Species composition of coral reef fish in the Nonoc Island, Philippines

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Abstract. This study aimed to determine the species composition of reef fish in Nonoc Island, Surigao City, Philippines. Multiple fishing techniques were conducted within established 50x50 m quadrats, at three sampling stations, in January 2020, yielding 16 species from 12 families of reef fish fauna. All species are native in the Philippines and the majority are of a least concern status (94%). *Chlorurus sordidus* has the highest relative abundance (12%) among the collected species. Station 1 located in Brgy Nonoc had the highest number of species (S=16) and the most diverse taxa (H'=2.65), among the three sampling stations. The Nonoc Island still hosts a noteworthy number of reef fish fauna, despite the mining activities that lasted for decades and the intensive fishing activities deployed by the population living in the area. Hence, regular monitoring and intensive study are essential to come up with comprehensive data related to the reef fish fauna of the area.
Key Words: least concern, native species, perciformes.

Introduction. Coral reefs are highly valuable ecosystems. All seas of the Philippines belong to a coral triangle which contains 75% of all coral species, 35% of the world's coral reefs and at least 3,000 fish species, which makes it a global center of the marine biodiversity (Wilkinson 2008; Veron et al 2009). Coral reefs provide mankind with many economically important products and natural services. In the Philippines, the most important coral reef products are fish and other marine animal species serving as food. Fish such as serranidae (grouper), lutjaneda (snappers) are among the few with the highest species richness followed by lithridae (emperor), scarinae (parrotfish) and many others (Delrieu-trottin et al 2020) across the Coral Triangle. The species of fish seek shelter since coral reefs provide breeding nests and spawning for various species (Setiawan et al 2013).

Fish are considered to be an important element in the economy of the Philippines and other nations and play an important role in human's diet and for the ecosystem (Tessema & Mohamed 2016). However, as the human population exponentially increased, these organisms have been overexploited for consumption and their habitat has been destroyed, due to inadmissible fishing practices. Distribution of fish assemblages changes due to some environmental variables and differences in species ecological requirements (Huang et al 2019) leaving fish that can adapt to changes. Moreover, composition differences of fish species could be well understood by a combination of habitat variables and human desctructions and interventions (Cheng et al 2019), which means that reef fish community would be affected by the physical complexity of the subdtrate (Adrim et al 2012). Past studies on the specific effects of the destructive fishing practices were customarily focused on the direct impacts, either on the physical structure of the habitat or on the target organisms.

Nonoc Island is situated in the North-eastern tip of Mindanao, in the Philippines, where the coral reef is considered to be abundant. In the Eastern Pacific Seaboard with oligotrophic waters most species such as those migratory fish rely on the abundance of phytoplankton for food (Nepomuceno et al 2020). This oceanographic condition is a good water profile and significant indication of favorable environment (Nepomuceno et al 2020). The island was part of the Surigao Mineral Reservation (SMR) which was

established as early as 1912. However, decades of mining activities and illegal fishing in Nonoc Island had negative impacts on Surigao sea's coral reefs and on the associated marine organisms, including fish.

The scarcity of the published studies concerning the coral reef fish in the island has prompted the researchers to conduct this study, aiming to provide an inventory of reef fishes in Nonoc Island, Philippines. The study could help address problems in the near future such as unresolved and insufficient barcode coverage for fish.

Material and Method

Study area and establishment of sampling stations. Nonoc is an island in Surigao city, with a total land area of 245.34 km^2, which consists of three barangays, namely Nonoc, Cantiasay and Talisay. According to the 2015 census, the barangay Nonoc has a population of 1,310 individuals, while Cantiasay and Talisay have a total population of only 984 and 1,403 individuals, respectively (Philatlas 2020). Three sampling stations were identified in the area (Figure 1) comprising the three barangays of the island, namely: Station 1 (Barangay Nonoc), lying geographically at 9 47' N and 125 29' E; Station 2 (Barangay Cantiasay), lying geographically at 9o85' N and 125o58' E and Station 3 (Barangay Talisay), lying geographically at 9.82' N and 125.62' E.
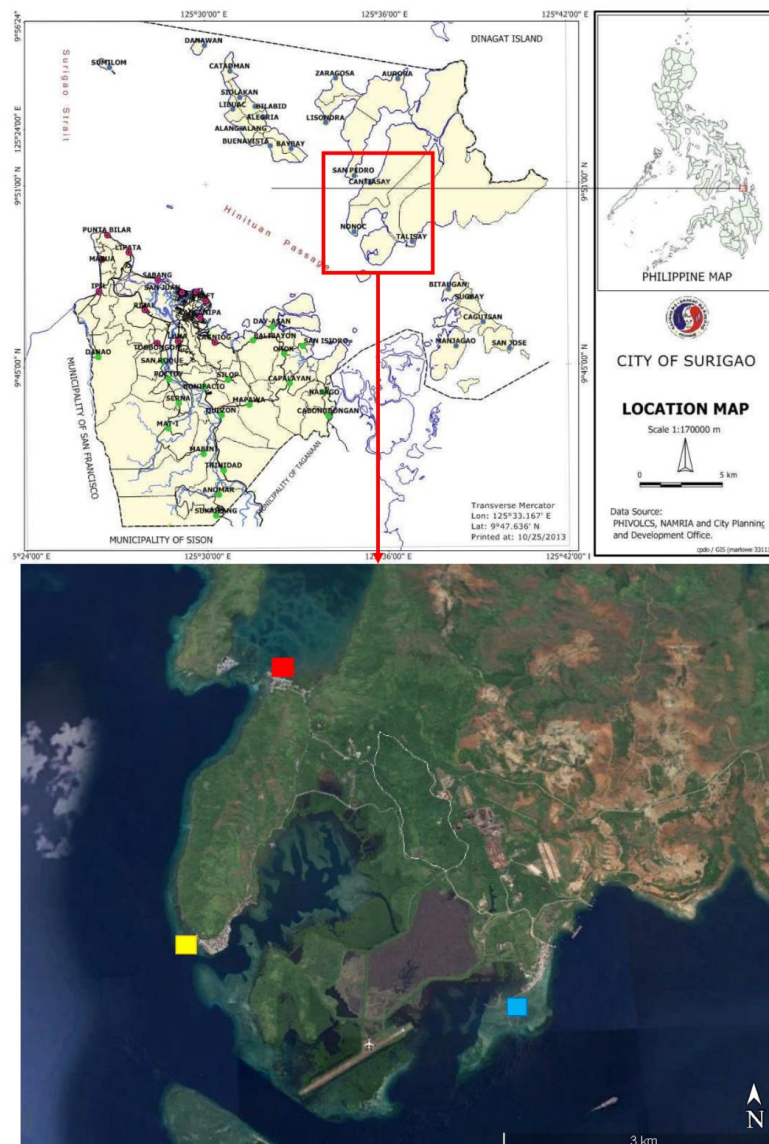

Figure 1. Location of Mindanao Island in the Philippines and the three sampling stations in Nonoc Island. Station 1 (Yellow); Station 2 (Red); Station 3 (Blue).

Fish inventory and identification. A 50 x 50 m quadrat was established in the coastal areas, at a distance of 150 m from the shoreline, in every station. Fish samples were collected by multiple fishing techniques using typical fishing gears, such as spear gun and seine net measuring 15 m long. Fish sampling was performed on the whole month of January 2020. Species were identified up to the lowest possible taxon, using references, namely Allen et al (2003) and Gonzales (2013), and online data sources such as fishbase.org. The conservation and distribution statuses were determined from the IUCN Redlist of Threatened Species website (https://www.iucnredlist.org/).

Data analysis. Biodiversity indices such as evenness, species richness index (S), Shannon-Wiener index (H'), and Simpson's Dominance index (D) were computed using Palentological Statistics PAST.

Results and Discussion

A total of 249 individuals belonging to 16 species from 12 families were recorded in Nonoc Island during the study (Table 1). Station 1 had the highest number of individuals (N=105), followed by station 3 (N=93) and station 2, with the lowest number of recorded individuals (N=51). The high number of individuals in station 1, compared to other stations, might be due to its location in the open sea, far from any anthropogenic activities, which is suitable for the existence of a diversity of marine organisms, including fish species.

Most of the species are from the order Perciformes (56%), followed by Scorpaeniformes (19%) and Tetraodoniformes (13%) (Figure 2). All species are native to the country (100%) and the majority have a least concern (94%) status (Figure 3), indicating that the collected marine fish species are not threatened or endangered.

Table 1

The recorded reef fish species in Nonoc Island, Philippines

Order	Family	Species	Station 1	Station 2	Station 3	Total
Anguilliformes	Muraenidae	*Gymnothorax javanicu*[N,LC]	5	0	3	8
Labriformes	Scaridae	*Chlorurus sordidus*[N,LC]	12	8	10	30
Perciformes	Acanthuridae	*Naso Lituratus*[N,LC]	5	6	9	20
	Caesionidae	*Caesio cuning*[N,LC]	10	7	5	22
	Lutjanidae	*Lutjanus corponotatus*[N,LC]	3	3	5	11
		Lutjanus sebae[N,LC]	10	6	4	20
	Serranidae	*Cephalopholis argus*[N,LC]	6	2	7	15
		Epinephelus malabaricus[N,LC]	3	0	6	9
	Siganidae	*Siganus guttatus*[N,LC]	4	1	8	13
		Siganus virgatus[N,LC]	9	3	12	24
	Zanclidae	*Zanclus cornutus*[N,LC]	11	7	6	24
Scorpaeniformes	Platycephalidae	*Cymbacephalus beauforti*[N,LC]	1	1	3	5
		Platycephalus fuscus[N,NE]	7	4	0	11
	Synanceiidae	*Synanceia verrucosa*[N,LC]	6	1	11	18
Tetraodontiformes	Balistidae	*Canthidermis maculate*[N,LC]	5	0	3	8
	Monacanthidae	*Aluterus sciptus*[N,LC]	8	2	1	11
	Total		105	51	93	249

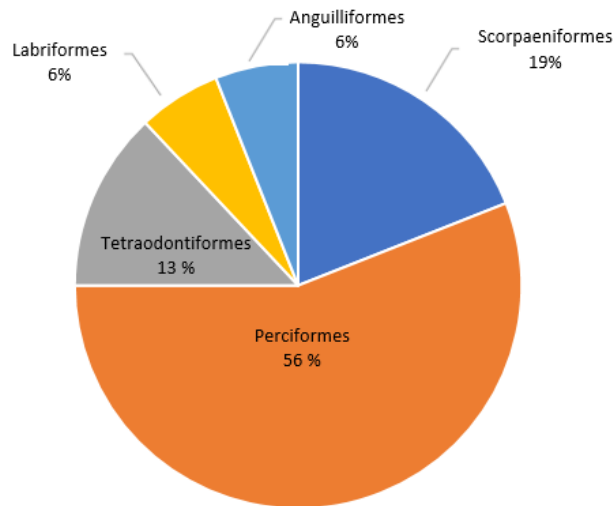N-Native; LC-Least Concern; NE-Not Evaluated.

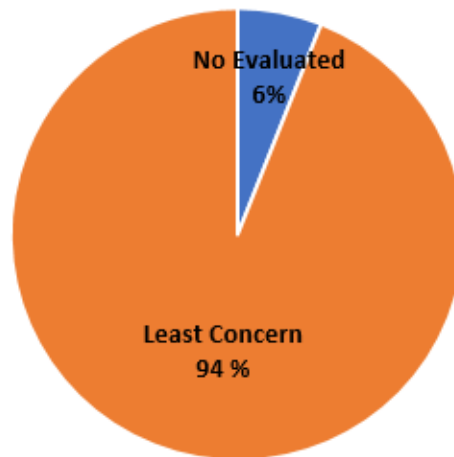Figure 2. Order composition of reef fish fauna in the area.

Figure 3. Percent conservation status.

Among the collected species, *Chlorurus sordidus* has the highest relative abundance value (12%), while *Canthidermis maculata* has the lowest relative species abundance value (3%) (Figure 4). This indicates that *C. sordidus* is a common species, compared to other species at the three sampling stations. This species is reportedly one of the most abundant and widespread scarid species in the Indo-Pacific and it occupies a variety of habitat types, although it prefers the shallow slopes of coral reefs and one of the commercially important coral reef fish within or outside the Marine Protected Areas (MPAs) even in the Tubbatahha Reef National Park (Muallil et al 2019).

Among the three sampling stations, station 1 has the highest taxa richness (S=16), the highest diversity index (H'=2.653) and the highest evenness index equal to 0.8876 (Table 2). The Shannon index increases as both the richness and the evenness of the community increase. The evenness index of the three sampling stations almost approaches to 1, demonstrating an even distribution of reef fish fauna in the area. According to Kumar et al (2014), an evenness value closer to 1 indicates that each species consists of the same number of individuals while if the value is close to zero, it indicates that most of the individual belongs to one or a few species. These coral reef fish species were found to be abundant in coral reef triangle and commonly caught when fishing (Fatimah et al 2018; Delrieu-Trottin et al 2020).
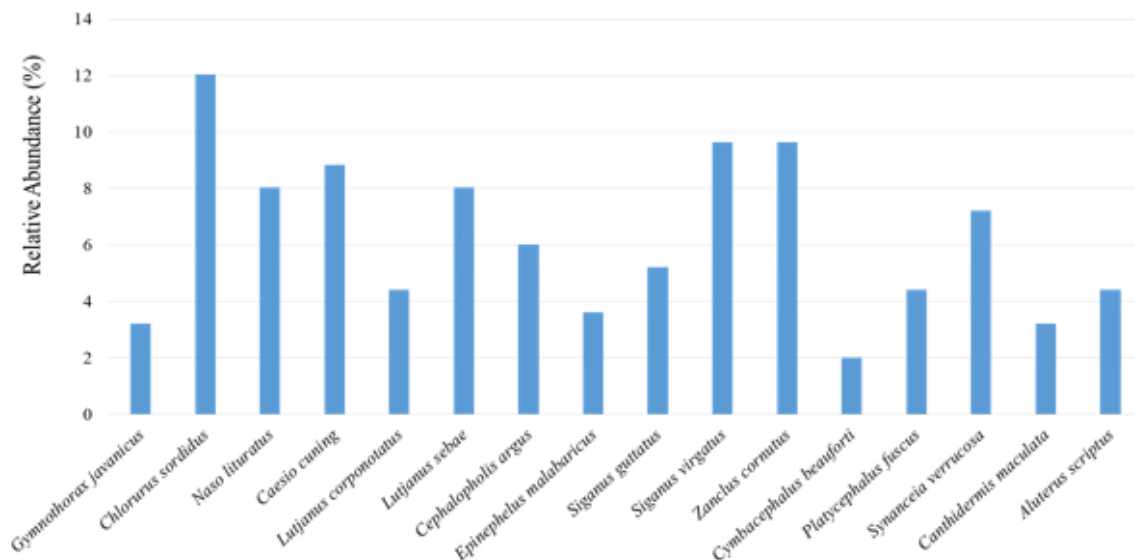
Figure 4. Relative abundance of reef fish fauna.

Biodiveristy indices of the three sampling stations

Indices	Station 1	Station 2	Station 3
Taxa (S)	16	13	15
Dominace (D)	0.07628	0.1073	0.08382
Shannon (H')	2.653	2.358	2.573
Evennes (e^H/S)	0.8876	0.8127	0.8733

Conclusions. Based on the findings of the study, the following conclusions were drawn: there were 16 species found in the study area. Species richness at the three stations is high, but station 1 has the highest species richness value, as compared to the other stations, which is in concordance with the diversity index H'=2.653. *C. sordidus* accounted for the highest relative species abundance (12%). No threatened or endangered species were identified in the study area.

Conflict of interest. The authors declare no conflict of interest.

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