

# **MARINE BIODIVERSITY AT THE PROPOSED AREA FOR THE NINH THUAN II NUCLEAR POWER PLANT AND MONITORING OF CORAL REEFS IN THE COASTAL WATERS OF NINH HAI – NINH THUAN IN 2012**

In 2012, 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*” supported an assessment of marine biodiversity of coral reefs to form a baseline for long-term assessments of potential impacts from establishment and operation of the Ninh Thuan II nuclear power plant in the near future and monitoring of coral reefs in the coastal waters of Ninh Hai – Ninh Thuan. The baseline assessment of coral reefs was conducted at 2 sites (nearshore site and offshore site) along a transect from the shoreline to the margin of the reefs at the proposed area for establishment of the nuclear power plant, each site was placed with 2 countour transects at 2 depths (2m and 4m for nearshore site; 8m and 10m for offshore site). Monitoring was conducted at 9 permanent sites using line transect methods, in which 3 sites (Dam Dang, Mui Thi and My Hoa) are located in the unprotected area, 3 sites (Bai Nho, Hang Rai and Mui Do) in the protected area and 3 sites (Lach Nuoc Ngot, Bai Thit and Hon Chong) in the proposed restoration area. Indicators used for monitoring in 2013 are similar to that used previously following Reefcheck (Hodgson and Waddell, 1998) and Global Network of Coral Reef Monitoring (English *et al.*, 1997) with some additional local indicators. Some of major results are highlighted as followings:

## **1. Status of marine biodiversity of coral reefs at the proposed Ninh Thuan II nuclear power plant**

- A total of 112 species of 36 genera and 16 families of hard corals (mainly Faviidae, Acroporidae, Poritidae, Fungiidae, Mussidae and Pocilloporidae); 76 species of 44 genera and 22 families of reef fishes (mainly Labridae, Pomacentridae, Chaetodontidae, Acanthuridae, Blenniidae and Scaridae: 3 species/family); 19 species of 14 genera and 8 families of molluscs (mainly Muricidae, Conidae, Turbinidae and Phyllidiidae); and 8 species of 8 genera and 5 families of echinoderms (mainly Diadematidae, Ophidiasteridae and Toxopneustidae) were recorded on the 4 at the 2 study sites. The number of species ranged between 36 – 63 species/transect for hard corals, 33 – 40 species for reef fishes and 8 -19 species for macro-invertebrates.

- Status of coral reefs in this location were not in good condition, giving mean cover of hard corals ranged between 11.3 – 29.4% (average: 18.3%), in which *Montipora*, *Acropora*, *Pocillopora*, *Millepora*, *Leptoria*, *Leptastrea* were dominant in shallow waters (2 – 4m) while *Heliopora*, *Porites*, *Pachyseris*, *Montastrea* were dominant in deep waters (8 - 10m depth). Covers of coralline algae, sagassum and turf algae were relatively high whereas cover of soft corals, nutrient algae and sponges were extremely low.

- Associated-reef resources are very rare, in which the density of reef-fishes averaged 79.4 inds./100m<sup>2</sup>, mainly dominant by small fishes (Pomacentridae, Labridae and Chaetodontidae) belonging to the group of ornamental fishes and some families of algal feeders (Siganidae, Acanthuridae and Scaridae) of target fishes. Macro-invertebrates was also recorded at low density, averaging at 10.8 inds./100m<sup>2</sup>, mainly by turbo shells, top shells and sea urchins.

## **2. Results of coral reef monitoring**

- Analysis of monitoring data show that cover of hard corals was temporally decreased from 2005 to 2012 with a higher decline being found in the period of 2005-2007, however this was stable or gradually increased between 2007-2012 (especially at Hang Rai, Mui Thi and Mui Do). This indicates that conditions of habitats of coral reefs have been temporally improved in the recent years although they were heavily impacted by coral bleaching event occurred in 2010.

- The total density of reef fishes were generally stable or slightly increased from 2005 to 2012, of which the increases were recorded for rabbitfishes (Siganidae) and surgeonfishes (Acanthuridae), whereas some important target fishes (groupers, snappers, sweetlips,..) showed no change between years. Sites located in the protected area (Hang Rai and Mui Do) supported higher densities of fishes and these were stable or gradually increased following monitoring years, especially butterflyfishes, damselfishes, wrasses, groupers, snappers compared to that in the other areas. These sites should be considered as important sanctuaries in maintaining and replenishing of fish resources to the adjacent reefs in the future.

- Resources of macro-invertebrates were recorded at very low densities and showed no clear changes between years of monitoring, especially target species. Sea urchins (*Diadema* spp) were mostly common and dominated at all monitoring reefs, however the temporal change in density was not so clear with an exception of increase found at Dam Dang. In general, sites in the protected area (Hang Rai and Mui Do) supported higher densities of target macro-invertebrates and these were stable between years.

- Indicators of impacts to coral reefs (COTS, dynamite, anchors, coral bleaching scars, fishing nets and other trash) were recorded at low densities

and these showed no significant temporal changes between years with an exception of an increase in the density of scars being found in 2010 due to coral bleaching event. However, presence of COTS, coral bleaching scars, anchors and trash are considered as potential impacts to coral reefs in the near future.

### **3. Recommendations**

Improvement of management of existing community-based management models at Hang Rai and Mui Do and establishment of additional management models similar to that at Bai Thung, Bai Nho, Lach Nuoc Ngot, Bai Thit and Hon Chong with co-management of local stakeholders and local agencies (Nui Chua National Park Authority, Provincial Department of Fisheries Protection, Border Army and People's Commune Committees) should be necessarily implemented. Restoration of coral reefs by transplanting hard corals and restoring major resources (giant clams, top shells, abalones, sea cucumbers,...) should be conducted at the restoration sites (Hon Chong and Bai Thung). Collection of COTS should be annually arranged at Bai Thung, Dam Dang, Bai thit and Hon Chong.