Different Types of Anthropogenic Disturbances Have Unique Impacts on Sea Urchin and Coral Abundances in a Near-shore Marine Habitat of the Solomon Islands

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BACKGROUND

There is growing consensus that protecting marine ecosystems in the absence of concurrent management of adjacent terrestrial ecosystems is insufficient in the long-term (Halpern *et al.,* 2013). Various common disturbances in the remote Solomon Islands can lead to sediment loading and nutrient loading in coastal ecosystems. By studying the populations of species indicative of ecosystem health, the impacts of different terrestrial disturbances can be compared.

Here, we studied three areas adjacent to a logging port, village, and natural forest to see if different terrestrial disturbances impact sea urchin abundance and coral coverage differently.

METHODS

A. Designate logging, village, and natural areas, and establish 10 m x 10 m plots in each (n_{vil}=8, n_{log}=7, n_{nat}=8).

B. Count each sea urchin and sea star within the plot

C. Run a transect diagonally across taking photos of the sea floor with a scale bar every 2 meters

D. Measure visibility using contrasting colors.

E. Quantify coral coverage using coral point count software

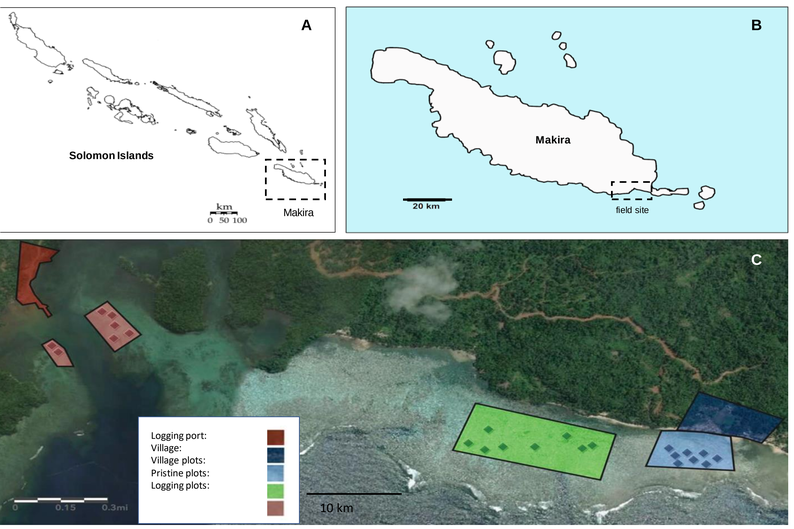

Fig 1A: Map of the Solomon Islands with Makira outlined
Fig 1B: Map of Makira and its surrounding islands with the field site outlined.
Fig 1C: Satellite image of the field site with the survey areas and disturbance sites outlined and the plot locations shown within the survey areas.

RESULTS

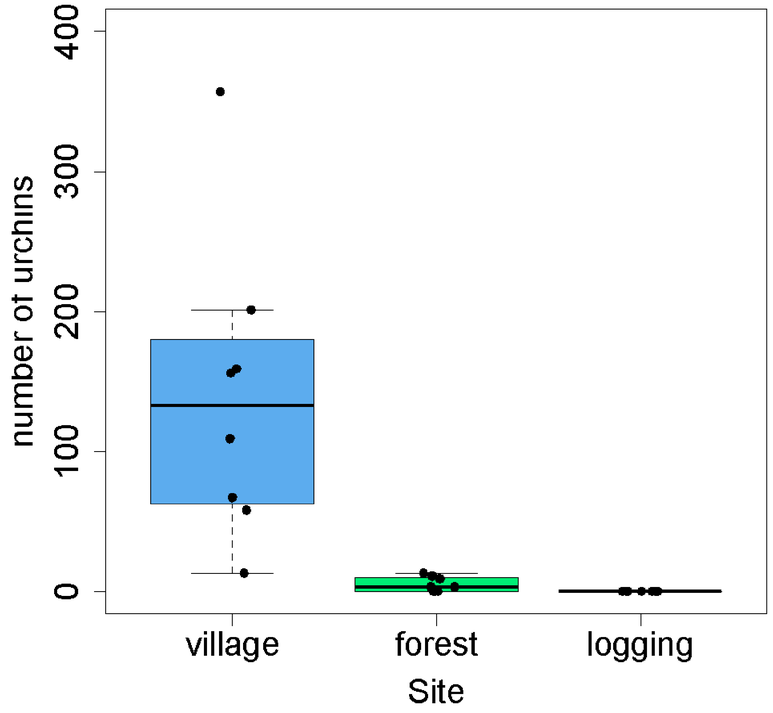

Fig. 1. Comparison of number of urchins between the village, pristine and logging study sites. Each dot/data point represents the number of urchins for each replicate plot within each study site. Each box plot shows the median, 25th and 75th percentiles, and the whiskers show the 5th and 95th percentiles. Statistical significance found between village and forest site, and village and logging site.

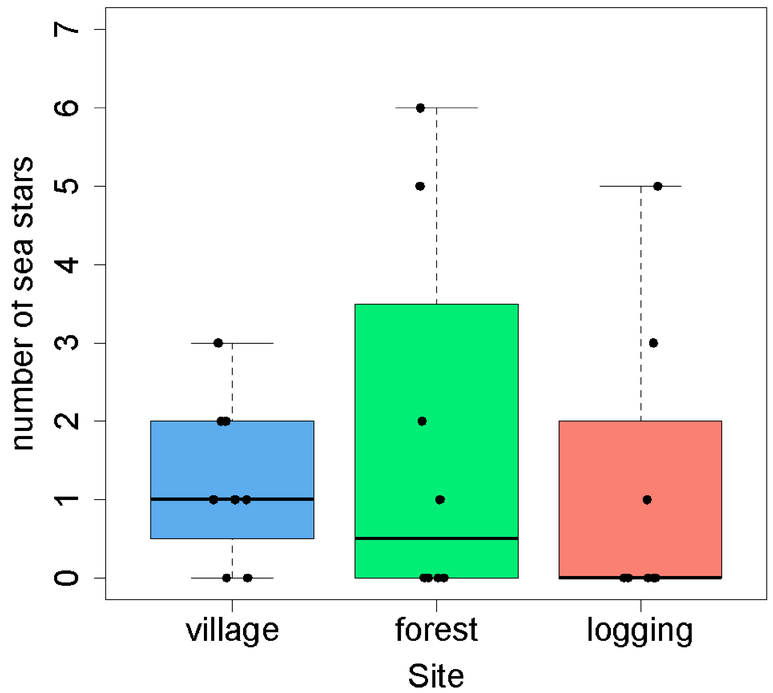

Fig. 2. Comparison of number of sea stars between the village, pristine and logging study sites. Each dot/data point represents the number of sea stars for each replicate plot within each study site. Each box plot shows the median, 25th and 75th percentiles, and the whiskers show the 5th and 95th percentiles. Statistical significance was not found between any of the sites.

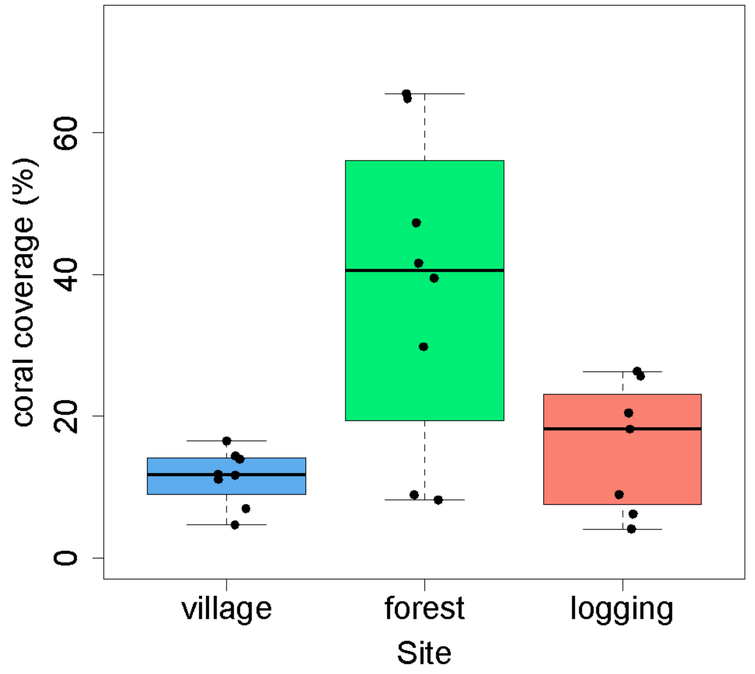

Fig. 3. Comparison of percent coral coverage along transects between the village, pristine and logging study sites. Each dot/data point represents the mean coral cover from seven digital images taken within each replicate plot for each study site. Each box plot shows the median, 25th and 75th percentiles, and the whiskers show the 5th and 95th percentiles. Statistical significance was found between the village and forest sites and the logging and forest sites.

Discussion

1. Coral coverage and urchin abundances are impacted differently by different types of disturbances.
2. Disturbances leading to increased sediment deposition reduce coral coverage and may be intolerable for urchins.
3. Nutrient-rich pollutants near the village likely spur benthic algal growth, outcompeting corals for light and greatly increasing food availability for urchins.
4. Logging and other terrestrial activities can greatly impact coastal ecosystems, and effective coastal management must consider both marine and terrestrial ecosystems.

ACKNOWLEDGMENTS

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CITATIONS

Halpern, B. S., Selkoe, K. A., White, C., Albert, S., Aswani, S., and Lauer, M. (2013). Marine protected areas and resilience to sedimentation in the Solomon Islands. *Coral Reefs*, *32*(1), 61-69.