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Fish fauna of seagrass beds in south Sulawesi, Indonesia

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Abstract

The composition of the fish communities associated with two different seagrass habitats in South Sulawesi (Indonesia) was studied by making representative collections with the chemical ichthyocide rotenone. A coastal seagrass bed on an intertidal mudbank and a seagrass meadow on a shallow reef flat of a coral island had different fish communities. Both habitats were equally rich in species (26 and 27 species respectively). The coastal seagrass fish community was dominated by estuarine-dependent species, whereas reef-dependent fish species dominated in the meadow on the reef flat. Only a few species could be regarded as specific to the seagrass habitat. Potential significance of the seagrass habitats as nursery areas for fishes was indicated by the numbers of juveniles of several species, including some of economic importance.

Introduction

Seagrass beds are widely distributed in the tropical Indo-Pacific region. They often occur adjacent to coral reefs and mangrove forests. The importance of seagrass meadows as habitat for fishes and decapod crustaceans is well documented (Bell and Harmelin-Vivien 1982,1983; Blaber *et al.* 1989; Parrish 1989; Sogard and Able 1991). Several authors reported significantly higher faunal densities in seagrass beds relative to unvegetated sand or mud substrates (see review by Orth *et al.* 1984). The physical nature of the seagrass canopy is thought to play a major role, potentially influencing available shelter, food and protection from predators (Heck and Orth 1980; Leber 1985; Stoner and Lewis 1985). The importance of seagrass beds as a nursery habitat for juvenile fishes and crustaceans, including several of economic importance, is also widely acknowledged (Pollard 1984; Bell and Pollard 1989; Heck and Weinstein 1989; Chester and Thayer 1990; Orth and Van Montfrans 1990).

Little is known of the composition of the seagrass-associated fish communities in Indonesia. Hutomo and Martosewojo (1977) reported on the fishes associated with seagrass beds from Burung Island (Pari Island, Seribu Islands, Java). Martosewojo (1989) documented fish communities of reef flat, reef edge and pelagic habitats in the Flores Sea, which included several stations in seagrass beds. The present study documents the species composition of fish communities associated with two contrasting seagrass habitats in South Sulawesi, Indonesia. Some preliminary observations on habitat specificity are discussed.

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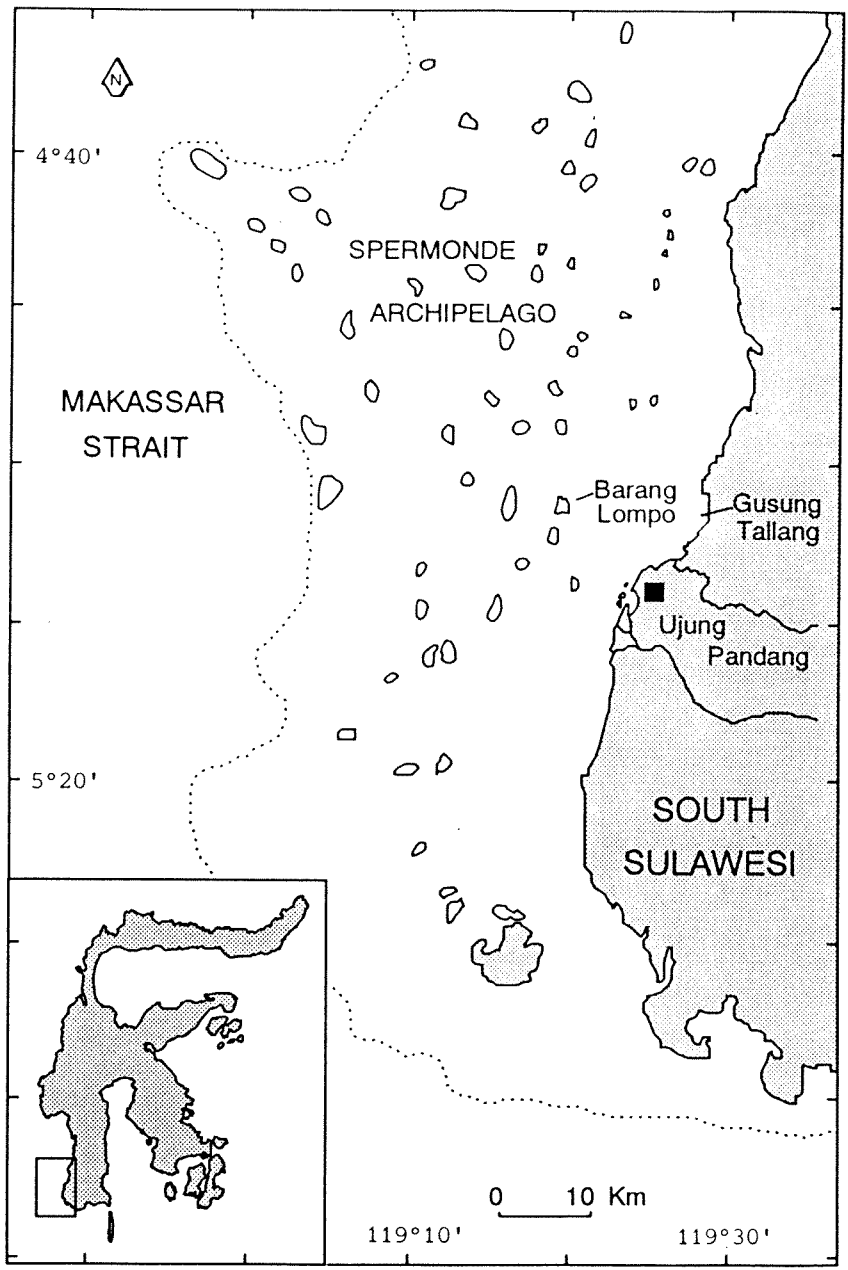

Figure 1 Map of the study area, showing the locations mentioned in the text (dotted line is approximate edge of continental shelf).

Materials and Methods

Study area

The study was undertaken at two sites in South Sulawesi, Indonesia, representing different seagrass habitats (Figure 1). These sites have been subject of a detailed study of biological and physical parameters, which will be published elsewhere (Erftemeijer, in prep.).

1. Barang Lompo (5°03'S, 119°20'E), a coral reef island in the Spermonde Archipelago, located c. 14 km from the coast, has an extensive shallow reef flat of approximately 100 ha covered by carbonate sands. Mixed seagrass beds dominated by *Thalassia hemprichii* and *Enhalus acoroides*, with smaller patches of *Halophila ovalis, Halodule uninervis,* and *Cymodocea rotundata,* cover over 50 ha of this reef flat. Several blow-outs and open sand areas occur in these beds. Isolated sea anemones and small coral patches are also scattered over the reef flat. Rich coral growth, however, is limited to the reef edge and slopes. The water at this site has a very low turbidity, and is characteristic in composition to that of tropical oceanic waters.

2. Gusung Tallang (5°04'S, 119°27'E) is an intertidal area along the South Sulawesi west coast, located c. 0.5 km north of the mouth of the Tallo River. The substrate is dominated by sandy mud, protected from waves and currents by a long and narrow sandbar in the north, running perpendicular to the coast. On this muddy sand, a monospecific seagrass meadow occurs of *Enhalus acoroides*, covering an estimated 40 ha. This area is bordered by a narrow strip of mangrove forest backed by extensive brackish water fishponds. The water at Gusung Tallang is characterized by a high concentration of phytoplankton and suspended organic material, resulting in poor visibility.

Methods

Representative collections were made of the fish communities in the seagrass beds at each locality, by utilizing the chemical ichthyocide rotenone. Approximately 0.5-0.8 kg of powder was used for each station, which was conducted during neap low tide (minimal current velocity). The effective sample area was about 50 x 50 m, to some extent affected by wind-driven currents. Stunned fishes were collected with small handnets. Special effort was made to pick up all specimens to obtain data on relative abundance of the different species. Fishes were preserved in 10% seawater formalin. Most species were identified by the second author (G.R. Allen) at the Western Australian Museum. Certain problematical gobiids were identified by Helen K. Larson (Northern Territory Museum, Darwin). Identification was aided by photographs taken of specimens while fresh. All material was deposited at the Western Australian Museum, Perth (WAM). Data on habitat specificity are largely based on the long experience in ichthyological surveys in this region by the second author (G.R. Allen).

Table 1 List of fishes collected in seagrass beds. Phylogenetic order of families follows the classification of Nelson (1984) with slight modification. (BL = Barang Lompo, 31-I-1992; GT = Gusung Tallang, 13-VIII-1991). Figures refer to the total number of specimens in the sample. Species marked with an x were often observed in the seagrass beds while snorkeling, but did not occur in the samples.

Family and species name	BL	GT
Ophichthidae		
Muraenichthys macropterus Bleeker, 1857	-	7
Ophichthus apicalis (Bennett, 1830)	-	1
Clupeidae		
Spratelloides delicatulus (Bennett, 1831)	3	-
Spratelloides gracilis (Temminck and Schlegel, 1846)	>100	-
Engraulididae		
Stolephorus sp.	-	9
Plotosidae		
Plotosus canius Hamilton, 1822	-	7
Plotosus lineatus (Thunberg, 1787)	-	9
Synodontidae		
Saurida gracilis (Quoy and Gaimard, 1824)	1	-
Hemiramphidae		
Hyporhamphus dussumieri (Valenciennes, 1846)	2	-
Atherinidae		
Hypoatherina sp.	-	8
Syngnathidae		
Microphis brachyurus (Bleeker, 1853)	-	4
Syngnathid sp.	-	1
Scorpaenidae		
Dendrochirus zebra (Cuvier, 1929)	2	-
Paracentropogon leucoprosopon (Bleeker, 1856)	-	1
Platycephalidae		
Platycephalus isacanthus (Cuvier, 1829)	-	5
Chandidae		
Ambassis nalua (Hamilton, 1822)	-	>50
Serranidae		
Centrogenys vaigiensis (Quoy and Gaimard, 1824)	2	-
Epinephelus coioides (Hamilton, 1922)	-	1
Pseudochromidae		
Pseudochromis fuscus Müller and Troschel, 1849	1	-
Terapontidae		
Pelates quadrilineatus (Bloch, 1760)	-	13
Apogonidae		
Apogon melas Bleeker, 1848	3	-
Cheilodipterus quinquelineatus Cuvier, 1828	3	-
Foa brachygramma (Jenkins, 1902)	-	3
Sillaginidae		
Sillago sihama (Forsskål, 1775)	-	2

Table 1 (cont.)

Family and species name	BL	GT
Leiognathidae		
Leiognathus brevirostris (?) (Valenciennes, 1835)	-	1
Gerreidae		
Gerres filamentosus Cuvier, 1829	-	3
Nemipteridae		
Pentapodus trivittatus (Cuvier, 1830)	5	-
Pomacentridae		
Amphiprion ocellaris Cuvier, 1830	1	-
Dischistodus chrysopoecilus (Schlegel and Müller, 1839)	2	-
Dischistodus perspicillatus (Cuvier, 1930)	3	-
Pomacentrus tripunctatus Cuvier, 1830	2	-
Labridae		
Cheilinus chlorurus (Bloch, 1791)	2	-
Cheilio inermis (Forsskål, 1775)	x	-
Halichoeres chloropterus (Bloch, 1791)	3	-
Novaculichthys macrolepidotus (Bloch, 1791)	2	-
Blenniidae		
Petroscirtes variabilis Cantor, 1850	x	-
Eleotrididae		
Butis amboinensis (Bleeker, 1853)	-	13
Gobiidae		
Acentrogobius caninus (Valenciennes, 1837)	-	4
Amblyeleotris sp.	x	-
Amblygobius bynoensis (Richardson, 1844)	4	-
Cryptocentrus sp.	x	-
Drombus sp.	-	11
Glossogobius biocellatus (Valenciennes, 1837)	-	5
Myersina macrostoma Herre, 1931	-	1
Valenciennea sexguttata (Valenciennes, 1837)	1	-
Siganidae		
Siganus canaliculatus (Park, 1797)	1	-
Siganus javus (Linnaeus, 1766)	-	20
Siganus virgatus (Valenciennes, 1835)	1	-
Bothidae		
Pseudorhombus neglectus Bleeker, 1866	-	1
Cynoglossidae		
Cynoglossus kopsi (?) (Bleeker, 1851)	-	11
Monocanthidae		
Acreichthys tomentosus (Linnaeus, 1758)	2	-
Tetraodontidae		
Arothron manilensis (de Proce, 1822)	-	11
Arothron mappa (Lesson, 1830)	1	-
Total number of species:	27	26

Results

A total of 49 fish species were collected in seagrass beds in South Sulawesi. Visual observations (snorkeling) added 4 additional species to the list at Barang Lompo (reef flat), which were considered to be characteristic of the seagrass beds at this site, but which did not occur in the samples. No species was common to both habitats (Table 1). The total number of species was nearly equal at the two sites (27 and 26 species respectively).

Of the fishes collected during this survey, only a few can be regarded as typical for seagrass habitats. The majority of fishes collected at Gusung Tallang are species known to be characteristic of estuarine habitats and brackish waters. With exception of the cardinalfish *Foa brachygramma* (a species typical of sheltered places in seagrass beds such as underneath logs or in empty shells), none of the species found in the seagrass beds at this site are confined to this habitat.

At least three species collected in the seagrass beds at Barang Lompo may be considered typical of this habitat and are rarely encountered in other habitats, i.e. the leatherjacket *Acreichthys tomentosus*, the green weed wrasse *Novaculichthys macrolepidotus* (also found in meadows of the weed *Sargassum*), and the false scorpionfish *Centrogenys vaigiensis* (preferably with some hard substratum around). Some other species that were collected at this site are typical weed species (not necessarily seagrass), including the green-spotted wrasse *Halichoeres chloropterus* and the cigar wrasse *Cheilio inermis* (not in samples, but frequently observed while snorkeling).

The majority of the fishes collected at Barang Lompo are species characteristic of the reef flat environment (regardless of the presence of seagrasses), notably the yellow-banded threadfin bream *Pentapodus trivittatus*, the white-patch damsel *Dischistodus chrysopoecilus*, the three-spot damsel *Pomacentrus tripunctatus*, and the tropical garfish *Hyporhamphus dussumieri*. Others are confined to sandy environments (not necessarily reefflats), such as the striped catfish *Plotosus lineatus*, the six-spot goby *Valenciennea sexguttata*, the byno goby *Amblygobius bynoensis*, white damsel *Dischistodus perspicillatus*, the slender grinner *Saurida gracilis* and shrimp gobies (*Amblyeleotris* sp. and *Cryptocentrus* sp.). In addition, the false clownfish *Amphiprion ocellaris* is the only anemonefish that occurs in shallow seagrass beds, in association with its host anemone *Stichodactyla gigantea*; however these species also occur in deeper waters (Allen 1980). The remaining fishes collected at this location are typical reef species that occasionally visit the seagrass beds, or species that occur in a wide range of habitats.

Some of the species collected (or observed) in the seagrass meadows at Barang Lompo, display camouflage colour patterns clearly adapted to seagrass (or weeds in general): *Acreichthys tomentosus*, *Novaculichthys macrolepidotus*, *Halichoeres chloropterus*, *Cheilio inermis* (green initial phase), and *Petroscirtes variabilis*.

Shrimp gobies were abundant in seagrass beds at Barang Lompo, but were not retrieved in the samples. Visual observations indicated that at least two genera were represented (*Cryptocentrus* and *Amblyeleotris*) but no positive identifications were made to species level. These gobies live in symbiosis with burrowing alpheid shrimps *Alpheus* spp. (Karplus 1987). Withdrawal in the burrows during sampling probably

explains their absence in the rotenone collections. Their density at this site was estimated at 4-5 individuals per m^2 (visual observations).

The majority (15 species) of fish individuals collected at Gusung Tallang were juveniles or subadults. Species of which more than 10 juveniles occurred in the samples, included *Butis amboinensis*, *Siganus javus*, *Pelates quadrilineatus*, *Arothron manilensis*, and *Stolephorus* sp.. At Barang Lompo, a much smaller proportion (6 species) of the total catch consisted of juveniles. They included *Arothron mappa*, *Plotosus lineatus*, *Cheilinus chlorurus*, *Apogon melas*, *Spratelloides delicatulus*, and *S. gracilis*. With the exception of the two species of clupeids (*Spratelloides* species), which occur in a variety of shallow-water habitats, these are typical reef species.

Visual observations and sampling data indicate that siganids (rabbitfishes) are among the most dominant fishes utilizing the seagrass habitat. Rabbitfishes are economically important food fishes in many parts of Indonesia (Polunin 1983). They are herbivores that generally occur in shallow waters, usually encountered in pairs or small schools (Woodland 1990). We have observed them to forage on seagrass leaves with attached epiphytes.

Discussion

The present study identified 53 species associated with seagrass habitats in South Sulawesi. They belonged to 29 different families, which included 8 of 10 families reported as dominant in Australian seagrass beds (Pollard 1984).

The two contrasting seagrass habitats investigated had no single fish species in common. The seagrass associated fish community at the coastal site (Gusung Tallang) was dominated by estuarine and brackish water fish species, practically none of which are considered specific to the seagrass habitat. The fish community of the seagrass meadows at the coral island Barang Lompo consisted mainly of species characteristic of coral reef environments, a few of which can be regarded as specific for the seagrass beds.

Although only a few fish species are typically confined to seagrass meadows, this habitat is important to many others by providing shelter and food resources. The majority of the fishes collected at Gusung Tallang and a substantial proportion of those caught at Barang Lompo were juveniles, which might indicate that the beds were being used as a nursery habitat. Some of these species are of economic importance as food fishes, notably the siganids, clupeids and engraulids (Polunin 1983). The utilization of seagrass beds as nursery grounds appears to be based on their provision of both adequate shelter from predators and an abundant food source, particularly in the form of small epibenthic crustaceans (Pollard 1984; Parrish 1989). Hutomo and Martosewojo (1977) collected 78 fish species associated with seagrass beds at Pari Islands (Java) by repeatedly using a beach seine-net, and reported on some seasonal variations in their abundance. They noted a community composition similar to that recorded in the present study, with cardinalfishes, wrasses, siganids, monocle-breams, silver-biddies and leatherjackets among the dominant groups.

Hutchins (1990 a,b) collected 56 fish species in seagrass beds at Shark Bay (Western Australia, 25°-27° S, 113°-114° E) by box-trawling. He found no

significant differences in species composition of the fish community between *Amphibolis* and *Posidonia* meadows in the same area. Both Hutchins (1990 a,b) and Hutomo and Martosewojo (1977) found evidence of utilization of seagrass beds by fishes as a nursery ground. Although the sampling methodology differed between these two surveys and also from the present study, the results are well comparable. Future sampling with different techniques might reveal additional species, notably when carried out during different months of the year and also during the night. Several fish species are known to migrate between reefs and seagrass beds for nocturnal foraging or shelter (Parrish 1989). Recent work by Black *et al.* (1990), who performed beach seining in intertidal *Amphibolis* seagrass beds in Shark Bay, indicated significant differences in species diversity and abundance of fishes between seagrass beds and adjacent sand flats, between day and night, and between February (winter) and June (summer).

In accordance with available literature, our data confirm that the fish communities of seagrass meadows mainly consist of 'estuarine-dependent' fishes in coastal areas and of 'reef-dependent' fishes at coral islands. Seagrass vegetation rarely functions as a specific habitat type to which certain fishes are restricted, but it may greatly increase the habitat variability in these systems. One of the most important functions of seagrass beds in relation to fishes, is their role as a nursery area (Pollard 1984). The meadows may intercept large numbers of recruits that apparently profit from the abundant food supply and the shelter from predators.

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