

POSSIBLE EFFECTS OF HUMAN IMPACTS ON THE EPIBENTHIC COMMUNITIES AND CORAL RUBBLE FEATURES IN THE MARINE PARK OF BUNAKEN (NORTH SULAWESI, INDONESIA)

*Federica Fava*¹, Massimo Ponti¹, Alice Scinto², Barbara Calcinaï³, Carlo Cerrano²*

¹*Centro Interdipartimentale di Ricerca per le Scienze Ambientali (C.I.R.S.A.), Università di Bologna*

²*Dipartimento per lo Studio del Territorio e delle sue Risorse (Dip.Te.Ris.), Università di Genova*

³*Dipartimento di Scienze del Mare (Di.S.Mar.), Università Politecnica delle Marche*

**Corresponding author federica.fava3@unibo.it*

The Indo-Pacific coral reefs are considered the most complex and biodiversified ecosystems in the world and are threatened by both natural and anthropogenic factors. Assessment of anthropogenic disturbances is necessary to protect and manage these marine natural resources. The effects of human impacts due to boat traffic and anchoring on epibenthic assemblages and coral rubble features have been analysed in the Bunaken Marine Park. This park, established in 1991, consists of five islands and coastal sections of Sulawesi and supports a local population of some 30,000 villagers. Four impacted sites located close to the villages, and four well preserved sites used as a control, were analysed at 6, 12 and 18 m depth. Assemblages were sampled by photograph, while coral rubble covering, grain size and living portion, were assessed by direct samples. Data showed significant differences between the study sites with regard to anthropic presence. Species diversity and relative abundance of erect organisms decreased close to the village while encrusting sponges and massive corals increased. The percentage of coral rubble cover was significantly higher in the impacted sites, while the living portion was higher in the control samples. The fine fraction of coral rubble was more abundant in the impacted sites, coarse fraction prevailed at the control sites while intermediate fractions didn't show any differences. The assemblages lost three-dimensional structural complexity with increasing physical disturbances. These results are strongly independent regardless of depth. Anthropic activities, which damage corals and cause coral rubble rain, is performed on the flat and reef edge but its effects are transferred along the reef wall in depth.

Keywords: coral reefs, human impact, epibenthic assemblages, coral rubble, marine protected area