COMMENT

Mangrove fish assemblages from data-sparse regions and the measurement of ecological equivalence: Comment on Sheaves (2012)

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ABSTRACT: The global comparison of mangrove fish assemblages and their ecological equivalence by Sheaves (2012; Mar Ecol Prog Ser 461:137–149) presents useful novel information for this specific ecosystem faunal assemblage. This comparison, however, included only a single study from the tropical Eastern Pacific region (TEP), which was assigned to an Eastern Central Atlantic group. Here, we present data that supplement the analysis made by Sheaves and show that the taxonomic composition (at the family level) of the TEP mangrove fish fauna is considerably different from the Eastern Central Atlantic, and warrants a different classification. To characterize TEP mangrove fish fauna, we used the same descriptors as in Sheaves (2012) (i.e. % of families with widespread vs. restricted distributions, and their affinity with families characteristic of coral reefs). Based on our analysis, the estuarine mangrove fish assemblages from the Neotropical region (TEP and Western Central Atlantic) substantially differ—both taxonomically and functionally—from the ones at the West African coast (tropical Eastern Atlantic) so that overall, Sheaves' (2012) Eastern Central Atlantic group likely consists of 3 groups: TEP, Western Central Atlantic and tropical Eastern Atlantic. An examination of the relative abundance and biomass of fish families revealed striking differences in their representativeness, especially between Neotropical and tropical Eastern Atlantic assemblages. Therefore, further comparisons of ecological equivalence should use metrics with a higher ecological resolution (i.e. biomass) than the ones employed by Sheaves (2012), giving a more meaningful basis to compare mangrove fish assemblages worldwide.

KEY WORDS: Mangrove fish assemblages · Ecological equivalence · Tropical Eastern Pacific · Neotropics

Introduction

There have been attempts to synthesize our current knowledge of global mangrove fish assemblages from a taxonomic perspective (e.g. Blaber 2000), but no specific studies have attempted to increase our understanding of the composition and ecological equivalence of these assemblages until Sheaves (2012). Sheaves (2012) analysed the similarities and differences of mangrove fish assemblages from studies around the world by using the proportions of the total species pool contributed by each fish family for

each study. He acknowledged that the inclusion of only one study from the tropical Eastern Pacific (TEP) as part of an Eastern Central (EC) Atlantic group has to be interpreted with caution. However, this clear bias may have severe effects on the interpretation of taxonomic and possibly functional relationships among mangrove fish assemblages in different biogeographical areas. Sheaves' (2012) EC Atlantic group classification was based on data from South America and Africa, considering only 4 data sets from Brazil and 13 from the West African coast. Data from major mangrove regions of the EC Atlantic that are underrepresented in the literature were not included, making the global comparison of Sheaves (2012) incomplete. Here, we present a reanalysis using additional studies on mangrove fish assemblages from the TEP and the Western Central Atlantic (French-Guyana, Brazil; see the supplement at www.int-res.com/articles/suppl/m474p299_supp.pdf). In our reanalysis (following the approach of Sheaves 2012), the EC Atlantic category has been split into 3 regions, namely the TEP, the Western Central Atlantic and the tropical Eastern Atlantic, emphasizing that considerable differences exist in the mangrove fish assemblages between these regions.

Tropical Eastern Pacific mangrove fish assemblages

The TEP is considered the most isolated tropical marine biogeographical region of the world, with fish fauna endemism estimated at ca. 80% (Robertson & Cramer 2009). The mangrove areas in this region comprise ca. 27% of the total mangroves in the Neotropics and ca. 8% of the world (Lacerda et al. 2002). Mangrove fish assemblage studies in the TEP are lacking from the peer-reviewed literature (Faunce & Serafy 2006). Yet, this underrepresentation has been partially overcome through a recently published review by Castellanos-Galindo et al. (2012) of 9 mangrove fish fauna studies. The database of Sheaves (2012) contained a single TEP study from a Mexican coastal lagoon system (Warburton 1978), which was grouped with the EC Atlantic.

For the mangrove fish studies from the TEP region, we found 8 fish families (Heterenchelyidae, Lophiidae, Microdesmidae, Ophidiidae, Rajidae, Torpedinidae, Triakidae and Urotrygonidae) that were absent from the data sets of Sheaves (2012). Of the 41 families that were present in all 4 faunal groups identified by Sheaves (2012), 9 were not present in the TEP in our analysis (Fig. 1). When comparing the families in common between the TEP region and EC Atlantic

faunal group, we found differences that will likely alter the faunal groups identified in Sheaves (2012). A definitive classification will require a reanalysis of the data set used by Sheaves (2012) together with the data provided here. Tetraodontidae, Engraulidae, Lutjanidae, Atherinopsidae, Cichlidae and Centropomidae showed contrasting representation (% of studies within a region where families occurred) between the TEP in our analysis and Sheaves' (2012) EC Atlantic faunal group (our Fig. 1). The contribution from families with widespread distribution (recorded as occurring in most parts of the world where mangroves are found; sensu Sheaves 2012) in the TEP (88%) was much higher than the contribution from families with restricted distribution (i.e. only present in the TEP or the Neotropical region) (12%). These proportions more closely resemble those found by Sheaves (2012) for the EC Atlantic faunal group.

To investigate the degree of overlap of mangrove fish families with coral reef families in the TEP, we compared the occurrence of the 10 fish families in Bellwood's (1996) consensus list of coral reef fish families. We only identified Carangidae and Labridae occurring in >25% of samples of the TEP region (100% and 30% of occurrence in data sets, respectively). The rest of Bellwood's (1996) reef fish families had <20% representation in studies of the TEP (Chaetodontidae, Apogonidae, Mullidae, Pomacentridae) or were not part of the mangrove fish fauna of the region (i.e. Acanthuridae, Blenniidae, Holocentridae, Scaridae). Thus, a very low reef affinity characterized the mangrove fish fauna of the TEP region, similar to what Sheaves (2012) found for the EC Atlantic and Australasian faunal groups.

Neotropical versus tropical Eastern Atlantic fish assemblages

The taxonomic classification of Western Central Atlantic and tropical Eastern Atlantic mangrove fish assemblages as Sheaves' (2012) EC Atlantic faunal group is potentially problematic. Even though most indicator families for the EC Atlantic faunal group (sensu Sheaves 2012) are present in Brazil, the family Claroteidae (freshwater catfishes), for example, is only present in tropical Eastern Atlantic mangroves (Table 1). Likewise, Cichlidae and Elopidae are rarely reported in studies from the Western Central Atlantic (Fig. 1). Moreover, common families in the Western Central Atlantic like Tetraodontidae, Carangidae, Engraulidae, Lutjanidae, Ephippidae, Ariidae
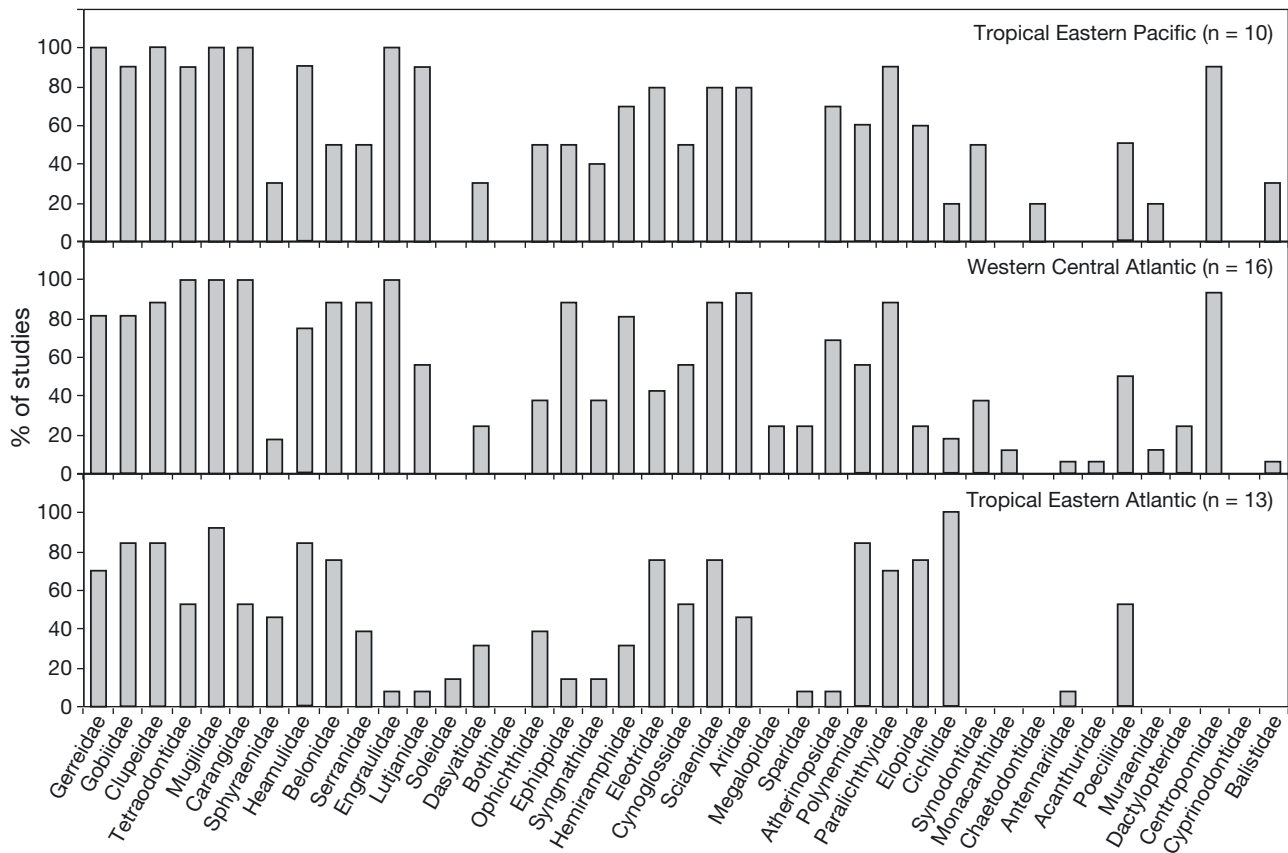
Fig. 1. Percentage of data sets analyzed from the tropical Eastern Pacific region (including the data set of Warburton 1978), the Western Central Atlantic and the tropical Eastern Atlantic (see the supplement at www.int-res.com/articles/suppl/m474p299_supp.pdf for a list of references) in which fish families common to all faunal groups identified by Sheaves (2012) occurred. These 3 biogeographical regions constitute the Eastern Central Atlantic faunal group identified by Sheaves (2012). Family order on *x*-axis follows Fig. 5 in Sheaves (2012)

and Centropomidae are clearly less common in the tropical Eastern Atlantic region (Fig. 1). Therefore, Sheaves' (2012) grouping of mangrove ichthyofaunas of these 2 regions could be an artifact of considering a greater number of data sets from the tropical Eastern Atlantic (13) than from the Western Central Atlantic (4). Our reanalysis includes 16 data sets from the Western Central Atlantic region (see the supplement). In addition, further differences between Neotropical estuarine areas and West Africa (tropical Eastern Atlantic) emerge when abundance or catch mass metrics are employed: our preliminary analysis employing such metrics shows that TEP and Western Central Atlantic mangrove fish assemblages are considerably more similar to each other, and very different from West Africa (Table 1, Fig. 1). In particular, the families Tetraodontidae and Ariidae are only marginally represented in West Africa in terms of biomass, whereas in the TEP and the Western Central Atlantic these two families have top ranking (Table 1).

Conclusion

The starting point to test hypotheses regarding taxonomic and ecological equivalence of mangrove fish assemblages has been set by Sheaves (2012). We supplement the analysis made by Sheaves (2012) with additional data sets from the Neotropics and show that the EC Atlantic group of Sheaves (2012) likely consists of 3 faunal groups: the TEP, Western Central Atlantic (Atlantic coast of South America) and the tropical Eastern Central Atlantic (Atlantic coast of Africa). An ultimate classification would require a reanalysis using the whole database used by Sheaves (2012) and the database presented here. In the future, more meaningful global comparisons need to incorporate studies that are available from underrepresented mangrove areas (e.g. the TEP, estuarine areas of the Caribbean) and also consider the use of metrics like biomass (Magurran & Henderson 2012) that are of much greater ecological significance than the proportions of the total species contributed by each fish family.

Table 1. Comparison of different metrics from mangrove fish assemblages from the tropical Eastern Pacific, Western Central Atlantic and tropical Eastern Atlantic. Contribution in number of species, abundance (no. of individuals) and biomass (B) at the family level for indicative families (sensu Sheaves 2012) in the Eastern Central (EC) Atlantic faunal group

Family	Tropical Eastern Pacific[a]			Western Central Atlantic[b]			Tropical Eastern Atlantic[c]		
	No. of species (%)	No. of ind. (%)	B[d] (%)	No. of species (%)	No. of ind. (%)	B (%)	No. of species (%)	No. of ind. (%)	B (%)
Ariidae	6.67	3.98	19.14	7.41	31.53	32.41	4.29	1.31	3.39
Cichlidae	0.95	0.01	0	0	0	0	4.29	0.02	0.06
Claroteidae	0	0	0	0	0	0	4.29	0.47	1.45
Clupeidae	2.54	15.41	6.93	2.36	2.35	0.37	5.71	46.54	27.20
Eleotridae	2.54	0.79	0.61	0.77	0.05	0.07	1.43	0.01	0.01
Elopidae	0.32	0.14	0	0.85	0.03	0.04	1.43	0.28	0.41
Engraulidae[e]	5.40	9.48	0.01	9.95	18.24	7.39	0	0	0
Gerreidae[e]	4.13	20.41	1.61	2.91	1.56	0.75	2.86	0.11	0.11
Mugilidae	1.27	8.67	1.31	4.56	8.46	8.70	7.14	2.23	2.74
Polynemidae	0.63	0.65	0	0.67	0.02	0.03	4.29	1.69	3.39
Pristigasteridae	0.95	0.21	0	0.83	0.04	0.01	0	0	0
Sciaenidae	12.38	3.07	0.26	16.62	10.43	9.07	8.57	39.65	50.40
Tetraodontidae[e]	2.86	3.02	19.53	3.94	9.21	21.93	1.43	0.07	0.10

[a]Data from Castellanos-Galindo et al. (2012); [b]data from Giarrizzo & Krumme (2008); [c]data from Albaret et al. (2004); [d]data from a single study where biomass data are available (authors' unpubl. data); [e]information on ecologically important families in the Neotropics based on studies not included in Sheaves (2012)

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