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Original paper

Current status of the distribution of the coral-encrusting cyanobacteriosponge *Terpios hoshinota* in southern Japan

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Abstract The cyanobacteriosponge *Terpios hoshinota* encrusts living coral and other benthos, and occasionally undergoes massive outbreaks, resulting in large amounts of damage to coral reef ecosystems. At the same time, this species is theorized to be expanding its range in the northwestern Pacific. Despite this, the current distribution of this species in Japan is unknown, with no research having been conducted since an initial assessment in 1984−1985. To address this information deficiency, a survey of the Ryukyu Archipelago from Amami Oshima Island south to the Yaeyama Islands was conducted to assess the distribution of *T. hoshinota* over the period of 2009 to 2011. Field images have been posted as an online image archive for researchers to utilize in future research. Our findings show that the presence of *T. hoshinota* is not uncommon in this region, with at least 23 of 64 (=36%) sites with this species. This is a considerable increase from levels reported in 1984−1985 (11 of 182 sites, =6%), and suggests this species is now a permanent feature in the coral reef ecosystems of this region. However, large outbreaks were at approximately the same levels as reported in 1984−1985. Most *T. hoshinota* were found in shallow (<5 m) depths, and abundance does not appear to be greatly influenced by seasons. It may be that general degradation of reefs in these decades has contributed to the spread of this species. Long-term monitoring and additional research are needed to assess the threat *T. hoshinota* poses to the coral reefs of southern Japan.

Keywords cyanobacteriosponge, *Terpios*, coral reef threat, distribution, Ryukyu Archipelago

Introduction

Coral reef ecosystems are undergoing degradation due to a myriad of different yet interlinked problems (Pandolfi et al. 2003). As these ecosystems harbor very high levels of biodiversity, and have important service function in both economic and cultural terms for humans, protecting reefs is now considered "of immediate importance" by the United Nations (Plenary, 65th General Assembly, 69th Meeting, December 20, 2010). In order to properly protect coral reefs, understanding of the threats facing them is necessary. In recent years, researchers have identified and investigated many causes of coral reef degradation, including coral bleaching due to abnormally high (e.g. Lesser et al. 1990) and low ocean temperatures (Hoegh-Guldberg and Fine 2005), crown-of-thorns starfish outbreaks (Moran et al. 1988), pollution and nutrification (Pastorak and Bilyard 1985), and overexploitation (Glynn 1996; Guard and Masaiganah 1997).

One additional threat to be added to the above list is one species of cyanobacteriosponge, *Terpios hoshinota* (Suberitidae). Although first notice in Guam (Bryan 1973) and only formally described in 1993 (Rützler and Muzik 1993), this sponge is known to occasionally undergo massive outbreaks in the northwestern Pacific (e.g. Marine Park Center Foundation 1986), and is distributed from the Northern Mariana and Western Caroline Islands, with additional distribution in the Philippines, Taiwan and American Samoa (Plucer-Rosario 1987). As an encrusting sponge, during outbreaks *T. hoshinota* overgrows almost any hard substrate, including corals and other coral reef benthos, which it often smothers. Thus, due to these outbreaks, coral reefs can suffer large amounts of damage. The presence of *T. hoshinota* was reported from the Ryukyu Archipelago in 1984−1985 (Rützler and Muzik 1993), and in 1985−1986 the first massive outbreak was documented in Japan, where much coral died at Yonama and Boma, Tokunoshima Island, due to *T. hoshinota* overgrowth (Marine Park Center Foundation 1986; Rützler and Muzik 1993). Due to its black color and encrusting shape, it was first referred to as a "black disease" by local media, and this sponge covered $>$80% of hard substrate in some areas (Marine Park Center Foundation 1986; Rützler and Muzik 1993).

Furthermore, recent research from Taiwan (Liao et al. 2007) and the Great Barrier Reef, Australia (Fujii et al. 2011) suggests this sponge is expanding its range in the Pacific, perhaps as coral reefs weaken due to cumulative stress and degradation (Rützler and Muzik 1993). Despite this, there are almost no data on the distribution of *T. hoshinota*, and baseline data on this potential threat are desperately needed. In this study, in order to both assess the current situation of *T. hoshinota* distribution in Japan, and to provide a baseline data set for future researchers, we have conducted a one-year survey examining *T. hoshinota*'s presence in the Ryukyu Archipelago (Nansei Islands) to the south of Amami Oshima Island. Additionally, we have posted field images of *T. hoshinota in situ* online to help assist future researchers. We compare our results to data from Rützler and Muzik (1993), who examined the same areas in 1981−1985, and discuss future directions of research on this important and potentially destructive encrusting sponge.

Materials and methods

Identification of *Terpios hoshinota*

Terpios hoshinota was identified based on morphological diagnostic characters as described in Rützler and Muzik (1993). *Terpios hoshinota* is easily identifiable from numerous characters both *in situ* and *ex situ*. In the field, the sponge forms a thin ($<$1 mm) crust that overgrows hard substrate, and this crust is thin enough so that the texture of the underlying substrate remains visible. In shallow habitats, the upper side (e.g. light-exposed) is often light gray to silver, while the underside (bottom-facing) of the sponge is dark brown (Fig. 1A). In areas with relatively few waves or currents, the sponge may be slightly thicker. Additionally, small oscula (pore-like openings) are often visible in the field (Fig. 1A), and have astrorhizae radiating outwards from them (Fig. 1B). *Terpios hoshinota* has large numbers of endosymbiotic cyanobacteria, and upon preservation in ethanol the solvent will turn dark green (Hirose and Murakami 2011).

Assessment of presence of *Terpios hoshinota*

Various locations (64 sites, Table 1) in the Middle and South Ryukyus were investigated by snorkeling or SCUBA between January 2010 and February 2011 for the presence or absence of *T. hoshinota*, which were identified *in situ* as given above.

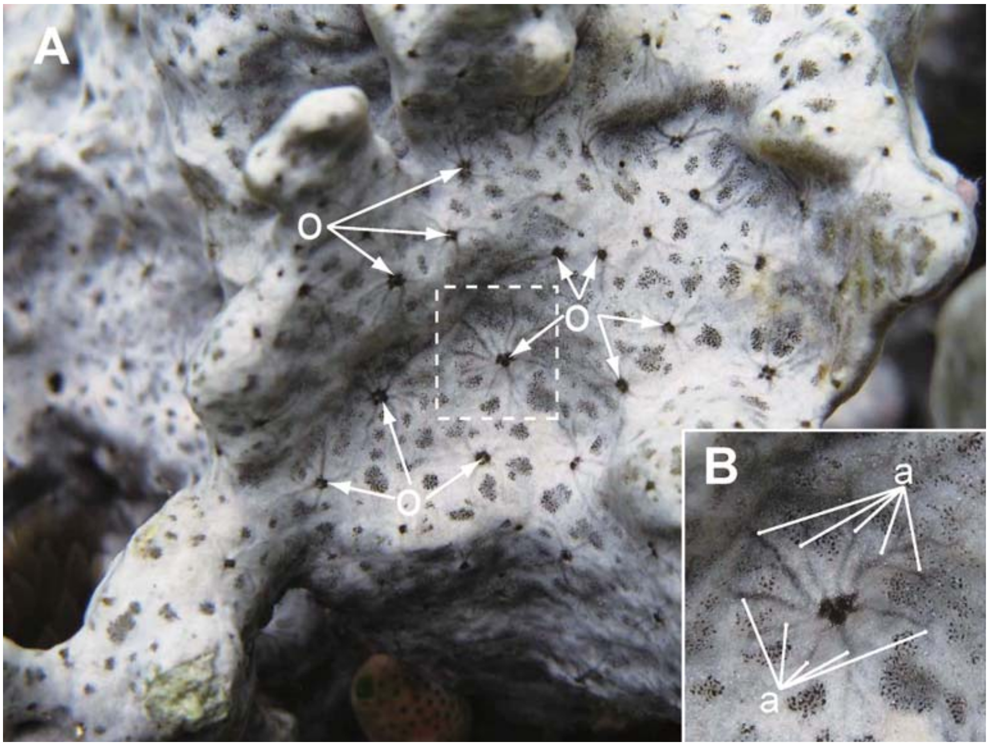

Fig. 1 *Terpios hoshinota in situ*. A. Showing characteristic light gray color and numerous small oscula (pore-like openings; =o), with inset area of B shown as dashed line. B. Detailed image of astrorhizae (a) radiating outwards from oscula. Image from Bise, Okinawa Island, January 16, 2010. Dashed inset image approximately 1 cm^2

Generally, search times were approximately one hour, although some sites were visited more than once, particularly on Okinawa Island, and on Yoron, Okinoerabu, and Tokunoshima Islands. If present, images of *T. hoshinota* were taken with an underwater camera, and the depth, substrate and relative abundance were noted. Abundance was judged and classified using the following criteria: 1) “not present”, with no *T. hoshinota* noted; 2) “limited”, defined as small or single patches of *T. hoshinota* present that were <30 cm in diameter (Fig. 2A); 3) “moderate”, defined as the presence several *T. hoshinota* patches of up to approximately 50 cm in diameter over a semi-extensive area (tens of meters) (Fig. 2B); and 4) “extensive”, with extensive large patches (>50 cm) present over a large area and covering most (>50%) of available hard substrate (Fig. 2C). Additional distribution data reported from other researchers were added only if both 1) images were present, and 2) the exact location was known.

Results

Presence of *Terpios*

Of the 64 sites investigated during the course of this study, *T. hoshinota* was confirmed at 23 sites, with two more potential sites (Bora, Miyako Island and Sesoko Island) where encrusting sponges growing over live coral were seen but not confirmed (=not collected and examined) to be *Terpios* (Fig. 3, Table 1). At 40 sites, *T. hoshinota* was “not present”, with no colonies noted. However, at several sites (n=19), the presence of *T. hoshinota* was “limited” (Fig. 2A, Table 1). At five sites (Nagayama Port, Irabujima Island; Ikemajima Island, Miyako Islands; Bise, Motobu; Ie, Kunigami; and Nishizaki, Ie Island), we deemed the presence of *T. hoshinota* to be “moderate”, with usually several large patches of approximately 50 cm growing over hard coral (Fig 2B, Table 1). At one location (Yakomo, Okinoerabu Island), the presence of *T. hoshinota* was “extensive”,

Table 1 Records of distribution of *Terpios hoshinota* in the Middle and South Ryukyus

Location	Date(s)	Abundance	Depth investigated (m)	Reported by	Notes
Yaeyama Islands					
Shiraho, Ishigaki	2010.2.4	+	1-3	JDR, EH	Samples collected.
Uganzaki, Ishigaki	2010.9.7	+	8	MN	Appeared in 2004-5.
Yonehara, Ishigaki	2010.2.4	-	1-3	JDR, EH	
Miyako Island + close islands					
Aragusuku, Miyako	2010.3.22	-	0-5	MN	
	2010.8.10	+	1-2	MN, MM	In-reef only.
Bora, Miyako	2010.8.14	?	8	MN	
Majya North, Miyako	2010.8.11	+	0-3	JDR, MM	Both out-reef, in-reef.
Nagayama Port, Irabujima	2010.11.30	++	0-5	HS, KY	
Hokutonohama, Ikemajima	2010.7.26	+	2	HS, KY	
Niiramaenohama, Ikemajima	2010.3.25	++	0-5	MN, HS, KY	In-reef only, samples collected.
	2010.8.11	++		EH, MN, JDR	
Yabiji, Ikemajima	2010.8.13	+	2-11	MN	
Kumejima Island					
Arahama	2010.2.22	-	0-5	RY	
	2010.6.14	+	0-1	EH	On *P. digitifera* only (1 colony).
Inamuse	2010.2.25	-	0-2	RY	
Maja	2010.6.14	-	0-1	EH	
Shimajiri	2010.6.14	-	0-1	EH	
Shinri-hama	2010.6.13	-	0-1	EH	
Okinawa Island + close islands					
Awa, Nago	2011.1.24	+	5	MO	On faviid corals.
Bise, Motobu	2009.12.12	++	0-1	AK	
	2010.1.16	++	0-1	EH	Monitoring.
	2010.3.1	++	0-1	EH	Monitoring.
	2010.7.8,	++	0-1	EH	Monitoring.
	2010.9.8	++	0-1	EH	Monitoring.
	2010.11.4	++	0-1	EH	Monitoring.
	2011.1.21	++	0-1	EH	Monitoring.
Bise (channel), Motobu	2010.10.8	+	0.5	EH	Not present in previous checks in 2009. Tidepool directly in front of parking area.
Convention Center, Ginowan	Numerous	-	0-5	JDR et al.	
Hedo-misaki, Kunigami	2010.10.23	-	0-2	JDR, MN	
Ie, Kunigami	2010.12.3	++	1-2	MN	On *Porites.*
Irijima, Urasoe	2010.5.20	-	0-1	EH	
Kin (Red) Beach, Kin	2010.1.3	-	0-13	RN	
Kouri Higashi, Korijima Island	2010.3.11	-	0-2	RY	
Maeda, Onna	Numerous	-	0-30	JDR et al.	
Manza, Onna	2010.8.29	+	2	MN, RN, MO	In-reef, on *Porites*, faviid corals.
	2010.10.14	+	2	MO	In-reef, on *Porites*, faviid corals.
	2011.2.8	+	2	JDR et al.	In-reef, on *Porites*, faviid corals.
Mizugama, Kadena	2009.12.11	-	1-3	RY	
Nishizaki, Ie Island	2011.3.5	++	0-1	KN	
Odo, Itoman	2008.12.14	+	NA	ORC	
Oura Bay, Nago	2009.12.16	-	5-20	RN	
	2010.3.22	+	7-9	TF	
Sakiyama, Nakijin	2010.7.17	+	1	CN	
Seragaki, Onna	2010.6	+	0-1	MN	
Sesoko Island	2010.2.15	?	30	YF, MO	Red encrusting sponge on *Acropora* coral.
North side, Sesoko Island	2010.6	+	2	MN, HS	In-reef.
Sunabe, Chatan	Numerous	-	0-18	JDR et al.	
Teniya, Nago	2010.11.4	-	0-16	JDR, MN	

Table 1 Continued

	2011.1.1	-	0-16	JDR et al.	
Toguchi, Kadena	Numerous	-	0-5	JDR et al.	
Yona, Kunigami	2010.10.22	+	5	JDR	On rock, samples collected.
Zampa, Yomitan	Numerous	-	0-30	JDR et al.	
Zatsun, Kunigami	2010.10.23	-	0-20	JDR, MM	
Yoron Island					
Maehama	2010.3.3	+	17	JDR, MN, MM	
Ukachi	2010.3.4	-	0-20	JDR, MN, MM	
Ukachi South	2010.3.4	-	Intertidal	JDR, MN, MM	
Okinoerabu Island					
Kasaishi	2010.3.7	-	0-15	JDR, MN, MM	
Okidomari	2010.3.5	-	0-10	JDR, MN, MM	
Sumiyoshi	2010.3.5	-	0-20	JDR, MN, MM	
Yakomo	2010.3.6,	+++	1-4	JDR, MN,	Monitoring, samples collected.
	2010.8.30,	+++	1-4	MM	Monitoring, samples collected.
	2010.9.23,	+++	1-4	MM	Monitoring, samples collected.
	2010.10.22,	+++	1-4	MM	Monitoring, samples collected.
	2010.12.6	+++	1-4	MM	Monitoring, samples collected.
				MM	
Tokunoshima Island					
Aze Prince Beach	2010.3.9	-	0-3	JDR, MN, MM	
Maedomari (Isen)	2010.3.8, 2010.3.11	- -	0-20	JDR, MN, MM	
Omonawa	2010.3.9	-	0-15	JDR, MN	
San East In-reef	2010.3.9, 2010.3.10	+	0-3	MM	
San East Out	2010.3.10	-	3-20	JDR, MN	
Shokita	2010.3.9	-	0-3	MM, MN	
Yonama	2010.3.8	-	0-3	JDR, MN, MM	
Amami Island					
Kurasaki North	2010.3.7	-	0-10	RN	
Kurasaki South	2010.3.5	-	0-11	RN	
Power Station	2010.3.6	-	0-15	RN	
Sakihara	2010.3.5	-	0-10	RN	
Tebiro	2010.3.4	-	0-12	RN	
Tebiro North	2010.3.10	-	0-12	RN	
Tebiro South	2010.3.10	-	0-11	RN	
Uten	2010.3.7	-	0-8	RN	
Yadori North	2010.3.8	-	0-8	RN	
Yadori South	2010.3.8	-	0-8	RN	

Terpios hoshinota abundance symbols: - =no *T. hoshinota* observed, +="limited" *T. hoshinota* observed, ++="moderate" *T. hoshinota* observed, +++="extensive" *T. hoshinota* observed; ?=unknown encrusting sponge observed.
Abbreviations (in order of appearance): JDR=James Davis Reimer, EH=Euichi Hirose, MN=Megumi Nakano, MM=Masaru Mizuyama, HS=Hikaru Sunagawa, KY=Kojiro Yonaha, RY=Ryuta Yoshida, MO=Masami Obuchi, AK=Aoi Kojima, RN=Rie Nakano, KN=Kazuhiko Nagaya, ORC=Okinawa Reef Check, TF=Takuma Fujii, CN=Chihiro Nishihara, YF=Yoshihisa Fujita.

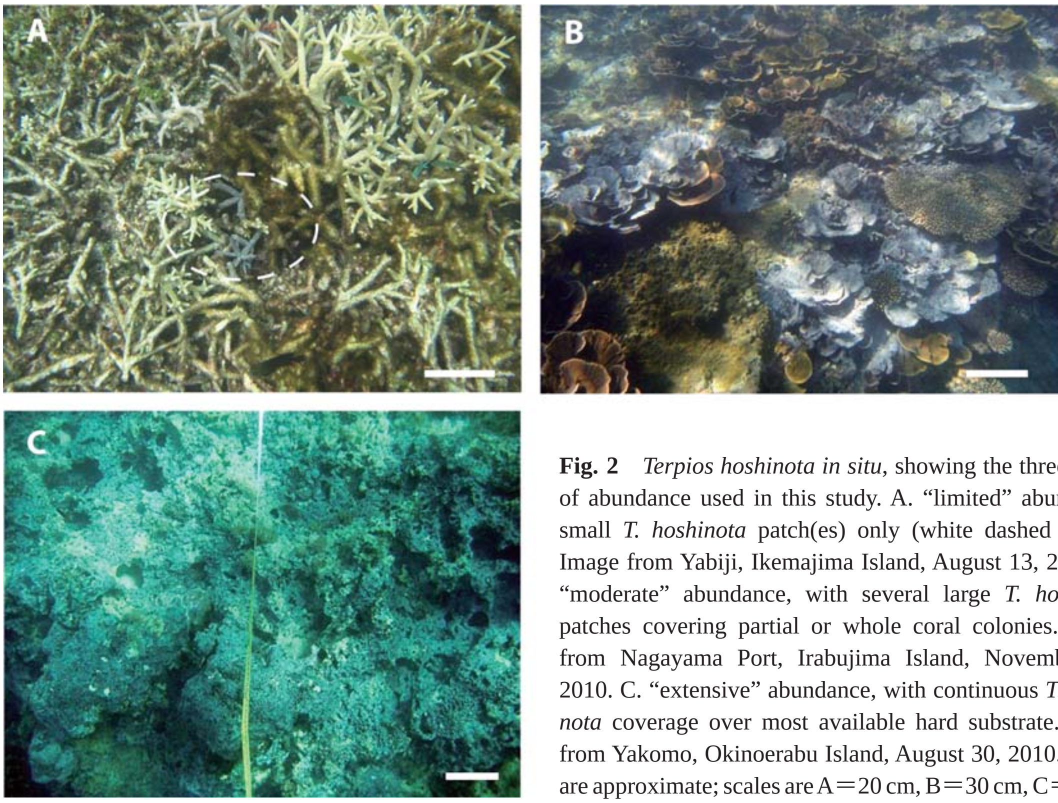

Fig. 2 *Terpios hoshinota in situ*, showing the three levels of abundance used in this study. A. "limited" abundance, small *T. hoshinota* patch(es) only (white dashed circle). Image from Yabiji, Ikemajima Island, August 13, 2010. B. "moderate" abundance, with several large *T. hoshinota* patches covering partial or whole coral colonies. Image from Nagayama Port, Irabujima Island, November 30, 2010. C. "extensive" abundance, with continuous *T. hoshinota* coverage over most available hard substrate. Image from Yakomo, Okinoerabu Island, August 30, 2010. Scales are approximate; scales are A=20 cm, B=30 cm, C=10 cm

with large extensive patches that formed a continuous mat over almost all hard substrates, with cover approaching 80% in areas (Reimer et al. 2011; Fig. 2C, Table 1). Images from most locations are available as Supplementary Fig. 1 – Image Archive available for public download at: http://www.dropbox.com/gallery/4269504/1/Terpios%20hoshinota%20Archive?h=e8fab9, or upon request from the corresponding author.

Terpios hoshinota colonies were found at all major islands/island groups investigated except for Amami Oshima Island (thus, on the Yaeyama Islands, Miyako Islands, Okinawa Island and surrounding islands, Kumejima Island, Yoron Island, Okinoerabu Island, and Tokunoshima Island) (Fig. 3, Supplemental Fig. 1 Image Archive). Most colonies (n=20/23 locations with *T. hoshinota*, =87%) were only found in depths of 5 meters or less, with only three locations (=13%) with *T. hoshinota* exclusively at depths of 5–20 meters (at Yabiji, Ikemajima Island, Miyako Islands, *T. hoshinota* was present from 2 to 11 meters). The deepest *T. hoshinota* colony confirmed was at 17 meters (Maehama, Yoron Island; Table 1).

Stability of *Terpios* populations

Among the 23 sites in which *T. hoshinota* was recorded, we surveyed five sites more than once; Niiramaenohama (Ikemajima Is.), Bise (Okinawa Is.), Manza (Okinawa Is.), Yakomo (Okinoerabu Is.), and San East In-reef (Tokunoshima Is.), and *T. hoshinota* populations were always found at these locations (Table 1). For instance, patches of *T. hoshinota* at Bise, Okinawa Island, were always found over the period from December 2009 to January 2011 in bi-monthly monitoring, and the massive outbreak at Yakomo did not drastically change in size during monitoring from March to December 2010 (surveyed five times; Table 1).

Covering on non-coral organisms

Terpios hoshinota covered not only dead and live corals but also coral limestone and other organisms such as coralline algae, *Halimeda* spp. (green alga), and occasionally shells of giant clams (Supplementary Fig. 2A–C). As well, in the zoanthid *Palythoa tuberculosa*, one colony's periphery that was partly covered with *T. hoshinota* was discolored (Supplementary Fig. 2D). In contrast, some

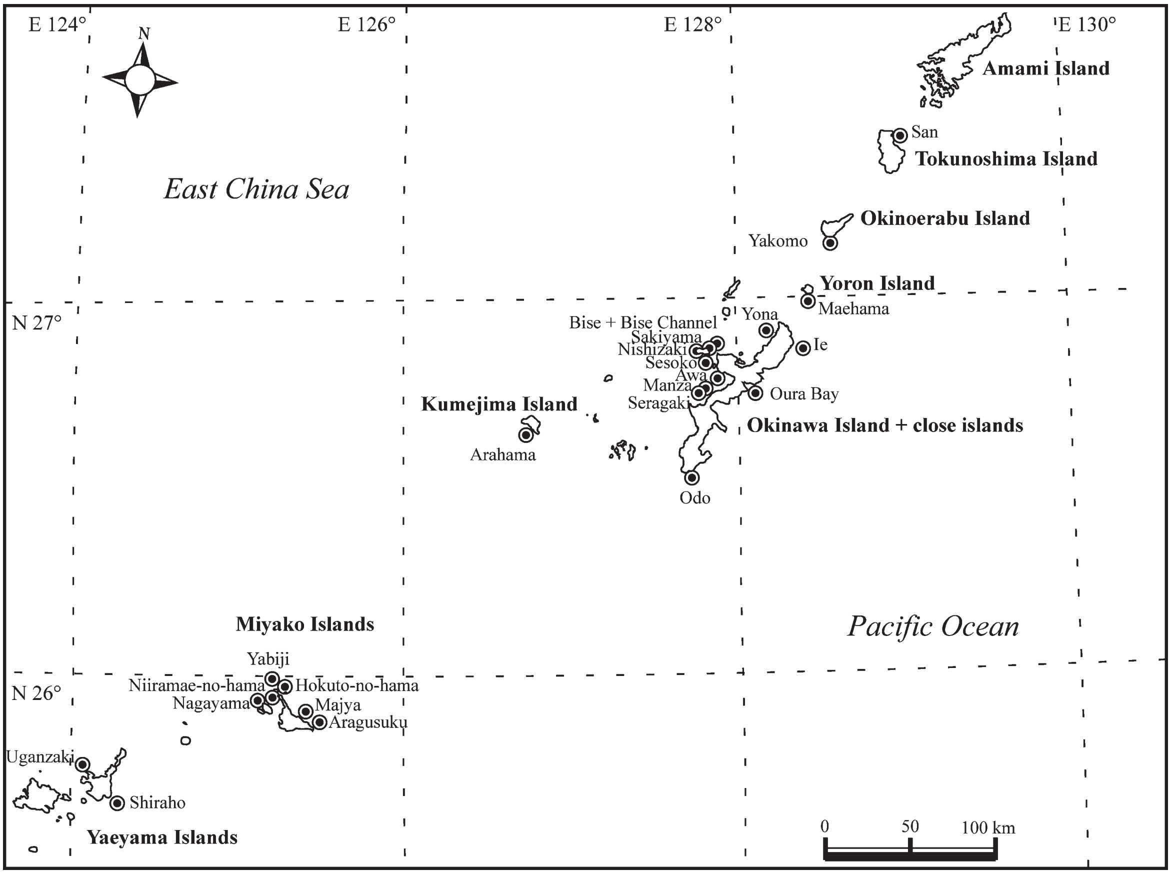

Fig. 3 Map of *Terpios hoshinota* distribution in the Middle and South Ryukyu Archipelago as confirmed in this study. Locations with presence of *T. hoshinota* confirmed are shown as closed circles. For detailed information on each location, see Table 1 and Supplemental Fig. 1 (image archive)

algae (e.g., *Ceratodictyon spongiosum* and *Cladophoropsis vaucheriaeformis*), sea anemones (likely *Mesactinia ganensis*), sea urchins, and *Didemnum molle* colonies (ascidians) were not covered even when they existed on or nearby patches of *T. hoshinota*. These organisms may be able to coexist with *T. hoshinota* (Supplementary Fig. 2).

Discussion

Distribution and abundance of *Terpios hoshinota* in the Ryukyu Archipelago

Similar to Rützler and Muzik (1993), it appears that *T. hoshinota* is widely distributed from Tokunoshima I. southward in the Ryukyu Archipelago, although only in small numbers at most locations, and generally at shallow (<5 m) depths. From the comparison of our data to the data from 1985–1986 it appears that *T. hoshinota* is spreading slowly in this region, and is a usual but minor component of coral reef ecosystems in the Ryukyu Archipelago. In this study, we confirmed the presence of *T. hoshinota* at 23 of 64 sites (=36%), while in Rützler and Muzik (1993), *T. hoshinota* was only noted at 11 of 182 sites (=6%). This increase could be partially due to the overall degradation of coral reefs in this region due to ecosystem stress incurred by bleaching, crown-of-thorns starfish outbreaks, and/or human impacts. When this species arrived in this region is unknown, and we cannot ascertain from the data of this study as to whether or not *T. hoshinota* is spreading its distribution in the northwestern Pacific as theorized in Liao et al. (2007), although Rützler and Muzik (1993) mention that the species was not noticed in surveys until 1985. Asides from Amami Oshima Island, the presence of *T. hoshinota* was confirmed from every major island or island group (Fig. 3).

Terpios hoshinota has not been reported from sites north of Amami Oshima Island in Japan, suggesting that its distribution may be limited to warmer subtropical or tropical waters. In this study, no *T. hoshinota* colonies were seen north of Tokunoshima. Rützler and Muzik (1993) reported the small occurrence of *T. hoshinota* at two sites on Kakeroma-jima Island (southern Amami Islands) where we did not investigate in the present study. We investigated ten sites on Amami Oshima Island (Table 1), and found no *T. hoshinota*. Furthermore, to date the occurrence of *T. hoshinota* has never been reported from the Osumi Islands and southern Kyushu. Thus, a tentative northern limit of *T. hoshinota* may lie somewhere in the Amami Islands. In general, the diversity of many zooxanthellate hard corals and related animals such as zoanthids (Ono et al. 2008) and photosymbiotic ascidians (Hirose and Nozawa 2010 and references therein) decreases along a northerly gradient in the Ryukyu Archipelago, so the theory of *T. hoshinota*'s northern limit is not without precedent. Future research into the distribution in the North Ryukyus (Kagoshima Prefecture) and southern Kyushu are needed to confirm the distribution of this species.

Despite the overall increase in the presence of *T. hoshinota* in the Ryukyu Archipelago, it appears as if the number of large outbreaks (＝“extensive”) did not increase much between 1985–1986 and 2010 (2/182＝1.1% of locations in 1984–1985; 1/64＝1.6% of locations in this study). Furthermore, outbreaks again were confined in the Ryukyu Archipelago to the islands of southern Kagoshima Prefecture (Tokunoshima Island in 1985–1986; Okinoerabu Island in 2010).

Ecology of *Terpios hoshinota* outbreaks

While this study and other recent research (Liao et al. 2007; Fujii et al. 2011) have documented the distribution of *T. hoshinota*, the ecology of this species remains understudied. In particular, the mechanism(s) behind massive outbreaks remain unknown, as well as the dynamics of the outbreaks themselves. Rützler and Muzik (1993) speculated that turbidity in nearshore areas may contribute to outbreaks of this sponge. However, in this study, *T. hoshinota* was found not only in areas with high turbidity, but also at relatively pristine locations (e.g. Manza, Ie, Bise, for example). Combined with the likely increased presence of *T. hoshinota* on reefs in the Ryukyu Archipelago when compared to Rützler and Muzik's (1993) data, it appears that this species is now well established in this region. It may also be that continued coral reef degradation and/or stress has contributed to the spread of *T. hoshinota*, as coral reefs in the Ryukyu Archipelago are in much poorer condition now than in 1984–1985 (T. Kimura, personal communication).

However, it may be that turbidity is one factor causing massive outbreaks of *T. hoshinota*. In this study, we could only confirm one site undergoing a massive outbreak, at Yakomo, Okinoerabu Island. The reef is located in front of a small stream, and along the shore bordering the stream is a stone-cutting factory. Thus, it is plausible that the waters of Yakomo are more turbid than surrounding areas, although this remains to be confirmed. Similarly, the original massive outbreak reported from Yonama, Tokunoshima Island, was in a nearshore reef next to construction (Rützler and Muzik 1993).

The dynamics of outbreaks remain to be examined as well. Patches of *T. hoshinota* at Bise, Okinawa Island, and Yakomo, Okinoerabu Island, were always found over the period from December 2009 to January 2011, and the massive outbreak at Yakomo also did not drastically change in size over approximately the same period. These short-term (one year) data suggest that usually *T. hoshinota*'s coverage remains relatively stable regardless of season. Furthermore, at the site of the massive outbreak in Tokunoshima Island in 1985 (Yonama), no *T. hoshinota* was found in 2010 (Reimer et al. 2011). These findings imply that massive *T. hoshinota* outbreaks are not an ecological dead-end, and may be reversed. However, due to the lack of data, we cannot yet estimate length/durability of outbreaks, and clearly more research (e.g. monitoring) is needed to understand this subject. The outbreak of *T. hoshinota* likely directly impacts on some non-coral benthos by overgrowing them or competing for space. Interestingly, some organisms appeared to be able to coexist with *T. hoshinota* (Supplemental Fig. 2E, F). Regardless, since corals form the base architecture in the coral-reef ecosystem, degradation of these reef-builders should result in the death of these *Terpios*-resistant organisms over the long-term. Additional studies on *T. hoshinota's* competition with other benthos (hard corals, soft corals, etc) such as Wang et al. (2012) are also urgently needed to gain a better understanding of their ecology.

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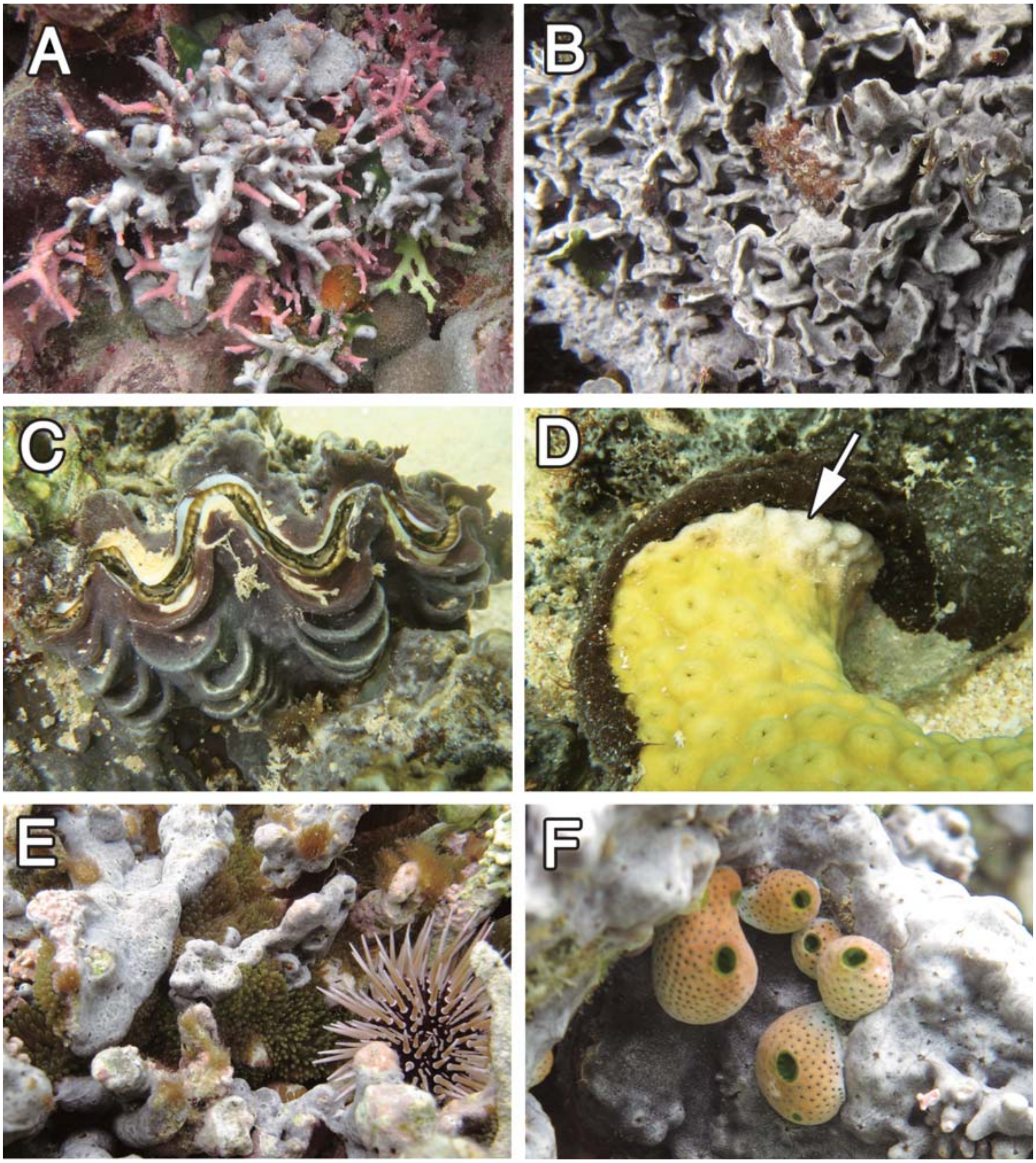
Supplemental Material

Supplemental Fig. 1 (Image Archive) Images of *Terpios hoshinota* taken *in situ* from this study. Images are available for download at: http://www.dropbox.com/gallery/4269504/1/Terpios%20hoshinota%20Archive?h=e8fab9, or upon request from the corresponding author, with location and date given in each subfolder name. For further information (depth, etc.) refer to Table 1.



Supplemental Fig. 2 Non-coral organisms in the patches of *Terpios hoshinota* were covered (A–D) or not covered with the sponge (E, F). (A) Coralline algae. (B) Green algae, *Halimeda* sp. (C) Shells of a giant clam, *Tridacna squamosa*. (D) Colony periphery of the zoanthid *Palythoa tuberculosa* partly covered with *T. hoshinota* and discolored (arrow). (E) Sea anemones, *Mesactinia ganensis*, and a sea urchin, *Echinometra mathaei*. (F) Ascidian colonies *Didemnum molle* on a coral skeleton completely covered with *T. hoshinota*