

Distribution and abundance records updated for *Thelenota rubralineata* in the western Pacific, with notes on the “vacant niche” hypothesis

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Introduction

Thelenota rubralineata at the time of its formal description in 1991 (Massin and Lane 1991) has generally been considered to be rare over its distribution range. More recent reports indicate that this species occurs in significant numbers at some localities such as the Bunaken–Manado Tua Marine Reserve in north Sulawesi (Lane 1999a), Solomon Islands (Kinch 2005), Zaragosa Island, Cebu, Philippines (Alexander Kerr, pers. comm.), and that in the Solomon Islands at least, it is exploited — to an as yet unquantified extent — as a beche-de-mer resource (Kinch 2005). Rarity and vulnerability have prompted concerns over the conservation status of this spectacular member of the echinofauna (Lane 1999b; Kinch 2005), but moves to list this, or indeed most other threatened beche-de-mer species, under CITES (Anon 2002) are as yet unsuccessful, largely because the global status of these species is currently considered data deficient, and species and product identification issues remain (Sant 2006).

This short note updates the known distribution records for *T. rubralineata* and documents sightings — by the author, through personal communications to the author, in the published literature, and from underwater photograph archives on the Internet (Fig. 1 and Table 1). I also address, but do not presume to fully answer, the following questions:

- (a) Is *T. rubralineata* a rare species?
- (b) Is the increased number of sightings a consequence of: 1) diving forays further afield and/or to deeper depths by diving scientists and underwater photographers, 2) an increase in population recruitment, 3) a migration to shallower depths on reef slopes, or 4) a combination of any or all of these factors?
- (c) If population numbers are indeed increasing on shallow reef slopes, could this be in response to the existence of a “vacant niche” resulting from overexploitation (Conand 1998; Uthicke and Benzie 2000; Uthicke et al. 2004) of other members of the beche-de-mer macro-

fauna, and their delayed or persistent lack of population recovery?

Results and discussion

Updated distribution data (Fig. 1 and Table 1) indicate many more sites, since the late 1990s (Lane 1999a), where *T. rubralineata* has been reported. These sites however, are all within the known distribution range, which, as noted by Kinch (2005), covers much of the “coral triangle” of maximum marine biodiversity, as well as the adjacent region of the tropical western Pacific Ocean. Delineation of the zone maximum marine biodiversity is currently the focus of much debate and research (Hoeksema 2007) but it is interesting to note that extension of the range for *T. rubralineata* to the southeast through Melanesia (Fig. 1.) concurs with the suggestion (Hoeksema pers. comm.) that for corals there may be need to extend the peak marine biodiversity zone to the southeast. Unlike its congeners, *T. ananas* and *T. anax*, which extend their range to the western Indian Ocean, *T. rubralineata* has not been reported from the Indian Ocean. A recent origin for this species within the maximum marine biodiversity triangle is a distinct possibility but this is currently speculative as molecular clock data on the phylogeny of the genus are not yet reported and details of the reproductive biology, particularly the duration of planktonic larval life and dispersal capability, are unknown.

In addition to the above-mentioned reports of *T. rubralineata* occurring in significant numbers and densities, there are also a number of other locations where multiple sightings have been recorded (Table 1). Three individuals were reported close together on 13 December 2007 at a depth of 20–25 m at Yeffam Island, northwest Pulau Keruo, Rajah Ampat, West Papua, and another on 2 December 2007 at a similar depth at southwest Kri Island nearby (Bert Hoeksema pers. comm. and photographs). Multiple sightings of *T. rubralineata* have been made by the author at Espiritu Santo, Vanuatu, with records from three sites (south Aore

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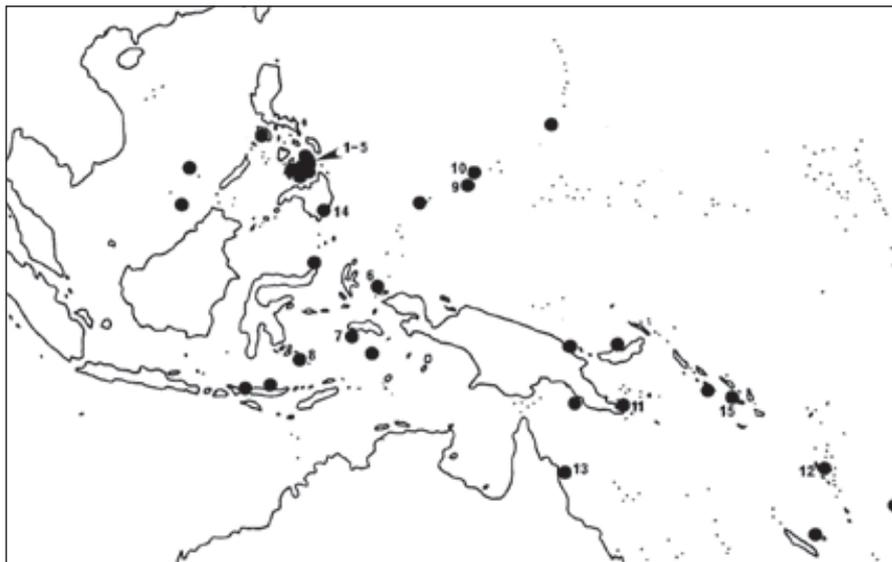


Figure 1. Distribution of *Thelenota rubralineata* (presence indicated by solid circles). Un-numbered sites are from Lane (1999 a,b). Numbered sites represent new records by the author, records from personal communications to the author, data from recent publications, and photographic records in Internet archives. The site numbers cross reference to Table 1, which provides details of records and sources.

Table 1. Data records for recent sightings (mainly after 1997) of *Thelenota rubralineata*.

| Site No. | Location | Number recorded | Date | Depth (m) | Source |
|----------|---|-----------------|-----------------|-----------|---|
| 1 | Tulang Is, Camotes Islands, Philippines | 1 | 2003, 2005 | 27 | http://www.poppe-images.com/images/search_results.php?category=sea%20cucumber&species=Thelenota%20rubralineata |
| 2 | Panglao, Philippines | 1 | 2006 | 34 | |
| 3 | Mactan Is., Philippines | 1 | 2006 | 37 | |
| 4 | Cuatro Islas, Leyte, Philippines | 1 | ? | 20+ | Schoppe 2000 |
| 5 | Zaragosa Is., Cebu, Philippines | Abundant | 2006 | 6-30+ | Alexander Kerr, pers. comm; Kerr et al., 2006 |
| 6 | Rajah Ampat, West Papua | 4 | 2–13 Dec 2007 | 20-35 | Bert Hoeksema, pers.comm. |
| 7 | Ambon, Indonesia | 2 | 1996 | 20-30 | |
| 8 | Wakatobi Is, Tukangbesi Islands, SE Sulawesi | 1 | 2006 | ? | http://paulsim.myphotos.cc/Photo%20Pages/Indonesia/Sulawesi/Wakatobi/House%20Reef/thele.htm |
| 9 | Yap, Caroline Islands Micronesia | 1 | 2007? | 60+ | Brian Greene, cited in Kerr et al. 2007 |
| 10 | Ulithi Atoll, Caroline Islands, Micronesia | 1 | ? | ca 25 | Alexander Kerr, pers. comm. (data from Vanessa Fread) |
| 11 | Milne Bay Province | 4 | 2002 | 0-20 | Skewes et al. 2002 |
| 12 | Aore Is., Áesé Is. & Palikaulo Bay, Espiritu Santo, Vanuatu | 8 | 14–30 Sept 2006 | 30-35 | Records of the author and Willem Renema |
| 13 | Ribbon Reef, northern Great Barrier Reef, Australia | 1 | ? | ? | http://www.reef.crc.org.au/publications/annualreport/annrep98_99.pdf |
| 14 | N. Samal Is., Mindanao, Philippines | 2 | Nov 2006 | ? | Steve Purcell, pers. comm. |
| 15 | Bonegi, Guadalcanal, Solomon Islands | 3 | 2006 | 18-30 | Ramohia 2006 |

Island, 35 m depth, 14 September 2006; Palikaulo Bay, 30 m⁺, 23 and 30 September 2006; northwest Áesé Island, 30 m depth, 29 September 2006), and up to four individuals were seen during a single dive (northwest Áesé Island). Two individuals were reported and photographed in November 2006 from north Samal Island, near Davao, Mindanao, Philippines (Steve Purcell, WorldFish Center, pers. comm.). At Bonegi, Guadalcanal in the Solomon Islands, three individuals were found in a single “deep” transect (18–30 m) during marine fishery resource assessments (Ramohia 2006). However, none were noted off-transect or in any of the other 62 deeper transect sites. Other reports similarly indicate infrequent sightings of *T. rubralineata* during intensive sea cucumber stock assessments. For example, large-scale surveys (1126 dives covering an area of 256,000 km²) throughout Milne Bay Province (Skewes et al. 2002) recorded just four individuals for this species and at Yap a stock assessment and biodiversity inventory records a single individual at 60 m⁺ depth (Brian Greene, cited in Kerr et al. 2007).

Thus, it appears that *T. rubralineata*, an unmistakable and not easily overlooked member of the macrofauna that is non-cryptic in its behaviour (as an adult at least), occurs widely over its range but is patchy in distribution and rare at many localities. Perhaps the highest densities recorded thus far are at Bunaken Island, northern Sulawesi (Lane 1999a,b), with a density of 17 individuals per 3750 m², equating to 45 individuals per ha. It is possible that localised aggregation of this species at the Bunaken site is the consequence of eddy current entrainment of larval recruits behind the promontory of this boomerang-shaped island. However, since aggregations occur elsewhere, an alternative explanation is possible. Large aspidochirote sea cucumbers are generally overfished and severely depleted throughout much of the tropical western Pacific (Conand 1998; Uthike and Benzie 2000; Uthicke et al. 2004) and it is possible that new juvenile recruits of *T. rubralineata* or migrants from deeper water are colonizing a vacant niche on shallow reef slopes. At the Bunaken–Manado Tua Marine Reserve, populations of high and medium value commercial beche-de-mer species remain low, apparently a legacy of earlier exploitation (Lane 1999a). During a week-long scuba search by the author at the Bunaken Reserve in December 2007, not a single specimen of *Thelenota ananas* or *Holothuria whitmaei* was seen; only two *Holothuria fuscogilva* were found and other beche-de-mer species were infrequently encountered. Thus, although hard quantitative data are lacking, recovery of commercial beche-de-mer stocks at this now protected marine reserve near Manado is imperceptible. The food resource for benthic-feeding aspidochirote sea

cucumbers on reef slopes thus appears to be underutilized at this location and probably also on fished-out reef slopes elsewhere.

The December 2007 visit to Bunaken Island revealed the continued presence of significant numbers of *T. rubralineata* at the site surveyed 10 years previously in 1997 (Lane 1999a,b). Six individuals were sighted during a single dive on 20 December 2007 over a depth range of 15–30 m. None were measured but all were adult and of similar size to those measured in 1997. Since juveniles or intermediate sizes (less than 1 kg) were not observed either in 1997 or 2007, and since the population appears to be localized, the question of individual longevity arises. Photographs of numerous individuals were taken in 1997 and a repeat of this exercise, in collaboration with Faculty of Fisheries and Marine Science, Sam Ratulangi University, Manado, is anticipated for early 2008 in the hope of matching individuals, on the basis of the not unreasonable assumption that the complex fingerprint-like patterns of crimson lines are stable over time.

Acknowledgements

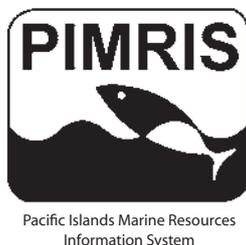
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References

- Anon. 2002. Trade in sea cucumbers in the families Holothuridae and Stichopodidae. A paper presented for the 12th Meeting of the conference of the Parties: Interpretation and Implementation of the Convention Species Trade and Conservation Issues. 3–15 Nov. Santiago, Chile. 28 p.
- Conand C. 1998. Overexploitation in the present world sea cucumber fisheries and perspectives in mariculture. p. 449–454. In: Mooi R. and Telford M. (eds). Echinoderms. Proceedings of the Ninth International Echinoderm Conference San Francisco, California, USA, 5–9 August 1996. Rotterdam/Brookfield: Balkema.
- Hoeksema B.W. 2007. Delineation of the Indo-Malayan Centre of Maximum Marine Biodiversity: The Coral Triangle. p. 117–178. In: Renema W. (ed). Biogeography, time, and place: Distributions, barriers, and islands. Springer Press. 416 p.
- Kerr A.M., Netchy K.H. and Gawel A.M. 2006. Survey of the shallow-water sea cucumbers of the Central Philippines, 20 May to 20 June 2006. University of Guam Technical Report No. 119. 51 p.

- Kerr A.M., Netchy K.H. and Hoffman S.M. 2007. The shallow-water echinoderms of Yap. Results of a survey performed 27 July to 9 August 2007, including a stock assessment of commercially valuable species. A report prepared for the Director of Resources and Development, Yap State, Federated States of Micronesia. University of Guam Marine Laboratory Technical Report 121, Aug 2007. 38 p.
- Kinch J. 2005. The commercial use of *Thelenota rubralineata* in the Solomon Islands. SPC Beche-de-Mer Information Bulletin 21:3–4.
- Lane D.J.W. 1999a. A population survey of the 'rare' stichopodid sea cucumber, *Thelenota rubralineata*, off northern Sulawesi, Indonesia. p. 499–503. In: Carnevali M.D.C. and Bonasoro F. (eds). Echinoderm Research 1998: Proceedings of the 5th European Conference on Echinoderms, Milan. Rotterdam: A.A. Balkema.
- Lane D.J.W. 1999b. Distribution and abundance of *Thelenota rubralineata* in the western Pacific: Some conservation issues. SPC Beche-de-Mer Information Bulletin 11:19–21.
- Massin C. and Lane D.J.W. 1991. Description of a new species of sea cucumber (Stichopodidae, Holothuroidea, Echinodermata) from the Eastern Indo-Malayan Archipelago: *Thelenota rubralineata* n. sp. *Micronesica* 24(1):57–64.
- Ramohia P. 2006. Fisheries resources: Commercially important macroinvertebrates. In: Green A., Lokani P., Atu W., Ramohia P., Thomas P. and Almany J. (eds) Solomon Islands marine assessment: Technical report of the survey conducted May 13 to June 17, 2004. The Nature Conservancy Pacific Islands Countries Report No. 1/06.
- Sant G. 2006. CITES and sea cucumbers. In: Bruckner A. (ed). Proceedings of the Technical Workshop on the conservation of sea cucumbers in the families Holothuridae and Stichopodidae. NOAA Technical Memorandum NMFS-OPR 44, Silver Spring MD. 239 p.
- Schoppe S. 2000. A guide to common shallow water sea stars, sea urchins, sea cucumbers and feather stars (Echinoderms) of the Philippines. Times Editions, Singapore. 144 p.
- Skewes T., Kinch J., Polon P., Dennis D., Seeto P., Taranto T., Lokani P., Wassenberg T., Kousoukos A. and Sarke J. 2002. Research for the sustainable use of beche-de-mer resources in the Milne Bay Province, Papua New Guinea. CSIRO Division of Marine Research Final Report. 40 p.
- Uthicke S. and Benzie J.A.H. 2000. The effect of bêche-de-mer fishing on densities and size structure of *Holothuria nobilis* (Echinodermata: Holothuroidea) populations on the Great Barrier Reef. *Coral Reefs* 19:271–276.
- Uthicke S., Welch D. and Benzie J.A.H. 2004. Slow growth and lack of recovery in overfished holothurians on the Great Barrier Reef: Evidence from DNA fingerprints and repeated large-scale surveys. *Conservation Biology* 18(5):1395–1404.

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