

The primary assessment on the dugong population in Viet Nam

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ABSTRACT

The biggest dugong reaches to 3m in length and weighs more than 500 kilograms. Dugongs swim in the shallow coastal waters of southern part, which have protected them from large waves and storms. Dugongs float up only to breathe, and never come on to land. There is still lack of information on the population status of dugong. The Research Institute for Marine Fisheries (RIMF) and other institutions estimated that there are approximately 25 to 100 dugong individuals still living in the Southern part of Viet Nam. However, 5-6 dugongs were incidentally died each year in Phu Quoc, Con Dao and Tho Chu Islands as well as their adjacent, where are the most important seagrass meadows in Vietnam Seawaters. Dugongs are considered as a protected species listed in "Red Data Book" of Viet Nam as well as listed by CITES under the highest at-risk category. They only live in or in the vicinity of plentiful seaweed and seagrass, which has been destroyed due to the pollution, dredging and farm soil being washed into the sea. Dugongs have the dramatic decline in their numbers. Serious threats include the environmental degradation, serious typhoons (*Linda* hurricane for example), which destroy their favor habitats, and the accidental catch of dugongs in fishing operations, especially by trawling with big mesh-size and open-mouth net. The results of this study add important information about this species to the sparse information currently available, and recommend further research required particularly for Vietnam and neighbouring countries. Additionally, exchanging information, experiences and constructive discussions on proper actions and cooperation in terms of the scientific research, coastal management and the responsible fishing operation will be positive direction towards a better future for the dugong population in Vietnam.

KEYWORDS: Dugong (*sirenian*), family *Dugongidae*, calf, seagrass meadow, *Thalassia hemprichii* (Co bo bien), *Enhalus acoroides* (Co dua bien), *Halophylla ovalis* (co xoan), "cao bay" trawling net, Phu Quoc and Tho Chu (Kien Giang Province) and Con Dao National Park (Ba Ria-Vung Tau), Marine Protected Area (MPA).

INTRODUCTION

There are few scientific records available about the distribution, abundance and ecology of dugongs in Vietnam. Dugongs are referred as "Sea Cows", because they graze on seagrass. They are the only mammals that eat large amounts of seagrass, leaving behind feeding trails of bare sand and uprooted seagrass. Primarily foods of dugong are sea grasses and sea algae (Koike, 1999). Dugong (*Dugong dugon*) has wide range of distribution, from longitude 30°E to 170°E and between the latitude of 30°N to 30°S. Dugongs are the only Indo-Pacific sirenian species alive today, occurring in limited numbers in various locations of Indonesia, Malaysia, Thailand, Myanmar, Papua-New Guinea, Philippines, Australia, Japan and Viet Nam (Nick Cox, 2002).

However, their population is thinly distributed

in scattered groups within this range of seawaters. The dugong population is fast thinning in their range of distribution and is definitely an endangered species that are close to extinction.

The World Conservation Union (IUCN) has classified dugong as a vulnerable species for several years (Anonymous, 2000). Dugongs are a protected species also in Viet Nam. Dugongs only live where there is abundant seaweed and seagrass, which is being destroyed by dredging, farm soil and pollution being washed into the sea. They are also accidental victims of trawler net fishing (Cao bay) and gill net (Nguyen Long, 2003).

There is an increasing demand to use coastal zone for residential, recreational, and agricultural purposes. These activities will make the coastal zone more susceptible

to the pollution, which cause the destruction and degradation of the seagrass beds. Pollution can also affect dugong physiologically through the bioaccumulation of toxic compounds. Dugong has been reported to accumulate mercury and chlorine compounds in the muscles (Anonymous, 2003).



Fig. 1. Location map for Southern Vietnam and Cambodia (modified from Marsh *et al.*, 1999)

The purpose of this study is to present a brief overview of the status of the dugong and its management in Viet Nam. We intended to provide comparative information that will enable us to develop our national conservation plans for dugong and other listed species.

This paper contains little information of previous survey on dugong biology, distribution and abundance, threatening processes, legislation, and existing and suggested research and management proposals for Viet Nam.

The special objectives of this study are:

- ▶ To identify areas that still appearing significant numbers of dugongs;
- ▶ To consider how the negative impacts on dugongs can be minimized and their habitat protected;
- ▶ To identify the suitable areas for dugong conservation;
- ▶ To foresee and consider coordinative management plans for dugongs across neighboring water bodies if required.

MATERIALS AND METHODS

The range of dugong distribution is huge and scattered, making the data of the population dugong is quite difficult and costly. Aerial survey is the best method of assessing their population, but it is never used in Viet Nam because

it is highly dependent on the weather conditions, the transparency of water and the available facilities. Therefore, within this research, the following way has been used to the primary collection of the related information:

- ✓ Field survey on the fisherman boats, assess the using fishing gear and their impacts,
- ✓ Gather and collect information from logbook of fishing boats,
- ✓ Collect information and news from Navy Force, Marine Investigator, Local Fishery Department,
- ✓ Interview and discussion by face-to-face, telephone, mobile phone, email in relation to dugong topic,
- ✓ Use questionnaires and analysis feedback,
- ✓ Take picture of specimen and habitats.

Phu Quoc and Tho Chu (Kien Giang Province) and Con Dao National Park (Ba Ria-Vung Tau), which situate in the Southern part of Viet Nam seawaters (see more in fig. 4), have been selected as the study areas for data collection from 1997 till 2003.

RESULTS AND DISCUSSIONS

Phu Quoc, Tho Chu and Con Dao archipelagoes in southern Vietnam, are locations in the country where dugongs are regularly seen. Recent seagrass surveys in the coastal waters of Con Dao, Tho Chu and Phu Quoc Island, recorded several apparent dugong feeding trails (Pham Ngoc Tuan, 2003), and evidence of the existence of dugongs around those areas are supported by reports of locally caught dugong meat being sold openly in local markets. Previous results from local fisher surveys conducted in Cambodia suggest the existence of a dugong population around Kep and Kampot, near to the Vietnamese border and Phu Quoc island (Beasley *et al.*, 2001).

Interviews for local fishermen were conducted in 2003 in Phu Quoc-Tho Chu (Kien Giang province) and Con Dao (Ba ria-Vung Tau province) revealed that dugongs were seen much more regularly and in greater abundance 10-25 years ago than they are now. Whilst it appears that dugongs were often hunted specifically for meat and medicinal purposes, dugongs caught now, are done so accidentally, and mortality is presumable as a result of drowning in nets. More than thirty dugong carcasses were recorded in Phu Quoc, Tho Chu and Con Dao between 1997 and 2003.

SOME BIOLOGICAL CHARACTERISTICS

Dugong dugon belongs to the family Dugongidae. Sirenians are lonely, travel in pairs, or associate in groups of three to about six individuals. Generally slow and harmless, they spend all their life in the water (Lang Van Ken.

1997). They are vegetarians and feed on various aquatic plants (Kasuya *et al.*, 2000).

Dugongs surface only to breathe, and never come on to land. Female Dugongs give birth underwater to a single baby. Birth takes place in shallow water and the baby dugong is able to swim to the top layer of the water for its first breath. Baby dugongs are about 100 to 120cm long and weigh 10 to 30 kg. The calf stays with its mother, drinking milk from her teats and following close by until 18-24 months of age (Aquino, 1998).

Based upon our staffs' observation in October and November, 2003 described that feeding dugong occurs primarily at night, when animals enter shallow waters to graze. Dugongs require about 25-30 kilograms of food per day (estimation based upon on their weight). In addition, when grazing, the dugong "walks" along the seabed with its flippers. The average swimming speed is about 2-7 km per hour, but if pressed this speed can be nearly doubled over short distances. Dives generally last 1-3 minutes, surfacing for very short periods per breath. Destructive behavior is very rare. Language, including whistling sounds and bleats, are generally only used when frightened. Breeding may occur throughout the year, although many births occur between July and September, annually (Nick Cox, 2002). Young animals hitch rides on their mother's backs, surfacing and submerging in enforced harmony. Although the drinking of milk continues for a year and a half, young dugongs begin sampling sea grasses at about three months of age. Dugongs feed strictly on submerged vegetation-leaves, roots, and rhizomes of seagrasses and sometime seaweed. Babies of dugongs are breast-fed for about 18 months and after weaning will stay with the mother until new calves are born (Adulyanukosol *et al.*, 1998).

With the low reproductive rate, long generation time and a large investment in each offspring, it is estimated that the maximum rate of increase is likely to be about 5 % per year (Anderson, 1981). As such, they are susceptible to over-exploitation. Their vulnerability increased by the

dependence on a specialized environment, the sea grass habitat. In Vietnam, dugongs reach 3m in length and weighs more than 500 kilograms. Dugongs swim in the shallow coastal waters of southern part where they find protection from large waves and storms. Dugong males have ivory tusks used for fighting during male-male competition and caused of injury by themselves as well as for uprooting seagrasses (Nick Cox *et al.*, 2003).

SEAGRASS ASSESSMENT

Seagrass play an important role in terms of adjustment and balance for coastal ecosystem; accretion and building up of sea substructure and as living habitats for dugongs. In addition, their functions have been recognized in the national strategies for sustainable fisheries development. There are 10 species of seagrasses had been found at those studied locations, namely: *Enhalus acoroides*, *Halophylla decipiens*, *H. minor*, *H. ovalis*, *Thalassia hemprichii*, *Cymodocea serrulata*, *C. rotundata*, *Halodule uninervis*, *H. pinifolia*, *Syringodium isoetifolium*. Total area of alone seagrass ecosystem is approximate 1930 ha in Phu Quoc, Con Dao and Tho Chu Islands as well as their adjacent seawaters (Nguyen Xuan Hoa, 2003 and Nguyen Van Tien, 2003).

Due to the poor perception and together with many kinds of mismanaged operations, those resources, however, have been exploited and reduced, environment polluted, habitats of aquatic animal seriously decreased and degraded. The best ways to preserve seagrass is by leaving it undisturbed, mainly by preventing trawling, maintaining water quality by reducing nutrient and suspended solids loads and by using appropriate fishing gear.

The value of the products and ecological services provided by the seagrass systems of the South China Sea is estimated at US\$ 22,400 per ha.year. The area of seagrass is not known precisely and improving estimates of the area and economic value of seagrass beds in the South China Sea is a key to improving their management (Fortes, 1993).

Table 1: Area of seagrass at three studied sites

Index	Con Dao	Phu Quoc	Tho Chu	Others	Total seagrass of Viet Nam
Area (ha)	644	966	322	2668	4600
Percentage (%)	14	21	7	58	100

Table 2: The eyesighted dugong during period of 1997 till 2003

Index	1997	1998	1999	2000	2001	2002	2003	Average per year
Eyesighted dugong	77	82	34	56	71	63	49	61 ± 1

DUGONG IMPACTED BY HUMAN

The result survey conducted by Research Institute for Marine Fisheries (RIMF)'s researchers suggested that the predictable amount of 5-6 dugongs were killed each year in Phu Quoc, Tho Chu and Con Dao Islands and their neighboring, which is the most important dugong school in Viet Nam Seawaters. Although communities are not dependent upon the harvesting of dugongs, these animals are highly prized as food items. Since there is the weak enforcement of regulation to restrict the use of modern equipment, efficient hunting is possible. If the rate of died dugong population is greater than the renewable rate of dugong population of 10 % per year, then the dugong population is dropping.

Dugongs are slow moving and have little protection against predators. Being large animals, however, only large Sharks, Saltwater Crocodiles and Killer Whales are dangerous to them, but main Predators are humans. Threatened until recently by hunting for its meat (which is said to taste like beef), leather-like cover or fur-suit, oil (24-56 liters per adult), and bones and teeth, which are used to make healthy glues.

In the previous years, the southern Viet Nam seawaters (including Phu Quoc, Tho Chu and Con Dao island) population dugong was counted that there had been attached approximately 42 individuals since 1990's (Nick Cox, 2002 and Pham Ngoc Tuan, 2003). The recorded data were collected in relation to dugong appearances during the period of 1997 till 2003, based upon the locally fisherman interviews, logbook on the fishing boats had been made by the concerning officers of those Provincial Department of Fisheries Protection that listed in table 2.

The major kind of fishing gear is the gill net and

trawling net (which consist of 72% of total multigears) has reduced population off the coastal areas in southern Vietnam. The especial trawling with big mesh-size net "Cao bay" has significant reported to accidentally kill the dugongs (Nguyen Long, 2003).

Fishermen at Phu Quoc accidentally trapped an adult dugong on 10th December 2002. Other 9 of dugongs were attached during period of 2002 in the northern part of Phu Quoc Island (Ham Ninh seawater). Local fishermen trapped them and sold their meat with price of VND 25-35 thousands. Local informants always observe dugong and some of them think that they are only appearing in Ham Ninh seawater nearby a great seagrass meadows, which elongate approximately 20 km from Ham Ninh to Hon Son. This area maintain 3 species of sea grass, namely *Thalassia hemprichii* (Co bo bien), *halophyla ovalis* (co xoan) and *Enhalus acoroides* (Co dua bien) that is the most favor food of dugong (Fonseca, 1987).

During the field survey, the informant also mentioned that dugong usual appear during July till November (Summer- Autumn). In addition, dugong is couple or group and one of them was caught, another turned around to look for missing one. That is a reason why dugongs have been trapped nearly entire group. According to the analyzed results from those studied areas, the distribution of dugong in Viet Nam are showed in table 3 and figure 2.

According to our result, there is a close relationship between eyesighted dugong and seagrass abundance (see table 4 and figure 3 below).

From the figure 3 showed that there is a close relationship between the abundance of seagrass and frequency of dugong eyesight at the studied location.

Table 3. Distribution of dugong in Vietnam Seawaters during period of 1997-2003

Location	1997	1998	1999	2000	2001	2002	2003	Locally average appearance per year
Con Dao	15	21	17	23	19	16	15	18 ± 1
Phu Quoc	35	31	11	19	28	26	32	26 ± 1
Tho Chu	27	35	6	14	24	31	2	19 ± 2
Total	77	87	34	56	71	73	49	63 ± 2

Table 4. Abundance of seagrass and frequency of dugong observation at three studied sites

index	Con Dao	Phu Quoc	Tho chu
Percentage of seagrass (%)	14	21	7
Frequency of dugong (%)	18	26	20

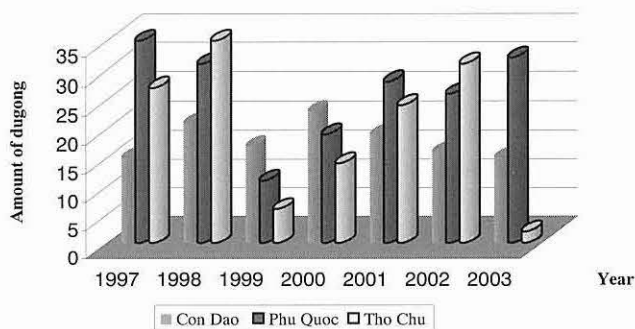


Fig. 2. Distribution of dugong in Vietnam Seawaters

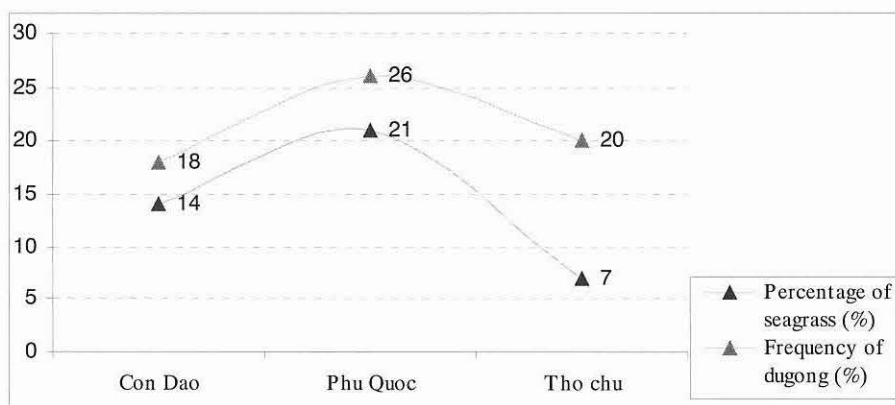


Fig. 3. Abundance of seagrass and frequency of dugong observation at three studied sites

MANAGEMENT APPROACHES

The dugong population is declining and they are in serious risk of extinction in Viet Nam due to limit of proper management in controlling of the fishing operation and nowhere to be found they are properly protected. Without conservation measures taken in Viet Nam such as prohibiting harvest and protection of its habitats. A questionnaire survey of dugong abundance in southern part of Kien Giang, Con Dao and Phu Quoc have been conducted by local authorities since 1998 due to the general concern about the local status of the dugong population. Additionally, those were followed by boat surveys that had been conducted since 2000.

Research

The research is to acquire information to assist in the recovery and maintenance of dugong populations. An integrated research project has been initiated since 1997, which reflect a wide range of priorities among managers, researchers and stakeholders with interests in dugongs. This project has been incorporated into the Dugong Research Strategy for Viet Nam in the forthcoming year. The categories include:

- ✓ Project designed to assess the effectiveness of the current dugong protection measures,

- ✓ Project likely to result in information, which will directly assist in maintaining dugong numbers,
- ✓ Project that will assist with the development and implementation of cooperative management arrangements,
- ✓ Project designed to minimize the impacts of management decisions on affected groups.

High priority should be given to monitoring dugong distribution and relative abundance using regular boat surveys and questionnaire circulation. Regular seagrass surveys are also required to assess temporal changes in seagrass meadows, and the impacts of events on dugong habitats in the Vietnam Seas. Research is also to study seasonal changes in seagrass growth rates and productivity with a view to developing a model of dugong grazing. Satellite tracking of dugongs in key areas is not available but those will provide detailed information on dugong habitat use, but has to get the permission from Ministry of Defense. Such information will be very useful for assessing the local impacts, for proposing the developments on dugongs and for other wildlife species.

Local Management

There is still a strong desire within the local communities to hunt dugongs as they are economic importance. All groups involving recognize the need for the development of cooperative managements and arrangements for marine resources between management agencies and local peoples. The success of cooperative managements and arrangements will involve communities being a full partner in all stages of the management process, bringing together customary owners, science and management. The next step in this process is a formal agreement between the partnerships, which will need to provide the resources required to operationally cooperative management.

In order to develop a better understanding of small scale population changes in dugong populations, community-based dugong preservation programs will have to be developed incorporating local expertise, provided personnel are available to coordinate such programs. This activity would contribute to developing appropriate mechanisms and tools for integrating local knowledge and scientific data.

Fishery Interactions

The effectiveness of the mesh netting restrictions and attendance in the Marine Protected Areas (MPAs) need to be monitored. It is important to note that a significant proportion of dugongs along the south coast of Viet Nam occur outside these Marine Protected Areas.

Therefore, management regimes for the dugong's area of possession but outside the MPAs need to be considered if the objective of management is to minimize human impacts on dugongs.

Regulation and enforcement

Viet Nam are supporting the following initiatives to maximize the effectiveness of fishing closures in the Marine Protected Areas (MPAs):

- ✓ Legislation of attendance at net rules under the Fisheries Resource Protection ordinance, which propagated in 1989;
- ✓ The enhancement of surveillance and enforcement patrols to focus on the MPAs. The intensity of patrolling and surveillance varies based on programmed priorities (i.e. knowledge of illegal activity and records of dugong deaths);
- ✓ Severe penalties for breaking netting regulations;
- ✓ The development of performance indicators to assess the impacts of the MPAs;
- ✓ The introduction of further measures to address impacts on dugongs other than mesh netting, especially in the MPAs (i.e. coastal runoff, habitat degradation);
- ✓ An independent socio-economic investigation of the operations of fishers with netting endorsements that are operating nearby the MPAs. The study will include an investigation on which fishers are using the current MPAs. A social impact assessment on

resource used to (commercial and recreational fishing and tourism) in each of the MPAs to assess the implications of any further modifications to regulations in the MPAs;

- ✓ An investigation of how the current regulations in the Marine Protected Areas could be further modified to reduce adverse impacts on dugongs.

National framework Management

The effectiveness of the mesh netting closures and restrictions depends on there being no overall movement of dugongs from the one to other areas. To minimize the risks of this happening, it is particularly important to conserve dugong habitat, especially in the Marine Protected Areas.

The relevant management should collectively review the zoning of the relevant sections of the Marine Protected Areas and Fisheries Habitat Areas with a view to assessing their capacity to protect dugongs and their habitats. Key areas should be the focus. This initiative will provide resolve in the selection of seagrass and dugong habitat for inclusion in highly protected zones of the Marine Protected Areas.

The Marine Protected Areas will be zoned in consultation with user and interest groups, and will enhance the prospect of dugong survival in the area. Seagrasses and mangroves are given specific protection in Fisheries Habitat Areas, where all marine plants are protected, and can only be damaged or removed under permit.

CONCLUSION AND RECOMMENDATION

The Con Dao, Phu Quoc and Tho Chu National Park have been identified that still appearing significant numbers of dugongs. Those locations are the highest amount of dugong population, because of being distributed seagrass bed, the feeding habitats. The National Park Authorities controlled the harvesting of dugong by the national regulation system. Dugong is now endangered and being strictly protected. A proposal recreation of aquarium is needed, for display and research purpose will be succeeded in taking care of these animals for few years. The long-term effectiveness of those areas will depend on community support and the maintenance of the dugong habitat by the marine protected area (MPA) establishment and management. It is important to have a high precision of population estimates for this vulnerable species. Precautionary management measures should be taken to minimize the continuing harvest and reduce the negative impacts on dugongs. It is recognized that it will be essential addressed for the socio-economic balancing adjustment to dugong conservation from governmental authorities. Finally, exchanging information, experiences and constructive discussions on proper actions and cooperation in terms of the scientific research, coastal management and the responsible fishing operation will be positive direction towards a better future for the dugong population in Vietnam and other countries in our region.

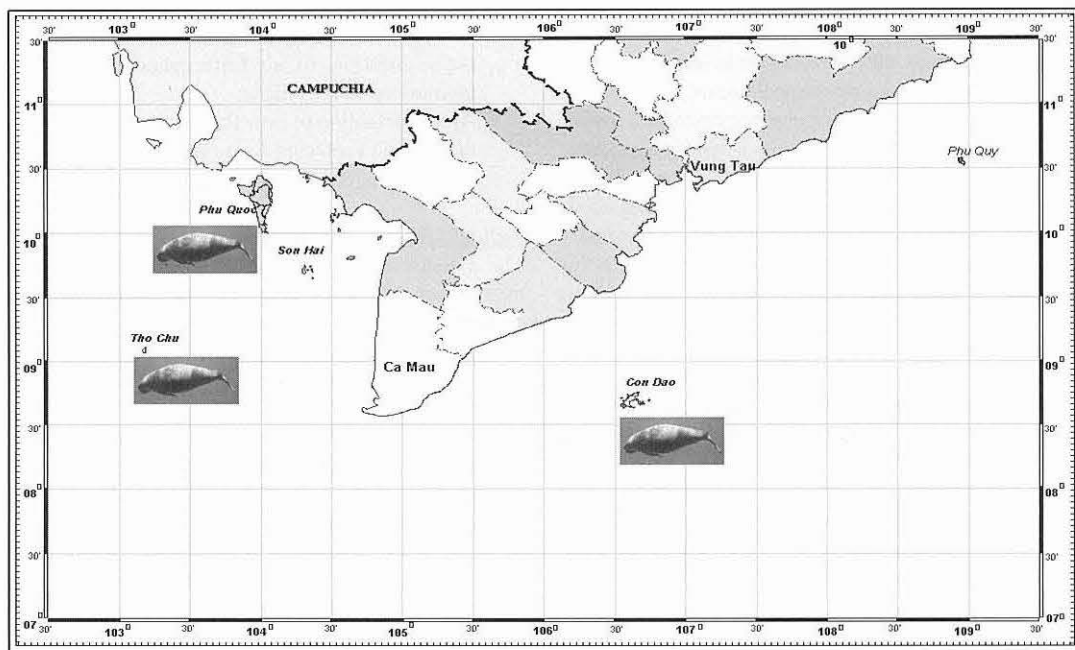


Fig. 4. Primary Map of Dugong distribution in Southern Part of Viet Nam



Fig. 5. Typical surfacing, and submerging sequence of dugong in Con Dao National Park

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