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Reefs at risk in Central Sulawesi, Indonesia - status and outlook

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Abstract. Central Sulawesi Province, Indonesia in the heart of the Coral Triangle with over 4,500km of coastline including the Banggai Archipelago, Togean Islands Park and several smaller MPAs. Since the Reefs at Risk study in 2000/2001 predicted high threat levels for most reefs in the Province, several survey and monitoring programmes have been supported by international, national and local sources. This paper summarises coral reef condition and socio-economic data over the period 2001-2007 in 7 of the 10 District/City areas, key conclusions and local initiatives. Based on the Global Coral Reef Monitoring Network (GCRMN) scale, the average condition is Poor, with reefs in Very Poor, Poor, Average and Good condition in all 7 areas but extremely limited areas in Very Good condition. Major impacts include coral mining, sedimentation, destructive fishing (including invertebrate collection.), increasingly severe overfishing, take of protected species and predation by *Acanthaster plancii*, with low awareness regarding many illegal and/or destructive practices. Initiatives include coastal/reef ecology, survey and conservation for undergraduates, community MPAs, COTs clean-up and habitat restoration. However the extent and scope of management efforts still needs to be greatly increased to reverse the destructive trends and ensure "Reefs for the Future" here.

Key words: Central Sulawesi, Reef status, Reef monitoring, Reef management

Introduction and Methods

Central Sulawesi Province, Indonesia in the heart of the Coral Triangle has over 4,500km of coastline and over 700 islands including the Banggai and Togean Archipelagos, with almost continuous fringing reefs, extensive barrier reefs, patch reefs and several atolls.

The Togean Islands National Park was declared in 2004 and there are several smaller national and local MPAs. Since the Reefs at Risk study in 2000/2001 (Burke et al. 2001) predicted high threat levels for most of the reefs in the Province, a number of survey and monitoring programmes have been undertaken using GCRMN methods: Reef Check (Hodgson et al., 2004); manta tow, Line Intercept and Point Intercept transects (LIT/PIT) (English et al., 1997) in 7 of the 9 Districts and in Palu City, with support from international, national and local sources (Fig. 1.).

Many of these surveys also collected socio-economic data, mainly using the KAP (Knowledge, Attitude and Perception) method (CRITC 2001) or livelihoods survey tools (STREAM 2002). Published survey data and official reports (listed under References) are supplemented with as yet unpublished data and information collected by the authors.

The data available was analysed for two geographical areas: the so-called "West Coast" facing the Makassar Straits and Sulawesi Sea, including the Donggala, Tolitoli and Buol Districts and the City of Palu, and the "East Coast" around the Gulf of Tomini and Gulf of Tolo, including the Districts of Parigi Moutong, Poso, Tojo Una-Una, Banggai Kepulauan, , Banggai and Morowali.

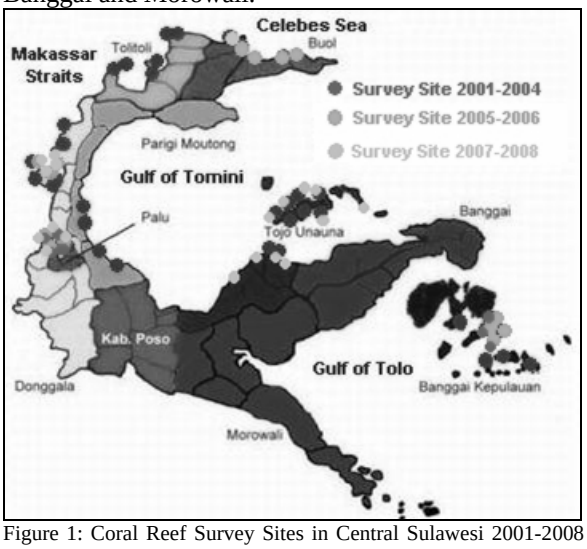

Figure 1: Coral Reef Survey Sites in Central Sulawesi 2001-2008 for which data was available for this study

West Coast: Makassar Straits and Sulawesi Sea

Tolitoli and Buol Districts form part of the Sulu-Sulawesi Marine Ecoregion (SSME) where Indonesia, Malaysia and Philippines have signed an agreement as basis for integrated sustainable management,. However so far there has been no involvement of regional (District and Provincial) Governments or stakeholders.

Where time series are available there has been little change in overall condition since 2004, though there is a slight downward trend. The average condition is Poor (11-30% hard coral cover), with highest coral cover generally observed near the reef crest except at Pasoso MPA where corals thrive to depths below Reef Check standards or even safe diving limits.

The most recent Manta Tow data indicating the range of coral reef condition by District and Reef Check/PIT data indicating hard coral cover at sites in this area are shown in Fig. 2.

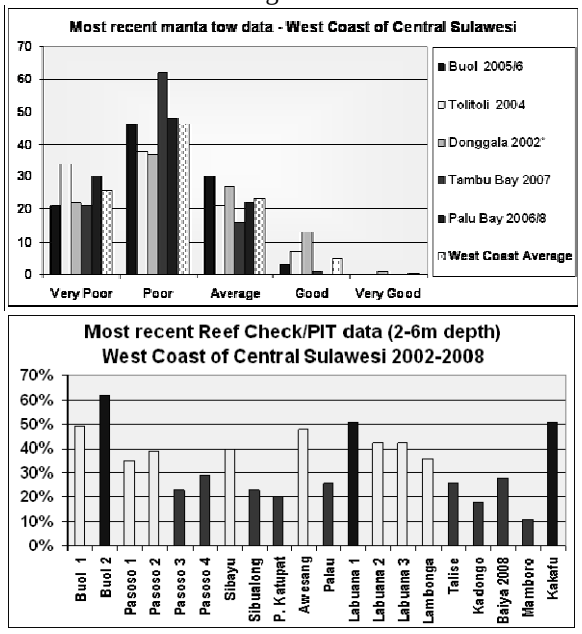

Figure 2: Most recent West Coast coral condition data, Manta Tow (above) and Reef Check/PIT (below)

Large fish are increasingly rare though some large demersal fish were seen in Buol. The Reef Check data from survey sites in the Makassar Straits and Palu Bay generally indicate very low populations of most commercial fish and invertebrate species.

KAP data from 2007 confirms this, with almost all fishers perceiving a fall in catch per unit effort (CPUE). In Tambu Bay, previously a source of fish for Palu City (Anonymous 2002) most fish sold is now from Kalimantan or the Gulf of Tomini (Anonymous 2007a)

Almost all marine species protected under the Law PP No. 7 1999 are found in the area and apart from the Coelacanth (recently discovered in Buol) all are exploited, most of them heavily. As an example, in Tambu Bay fishermen say the triton *Charonia tritonis* and napoleon wrasse *Cheilinus undulatus* are now fished out and turtles are increasingly rare; and all six species of Tridacnidae are collected in huge numbers and sold at low prices (cheaper than fish) in Tolitoli.

COTS attacks: the corallivorous Crown of Thorns starfish *Acanthaster plancii* is a major problem in all areas surveyed from 2004 onwards, a trend which was predicted from 2002 data (Anonymous 2002)

Coral mining: although illegal, massive corals are sold openly for around $10/m3. According to community members law enforcement personnel are often involved actively or in collusion

East Coast: Gulf of Tomini and Gulf of Tolo

Tomini Gulf data were available for Parigi Moutong and Tojo Una-Una, and Tolo Gulf data was from Banggai Kepulauan, whereas no data were available from Poso, Banggai, and Morowali Districts, meaning coral reef data for the Sulawesi mainland were limited with none for the Gulf of Tolo.

Banggai Kepulauan District comprises the Banggai Islands, and most coral reef data were from habitat and population surveys of the endemic Banggai cardinalfish, *Pterapogon. Kauderni*, there were no Reef Check indicator species data. However recorded observations and KAP study results indicate that overfishing is generally less severe than in the Gulf of Tomini or the West Coast. The abundance of fisheries produce has prompted the establishment of an industrial-scale fish processing plant at Biak in the Gulf of Tolo.

The average condition is (just) Average, with more Good reefs seen than on the West Coast (Fig. 3).

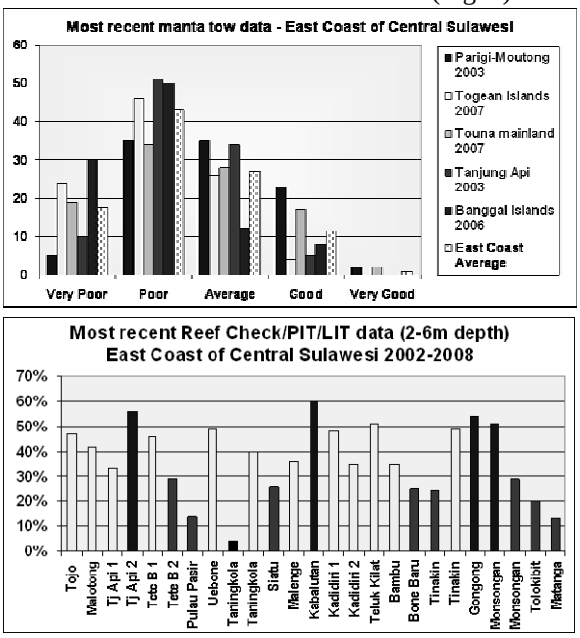

Figure 3: Most recent East Coast coral condition data, Manta Tow (above) and Reef Check/PIT (below)

Near to the shore, including the Togean Islands National Park, there is much severe damage due to

broadcast use of poisons (including cyanide), coral mining, gleaning etc, whereas bomb damage is generally worst at remote sites and mechanical damage when gleaning or harvesting invertebrates with crowbars especially abalone (*Haliotis* sp.) is often even more severe than the effects of better known forms of illegal and destructive fishing.

COTS: *A. plancii* is causing major damage at sites in Banggai Island (2004-2007) and was observed in high number at some sites in Tojo Unauna in (2008), other locations may be affected.

Ornamental fish trade: high in the Banggai Islands, increasing in Tojo Unauna and Parigi Moutong, as is the live reef fish trade which is prevalent in the area, with frequent use of poisons and mechanical damage.

Sedimentation is severe near larger rivers, high seasonal discharges seem to have killed some reefs near to estuaries, the remaining visible tips attesting to the recent nature of this phenomena. The majority of mangroves have been degraded or lost, according to a recent study comparing available historical data.

In most areas domestic garbage is a common sight, and in some areas severe eutrophication has been observed, especially near intensive paddy fields. However in the islands water quality is generally excellent, there is high marine biodiversity and despite extensive damage this area has several dive destinations with potential to expand, including reef conservation activities, "macro" photography and other specialty interests.

The process of establishing MPAs in Parigi-Moutong, Tojo Unauna and Banggai Kepulauan Districts has been facilitated by the communication of survey data to local stakeholders. Several de-facto reserves have evolved around marine tourism sites, often not without conflict.

General Trends and Threats

Some of the trends and threats observed across the Province include:

Coral condition monitoring: slight downward trend in coral condition; increased indirect impacts

Attitudes: KAP studies from 2002 and 2007 show growing community-level awareness regarding destructive fishing but little change as regards most other threats

Destructive fishing: bomb fishing: substantially reduced in some areas; poison fishing: reduced in some areas but increased in others, linked to the spread of the live and ornamental fish trades; other less-well known forms, especially related to invertebrate collection (abalone, clams etc), are often as damaging or even more so

Coastal abrasion: a growing problem in all areas, linked to the widespread coral mining & mechanical damage

Take of protected species: rife wherever economically worthwhile, sometimes due to ignorance but more often knowingly;

Overfishing: seems to be increasing

IUU fishing: many incursions by foreign vessels, mis/non-reporting of catch/cargo, etc

COTS outbreaks are occurring in all areas surveyed since 2004, causing substantial damage.

Recent initiatives and IYOR events

Initiatives since the presentation at the 10th ICRS in Okinawa in 2004 (Moore *et al*. 2004) have included:

Further dive/survey capacity building/training supported by the Sea Partnership Programme and Tojo Unauna Tourism Service.

The introduction of coastal ecology and conservation-related subjects into the curriculum of all local fisheries and marine undergraduate courses including field activities such as survey/monitoring and coral restoration trials

The establishment of several community MPAs (some proving effective) and the Togean Islands National Park (management to date ineffective with poor stakeholder relations)

Dive for Earth Day COTS control & reef monitoring (Reef Check, AWARE Fish Count, Coral Watch) in Palu Bay by YPH and STPL-Palu, supported in 2007 by Yayasan Reef Check Indonesia, in 2008 an IYOR event.

The establishment of the Tojo Una-Una Coral Triangle Centre (CTC) in February 2008 as a local response to the Coral Triangle Initiative (Fig 4.)

Figure 4: Declaration of the Tojo Unauna CTC in the Togean Islands by the District Head Drs Damsik Ladjalani.

Some IYOR activities have already taken place, however further events planned to celebrate the second IYOR in Central Sulawesi include:

Activities in connection with the Togean Festival and the Tojo Unauna CTC

"Fish homes" reef restoration in Palu Bay (Provincial Fisheries Service), Palu City and Donggala District (underway)

Biorock coral reef restoration training and application in Palu Bay (Provincial Fisheries Service) and Tojo Una-Una District (Sea Partnership Consortium and Tojo Unauna CTC)

Since 2004, a significant development is the promulgation of several national laws relating to coastal ecosystems, especially UU No27 of 2007 regarding coastal management, under which all activities which damage or destroy coral reefs are forbidden and most main threats to coral reefs are explicitly listed with heavy fines and prison sentences, including coral mining, at present possibly the number one direct threat to reefs in Central Sulawesi. However as far as the authors are aware no cases have yet been brought to court let alone resulted in conviction. At the local level, Provincial and District regulations for coastal management (PERDA Pesisir) and other instruments are in being drafted or even already promulgated, but similarly have yet to be (effectively) implemented.

Outlook for the future

Overall the outlook for reefs in Central Sulawesi is both better and worse than in 2004.

A positive point is the increase in awareness among stakeholders at community and government level including decision-making groups. However this is not always reflected in actions.

The improvements in the legal framework have yet to have a noticeable effect and law enforcement officials often seem to be among the least aware.

Government planning is beginning to be directed towards conservation and restoration and some local government authorities are beginning to implement programmes based on survey and monitoring data.

However the awareness of legislative bodies seems to lag behind that of the executive and in many cases have not ratified reef and other coastal system related budget items proposed by line agencies.

New threats are emerging. In particular, increasing threats from global climate change. Water temperatures range from 26-31°C, with 29-30°C being the most common, close to the upper tolerance limit for many coral species, though no significant bleaching has yet been recorded.

There is a long road ahead to ensure the protection of the reefs in good or average condition, stop or mitigate direct and indirect causes of degradation and restore damage. A major question is: can we increase the condition of our reefs and maximise their resilience to these new impacts, at a great enough scale and in time?

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References

Publications

Burke L., Selig E., Spalding M. (eds) (2001). Reefs at Risk in South East Asia. WRI, UNEP, WCMC, ICLARM,& ICRAN. Washington DC, USA.

CRITC (2001) Manual – Coral Reef Information And Training Center (CRITC). Project Management Office (PMO), Proyek Rehabilitasi Terumbu Karang (COREMAP), Jakarta.

English S, Wilkinson C, Baker V (1997). Survey Manual for Tropical Marine Resources. 2nd Edition, Australian Institute of Marine Sciences, Townsville, Australia.

Hodgson, G., Kiene, W., Mihaly, J., Liebeler, J., Shuman, C., and Maun, L. (2004). Reef Check Instruction Manual: A Guide to Reef Check Coral Reef Monitoring. Reef Check, Institute of the Environment, University of California at Los Angeles, USA.

Moore A. (2004). Coral Reef Survey & Monitoring for Management in Central Sulawesi, Indonesia, in UNEP (2004). Monitoring Coral Reefs for Better Management Schemes. UNEP EAS/RCU Small Grants Fund Programme 2002-2003, Bangkok, Thailand, pp.86-231.

Moore A, Yotolembah AS, Darwinto H (2006) Coral Reef Monitoring for Management in Central Sulawesi, Indonesia. Proc. 10th Int. Coral Reef Symp., Okinawa, Japan. 2004. 994-999 pp

STREAM (2002). A process and practice for understanding the livelihoods of fishers and farmers. Produced by www.multimediaasia.com. CD

Survey reports

Anonymous (2002). Laporan Final "Identifikasi Aktifitas Bagi Peningkatan Pendapatan Masyarakat Pesisir Dan Pengelolaan Sumberdaya Pesisir dan Laut di Lokasi MCMA". Yayasan Adi Citra Lestari kerjasama dengan BAPPEDA Propinsi Sulawesi Tengah, Palu, Indonesia.

Anonymous (2003). Penentuan Lokasi Pengembangan Budidaya Perikanan Pada Daerah MCMA Kabupaten Parigi Moutong. Kerjasama Dinas Perikanan dan Kelautan Kabupaten Parigi-Moutong dengan Yayasan Adi Citra Lestari, Palu Indonesia.

Anonymous (2006). Survey dan Inventarisasi Terumbu Karang Kabupaten Buol. Kerjasama BAPPEDA Kabupaten Buol dengan LPMS-KSDA.

Anonymous (2007a). Survey Terumbu Karang dan Ekosistem Perairan Dangkal di Teluk Tambu, Kabupaten Donggala. Laporan Akhir pada Program Mitra Bahari RC Sulawesi Tengah. Palu, Indonesia.

Anonymous (2007b). Reef Check Monitoring and COTS Control in Palu Bay, Central Sulawesi, Indonesia: Earth Day 2007 Activity Report. Yayasan Palu Hijau (YPH) and STPL-Palu (LP3M & MAPALA). http://www.reefcheck.org

LP3L Talinti (2006). Pendataan Habitat, Populasi dan Pemanfaatan Ikan Hias di Pulau Banggai, Sulawesi Tengah sebagai Dasar Perencanaan Pemanfaatan Bekelanjutan Secara Ekologis dan Ekonomis. Laporan Akhir pada Progam Mitra Bahari

Ndobe S (2008). Ekosistem Terumbu Karang Kabupaten Tojo Una-Una. Presentase pada Seminar Akhir kegiatan Penyediaan Baseline Data Ekosisem Pesisir dan Laut di Kabupaten Tojo Una-Una, Ampana, January 2008.

Ndobe S. (2005).Status Ekosistem Terumbu Karang Kabupaten Tolitoli, Propinsi Sulawesi Tengah. Makalah pada Seminar Nasional dan Kongress VII HIMAPIKANI (Palu, Indonesia.

Ndobe S, Moore A, Supu A (2005) Indonesian Ornamental Fish Trade: Case Studies and Options for Improving Livelihoods while Promoting Sustainability: Banggai Case Study. Final Report to NACA by Yayasan Palu Hijau, Palu, Indonesia.

STPL-Palu (2006). Pelatihan Survey Terumbu Karang dan Aplikasi pada Monitoring dan Zonasi Teluk Palu (Wilayah Pesisir dan

Laut Kota Palu dan Kabupaten Donggala). Laporan Akhir pada Program Mitra Bahari