

**METHODS FOR ASSESSMENTS AND MONITORING OF MARINE
BIODIVERSITY, FISHERIES AND SOCIO-ECONOMIC CONDITION
RELATED TO CORAL REEFS IN THE COASTAL WATERS OF
NINH HAI – NINH THUAN**

In recent years, there were several studies relating to assessments and monitoring of ecological (distribution and area of habitats, diversity) and socio-economic condition of coral reefs and associated resources conducted in the coastal waters of Ninh Hai – Ninh Thuan Province. However, scope and objectives were different between the studies, so results made were also different in space and time.

Assessments and monitoring of ecological and socio-economic condition are important components in the framework of the UNEP/GEF project entitled *“Demonstration of Sustainable Management of Coral Reef Resources in the Coastal Waters of Ninh Hai District, Ninh Thuan Province, Viet Nam”*. These activities will provide comprehensive data and information for establishment of practical solutions and assessments of effectiveness of management measures to be conducted during the implementation of the project phase and future. Based on review of existing data and information on ecological and socio-econommic characteristics, the report will be proposed methodologies for detailed assessments of status and monitoring of change in selected indicators of biodiversity, resources and socio-economic which will be considered as guidances for future activities of assessments and monitoring of coral reefs in the coastal waters of Ninh Hai – Ninh Thuan Province. Each methodology will be described in details of site selection, selection of parameters for assessment or monitoring, data

collection and analysis, reporting. Major results are summarized as the followings:

1. Methodologies for ecological and socio-economic studies

- ***Surveys of seagrass beds***: Assessements and studies of biodiversity of seagrass beds are proposed to conduct at 4 key locations including My Hoa, Mui Do, Binh Tien and Thai An in the coastal waters of Ninh Hai – Ninh Thuan. Criteria proposed are distribution of habitat, species composition, cover and densities of seagrasses at these seagrass beds. On the other hand, collection of samples of benthos in seagrass beds following NaGiSa protocol (Rigby *et al.*, 2007) are also proposed. Sampling procedure of this method are focused on collection of samples of macrobenthos and meiobenthos belonging to the 4 phyla including Athropoda (mainly for Crustacea), Echinodermata, Mollusca and Annelida (mainly for Polychaeta) in different zones of seagrass meadows (single or multi species) at each location.

- ***Surveys of coral reefs***: Surveys of biodiversity of coral reefs are proposed to use two different methods to rapid assessments of distribution and status of habitats and detailed studies of communities and major resources of coral reefs. The distribution, extent and status of marine and coastal habitats (coral reefs, soft bottom communities, seagrass beds, sandy beaches and rocky shores) of Ninh Hai waters should be assessed by using Manta tow technique in combination with robot to detect depth and record images of substrata along selected transects at some key locations along the coast and submerged reefs located in the south of Mui Do (Do Cape). Parameters collected following the Manta tow surveys include underwater visibility, covers of benthic substrata (hard corals, soft corals and dead corals); type, locations and cover seaweeds and seagrasses with ordinal

ranked categories from 1 to 5; abundant fishes (presence / absence of schools); abundance of macro-invertebrates (sea urchins, crown of thorn starfish, giant clams) and impacts to coral reefs (dynamites, anchors, coral bleaching). Community studies should be focused on assessments of species composition and community structure of some major groups of organisms including macro-seaweeds, reef-building corals, reef fishes, molluscs, echinoderms following Rapid Ecological Assessment - REA.

- ***Surveys of socio-economic condition:*** Assessments and studies of socio-economic condition proposed are based on primary and secondary data and information. The secondary data and information should be collected from annual technical reports from local authorities and relevant agencies (villages, communes, districts and province) and scientific institutions, implementation reports from current projects, GIS maps of the area. The primary data and information are based on interviews and consultations with local authorities and communities, focussing on major aspects as the followings: 1) Marine biodiversity and resource utilization including direct and indirect activities which may cause impacts to coral reefs); 2) Characteristics of stakeholders (populations and householders inside and outside communities; ethnics and religions; education; social organizations; economic condition of households; and livelihoods); 3) Sex issues (levels of income contribution and roles in the families between man and women; roles of man and women to communities); 4) Stakeholders awareness (condition of coral reefs; impacts to coral reefs; resource management; roles of stakeholders in resource utilization and management; and culture and religions); 5) Infrastructure and public services at local communities (medical services; educational and religious services; public

buildings); and 6) Market information (sources of marine resources harvested; consumption and tourist demand).

2. Methodologies for ecological and socio-economic monitoring

- ***Monitoring of seagrass beds***: Monitoring of seagrass beds are proposed to conduct at the 4 key locations including My Hoa, Mui Do, Binh Tien and Thai An in the coastal waters of Ninh Hai – Ninh Thuan. Parameters proposed are cover and densities of seagrasses, abundance of fishes (English *et al.*, 1997), species composition and abundance of macrobenthos and meiobenthos of the 4 phyla including Athropoda (mainly for Crustacea), Echinodermata, Mollusca and Annelida (mainly for Polychaeta) in different zones of seagrass meadows (single or multi species) along a permanent transect starting from the shoreline to offshore at each location following NaGiSa protocol (Rigby *et al.*, 2007).

- ***Monitoring of coral reefs***: The monitoring proposed should be conducted at 12 permanent sites, in which ten sites (Bai Bo Doi, Bai Rang, Dam Dang, Bai Nho, Hang Rai, Thai An, Mui Thi, My Hoa, Mui Do and Bai Mo Coi) have been previously established since 2005 and 2 additional sites (Hon Chong and Bai Thit) were surveyed in 2011 within framework of the UNEP/GEF project. Parameters proposed are cover of major substrata (hard corals, soft corals, recent killed corals, nutrient indicator algae, seaweeds, turf algae, coralline algae, sponges and rubble corals), reef fishes (groupers > 30cm, barramundi cod *Cromileptes altivelis*, humphead wrasse *Cheilinus undulatus*, bumphead parrotfish *Bolbometopon muricatum*, parrotfishes > 20cm, butterflyfishes Chaetodontidae, sweetlips Haemulidae, snappers Lutjanidae, moray eels Muraenidae, grouper Serranidae, rabbitfishes Siganidae and surgeonfishes Acanthuridae) and macro-invertebrates (triton

shells *Charonia tritonis*, giant clams *Tridacna* spp., lobsters, coral banded shrimp *Stenopus hispidus*, sea urchin *Diadema* spp., pencil sea urchin *Heterocentrotus mammilatus*, collector urchin *Tripneustes gratilla*, crown of thorn starfish *Acanthaster planci*, all sea cucumbers with an exception of the family Synaptidae, top shells *Trochus* spp. and fluted giant clam *Tridacna squamosa* following English và cs. (1997) and Hodgson and Waddell (1998) in combination with additional indicators which are suitable to local condition of coral reefs. The monitoring should be annually conducted in June.

- **Monitoring of fisheries:** This method made is based on results of review of available data and information relating to status of exploitation and utilization of marine resources from previous and current studies. Indicators are proposed for monitoring of fisheries in the coastal waters of Ninh Hai including seaweeds (*Gracillaria* spp.), molluscs (turbo shells, cuttlefishes and squids), crustaceans (lobster seeds and commercial lobsters), echinoderms (sea cucumbers) and fishes (commercial groupers, rabbitfishes, anchovies and belonids) from the 4 key fishing activities (gleaning on intertidal zone, hook and line fishing by hand and small boat, barrier net and hookah diving). Parameters collected for each fishing activity include catch (biomass or number) of target species, number of fishing boat and fishers, total horse power, number of hour fished per day, mean size of harvested species and mean catch per day per boat/person (CPUE).

On the other hand, monitoring of change in populations of each species of the 3 species of sea turtles (*Chalonia mydas*, *Eretmochelys imbricata* and *Caretta caretta*) are proposed to conduct at the nesting locations such as Bai Mong tay, Bai Thit, Bai Ngang, Bai Nuoc ngot, Bai Hom, Bai Suoi from January to October. Parameters collected are number of

individuals nesting, time of nesting, sites of nesting compared to tidal levels, number of nests, number of eggs per nest.

- ***Monitoring of socio-economic condition:*** The method proposed parameters for monitoring of socio-economic condition are fishing activities (fishing boats and gears, number of fishers, total horse power, income from fishing activities per family,...), services (tourist service operators, number of people involved in tourist service, number of tourist boats, number of tourists, number of SCUBA diving operators, number of SCUBA diving tourists, number of snorkeling tourists, locations for snorkeling and SCUBA diving operation, and total income of tourism operation); livelihoods (number of livelihoods, number of people involved in each livelihood, income from each livelihood); household income (total income, fishing income, agriculture income, service income); education (numbers of people at different levels of education); healthcare (medical offices, numbers of medical doctors and physicians). Monitoring of socio-economic condition is proposed to annually conduct once a year in December.