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Coral reef fishes in the marine area of Ba Mun Island, Quang Ninh Province

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Abstract—A total of 68 species belonging to 38 genera in 21 families have been identified in the marine area of Ba Mun Island (Bai Tu Long National Park). Coral reef fishes in the area are represented for a subtropical ichthyofauna characterized by lacking of some typical families found in tropical reefs. The distribution of the species among the surveyed transects is characterized by non-equivalent in the number of species. Among the surveyed transects, transect MC5 has the highest number of species (19 species, occupies 27.9% of the total recognized species), followed by MC6 (16 species—23.5%), MC1 (13 species—19.1%), and MC3 (10 species—14.7%). The transect site containing the smallest number of species is MC12 (5 species—7.4%). The monsoon regime does not seem to have much influence on changes in reef fish species composition in the study area, but strongly affects the individual counts of reef fishes. Although species richness of the Ba Mun Island sites is low compared to neighbouring reef sites (the northwest islands of the Tonkin Gulf), the potential values of reef fish resources in this area are significant as sources of seafood, ornamental fish and rare genetic resources. The destructive fishing methods employed by local fishermen can be considered the main threats to the preservation of reef fish resources. In addition to the emerging necessity of enhancing public awareness about nature conservation in the Bai Tu Long Bay area, local people should also be involved in the current and future establishment and management of the Bai Tu Long National Park.

Key words: Ba Mun Island, Bai Tu Long National Park, reef fishes, destructive fishing

Introduction

The marine area in Ba Mun Island plays an important role for the marine biota of Bai Tu Long Bay and, more broadly, Quang Ninh Province. It contains typical tropical marine ecosystems such as coral reefs and seaweeds, and provides habitats for many marine organisms. In the coral reef ecosystem, reef fishes reach highest biodiversity to compare with other vertebrates (Sale 1991). However, they have not been well studied due to constraints in methodology, equipment, and human capability.

A number of studies on reef fish resources and biodiversity have been carried out in the study area. The Institute of Marine Environment and Resources conducted a preliminary study on the species composition of reef fishes in the Ba Mun marine area in 1999, with limitation due to the sampling frequency of the study (one season only).

The project “Investigation and justification for the establishment of the Bai Tu Long National Marine Park, Quang Ninh Province” provided for a study on biodiversity and reef fish resources with the purpose of providing official statistics and data on the ichthyofauna in the marine area of Ba Mun Island. The results of two years of study (2003–2004) are presented in this paper. Results from the project will contribute to baseline information for policy makers as well as conservationists working towards to the sustainable use of marine fish resources.

Methods

Study area

Thirteen reef sites in the Ba Mun Island vicinity were selected in this study and marked from MC1 to MC13 (Fig. 1).

Field survey

Field trips were carried out during the rainy season (September 2003) and the dry season (May 2004) at the selected transects sites in Ba Mun Island. Because of the diversity in the habitat structures at the sites, several sampling methods were selected. The underwater visual fish census technique (English et al. 1997) was applied in combination with underwater camera/video techniques for assessment of reef fish abundance. Fish samples were collected by hook and line, gill net and trawl.

Laboratory analysis

Fresh fish samples were preserved in 30% formalin and brought to the Institute of Marine Environment and Resources’s laboratory for further analysis. All underwater photos and video clips were stored in a database and made available for other studies. The scientific names of fishes followed Beaufort (1940, 1941), Carcasson (1977), Chevey P. (1934), Chu Y. T. (1962, 1963), Thi (1991), Dinh and Thi (1985), Nelson (1994), De Bruin et al. (1994), Randall et al. (1997),

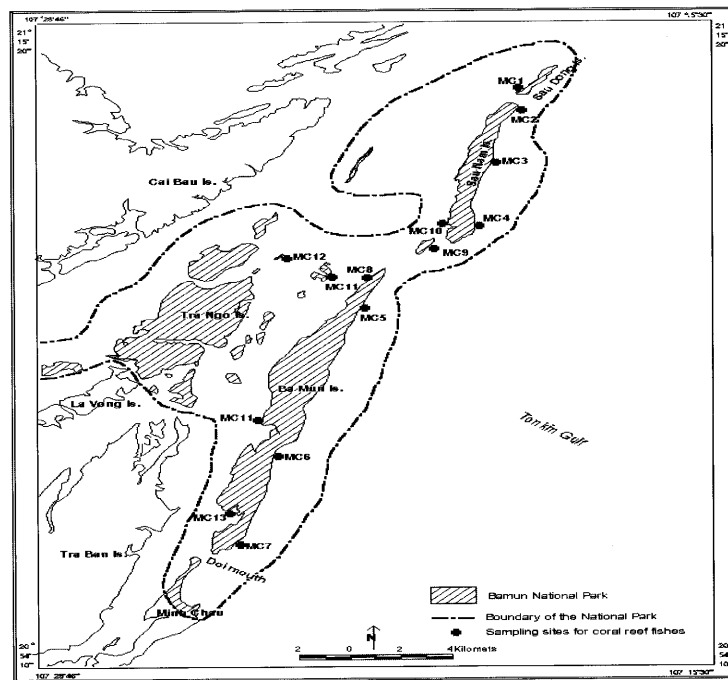


Fig. 1. Map of sampling sites for coral reef fishes.

Meyers (1991), Lieske and Meyers (1996), Allen (2000), Eschmeyer (1998) and correlated with FishBase 2004 (Froese and Pauly 2004).

Results

A comparison of the number of species in reef sites in the northwest islands of Tonkin Gulf (Table 1) shows that the ichthyofauna of Ba Mun Island has the lowest biodiversity, compared to the neighbouring reefs of Co To Island, Tran Island, and Ha Long Bay.

Species composition of reef fish in Ba Mun Island

A total of 68 species belonging to 38 genera in 21 families were identified through two investigations in September 2003 and April 2004 (Table 2). Families containing high numbers of species are: Pomacentridae (with 13 species, accounting for 19.1% of the total number of recorded species); Serranidae—(9 species, 13.2%); Labridae—(6 species, 8.8%); Apogonidae and Mullidae—(5 species each, each family accounts for 7.3% of the total number of recorded species). Other families such as Chaetodontidae, Nemipteridae and Gobiidae had 4 species each (each family accounting for 5.9% of the total number of recorded species). The remaining families had 1–2 species each (Fig. 2). There are no representatives of the family Acanthuridae, a typical reef fish family commonly found in the tropical reefs.

Table 1. Comparison of the number of fish species among reef sites in the northwest islands of Tonkin Gulf.

| No. | Reef site | Number of species |
|-----|---------------|-------------------|
| 1 | Co To Island | 133 |
| 2 | Tran Island | 157 |
| 3 | Ha Long Bay | 111 |
| 4 | Cat Ba Island | 79 |
| 5 | Ba Mun Island | 68 |

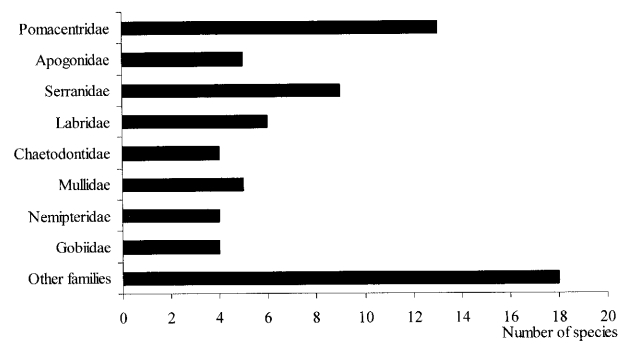


Fig. 2. Number of species per family in the fish fauna of Ba Mun Island.

Seasonal changes of reef fish communities in Ba Mun Island

The monsoon regime does not seem to have much influence on changes in reef fish species composition in the study area, but strongly affects the individual counts of reef fishes. Results from this study show that the number of individuals in each family is higher in the dry season and lower in the rainy season (Table 3, Fig. 3). However, the transect sites lo-

Table 2. List of coral reef fishes identified in the marine waters of Bai Mun Island.

| Sp. No. | Scientific name | Sp. No. | Scientific name |
|---------|---------------------------------------|---------|----------------------------------|
| | 1. BRANCHIOSTOMIDAE | | 13. CHAETODONTIDAE |
| 1 | <i>Branchiostomus belcheri</i> | 36 | <i>Chaetodon auriga</i> |
| | 2. SYNODONTIDAE | 37 | <i>C. octofasciatus</i> |
| 2 | <i>Synodus variegatus</i> | 38 | <i>C. wiebeli</i> |
| 3 | <i>Trachinocephalus myops</i> | 39 | <i>Chelmol rostratus</i> |
| | 3. HOLOCENTRIDAE | | 14. POMACENTRIDAE |
| 2 | <i>Neoniphon sammara</i> | 40 | <i>Abudefduf septemfasciatus</i> |
| 3 | <i>Sargocentron diadema</i> | 41 | <i>A. vaigiensis</i> |
| 4 | <i>S. rubrum</i> | 42 | <i>A. bengalensis</i> |
| | 4. TERAPONTIDAE | 43 | <i>A. sexfasciatus</i> |
| 5 | <i>Terapon theraps</i> | 44 | <i>Amphiprion clarkii</i> |
| | 5. APOGONIDAE | 45 | <i>Chromis fumea</i> |
| 6 | <i>Apogon quadrifasciatus</i> | 46 | <i>Neoglyphidodon nigroris</i> |
| 7 | <i>A. aureus</i> | 47 | <i>N. melas</i> |
| 8 | <i>A. lateralis</i> | 48 | <i>Neopomacentrus azysron</i> |
| 9 | <i>Apogon</i> sp. | 49 | <i>Ne. bankieri</i> |
| 10 | <i>Cheilodipterus quinquelineatus</i> | 50 | <i>Pomacentrus amboinensis</i> |
| | 6. RACHYCENTRIDAE | 51 | <i>P. bankanensis</i> |
| 11 | <i>Rachycentron canadum</i> | 52 | <i>P. moluccensis</i> |
| | 7. SERRANIDAE | | 15. LABRIDAE |
| 12 | <i>Cephalopholis boenack</i> | 53 | <i>Halichoeres margaritaceus</i> |
| 13 | <i>C. leopardus</i> | 54 | <i>H. biocellatus</i> |
| 14 | <i>C. urodeta</i> | 55 | <i>H. purpurescens</i> |
| 15 | <i>Diploprion bifasciatum</i> | 56 | <i>Halichoeres</i> sp. |
| 16 | <i>Epinephelus corallicola</i> | 57 | <i>Labroides dimidiatus</i> |
| 17 | <i>E. merra</i> | 58 | <i>Thalassoma lunare</i> |
| 18 | <i>E. rivulatus</i> | | 16. GOBIIDAE |
| 19 | <i>E. sexfasciatus</i> | 59 | <i>Amblyeleotris</i> sp. |
| 20 | <i>E. amblycephalus</i> | 60 | <i>Amblygobius phalaena</i> |
| 21 | <i>Epinephelus</i> sp. | 61 | <i>Cryptocentrus</i> sp. |
| | 8. LUTJANIDAE | 62 | <i>Istigobius campbelli</i> |
| 22 | <i>Lutjanus argentimaculatus</i> | | 17. SIGANIDAE |
| 23 | <i>L. russelii</i> | 63 | <i>Siganus canaliculatus</i> |
| | 9. CAESIONIDAE | 64 | <i>S. fuscescens</i> |
| 24 | <i>Caesio cuning</i> | | 18. CIRRHITIDAE |
| 25 | <i>C. teres</i> | 65 | <i>Cirrhitus pinnulatus</i> |
| | 10. NEMIPTERIDAE | | 19. ZANCLIDAE |
| 26 | <i>Pentapodus emeryii</i> | 66 | <i>Zanclus cornutus</i> |
| 27 | <i>P. vitta</i> | | 20. MONACANTHIDAE |
| 28 | <i>Pentapodus</i> sp. | 67 | <i>Monacanthus chinensis</i> |
| 29 | <i>Scolopsis vosmeri</i> | | 21. TETRAODONTIDAE |
| | 11. HAEMULIDAE | 68 | <i>Arothron hispidus</i> |
| 30 | <i>Plectorhinchus pictus</i> | | |
| | 12. MULLIDAE | | |
| 31 | <i>Parupeneus bifasciatus</i> | | |
| 32 | <i>P. indicus</i> | | |
| 33 | <i>Upeneus tragula</i> | | |

cated in the seaward direction of Ba Mun Island (MC1 to MC8) show this trend more clearly.

For example, the number of individuals recorded at the transect MC5 is 85 individuals/250 m² in the rainy season and reaches 126 individuals/250 m² in the dry season. The same trend also has been found at the MC6: 51 individuals/250 m² in the rainy season 98 individuals/250 m² in the dry season.

The fishes showing greater dynamics in the number of individuals in their populations are species belonging to the Serranidae (*Cephalopholis boenack*, *Epinephelus sexfasciatus*), the Pomacentridae (*Neopomacentrus azysron*, *Neoglyphidodon nigroris*) and the Chaetodontidae (*Chaetodon octofasciatus*). However, some transect sites did not show any changes between the dry and rainy seasons, including transects MC2, MC9 and MC11.

Table 3. Changes in the individual counts of the coral reef fish communities in Ba Mun Island.

| Transect site | Rainy season (individuals/250 m ²) | Dry season (individuals/250 m ²) |
|---------------|---|---|
| MC1 | 59 | 64 |
| MC2 | 32 | 33 |
| MC3 | 56 | 75 |
| MC4 | 35 | 42 |
| MC5 | 85 | 126 |
| MC6 | 51 | 98 |
| MC7 | 59 | 58 |
| MC8 | 42 | 49 |
| MC9 | 27 | 32 |
| MC10 | 55 | 69 |
| MC11 | 33 | 38 |
| MC12 | 47 | 50 |
| MC13 | 62 | 37 |

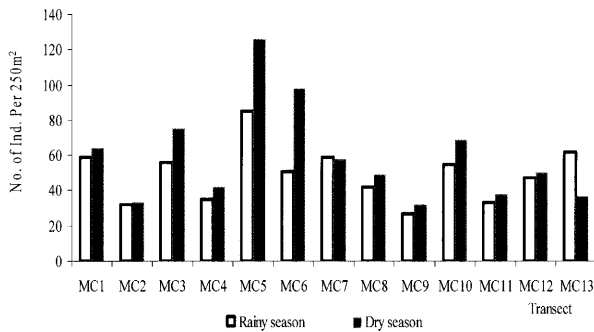


Fig. 3. Seasonal changes in individual counts of reef fish communities in Ba Mun Island (Abbreviations of transect lines are shown in the text).

Characteristic distribution of species among transects

The distribution of species among the surveyed transects is characterized by non-equivalent in the number of species (Table 4, Fig. 4). Among the surveyed transects, transect MC5 has the highest number of species (19 species, 27.9% of the total recognized species), followed by MC6 (16 species, 23.5%), MC1 (13 species, 19.1%), and MC3 (10 species, 14.7%). The transect site containing the lowest number of species is MC12 (5 species, 7.4).

The most common species found in each transect belong to the Pomacentridae (*Neopomacentrus azysron*, *Abudefduf vaigiensis*, *Abudefduf septemfasciatus*), the Chaetodontidae (*Chaetodon octofasciatus*, *Chelmon rostratus*, *Chaetodon auriga*), the Serranidae (*Cephalopholis boenack*, *Diploprion bifasciatum*, *Epinephelus sexfasciatus*) and the Labridae (*Halichoeres margaritaceus*, *Thalassoma lunare*, *Labroides dimidiatus*). The lancelet fish *Branchiostomus belcheri*, one of the rare/endangered species listed in the “Viet Nam Red Book 1992”, was only present in transect MC8 where the substrate was characterized by sand, gravels and coral rubbles. The discovery of this species in the study area illustrates the importance and value of biodiversity that need to be protected, as

Table 4. Quantitative species distribution among surveyed transects.

| Transect site | Number of recorded species |
|---------------|----------------------------|
| MC1 | 13 |
| MC2 | 8 |
| MC3 | 10 |
| MC4 | 12 |
| MC5 | 19 |
| MC6 | 16 |
| MC7 | 7 |
| MC8 | 7 |
| MC9 | 6 |
| MC10 | 9 |
| MC11 | 7 |
| MC12 | 6 |
| MC13 | 7 |

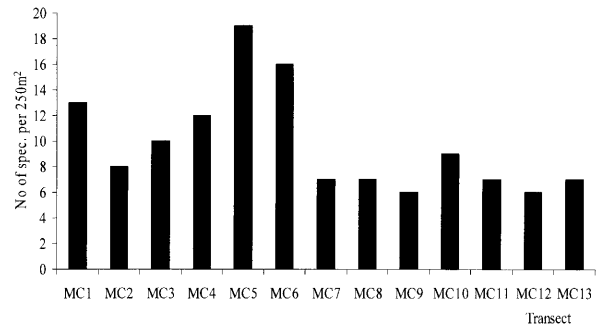


Fig. 4. Species distribution among surveyed transects.

well as the importance of the establishment of the core zone of the Bai Tu Long National Park in the near future.

Economic and rare species

Based on the results of the study on the ichthyofauna of the coral reef fishes of Ba Mun Island, species of high economic value for export purposes are large size species and foods species including fishes of the Serranidae, Haemulidae, Lutjanidae and Rachycentridae. These fishes are the main targets of local fishermen who employ hook and line fishing, gillnet, and diving with compressor.

Ornamental species of high value for diving tourism and aquarium trades are “decorated” with various colours and blend into the natural substrate when swimming around corals. They are highly attractive to tourists in both their natural habitats and in artificial aquariums. Such species belong to the Chaetodontidae, Labridae, Pomacentridae, Apogonidae, and Holocentridae. Due to their low food value, over-exploitation is not yet a problem and these species remain relatively abundant in almost all reef sites.

As noted above, the lancelet fish *Branchiostomus belcheri* is a species of high value to scientific research and is listed in the “Viet Nam Red Book 1992”. This species is a valuable contribution to evolution studies and can serve as a

bioindicator for water quality.

Threats to reef fish resource

In addition to the natural impacts on coral reef health (a habitat for fishes) of typhoons, turbidity, fresh water runoff, and other natural phenomena, human activities are the main contributors to the reduction of biodiversity and reef fish resources. Gill net directly reduces fish resources. Statistical data was collected at some anchorage points around Sau Nam Island where about 15 low motorized boats usually fish near shore, and where the target species are fish, green crab and shrimp. The many patches of fishing net remaining on coral substrates is evidence of the impact of these activities in the study area.

Following gill net fishing in terms of impact is hook and line fishing, used for harvesting juveniles of the Serranidae for cage farming. Hook and line fishing is a major contributor to fishermen's income during the breeding season of reef fishes (March to August of the lunar calendar). However, quantitative data about the number of fishing boats involved in hook and line fishing have not yet been obtained due to seasonal changes.

Dynamite fishing is most destructive, causing significant reductions of reef fish resources and other coral dwelling species. It still exists in the Minh Chau Island area where three households are found using this illegal gear to exploit fishes during breeding seasons. Dynamite fishing not only affects the long-term stability of fish stock by killing the breeders and juveniles, but also giving serious damages to corals.

Another fishing method, diving with compressor, existed in the 1990s, but it was no longer practiced "due to the exhausted reef fish resources in this area," according to fishermen.

Conclusions

Coral reef fishes in the marine area of Ba Mun Island represented a subtropical ichthyofauna characterized by lacking of some typical families found in tropical reefs (Acanthuridae, for example).

The diversity of the genera and species in Ba Mun Island is lower than that of neighbouring reefs. This may be due to the historical development of reefs and other natural conditions such as temperature, turbidity, larval supply, etc. Furthermore, the destructive fishing methods employed by local fishermen also contribute to this phenomenon.

Reefs at the seaward sites of Ba Mun Island such as MC5 and MC6 maintain high species diversity. In particular, the number of juveniles belonging to the Serranidae increases during the dry season. The sites may serve as breeding grounds for neighbouring reefs in Bai Tu Long Bay, and so in order to effectively manage the National Park, it is recommended that they become the core zone.

In addition to the emerging necessity of enhancing public awareness about nature conservation in the Bai Tu Long Bay area, local people should also be involved in the current and future establishment and management of the Bai Tu Long National Park.

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