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Integrating Fisheries and Habitat Management: Fisheries *Refugia* in the South China Sea

Abstract: This note covers an effort to address the over-exploitation of fisheries. Increasing levels of fishing effort, coupled with continued decline in the total area of habitats critical to the life-cycles of most species, have raised serious concerns for the long-term sustainability of artisanal fisheries. Given the feed back loops between fish stock and habitat quality on the one hand, and fishing activities and habitat quality on the other it was necessary to develop a regional initiative aimed at improving the management of fish stocks and their habitats. Fisheries *refugia* are, "*Spatially and geographically defined, marine or coastal areas in which specific management measures are applied to sustain important species [fisheries resources] during critical stages of their life cycle, for their sustainable use*." It appears that the *refugia* concept is a successful approach to addressing a significant barrier to effective management action that addresses fish stocks and habitats important to critical stages of the life cycle of those stocks, namely the adverse reaction to the Marine Protected Area concept that is elicited from fishing communities and fisheries officers at the local and provincial levels. It is anticipated that the experiences gained in this region will be suitable for application in other large marine ecosystems where over-fishing and the use of inappropriate fishing gear are significant impediments to more sustainable exploitation of fisheries resources. This experience is considered important because of the potential global fisheries benefits associated with effective fisheries and habitat management at the local level, which is particularly important in the case of Southeast Asia due to the continuing importance of fisheries to food security, and maintenance of livelihoods.

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Integrating Fisheries and Habitat Management: Fisheries *Refugia* in the South China Sea

Experience of the GEF sponsored

"Reversing Environmental Degradation Trends in the South China Sea and Gulf of Thailand"

GEF Project ID: 885

PROJECT DESCRIPTION

The project entitled "*Reversing Environmental Degradation Trends in the South China Sea and Gulf of Thailand*" is funded by the Global Environment Facility (GEF) and implemented by the United Nations Environment Programme (UNEP) in partnership with seven coastal states bordering the South China Sea. The project addresses three priority areas of concern identified in the Transboundary Diagnostic Analysis (TDA), namely the loss and degradation of coastal habitats, over-exploitation of fisheries in the Gulf of Thailand, and land-based pollution. The original outcomes and outputs of the project were anticipated as being: an approved Strategic Action Programme of targeted and costed actions; a recommended framework for improved regional co-operation in the management of the environment of the South China Sea; a series of national and regional management plans for specific habitats and issues; nine demonstration management activities at sites of regional and global significance; a system of *refugia* to maintain important transboundary fish stocks in the Gulf of Thailand; and pilot activities relating to alternative remedial actions to address priority transboundary pollutants. This note summarises the experience of the project in establishing an initial regional system of fisheries *refugia* in the South China Sea and Gulf of Thailand. It draws on the South China Sea Knowledge Document on Fisheries *Refugia* published in October 2007 (UNEP, 2007a[1]).

THE EXPERIENCE

Issues

Fish stocks in the South China Sea and Gulf of Thailand are subject to high levels of fishing effort, such that stocks of most economically important species are considered to be fully fished or overexploited. Increasing global demand for fisheries products and the dependence of coastal communities on fish for food and income result in a continued increase in fishing effort. This has led to "fishing down the marine food chain" and increasing dependence of the artisanal sector on small pelagic stocks due to the decline in demersal species. Declining fish availability has led to destructive fishing practices by some fishermen in order to maintain incomes and food production in the short-term. Fisheries trends suggest that production from capture fisheries will decline over coming years unless total fishing effort and capacity are reduced. The obvious problem in the reduction of fishing capacity is that most fisheries are small-scale with the majority of participants being highly dependent on fisheries for income, food and well-being (Paterson *et al*., 2006).

Whilst actions aimed at reducing the rate of loss of coastal habitats of significance to fisheries have been implemented by the countries bordering the South China Sea, the decadal rates of loss of such habitats remain high: seagrass (30%); mangroves (16%); and coral reefs (16%) (UNEP, 2007a). Increasing levels of fishing effort, coupled with continued decline in the total area of habitats critical to the life-cycles of most species, have raised serious concerns for the long-term sustainability of artisanal fisheries in the region. The dilemma for the fisheries and environment sectors is that conservation of habitat does not necessarily result in increased fish stocks; and lowering of fishing effort does not necessarily result in improved habitat condition. Although fish production is intrinsically linked to the quality and extent of habitats, and although the dependence of coastal communities on fish for food and income is high, understanding of this linkage is limited, such that intensive fishing in inshore areas has been identified as a factor

[1] *All project related documents cited in this paper can be found on the project website at www.unepscs.org.*

contributing to the continued degradation and loss of seagrass and coral reef habitat and associated biodiversity in the region (UNEP, 2006a).

The fact that many marine fisheries in Southeast Asia are over-capitalised, unregulated, and subjected to illegal fishing has provided the impetus for the development of innovative approaches to the management of fisheries in the region. Significant efforts are being made in most countries to decentralise the responsibility for fisheries management to the local level with the aim of establishing co-management particularly of demersal fish stocks (Lundgren *et al*. 2006). However, the intrinsic relationship between fish stocks and their habitats necessitates that fisheries management involving decentralised and rights-based systems will need to incorporate strategies that foster the improved management of fish stocks and associated critical habitat linkages.

Challenges

The complexity of the key threats to habitats and biodiversity necessitate adequate cross sectoral consultation between fisheries and environment departments in each country particularly in relation to the designation of Marine Protected Areas and other habitat management zones in order to ensure that areas designated for protection are congruent with critically important habitat areas for fish stocks.

The notion of improving the integration of considerations regarding fish habitats with other aspects of fisheries management represents a significant challenge in that it involves the merging of two related but, until recently, very distinct management domains. The first, habitat management, aims to maintain the functional integrity and biodiversity of ecosystems through actions focused on the biophysical attributes of these systems. The second, fisheries management, aims to secure sustainable returns from resource use through actions focusing on the relationship between fishing activities and target species. Barriers for effective action were recognised, namely: limited information regarding fish life-cycle and critical habitat linkages and the role that marine habitats play in sustaining fisheries; low level of understanding amongst stakeholders, including fisher folk, scientists, policy makers, and fisheries and habitat managers of the linkages between fish stocks and habitats; low level of community acceptance of "protected" area-based approaches to marine management in Southeast Asia; and, limited experience in national fisheries and environment departments and ministries with respect to the implementation of integrated fisheries and habitat management approaches (UNEP, 2006b).

The Approach

The UNEP/GEF Regional Working Group on Fisheries (RWG-F) agreed that, given the feed back loops between fish stock and habitat quality on the one hand, and fishing activities and habitat quality on the other it was necessary to develop a regional initiative aimed at improving the effective linkages between fish stocks and habitats. Following a review of existing fisheries and habitat management initiatives in the region, the RWG-F noted that few of these focused on the above objectives and agreed to elaborate a system of fisheries management areas (fisheries *refugia*) in the South China Sea and Gulf of Thailand that focuses on the critical links between fish stocks and their habitats. The longer-term goal of this system would be to build the resilience of Southeast Asian fisheries to the effects of high and increasing levels of fishing effort (UNEP, 2006b).

Defining the Fisheries* Refugia *Concept

The RWG-F is promoting the use of a broad based definition of *refugia* (see Information Box 1) for the identification of fisheries *refugia* to "replace" those lost due to over-exploitation and the destruction of fisheries habitats. There is now a common and widespread understanding that fisheries *refugia* relate to specific areas of significance to the life cycle of particular species, and that they should be defined in space and time, and serve to protect spawning aggregations, nursery grounds, and migration routes. *(see text box on next page)*

Dissemination of Information on the Fisheries* Refugia *Concept

In order to promote mainstreaming of the concept within the fisheries and environment sectors, and to enhance and sustain community participation in the initiative, the RWG-F disseminated information on the *refugia* concept

THE RWG-F DEFINITION OF FISHERIES *REFUGIA*

Fisheries *refugia* in the context of the UNEP/GEF South China Sea Project are defined as:
"Spatially and geographically defined, marine or coastal areas in which specific management measures are applied to sustain important species [fisheries resources] during critical stages of their life cycle, for their sustainable use."

Fisheries *refugia* should:
- NOT be "no take zones",
- Have the objective of sustainable use for the benefit of present and future generations,
- Provide for some areas within *refugia* to be permanently closed due to their critical importance [essential contribution] to the life cycle of a species or group of species,
- Focus on areas of critical importance in the life cycle of fished species, including spawning, and nursery grounds, or areas of habitat required for the maintenance of brood stock,
- Have different characteristics according to their purposes and the species or species groups for which they are established and within which different management measures will apply,
- Have management plans.

Management measures that may be applied within fisheries *refugia* may be drawn from the following [non-exhaustive] list:
- Exclusion of a fishing method (e.g. light luring, purse seine fishing),
- Restricted gears (e.g. mesh size),
- Prohibited gears (e.g. push nets, demersal trawls),
- Vessel size/engine capacity,
- Seasonal closures during critical periods,
- Seasonal restrictions (e.g. use of specific gear that may trap larvae),
- Limited access and use of rights-based approaches in small-scale fisheries.

through: regional and national fisheries and environment fora; national expert, stakeholder, and community consultations; publication of a series of popular articles on the concept; and promoted the concept online via the South China Sea Project website. The concept has been well received at all levels, and has been utilised within the participating countries to build partnerships and to enhance communication between the fisheries and environment sectors.

The *refugia* concept has also been well received at the regional level and has led to the publication of the "*Regional Guidelines on the Use of Fisheries Refugia for Sustainable Capture Fisheries Management in Southeast Asia"* as part of the ASEAN-SEAFDEC Regional Guidelines for Responsible Fisheries in Southeast Asia. These guidelines provide participating countries with an effective policy platform for the elaboration of the concept at both national and regional levels. The outcomes of extensive community and stakeholder consultations in the participating countries during 2005 and 2006 suggest that the *refugia* concept is also well accepted by small-scale fishing communities and local officials (UNEP, 2007b).

To date fishing communities in Cambodia, Philippines, and Viet Nam have expressed their strong support for the establishment and management of fisheries *refugia* in areas of critical fisheries habitats. Thailand is successfully using the concept to achieve the sustainable use of 50,000 km^2 of critical habitats along the western coast of the Gulf of Thailand for regionally significant species, and have proposed plans to develop an additional area as *refugia* in the eastern Gulf of Thailand (UNEP, 2007b; 2007c). Similarly, the Research Institute for Marine Fisheries of Viet Nam's Ministry of Fisheries has recently partnered with the Departments of Environment and Science of Kien Giang Province to establish and manage a fisheries *refugia* site covering a 10,000 ha seagrass area on the east coast of Phu Quoc Island (UNEP, 2007c).

Identification of Fisheries Refugia*: Critical Spawning and Nursery Areas*

The RWG-F noted that most fish populations are vulnerable to the impacts of over-fishing in areas and at times where there is high abundance of (a) stock in spawning condition, (b) juveniles and pre-recruits, or (c) pre-recruits migrating to fishing grounds. It was highlighted that the impacts of over-fishing are intensified in instances where small-scale fishers and commercial fishers share the same stock, often leading to disputes of the relative impacts of each group. Juveniles and pre-recruits are often caught in inshore areas by small-scale fishers, while commercial fishers catch adults of the same species offshore. In circumstances such as this, high levels of fishing effort in inshore waters may drive growth over-fishing, while the same circumstances in offshore areas may

cause recruitment over-fishing of the same stock. It was agreed that the use of inshore nursery *refugia* to protect fish during the juvenile and pre-recruit phases of their life-cycle can assist in the prevention of growth over-fishing, whereas spawning *refugia* may assist in the prevention of recruitment over-fishing (Annex 5 of UNEP, 2006b).

The RWG-F agreed to compile information on critical spawning and nursery areas for important transboundary fish species including the identification of the UNEP/GEF South China Sea Project's Habitat Demonstration Sites that are critical inshore nursery *refugia* for important demersal species, the identification of locations in the South China Sea and Gulf of Thailand that are utilised by important pelagic species for spawning, and the evaluation of existing fisheries management areas that might qualify as fisheries *refugia*. This information was used to list and characterise known fish spawning and nursery areas (Annex 4 of UNEP, 2007b) and the RWG-F reviewed the list of sites in relation to information on the distribution and abundance of fish eggs and larvae in the South China Sea during the post northeast monsoon periods from 1996-1999 and the outcomes of country consultations on the identification of fisheries *refugia*. The group agreed on 14 priority sites for inclusion in an initial system of fisheries *refugia*, and an additional 9 sites for which further information is required prior to their inclusion in the system (Figure 1).

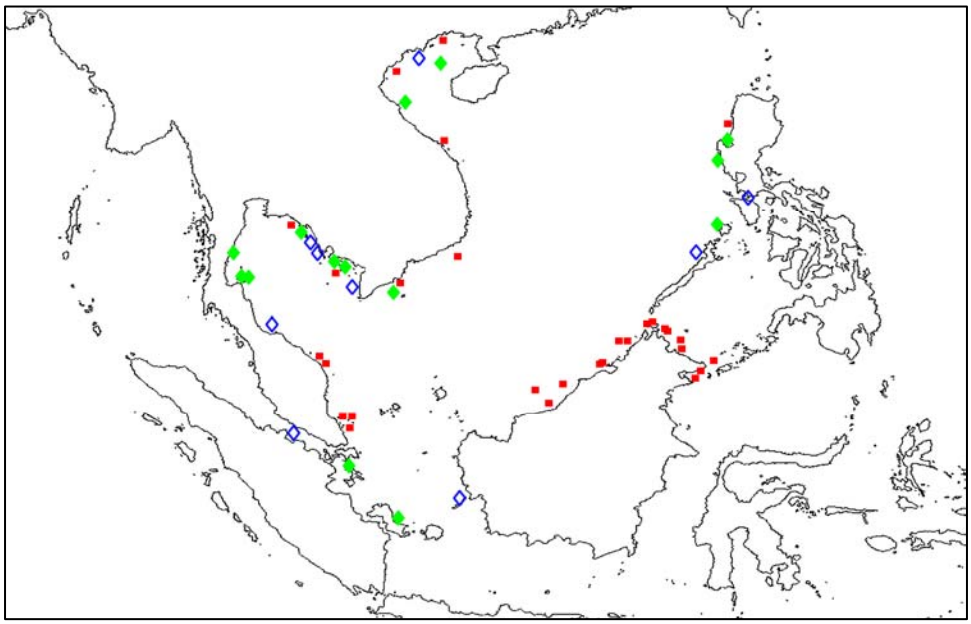

Figure 1 Location of: known spawning and nursery areas of transboundary fish species [▪]; initial sites selected for inclusion in the regional system of refugia [♦]; sites of high priority for inclusion in the regional system once the initial set are established

Improving the Scientific Basis for the Identification of Fisheries **Refugia**

Initial constraints in the identification of fisheries *refugia* related to the lack of information regarding the early-life history of the majority of significant species in the South China Sea and Gulf of Thailand. In this connection, the development of a collaborative programme of technical consultations, working group meetings, and training workshops, aimed at improving the scientific basis for the identification of fisheries *refugia* was agreed between the South China Sea Project and the Southeast Asian Fisheries Development Centre (SEAFDEC) during 2006.

SEAFDEC has worked with members of the RWG-F to develop a programme of work to review past and ongoing fish early-life history research work and to compile information on known spawning and nursery areas for important fish species including the utilisation of fish eggs and larvae collected during the fisheries resources assessment surveys by the M.V. SEAFDEC 2 in the South China Sea since 2004. To build technical expertise in the participating countries for the analysis of fish egg and larval samples, the South China Sea Project has initiated a collaborative training programme with SEAFDEC on Larval Fish Identification and Fish Early Life History Science. Participants in the training events have formed national teams responsible for processing the samples required to enhance the scientific basis for the identification of important fish spawning and nursery areas. Training materials used as part of this capacity building programme can be accessed by visiting http://www.unepscs.org/training.html.

RESULTS AND LEARNING

The original outcome of the project was simply anticipated as being "***a system of* refugia *to maintain important transboundary fish stocks in the Gulf of Thailand based on marine protected areas identified as critical habitats for fish stock conservation and protection***." The project document provides no guidance regarding a definition of what constitute "fisheries *refugia*", or the criteria for assessing the relative importance of individual areas as potential *refugia*. What has resulted from the work of the RWG-F are: (a) a listing of demersal species of fish, crustacea and molluscs of transboundary significance in the region; (b) a list of 52 known spawning and nursery areas of which 14 have been prioritised as the initial set and a further 9 accorded high priority for development as *refugia*; (c) criteria for defining fisheries *refugia*; and, (d) intergovernmentally approved guidelines for the establishment of fisheries *refugia* that constitute part of the ASEAN SEAFDEC Regional Guidelines for Responsible Fisheries in Southeast Asia (see SEAFDEC, 2006). Related information and outputs can be accessed by visiting the Fisheries *Refugia* Information Portal at http://refugia.unepscs.org.

It appears that the *refugia* concept is a successful approach to addressing a significant barrier to effective management action that addresses fish stocks and habitats important to critical stages of the life cycle of those stocks, namely the adverse reaction to the Marine Protected Area concept that is elicited from fishing communities and fisheries officers at the local and provincial levels. By emphasising the "sustainable use" aspects of *refugia* rather than the "no-take" approach adopted by many ministries of environment in their approach to marine protected areas adverse reactions are avoided. More importantly perhaps the fisheries *refugia* concept, since it is being promoted by fisheries departments, provides an initial platform for dialogue between the government institutions responsible for environment and for fisheries.

REPLICATION

It is anticipated that the experiences gained in this region will be suitable for application in other large marine ecosystems such as the Yellow Sea where over-fishing and the use of inappropriate fishing gear are significant impediments to more sustainable exploitation of fisheries resources. The concept is also under consideration by members of the Scientific Committee of the Western and Central Pacific Fisheries Commission for use in the management of tuna stocks in the Western Pacific.

Many past marine protected areas established around the world have been promoted in terms of their potential to improve the state of fisheries and their habitats, but have rarely included mechanisms to ensure the effective integration of fisheries considerations into management. In contrast fisheries departments and ministries largely focus on achieving sustainable yields from fish stocks. Experience in the South China Sea Project suggests that cross-sectoral co-ordination can be achieved through the fisheries *refugia* concept that has provided a platform for building partnerships and enhancing communication between the environment and fisheries sectors.

A second anticipated challenge in replicating the experience is generating sufficient support at the fishing community level for proposed interventions. At present many small-scale fishing communities, fisheries managers, and local government officials equate area-based (zoning) approaches to fisheries management as the equivalent of no-take Marine Protected Areas (MPA). The latter are often viewed as unacceptable at the fishing community level since they are rarely designated in locations of importance to the life-cycle of important fish species and neither improve fish stocks, nor the community's income. The net result of establishing classic MPAs has been the loss of fishing areas for small-scale fishers and non-compliance with fisheries management measures in the "protected" areas.

SIGNIFICANCE

The South China Sea and Gulf of Thailand is a global centre of shallow water marine biological diversity, supporting a significant world fishery that is important to the food security of, and as a source of export income for, Southeast Asian countries. Landings from this area contribute approximately 10 percent of reported global fisheries production per annum and make significant contributions to the economies of

countries bordering the Gulf of Thailand and the South China Sea. The majority of fisheries are small-scale in nature, and fish are landed in a large number of decentralised locations for distribution through complex marketing networks at the community level. As a consequence estimates of fisheries production are considered to be gross underestimates and do not adequately reflect the importance of the artisanal or subsistence production to the fisheries sector as a whole.

As noted above the decadal rates of decline in total area of critical habitats such as seagrass, coral reefs, and mangroves are currently estimated at 30%, 16%, and 16% respectively. Fishing contributes to the loss and degradation of seagrass and coral reefs habitats and the achievements of the fisheries component of the South China Sea Project have been significant in developing the scientific, institutional, and policy basis required to reduce the rates of loss of globally significant habitats and biodiversity due to fishing. This is considered important because of the potential global fisheries benefits associated with effective fisheries and habitat management at the local level, which is particularly important in the case of Southeast Asia due to the continuing importance of fisheries to food security, and maintenance of livelihoods.

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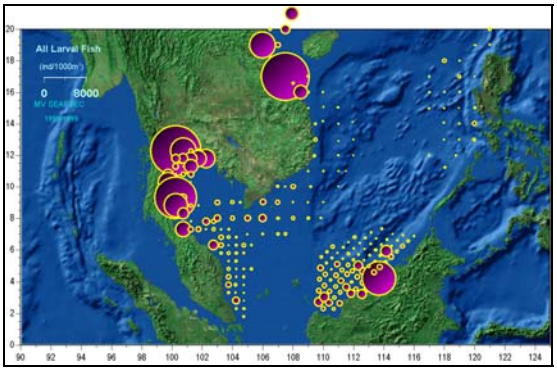
KEYWORDS

- Fisheries
- *Refugia*,
- Habitat
- South China Sea and Gulf of Thailand

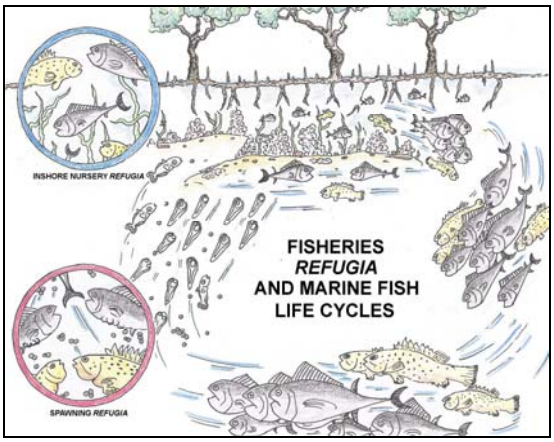
ADDITIONAL GRAPHICS



Distribution and abundance of fish larvae (all species combined) in the South China Sea and Gulf of Thailand during the post-northeast monsoon periods from 1996-2000, by Dr. Somboon Siriraksophon.

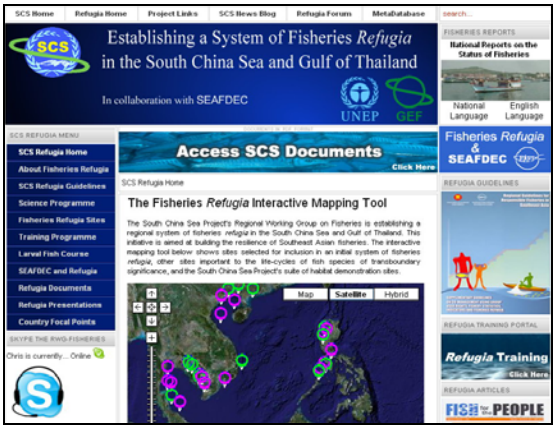
Fishing community consultation on the identification and establishment of fisheries *refugia* at Masinloc in the Philippines, by Mr. Noel Barut.

Provincial fisheries and border army officers working at-sea with fishermen and staff of Kien Giang's Department of Environment to map fisheries *refugia* at Phu Quoc Island in Viet Nam, by Christopher Paterson.



Schematic representation of types of *refugia* in relation to the generalised life-cycle of demersal marine fish, by Christopher Paterson.

Larval specimen of Scomberoides spp. collected from the South China Sea as part of the fisheries *refugia* training programme, by Dr. Yoshinobu Konishi



Screenshot of the Fisheries *Refugia* Information Portal homepage (http://refugia.unepscs.org)

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