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Diversity of intertidal fishes in Porok Beach, Gunungkidul, Yogyakarta

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Abstract. Porok Beach is one of the beaches in Gunung Kidul which has high diversity of fish species, especially in the intertidal zone. The diversity of fish species in Porok Beach needs to be maintained for its sustainability. This research aims to determine the diversity of fish in the intertidal zone of Porok Beach, Gunungkidul, Yogyakarta. The research was conducted on 17th October 2020 and 29th August 2021 with a purposive random sampling method by using a hand net. The results show that there are 5 families and 10 species of fish that were discovered, which consists of 5 species from family Pomacentridae: *Pomacentrus brachialis*, *Stegastes obreptus*, *Plectroglyphidodon leucozonus*, *Abudefduf sordidus*, and *Abudefduf vaigiensis*; 2 species from family Gobiidae: 1 individu of *Acentrogobius caninus* and 2 individu of *Istigobius ornatus*; 1 species from family Blenniidae: *Blenniella gibbifrons*; 1 species from family Clinidae: *Springeratus xanthosoma*; and 1 species from family Serranidae: *Grammistes sexlineatus*. This indicates that the condition of the intertidal zone in Porok Beach supports many fish species to live well.

1. Introduction

Porok Beach is one of the beaches in Gunung Kidul which has a high diversity of fish species. Porok Beach is located about 90 km from the city of Yogyakarta. Porok Beach is located at a tidal distance of 50 meters to the sea. In Porok Beach, there are many little basins which are the suitable place for fish habitat, making it possible to find fish trapped in the basins [1]. These basins are mostly found in the intertidal zone.

The intertidal zone is the area where tidal waves occur regularly [2]. Transient fish will swim into the intertidal zone during high tide in search of food, depositing eggs, or hiding among the substrate. Even at low tide, some varieties of fish, particularly juveniles, can survive successfully in the intertidal zone by occupying basins produced as the seawater withdrew, shielding them from predators. Fish that reside in the intertidal zone have distinct characteristics. Aquatic creatures' ability to adapt to their surroundings is limited in a range that varies with age and growth rates. In addition, the intertidal zone also has an abundance of food sources for creatures, such as algae. As a result of these circumstances, each individual has a natural propensity to migrate to waters with the best environmental conditions for biological activity, causing the composition, quantity, and distribution of fishes to change over time. Therefore, many species are found in the intertidal zone.

The diversity of fish species in Porok Beach, especially in the intertidal zone, needs to be



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preserved. Based on this, it is necessary to study the diversity of fish species in the intertidal zone of Porok beach as a form of support to the conservation of Indonesian biodiversity.

2. Materials and methods

This research was conducted on 17th October 2020 and 29th August 2021 in the intertidal zone of Porok Beach, Yogyakarta, Indonesia, which comprised an area of 10.385 m², (-8 ° 08'02.8 "S 110 ° 33'28.8" E) was dominated by the substrate of reef.



Figure 1. Location of the study site at coastal areas of Porok beach, Yogyakarta, Indonesia (Google Earth, 2021)

Materials and tools used in this research were a camera, millimeter block paper, seawater, alcohol 70%, hand net, identification using scientific articles related to certain species and online fish database, collection bottle, and plastic box. The method used in this research was random sampling. Fish were collected using a hand net then preserved in 70% alcohol and seawater. Fish samples were identified using an online fish database. Taxonomic keys relevant to the region are also used in the identification process.

The diversity index is a measure of community wealth as seen from the number of species in an area, along with the number of individuals in each species [3]. To calculate the diversity index, the Shannon-Wiener index is used as below [3] :

$$H' = \sum_{i=1}^n \frac{n_i}{N} \ln \frac{n_i}{N}$$

Explanation :

H' = Species diversity index

n_i = Number of individuals in

species-i N = Number of

individuals of all species

3. Result and discussion

Based on sampling and data analysis of Pisces species from the intertidal zone in Porok Beach,

Gunungkidul, Yogyakarta, the result obtained from this study is there are 10 species of pisces.

Table 1. Diversity of fish species found in Porok Beach

No	Family	Species
1	Pomacentridae	<i>Pomacentrus brachialis</i> <i>Stegastes obreptus</i> <i>Plectroglyphidodon leucozonus</i> <i>Abudefduf sordidus</i> <i>Abudefduf vaigiensis</i>
2	Gobiidae	<i>Acentrogobius caninus</i> <i>Istigobius ornatus</i>
3	Clinidae	<i>Springeratus xanthosoma</i>
4	Blenniidae	<i>Blenniella gibbifrons</i>
5	Serranidae	<i>Grammistes sexlineatus</i>

The results show that there are 5 families and 10 species of fish that were discovered, which consists of 5 species from family Pomacentridae: *Pomacentrus brachialis*, *Stegastes obreptus*, *Plectroglyphidodon leucozonus*, *Abudefduf sordidus*, and *Abudefduf vaigiensis*; 2 species from family Gobiidae: 1 individu of *Acentrogobius caninus* and 2 individu of *Istigobius ornatus*; 1 species from family Blenniidae: *Blenniella gibbifrons*; 1 species from family Clinidae: *Springeratus xanthosoma*; and 1 species from family Serranidae: *Grammistes sexlineatus*. This indicates that the condition of the intertidal zone in Porok Beach supports many fish species to live well.

From the sampling results that have been mentioned, the diversity of fish found in Porok Beach was moderate. This may occur as a result of the fish's less favorable environmental conditions. In Porok Beach, there were not many basins and had lesser algae as a natural food of fish, so the fish do not like such habitats and the abundance of fish species is moderate. The ability of juvenile fish to live well in the intertidal zone is supported by the availability of algae, seagrass, or plankton food sources. The basins formed at low tide act as shelters for the juvenile fish. Most fish will return to the basins after swimming for food and so on. Each species of fish will have a tendency to have different characteristics in terms of growth, development, behavior, spawning, and food requirements. At one time, the population of one type of fish becomes abundant, but at other times the population appears to be decreasing or disappearing in number. This is related to environmental conditions that affect fish life. In general, large fish populations can be found in healthy waters with environmental conditions that have abundant and adequate food sources. Identification of fish species found in Porok Beach was performed by observing the characteristics of each fish species. The types of fish found in Porok Beach were shown below:



A



B



C

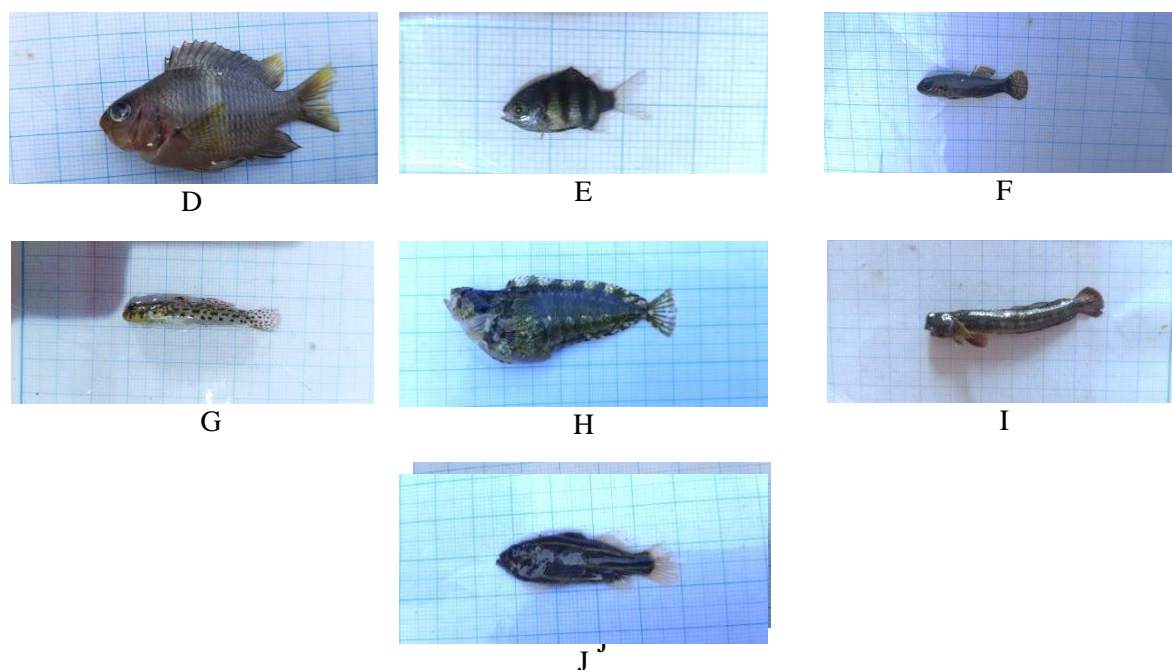


Figure 2. Fish species found in Porok Beach: *Pomacentrus brachialis* (A), *Stegastes obreptus* (B), *Plectroglyphidodon leucozonus* (C), *Abudefduf sordidus* (D), *Abudefduf vaigiensis* (E), *Acentrogobius caninus* (F), *Istigobius ornatus* (G), *Springeratus xanthosoma* (H), *Blenniella gibbifrons* (I), and *Grammistes sexlineatus* (J)

Based on the results, obtained 10 species of fish belonging to 5 families including Pomacentridae, Gobiidae, Clinidae, Blenniidae, and Serranidae in the intertidal zone of Porok Beach. The Pomacentridae family is a type of reef fish that has a variety of colors. This family is often found in tropical waters, especially the Indo-Pacific by inhabiting rocks, deep-sea caves, rock crevices, and rock fragments. Pomacentridae feeds on algae, sponges, benthic invertebrates, and zooplankton. Pomacentridae that was found on Porok Beach were *Pomacentrus brachialis*, *Stegastes obreptus*, *Plectroglyphidodon leucozonus*, *Abudefduf sordidus*, and *Abudefduf vaigiensis*.

Pomacentrus brachialis is commonly found in acropora coral habitats [3]. *Pomacentrus brachialis* has dark gray to blackish damselfish with large black spots covering the base of the pectoral fins and also has pectoral fin spots in juveniles [4].

Stegastes obreptus spreads from the Ryukyu Islands, covering the Indo-Malay Islands, Western Australia, Abrolhos Islands to the east along the northern boundary of the tropical Indian Ocean to Sri Lanka and India. *Stegastes obreptus* generally has a brown to almost black body and middle fin, paler ventral body, fins graded to smoky gray distally, scales edge on sides with black stripes, and a few small blue spots scattered on head and sides [5].

Plectroglyphidodon leucozonus spreads from the Red Sea and East Africa to the Marshall Islands and Pitcairn, north to Japan, south to Australia. *Plectroglyphidodon leucozonus* had a total of 12 dorsal spines, 15-17 dorsal soft fingers, 2 anal spines, and 12-13 anal soft fingers [6].

Abudefduf sordidus is a type of tropical marine fish that is commonly found along coastal areas of tropical and temperate regions. *Abudefduf sordidus* or often called the "Greybanded Sergeant Major" is distributed in the Indo-Pacific seas including the Red Sea and Hawaii with habitat of rocky pools or coral reefs and belongs to a fish that has a strongly territorial area of algae and small invertebrates. These fish have different morphological diversity in their color patterns. Has a deep, orbiculate, and compressed body. Head with single nostril on each side, the mouth is small, subocular shelf present, pre-orbital edge

with our a notch, has a single continuous dorsal fin with 13 spines and 15 softrays, their anal fin has two spines and 14 softrays, their caudal fin is forked, scales large (smaller on head), lateral line in this fish is incomplete, ctenoid, and scale-rows in transverse series 4/1/12. In addition, the color of this fish is olive-green-yellow on its body with five verticals, has dull- grey bands on sides, there are black spots at the base of the pectoral and across the nape. There is also a black spot/blotch on the caudal peduncle right behind the dorsal [7].

Abudefduf vaigiensis has an oval-shaped body, silvery-white belly in color with a yellow part around the base of the dorsal fin and five vertical conspicuous black bars, four on the trunk and the fifth located on the caudal peduncle. This species has a terminal mouth, emarginate caudal fin with formula of D.XIII.12; C.16; A.II.11; VI5; P.16, ctenoid scales, continuous lateral line. The total body length was 2.5 cm with the body width of 1 cm. It has gray body coloration with five black vertical lines [8].

The Gobiidae family is an amphidromous demersal fish that can live in muddy, sandy areas, in seawater, and freshwater [9]. Species from the Gobiidae family found on Porok Beach are *Acentrogobius caninus* and *Istigobius ornatus*.

Acentrogobius caninus has a long and compact body, has a flat head, gill openings that open from anterior to vertical, has elongated caninoid teeth, truncated tongue, has ctenoid-type scales except for the head, has papillae on the cheeks, has a scaly operculum. This fish has dark oval spots and is located behind the gill openings. On the head and body there are white spots on the body that are spread evenly, and 4-5 brown spots in the middle of the body [10].

Istigobius ornatus is a fish belonging to the Gobiidae family. This fish has a wide distribution in the Red Sea region south to north of Mozambique and east to Fiji, north to southern Taiwan, south to New Caledonia, and in recent times can be found in Tonga. *Istigobius ornatus* has 7 dorsal spines, 10-12 dorsal soft fingers, 1 anal spine, and 9-11 anal soft fingers [11].

From the Clinidae family, it can be found in shallow seas with tropical and subtropical climates. A total of 39 species can be found in littoral and sublittoral habitats in Australia. Species of the family Clinidae found in the intertidal zone of Porok Beach is *Springeratus xanthosoma*.

Springeratus xanthosoma can be found in rocky coral and seaweed-living areas. Its distribution is in the Philippines, Java, Ceylon, and the southeast coast of India. *Springeratus xanthosoma* has the characteristics of an upward-facing mouth, has a mouth gap that is parallel to the upper edge of the eye, on its gills, there is a free gill layer, has a cycloid type of scale, the cheeks and operculum are not scaly. This fish has a third vertebra that is short and not connected to the backbone that is fused to the back, has a double-porous front tubule structure and a single-pore rear tubule, has the shape of a tube nostril. This species has 2-3 rows of small premaxillary teeth, small vomerine teeth, mandible covered with 2-3 columns of acicular teeth. In the upper jaw, there are ten gill rakers, short in shape, with small straight spines on each side [12].

Blenniidae usually has small, scaleless, and very agile bodies. The family Blenniidae comprises 58 genera and 406 species. Members of this family are usually found in rocky substrates in the intertidal zone and subtidal zone. Based on previous research, in the southern oceans of Iran and the waters of Makran, 15 species were found belonging to the subfamily Salariae and Blenniidae from the family Blenniidae [13]. Species from the Blenniidae family found in Porok Beach in this study were *Blenniella gibbifrons*.

Blenniella gibbifrons have a lateral line with vertical pairs of pores. There's a black spot present on interspinous membranes of the 1st and 2nd dorsal-fin spines. Two orbital cirri are branched each having five variable branches. Caudal-fin elements segmented and branched. Paired preopercular pores. Gill openings continue across isthmus. Whiteyellowish body, clearly visible from the dorsal side while swimming. This species is a benthic fish that lives in shallow water on the reef flat shoreline in intertidal zone from a depth of 0.5 to 1.5 m in substrates composed of algae and sand. This species consumes algae [14]. *Blenniella gibbifrons* have a terminal mouth, rounded caudal fin with fin formula D.XIII.20; C.9; A.II.21; V.7; P.5, does not possess scales, and have continuous lateral line. The spots (patterns) appear dark distally on the anterior part of the dorsal fin. The total body length of *Blenniella gibbifrons* was 5.5 cm with the body width of 1.5 cm [14].

Serranidae is a coral and demersal fish. There are 159 species in the world and 39 species can be found in Indonesia [15]. *Grammistes sexlineatus* is a fish from the family Serranidae which is widely distributed in the Red Sea to the Marquesan and Mangaréva islands, North to Southern Japan, South to New Zealand. *Grammistes sexlineatus* has a dark brown body with yellow stripes and small juveniles with spots. This species has 7-7 dorsal spines, 13-14 dorsal soft rays total, 2-2 anal spines, and 9-9 anal soft rays [6].

The results of species diversity according to the Shannon-Wiener index in [3] in this study were 2,25 indicating that the diversity of fish species in Porok Beach in this study was classified as moderate. The distribution of the number of individual fish in Porok Beach for each species is moderate, community stability is moderate, and the condition of polluted waters is moderate.

4. Conclusion

From the study that has been carried out, there are ten species in five families of fish found at Porok Beach. These species were *Pomacentrus brachialis*, *Stegastes obreptus*, *Plectroglyphidodon leucozonus*, *Abudefduf sordidus*, *Abudefduf vaigiensis*, *Acentrogobius caninus*, *Istigobius ornatus*, *Springeratus xanthosoma*, *Blenniella gibbifrons*, and *Grammistes sexlineatus*. The most common family found was Pomacentridae while the least common families were Clinidae and Serranidae. The diversity of fish species in Porok Beach is 2,25 or is classified as moderate. There are still many possibilities regarding kinds of fish in the intertidal zone of Porok Beach. Periodic research are needed for better data collection and also for conservation purposes.

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