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SHORT COMMUNICATION

Novel fish-polychaete interactions, including the description of a unique partnership between a frogfish and a sabellid worm

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Abstract

Coral reefs host diverse ecological interactions, including a recently documented novel association between reef blennies and gobies and the species of *Spirobranchus* (Polychaeta, Serpulidae) commonly known as Christmas tree worms. We extend these records by adding *Ecsenius bandanus* Springer, 1971 to *Spirobranchus*-associated blennies. Furthermore, we report a previously unrecorded interaction between the frogfish *Antennarius pictus* (Shaw, 1794) and a species of Sabellidae likely belonging to *Sabellastarte*, two widely-distributed Indo-Pacific species. The frogfish directly approached the sabellid passing a pectoral fin through its extended radioles without triggering the worm's typical withdrawal response, and then settled beside it while extending its lure for feeding. This behavior may confer enhanced camouflage and feeding advantages to the frogfish and potential protective or energetic benefits to the worm. Further research is needed to assess its prevalence and ecological significance across Indo-Pacific reefs.

Keywords Antennariidae · Associated fauna · Coral reef · Ecological interactions · Sabellidae · Symbiosis

Introduction

Symbiosis is integral to highly-diverse tropical coral reef ecosystems, often involving habitat or food provision rewarded in exchange for predator deterrence or cleaning (Patton 1973; Reaka-Kudla 1997). Symbiotic interactions occur along a continuum rather than as discrete categories, making it difficult to draw clear boundaries between commonly used forms such as commensalism, mutualism, and parasitism. Symbiotic associations are typically classified by their effect on the host (beneficial or harmful) and duration relative to the symbiont's lifespan (Parmentier and Michel 2013).

Polychaete worms are frequent participants in such associations, usually as symbionts (but also as hosts) of other invertebrate taxa (Martin and Britayev 2018). Contrary, records of polychaete associations with small-bodied reef fishes, such as gobies and blennies, have been rarely reported and mostly involved the use of empty tubes or holes created by burrowing invertebrates (including polychaetes) as refuges or nesting sites (Wilson et al. 2013). An example is the Caribbean spinyhead blenny *Acanthemblemaria spinosa* Metzelaar, 1919 that inhabits empty serpulid tubes (Clarke and Tyler 2003).

Recently, blennies and gobies were observed perching on exposed radioles of the Christmas tree worm *Spirobranchus corniculatus* (Grube, 1862) (Serpulidae) in Kimbe Bay (Papua New Guinea), without triggering the worm's withdrawal response that is typically elicited by other reef fishes or physical disturbance (Bennett-Smith et al. 2025). Here we add the banded blenny *Ecsenius bandanus* Springer, 1971 to the list of *Spirobranchus* associates and report a similar, yet very distinct, observation of the frogfish *Antennarius pictus* (Shaw, 1794) interacting with a feather-duster worm (Sabellidae) likely belonging to *Sabellastarte*, and discuss potential benefits for both partners.

Material and methods

Observations were made during recreational scuba dives by the first author. The blenny/serpulid interaction was observed at Whale Rock, (Misool, Fiabacet Islands,

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Indonesia) at 14 m depth during a 74 min 32% nitrox dive on 30 October 2013, and recorded with a Nikon D7000 (AF-S 105 mm F2.8G VR Micro lens) in a Nauticam housing with a pair of Inon Z240 strobes. The frogfish/sabellid interaction was observed at Teluk Kembahu II, (Lembeh Strait, Sulawesi, Indonesia) at 13 m depth during a 62 min, 32% nitrox dive on 20 May 2008, and recorded with a Nikon F4 camera (60 mm F/2.8D Micro lens) in a Nexus F4 housing with a pair of Nikonos 105 SB strobes. In this case, images were taken with Fuji Velvia 50 film.

Results

Two distinct fish–polychaete interactions were observed: (1) Blenny/serpulid: *Ecsenius bandanus* was observed perching on the exposed radioles of *Spirobranchus* sp. for approximately three minutes (Fig. 1a). The worm's radioles were fully extended before the arrival of the blenny, and remained so during the presence of the fish and after its departure; (2) Frogfish/sabellid: *Antennarius pictus* slowly approached a specimen of cf. *Sabellastarte* and passed a pectoral fin through the worm's branchial filaments without provoking withdrawal (Fig. 1b–d). The fin was moved gently and gradually, allowing the worm's branchial filaments to move around it without disruption. This enabled the frogfish to position itself in intimate proximity – though not directly upon – the extended filaments (Fig. 1e). Once settled, the frogfish deployed its lure for hunting (Fig. 1e–f). The interaction lasted approximately ten minutes.

Discussion

Our observations expand the range of documented fish-polychaete associations by adding *E. bandanus* to the list of fish interacting with Christmas tree worms. Similar interactions were reported in Papua New Guinea, involving blennies and gobies (Bennett-Smith et al. 2025), and in the Caribbean, where yellow-nose goby *Elacatinus randalli* (Böhlke & Robins, 1968), known to feed on external fish parasites, was observed picking food particles from *Spirobranchus giganteus* (Pallas, 1766), suggesting kleptoparasitism (DeLoach and DeLoach 2020).

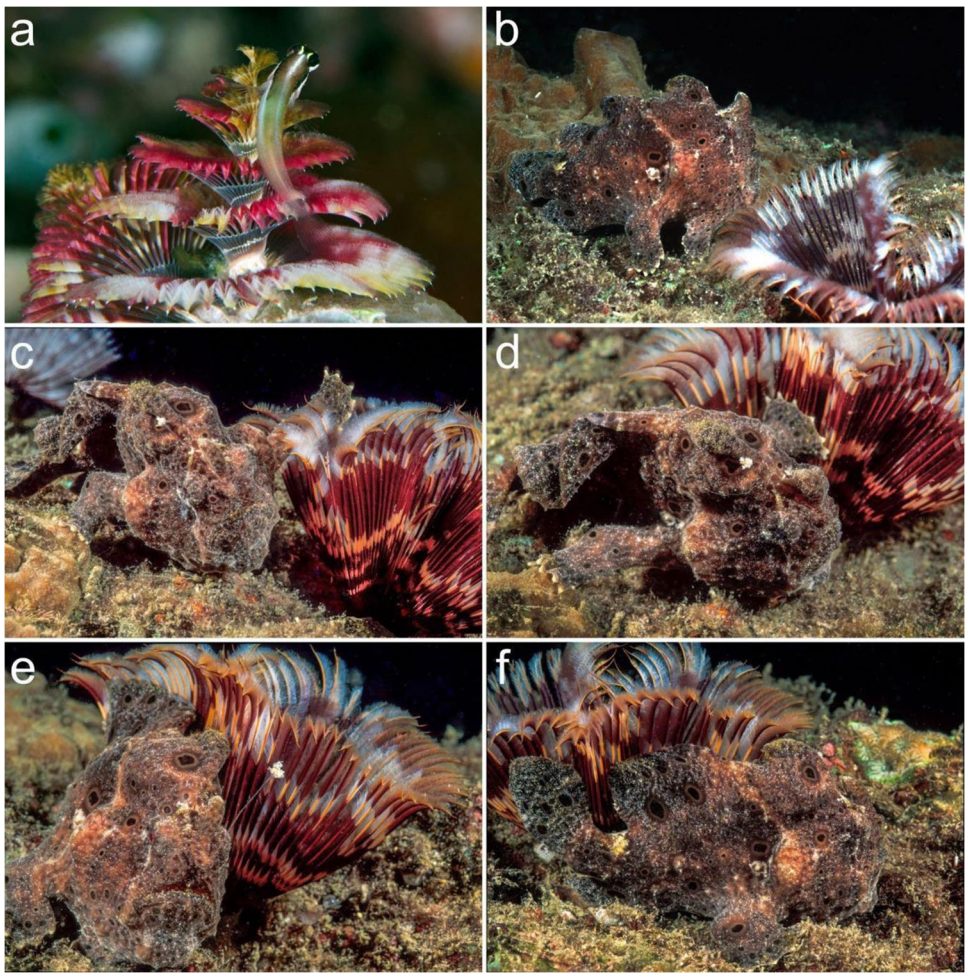

Fig. 1 Fish-polychaete interactions observed in Indonesia. **a**) *Ecsenius bandanus* perching on *Spirobranchus* sp. at Misool. **b-f**) *Antennarius pictus* interacting with cf. *Sabellastarte* sp. –from careful approachment (**a**) to lure extensions for hunting (**f**)– at Lembeh. Photos by A. J. Powderham

More notably, our record of a frogfish–sabellid interaction represents a previously unreported association. The frogfish's slow, precise, deliberate approach suggests a strategy to minimize disturbance and avoid triggering the worm's withdrawal reflex, and was executed with the seemingly practiced precision of a well-established relationship. This behavior reflects the species' reliance on substrate-based locomotion using a tetrapod-like gait rather than on buoyancy control –a consequence of lacking a swim bladder (Pietsch and Grobecker 1990). In contrast, blennies and other swim-bladdered teleosts can modulate buoyancy to achieve similar positional control. Frogfish, as ambush predators and masters of mimicry, show low vagility and limited mobility, discouraging relocation once a suitable position is found (Pietsch and Grobecker 1990). Thus, potential benefits for the frogfish may include enhanced camouflage among the worm's radioles, and increased feeding opportunities if suitable prey items are attracted by the worm. For the worm, possible advantages could involve reducing energy expenditure by avoiding withdrawal, access to residual prey material, and protection through proximity to a predator.

Several associations between sabellids and other invertebrates are documented in literature. For example, *Terebrasabella heterouncinata* Fitzhugh & Rouse, 1999 infests gastropods, usually boring on the shell apex (Fitzhugh and Rouse 1999; Martin and Britayev 2018), while mysid shrimps have been observed taking food particles from *Branchiomma nigromaculatum* (Baird, 1865), suggesting another case of kleptoparasitism (Wittmann and Wirtz 2017) – perhaps analogous to interactions between the Caribbean gobies and Christmas tree worms (DeLoach and DeLoach 2020). Consequently, *B. nigromaculatum* must balance trade-offs between foraging and predation risk (Pezner et al. 2017), as well as kleptoparasitism.

The uniqueness of our observation lies in the involvement of a frogfish, a partner not previously recorded in sabellid associations. However, based on an extended but single observation, with the tubiculous sabellid acting as the host for the frogfish, the nature of the relationship cannot be determined at present. Additional observations are needed to establish whether this interaction is facultative or obligate and to evaluate its prevalence and ecological significance across Indo-Pacific reef systems.

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Declarations

Conflict of interest The authors declare that they have no conflict of interest.

Ethics approval No animals were hurt during this study.

Sampling and field studies Given the incidental nature of this observation during a recreational dive, no dedicated surveys were planned in collaboration with local researchers or authorities. Consequently, no biological samples or systematic data were collected.

Data availability All data that support the findings are available in the main text.

Author contribution AJP conducted the field observations and took the photographs used in this study. AJP and SETvdM jointly contributed to writing and revising the manuscript.

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