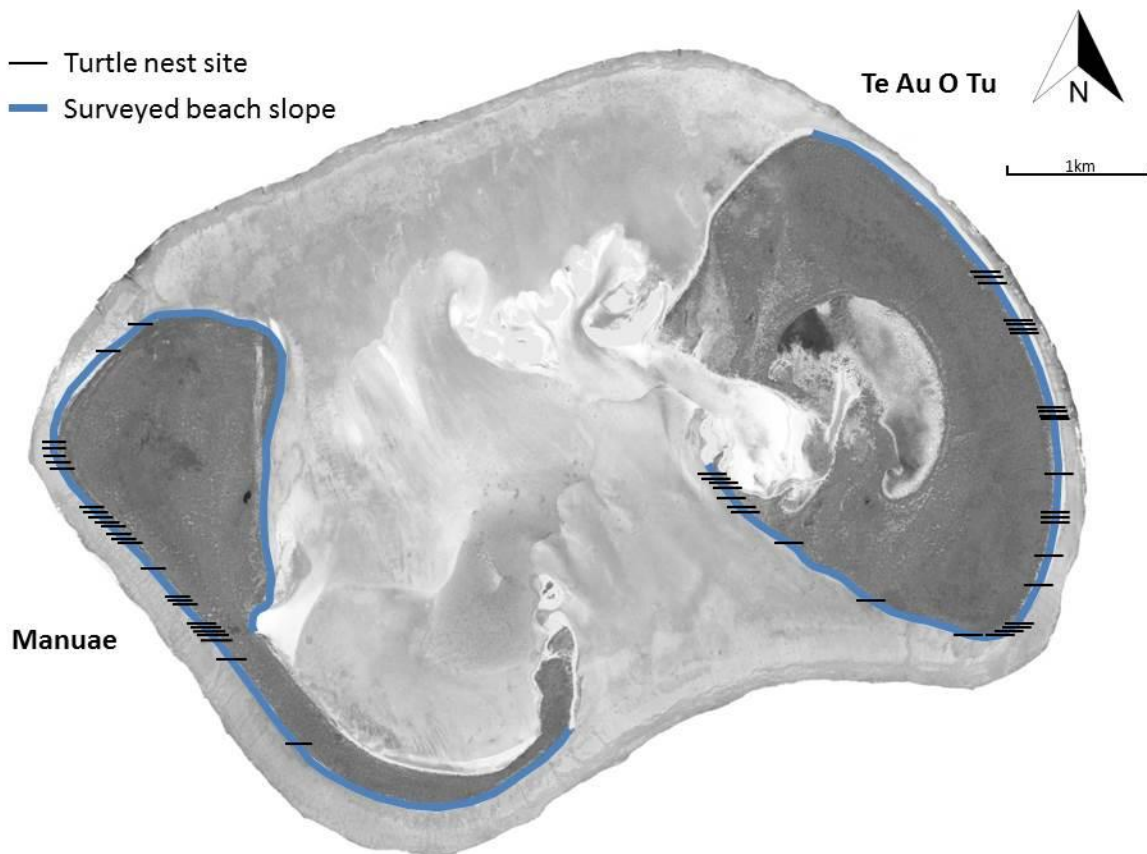


Figure 7. Turtle nest location and beaches surveyed on Manuae and Te Au O Tu Islets. Map source: Google Digital Globe.



A set of recent turtle tracks on Manuae. The tracks lead from the water to a nest and back to the water. Photo: Kirby Morejohn



An active turtle nest on the west side of the Manuae motu. Photo: Kirby Morejohn

HISTORICAL COMPARISONS & DISCUSSION

In both Aitutaki and Manuae, *paua* is a valuable resource and highly sought after by fishers and local communities for consumption. The *paua* populations, primarily of Aitutaki, have been severely over-harvested and population densities are now only a fraction of what they once were (Fig. 8).

Average *paua* densities in Aitutaki were 2.8 ind./100 m². These values are lower than that observed on the last assessment of *paua* densities in Aitutaki.^{5,6} Looking further into the past, historical data show a steep decline in *paua* densities since the mid-1980's.^{7,8} Typically, high densities of *paua* would be expected in *rā'ui* designated areas. In this study, the lack of significant differences in *paua* densities between *rā'ui* and control sites may indicate active *paua* harvest within *rā'ui* areas and/or low levels of successful reproduction and/or recruitment.

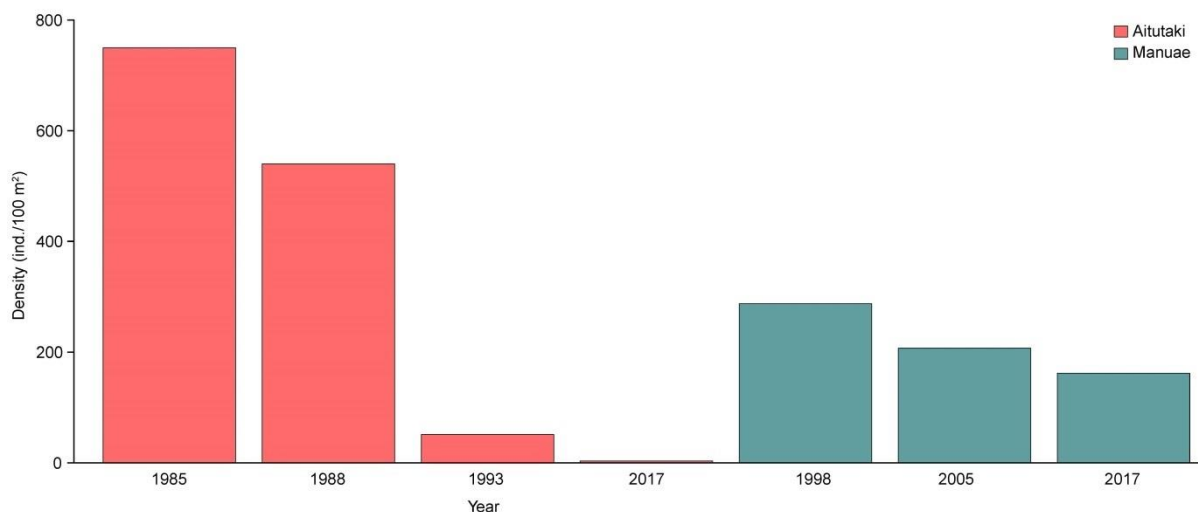


Figure 8. Historical comparisons of *paua* mean density for Aitutaki and Manuae.

In Manuae, *paua* were observed in densities up to 290 ind./100 m². Despite overall averages for Manuae, within some sites, *paua* densities were much higher and nearly equal to those previously reported for Aitutaki in the 1980s.

Manuae represents a unique ecosystem where dependence on marine resources by local communities is low. Manuae *paua* populations appear healthy and could support an effectively managed fishery, however, the failure of effective *paua* management in Aitutaki is a reminder that sustainable management and enforcement, while difficult, is essential. When compared to other southern group Cook Islands, Manuae is the last remaining area with high *paua* densities (Fig. 9). This provides even greater justification for conservation of Manuae *paua*. In the short-term, management decisions are best directed towards total protection of *paua* in Manuae rather than supporting a managed fishery.

⁵Bertram, I and Marurai, J. 1993. The status and management of paua in Aitutaki. Cook Islands Ministry of Marine Resources

⁶Ponia, B., Raumea, K., Turua, T. and Clippingdale, M. 1999. Coral and Fish Survey at Rarotonga Island. Ministry of Marine Resources. Report No. 99/?

⁷Morton, J. 1990. The Reefs of the Cook Islands, Shore Ecology of the Tropical Pacific (1st edition), UNESCO, Indonesia 113-124

⁸Sims, N. and Howard, N. 1988. Indigenous Tridacnid Clam Populations and the Introduction of *Tridacna derasa* in the Cook Islands. Ministry of Marine Resources

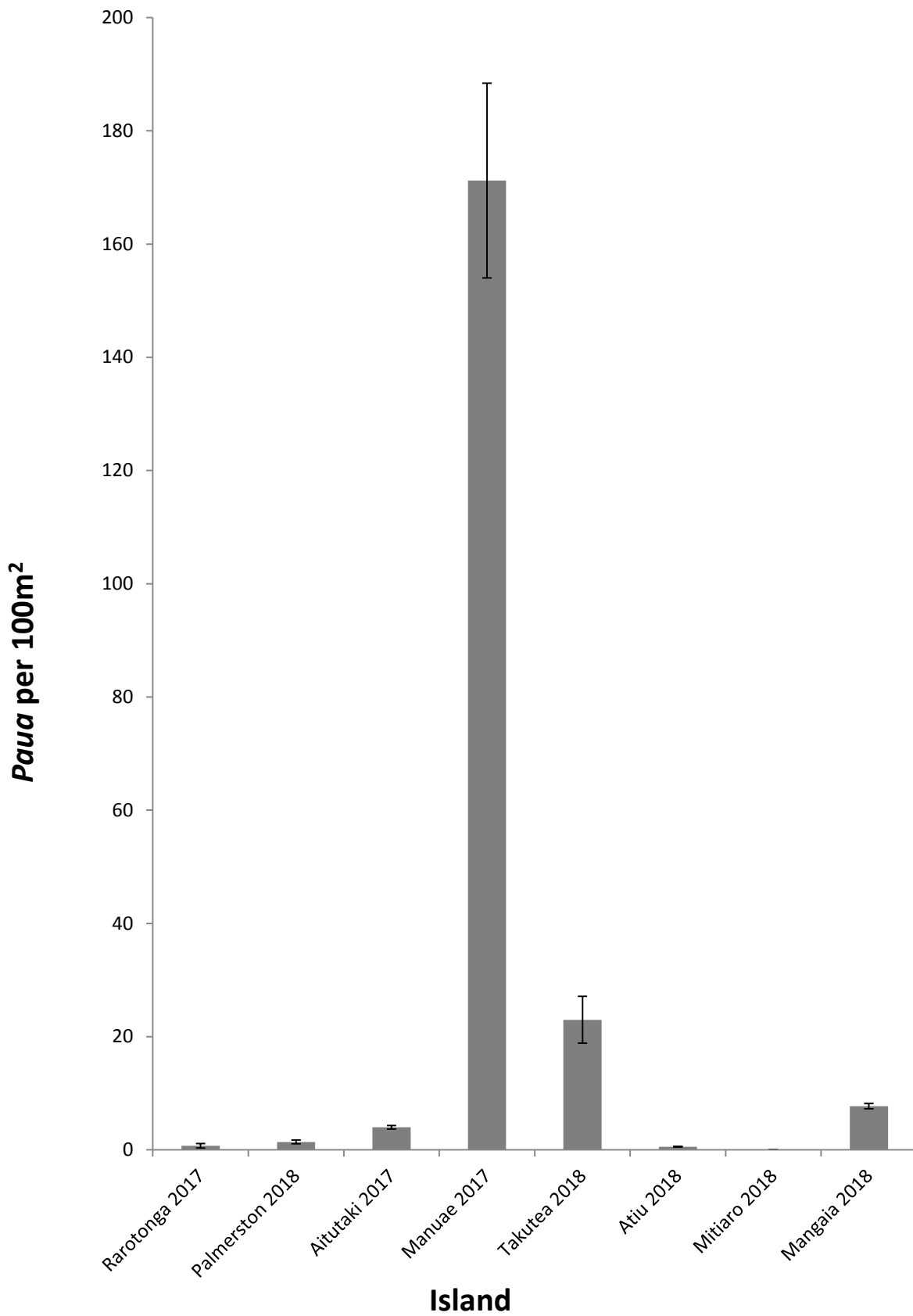


Fig. 9. Paua densities from recent surveys of Southern Group islands.

MANAGEMENT OPTIONS & RECOMMENDATIONS

Paua in Aitutaki are in need of functional protective measures. Current and historical management strategies have been insufficient at supporting a sustainable fishery and avoiding the population decline which occurred over the last 30 years. The *rā'ui* system may still be effective if stringent enforcement occurs. In the long term, for the purpose of growing and maintaining a healthy, wild stock of reproductive *paua*, we recommended that specific areas be permanently closed to *paua* harvest, implementation of more conservative daily bag limits and minimum harvestable size limits, and a ban of the sale of *paua* meat or parts.

In Manuae, *paua* are in high numbers and in what appear to be healthy densities. Although not observed on transect, our team noted lower densities near the main camp and passage which may indicate a shift in harvest effort from Aitutaki to Manuae and inter-island serial depletion. *Paua* habitat in Manuae is roughly 1/6 the size to that of Aitutaki. The small size of Manuae and therefore available *paua* habitat puts Manuae at increased risk of overharvest due to mismanagement. We recommend a closure to all *paua* harvest in Manuae until Aitutaki *paua* populations recover and a well-managed, functional fishery in Aitutaki is formed. Only after *paua* stocks have recovered and an effectively managed *paua* fishery in Aitutaki is formed, should the potential of harvesting *paua* on Manuae be investigated.

In Aitutaki, *maratea* were observed in high numbers. Fishing and spearfishing for these fish is reportedly uncommon and discouraged by locals. *Maratea* are a slow growing, long lived species which are easily overfished; global populations are currently endangered (IUCN). *Maratea* are important reef predators of *taramea* (*Acanthaster planci*) and a charismatic species for SCUBA and freedivers to encounter. We recommend restriction of take of these fish and encourage tour operators to include these fish as a component in ecotourism.

All species of sea turtles are globally endangered and local protection is necessary for their survival. Sea turtles were observed in both Aitutaki and Manuae and nesting was reported on Aitutaki and observed in Manuae. We recommend increasing efforts into turtle conservation activities such as reducing light pollution on nesting beaches, reducing plastic pollution and avoiding unnecessary interactions.

In some cases (e.g. *paua* management in Aitutaki), *rā'ui* has not been successful for species conservation. We recommend a review of management practices to assess an effective and sustainable way forward.



