



# Establishment and management of fisheries *refugia* in Phu Quoc Marine Protected Area, Vietnam

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## Abstract

Establishment and management of fisheries *refugia* have recently been recognized as important tools in sustainable use/management of fish stocks and their associated habitats. To initiate the fisheries *refugia* management approach in Phu Quoc, several activities were conducted to collect baseline information for establishment of fisheries *refugia* in Phu Quoc Archipelago since 2007, including local consultations and field surveys involving local communities and concerned stakeholders. Site selection for the establishment of model fisheries *refugia* was based on scientific data and consultations with local communities and based on criteria of habitat representativeness, target species diversity and abundance and site management potential. Results from the baseline surveys recorded 11 spawning and nursery grounds of several target species including; octopus (*Octopus dollfus*), cuttlefish (*Sepioteuthis lessoniana*), the Strombus shell (*Strombus canarium*), swimming crab (*Portunus pelagicus*), seahorses (*Hippocampus* spp.), rabbitfishes (*Siganus* spp.) associated with seagrass habitat and squids (*Loligo* spp.) associated with sandy bottom habitat. In the coral reef habitats, there were 10 locations where nursery grounds of barred-cheek coral trout (*Plectropomus maculatus*) were found in the waters surrounding most of the group of islands (An Thoi) in the southern part of Phu Quoc big island. Two pilot sites were selected for fisheries *refugia* management, one to protect the nursery grounds of grouper associated with coral reef habitats at Hon Roi fishing village and the other to protect the spawning/nursery grounds of the Strombus shell, octopus, swimming crab and seahorses associated with the sea

grass habitats of Bai Thom fishing village. Management has been implemented on an annual basis since 2013 during spawning/nursery seasons from July to December. The key lessons learned from the implementation of fisheries *refugia* at the two pilot sites include; using local fisher knowledge for baseline inventory and assessments to determine site selection and management measures for fisheries *refugia*; the value of involving local communities and government officers in the development and management of fisheries *refugia*; and the importance of identifying specific fisheries management issues and appropriate management measures. This approach is expected to ensure success of sustainable management of fisheries and their habitats in the future.

**Keywords:** Fisheries *refugia*, target resources, seagrass beds, coral reefs, Vietnam.

## Introduction

Overfishing and degradation of coastal and marine habitats are considered major issues to marine environment in the South China Sea and Gulf of Thailand (UNEP, 2007a). Fish stocks in this region continue to be subject to high levels of fishing effort due to increasing global demand for fisheries

products and strong coastal community dependence on fisheries, making it difficult to reduce inshore fishing capacity and unsustainable fishing practices (UNEP, 2007a). Recent synthesis of fisheries trends suggests that production from capture fisheries will decline over the coming years unless the fishing effort and capacity are reduced (Lundgren *et al.*, 2006). Therefore there is an urgent need to find solutions to improve management of fisheries in the region.

Phu Quoc Marine Protected Area (MPA) supporting more than 12,000 ha of seagrass beds (Nguyen, 2004) and 473 ha of coral reefs (Nguyen *et al.*, 2006) is considered as an important fishing ground in the western part of Vietnam and in the Gulf of Thailand. Since the establishment of the MPA in 2007, a series of management activities have been implemented aimed at conserving biodiversity and resources. The results of monitoring seagrass beds and coral reefs from 2006 to 2010 showed that the condition of the habitats gradually deteriorated and that habitat associated resources (especially those of the target species) were unable to recover significantly due to overfishing, destructive fishing, coral bleaching and sedimentation (Nguyen *et al.*, 2011).

Consultations with local fishers indicated that some areas of seagrass and coral reef habitat are important spawning and nursery grounds for commercial fish species. However, these important grounds have not been considered for MPA management due to lack of sufficient information. Consequently, the linkage between habitats and life cycle of habitat associated species has not received sufficient attention in the development of an MPA management plan. Current zoning plans are mainly based on distribution and status of habitats, species richness, occurrence of endangered species, resource use patterns, and human impact on environmental resources. This approach has led to slow recovery of marine resources in general and target species in particular.

Recently, the establishment of fisheries *refugia* for sustainable use of fish stocks and their habitats has been increasingly considered as an important tool for fisheries management (UNEP 2007b). The first fisheries refugium was developed in Phu Quoc at a pilot site with seagrass habitats at Ham Ninh Commune in 2007. This initiative was part of the framework of the UNEP/GEF Project "Reversing environmental degradation trends in the South China Sea and Gulf of Thailand". The activities under the initial project were continued in the subsequent project "Studies and establishment of some pilot sites of fisheries *refugia* in Vietnam" (2012-2014) under support from the Ministry of Agriculture and Rural Development (MARD) of Vietnam. This paper presents the preliminary results of the establishment and management of fisheries *refugia* in Phu Quoc MPA.

## Material and methods

Inventory and assessments of critical spawning and/or nursery grounds in Phu Quoc MPA were conducted through consultations and field surveys with involvement of local communities, managers and scientists to enable use of local knowledge. A total of 7 consultations were made, in which 4 meetings were organized at Cua Can, Ganh Dau, Bai Thom and Ham Ninh communes which have seagrass associated fisheries; and 3 meetings at An Thoi, Hon Thom and Hon Roi communes which have coral reef associated fisheries. At each consultation, there were 15 - 20 experienced local fishers fishing with different gears including trawling, hookah fishing, drift nets and purse seine. Fish traders from each commune were also invited to attend the meetings. From local consultations, the locations and seasons of different target species for scientific field assessment/validation were provisionally identified.

Field validation of the presence/existence of critical spawning and/or nursery grounds and identification of the areas of each of the critical spawning and/or nursery grounds was conducted with the involvement of experienced fishers and scientists. At each ground, 5 - 10 sites were checked by using scuba and hookah diving depending on the nature of the ground. Information on the presence of target species and characteristics of habitats were ascertained at each checked site. The boundaries of each spawning and/or nursery ground were marked using GPS.

Selection of sites for establishment and management of fisheries *refugia* was based on scientific data and consultations with local communities and used habitat representatives, diversity and abundance of target species, and management potential as selection criteria.

## Results and discussion

### *Distribution of spawning and/or nursery grounds of target species*

#### Seagrass beds

The data gathered from the surveys indicated that there were several target commercial fish species in Phu Quoc waters including octopus (*Octopus dollfus*), cuttlefish (*Sepioteuthis lessoniana*), strombus (*Strombus canarium*), swimming crab (*Portunus pelagicus*), seahorses (*Hippocampus kuda* and *H. trimaculatus*), rabbitfishes (*Siganus canaliculatus*, *S. guttatus* and *S. javus*), squids (*Loligo* spp.), shrimp (*Penaeus latisulcatus*) and Indian whiting (*Sillago sihama*).

A total of 11 spawning and/or nursery grounds for the above-mentioned target species were recorded in seagrass habitats

and on sand-gravel and sandy bottom habitats (Fig. 1). The strombus snail was the most common species found in 7 of the 11 spawning/ nursery grounds; seahorses and cuttlefish were found in 4, swimming crab, octopus and rabbitfishes in 2 - 3 and squids in one spawning/ nursery ground. In general, each spawning and/or nursery ground was supported by more than one species with the exception of the spawning grounds of squid in the south and of seahorses in the north-east of Phu Quoc big island. Shrimp and Indian whiting are also considered as important fisheries resources but their spawning/nursery grounds were very difficult to find.

The eggs of srombus were mainly recorded on the sand-gravel bottoms or nearby seagrass beds (Plate 1) while the eggs of cuttlefish were usually attached on seagrasses or seaweeds (Plate 2). The spawning octopus and their eggs were mostly found inside the dead shells of gastropods or bivalves (Plate 3). Juvenile and mature gravid swimming crabs, juvenile rabbitfishes and seahorses were mainly found in localities



Plate 1. Strombus shell (*Strombus canarium*) spawned on sandy-gravel substratum of seagrass beds



Plate 2. Eggs of cuttlefish attached on seaweeds of seagrass beds.



Plate 3. Octopus (*Octopus dollfus*) hiding in dead shells of bivalve for laying eggs in seagrass beds

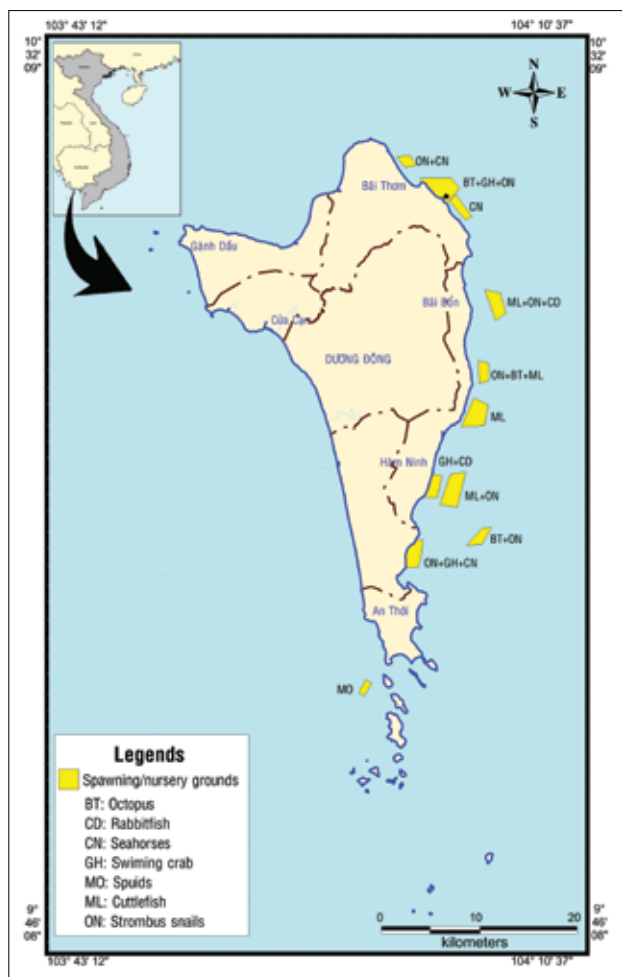


Fig. 1. Distribution of spawning/nursery grounds of target species in seagrass beds and sandy bottoms in Phu Quoc Archipelago.





for daily management at each site, especially during spawning/nursery seasons from July to December.

This is the first time the fisheries *refugia* tool has been applied in Vietnam for sustainable use of fish stocks and their habitats. Data and information from surveys show that there are several important spawning and/or nursery grounds of target species in different habitats, from seagrass to sandy-gravel bottoms and coral reefs. Among them, many grounds supporting high abundance of several target species were located outside the MPA restricted zone for management of seagrass beds and coral reefs. However most of these important grounds have not been considered during development of zoning plan of the MPA due to lack of data and information. Establishment and management of two pilot sites for seagrass beds in Bai Thom and for coral reefs in Hon Roi have indicated initial success in reducing fishing activities of target species during spawning and nursery periods in the project sites and in their associated habitats in general as well. Success from management of these pilot sites will be extended to other grounds, especially to the grounds located outside the restricted zone with less management in order to establish a network of fisheries *refugia*. Development of effective management of a network of fisheries *refugia* in the MPA will contribute to sustainable use of fish stocks and their habitats in the future.

Lessons learnt from the achievements so far are: 1) Using local fisher knowledge in compiling scientific data is an important step for compiling resource inventories and assessing fisheries *refugia*; 2) Involvement of local communities and local government officers (MPA and fisheries managers, police and border Army) plays an important role at all steps of development of fisheries *refugia*, in identifying specific fisheries issues and appropriate management measures.

More work will be conducted to develop fisheries profiles at each site as a basis for monitoring the results of the

management measures (resources, fishing sector, post-harvest sector), for developing guidelines for sustainable use and training for monitoring of target species, for evaluating management effectiveness, and for developing a mechanism and measures for long-term *refugia* management at demonstration sites and other potential sites in Phu Quoc.

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