IH280: Comparison between methods to assess coral reef habitat quality: physical and biological properties, Indonesia

IH281: Comparison between methods to assess coral reef fish community structure and the production of standardized protocols, Indonesia

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Coral reefs are one of the most heavily studied ecosystems, due to their extremely high biodiversity and productivity, as well as their socioeconomic importance to local communities and regional economies. The complex set of ecological interactions found amongst reef communities make them a valuable model ecosystem for general ecological research, as well as being of interest to specific studies on the reef organisms themselves. They are also particularly vulnerable to predicted climate change, due to the high sensitivity of the ecosystem architects; Scleractinian corals. This threatens severe consequences to the future of reef systems, as well as the knock on effects to fisheries, ecotourism and coastal defence.

Monitoring efforts are therefore crucial to inform researchers and conservation organisations on the state of coral reefs around the world, and to identify temporal changes in habitat quality. This allows management efforts to be modified to better counter the specific threats posed to these fragile ecosystems.

Therefore organisations worldwide adopt coral reef monitoring programmes. Each of these is tailored to the particular scope of the organisation, as well as the resources available to them, such as manpower, site access, and the level of expertise of their staff. Some are aimed to provide academics with detailed data sets on which their research can be based, whilst others are designed to promote the inclusion of untrained ecotourists, thus boosting awareness and participation of the general public. Thus, the methods of assessment vary enormously between different organisations. Although this variation is often a necessity, due to the specific project aims, it makes reliable comparisons between data sets very difficult.

One of the key parameters to monitor is habitat quality. This includes calculating important values such as hard coral cover, and algal cover. The percentage cover of Scleractinian corals is often used as a proxy for reef health, although the specific topography and environmental conditions at a reef make a direct inter-site comparison not entirely reliable. However, temporal changes at a site rely on this value to monitor changes in reef habitat quality. Similarly, a key indicator of reef degradation is an increase in algal cover. Benthic macroalgae compete for space with corals, and their faster growth rates mean they would easily outcompete corals if conditions permit. By monitoring algal cover, negative factors such as eutrophication and a loss of herbivores can be identified.

There are numerous techniques in use for reef habitat quality assessment. These range from broad methods such as subjective research observations and manta tows, which are useful for collecting low resolution data over a large geographical area, to more detailed and time consuming transect and quadrat techniques. Transect methods are themselves varied, and include point intercept and video transects, to the highly detailed continuous line intercept technique. Each of these methods can themselves be modified by altering the level of taxonomic detail included in a survey. For example, identifying to coral genera provides the

most information, but requires experienced surveyors and increased effort when compared to simply classifying as hard coral, or restricting data to growth morphology rather than taxonomy. Research into the various methods available for benthic reef surveys will investigate the accuracy and reproducibility of each technique in comparison to the effort required. This will enable the best protocols for use within the Wakatobi to be identified, as well as determining sources of error, and will ultimately allow a better comparison between the various methods around the world.

As well as overall habitat quality, the abundance, diversity and community structure of associated fauna are also of significant interest to researchers and conservationists. This is particularly true for reef fish. As a group they provide valuable ecosystem services, as well as contributing to the high biodiversity found on reefs. They are also a valuable resource to fishing communities, and to the ecotourism industry. In addition, reef fish are believed to be of enormous value to the pharmaceutical sector, with the predicted incidence of bioactive compounds, and their associated medical applications, increased in communities of such high biodiversity.

Techniques used for monitoring fish communities also vary greatly. The simplest methods utilise a small number of indicator species to represent important aspects of the community, with total counts collected. More complex methods identify all fish to species level, although the amount of effort and expertise required for this is greatly increased. Traditional methods use visual census techniques, whereby fish are identified and counted by the naked eye. However, advancements in underwater videography mean that many modern surveys are filmed, and analysed later on dry land. These advances have culminated in the emergence of stereo-video monitoring, which utilises a dual camera apparatus, allowing additional parameters such as fish length and, thus, biomass to be included. Survey effort is typically restricted by either time, or more commonly by distance via belt transects.

Projects focusing on methods of fish monitoring will compare the accuracy and reliability of each technique at sites of different habitat quality, in comparison to the effort required. This will culminate in the production of a set of protocols which will enable conservation managers to optimise their efforts. It will also improve comparisons between data sets collected by the various techniques.

Reading List

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