

Fishes from the Deep Demersal Habitats off Manado, North Sulawesi, Indonesia and Negros Island, Philippines

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ABSTRACT

This paper is a study of some rare and poorly known deep demersal fishes in two Indo-Pacific localities, one in the central Philippines (off Negros Island) and another off Manado, northern Sulawesi. The occurrence of the shark Indonesian Wobbegong *Orectolobus leptolineatus* in the Philippines is also confirmed. The recent information on the Indonesian Coelacanth (*Latimeria menadoensis*) and other fish species are also presented. The presence of an angled-rough shark, which is tentatively identified herein as *Oxynotus cf japonicus*, is also reported for the first time to occur in North Sulawesi waters, Indonesia.

Keywords: Indonesia, Philippines, deep, demersal fishes, habitat.

INTRODUCTION

The Indonesia-Malaysia-Philippines Archipelago (IMPA) has been regarded by many authors as the center of the world's marine biodiversity (Allen 2008; Carpenter & Springer 2005; Nañola et al. 2010; Sanciangco et al. 2013). Most of these studies, however, have emphasized the shallow marine organisms, mainly the coral reefs.

The deep (>50m) demersal habitats are less explored in the IMPA. It was only recently that explorations had been made in deep habitats off Luzon Island and in the Bohol Sea (de Forges et al. 2009). Off the eastern seaboard of Luzon, several new species of fish have been discovered by a group of scientists during the Aurora 2007 Expedition (Liao et al. 2009; Gon et al. 2015). In 2011, the California Academy of Sciences (CAS) and Philippine research institutions had scoured the mountains and deep seas off southern Luzon as part of the CAS Hearst Philippine Expedition 2011 (Iwamoto & McCosker 2014). The expedition discovered and described several new species of marine organisms, with the deep sea trawling having the highest record of new taxa discovered. The next methods in line, an alternative to collecting expeditions, is the use of Remote-Operated Vehicle (ROV) and Baited Remote Underwater Video (BRUV), which to the third-world standards, are quite expensive.

Obviously, such expensive efforts can never be easily afforded by any local institution or researchers either in the Philippines or Indonesia, except when there is a collaboration between institutions. Thus, in their own little effort, the researchers aimed to contribute to this growing body of knowledge on the fish fauna of the IMPA, at a lower cost because both of us are based locally. The approach, though time-demanding, is far cheaper compared to large expedition organized by well-established research institutions. It is hoped that this endeavor would spark interests among Filipino and Indonesian students and researchers.

OBJECTIVES OF THE STUDY

This study aimed to present annotated accounts of deep demersal fish species caught by artisanal fishers.

MATERIALS AND METHODS

Fishes are caught by fish traps and long lines of Dumaguete City, southern Negros Island and off Manado, North Sulawesi, are listed with annotations. In addition,

reliable fishermen (mainly those involved with the setting of traps and long hand-liners) were also interviewed as to the approximate depth and location where fishes listed below were caught. Additional samples were also examined from the local fish market in Dumaguete City and Manado, North Sulawesi. In this paper, the researchers considered deep demersal habitats as those that are beyond 50 m.

Species identification was generally based on taxonomic references (e.g., FAO's *The Living Marine Resources of the Western Central Pacific* edited by Carpenter & Niem 1999) but for the final taxonomic names, the researchers relied heavily on FishBase's online database (www.fishbase.org). Moreover, they also sent photographs for taxonomic verification by experts in selected museums and research institutions.

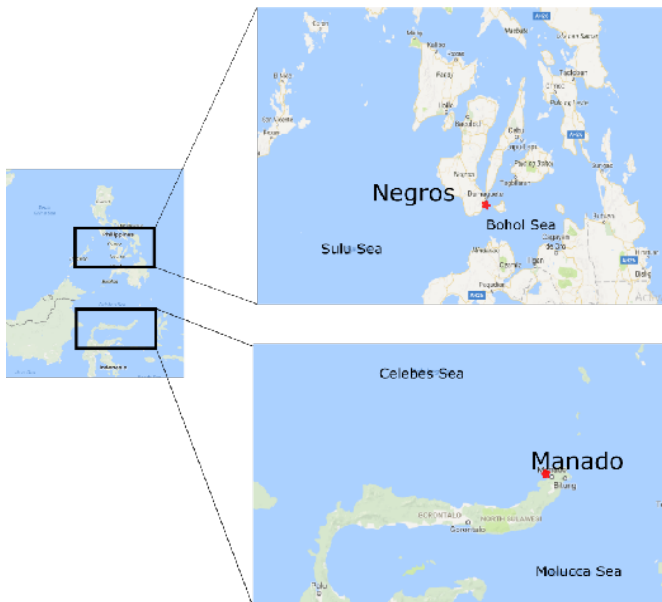


Figure 1. Map showing the location of the study sites in the Philippines and Indonesia and the study sites (Negros in central Philippines and Manado, North Sulawesi). Source: Google Map

RESULTS AND DISCUSSION

Whilst the number of species presented herein is rather low, it should be viewed as an initial step towards a far larger goal of documenting and compiling a more comprehensive species list for the Philippine-Indonesian deep ($\geq 50\text{m}$) marine waters.

Negros Island, Philippines:

Orectolobidae (Carpet or nurse sharks)

Orectolobus leptolineatus Last, Pogonoski & White, 2010

Indonesian Wobbegong (Figure 2)

Remarks: An individual (with brown transverse bars and white spots) was caught by a group of local shark fishers (Aladin Bucol and others) in deep waters ($>100\text{m}$) between Negros and Siquijor Islands, $>100\text{m}$ deep. The most recent identification guide on the sharks and rays in the Philippines (Alava et al. 2014) included this species in their list (but not illustrated) of questionable records of *Orectolobus* in the Philippines that needs confirmation.

Distribution: Indonesia; also from off Sarawak Malaysian (Borneo), and with unconfirmed records from Taiwan (Penghu Islands), and the Philippines (Visayas and Cebu City), Ryukyu Islands (Froese & Pauly 2015).

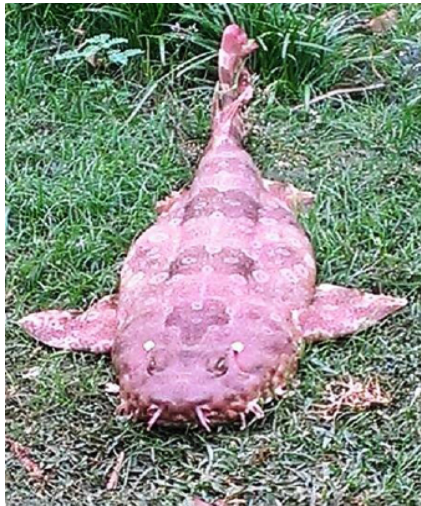


Figure 2. The Indonesian Wobbegong *Orectolobus leptolineatus*, known also outside of Indonesia, including the Philippines. (Photo by Aladin Bucol)

Muraenidae (Morays)

Gymnothorax sp.

Moray Eel (Figure 3)

Remarks: This white-spotted moray was caught off Sibulan, Dumaguete using long hand-lines. At first glance it can be confused with *G. johnsoni*, which is found in East Africa and the Indian Ocean. A detailed taxonomic assessment is on-going to clarify the species, which might be new to science. Iwamoto and McCosker (2014) briefly annotated a similar muraenid caught in the deep waters of the Verde Island Passage using a beam trawl. Both morphometrics and x-ray counts of vertebrae revealed it as a new species.



Figure 3. *Gymnothorax* sp. from Dumaguete Fish Market. Scale bar=5cm
(Photo by Abner Bucol)

Nemipteridae (Threadfin Breams)

Parascalopsis eriomma (Jordan & Richardson 1909)

Rosy Dwarf Monocle Bream (Figure 4a)

Remarks: Distinguished in having head scales reaching forward to between middle of eyes, posterior margin of preopercle more or less vertical, or sloping forward slightly (Froese & Pauly 2015).

Depth range: 25-264m (~120m in this study)

Distribution: Red Sea and East Africa to the Philippines and Indonesia, north to southern Japan (Froese & Pauly 2015).

Tribe Anthiinae (Anthias)

Odontanthias borbonius (Valenciennes 1828)

Checked Swallowtail (Figure 4b)

Remarks: A single specimen was photographed by A. Bucol from Dumaguete Fish Market on May 12, 2015. Previous account of this species indicates that it can be found in deep volcanic caves where coelacanths can also be found.

Depth range: 70-300m

Distribution: South Africa, the Comoros, Madagascar, Reunion, Mauritius and Japan (Froese & Pauly 2015).

Pseudanthias fasciatus (Kamohara 1955)

Onestripe Anthias (Figure 4c)

Remarks: A single specimen was caught off Sibulan, Negros Oriental using hand line fishing.

Depth range: 20-150m

Distribution: Widespread in the Indo-Pacific (Red Sea to southern Japan south to Great Barrier Reef, Tonga) (Froese & Pauly 2015) and recently reported by Bos (2014) in Davao Gulf, Philippines.

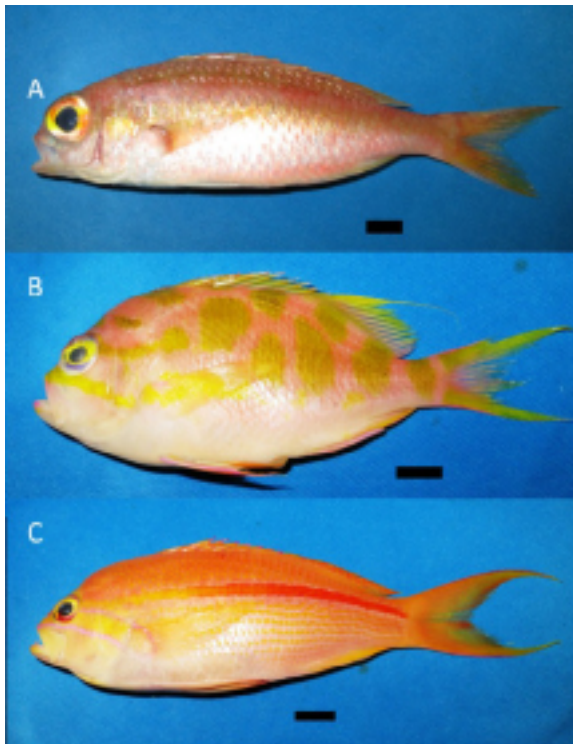


Figure 4. *Parascalopsis eriomma* (A), *Odontanthias borbonius* (B), *Pseudanthias fasciatus* (Scale bars=1 cm). (Photo by Abner Bucol)

Epinephelus coioides (Hamilton 1822)

Orange-spotted grouper

Remarks: Adults encountered were from fish traps deployed off Dumaguete city. Juveniles (8-12cm total length) were also caught from river mouths in Negros Occidental, suggesting that estuaries play a major nursery role for this species.

Indo-West Pacific: Red Sea south to at least Durban, South Africa and eastward to Palau and Fiji, north to the Ryukyu Islands, south to the Arafura Sea and Australia. Recently reported from the Mediterranean coast of Israel (Froese & Pauly, 2015)

Depth range: 1 - 100 m (Froese & Pauly 2015; this study)

Haemulidae (sweetlips)

Plectorhinchus chrysotaenia (Bleeker 1855)

Yellow-striped sweetlips

Remarks: Specimens were caught off Dumaguete using fish traps

Depth range: 6 - 70 m

Western Pacific: Singapore and the Philippines to the Solomon Islands, north to the Ryukyu Islands, south to the Great Barrier Reef and New Caledonia.

Diagramma pictum (Thunberg 1792)

Painted sweetlips

Remarks: Specimens were caught off Dumaguete using fish traps. One local fisher recalled a group of more than 50 individuals were caught in a single deployment off Dumaguete at ~120m in April 2010, suggesting that this may form aggregations in deep waters.

Depth range: 1 - 170 m

Indo-West Pacific: Red Sea and East Africa to Japan, south to New Caledonia.

Diagramma melanacrum (Johnson & Randall 2001)

Blackfin slatey

Remarks: Specimens were caught off Dumaguete using fish traps

Depth range: 3-40 m

Western Central Pacific: Indonesia, Borneo and the Philippines. Also known from Ashmore Reef in the Timor Sea.

Ostraciidae (boxfishes)

Ostracion rhinorhynchos (Bleeker 1851)

Horn-nosed boxfish (Figure 5)

Remarks: Easily recognizable by its large protuberance on the snout (Froese & Pauly, 2015). Most of the specimens that I have seen from fish traps deployed at about 100m were of damaged guts that came out of the mouth as a result of abrupt changes in pressure.

Depth range: 35 - 50 m (Froese & Pauly 2015); ~60-100m (this study)

Distribution: widespread in the Indo-Pacific (Froese & Pauly 2015).



Figure 5. Horn-nosed boxfish caught by fish trap off Silliman Beach, Dumaguete.
(Photo by Abner Bucol)

Cepolidae (bandfishes)

Acanthocepola krusensternii (Temminck & Schlegel 1845) (Figure 6)

Red-spotted bandfish

Remarks: Inhabits 3-50m unlike other cepolids but included in our accounts as it was trawled at ~50m, probably off the Sulu Sea.

Distribution: Western Pacific: southern Japan to the China Sea. Also reported from Indonesia and northwestern Australia (Froese & Pauly 2015).



Figure 6. *Acanthocepola krusensternii* from Kabankalan Fish Market, probably trawled in the Sulu Sea area. Scale bar=1 cm (Photo by Abner Bucol)

Owstonia contodon (Smith-Vaniz & Johnson 2016) (Figure 7)

Remarks: Two specimens photographed were obtained from Dumaguete Market on December 10, 2015. These were trawled in the Sulu Sea according to local vendors. The specimens shown in this paper belongs to the recently described new Genus and species *Owstonia contodon* (see Smith-Vaniz & Johnson 2016).



Figure 7. A cepolid *Owstonia contodon* from Dumaguete Fish Market. Scale= ~2cm.
(Photo by Abner Bucol)

Labridae (Wrasses)

Oxycheilinus orientalis (Gunther 1862)

Oriental Maori Wrasse (Figure 8)

Remarks: A single individual was obtained from Dumaguete Fish Market on August 13, 2015, caught using hand-lines; known depth range 10-80m.

Distribution: Red Sea, Indonesia to Ryukyu Is., Marshall Is. (Froese & Pauly 2015)



Figure 8. *Oxycheilinus orientalis* caught off Dumaguete, Negros Oriental.
(Photo by Abner Bucol)

Scarinae (Parrotfishes)

Scarus ghobban (Forskål 1775)

Blue-barred parrotfish

Remarks: A 50-cm parrotfish was noted from a fish trap off Silliman Beach, caught ~80m deep. This depth range is not surprising as this species is known to reach at 90m deep (Froese and Pauly 2015). The species complex *S. ghobban* may constitute of several species.

Scorpaenidae (Lionfishes, firefishes)

Pterois cf antennata (Bloch 1787)

Broad Firefish

Remarks: A single individual with red coloration was caught by fish trap about 60m off Dumaguete.

Distribution: Widespread in the Indo-Pacific

Acanthuridae (surgeonfishes)

Acanthurus mata (Cuvier 1829)

Elongate Surgeonfish

Remarks: Samples were from fish traps set at ~100m

Distribution: Indo-Pacific: Red Sea south to Natal, South Africa and east to the Marquesas and Tuamoto islands, north to southern Japan, south to the southern Great Barrier Reef and New Caledonia (Froese and Pauly 2015).

Depth range: 5-100m (Froese and Pauly 2015).

Naso minor (Smith 1966)

Slender Unicorn

Remarks: Often seen in groups along reef slopes but samples were also caught deeper using fish traps.

Distribution: Mozambique to the Philippines (Froese and Pauly 2015).

Depth range: 8-55m (Froese and Pauly 2015); ~80-100m (this study)

Lutjanidae (snappers)

Lutjanus argentimaculatus (Forskål 1775)

Mangrove Red Snapper

Remarks: Adults were usually caught by hook-and-line off Siaton, Negros Oriental in deep pinnacle reefs. Juveniles were often caught in river estuaries.

Distribution: widespread in Indo-Pacific (Allen et al. 2003)

Depth range: 1-120m (Allen et al. 2003)

Aphareus furca (Lacepède 1801)

Smalltooth Jobfish

Remarks: Often caught using hook-and-line or fish traps in deep shoals off Siquijor and Negros.

Distribution: widespread in Indo-Pacific (Allen et al. 2003)

Depth range: 5-100m (Allen et al. 2003)

Lethrinidae (emperors)

Lethrinus olivaceous (Valenciennes 1830)

Remarks: often caught off Dumaguete and Siquijor Island using fish traps.

Depth range: 1-185m (Froese & Pauly 2015).

Manado, North Sulawesi:

Latimeriidae (Coelacanth)

Latimeria menadoensis (Pouyaud, Wirjoatmodjo, Rachmatika, Tjakrawidjaja, Hadiaty & Hadie 1999)

Sulawesi Coelacanth (Figure 9)

Remarks: The second species of coelacanth (highly regarded as a living fossil) discovered in 1997 by M. Erdmann and described in 1999 by Pouyaud and others. Erdmann (1999) and Erdmann et al. (1999) provided detailed accounts of the first and second known coelacanths from Manado, Sulawesi. Depth of observed specimens ranged from 150-200m (Fricke et al. 2001). This species is an excellent example of how deep-dwelling fishes in the Indo-Pacific are poorly understood. Moreover, this species was discovered in the local fish market. The first two specimens of *L. menadoensis* were reportedly caught using nets set for sharks (Erdmann 1999a,b) while in 2007, a fisherman named Justinus Lahama caught another specimen off Manado Bay, North Sulawesi using a long line called “Papiti or taligandeng”, as shown below (Fig. 10). The specimen measures 131 cm and weighed 51 kg.

Distribution: Known thus far in volcanic caves off north Sulawesi



Figure 9. The Sulawesi Coelacanth (*Latimeria menadoensis*) captured by a local fisher off Manado, North Sulawesi in 2007 (Photos courtesy by Fisheries and Marine Resources Agency North Sulawesi Province). Total length= 131 cm.

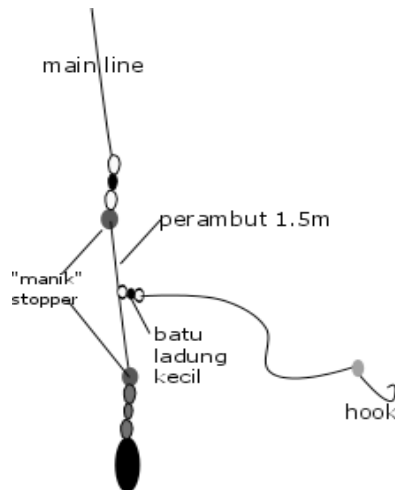


Figure 10. Diagram of a typical long line that captured the coelacanth in 2007. (Source: Google.com)

Epinephelus areolatus (Forsskål 1775)

Areolate grouper (Figure 11)

Remarks: Distinguished in having round dark spots with white-edged caudal fin margin. Some specimens usually encountered in Manado Fish Market.

Distribution: Indo-Pacific: Red Sea and the Persian Gulf to Natal, South Africa and east to Fiji, north to Japan, south to the Arafura Sea and northern Australia.

Recently recorded from Tonga (Froese & Pauly 2015)

Depth range: 6 - 200 m (Froese & Pauly 2015)



Figure 11. *Epinephelus areolatus* from Manado fish market.
(Photo by B. Wagey)

Cephalopholis urodeta (Forster 1801)

Darkfin hind

Remarks: B. Wagey photographed several specimens of this species in Manado Fish Market.

Distribution: Widespread in Indo-Pacific (Froese & Pauly 2015)

Depth range: 1-60m (Froese & Pauly 2015)

Variola louti (Forsskål 1775)

Yellow-edged Lyretail

Remarks: Fishers from Manado also caught this species in deep habitats (~100-200m) but it can be encountered also in reef slopes. In the Philippines, underwater photographs were taken of this species in steep slopes and walls.

Distribution: widespread in the IndoPacific (Allen et al. 2003)

Depth range: 3-240m (Allen et al. 2003)

Lutjanidae

Lutjanus timorensis (Quoy & Gaimard 1824)

Timor Snapper

Remarks: Several samples were photograph by B. Wagey in Manado fish market. It can be confused with *L. malabaricus* in overall red appearance and scale patterns but it distinguished from the latter in having black dark spot at base of pectoral fins (Allen et al. 2003).

Distribution: Andaman Sea to Samoa, north to the Philippines (Allen et al. 2003)

Depth range: 10-130m (Allen et al. 2003).

Etelis carbunculus (Cuvier 1828)

Deepwater Red Snapper (Figure 12)

Remarks: At least five specimens were photographed by B. Wagey on 24 April, 2016 from a local fish market in Manado. These were caught off Talaud Island according to the local fishers.

Depth range: 90-400m (Froese & Pauly 2015).



Figure 12. *Etelis carbunculus* from Talaud, North Sulawesi.
(Photo by B. Wagey)

Aprion virescens (Valenciennes 1830)

Green jobfish (Figure 13)

Remarks: A single specimen weighing ~2kg was caught on 21 May 2016 by hook-and-line off Sangihe-Talaud archipelago, located near the border between Indonesia and the Philippines. Locally this fish is called “kalkop”.

Distribution: Widespread in the Indo-Pacific, see Froese & Pauly (2015)

Depth range: 0-180m (Froese & Pauly 2015)



Figure 13. *Aprion virescens* from Sangihe-Talaud archipelago (TL=50cm).
(Photo by B. Wagey)

Aphareus rutilans (Cuvier 1830)

Rusty jobfish (Figure 14)

Remarks: A single specimen of what the locals called “Belbo”, weighing ~2kg was caught on 21 May 2016 by hook-and-line off Sangihe-Talaud archipelago together with the Green Jobfish *A. virescens*.

Distribution: Widespread in the Indo-Pacific, see Froese & Pauly (2015)

Depth range: 100-330m (Froese & Pauly 2015)



Figure 14. *Aphareus rutilans* from Sangihe-Talaud archipelago (TL=55cm).
(Photo by B. Wagey)

Oxynotidae (rough sharks)

Oxynotus cf japonicus (Figure 15)

Remarks: On August 07, 2016, a certain police officer, Mr. Jeffrey Nggala, found on the beach of Manado, Indonesia a female (no clasper) rough shark (Family Oxynotidae). The specimen was immediately preserved by Indonesian researchers, including the senior author B. Wagey. It was initially reported as *O. bruniensis* but an alternative identification was also suggested as *O. japonicus*, based on overall body profile. Although we cannot assert its identification with finality, pending further examination and confirmation by shark experts, the latter identification is probably more palusible based on the meristic characters provided by Yano and Matsura (2002). Based on the ratio of the length from tip of spine to apex of first dorsal fin and the vertical height from tip of spine to fin base which is ~ 1.69 at 600mm, suggests that it is intermediate between *O. bruniensis* and *O. japonicus*. Ratios of the tip of spine to apex of 2nd dorsal fin/vertical height of spine to base of fin (~ 1.9), as well as interdorsal/2nd dorsal fin base further suggests affinity to *O. japonicus*. It should be pointed out that *O. bruniensis* has interdorsal length less than or equal to length of 2nd dorsal fin base (Yano and Matsura 2002; see also Ebert and Mostarda 2013 p. 18) while nearly double in that of the Indonesian specimen. In terms of their known geographic distribution (Yano and Matsura 2002, the other three species are found in the following, *O. centrina*: Mediterranean, eastern north Atlantic, tropical east Atlantic, and eastern south Atlantic; *O. caribbaeus* (Caribbean Sea); and *O. paradoxus* (eastern North Atlantic). *O. japonicus* is known to occur only in Japan while *O. bruniensis* is known to occur in Australia and New Zealand with 50-1000m depth range.



Figure 15. The first and only Indonesian specimen of *Oxynotus* from Manado. Total length=60cm. (Photo by Jeffrey Nggala)

While the *Oxynotus* specimen described above was found on the beach, we assume that it was a deep water inhabitant as no shallow-water catch or sightings were reported in Indonesian waters.

While the number of species reported in this study is still low, here one can argue the importance of data gathered from local sources, namely local fish markets (Helm 1992) and fishers that deploy traps in deep waters (Garrison et al. 1998), beyond 50 meters (e.g. mesophotic reefs, see Weinstein et al. 2015) that cannot be easily accessed by scuba diving. Ideally, the latest technology applicable for this type of research endeavour is the so-called stereo cameras (e.g. baited remote underwater video or BRUV) (Goetze et al. 2011). However, this equipment is of high cost and would require bigger boat and high-end memory storage devices. These cannot be easily procured by any institution based in a third-world, developing countries like the Philippines and Indonesia.

For this reason, to expound knowledge on fishes found in deep demersal habitats, it is sought that the exploitation by the fishermen were relatively poor. Some of the species reported in this paper are either poorly known (e.g. distribution or depth ranges) or scientifically important (e.g. Indonesian Coelacanth *L. menadoensis*). The confirmation of the occurrence of the Indonesian Wobbegong (*O. leptolineatus*) was based on a photograph of a freshly caught shark caught off Siquijor with the help of a local fisherman further emphasize the important role of local indigenous knowledge championed by artisanal fishers.

Recent works by Bos and Gumanao (2013) and elsewhere (e.g. Vilasri et al. 2015) revealed the importance of fishing gears that are deployed in deep, demersal habitats and fish market surveys in documenting species new to science and new records for fishes in the less-explored areas of the Philippines.

Zoogeographic affinity

There is evidence to show that the present deep-water demersal fish fauna of Indonesia-Philippine region is rich and highly underestimated. Wagey & Bucol (2015) documented that certain deep-water muraenid eels known as temperate species (e.g. *Gymnothorax prionodon* and *G. minor*) could be found in the tropical waters of Indonesia and the Philippines, especially in deep waters. Another example is our discovery of the deep-water prickly shark *Oxynotus*, described above, in Indonesia. The closest relative would be *O. brunniensis*, found in New Zealand and Australia.

Trophic level

While the present paper described a handful of species (29 in both localities combined), it is noteworthy that majority of which (26 species) (Figure 16) are categorized as predators of fishes and invertebrates (trophic level 3.5 and above based on Froese & Pauly 2015) while two species are known as zooplanktivores (*Acanthurus mata* and *Naso minor*) and one species of parrotfish (*Scarus ghobban*) (level 2.0) which is probably an endolithic feeder. Our findings would help other equally important questions such as to the biology of *Scarus ghobban* (reportedly known at ~90m, see Froese & Pauly 2015), given the recent findings by Clements et al. (2016) that parrotfishes are microphages, targeting endolithic and epilithic autotrophs (cyanobacteria).

Trophic scores found in Froese & Pauly (2015) ranged from 2.0 (herbivores) to >5 (top predators). It is to be re-called also that moderate to high vulnerability to overfishing of fish species also belong to higher trophic levels.

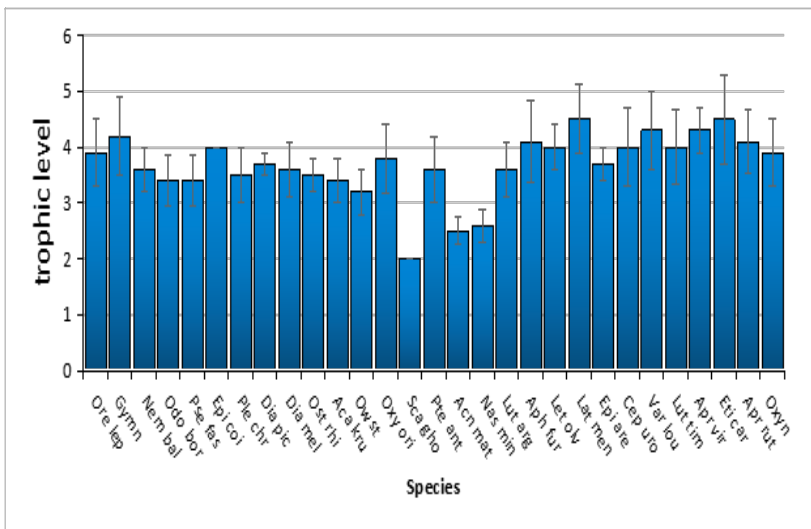


Figure 16. Trophic level of each species based on prey known items (scores from Froese & Pauly 2015).

CONCLUSION

In conclusion, this study documented further the rich diversity of the less-explored deep demersal habitats of the Philippines and Indonesia using samples derived mainly from artisanal fishery. The discovery of the Indonesian Wobbegong is a confirmation of a long standing interest to document this species in central Philippines. In addition, the deep-water shark *Oxynotus cf japonicus* would spark more research interest given its first discovery outside of the known range of the genus. Most of the taxa presented in this study are those of higher trophic level (top predators). Given that they are subjected to fishing pressure, certain ecological impacts to the demersal ecosystem are expected.

RECOMMENDATIONS

It is hoped that future studies be conducted to continue to document the fishes in deep, demersal habitats in our study sites. There is a need for advanced studies, such as the use of molecular markers to elucidate taxonomic status of certain taxa. The use of fish markets and local gears will be of great advantage to local institutions and researchers.

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