

IS IT POSSIBLE TO DETERMINE A SPECIAL FISH GROUP BY ONE HABITAT?: A SHORT DISCUSSION

[¿Es posible determinar un grupo especial de peces por su hábitat?: breve discusión]

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RESUMEN: Los arrecifes de coral son entornos complejos con gran biodiversidad. Se han realizado muchas investigaciones para entender su diversidad y ecología. Especialmente, los ictiólogos han examinado la relación e interacción entre su gran número de especies. En los últimos años algunos autores han tratado de definir los peces arrecifales por medio de la taxonomía o la ecología, pero, de momento, no existe un consenso acerca de una definición general de dichos peces. La mayoría de los investigadores sólo trabajan con peces teleósteos. Sin embargo, la historia de los peces arrecifales de aguas someras es mucho más antigua que la “edad de los teleósteos”. En esta breve discusión se han comparado algunos peces de aguas someras del Mesozoico (Pycnodontiformes) con peces arrecifales actuales. Su principal resultado es que es imposible dar una definición general de los peces arrecifales, dado que los peces arrecifales de aguas someras son heterogéneos en su estilo de vida y no guardan ninguna relación taxonómica a lo largo del tiempo.

Palabras clave: Definición, peces, Mesozoico, Pycnodontiformes.

ABSTRACT: Coral reefs are a complex environment with a large biodiversity. Much research has been done to understand the diversity and ecology of coral reefs. Especially ichthyologists examined the relationship and interaction between the large numbers of fish species. In the last years, some authors tried to define

coral reef fishes by means of taxonomy or ecology, but until today, there is no consent about a general definition of fishes on coral reefs. Most researchers only worked with teleost fishes in their studies. However, the history of fishes on shallow-water reefs is much older than the “teleost era”. Some typical extinct Mesozoic shallow-water fishes (Pycnodontiformes) are compared with extant coral reef fishes. The main result of this short discussion is that it is impossible to give a general definition of coral reef fishes. Shallow-water reef fishes are heterogenic in their lifestyle and have no closer taxonomic relationship in the course time.

Key words: Definition, fishes, Mesozoic, Pycnodontiformes.

DISCUSSION

During the last decades, much research has been done on coral reefs by many authors. The distribution, ecology, and protection of coral reefs build the main focus of these studies, especially since recognition of global warming and the ecological importance of such an environment. Fishes are one important group of animals associated with coral reefs. About 5.000 species of extant fishes are found on coral reefs and are not easy to characterize only by their environment. In the last years, several scientists have tried to answer the basic question: What are coral reef fishes?

Different approaches (mostly taxonomy and ecology) build the basis of the definition. To most scientists, coral reef fishes are found to be associated with coralline structures and rarely some pelagic forms are found on these structures (e. g. SALE, 1980; FEITOZA *et al.*, 2003). BELLWOOD (1996) tried to define coral reef fishes taxonomically after new fossil findings in Monte Bolca, Italy (Eocene, ca. 50 Ma). He suggests a broader definition than “coral reef fishes are brightly colored” is needed to combine extant and extinct individuals. He used the family level to define a recent reef fish assemblage and gave a minimum consensus list based on the Monte Bolca assemblage and the twenty-one locations of coral reefs found until today. According to BELLWOOD (1996), eight families are present at coral reefs: Acanthuridae, Apogonidae, Blenniidae, Chaetodontidae, Labridae, Mullidae, Pomacentridae, and Scaridae. The following seven coral reef associated families may be present: Holocentridae, Siganidae, Ehippidae, Serranidae, Pomacanthidae, Carangidae, and Zanclidae. His result is that presence or absence of taxa reflect a coral reef assemblage rather than ecological criteria. ROBERTSON (1998) criticized this consensus list and came to the conclusion that coral reef fish assemblages have major, distinctive, and ecological characteristics because the families of this list are not solely restricted to coral reefs. BELLWOOD (1998) brought out that the families of the consensus list are characteristic of, but not restricted to, coral reefs. He still assumes that ecology is unlikely to provide a better definition than taxonomy. BELLWOOD & WAINWRIGHT (2006) amplified this definition and came to the conclusion that coral reef fishes are those taxa which belong to the consensus list plus taxa characteristic of coral reefs in specific areas.

Until today, all definitions of coral reef fishes are only based on extant teleost fishes. The history of fishes associated with coral reefs is much longer than the Monte Bolca assemblage. For example, in the consensus list, which is defined by BELLWOOD (1996), he did not include the extinct shallow-water fishes (Pycnodontiformes: 1.8% of the Monte Bolca fish fauna).

IS IT POSSIBLE TO DEFINE "CORAL REEF FISHES" IN A MERELY TAXONOMIC OR ECOLOGICAL WAY?

Maybe it is better to use morphological characteristics to define fishes associated with coral reefs. The morphology of fishes indicates much about their behavior and the environmental preference. Extinct teleost fishes from Monte Bolca are morphologically and maybe functionally similar to recent

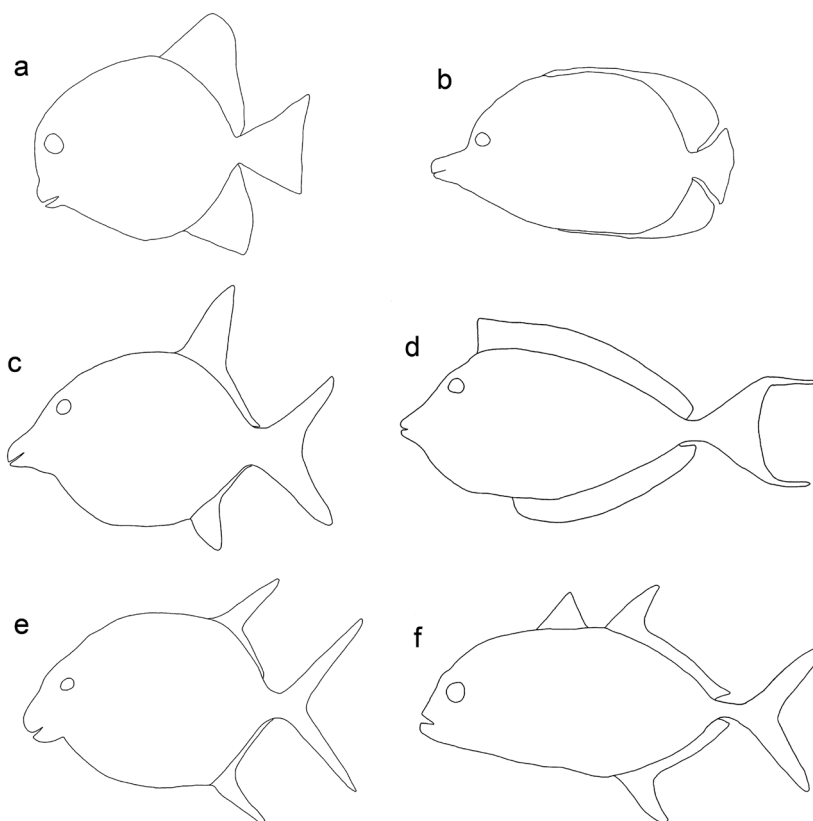


Figure 1. Different fin forms of extinct (a, c, e) and extant (b, d, f) reef associated fishes. Slow swimmer: (a) *Macromesodon* sp., (b) *Chaetodon lineatus*; faster swimmer: (c) *Proscinetes* sp., (d) *Naso lituratus*; pelagic forms: (e) *Gyrodus* sp., (f) *Caranx ignobilis*.

taxa and can be interpreted as fishes which lived facultatively on coral reefs (BELLWOOD, 1998). The body form results from the interplay of the type of locomotory system, skeletal framework, the internal system, and behavioral habits. These factors show the behavioral tendency (GREENWAY, 1965). Identified morphological characters can be used to interpret the potential abilities of extinct and extant taxa (BELLWOOD & HOEY, 2004). These characters are a link between the morphology, performance, and ecology.

Mesozoic shallow-water fishes, e. g. Pycnodontiformes, from the Solnhofen area (S-Germany) allow comparison with living forms because of their good preservation (SENN, 1996). These fishes are mostly deep bodied and resemble the shape of the most modern teleosts on reefs, except anguilliform fishes like Muraenidae (SENN, 1996; VIOHL, 1996) (figure 1). This shape of the body expresses the way of swimming, especially the fin forms (SENN, 1996). Extant “coral reef fishes” show different fin forms and behavior. These fin forms are already seen in extinct “coral reef fishes”. The dorsal, caudal, and anal fins of *Macromesodon* (figure 1a) build a functional unit and indicate that it was a slow swimmer with precise maneuvering movements (SENN, 1996; VIOHL, 1996). Slow swimmers usually do not move far from their shelter (VIOHL, 1996), like *Chaetodon* (figure 1b) (pers. observ.). The dorsal and anal fins of *Proscinetes* (figure 1c) are separated from the caudal fin. This indicates that this species could swim faster and could not maneuver precisely like *Macromesodon* (VIOHL, 1996). Acanthuridae have a similar arrangement of the fins like *Proscinetes*, and this indicates that they have a higher vagility (figure 1d). In *Gyrodus* (figure 1e), the fins are more pronounced, the caudal fin is deeply forked, and this indicates that it was a fast swimmer (SENN, 1996; VIOHL, 1996). This fin shape is typical of pelagic fish types (figure 1f), which patrol along the outer reef slope (POLOVINA, 1984; SENN, 1996).

Morphological characters reflect the possibility to use a habitat, but cannot characterize a special environment. Habitat, behavior, and morphological structure do not correlate with certainty (GREENWAY, 1965). Many extant and extinct “coral reef fish” families/species are not exclusively restricted to coral reefs directly and it is not possible to identify fishes that lived on ancient coral reefs, as BELLWOOD (1998) already mentioned. Most species are just temporarily found on reefs (e. g. SALE, 1980; POLOVINA, 1984; PARRISH, 1989; ROBERTSON, 1998). They commute between coral reefs and the neighboring habitats (e. g. seagrass beds and mangroves). The neighboring habitats provide important food sources for herbivores and for fishes which prey on benthic invertebrates (PARRISH, 1989). Holocentridae, many snappers species, Mullidae, Scianidae and Muraenidae are some examples of fishes, which are also found in the neighboring habitats (PARRISH, 1989). Seagrass beds and mangroves are often used as nurseries by “coral reef fishes” because coral reefs are limited in their area and the neighboring habitats maybe provide protective concealment for young “coral reef fishes”. For example: Large numbers of reef fish juveniles has been recorded in indo-pacific seagrass beds (PARRISH, 1989).

Morphologically, it is very easy to characterize fishes which can live on coral reefs, but it is impossible to define them just for this habitat. Mobile animals, like fishes, migrate (actively or, in a larval stage, passively) and cannot be defined by a single environment. Coral reefs represent one habitat, but not the only habitat (BELLWOOD, 1998). The availability of food and defense may be the most significant factor in deciding where to settle down, and not a special environment.

A general definition (ecological, taxonomical or morphological) of “coral reef fishes” is not possible for so many species with different preferences. It can be helpful to build two groups of extant fishes on coral reefs, like many authors do for their studies (e. g. FEITOZA *et al.*, 2003). The first group are species which only have a larval stage outside of the reef and the second group are species which are temporarily on reefs. The second group has to be divided into two further groups. The first are species which leave the reef to feed and the second are species which come to feed on the reef. This allocation is no definition and only pertains to extant fishes on coral reefs. It is not possible to reconstruct this for extinct fishes, which may have lived on coral reefs.

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