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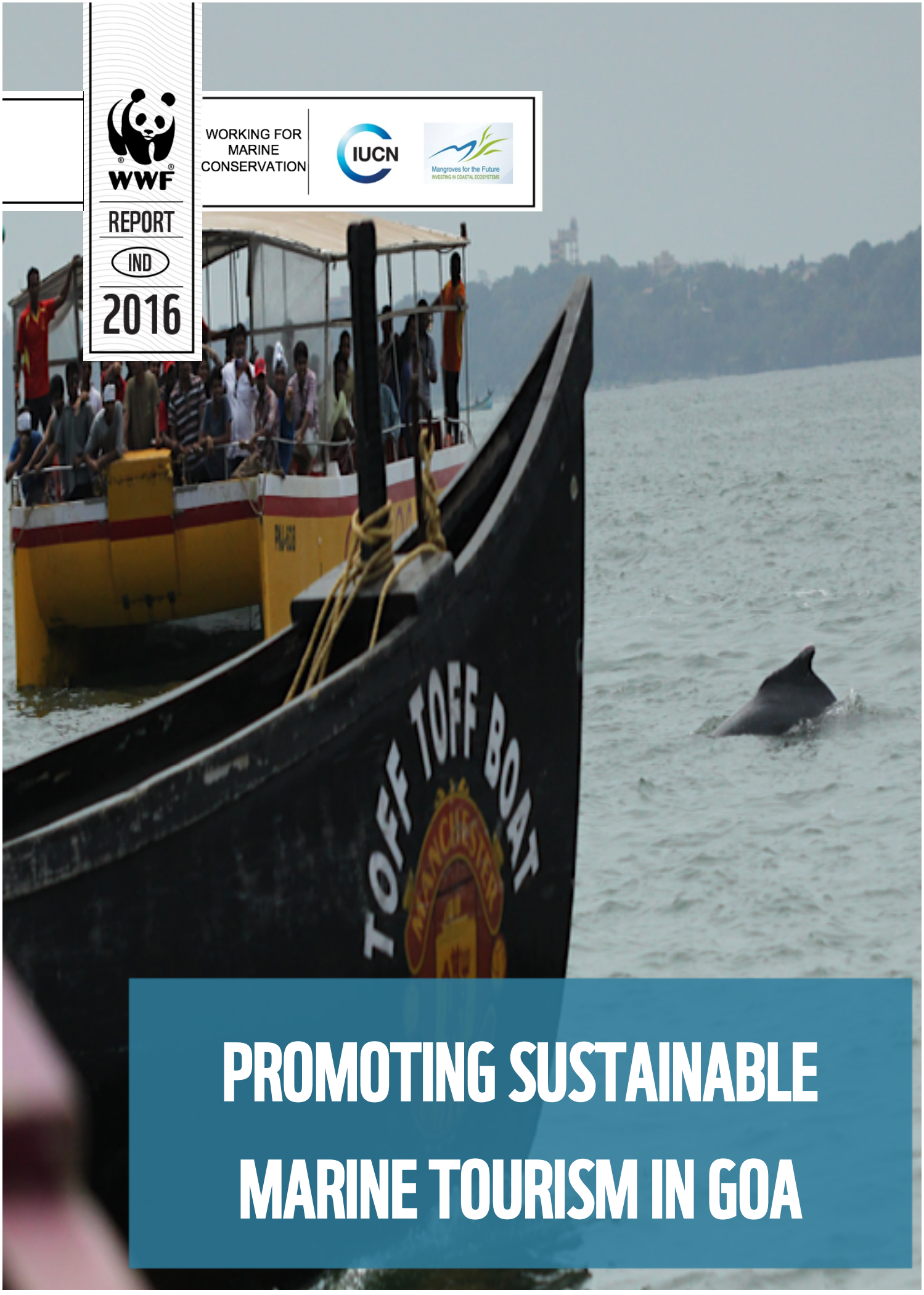

PROMOTING SUSTAINABLE MARINE TOURISM IN GOA

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The WWF-India, Goa Team

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PREFACE

Coastal areas are some of the most productive and biologically diverse on the planet. They're also the most densely populated: according to the UN, 60% of the world's population - more people than inhabited the entire planet in 1960 - live within 60km of the coast. On top of this, 80% of all tourism takes place in coastal areas, with beaches and coral reefs amongst the most popular destinations. India's 8000 km of coastline is rich in marine biodiversity. Apart from sustaining fishing grounds, India's coastal waters and beaches are home to important species, such as coral reefs and cetaceans (whales, dolphins and porpoises). Both these globally important species are protected under the Schedule I of the Wildlife Protection Act of India, 1972.

The rapid growth of coastal tourism in the last 40 years is one of the major reasons for the urban infrastructural development of these coastal areas and consequent coastal environmental problems (Hall, 2001). The question of sustainability is particularly important in the context of coastal tourism, which is an activity at the interface of humankind, land and water. Goa is a premier tourism destination in India. According to the Goa tourism department, 820578 tourists have already visited Goa in the year 2015.

The marine tourism industry in Goa comprises of water sports, pleasure boat cruises for picnics, SCUBA diving, snorkeling, line fishing and dolphin watching. Diving is largely centered on the coral reefs present at Grande island, Vasco as are picnic cruises, while dolphin watching takes place mainly at Sinquerim bay, Aguada, with boats plying from four registered jetties and from different beaches. There is significant pressure due to tourism on the Humpback dolphin and the coral reefs surrounding Grande Island, which are the focal species for these activities.

This report presents the result of surveys conducted by World Wide fund for Nature – India (WWF-India) with support from the International Union for Conservation for Nature under the Mangroves for Future Small Grant Program (IUCN-MFF). These surveys are a part of a species conservation project titled 'Promoting Sustainable Marine Tourism in Goa' and are aimed at assessing the impact of dolphin watching on the humpback dolphins found along Goa's coastline, and impact of picnic boats and SCUBA diving on the coral reefs surrounding Grande Island. The results for the coral survey show that the reefs are beginning to show signs of degradation in the form of algal growth, bleaching, presence of trash and coral breakage. The results for the dolphin survey show that the dolphins display boat avoidance behaviour while being chased by the boats and also their habitat is polluted by the presence of litter thrown from these boats.

Recognizing that tourism is a key industry in Goa and an important source of livelihood for local communities, WWF -India envisaged a gap analysis study to assess the impact of marine tourism activities on the Grande island archipelago and the Humpback dolphin, to identify and assess the key threats to conservation of these species and sustainability of the tourism activities dependent on them. This report, aims to inform guidelines/strategies for the development of community based marine tourism management. It will also contribute towards enhancing the capacities of local stakeholder communities to practice sustainable tourism. Finally, this report is intended to assist governance agencies and community stakeholders to mitigate these issues by developing recommendations through a consultative process between WWF-India and the identified stakeholder groups, i.e., the tour boat operators.

INTRODUCTION


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SECTION A: A REVIEW ON DIVERS' PERCEPTIONS ON CORAL BASED TOURISM AND ITS IMPACTS ON CORAL REEFS AROUND GRANDE ISLAND

ABSTRACT:

The Grande Island archipelago, off the coast of North Goa, is a site of significant marine tourism activity in the state, with recreational SCUBA diving being an important form of tourism here. In order to better understand the history and nature of dive tourism at this site and the changes noticed in the local marine life over the years, we conducted questionnaire-based surveys of professional divers working in the region. Findings from this study highlight that diving plays a major role in Goa's tourism industry. Professional divers in Goa noted the presence of picnic boats and the damage their anchors cause, along with the amount of trash they generate to be of significant threat to the reefs and the dive industry itself. Although most divers state that they adhere to international guidelines for responsible diving, we recommend that a more specific and detailed study on diver behaviour and the carrying capacity of the reef itself be conducted, to effectively measure current impacts of this activity at Grande Island.

KEYWORDS: SCUBA • Diving • Goa • Tourism • Coral reefs • Conservation

INTRODUCTION:

The Grande Island Archipelago, comprising Grande Island and St. George Island, is located at 15°21'N, 73°46'E roughly 3 km off the shore of Vasco, Goa (Figure 1). The archipelago is a tourist attraction primarily because of the reefs and two sandy beaches. The main economies prevalent off the island are picnic boat operations and recreational diving. These two industries are responsible for carrying a majority of domestic tourists to the area.

As stated by Hoon (1997), to have an understanding of the human ecology of coral reef islands, it is important to understand the relationship between local populations and the reef resources. Tourism in Goa is concentrated along the coastal zone. It has had a number of positive benefits in terms of increased incomes, increased employment, added avenues for upward mobility for locals, increased revenue and increased foreign exchange earnings (Sawkar *et al*, 1998). Therefore, sustaining tourism is vital to sustaining the economy of the state.

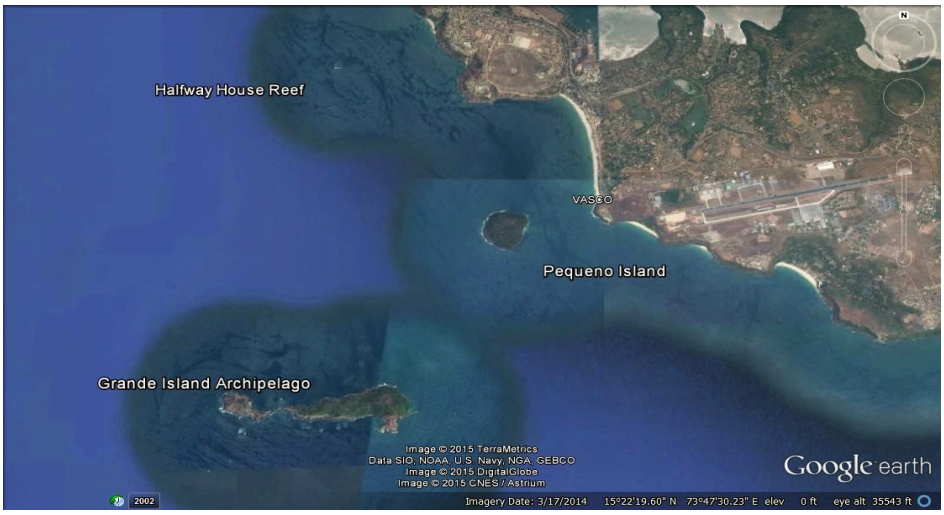

Figure 1: Grande Island Archipelago

Island tour boats contribute to the majority of the tourists that visit the island. They offer tourists an opportunity to swim or snorkel around the island as well as visit the beach where they picnic. There is no exact number of boats that can be allocated solely to this practice as they are usually dolphin sighting boats that take large tourist groups to the island depending on the availability of tourists for the day.
Diving is a more structured economy in the region. Goa is one of the very few coastal regions on mainland India that has a recreational diving industry. Recreational diving in Goa is conducted only at Grande Island, known for the presence of corals (Mascarenhas; pers. comm. with dive operators). There are four dive centres currently operational in Goa, some of which have been functional for almost 20 years (pers. comm.). They offer tourists dives on the reef off the islands (Figure 2), but do not however frequent the beaches on the island. All these dive centres are registered and authorised either by PADI (Professional Association of Diving Instructors), SSI (Scuba Schools International), or both.

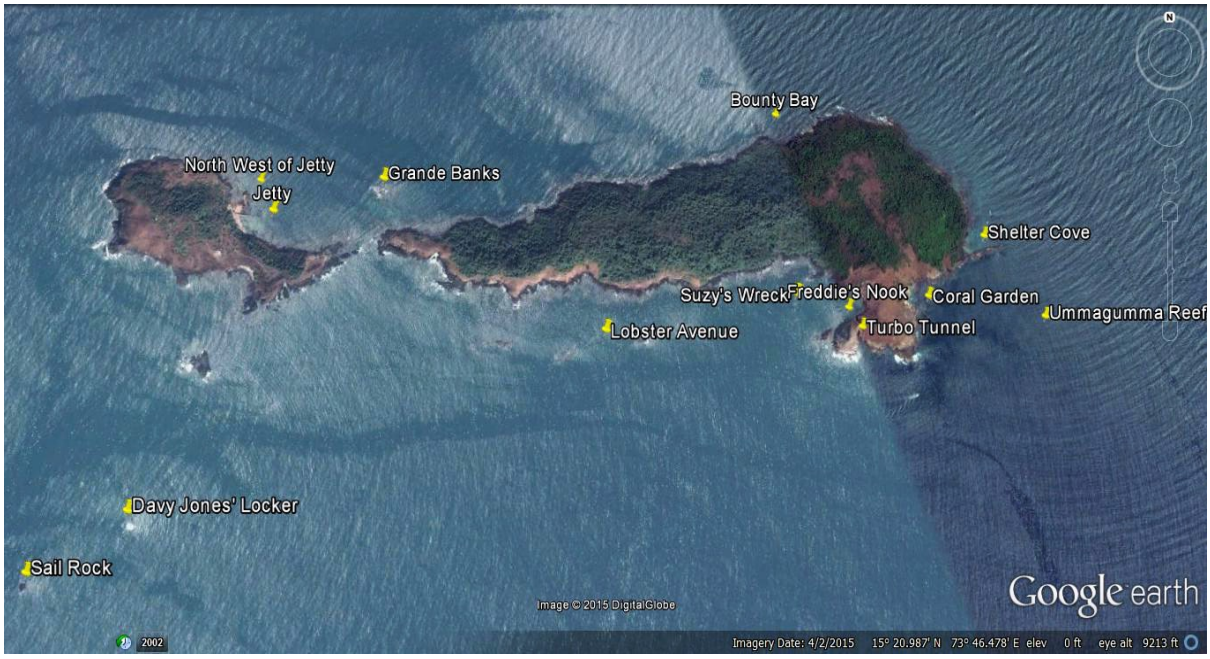

Figure 2: Popular dive sites around Grande Island

Threats to the reef at the Island appear to be meted out by the tourism that is concentrated along the reef. With the increasing number of tourists visiting the island with every season, there is a visible decline in the health of the reef as well as the beaches, which are now littered with garbage.
Boat traffic appears to be a major threat to the reefs around the island as all the boats anchor close to the reef. On observation of corals during regular pleasure dives it was observed that the coral had been broken on several occasions by anchors (Figure 3). This is likely the most damaging result of the boat traffic at the Island. Boat traffic also creates a lot of noise pollution due to the use of low power engines and motors. Research has shown that underwater noise can affect a variety of marine animals, from whales to sea turtles, and from fish to squid (Convention on Biological Diversity, 2012).

Travel agency owners from the Calangute-Candolim beach-belt, who offer boat trips to Grande island, had appealed the tourism department to clean up the beach on the island as the litter, they claimed, was affecting their business (Times of India, March 28, 2015).

The purpose of this study is to examine and understand the perceptions of employed divers in Goa's dive centres, who regularly use the reef around Grande Island, Goa. The dive centres surveyed were namely: (1) Barracuda Diving India, (2) Dive Goa, (3) Goa Aquatics and (4) Goa Diving. The main objective of this review is to assess their understanding of the threats facing Grande Island and approaches that can be employed to mitigate the same.

SECTION B: REVIEW ON PICNIC / ISLAND OPERATORS AROUND GRANDE ISLAND

In addition to recreational SCUBA diving, a number of boat operators, including at least five established tour agencies, conduct island tours which include activities such as swimming, snorkeling, line fishing and lunch/drinks on the two beaches at the island. Being a comparatively heterogeneous group of operators with differing socio-economic backgrounds, we did not conduct a dedicated survey of this sector of island tourism. However, our primary observations during reef surveys revealed impacts on

Although these surveys found that the total damage to coral at the study sites was lower than expected, we observed that breakage was one of the two major types of damage, and it was observed at all six survey sites. While identifying the cause of all the observed instances of breakage was not possible, we did find evidence of anchors directly breaking table coral during dives when off survey effort (Figure 8.3; Figure 8.4; Figure 9). A large number of boats were found to anchor directly on the reef, with up to 19 boats at Shelter Cove, a relatively low-area site (Figure 10). In order to assess the degree of impact boat anchoring has on the reefs, a dedicated study will be conducted.

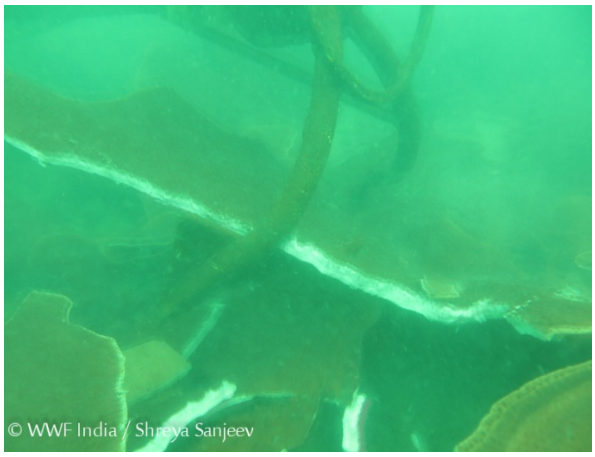

Figure 9: Table coral breakage caused by boat anchoring

Figure 10: A large number of tour boats anchored near a cove at Grande Island

The reef surveys conducted during this study found trash in the form of plastic packaging, plastic bottles, glass bottles, cloth and derelict fishing nets and lines (Figure 8.1; Figure 8.2). Additionally, voluntary annual clean-ups conducted by the local dive companies reveal large amounts of garbage underwater as well on the shores of the island (Figure 11; Figure 12). It should be noted that we did not survey specifically for the quantity of trash, and a detailed survey into this issue may produce a clearer picture. While our study cannot determine with certainty the source of all this trash, with some of it believed to come from the municipal garbage dump on the mainland (professional divers, pers. com.), a significant amount of it, namely glass bottles and hand lines used for fishing, can be traced back to the island tourists, who carry these objects during their trips and offer activities that are potential sources of this trash (pers. obs.).

Figure 11: Glass and plastic bottles collected from The Jetty (dive site) and its adjacent beach

Figure 12: Trash collected from the Jetty (dive site) and its adjacent beach during a clean-up drive organised by a dive centre

PART II: A PRELIMINARY ASSESSMENT OF CORAL REEFS AROUND GRANDE ISLAND, NORTH GOA, WESTERN INDIA

ABSTRACT:

The Grande Island archipelago in Goa is a group of two coastal islands fringed by coral reefs. This, along with the islands' proximity to the coast of Vasco, Goa make it one of the few hubs of dive tourism on the west coast of India, as well a site frequented by island tour operators. In this study, underwater surveys were conducted on six different dive sites representing three categories of usage intensity. As no baseline was available, the sites were selected based on a diver's knowledge of the region, potentially creating some bias. These sites were surveyed for composition of living substrata on the reef and for fish life. Poor visibility in these waters and the dearth of documentation of the fauna of this region limited the analysis of our observations. However, we found that turf algae is by far the dominant substratum type on these reefs, conforming to local divers' opinions of increasing algal growth over the years. Turf algae was more abundant than any type of coral at all the sites, and was more abundant than total coral cover at all but one site. Among coral types, encrusting coral was found to notably exceed other types at each site, followed by table corals. Damage to corals in the form of breakage, bleaching and disease was observed, as were dead corals (broken and diseased corals being more abundant than bleached and dead ones) and evidence of boat anchors breaking table coral was also found. While the damage at these sites is not notably high, there are clear signs of its occurrence, meriting conservation and management measures before the damage increases. Fish life belonging to eighteen families (barring other sightings when off effort) were recorded, including parrotfish (scarids), butterfly fish (chaetodontids) and damselfish (pomacentrids), as well as other fauna such as sea urchins (*Diadema* sp.), which could be used as indicator species to study individual aspects of reef health in this region in the future. We recommend certain measures to counter the threats we have observed, such as zoning of specific activities at/off the island, prohibition of spear fishing, the installation of mooring buoys, regular patrolling and the introduction of educational modules for tourists. Additionally, we recommend further studies of the algal blooms and of reef health using the potential indicator species recorded during this study.

INTRODUCTION:

Over a hundred countries in the tropical regions of the world encompass in their waters, the richest territories for marine biodiversity –coral reefs. They cover approximately 0.2% of the ocean surface, yet, they are home to as many as 6,000-8,000 species of fish (Lieske and Myers, 2000; Cesar *et al.*., 2003) and are among the most complex and beautiful of Earth's ecosystems. Coral reefs are of innumerable value for many reasons, such as: (a) they serve as a protective barrier around coasts and islands; (b) they are highly productive, creating more living biomass than any other marine ecosystem; (c) they serve as an important food source for people who live along the coastlines and (d) their spectacular beauty, contributes to the local economies through tourism (Odum and Odum, 1995; Cesar, 2000). They have significantly important ecosystem functions, which provide critical goods and services for millions of people around the world. They form the crucial source of income to local populations that reside along coastlines, especially in developing countries (fisheries, tourism and related ancillary enterprises). Despite their obvious merit, coral reefs are under threat around the world and recent estimates suggest that approximately 20% of the world's coral reefs have been destroyed and show no immediate probability of recovery (Roberts, *et al.*., 2006). This decline in reef health comes when marine tourism is expanding (Barker and Roberts, 2004).

The aesthetic value of coral reefs has over time, appealed to millions of people around the world, which has in turn, led to the expansion of reef-related tourism. Globally, tourism is the fastest growing industry, with dive tourism growing at the rate of 20% per year (Cesar, 2003). Diving is commonly considered to be a sustainable use of coral reef ecosystems in comparison to the magnitude of other threats reefs face (bleaching, disease and ocean acidification). However, a significant body of literature implies that diving is also considered a source of reef damage (Prior *et al.*., 1995; Schleyer & Tomalin, 2000; Barker & Roberts, 2003). Dive boat anchors being tossed onto reefs (Hale & Olsen, 1993), the discharge of dive boat effluents (oil and gas residue), throwing of garbage directly onto reefs has all noted to be of serious threats (Harriot *et al.*., 1997).

The coastal state of Goa in western India, is one of the country's prime international tourist destinations. The Grande Island archipelago in Goa, comprising two coastal islands (Grande and St. George) separated by a short, narrow channel, is one of the few coastal islands on the west coast of peninsular India where coral reefs have been documented. The waters around the islands house patches of coral growth and small expanses of fringing reef, which give way to a sandy sea bed. Ecological studies have been conducted at this site by Sluka (2005) who estimated the coral cover around the island at 31%. The reefs around these islands consist primarily of table coral and encrusting coral, with a few sandy patches supporting abundant sea whip growth as well (pers. obs.). Pillai (1996) recorded the occurrence of *Porites, Coscinarares, Turbinaria,* some favids and *Pseudosiderastrea,* but no ramose forms in this region. Ecological studies have been conducted at this site by Sluka (2005) who estimated the coral cover around the island at 31%. No long term study on the health and ecological status of the corals and associated life in this region has been conducted.

In this study, we initiate a preliminary examination of reef's around Grande island with the main aim of assessing their species and community richness, their health and ecological status. The main objectives of our study is to: 1) Survey sites around the island to assess percentage cover for types of coral; 2) Survey sites around the island to assess fish diversity; 3) Survey sites around the island to assess for coral reef damage and health status and 4) Survey sites around the island to assess percentage cover of macro and turf algae. In the future, we aim to continue this study so that the long-term management recommendations can be provided on sound science to conserve the reefs around Grande island.

Figure 1. Map of dive sites around the Grande Island archipelago

PART III: A PRELIMINARY ASSESSMENT OF DOLPHIN-WATCHING TOURS NORTH GOA, WESTERN INDIA

ABSTRACT:

Dolphin-watching tourism has been growing rapidly in North Goa, with the focal species being the Humpback dolphin. This is the first preliminary study that looks at the interactions between dolphin-

watching tour boats and dolphins in Goa, where dolphin-watching tourism has been exponentially increasing over the last decade. Thirty boat-surveys were conducted on dolphin-watching trips carried out in Aguada Bay from Sinquerim jetty, Coco beach and Miramar beach, to assess the operations of the tour boats around dolphins, the nature of these sightings and the behaviour of dolphins in response to the presence and operations of these boats. The research platform being a dolphin-watching tour boat may have added to the response of observed dolphins and could be a potential source of bias. A survey of the coastline of North Goa was also conducted to understand the magnitude of this industry in Goa. The findings from this study reveal that intrusive boat-operations are being carried out by dolphin-watching boats. 50% of the trips showed cutting the dolphin's path of travel, 28.57% circling 10.71 % chasing them. Boat drivers have little knowledge about the species and its biology, and primarily focus on sight-seeing. Dolphins were seen avoiding boats and changing their direction of travel in response to approaching dolphin-watching tour boats. There are many unregistered boat operators who carry out dolphin-watching tours along the coast line and this activity is opportunistic to the presence of dolphins. However, dolphin-watching tourism in Goa plays a vital role in the state's economy, as well as for providing various means of livelihoods for the local community. Therefore, in the interest of both the sustainability of the industry and the local communities, we recommend a separate licensing vertical for boats that conduct these trips and guidelines be put in place for all operators to adhere to, while carrying out dolphin-watching tours. We also recommend that education and interpretation be stressed upon for these trips engaging local communities, as well as introducing a monitoring system for effective compliance.

KEYWORDS: Humpback dolphin • Dolphin-watching • Goa • Sustainable tourism • Conservation

INTRODUCTION:

Marine mammals, particularly dolphins have a wide appeal for many people, leading to a rapid growth in marine mammal based tourism around the world. The popularity of human interaction with cetaceans has substantially increased over the last few decades (Duffus and Dearden, 1990; Simonds, 1991; Hoyt, 1994; Samuels *et al*., 2000). They are readily found around many coastal areas of the world (Jefferson *et al*., 1993), and are therefore easily accessible to a fairly large number of people (Constantine, 1999). This has reverberated in financially viable businesses based on taking tourists to see them, contributing to a rapid growth in dolphin watching tourism. The increase in sociable contact between humans and cetaceans appears to have moderated an enormous expansion of formalized commercial operations, which provide opportunities for locals and tourists to interact with them. The development of such activities has resulted in a form of intensive exploitation of these animals around the world (Simonds, 1991; Frohoff, 2000).

Cetacean focused tourism boomed in the 1990s, with nearly 100 countries engaging in dolphin and whale watching by the year 2000 (Hoyt, 2001). Even so, with the increase in popularity of these activities, reports of harassment to the animals, including severe injuries and in some cases, mortalities have been accounted worldwide (Bryant, 1994; Lockyer, 1990; Santos, 1997). As a consequence, scientists, managers, policy makers and the general public have expressed concern about the detrimental, yet poorly understood impacts of these activities on tourism-targeted cetaceans (Dudzinski *et al*., 1994; IFAW, 1995; Frohoff, 2000). Some studies also (Lusseau, 2003; 2004; 2005; Bejder *et al*., 2006) report on the long-term, biologically significant impacts that tourism has on target cetaceans, that make sustainability of local tourism questionable (Lusseau *et al*., 2006; Allen, 2007).

Humpback dolphins (Figure 1) have a near-shore distribution, where they are known to inhabit coastal waters, bays and estuaries usually within 0.5 km of the coastline (Parsons, 2004; Sutaria and Jefferson, 2004). Due to this, they are potentially influenced by and vulnerable to coastal activities such as fishing, coastal development, boat traffic and tourist operations. Humpback dolphins are found all along the coast of Goa and southern Maharashtra. (Parsons, 1998a; Sutaria, 2003; Sutaria and Jefferson, 2004). However, no accurate census of the population size exists for this region. Sutaria and Jefferson (2004)

sighted a total of 842 Humpback dolphins along Goa's coastline of over 678 km of survey effort, thus showing a population density of 3.9 individuals per kilometre by distance. Goa in western India, is a major international tourist destination where, the prevalence of dolphin watching tourism was noted over a decade ago (Parsons, 1998a; Jefferson & Sutaria, 2004) and has been growing exponentially over the years (personal comm. Goa Tourism Department). The dolphin-watching tours are targeted around a local population of Humpback dolphin (*Sousa plumbea*), which serves as a source of livelihood for some local communities in the region. Boat owners and operators offer near-shore sightseeing and dolphin-watching boat trips to tourists around the area's hotels and popular beaches. In Goa, around 60,000 tourists watched Humpback dolphins in 2008, showing very strong growth since 1998 (O'Connor *et al*., 2009).

The Report of the Second Workshop on the Biology and Conservation of Small Cetaceans and Dugongs of Southeast Asia (Perrin *et al*., 2005) identified the potential conservation issues with the Humpback dolphin, whose distribution being highly coastal, overlaps with that of dense human populations. The International Union for the Conservation of Nature (IUCN) classifies the Humpback dolphin as "Near Threatened" (IUCN 2015), defined as a taxon that "may be considered threatened with extinction in the wild in the near future". In India, this species falls under the Schedule I of the Wildlife (Protection) Act 1972, and thus receives the highest degree of legal protection. There are great concerns about the future existence of this population, because high human population density, intensive harmful fishing activities and the ever-increasing tourist operations along the coastline continue to expand with little or no consideration for these dolphins (Parsons, 1998a).

In Goa, the large number of active tour boats in a relatively small area, combined with the lack of any regulations, guidelines or code of conduct for dolphin watching and, the cumulative impacts of other commercial and recreational activities (fishing, parasailing, jet-boating) could prove to be of grave threat to these coastal cetaceans, as well as deprave the overall experience for tourists who undertake these trips. The whale-watching subcommittee of the International Whaling Commission stated in 2006 (as cited by Parsons, 2012) that "…there is new compelling evidence that the fitness of individual odontocetes repeatedly exposed to whale-watching vessel traffic can be compromised, and that this can lead to population-level effects".

The main aims of this study were: 1) to gain a better understanding of the operation and practices of dolphin-watching tour boats, 2) the behaviour of dolphins towards the tour boats, 3) tourists' perceptions of their dolphin-watching experience. Based on this information, guidelines for sustainable dolphin-watching will be recommended. Additionally, in order to better understand the magnitude and strength of the dolphin-watching practices currently operating in the region of study, the coastline of North Goa was mapped for the presence and number of operators (registered and unregistered with the Tourism Department of Goa) who offer dolphin-watching trips. Results from this study are aimed at directly informing future decisions related to the protection of the Humpback dolphins in Goan waters.

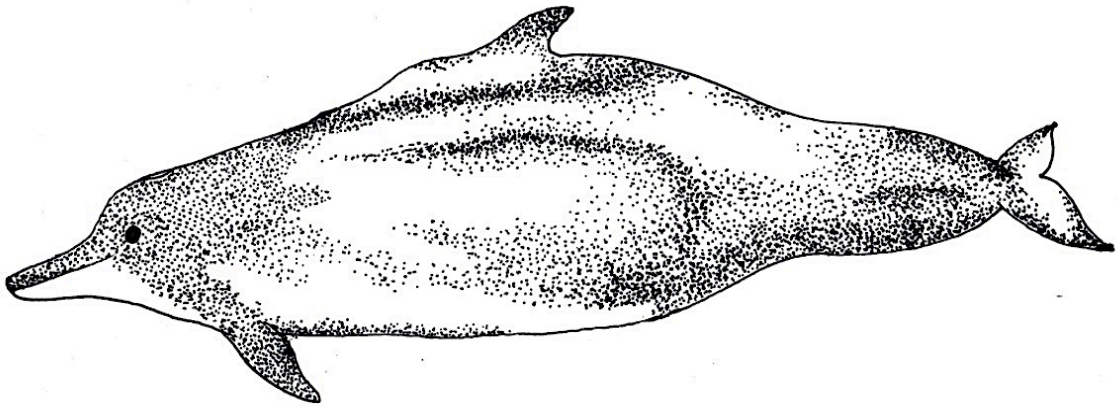

Figure 1: Humpback dolphin (*Sousa plumbea*)

METHODOLOGY AND STUDY SITES

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PART I: ASSESSING THE VIEWS OF TOURISM OPERATORS ON THE IMPACTS OF TOURISM ON GRANDE ISLAND, NORTH GOA, WESTERN INDIA

METHODOLOGY:

In order to understand dive operators' perceptions of this industry and marine life in the region, structured questionnaires were prepared and distributed to dive personnel from all four dive schools that conduct diving activities and courses at Grande Island. The sample size for analysing the answers consisted of the 18 divers who responded.
The questionnaires were constructed so as to obtain information on each interviewee's level of experience (in terms of time and qualification), their views about the status of the reefs and marine life in Goa, the threats faced by marine life and the diving industry, their ideas to mitigate/remedy the effects of these threats, and their current approach and initiatives towards conservation.

PART II: A PRELIMINARY ASSESSMENT OF CORAL REEFS AROUND GRANDE ISLAND, NORTH GOA, WESTERN INDIA

MATERIALS AND METHODS:

Study Site:

Grande Island (15°21.133'N, 73°46.655'E) and St. George Island (15°21.134'N, 73°45.836'E), which form an archipelago 3km off the shore of Vasco, Goa, are the two islands that comprise the region of this study (Figure 1). Grande Island is privately owned, while St. George Island is currently under the control of the Indian Navy, who use it for drills. The islands are of volcanic origin, and most of their area is covered in dense forest. The islands have steep rocky shores all around except at two sites where short sandy stretches exist. A dilapidated jetty which is partly submerged exists at the north-east part St. George Island, while an old shipwreck rests just off the south shore of Grande Island. The waters around the islands house patches of coral growth and small expanses of fringing reef, which give way to a sandy sea bed.

Grande Island and St. George Island collectively constitute about 16 dive sites that are used for recreational diving (the number, names and precise locations of the sites vary by dive company). The dive sites that comprise parts of this fringing reef extend to about 14 m at their deepest, but most coral growth is seen to about 6 – 8 m deep (barring a shipwreck that has formed a reef-like habitat that extends deeper than most other comparable sites).

Besides diving, island tour operators also use this area. Their operations involve swimming, snorkelling and recreational hand-line fishing, notably for red-tooth triggerfish *Odonus niger* (stakeholders, pers. com.). Many also use the two sandy beaches and the jetty at the archipelago, disembarking at these sites for picnics and for lunch.

Table 1. Sites surveyed for the present study

Site name	Site Code	Traffic Level	Location around the Island
Lobster Avenue	LA	None	South
North-west off Jetty	NW	None	Northwest
Bounty Bay	BB	Low	North
Shelter Cove	SC	Low	East
Jetty	JE	High	Northwest
Coral Garden	CG	High	East

Field Survey Methodology:

For this study, six dives sites in total were selected, grouped into three categories based on the perceived intensity of tour boat traffic and diver traffic at the sites; and the location of the dive sites in relation to the island topography and in relation to mainland. – two sites each as control (no usage), low-usage and high-usage respectively. These categories were decided after a pilot consultation with a diver who runs a dive company in the region and our study will assess if the perceived degree of usage has any influence on the health status or damage seen at the reef's. This method of site selection may have been biased, but considering the lack of any baseline literature, we decided to use the same. The sites are listed in Table 1 and depicted on a map of the archipelago in Figure 1.
Line-intercept methods and Quadrat methods were first tried in the area. Given the strong current, limited time, and low visibility underwater, video transects were used for this study. A GoPro Hero 3 camera was used for underwater videography. At each site, two video line transects of 30 m length each were surveyed, both parallel to the shore, with one at a greater mean depth of 6.4m (min=6m, max=8.5m, mode=6m) and the other at a mean depth of 4.1m (min=4m, max=4.5m, mode=4m). The variation in depth was largely due to the differences in topography at sites. The depths of transects were selected based on the distribution of corals at these locations (since very little coral cover is found above and below this depth range). Three replicates of the two transects at each site were carried out over a period of roughly 3 months from February to April 2015, summing up to a total of 6 sets of data from each site.

Video footage of the reef and associated fish were obtained from the dives. Two unidirectional runs were done along each transect, the first for footage of corals and the second for footage of fish. For footage of the coral reef, the video was recorded at a downward angle in a steady straight line along the transect; for footage of fish, the camera was continuously panned horizontally on either side of the line with the tape measure always visible within the frame, or deviating from this pattern as and when fish were sighted. No specimens of coral, fish or other life forms were collected.

This methodology however had drawbacks. The poor visibility and relatively strong currents did not permit the use of a $1m^2$ quadrat as planned, leading to much lower-density sampling.

Analysis:

Footage of the reef was analysed using a random point sampling method. Screenshots (samples) taken at 10 second intervals were analysed by overlaying 5 equidistant points on the display, identifying the substrata at these points and hence counting the frequency of occurrence of these substrata along the

transect. The number of samples per transect varied, because although the transect length was constant (30 m) the number of sampling intervals was not (ranging from 18 to 33), since swim speeds while surveying varied at each transect due to differing currents, visibility and surge. The total counts and average counts for each category were calculated and converted into percent cover for each site. In addition to identification of substrata, damage to corals was also noted, as was the presence of debris along the transects. Coral substrata were grouped under six categories – encrusting coral, table coral, massive coral, branching coral, soft coral and other live coral. Algae were categorised into macro algae and turf algae. Any other sessile life forms were recorded as 'other non-coral'.

For assessing the fish life, the footage was viewed and fish (and additionally echinoderms and nudibranchs) were identified to the family level. Not all specimens were identifiable to the genus or species level, either due to a present lack of documentation of species found in the region, or due to poor visibility in the footage. Hence for further analysis, identities for all fish used were at the family level in order to maintain uniformity and homogeneity. The numbers of each animal were counted using a simple tally method, grouping counts together in the case of schools/aggregations. For very large schools, an approximation was made from a single random screenshot representing the school.
The percent cover of each substratum type (including damaged coral) was calculated from the random point sampling data. A mean of each type was calculated for each site, and these were represented graphically for each individual site and across sites.

Diversity of fish at the family-level was calculated for each site using Simpson's index of diversity. This index was chosen over the Shannon-Wiener diversity index because it is more accurate than the latter at representing diversity in low density samples (McClanahan, 1989). Simpson's index is calculated as $D = 1 - (n/N)^2$, where n = number of individuals counted for each family, N = total sample size. For each family found at every site, a mean number of individuals sighted over six transect surveys was calculated and these values were used to calculate the diversity index at each site.

PART III: A PRELIMINARY ASSESSMENT OF DOLPHIN-WATCHING TOURS NORTH GOA, WESTERN INDIA

MATERIALS AND METHODS:

Study Site:

Goa, located in western India (14°50'-15°45' N, 73°40'-74°15' E) has approximately 105 km of open coastline with over twenty-five listed beaches from Arambol beach in the north to Galgibaga in the South. According to the National Institute of Oceanography, of the 105 km long coast, more than 70 km comprise linear and wide sandy beaches, all backed by 1 to 10 m high dunes; sandy pockets and secluded coves backed by rocky cliffs are also found. The coastal plain, 20 to 35 km in width, consists of lowlands traversed by seven major and four minor river systems that experience tides. Small islands, shoals and mangrove swamps are observed within water bodies (Mascarenhas, 1990). Goa has 6 major rivers that traverse its landform flowing westwards out into the Arabian Sea. The northern most being River Tiracol, River Chapora, River Mandovi, River Zuari, River Sal and River Galgibaga at the southernmost tip of the state.

Aguada Bay (15°28'41.64" N, 73°46'58.78" E) is the region where the Mandovi River meets the Arabian Sea (Figure 2). The bay is 4 km at its widest and has an average depth of 5 m (Shetye *et al*., 2007). The area observed for the aim of this study is renowned for regular dolphin sightings and hence a vast majority of dolphin-watching trips in North Goa occur at this region. Additionally, other recreational boating activities (jet skis, speed boats, recreational catamarans and yachts) as well as commercial fishing are highly concentrated in this region.

Thirty boat-based surveys were conducted to observe the behaviour of the Humpback dolphins present in the region, and the operation of tour boats around them. Observations were conducted from locally-owned and operated dolphin-watching boats.

Figure 2: Location of Aguada Bay, Goa in Western India

Study Methods:

Three jetties were chosen from where dolphin-watching trips are commercially advertised to tourists (Figure 3) Observations were mainly conducted from locally-owned and operated dolphin-watching boats, namely, i) Sinquerim (17 trips), ii) Coco Beach (11 trips), and iii) Miramar Beach (2 trips). Surveys were conducted in March 2015-April 2015 which coincides with the peak in Goa's tourism activity (i.e. summer vacation). In order to account for changes in diurnal activities of dolphins, surveys conducted during three different times of the day – morning (between 9am to 10am), noon (between 12pm to 1pm) and evening (between 3pm to 4pm).

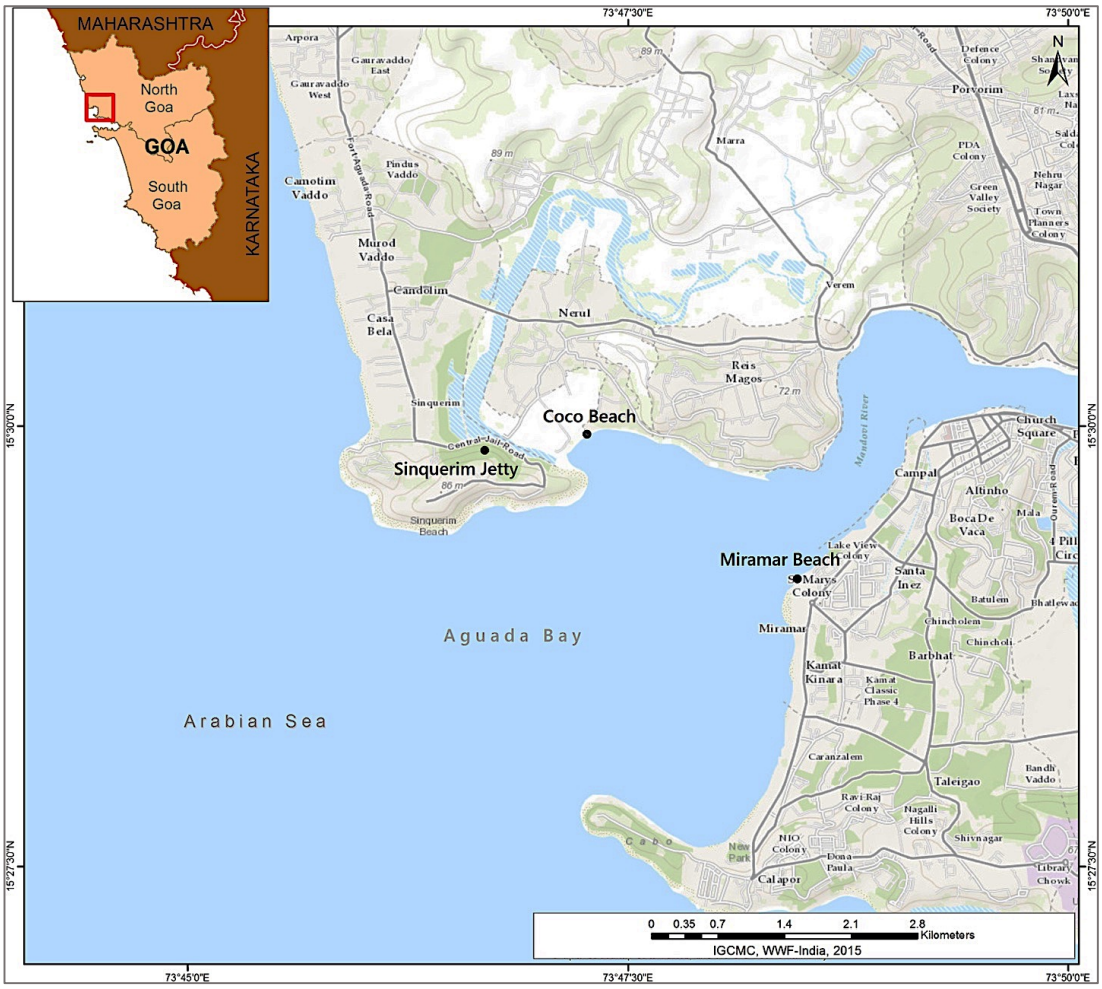


Figure 3: Location of sites chosen for surveying dolphin-watching trips

Objective I: *Assessing the operations of dolphin-watching tour boats*

Two observers were aboard every trip, making observations in terms of understanding the overall quality and sustainability of the dolphin-watching trips for tourists and the dolphins, respectively. Dolphin-watching tours were assessed using a questionnaire format for the following factors: i) safety, ii) education and interpretation, iii) operation of our tourist boat around dolphins during the trip, iv) observations of other dolphin-watching boats and v) tourists' experience on the trip.

Objective II: *Assessing the behaviour of Humpback dolphins to tour boats*

Visual distance for relative positions of boats around dolphins were also noted for every sighting. Observations the behaviour of individual dolphins to boat traffic as they moved through the study area were noted. A scan sample was attempted in which, the behaviour of each dolphin (if solitary) or predominant group behaviour (if in a group) at the time of the start of each sighting was recorded as "start" behaviour; behaviours exhibited during the entire duration of the sighting was recorded as "during" behaviour, and that at the end of the sighting was recorded as "end" behaviour. The behavioural events recorded followed Parsons (1998b) and are described in Table 1. GPS locations for every sighting was recorded. An attempt was made to photograph every dolphin observed using a Canon EOS 500D with a 75-300mm autofocus lens.

It must be noted that the research platform could be a source of bias, and may have also influenced the observed behaviour of the dolphins, along with other boats.

Table 1: Brief description of behaviour events exhibited by humpback dolphins in Aguada Bay, Goa *(Refer Figure 14 for images)*

Behavioural States	Description	Reference
Slow Travel (ST)	Persistent directional movement with relatively longer intervals between surfacing	(Parsons, 1998b; 2004)
Fast Travel (FT)	Persistent directional movement with relatively shorter intervals between surfacing	(Parsons, 1998b; 2004)
Milling (M)	Showing little movement, tend to remain in the same place or at the surface for prolonged periods of time	(Van Parijs and Corkeron, 2001)
Socializing (SO)	Exhibiting leaps, high speed movement in tight groups and frequent body contact with other individuals	(Parsons, 1998b)
Foraging (FO)	Repeated deep diving at one spot (by multiple individuals if in a group)	Parsons, 1998b; 2004
Regrouping (REG)	A group of dolphins (after separation) emerge in close proximity to each other	Parsons, 2004

Behavioural Events	Description	Reference
Deep Dive (DD)	Diving steeply downwards with the tail fluke coming clear of the water surface	Parsons, 1998b; 2004
Breaching (BR)	The animal rises out of the water at a 90°-45° angle and then falls back on the surface	Parsons, 1998b
Separation (SEP)	A group of dolphins travelling together, dive and separate while emerging at different locations	Parsons, 2004

Objective III: *Assessing the magnitude of dolphin-watching operations along the coastline of North Goa*

A preliminary study was conducted to document the number as well as the strength of operators along the coast of North Goa. Sites were identified by surveying the coastline for advertised dolphin-watching tours and by surveying all public beaches and jetties. Short structured interviews were conducted with boat operators where available (by randomly selecting one operator at each site, in accordance with time constraints), or with persons advertising dolphin tours, such as local restaurant staff). Data obtained from the surveys pertain to the number of operators at each site, timings and duration of dolphin watching tours, area of operation, type of craft used, and the nature of dolphin sightings.

The beaches and jetties in North Goa documented through the survey are Terekol, Arambol, Mandrem, Ashwem, Morjim, Vagator, Anjuna (north and south part), Candolim (north and south part), Sinquerim, Calangute, Baga, Coco, Miramar and Dona Paula (Figure 4).

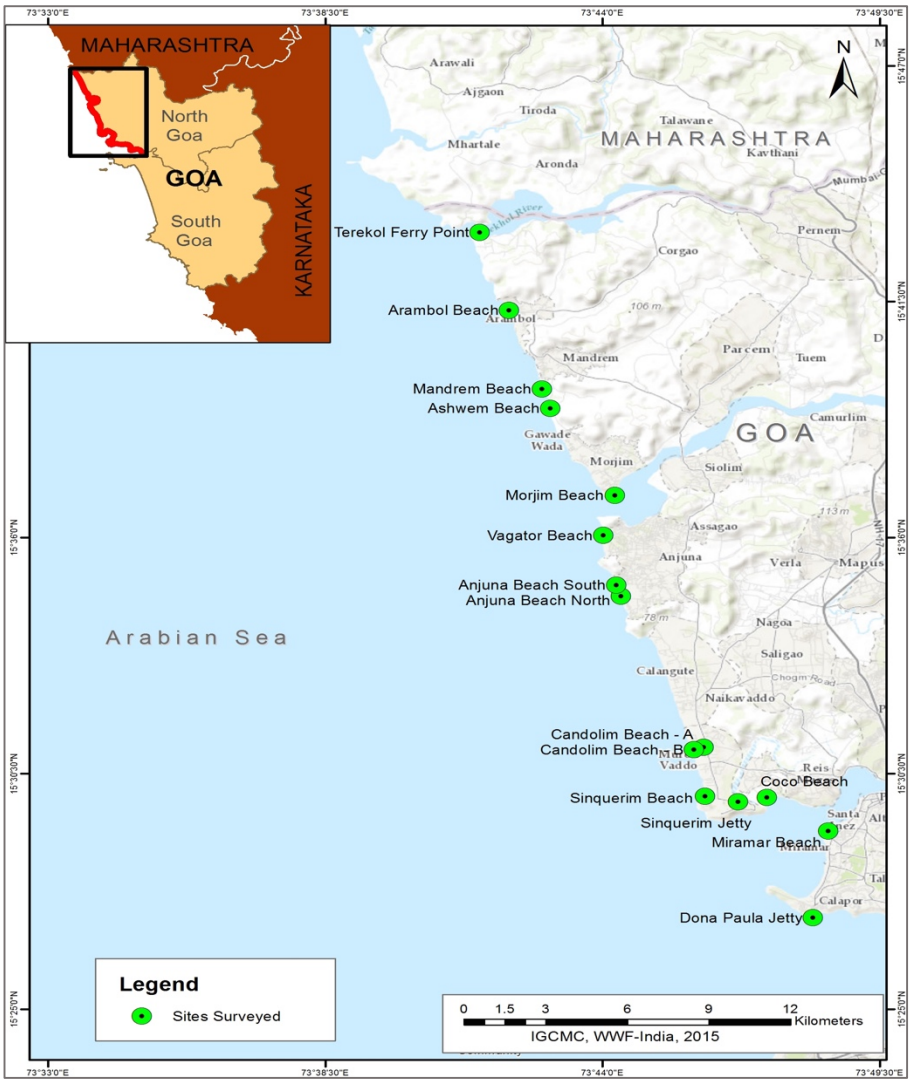


Figure 4: Beaches surveyed while mapping the coast line for dolphin-watching tours and operations

RESULTS AND OUTCOMES

PART I: ASSESSING THE VIEWS OF TOURISM OPERATORS ON THE IMPACTS OF TOURISM ON GRANDE ISLAND, NORTH GOA, WESTERN INDIA

RESULTS:

Although a larger sample size was targeted, only 18 divers responded to the questionnaires. 11 of these were instructors, 6 were Dive Masters or Dive Master trainees, one was a Rescue Diver. They ranged from 20 to 53 years of age, and their years of experience in the dive industry varied from 6 months to over 20 years.

Regarding the level of importance of diving as a form of tourism in Goa, a majority of divers (10) rated it as "important", while 3, 2 and 1 rated it as "very important", "not very important" and "not important" respectively (Figure 4).

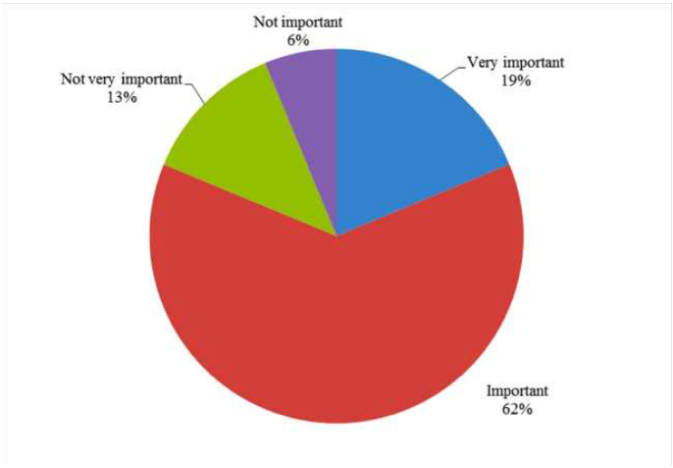


Figure 4: Divers' perceptions about levels of importance of diving as a form of tourism in Goa

From the answers to questions about dive tourism traffic at Grande Island, it was found that out of the four companies in the region, two possess/hire one boat, while the other two rent out two boats (although this is dependent on the number of customers). Answers about the number of trips per month vary, but a majority (7 out of 11 who answered this question) indicate that each of the companies conducts 25-30 trips a month.

Fifteen of the 18 interviewees, including the sole interviewee from one particular dive company, stated that they employ locals for their operations (of those that did not, two did not answer the question, with only one specifically denying it). Five responses mentioned that locals are employed as boat personnel, and three (including 2 of the former) said they are also employed as staff divers.

Twelve divers said that they had noticed changes in the reefs over the years. Another trainee with relatively very little experience mentioned that he had heard of it but not observed it himself. Of the five that denied witnessing any changes (or did not answer), only two are dive instructors with 11 years' and 3 years' experience diving in Goa, while the others have been diving here for 6 months or less, possibly reducing their chances of noticing change. The changes described by the divers include coral bleaching, siltation, increasing algal cover and, according to six divers, coral breakage from boat anchors. One diver mentioned another interesting change- the apparent return of parrotfish and porcupine fish, whose numbers seemed to have dwindled over the years. One diver stated that though there are some changes, there are no severe overall changes; another said that though corals get damaged, they are hardy and recover the following season. Other special observations by the divers

included claimed changes in the species found at the site and an increase in the amount of garbage in the water.

The interviewees were asked to list their favourite dive sites and rank them on a scale of 1 to 10 (1 being the best). This scale was then converted into three classes – Excellent (1-3), Very Good (4-6) and Good (7-10) (Figure 5).

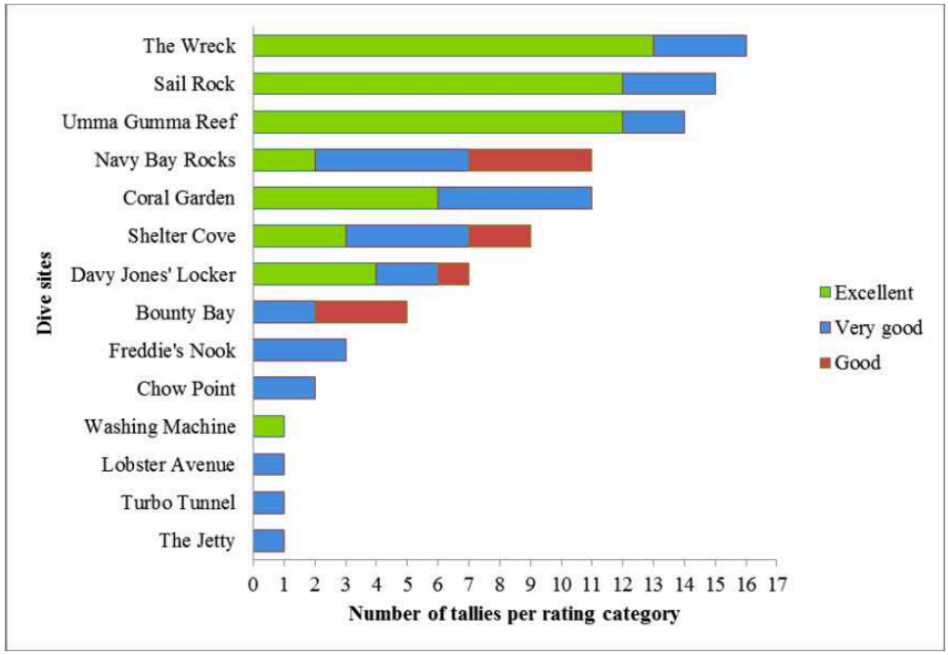


Figure 5: Ratings for favourite dive sites

When asked about the threats to dive tourism in Goa, the single most frequently named threat was the effects of island tour/picnic boats on the dive sites and marine life. Many of the divers attributed the garbage and coral breakage at the sites to irresponsible activities conducted by these boats. The threats as listed by the divers are shown in (Figure 6). The "Other" category includes threats that were mentioned by not more than one interviewee. These include- low cost of diving attracting too many divers leading to crowding of sites, low underwater visibility, rise in temperature and sea level, overfishing, and "rude behaviour by locals" affecting the dive staff.

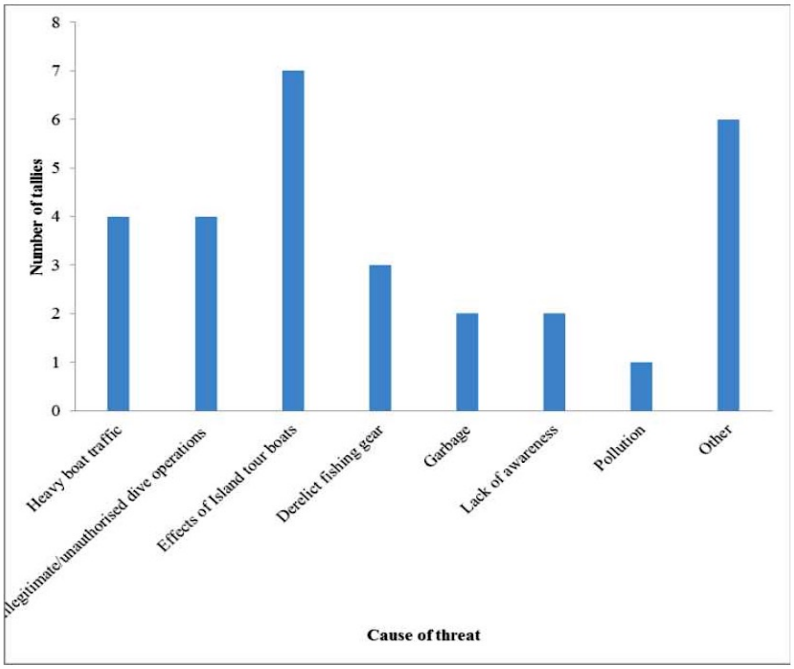


Figure 6: Threats to dive tourism as per professional divers' opinions

As a threat to marine life and reefs in the area (Figure 7), coral damage by indiscriminate/irresponsible anchoring was most frequently mentioned (11), followed by garbage (9) and fishing gear at the dive sites (8). Five divers, three of whom have considerable experience diving in the area, listed spear fishing in the area as a serious threat, with one diver having encountered spear fishermen during a dive. The divers claim that spear fishermen catch large numbers of Malabar Groupers (*Epinephelus malabaricus*), a large, slow-breeding species found at these reefs, which if fished in the claimed numbers, could easily be depleted. The category 'Other' includes miscellaneous threats mentioned by not more than one interviewee; these include industrial pollution, untreated or excessive sewage disposal, accident or negligent dumping of fuel from vessels, dredging, unmonitored fishing activity, high boat traffic, careless divers, silting and algal growth.

The divers were asked to select the types of fishing gear that in their opinion caused damage to the reefs and marine life at Grande Island (Figure 8). Gill nets (used occasionally along the south side of the island) and spear fishing gear (used to hunt Malabar groupers at a few sites) were most frequently selected (n=9). These were followed by recreational hook & line fishing (n=8) and trawls (n=7), both of which were mentioned as threats by some divers via personal communication.

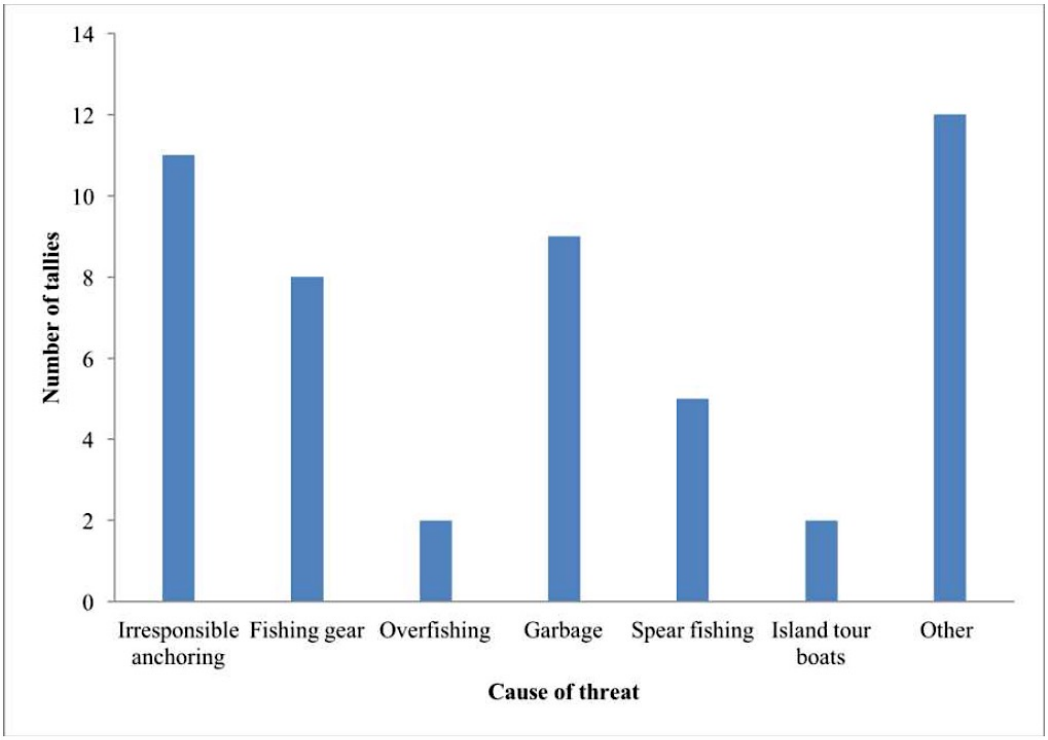


Figure 7: Threats to reefs and marine life in Goa as per professional divers' opinions

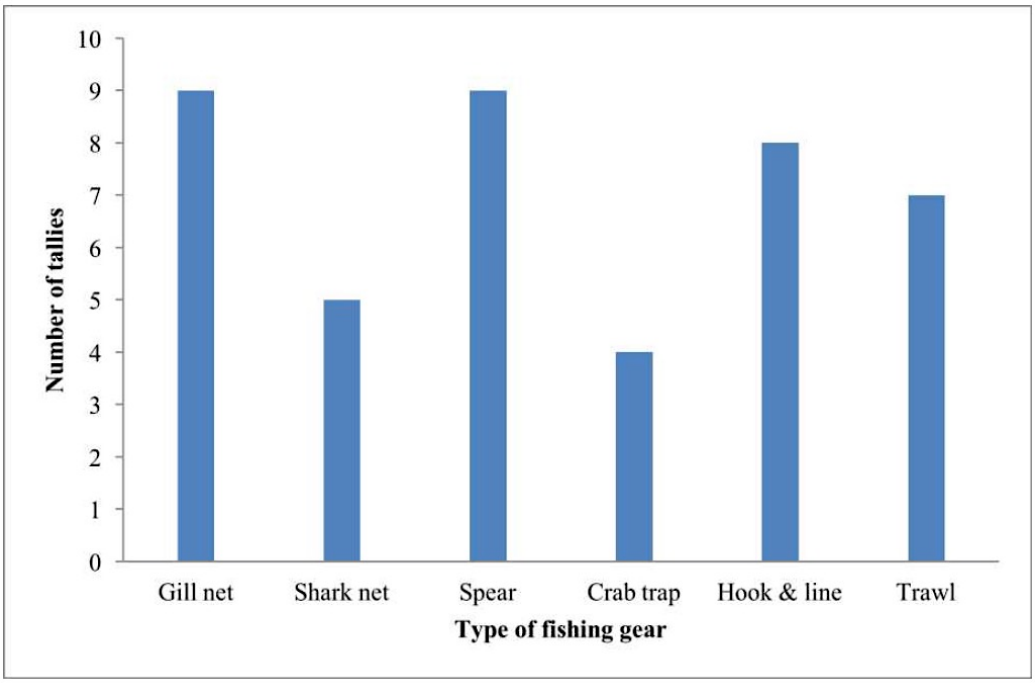


Figure 8: Fishing gear that threaten marine life at Grande Island, as per professional divers' opinions

To the question regarding their affiliation to conservation initiatives and organisations, only 11 of the 18 interviewees answered (all these answers were in the positive, with all but one listing the names of the initiatives/organisations). Seven of these listed PADI Project Aware, either solely or as one of their affiliations. The others mentioned (none more than once) were Greenpeace, Sabotage, Bite Back, Reef Watch, WWF-India, National Institute of Oceanography and Central Marine Fisheries Research Institute (although the last two are not true conservation organisations, focusing rather on marine research). One of the interviewees additionally runs his own organisation, 'Coastal Impact', which is affiliated to his dive company and conducts conservation awareness activities.

Eight interviewees stated that they conduct their own awareness building activities. Two detailed this as underwater/beach clean-up activities, while another conducts educational programs at local schools and colleges.

An umbrella organisation called the Association of Dive Centres in India (ADCI) already exists, and 9 of the interviewees (including at least one representative of each dive company) stated that they were members of this organisation. However, only 6 of these (with no representatives from one dive company) claimed to have benefited from it, and this opinion is divided within two other companies as well, with the more experienced divers/owners (except one, the sole representative interviewee of his company) denying any benefit. 11 interviewees expressed that they would be interested in being part of a state-level umbrella forum in the future.

The divers were asked about the growth of the dive industry over the years in Goa. Of the 15 who answered this question, all agreed that it is growing continuously, with 7 stating that is it growing very rapidly; one of these 7 stated that the growth is "irresponsible". One of the respondents attributed the rapid growth mainly to the steady increase in the number of 'Discover Scuba Diving' tourists (uncertified tourists with no diving experience and little or no knowledge of safety and responsible protocols).

The responses to the question about crowding of a dive site varied greatly, in all likelihood because of the respondents misunderstanding the context. 3 respondents said that they have hardly ever found a dive site too crowded. One said that dive sites get overcrowded when bad conditions force many divers to dive at relatively few sites that have clearer water. The owner of one of the dive companies commented that overcrowding does not occur, since the divers follow a mutual understanding to avoid already occupied dive sites. Only one respondent stated specifically that the sites are "crowded compared to before".

PART II: A PRELIMINARY ASSESSMENT OF CORAL REEFS AROUND GRANDE ISLAND, NORTH GOA, WESTERN INDIA

RESULTS:

Percentage cover for each substrate type at each site, along with types of damage to coral were calculated and are represented graphically (Figures 2.1 – 2.6, see Table 2 for abbreviations).

Abbreviation	
BC	Branching coral
MC	Massive coral
TC	Table coral
SC	Soft coral
EC	Encrusting coral
BrC	Broken coral
DdC	Dead coral
BlC	Bleached coral
DsC	Diseased coral
MA	Macroalgae
TA	Turf algae

At Lobster Avenue (Figure 2.1), turf algae were found to be the predominant substratum type by mean percent cover (35.09%, SD = 8.99%); macroalgae were also found but covered a much lesser area (3.67%, SD = 3.45%). Among the types of coral found here, encrusting coral was the most abundant (25.81%, SD = 20.54%), followed by table coral (12.93%, SD = 11.28%) and massive coral (6.07%, SE = 5.31%). Very small percentages of branching coral and soft coral were found (0.38% and 0.1% respectively). 0.1%, 0.53% and 2.56% of the coral at this site was found to be broken, bleached and diseased respectively

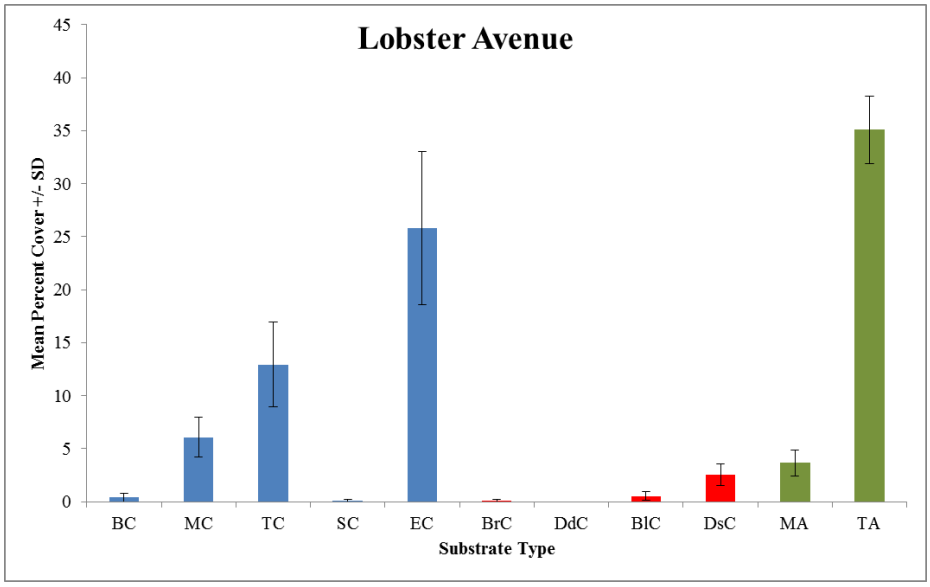


Figure 2.1: Mean percent cover of different substrate types (along with percent damaged coral) at Lobster Avenue (control site 1)

At North-west off Jetty (Figure 2.2), turf algae were found to be the predominant substratum type by mean percent cover (19.83%, SE = 12.42); macroalgae were also found but covered a much lesser area (1.68%, SD = 1.95%). Among the types of coral found here, encrusting coral was the most abundant (8.43%, SD = 11.23%), followed by table coral (5.16%, SD = 8.58%) and massive coral (1.28%, SD = 3.12%). No branching coral and soft coral were found. 0.84%, 0.14% and 0.1% of the coral at this site was found to be broken, bleached and diseased respectively.

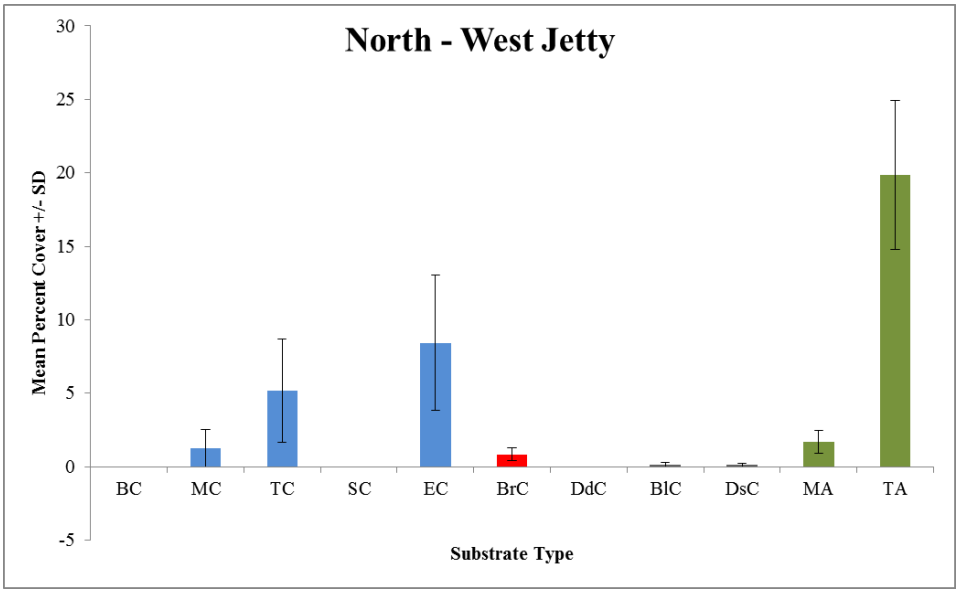


Figure 2.2: Mean percent cover of different substrate types (along with percent damaged coral) at North-west off Jetty (control site 2)

At Bounty Bay (Figure 2.3), turf algae were found to be the predominant substratum type by mean percent cover (26.01%, SD = 12.82); macroalgae were also found but covered a much lesser area (3.78%, SD = 4.39%). Among the types of coral found here, encrusting coral was the most abundant (6.64%, SD = 3.68%), followed by massive coral (2.46%, SD = 3.23%). A very small percentages of soft coral (0.16%) was found. Table coral and branching coral were absent at this site. 0.22% and 0.76% of the coral at this site was found to be broken and diseased respectively

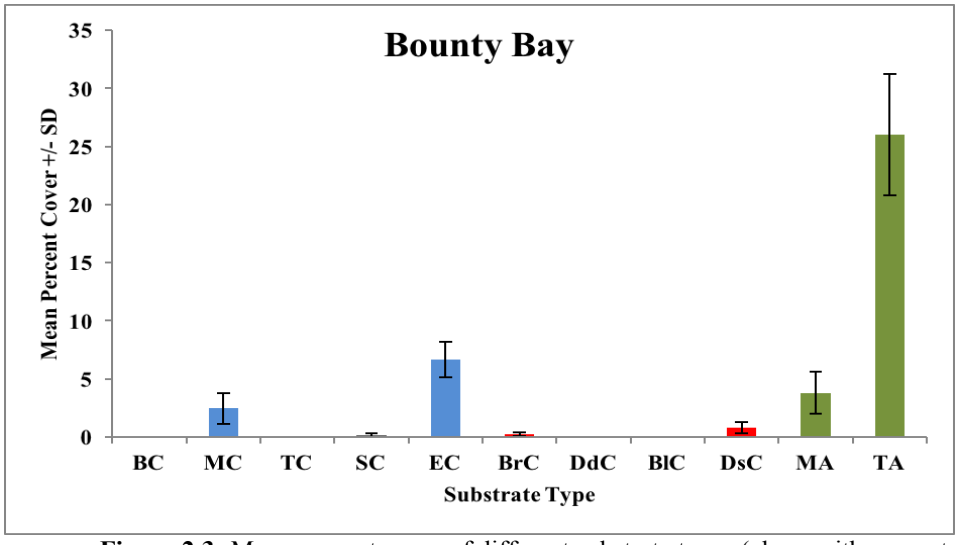


Figure 2.3: Mean percent cover of different substrate types (along with percent damaged coral) at Bounty Bay (low-usage site 1)

At Shelter Cove (Figure 2.4), turf algae were found to be the predominant substratum type by mean percent cover (46.1%, SD = 23.21); macroalgae were also found but covered a much lesser area (6.45%, SD = 5.87%). Among the types of coral found here, encrusting coral was the most abundant (21.02%, SD = 16.74%), followed by a relatively small percentage of table coral (1.81, SD = 3.4%) and soft coral (0.7%, SD = 1.7%), while massive coral and branching coral were absent. 1.48% and 1.03% of the coral at this site was found to be diseased and broken respectively.

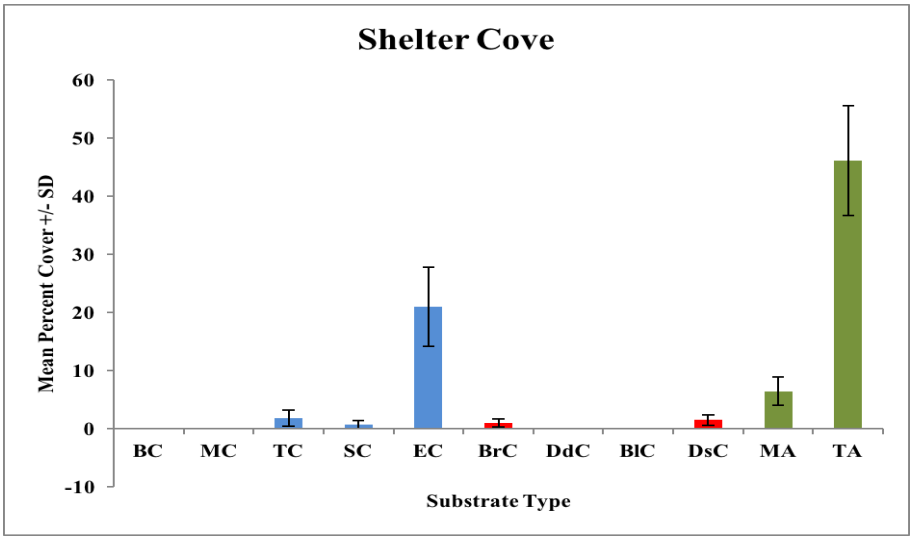


Figure 2.4: Mean percent cover of different substrate types (along with percent damaged coral) at Shelter Cove (low-usage site 2)

At Coral Garden (Figure 2.5), turf algae were found to be the predominant substratum type by mean percent cover (38.29%, SD = 17.89%); macroalgae were also found but covered a much lesser area (2.19%, SD = 2.89%). Among the types of coral found here, encrusting coral was the most abundant (19.22%, SD = 21.09%), followed by table coral (3.35%, SD = 5.31%) and soft coral (1.59%, SD = 3.47%). A very small percentage of massive coral was found (0.38%); branching coral was absent at this site. 1.85%, 0.87%, 1.26% and 0.38% of the coral at this site was found to be broken, bleached, diseased and dead respectively.

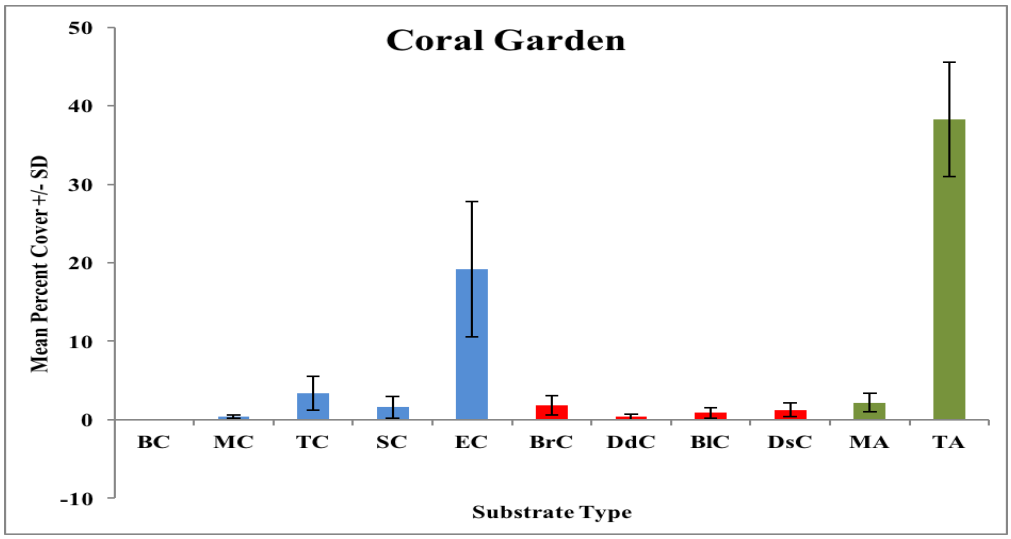


Figure 2.5: Mean percent cover of different substrate types (along with percent damaged coral) at Coral Garden (high-usage site 1)

At the Jetty (Figure 2.6), turf algae were found to be the predominant substratum type by mean percent cover (30.3%, SD = 24.88%); macroalgae were also found but covered a much lesser area (1.7 %, SD = 1.9%). Among the types of coral found here, encrusting coral was the most abundant (11.48%, SD = 7.04%), followed by table coral (5.44%, SD = 5.33%), soft coral (1.68%, SD = 2.28%) and massive coral (1.37%, SD = 2.4%). Branching coral was absent at this site. 0.64%, 0.87% and 0.29% of the

coral at this site was found to be broken, diseased and dead respectively, while no bleached coral was recorded.

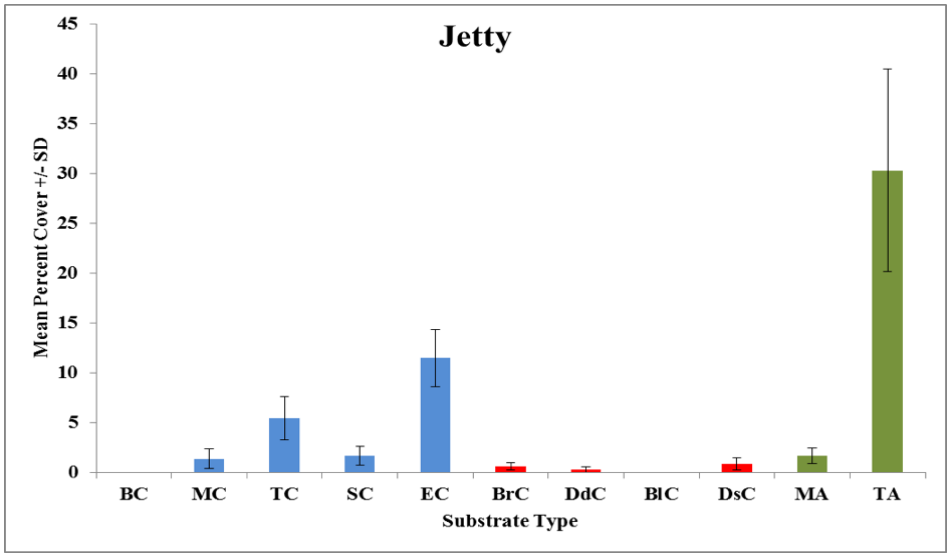


Figure 2.6: Mean percent cover of different substrate types (along with percent damaged coral) at the Jetty (high-usage site 1)

Comparisons between living substrates across sites

Algae were found to be the predominant substrate type at each of the sites surveyed. Turf algal cover ranged from 19.84% (SD=12.42, SE=5.071) at North-west off Jetty to 46.10% (SD=23.21, SE=9.475) at Shelter Cove. At all six sites, it was found to be greater than encrusting coral cover, which represented the most abundant coral type, with percent cover differences between these two substrates ranging from 9.29% (Lobster Avenue) to 25.08 (Shelter Cove). Turf algal cover was even greater than total coral cover (inclusive of all coral types) at all sites except Lobster Avenue (Figure 3).

Figure 3: Comparisons of percent turf algal cover against percent total coral cover at each site.

The proportions of total coral cover occupied by different types of coral are represented across sites in Figure 4. Encrusting coral forms a majority of the coral type found at every survey site, ranging in percentage cover from 6.64% (SD=3.68, SE=1.50) to 25.81% (SD=20.55, SE=7.26), followed by table coral at all but one site (Bounty Bay), ranging from 1.81% (SD=3.40, SE=1.39) to 12.93% (SD=11.28, SE=3.99). Massive coral and soft coral were found at 5 sites each, albeit generally in much lower numbers than the former two types. Branching coral was found only at one site (Lobster Avenue) and

covered only 0.379% (SD=1.07, SE=0.38) of the surveyed area. The encrusting coral cover was found to be greater than table coral cover at all sites, with a minimum difference of 3.27% (at North-west off Jetty).

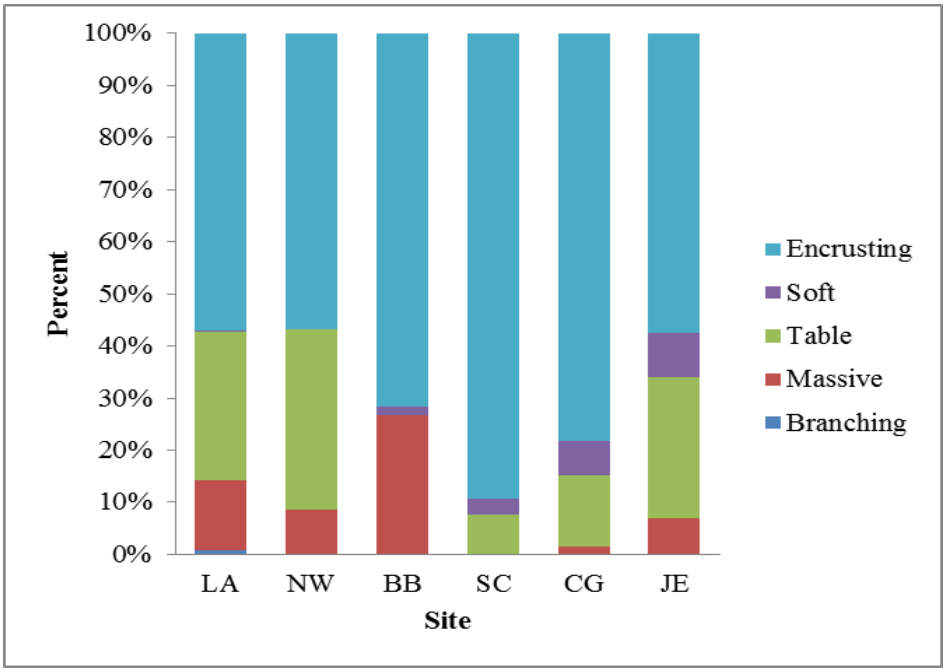


Figure 4: Proportions of types of coral represented as percent total coral cover at each site

Damaged corals (including broken, bleached, diseased and dead corals) were found at the study sites, but the percent values for these were very low and not comparable to those of healthy substrate. Among the categories of damage we observed, diseased and broken coral were the prevailing types and were found at all sites. Bleached and dead coral were found at three and two sites respectively.

Reef-associated fish belonging to eighteen different families were found across the six sites surveyed. The maximum diversity of families was fifteen, at both the low-usage sites (Shelter Cove and Bounty Bay), while the minimum was seven at North-west off Jetty, a control site. Chaetodontids, pomacentrids, pomacanthids, labrids and gobiids were found at every site.

Table 3: Simpson's diversity index and richness of reef fish, as calculated for each site at the family level

Site	Simpson's index of diversity	Family richness
LA	0.6453	14
NW	0.3239	7
SC	0.3079	15
BB	0.6723	15
JE	0.3899	8
CG	0.3418	11

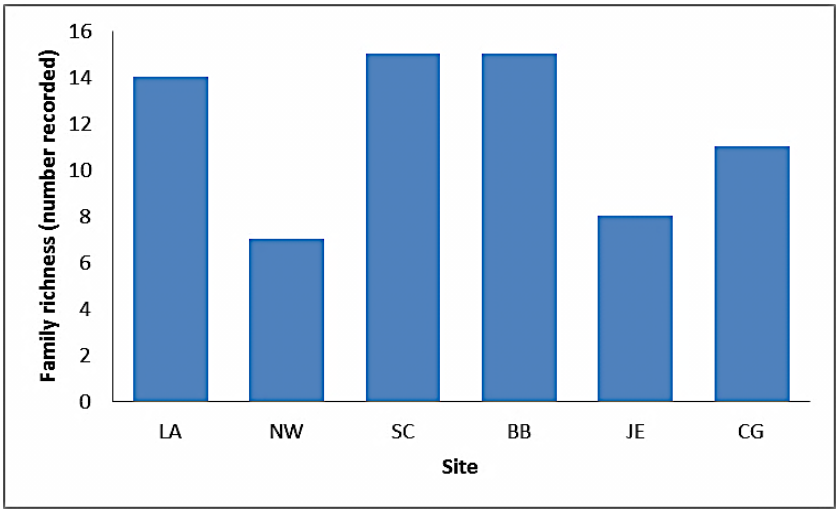


Figure 5: Family richness of reef fish at each site

Diversity of fish families was found to be higher at Bounty Bay (D=0.6723) and Lobster Avenue (D=0.6253) (a low-usage site and a control site respectively), with lower diversity indices for the other four sites surveyed, which include a control site (North-west off Jetty), a low-usage site (Shelter Cove) and both high-usage sites. The diversity indices calculated here could, however, be erroneous to some extent due to the small sample size, and because of the possibility of the influence of several other biotic and abiotic factors, may not be representative of the impacts of tourism alone.

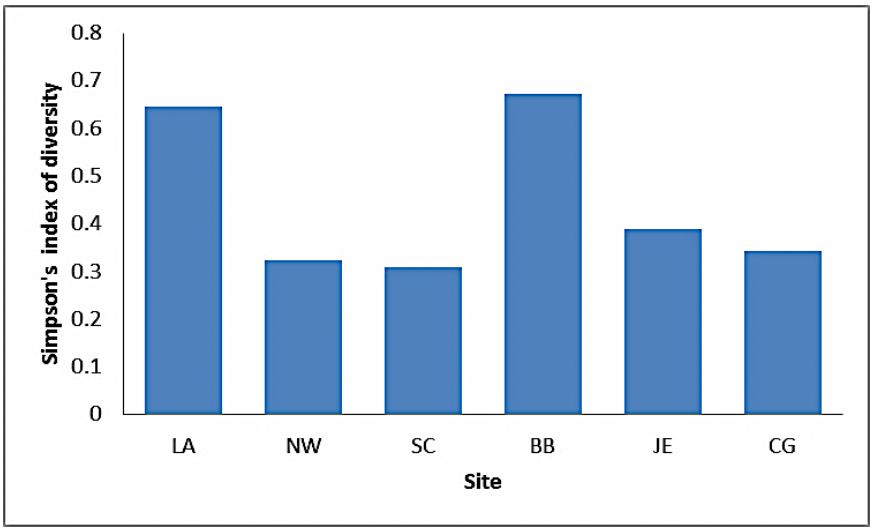


Figure 6: Diversity of fish families represented as Simpson's diversity index for each site

PART III: A PRELIMINARY ASSESSMENT OF DOLPHIN-WATCHING TOURS NORTH GOA, WESTERN INDIA

RESULTS:

Objective I: *Assessing the operations of dolphin-watching tour boats*

Observations were conducted for 11 days, with 3 partial and 7 entire days ('entire'= all three time slots were surveyed within the same day; 'partial' = one or two time slots were not surveyed on the same day), for a total of 17.43 hours. In this study, dolphins were sighted in 28, of the 30 dolphin-watching trips.
Dolphin-watching trips in all three sites are conducted from 9 am and the continue till 5 pm everyday, and primarily occur between the months of October to May.

Sightings lasted an average of 13 minutes 28 seconds (min= 6 min, max=43 min).

The mean number of dolphin watching boats present at the same time as our tourist boat around a group of dolphins was found to be 6 (min=1, max=17). However, on one occasion (at the end of a sighting, when the observer boat was heading back to the jetty, 21 boats were observed circling a group of 2 dolphins).

Speedboats (generally used for watersports) viewing the focal dolphin/group were observed only on three occasions (1, 1 and 2 speedboat(s) respectively. Catamarans (mostly from Miramar beach) were observed on five occasions (min=1, max=2).

The mean maximum distance from the dolphin groups during a sighting was 43.5 m (max=100 m, min=10 m). On two occasions, dolphins were sighted from a distance of 400 m and 200 m respectively (these readings were not considered for calculating the mean maximum distance as they were significant outliers). An average time of 1 minute 25 seconds was spent at this maximum distance (barring cases where the animals were observed only for an instant and no duration could be recorded). The mean minimum distance from the animals during a sighting was calculated to be 6.41 m (min=2 m, max=50 m), for an average duration of 1 minute 19 seconds. The mean distance maintained from the focal groups/animals throughout the sightings was 35.31 m (max=60 m, min=5 m).

Boat operation was observed and categorized into the following types: these include path cutting (driving the boat perpendicularly across the dolphin's direction of travel), chasing (boats closely pursuing dolphins) and circling (boats moving in an arc, attempting to restrict the dolphins' movements). Path cutting, chasing and circling were noticed on 14, 8 and 3 trips respectively of the total 30 survey trips (Figure 5). Observations on the relative positions of boats around dolphin(s) and the manner in which they operated were also made during the sightings (Figure 6).

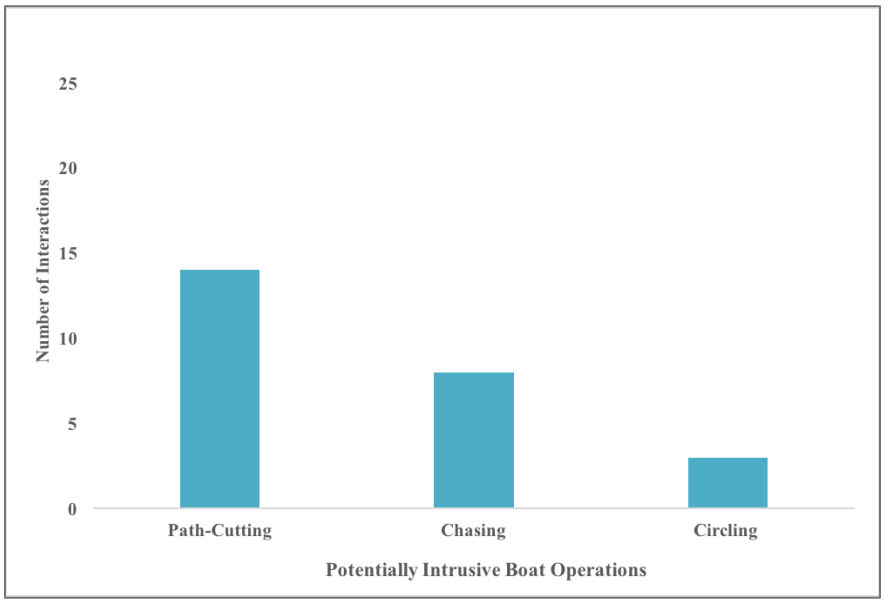
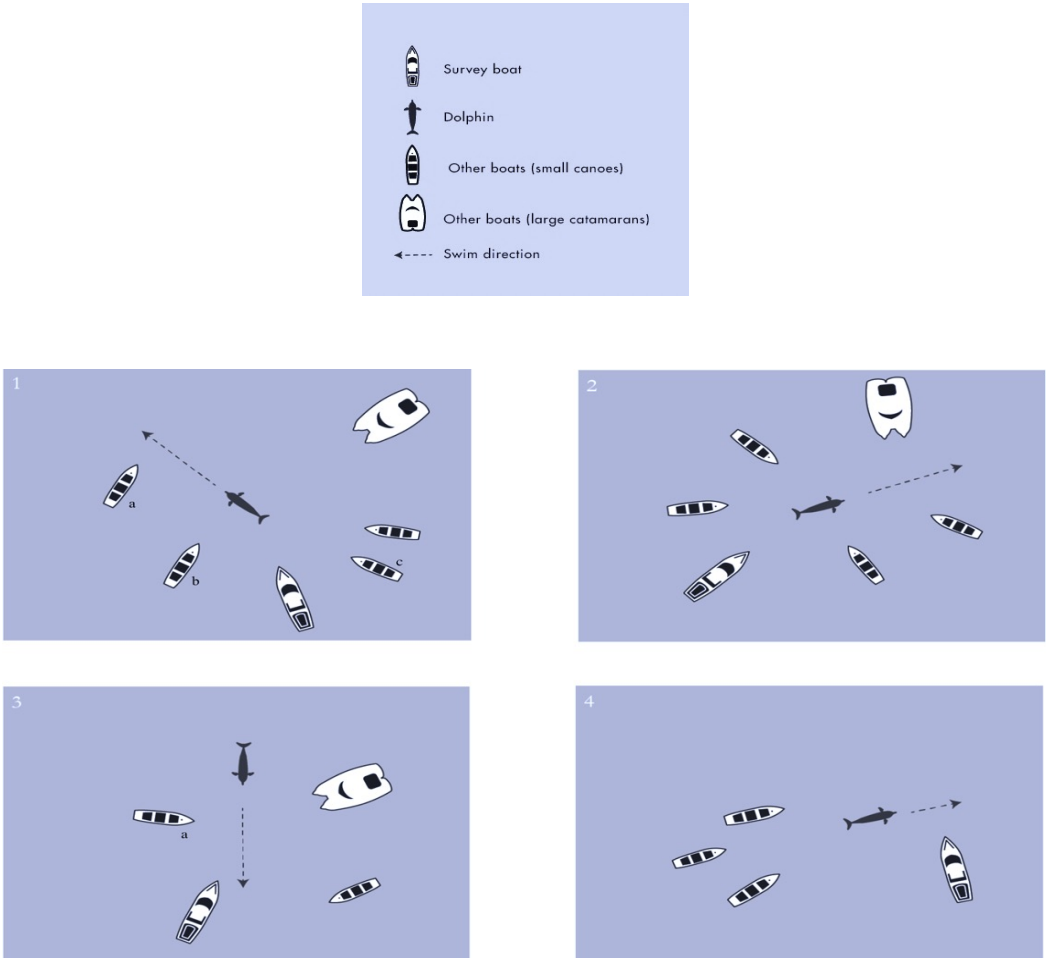


Figure 5: Potentially intrusive boat operations observed around dolphins (total no. of dolphin sightings=28)
(Refer Figure 15 for images)



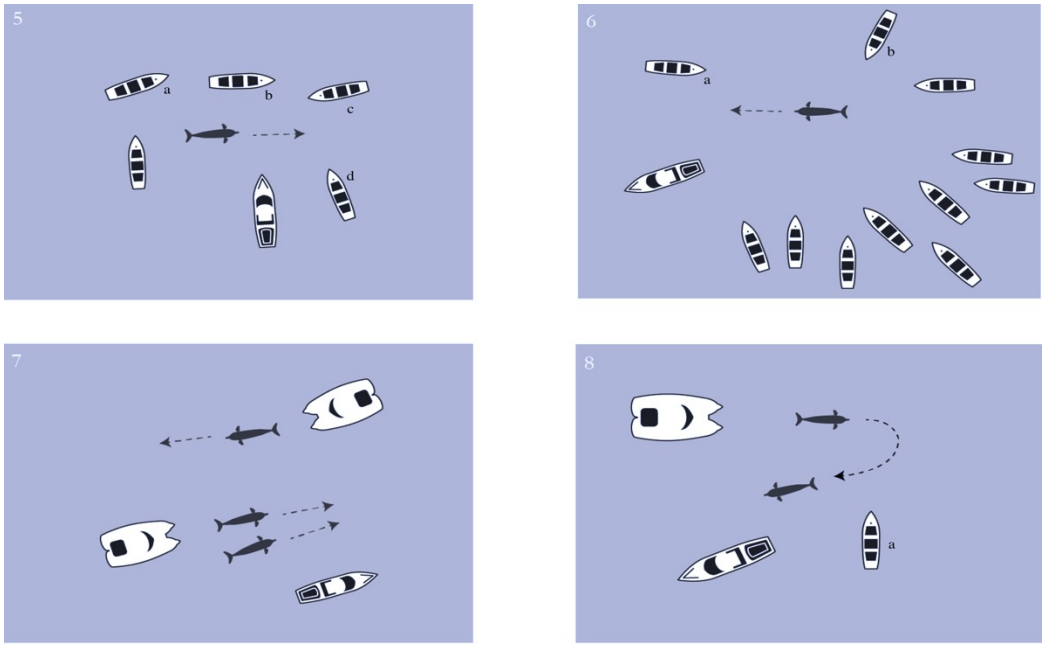


Figure 6 (1-8): Relative positions of boat and dolphins during sightings

***Figure 6.1*:** Five dolphin-watching tour boats, including observer boat and a catamaran, were seen approaching the dolphin from the rear at very close distances and high speed. 2 boats (a, b) were seen were seen heading straight for the dolphin, while one of them (a) was cutting its path of travel.

***Figure 6.2*:** Five dolphin-watching tour boats, including observer boat were seen approaching the dolphin at high speed, almost chasing the dolphin. All boats were facing the dolphin directly and a catamaran was seen cutting its path of travel. In this scenario, the catamaran nearly halted right on top of the dolphin before it dived underwater and did not surface for a long time.

***Figure 6.3*:** Three dolphin-watching tour boats, including observer tour boat were see approaching the dolphin. The observer boat was heading straight for the dolphin at high speed. A catamaran, along with another tour boat (a) was seen cutting its path of travel.

***Figure 6.4*:** Four dolphin-watching tour boats were seen chasing the dolphin at very high speeds. The observer tour boat cut the dolphin's path of travel, and started chasing it till the end of the sighting, where it dived and did not surface for a long time. This marked the end of the sighting for the observer boat.

***Figure 6.5*:** Two dolphin-watching tour boats (a, b) were parallel to the dolphin's path of travel (<10 m), while another tour boat (c) was heading straight for the dolphin, then switched its engine to neutral. One tour boat (d), along with the observer boat was seen cutting the dolphin's path of travel.

***Figure 6.6*:** Crowding of boats was significantly seen in this case, where 12 boats were seen clustering around an individual dolphin, accompanied by 9 more boats that arrived shortly after. During the sighting, most of the boats were seen halting <5 m away from the dolphin and then switching their engines to neutral. Two of them (a, b) was seen heading straight for the dolphin.

***Figure 6.7*:** Three dolphins (individual + group of 2) were sighted in this instance, where, two catamarans were seen chasing the dolphins (~ <20 m away). The observer boat was cruising parallel at ~15 m from the group of two dolphins.

***Figure 6.8*:** One dolphin was encountered during this sighting, where the catamaran was seen chasing the dolphin. The dolphin, after a brief interval of time, changed its course of direction and swam parallel to the chasing catamaran in the opposite direction. During this time a tour boat (a) and the observer tour boat was cruising with its engines in neutral

Boat driver and tourist behaviour:

During the boat-based surveys, the behaviour of the boat driver/guide and that of tourists taking these trips was observed and noted, specifically their interactions with the animals and the environment and their levels of interest in dolphin-watching and associated activities.

A parameter that was focused on was the briefing and subsequent information provided by the boat driver as a tour guide. Of the 30 boat trips surveyed, only 2 had guides who spoke to their customers about the dolphins. The information pertained mainly to the dolphins' activities by time of day and to the sightings directly. The species was, however, misidentified by both these tour guides; the dolphins were referred to as the Indo-Pacific bottlenose dolphin (*Tursiops aduncus*) rather than the Humpback dolphin (*Sousa plumbea*). 27 of the 30 trips (90%) had detailed information pertaining to the sight-seeing that ensues alongside dolphin-watching as an activity on these trips. 19 trips (63.33%) had a safety briefing before departure, which included the provision of life-vests and a few boat safety instructions (Figure 7).

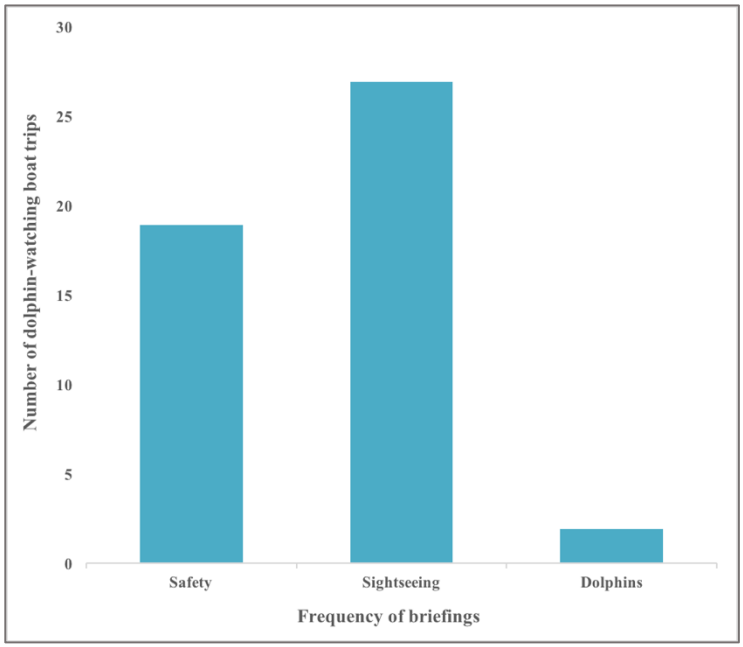


Figure 7: Frequency of types of briefings observed in the dolphin-watching tours (Total no. of trips=30)

The observations of tourist behaviour comprised five parameters – (1) following safety instructions, (2) noise, (3) attempting to feed dolphins, (4) littering, (5) other (Figure 8). Eleven out of the surveyed 30 trips had passengers violating safety regulations by way of not wearing life-vests, standing or gathering towards one side of the boat or leaning over the edge; 5 of these eleven instances occurred on trips that had conducted safety briefings prior to departure. Noise was noted when passengers screamed and

behaved in an unruly fashion aboard these trips, often violating safety rules. Two trips had passengers attempting to attract dolphins by scattering food into the water. On five trips, passengers were found littering the water with bottles, beverage cans and plastic packets/wrappers (none of the surveyed boats had any provision to collect trash, nor did they prohibit carrying plastics and other disposable materials aboard). On 11 trips, passengers were found curiously posing questions to the boat driver about the dolphins and its whereabouts.

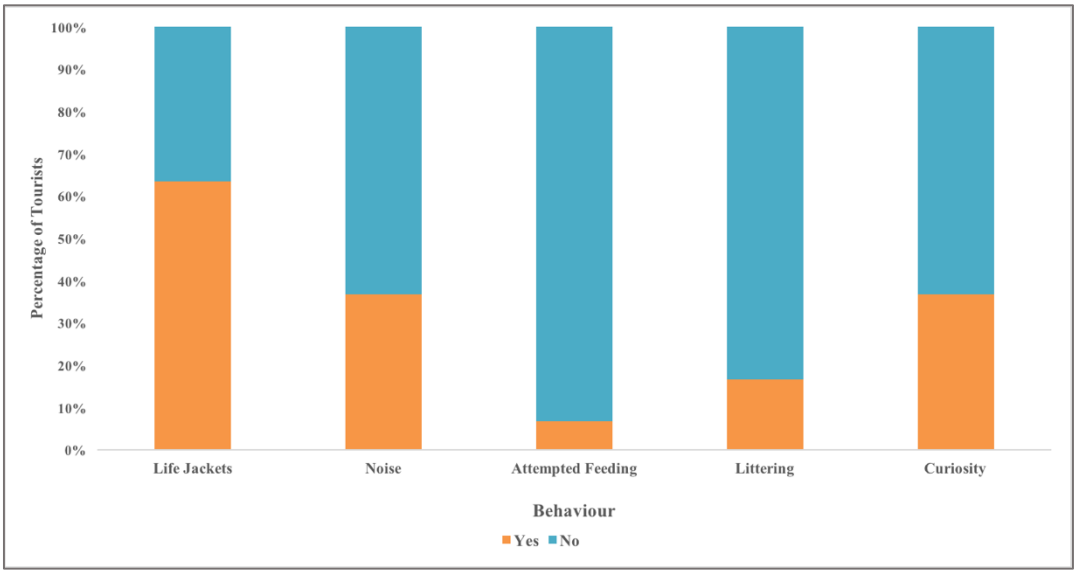


Figure 8: Tourist behaviour on dolphin-watching trips (Total no. of trips=30)

Objective II: *Assessing the behaviour of Humpback dolphins to tour boats*

Dolphins were sighted in 28 (93%) of the 30 dolphin-watching trips taken. The average group size of dolphins observed was 1.79 (min=1, max=8). On two trips, no dolphins were sighted, but both these trips were aborted sooner than usual due to rough weather and at the request of passengers.

They were predominantly sighted at the river mouth in Aguada Bay (Figure 9). Mother-calf pairs were sighted on 3 occasions (10.71%), where they were seen travelling with 2 adults and 1 juvenile, 4 adults and 2 sub-adults respectively.
The most common observed behaviour of the 28 trips with dolphin-sightings, at the start of a sighting was slow travelling (67.86%), during the sighting was deep diving (42.86%) and at the end of the sighting was slow travelling (35.71%) and deep diving (21.43%).

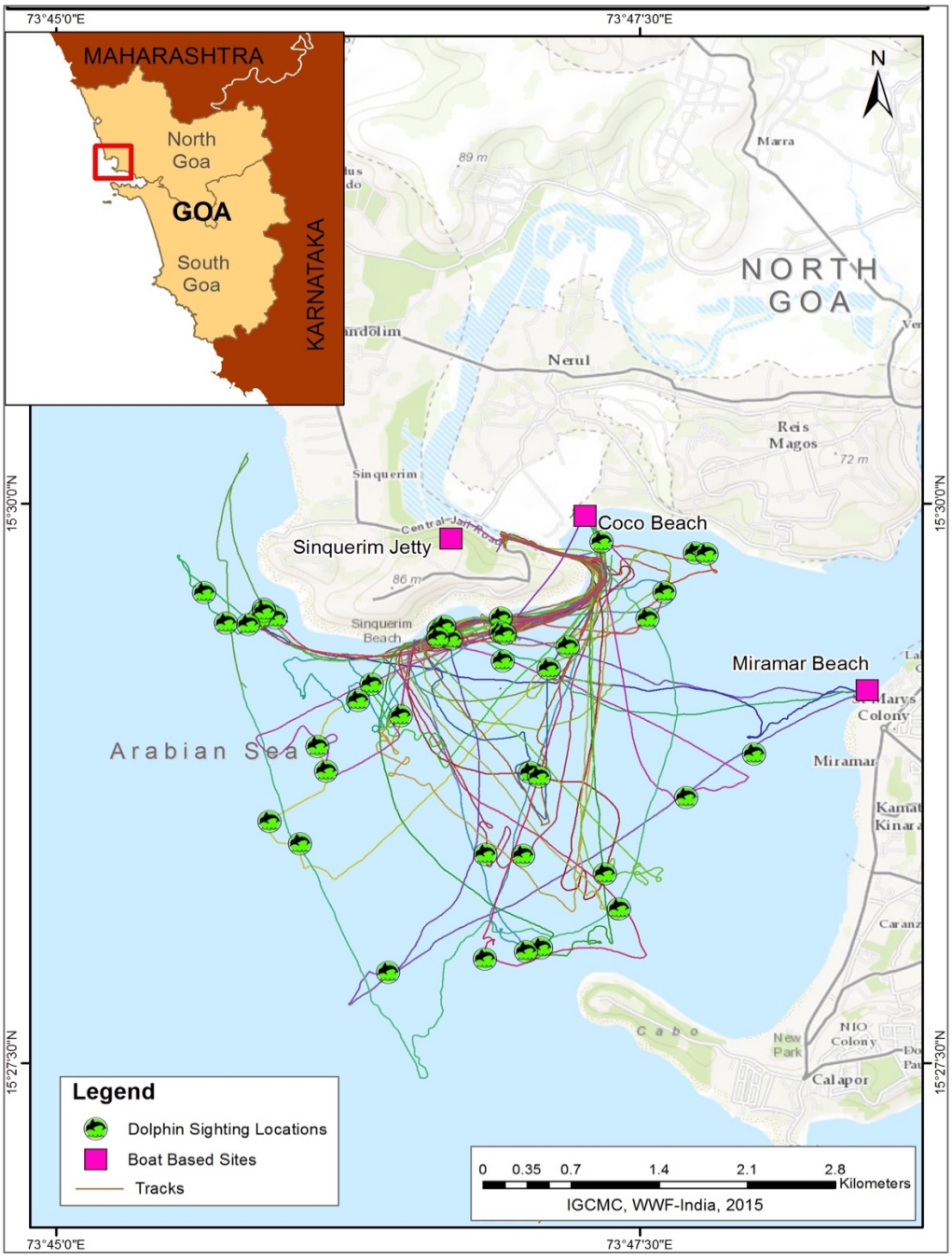


Figure 9: Dolphin sightings and observer-boat tour tracks for dolphin trips

For doing a preliminary assessment of the effects of boats on dolphin behaviour, namely, change in behavioural state (calculated using the start and end behaviour events for all 28 sightings) and change in direction of travel (calculated using notes from when dolphins were seen changing their path of travel due to boat interference) was noted and calculated. Change in behaviour occurred in 19 (67%) and change in direction of travel occurred in 20 (71%) of the 28 dolphin sightings (Figure 10).

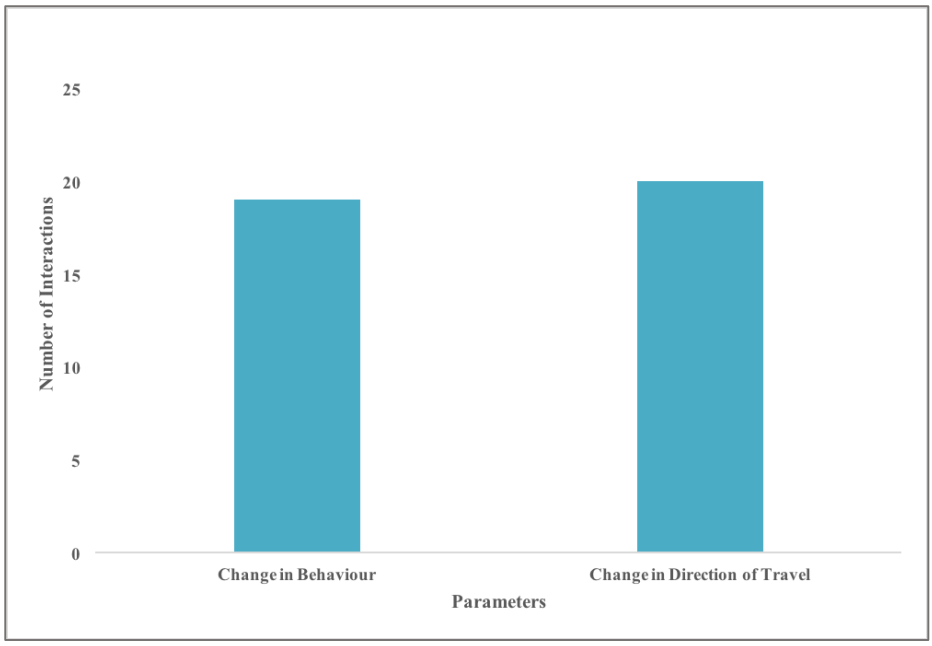


Figure 10: Change in behaviour and direction of travel by dolphins in the presence of tour boats (Total no. of sightings=28)

Objective III: *Assessing the magnitude of dolphin-watching operations along the coastline of North Goa*

About two hundred registered boats (10-20 seater powered canoes) conduct dolphin-watching tours from Sinquerim Jetty and Coco Beach respectively, and about 20 registered large catamarans with a capacity of 50-70 passengers operate from Miramar Beach. Additionally, some watersports operators from nearby Dona Paula Jetty, Sinquerim Beach, Candolim Beach and Calangute Beach also offer dolphin-watching as an activity, albeit opportunistically and not as a primary enterprise like the aforementioned three study sites; the exact number of registered operators is also unclear for the latter four sites except Dona Paula Jetty, since access to formal records has not yet been possible at the time of writing, and interviewees' accounts vary greatly.

From the fifteen sites surveyed, all but 2 (Ashwem and Anjuna beach north) were bases for dolphin tour operations. However, of these 13 sites, only 6 (Terekol ferry point, Morjim beach, Sinquerim jetty, Coco beach, Miramar beach, Dona Paula jetty) had operators who claimed to possess valid permits to conduct boat tours. At the other 7 sites, dolphin watching tours are offered only opportunistically (Figure 11), by fishery operators, watersports operators and other proprietors unavailable for communication; these operators do not possess licences to do so.

Only 3 sites around the Mandovi bay (Sinquerim jetty, Coco beach and Miramar beach) operate dolphin watching tours throughout the day, from around 9am to 5pm. The water sports operators at one site (Candolim beach – north) claimed to operate dolphin watching tours opportunistically from morning to noon, and operators at all other sites conducted only 1 or 2 tours early in the morning (usually 7am to 9am) stating the conspicuous activity of dolphins at this time of day to be the reason.

It was noticed that all but 5 operators conducted their tours at least partly around the nearest river mouths (the rivers Terekol, Chapora, Mandovi and Zuari from north to south along the surveyed area). Of the other 5, one covered the area off a rocky shore, while no information on the region of sightings was obtained from the remaining 4 (Figure 12).

Tours from 8 sites were conducted using covered FRP canoes powered by 9.9 HP engines and seating approximately 10 persons. Tours from 5 sites were conducted using speedboats; at 4 of these sites, these were the only large enough boats, while at the fourth, speedboats were used alongside larger FRP

canoes. From at least one site (and possibly 2 more that could not be adequately surveyed), motor-driven fishing canoes were used for opportunistic dolphin-watching tours. One site, Miramar beach, regularly uses large twin hull catamarans seating approximately 50 to 70 persons.

Operators at only six jetties commented on the identity of the species sighted, and only two (Terekol ferry point and Dona Paula jetty) conclusively identified the Humpback dolphin (*Sousa plumbea*) as the species sighted. Most other operators either claimed to see the bottlenose dolphin (*Tursiops truncatus*), with one opportunistic tour operator misidentifying the finless porpoise (*Neophocoena phocoenoides*) as a female dolphin, or were either unable to identify the species (Figure 13).

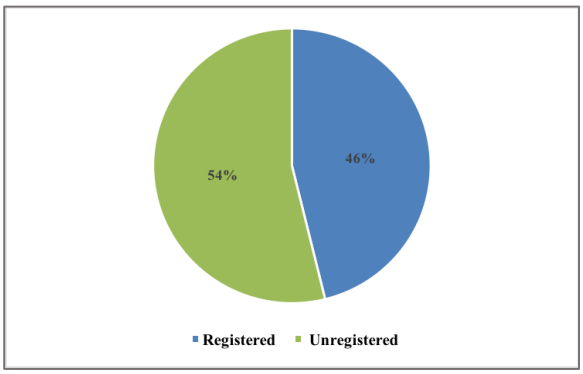


Figure 11: Percentage of registered and unregistered operators conducting dolphin-watching tours in North Goa

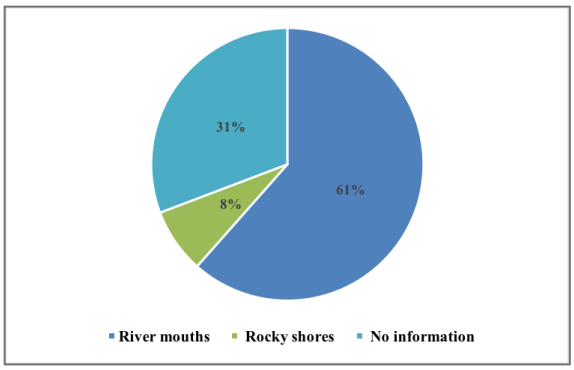


Figure 12: Locations where dolphin-watching tours are conducted

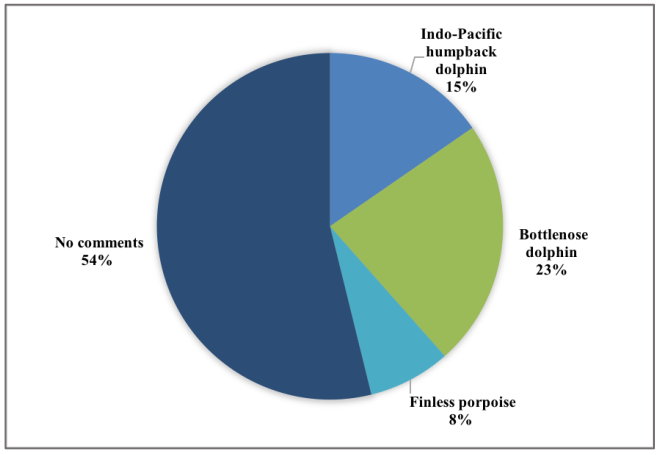


Figure 13: Identification by operators of the dolphin species central to the dolphin-watching tours

Most operators claimed to see groups of around 5-10 dolphins, but operators at the north end of the coastline at Terekol and Arambol claimed to see groups of 200-300 and up to 30-40 dolphins respectively. Interestingly, a jet ski operator at Vagator, who also conducts opportunistic dolphin watching tours, said that there had been no dolphin sightings at all for a month, speculating that the animals had left the area. At least 5 operators guarantee dolphin sightings, and offer discounts or full refunds if no dolphins are sighted.

At one site (Arambol beach), there were anecdotal reports of unregistered operators being arrested a few days prior to the time of survey, but a fisherman operating dolphin tours was present and still

offering tours. The beach shack that advertises the tours (and to which this operator was affiliated) was still openly advertising it and denied such reports.

Figure 14.1: Slow traveling

Figure 14.2: Socialising

Figure 14.3: Deep Diving

Figure 14.4: Breaching

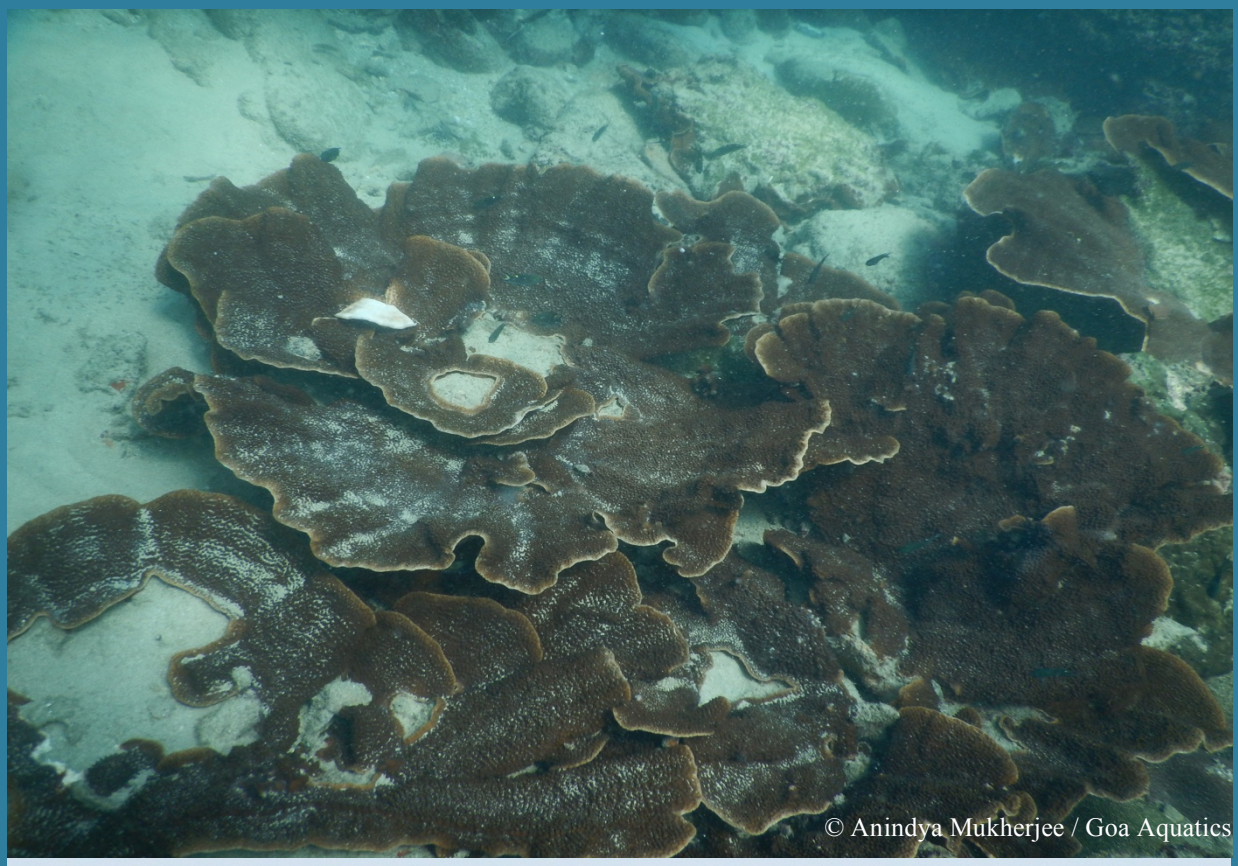
Figure 14 (1-4): Dolphin behavioural states and events observed
Photos: © WWF-India/Shreya Sanjeev & Abhishek Jamalabad

Figure 15.1: Close approach towards a group of dolphins (boat was <10 m away from the group)

Figure 15.2: A boat cutting the travel path of a dolphin ("path cutting")

Figure 15 (1-2): Potentially intrusive boat operations observed
Photos: © WWF-India/Shreya Sanjeev

DISCUSSION AND RECOMMENDATIONS



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PART I: ASSESSING THE VIEWS OF TOURISM OPERATORS ON THE IMPACTS OF TOURISM ON GRANDE ISLAND, NORTH GOA, WESTERN INDIA

DISCUSSION AND RECOMMENDATIONS:

Damage to corals from indiscriminate and irresponsible anchoring of boats is a threat in this region as per our observations. The root causes of this problem are the sheer number of boats that use the limited sites at the island, and the fact that not all boat operators are aware of the locations and distribution of corals and sandy patches around the island. This problem could be controlled by regulating the number of boats visiting the island at any given time, and by indicating safe anchoring locations with the help of marker buoys or mooring buoys at each of the popular sites.

Dive tourism in its current state could also have adverse effects on the marine environment around Grande Island. At least two dive centres use multiple small (10 seater) boats rather than a single large one, this adds to the boat traffic and anchoring near the island. Additionally, it is possible that some divers, especially inexperienced individuals such as students and single-dive customers (opting for the "Discover SCUBA Diving" or "Try SCUBA Diving" packages) could cause inadvertent damage to the coral due to their poor buoyancy skills especially when divers are in large numbers during peak tourist season. This needs to be assessed through a dedicated study of diver behaviour underwater, but the problem has been mentioned by interviewees. This could be regulated either by limiting the number of divers at a site at a given time, and by restricting relatively inexperienced divers to those parts of the site that have fewer coral and a higher area of sandy patches. A brief awareness module if conducted by the dive companies, to provide information about the fragile nature of the dive environment, could minimise any intentional damage to marine life (such as by tourists picking or otherwise damaging coral and other marine organisms).

Abundant algal cover was observed at many parts of the reef, often over dead or diseased coral. A study of the nutrient content of the water along with other abiotic environmental parameters would be required to examine this phenomenon in further detail, and to ascertain the possible seasonal nature of this occurrence.

PART II: A PRELIMINARY ASSESSMENT OF CORAL REEFS AROUND GRANDE ISLAND, NORTH GOA, WESTERN INDIA

DISCUSSION:

The most significant observation (by visual analysis during surveys as well as the subsequent statistical analysis) was the abundance of turf algae at all six sites. The percent cover of turf algae at each site was found to be greater than any category of coral, and at all but one site, greater than the percent total coral cover. This is consistent with previous findings of turf algae being the dominant living substrate on reefs on the west coast of India (Sluka and Lazarus, 2009). This finding also conforms to the 'increase in algal blooms over the years' mentioned by several dive operators via questionnaires (See Chapter 1). The possible causes of algal blooms in this region are multiple and presently unclear. Untreated sewage and domestic waste disposal, along with runoff from land, could increase the nutrient levels to the point of inducing algal blooms. Nutrient levels could possibly be increased locally by smaller scale causative agents such as the stirring up of sediment by divers, boats, frequent anchoring and natural surge during

rough weather. Simultaneously, alongside increased nutrient levels, the removal of herbivores from this ecosystem could trigger an unchecked growth of algae. As reviewed by Hughes *et al.* (1999) and Lessios (1988), in the Carribbean, an increase in algal abundance followed a mass mortality of *Diadema* (a genus of herbivorous sea urchin), except within damselfish territories, where algal cover was always found to be high due to the sea urchins' restricted access to these guarded patches (Morrison, 1988; Hughes *et al.*, 1999). Sea urchins of the genus *Diadema* are found at our study sites, but their association to increasing algal growth could not be determined due to a lack of any baseline studies on their population. We did not observe any direct or indirect fishery of sea urchins in this region. While trawling could drastically reduce their population, we did not observe trawl fisheries close to the islands, which conforms to the opinions of professional divers as well (see Chapter 1).

At several sites in the tropical reefs of the Caribbean, several authors report a transition from living coral to macro algae as the dominant living substrate type (Hughes, 1994; McClanahan and Muthiga, 1998; McClanahan *et al.*, 1999; Ostrander *et al.*, 2000). Algal blooms in coastal waters could be attributed at least partly to a rise in nutrient levels possibly through run-off from land. However, it has been found that grazers are capable of controlling algal growth, even when nutrients are experimentally added (Hatcher and Larkum, 1983; Hughes and Connell, 1999). Studies have shown that eutrophication and overfishing are common stressors that can influence algal blooms (Hughes and Connell, 1999) and specifically macro algae (Hatcher, 1990; Jackson 1997; Done, 1999; Ostrander *et al.*, 2000). Ostrander *et al.* (2000) observed rapid changes in a Caribbean reef system where macro algae became dominant against coral, but pointed out that the causes could be due to subtle interactions between a complex set of biotic and abiotic factors of both natural and anthropogenic origin. Moreover, it has been suggested that intensive long-term studies are required to understand the exact causes of these changes and how the multiple factors interact to affect reef community structure (Hughes, 1996; Connell *et al.*, 1997; Hughes and Connell, 1999; Ostrander *et al.*, 2000).

Our preliminary studies of the reef fish (Figure 7) in the region revealed fish from eighteen reef-associated families across the six sites surveyed. Parrotfish (Scaridae) were recorded during our surveys; divers in the region had reported a gradual disappearance of these fish from this region during the past few years. Damselfish (Pomacentridae) were observed in large schools at certain parts of our survey sites. Pomacentrids are known to be associated to algal cover on reefs, even promoting the growth of palatable algae within their territories (Ceccarelli *et al.*, 2005). The associations that these and the other recorded reef-associated fish families have with the ecosystems in this region require further ecology-focused studies. Moreover, fish belonging to additional families were sighted at the study sites when off survey effort, including lionfish (*Pterois volitans*), blue-spotted stingrays (*Dasyatis kuhli*) and large specimens of mullet (*Mugil* sp.). The cuttlefish *Sepia pharaonis,* a commercially important cephalopod species, was sighted once when off survey effort; several recreational divers report seeing cephalopods and their eggs at these reefs and we have been shown photographic and video graphic evidence of this species breeding on the reefs at Grande Island (Anindya Mukherjee / Goa Aquatics, pers. com.). Sea urchins (*Diadema* sp.) were found in significant numbers at one site (Bounty Bay) during surveys, and were found in smaller numbers when off effort at other sites. An abundance of sea cucumbers (Holothuriidae) were sighted at most sites when off survey effort; understanding the relationships between their populations and the environmental/ecological conditions would merit a detailed study.

Damage to the coral (Figure 8) in the form of breakage, bleaching, disease and death was observed, but in very low values, contrary to our expectations (especially for breakage). However, this could have been due to biased transect locations, as most transects were located further away from shore as compared to the locations of tour boat anchoring. A larger survey area at each site, or surveys specifically to assess breakage by anchors, may reveal a more accurate estimation of damage of this type.

Additionally, trash in the form of plastic packaging, cloth, derelict fishing nets and lines and plastic and glass bottles was encountered on the surveys. The major source of the bulk of this trash (whether from the mainland or from boats visiting the island) is unclear, but the latter contributes at least in part to this

problem, as fishing lines, glass bottles and plastic packaging discarded by visitors have been observed. The local dive companies collect large amounts of trash during annual underwater clean-ups of the reef (pers. obs.).

Due the preliminary nature of this study that was intended to be a pilot survey to establish a baseline, we cannot conclusively identify the causes, drivers and stressors affecting these reefs. However, from our primary observations of damage to the reef, it is clear that tourism in its current state has an impact on the region. However, we cannot deny that tourism is an effective medium for education and to aid conservation. Drawing from the reef conservation measures enforced at Bonaire (Hawkins *et al.*, 1999), zoning of activities, a ban on spearfishing (to counter the sport fishing of the Malabar grouper *Epinephelus malabaricus* in the region), the establishment of mooring buoys, and regular patrols could serve to minimise damage caused by tourist activities in the area while allowing tourism to continue. Additionally, education components for divers and island tourists may help better tourists' perceptions about the reefs and marine life, enhance their understanding of the area and ensure more responsible behaviour in these environments. Meanwhile, we suggest further studies to identify more specific causes of damage not confined to tourism, a detailed study of the algal growth on the reef, and the identification and role of certain indicator species to better understand the health of these reefs.

Figure 7.1: Longfin bannerfish (*Heniochus acuminatus*)

Figure 7.2: Indian vagabond butterflyfish (*Chaetodon decussatus*) (L) and Collared butterflyfish (*Chaetodon collare*) (R)

Figure 7.3: Malabar grouper (*Epinephelus malabaricus*)

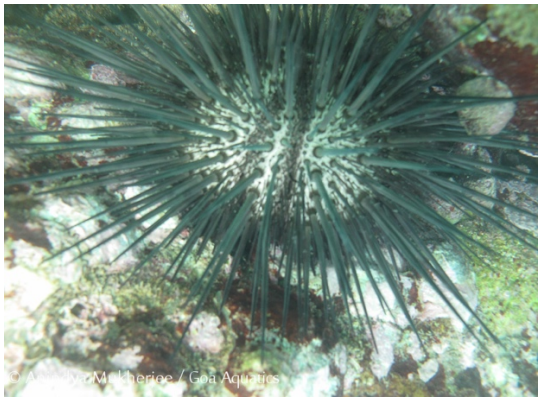


Figure 7.4: Sea urchin (*Diadema sp.*)

Figure 7.5: Cuttlefish (*Sepia pharaonis*)

Figure 7.6: Cuttlefish eggs

Figure 7.7: Blue-spotted stingray (*Dasyatis kuhli*)

Figure 7.7: Indo-Pacific red lionfish (*Pterois volitans*)

Figure 7 (1-7): Biodiversity found around Grande Island

Figure 8.1: Discarded net

Figure 8.1: Sea urchin entangled in a discarded fishing line

Figure 8.3: Broken coral

Figure 8.4: Broken coral as evidence of anchor-caused damage

Figure 8 (1-4): Stressors on Grande Island

PART III: A PRELIMINARY ASSESSMENT OF DOLPHIN-WATCHING TOURS NORTH GOA, WESTERN INDIA

DISCUSSION:

Many studies worldwide have elaborated on the existing relationship between free-ranging cetaceans and tourism, and the potential impacts they have on each other (reviewed by Frohoff, 2000; Davenport and Davenport, 2006).

In the district of North Goa, dolphin-watching tours are heavily concentrated in the near-shore area around the mouth of the river Mandovi, with a vast majority of boat tours operating from the beaches and jetties surrounding this region. The Humpback dolphin were the only species of dolphins sighted aboard the dolphin-watching trips, and can therefore be considered as the focal species for the industry. Earlier observations made by Parsons (1998a) and Sutaria and Jefferson (2004) have also noted the same. Dolphin sightings occurred primarily in inshore waters, at approximately 3-4 km from the coast and were frequently found in close proximities to the river mouth. This reiterates the fact that Humpback dolphins are a highly coastal species, and unlike most dolphins, spend a significant amount of their time in coastal areas (Corkeron, 1990; Saayman and Tayler, 1979; Karczmarski *et al*., 1998; Jefferson, 2000).

A busy day during peak tourist season, results in a fairly large number of boats (mean=6, max=17) watching a relatively small number of dolphins (average group size=1.79) within the confined area of Aguada Bay, especially when the opportunistic operators also enter the region. Although dangerously close approaches (averaging 6.41 m) have been observed even with as few as five active boats, a higher number of boats probably elicit close approaches, as all vessels tend to converge on one or a few dolphins, as evidenced by the lowest minimum distance of 2 m from the dolphin which was observed when there were 17 boats in the area. Several instances of potentially dangerous intrusive boat operation (including path-cutting, chasing and circling (Figures 6.1-6.8) were observed during the surveys; some operators stated that they were forced to engage in these in order to ensure sightings when too many boats were present (pers. com.). Besides close approaches, chasing and circling, engine revving was also observed, seemingly to elicit surface activity by the dolphins.

Mother-calf pairs were observed on three sightings, where they were seen travelling with, perhaps indicating that these waters are used as calving grounds. All three sightings of mother-calf pairs showed instances where the mother (individual travelling closest to the calf) would position herself in between an approaching boat and the calf, in a protective fashion. This indicates that these dolphins perceive the boats to be of potential threat to their calves. This type pf protective behaviour in response to boat traffic was also noted by Karczmarski *et al*., (1997) in the Algoa Bay region of South Africa where, females with calves were observed joining other females and interposing themselves between approaching boats and the calves. Therefore, special discretion must be given to groups of dolphins with calves, on these tours. Boat operators should exercise additional caution when observing pods with calves, if not avoid approaching them completely.

Dolphins in Aguada Bay were seen changing their behaviour (67%) and changing their direction of travel (71%) when approached by boats. The most common behaviours observed in the presence of boats were travelling and diving, while previously exhibiting other behaviours, which is a common response to disturbance. Similar patterns were seen in bottlenose dolphins of Doubtful Sound of New Zealand (Lusseau, 2003). Dolphins were seen slow travelling (67.86%) upon the start of a sighting; when boats approached a group or individual dolphins, they were observed to dive deep (Figure 14.3) and resurface at a distance away from the huddle of dolphin-watching boats. Although we do not know about the significance of these short-term disruptions of their activities, several studies (reviewed by Parsons, 2012) have shown that such boat disturbance leads to alteration or cessation of essential behaviours like foraging, resting and socializing, and these changes could reduce the overall fitness of encountered on these dolphin-watching trips seemed to be highly susceptible to the disturbance caused by intrusive boat operations (path-cutting, circling and chasing). The animals portrayed an avoidance reaction to approaching boats by taking a long dive (Pilleri and Gihr, 1974) and changing their direction of travel, usually swimming away perpendicular to the travel route of the boats (Karczmarski *et al*., 1997). This type of avoidance behaviour was also noted in the humpback dolphins of the Arabian Gulf (Pilleri and Gihr, 1974) and South Africa (Karczmarski *et al*., 1998).

Ng and Seung (2003) found that high-speed vessels are more likely to disrupt the behaviour and social life of Humpback dolphins. These authors suggest, among other measures, imposing speed restrictions at a regional level. Additionally, it may help to divert higher-speed boat operations to other areas beyond those used for dolphin-watching. Doing away with the advertisement of a ‘guarantee’, while simultaneously introducing educational modules for customers, could help avoid this problem. Orams (2000) suggests that close approach by boats alters the behaviour of cetaceans and could be potentially detrimental to the animals. Many nations where whale and dolphin-watching are prevalent, have adopted a regulatory approach in managing such practices (Carlson, 1996). Such regulations typically restrict the number of boats in close proximity to the cetacean(s) and specify the minimum approach distances (e.g. see Queensland Department of Environment and Heritage, 1994). Based on our assessment, designing and implementing dolphin-watching guidelines would be of utmost importance to sustain the population of dolphins and this industry in the future.

Our primary observations during survey trips indicate that a small number of boats conducting tours at any given time could perhaps serve to make these operations safer. Issuing specific dolphin-watching

licenses, and mandatorily requiring all boats conducting these tours to possess these licenses, would help identify dolphin-watching tour operators, as well as play an incidental role in limiting boat numbers. Additionally, we suggest imposing speed and approach distance restrictions on certain craft, for example speedboats, which during our surveys were observed to make very fast approaches directly at surface-active dolphins.

This study draws attention to the current practices of boat operators that may cause dolphins to avoid them or escape their presence during sightings. Additionally, the noise produced by the 9.9 HP engines used to propel the boats could potentially cause distress to the animals at close range. It may be safely assumed that this unregulated tourist boat traffic in Goa is a potential source of underwater noise, in addition to that of fishing and shipping activities within the same region. However, it must be acknowledged that the research platform employed for this study could have been a bias, and the presence of the observer boat may have also contributed to the dolphins' behaviour. Hence, to eliminate such a bias, a land-based study is recommended for this particular scenario. These dolphins are mostly restricted to the inshore waters of the bay, which facilitates land-based observations of interactions between the dolphins and the boats without the element of bias in the data acquired.
There is scarcity of information on the ecology, population and behaviour of these dolphins occupying such a heavily-trafficked area. It is clear from this study, that dolphins are exposed to prolonged periods of boat traffic. No control or regulations are in place to manage these dolphin-watching activities and prevent the occurrence of such disturbances to the dolphins in the area. It is therefore also critical to monitor these boat activities and ensure that all operators comply by standard guidelines and regulations. Additionally, further scientific research is required on the species itself to better inform further conservation and management strategies.
In the study region, on-board briefings and information currently provided include, only basic safety briefings and information pertaining to sight-seeing. Only two operators from our surveys provided any information at all about dolphins, and even these were inaccurate. Misinformed tourists were also seen attempting to feed dolphins. No instructions are provided for maintaining cleanliness at sea, leading to a lot of tourists littering the bay with plastics and metal cans. Moreover, there is a lack of on-board dustbins and trash collection systems at the jetties. We suggest that these be installed mandatorily on each tour boat at all three jetties, in order to make the region a safer environment for its wildlife.

A better educational component is therefore the need of the hour in order to make enhance the quality of these trips and reap conservation benefits from them. Surveys of whale watching tourists in the San Juan Islands, USA conducted by Andersen and Miller (2006) showed that 38% of the interviewees looked forward to the educational component of a whale watching trip, and the tourists' evaluations indicated that the educational component is a significant factor (ranked immediately after whale sightings, active behaviour and proximity) to their satisfaction. Therefore, in spite of the negative impacts dolphin-watching tourism can have on dolphins and marine environments, it is without doubt a valuable tool in spreading awareness about the marine environment and aids its conservation. On-board education programs can be used as a tool for conservation awareness whilst enhancing tourists' experience and thus increasing business prospects for operators.

Implications for dolphin conservation in North Goa – Key Issues:

The importance of interpretation and education, while promoting community engagement in managing a sustainable dolphin-watching practice in north Goa

There is a need for the implementation of appropriate guidelines and standard regulations that are to be followed by all boats that undertake dolphin-watching activities in Goa.

Interpretation refers to activities that educate tourists about the significance of what they are experiencing; and aims to promote learning, stimulate interest and guide visitors in following an appropriate behaviour for sustainable tourism and encourage enjoyment and satisfaction (Moscardo *et*

al., 2004). Additionally, the establishment of a symbiotic relationship between the local community actively engaged in tourism enables the efficacious survival of both (Stevens, 1997; Hoyt, 2007; Mustika *et al*., 2012). With various explanations in the literature describing interpretation and subsequent engagement of local communities in promoting sustainable practices, a culmination of all of them indicates that the primary aim should be to educate and provide visitors with sufficient information to further educate themselves (Markwell & Weiler, 1998; Moscardo, 1998). This study informs the importance of promoting education and community engagement in managing sustainable dolphin-watching tourism.

The management of a sustainable dolphin-watching experience, in amalgamation with the engagement of the local community has many facets. Stakeholders are anyone who has an interest in, or is affected by the establishment and functioning of a particular area or practice (Hoyt, 2005). Consultation by networking between stakeholders and the community helps achieve communication between various groups of interests, such as, in this case, dolphin-tour operators, the local government, local businesses and the broader community. According to Australia's Strategic Management Plan for the Great Barrier Reef (2013), the objectives of engaging stakeholders must be to gather information from their experience to improve decision making and engage the communities as part of the process to provide a transparent structured framework. For the implementation of any management plan, it is important and very critical that stakeholders are involved early and continually in all phases of a decision making process, which includes all phases of planning, plan evaluation, implementation and post-implementation strategies.

In addition to engaging stakeholders, is the role of naturalists or guides who are responsible for conducting these trips in an educative and informative manner. They are pivotal in forming a bridge between the largely-urban dolphin watchers and the marine environment itself (Hoyt, 1998). Firstly, they bring an element of education which is critical in providing tourists with information on how to behave, so as to, reduce their own impact on the area (including flora and fauna) and elucidating management strategies and safety measures (MacArthur & Hall, 1993; Moscardo, 1998). Secondly, they can help increase curiosity, knowledge and awareness among tourists, in regard to the area's natural habitats, its wildlife and thus encourage pro-conservation attitudes and motivate them to act on much larger conservation issues (Gray, 1993). In this case, the respective dolphin-watching associations should make an effort to educate their tourists on the dolphins they encounter and the anthropogenic threats they face, and how they can help conserve them, instead of continually concentrating on the sight-seeing features of the trip. As reported earlier, only 6.66% of all the dolphin trips constituted an element of interpretation and education, with complete misidentification of the species itself. And thirdly, quality interpretation can increase tourist satisfaction and can contribute to the commercial viability of tourist operations (Ham, 1992). Considering the present study, it has become apparent that interpretation programs associated with the engagement of local communities can be effective in reference to informing visitors of the consequences of certain behaviours, and therefore educating them to engage in those behaviours. Therefore, it appears to be reasonable to argue that the principles set forth by quality interpretive information are sound, and tourism operators dependent on natural habitats and its components should explore the extent to which their current practices are consistent with these set principles. Additionally, this provides a platform for increasing employment opportunities for the younger members of the local communities; unless most of the benefits ensue to local communities, a sustainable industry is impossible (Hoyt, 2007).

The importance of planning, monitoring and research in sustainable dolphin-watching tourism in North Goa

Tourism and the environment are closely interrelated and planning tourism with an environment-friendly perspective is essential (Inskeep, 1987) and is becoming recognized throughout the world (Cohen, 1978). Over the years, it has been recognized that planning and research in the tourism industry is not only important for scientific purposes and conservation, but also for the long-term protection of investments that go into tourism infrastructure, attractions, facilities, services, and marketing programs (Inskeep, 1987). Over recent years, considerable knowledge has been acquired about the implications

tourism and development may have on the environment, and some studies have included analyses of consequences that have occurred from mismanagement and lack of effective planning (Dasman *et al*., 1973; Wall & Wright, 1977).

In this case, there is a need for promoting the adoption of sustainable dolphin-watching practices among the tour operators and relevant government agencies to ensure guidelines are adopted at both a community and legislative level. Tourism in Goa, particularly in the marine sector has been growing at an exponential rate. Many Goan artisanal fishermen have changed their practices towards tourism. Furthermore, with the ban on mining in Goa (Talule and Naik, 2014), the foregoing workforce has shifted to tourism, therefore it can be assumed, that tourism and more specifically marine tourism will grow as the state invests in promoting water based activities. Coastal areas are always difficult regulate as boundaries are not easily demarcated, however growing global threats such as mass species extinction and climate change threaten both the environment and dependent livelihoods such as fisheries, coastal tourism. Thus, it is critical to maintain a balance between development and environmental conservation, if these environmentally dependent livelihoods are to remain sustainable without having a catastrophic impact on the survival of species such as the Humpback dolphin in Goa, which in addition to being on the Schedule I of the Wildlife Protection Act of India, 1972 is also listed as *'Near Threatened'* by the International Union for Conservation of Nature.

The tourist boat operators in Goa represent a fragmented community, comprising both of residential local community members and transient labour from other states. This makes it imperative that annual training programmes are conducted, which enable the boat operators to comply with internationally accepted dolphin guidelines. This can be done with the support of Goa's Tourism Department, Forest Department and Captain of Ports. Conservation of a key marine species outside a protected area and sustainability of allied livelihoods, can only be enabled through a participatory management approach in which all stakeholder communities work together to compensate for and overcome existing gaps in policy and jurisdiction. Thus, science and research must be the connecting bridge between sustainable practices and effective management of the same. Additionally, our knowledge of the Humpback dolphins' behaviour and population abundance in Goan waters is deficient. Hence, understanding the characteristics of the dolphins and the impacts that anthropogenic stressors have on them, proves to be of grave importance if, the species is to be conserved and protected, while allowing for the continual operations of dolphin-watching trips in the region. The best of tourism is one which encourages environmental conservation and awareness; this is because, natural environmental features are often, if not always, the reasons for tourists to visit an area, and these natural features must be conserved in order to develop and maintain a successful tourism industry. Therefore, if tourism is not cautiously planned and managed, it can be damaging to the natural environment. Hence, in Goa's tourism planning, particularly for its marine wildlife, should be closely coordinated and integrated with appropriate guidelines, conservation measures and effective management strategies.

DOLPHIN-WATCHING OPERATOR / DRIVER TRAINING WORKSHOP
GOA, WESTERN INDIA

PURPOSE:

The purpose of this workshop was to create a dialogue and impart a better understanding of the impact of dolphin-watching tourism activities on the focal species of humpback dolphin (*Sousa plumbea*). This training program and engagement with dolphin-tour operators, was to enable them to understand and comply with international dolphin-watching standards, in order to improve their livelihood and promote sustainable tourism, thereby reducing anthropogenic stress on the species. This forum also provided them with a conducive environment to communicate their perceptions of the current dolphin-watching practices, as well as, gave them a platform to voice their opinions and concerns regarding the dolphin-watching industry prevalent in the state.

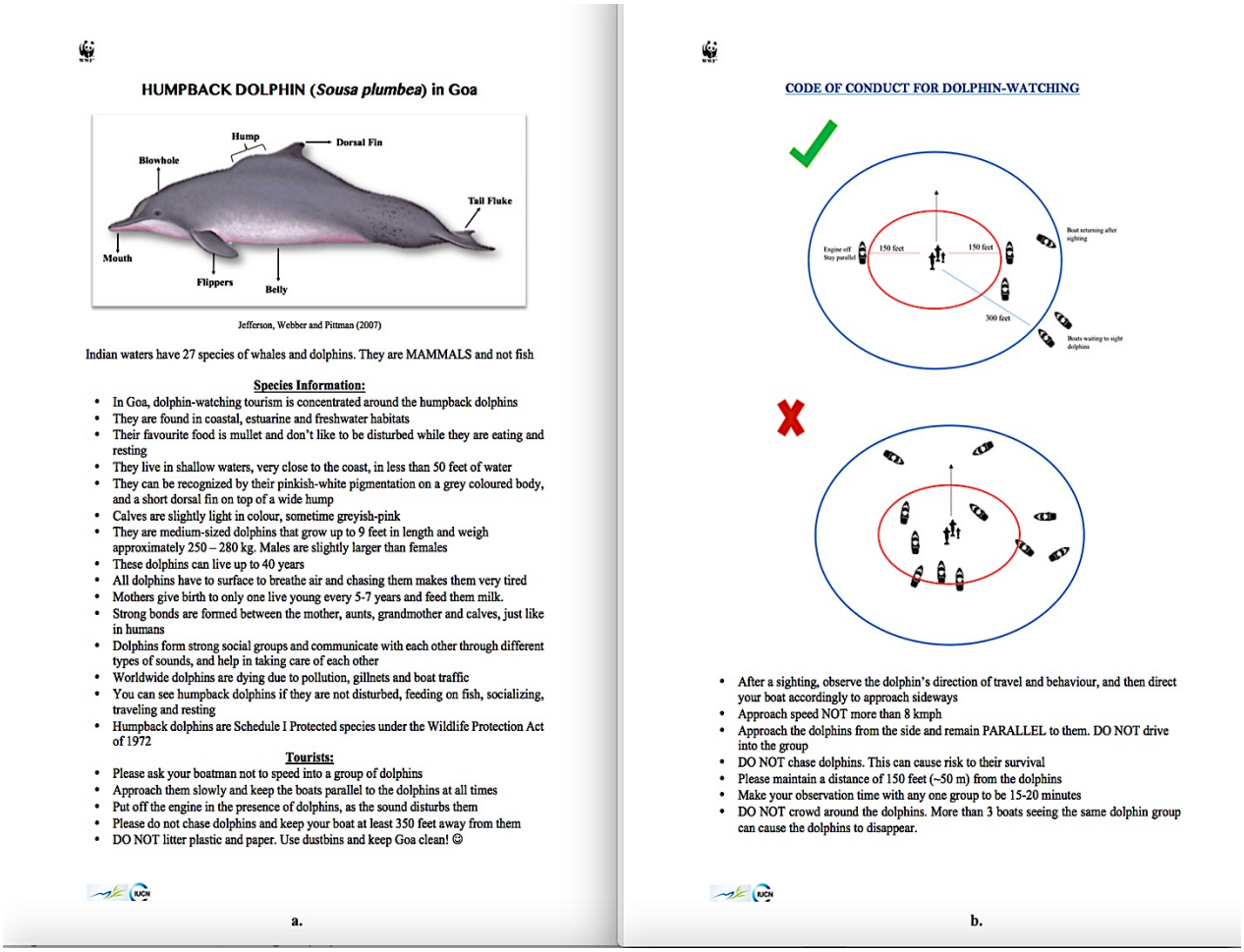
OVERVIEW:

WWF-India, Goa State Office, supported by the IUCN-MFF Small grants program conducted the first round of dolphin-watching workshops at the Parayatan Bhanvan provided by the Department of Tourism, Goa on September 12, 2015. This workshop was attended by an assemblage of 40 boat operators, drivers and owners from Calangute, Candolim, Miramar and Sinquerim in North Goa and Divar Island in South Goa.

The workshop was conducted and led by Dr. Dipani Sutaria (PhD), who is a well-known marine ecologist in India, and has worked widely on various projects concerning Indian cetaceans, followed by Shreya Sanjeev (MSc) and Puja Mitra (MSc) from WWF-India, Goa state office and Nisha D'souza (MSc) from IUCN.

The workshop began by presenting the results of the project's ecological and socio-economic surveys by Shreya Sanjeev. Shortly after, sustainable dolphin-watching practices were explained to the operators by Dr. Dipani, and an information sheet enclosing facts about the dolphin and sustainable dolphin-watching guidelines were distributed to every boat operator who attended the workshop. The operators were then split into five groups for a more focused discussion on the issues surrounding the dolphin-watching industry. The discussions with each group were led by a representative conducting the workshop.

Discussions with each group aimed at covering two exercises, and provided a more focused dialogue on concerns surrounding the industry. Each group were asked questions about the dolphin-watching industry and the dolphins their trips are focused around. Every attendee was given an 'Information Sheet' (Figure 1), that contained updated knowledge, facts and figures of the humpback dolphins found along the west coast of India. Additionally, it also contained diagrammatic representations of sustainable dolphin-watching practices, as well as, guidelines for dolphin-tour boat operators/drivers to follow while conducting, and tourists to follow while aboard these trips.



HUMPBACK DOLPHIN (*Sousa plumbea*) in Goa

Jefferson, Webber and Pittman (2007)

Indian waters have 27 species of whales and dolphins. They are MAMMALS and not fish

Species Information:

- In Goa, dolphin-watching tourism is concentrated around the humpback dolphins
- They are found in coastal, estuarine and freshwater habitats
- Their favourite food is mullet and don't like to be disturbed while they are eating and resting
- They live in shallow waters, very close to the coast, in less than 50 feet of water
- They can be recognized by their pinkish-white pigmentation on a grey coloured body, and a short dorsal fin on top of a wide hump
- Calves are slightly light in colour, sometime greyish-pink
- They are medium-sized dolphins that grow up to 9 feet in length and weigh approximately 250 – 280 kg. Males are slightly larger than females
- These dolphins can live up to 40 years
- All dolphins have to surface to breathe air and chasing them makes them very tired
- Mothers give birth to only one live young every 5-7 years and feed them milk.
- Strong bonds are formed between the mother, aunts, grandmother and calves, just like in humans
- Dolphins form strong social groups and communicate with each other through different types of sounds, and help in taking care of each other
- Worldwide dolphins are dying due to pollution, gillnets and boat traffic
- You can see humpback dolphins if they are not disturbed, feeding on fish, socializing, traveling and resting
- Humpback dolphins are Schedule I Protected species under the Wildlife Protection Act of 1972

Tourists:

- Please ask your boatman not to speed into a group of dolphins
- Approach them slowly and keep the boats parallel to the dolphins at all times
- Put off the engine in the presence of dolphins, as the sound disturbs them
- Please do not chase dolphins and keep your boat at least 350 feet away from them
- DO NOT litter plastic and paper. Use dustbins and keep Goa clean! ☺

a.

CODE OF CONDUCT FOR DOLPHIN-WATCHING

- After a sighting, observe the dolphin's direction of travel and behaviour, and then direct your boat accordingly to approach sideways
- Approach speed NOT more than 8 kmph
- Approach the dolphins from the side and remain PARALLEL to them. DO NOT drive into the group
- DO NOT chase dolphins. This can cause risk to their survival
- Please maintain a distance of 150 feet (~50 m) from the dolphins
- Make your observation time with any one group to be 15-20 minutes
- DO NOT crowd around the dolphins. More than 3 boats seeing the same dolphin group can cause the dolphins to disappear.

b.

Figure 1: Information sheet provided to all attendees of the workshop

INTRODUCTION:

Goa currently has 300 registered boat operators conducting dolphin-watching tours in Aguada Bay, North Goa. Additionally, a North Goa coastal mapping exercise conducted under this project reveals that unregistered operators are conducting dolphin trips along the coast as well. Therefore, it is clear that the dolphin watching tour industry in Goa is large and rapidly growing. However, this industry currently operates in a vacuum of legislation and regulation. Boat owners and boat drivers alike are largely uneducated and are not aware of internationally accepted dolphin watching practices, nor are they familiar with the locally found dolphin species, that forms the focus of this industry, that is, humpback dolphins. Furthermore, some of the operators also conduct recreational or 'picnic' trips to Grande island, which is home to coral reefs. However, a preliminary survey at this site, revealed that many of the corals were damaged due to indiscriminate anchoring by these 'picnic' boats, and dumping of garbage (mainly bottles). Many of the operators are unaware of the distribution of corals at the site and of the long - term implications of dumping garbage at an ecologically sensitive area such as Grande Island.

WWF-India, Goa aims to address this gap, by conducting a capacity building program to sensitize both boat owners and boat drivers and help equip them with the relevant scientific information on the focal species of dolphin and corals, as well as train them on how to implement sustainable dolphin watching practices and responsible tourism at both sites.

A pilot workshop under this project, supported by the IUCN-MFF Small Grants Programme was conducted on 12/09/2015 for 40 dolphin/picnic tour operators. The workshop was the first of its kind, to be conducted in the state and was also supported by the Department of Tourism, Goa.

DATA PRESENTATION: A summary of the project's aims and results were presented to all the boat operators and drivers.

Coral Reefs around Grande Island:

The Grande Island archipelago in Goa is a group of two coastal islands fringed by coral reefs. This, along with the islands' proximity to the coast of Vasco, Goa make it one of the few hubs of dive tourism on the west coast of India, as well a site frequented by island tour operators. In this study, underwater surveys were conducted on six different dive sites representing three categories of usage intensity. As no baseline was available, the sites were selected based on a diver's knowledge of the region, potentially creating some bias. These sites were surveyed for composition of living substrata on the reef and for fish life. Poor visibility in these waters and the dearth of documentation of the fauna of this region limited the analysis of our observations. However, we found that turf algae is by far, the dominant substratum type on these reefs, conforming to local divers' opinions of increasing algal growth over the years. Turf algae was more abundant than any type of coral at all the sites, and was more abundant than total coral cover at all but one site. Among coral types, encrusting coral was found to notably exceed other types at each site, followed by table corals. Damage to corals in the form of breakage, bleaching and disease was observed, as were dead corals (broken and diseased corals being more abundant than bleached and dead ones) and evidence of boat anchors breaking table coral was also found. While the damage at these sites is not notably high, there are clear signs of its occurrence, meriting conservation and management measures before the damage increases. Fish life belonging to eighteen families (barring other sightings when off effort) were recorded, including parrotfish (scarids), butterfly fish (chaetodontids) and damselfish (pomacentrids), as well as other fauna such as sea urchins (*Diadema* sp.), which could be used as indicator species to study individual aspects of reef health in this region in the future. We recommend certain measures to counter the threats we have observed, such as zoning of specific activities at/off the island, prohibition of spear fishing, the installation of mooring buoys, regular patrolling and the introduction of educational modules for tourists. Additionally, we recommend further studies of the algal blooms and of reef health using the potential indicator species recorded during this study.

Dolphin-watching tourism:

Dolphin-watching tourism has been growing rapidly in North Goa, with the focal species being the Indo-Pacific humpback dolphin. This is the first preliminary study that looks at the interactions between dolphin-watching tour boats and dolphins in Goa, where dolphin-watching tourism has been exponentially increasing over the last decade. Thirty boat-surveys were conducted on dolphin-watching trips carried out in Aguada Bay from Sinquerim jetty, Coco beach and Miramar beach, to assess the operations of the tour boats around dolphins, the nature of these sightings and the behaviour of dolphins in response to the presence and operations of these boats. The research platform being a dolphin-watching tour boat may have added to the response of observed dolphins and could be a potential source of bias. A survey of the coastline of North Goa was also conducted to understand the magnitude of this industry in Goa. The findings from this study reveal that intrusive boat-operations are being carried out by dolphin-watching boats. 50% of the trips showed cutting the dolphin's path of travel, 28.57% circling 10.71 % chasing them. Boat drivers have little knowledge about the species and its biology, and primarily focus on sight-seeing. Dolphins were seen avoiding boats and changing their direction of travel in response to approaching dolphin-watching tour boats. There are many unregistered boat operators who carry out dolphin-watching tours along the coast line and this activity is opportunistic to the presence of dolphins. However, dolphin-watching tourism in Goa plays a vital role in the state's economy, as well as for providing various means of livelihoods for the local community. Therefore, in the interest of both the sustainability of the industry and the local communities, we recommend a separate licensing vertical for boats that conduct these trips and guidelines be put in place for all operators to adhere to, while carrying out dolphin-watching tours. We also recommend that education and interpretation be stressed upon for these trips engaging local communities, as well as introducing a monitoring system for effective compliance.

EXERCISES:

***Group discussions*:** Upon the completion of the data report presentation, all boat operators and drivers were divided into five focus groups. Each group was led by a representative conducting the workshop. The purpose of these groups was to enable more focused discussions on the issues surrounding the dolphin-watching industry. In these discussions, emphasis was laid on assimilating the boat operators' and drivers' knowledge of dolphins inhabiting their waters, and the dolphin-watching industry (Appendix 1). Additionally, concerns and issues delimiting the dolphin-watching industry and its current practices, were raised by them towards the latter part of these discussions.

***Sustainable dolphin-watching guidelines*:** Upon the completion of focused group discussions, sustainable dolphin-watching guidelines and practices were discussed with all attendees. The appropriate 'Code-of-Conduct' to be followed by all dolphin operators and drivers was thoroughly elucidated and discussed (Figure 1.b).

Introduction to the training workshop by Puja Mitra

Sustainable dolphin-watching practices explained to operators by Dr.Dipani Sutaria

Explanation of project goals and results by Shreya Sanjeev

Group discussion with Nisha D'Souza

Group discussion with Puja Mitra

Group discussion with Dr. Dipani Sutaria

Figure 2: Exercises involved in the dolphin-watching training workshop

REPORT FROM THE EXERCISES:

Dolphins:

- *Knowledge about dolphin biology*: Most operators were aware that dolphins breathe air like mammals, and unlike fish, do not lay eggs, and give birth to live young. However, most were not aware that they suckle their young ones, however, mothers take care of their young, help bring them up to the surface to breathe and are very protective. They did not know that dolphins live and travel in family groups. They deem the dolphin's gestation period to be roughly between 9 – 11 months
- *Knowledge about dolphin presence*: Most operators claimed to spot dolphins mainly in Aguada Bay and are found in shallow waters, very close to the shoreline. Most of them stated that these dolphins feed on mullet and sometimes kingfish. They spot dolphins mainly during the morning and early evening hours, when boat traffic is less. They believe that dolphins do not harm anyone and are very friendly
- *Knowledge about dolphin behaviour*: Most operators are aware that dolphins get disturbed by very close approaches and they swim away when this happens. They are of the understanding that dolphins jump out of the water when they are having fun. They claim to have seen these dolphins swimming in groups of 10, and sometimes up to a 100
- *Knowledge about dolphins around fishing nets*: Most operators believe that fishing nets pose great threat to the dolphins, entangling and drowning them, where they sometimes struggle to get free. Other than this, too many nets in the area and overfishing are troubling them –there is a law that states that nets have to placed at a distance of 5 km from shore, however this is not being followed. Nets are found as close as 0.5 km away from shore
- *Problems faced by dolphins*: Most operators unanimously agree that dolphins face problems such as water pollution, boat propellers and loud harsh noises

Dolphin-watching tourism industry:

- *History of tourism*: Most of the operators and boat drivers have been working in this industry for longer than 5 years, while some for over 20 years. They claim that dolphin-watching tourism has been around for nearly 40 years, however increased exponentially and gained more popularity only in the last 10 years, when the influx of domestic tourists increased. Water sports especially boomed only after domestic tourists started visiting more
- *Boats*: Sinquerim, Coco Beach, Miramar and Dona Paula are the main starting points for the dolphin-watching trips. Miramar uses 60-seater catamarans powered by two 40 HP engines, while the other three use 12-seater boats powered by a 9.9 HP engine. Sinquerim and Coco Beach alone have around 200 and 50-60 boats for operation, out of which most are illegally used for dolphin-watching tours, while Miramar has around 13 licensed catamarans
- *Stakeholders*: The main stakeholders involved in this industry are the boat operators/owners and drivers, as well as the 'package tour guides' who bring in the flow of tourists to these respective jetties and beaches.
- *Dolphin-watching rates and time*: They carry out trips from 9 am to 5 pm everyday during the season. Tickets cost ₹ 300/- per person, and remains the same across all jetties/beaches. However, half of this money goes to tour guides who bring customers to their jetties. Almost all those who attended this workshop expressed that they are not happy with their earnings, and paying off loans become very difficult. Some use fishing and water sports as an alternate source of income.
- *Salaries and profits from the industry*: Most of those who attended the workshop stated that they are not happy with their earnings, as 50% of what they obtain from every trip is given to the tour guides who brig tourists to these jetties and beaches. Many also stated that it has become very difficult for them to "make ends meet" with their current salaries, especially those with loans and mortgages to pay off

- *Conflict between boat operators and tour guides*: Dolphin-watching trips are advertised at the rate of ₹ 300/- per person, and remains the same across all jetties/beaches. Many operators and drivers criticize that this rate is significantly low in terms of the income they earn from this rate. This is mainly due to the role tour guides play in running the enterprise. Nearly 50% of the amount charged *per* tourist (approximately 10 tourists per trip) is given to tour guides (approximately ₹ 1,500/- per trip), making it very laborious for boat operators and drivers to make a decent earning from these trips. They continuously stated that tour guides were not locals of the state, and "get away" with earning more than the locals, who are integrally involved in running the dolphin-watching trips. Moreover, this poses to be a significant problem for those who have loans to repay. Tour guides misinform tourists about dolphins, promising more acrobatic behaviour by the animals, in contrast to their normal behavioural patterns. Due to this, tourists are very rude to boat drivers and demand their money back if they do not see dolphins "jumping", which in turn forces them to chase and harass dolphins. Additionally, boat drivers stated that guides bring tourists in very large numbers and do not have a fixed time. As a consequence, boat operators are then obliged to take every tourist on these trips, hence overcrowding of boats around dolphins at all times
- *Licensing of boats*: Boat licenses are issued by the Captain of Ports in Goa. These licenses are currently for 'passenger boats' which means that the applicant only has to meet the boat specification requirements and safety standards, as set forth by the Captain of Ports and National Institute of Water Sports. Once the license is issued, the boat driver does not require any clearances from the State Forest Department even if he/she is conducting wildlife based activities such as dolphin watching. This is despite cetaceans being protected under Schedule I of the Wildlife Protection Act of India, 1972. Wildlife based tourism that is conducted in non-protected areas especially marine areas, is currently not regulated in Goa, leading to new boat licenses issued every year, thus significantly increasing pressure and stress on both the animals and the environment. This gap in governance needs to be addressed, with relevant departments collaborating to create regulatory frameworks that can ensure that the tourism activities are conducted with minimal impact on marine wildlife and their habitat.

SUMMARY:

Success of the workshop: The workshop was a pioneering step taken in the state through a collaborative approach between WWF-India and the Goa Department of Tourism. Forty boat operators from 4 different jetties participated voluntarily, which is indicative of their interest in learning more about marine wildlife and sustainable tourism practices. It also gave the operators an opportunity to voice their views and suggestions on how to improve the industry. However, it must be understood, that changing attitudes, of boat operators, tourists and tour promoters is a long term challenge and that only through consistent engagement can there be a tangible change in mind-set and correspondingly in legislation be brought about.

Changes needed in the workshop:

The workshop needs to be conducted in the vernacular for it to have greater impact and should also be conducted on an annual basis, as many of the boat drivers are sourced from the migrant work force and thus need to be trained every year. Review and consistent follow up with clear penalties for violations is key to ensure that boat operators follow best practices and are ensured of a better monetary return on their investment.

Positives of the workshop:

At the onset of this project, boat operators were largely suspicious of the project goals and reluctant to participate in the surveys. Over time, through consistent engagement, we were able to convince them of the project vision and their voluntary participation is indicative of their interest in improving their capacity to practice sustainable marine tourism.

Negatives of the workshop:

They were also unable to effectively implement the practices learnt at the workshop, as a significant number of operators are still to be trained, and thus the irresponsible actions of the latter, while conducting the trips, compromised the ability of the pilot batch of operators to implement sustainable dolphin watching practices. As stated previously, a consistent engagement is needed to facilitate long-term change, and WWF-India is committed to scaling this capacity building initiative over the next year to train all dolphin/picnic tour boat operators in the state.

Impact evaluation of the workshop:

Follow up sessions revealed that many of the operators who attended the workshop have not been using the teaching aids that were provided at the workshop. Therefore, supplementary training workshops are required to ensure that all boat operators follow sustainable dolphin-watching guidelines in the state.

Further recommendations:

A clear regulatory framework for marine wildlife based tourism is key for capacity building programs to be effective. In the absence of regulations, the largely commercial, migrant and fragmented communities of dolphin/picnic boat operators in Goa are unable to self-regulate due to competition between operators, lack of awareness as well as a sense of disempowerment that prevents them from regulating tourist behaviour on the boat. We recommend that along with continuous capacity building, training for the operators and communication with tourists, tour promoters; clear regulatory frameworks implemented through inter-departmental collaboration is essential to ensure that wildlife based marine tourism is sustainable in the state of Goa.

APPENDIX 1: *Questions for Boat Operators/Drivers/Owners*

I. *Dolphin – Biology/Ecology*

1. What do you know about the dolphins in Goa?
2. Where do you see them most often?
3. Are they seen more in shallow or deep waters? – at what depths if you can tell me
4. What time of the day do you see them most often?
5. How many in number are they found usually?
6. What kind of dolphins do we have in Goa?
7. Are dolphins mammals or fish? What is the difference between the two?
8. Do they suckle their young?
9. How big do they grow?
10. How often do you think they give birth to babies?
11. What do these dolphins like to eat?
12. How long do they live?
13. Do they have family bonds? – like us
14. Do mothers take care of their young ones?
15. Do they help each other when in trouble or feeding?
16. What problems do you think these dolphins are facing today?
17. Do you think these dolphins like being around the boats and tourists?

II. *Socio-Economic*

1. Do you know the history of the dolphin-watching industry in Goa?
2. What are your views about how the industry is running at the moment?
3. Hos has the industry changed over the years?
4. How long have you been involved in the dolphin-watching tourism, here in Goa? What is your role?
5. Anything else along with dolphin-watching tourism that you do?
6. Are you happy with the income from the dolphin-watching?
7. Is your staff happy?
8. Who are the other people who play an important role in running your dolphin-watching business? Other stakeholders?
9. Are you involved only in dolphin-watching tourism or some other form of tourism as well? (scuba, adventure sports)
10. What are the problems that you face in this type of tourism activity?
11. Have you had any special or memorable encounters with dolphins? If yes, could you describe it for us?

APPENDIX II: *Participation of Boat Operators/Drivers/Owners*

WWF

CERTIFICATE OF PARTICIPATION

This is to certify that_____ participated in a capacity building workshop on **'Sustainable Dolphin Watching Practices'** conducted by WFF-India in collaboration with the Department of Tourism,Goa under the IUCN-MFF Small Grants Project titled *'Promoting Sustainable Marine Tourism in Goa'*

IUCN Mangroves for the Future INVESTING IN COASTAL ECOSYSTEMS GOA

Serial No.	Name	Age	Hometown	Outstation	No. of boats owned& type of boat	No. of family members	Any past occupation
1	Premanand Phadte	40	*Combharjha*	Goa	PNJ-669, PNJ-695, catamaran	4	worked on barge
2	Rohidas C. Pague	63	Divar Island	Goa	catamaran-2, Nikhil cruises, Miramar	3	Govt. COP
3	Avril Pereira	33	Miramar	Goa	2 boats		
4	Vincent Fernandes	44	Candolim	Goa	black arrow	5	N.A
5	Rozaro Fernandes	46	Calangute	Goa	*white boat*	4	N.A
6	Paulo Fernandes	32	Candolim	Goa	Joyson Star(5), 2 boats	9	N.A
7	Pedro Dias	44	Candolim	Goa	*3 boats-owner, St.peter(2), 10 seater-sinquerim*	3	fishing
8	Angelo Dias	42	Candolim	Goa	Valainher	4	fishing

9	William Gomes	41	Sinquerim	Goa	1 ten seater	4	fishing
10	Diogo Fernandes	49	Panjim/Mira ma	Goa	2 boats (10 seater)	4	fishing
11	Tommy Oliver Fernandes	49	Panjim/Mira mar	Goa	1 no. 50 seater - Owner	8	hardware business
12	Joaquim Fernandes	50	Panjim/Mira mar	Goa	2 boats-50 seater	6	shop pwner
13	Michael Fernandes	38	Panjim/Mira mar	Goa	3 boats- 50 seater	15	car rentals
14	Joe Viegas	50	Panjim/Mira mar	Goa	2 boats ('Joey')-50 seater		car rentals
15	Ramkrishn a Naik Bandorkar	44	Candolim	Goa	2-10 seater		fishing
16	David Silvera	33	Candolim	Goa	2-(s) 10 seater, 6 seater, dolphin,bana na boat ride	3	N.A
17	John Dereh	31	Candolim	Goa	1-(s)- 10 seater ('Horizon')- Sinquerim - Owner	4	Jetty
18	Gabriel Pereira	42	Candolim	Goa	1-(s)- 10 seater ('Octopus')O wner	3	watersports (parasailing)
19	Manuel Cabral	64	Taleigao	Goa	1-eighteen seater, owner+driver , 'Anne Marie'	5	Taj Hotels(sports club)
20	Savio Dsouza	34	Candolim	Goa	2-ten seater, 2-eight seater, 1-four seater, 1-six seater - Sinquerim	3	ship

21	Paul Rodriguez	39	Candolim	Goa	3-ten seater - Sinquerim	5	river boat
22	Lydio Silveria	40	Sinquerim	Goa	2- ten seater - Sinquerim	2	N.A
23	Rohidas Bandoho	22	Sinquerim	Goa	1-twelve seater - Sinquerim	5	Mall
24	Francis Gonsalves	21	Candolim	Goa	1-twelve seater,owner +driver - Sinquerim	3	bar/restraunt owner
25	Francoso Fernandes	40	Candolim	Goa	1-ten seater - Owner and Driver	4	N.A
26	Joseph Fernandes	31	Candolim	Goa	1-twelve seater - Owner and Driver	6	school
27	Antonion Fernandes	43	Candolim	Goa	1-ten seater - Owner and Driver	4	driving
28	Lloyd Simoes	32	Candolim	Goa	1-ten seater- Owner and Driver	3	abroad
29	Vincy Fernandes	30	Candolim	Goa	2-ten seater - Owner	6	N.A
30	Valellington Lobo	25	Candolim	Goa	1-ten seater - Owner and Driver - 'Toff Toff'	2	driver
31	Phillip	46	Candolim	Goa	2-ten seater - Sinquerim- Owner and Driver- 'Mascus'	6	electrician
32	Domnic Fernandes	52	Candolim	Goa	2-ten seater- Sinquerim - Owner and Driver	4	fishing

RECOMMENDATIONS FOR PROMOTING SUSTAINABLE MARINE TOURISM IN NORTH GOA, WESTERN INDIA

Goa's primary revenue rests on the tourism industry, which handles nearly 12.5% of the tourist influx in India. It has high domestic and international tourist footfall; The statistics collated by the State Tourism Department reveal that approximately 4,058,226, tourists visited Goa in 2014. Goa has the potential to build international visibility as it had approximately 513,592 international tourists visiting the state in 2014-15. The state's tourism industry contributes to 15% of India's total foreign exchange earnings. In 2006-2007 there were more than 2.5 million tourists reported to have visited Goa, both domestic and foreign and total revenue earned for the fiscal year 2006-07 from tourism is ₹4000 crore as against ₹ 3700 crore in 2005-06.
However, being a small state, Goa is developing its 101 km of coastline at a rapid rate to support its tourism industry, which is the key economic livelihood in the state and has a high impact on its fragile ecosystems. The state is home to two marine flagship species, Humpback dolphins and coral reefs, while also being part of the Western Ghats, a biodiversity hotspot, all of which contribute to making Goa an extremely important site for conservation action and sustainable tourism.

Why is developing a sustainable tourism model necessary?

important that concepts of sustainable and eco tourism practices are implemented in the state. Goa's Tourism Department is revising its policy and pushing an eco tourism agenda and it is important that conservation agencies and local communities, who are directly dependent on healthy marine ecosystems for their livelihood, are able to participate in the development of these policies to enable better protection for Goa's wildlife and natural habitats. A transparent, participatory process designed to meet community goals can ensure greater compliance and subsequent conservation success. Globally, with the challenges of climate change becoming more apparent and declining fish stocks affecting livelihoods across various coastal communities, it is imperative that marine ecosystems are studied and better protected. Our study concentrated on two key facets that support Goa's tourism industry and local economy to a very large extent, namely, coral reefs around Grande Island and the Humpback dolphins inhabiting the state's coastal waters. This study was focused on assessing the impact of tourism on Humpback dolphins found along the coast of Goa, as well as identifying and assessing the impact of tourism on the coral reefs found around the Grande Island archipelago. The results, as discussed in previous chapters, reveal gaps in governance, regulations as well as in the capacities of local tour operators to practice sustainable marine tourism

Addressing these gaps is critical to ensure better protection and conservation of these key iconic marine species, upon which the livelihoods of many local communities in the state, depend. A brief review of governance structures in the state regulating marine tourism, reveal a complicated process that currently lacks any agency to monitor the impact of these tourism activities on marine ecosystems.

Governance Review:

At present, three main departments are involved at the state level to regulate dolphin watching and coral based tourism. These are the Department of Tourism, Captain of Ports and the Marine Police. In certain instances, the Coast Guard, Navy, Fisheries Department and National Institute of Water Sports are also involved in addressing issues, such as safety and nautical mile violations.

The process to begin a dolphin watching tour or coral based tour and the gaps in governance:
In the case of both types of tours, a boat license is obtained from the Captain of Ports, depending on the size of the vessel and other features. The vessel is then licensed as a 'Passenger Boat', to allow it to be used to ferry passengers. A nautical mile limit is set depending on the type of craft.

1. The boat operators then need to obtain 'No Objection Certificates' (NOC) from the Fisheries Department and Marine Police.
2. They are given the safety guidelines and registered with the National Institute of Water Sports.
3. Finally, they are listed with the State Department of Tourism.
4. In the case of dolphin tours, the operator is part of a 'Dolphin Tour Boat Association' that is geographically aligned with where the boat is anchored when not in use. Goa has four main Associations in North Goa, that are based at the Dona Paula, Miramar, Coco Beach and Sinquerim jetties respectively. These associations determine the price of the ticket of a dolphin tour, the queue system which decides how many boats are out on the water at a given time and also handles any disputes, issues within the members. All new members are required to become a part of the associations.
5. In the case of coral based tourism, namely SCUBA diving and recreational boat trips to the island, the operations are currently conducted in a vacuum of governance, as the Navy uses the island for certain activities and intermittently monitors boats visiting the island for tourism activities. The Tourism Department, Captain of Ports, National Institute of Water Sports, currently play no role in monitoring the tourism around the island beyond issuing boat licenses and safety guidelines.

The focal species in both forms of the aforementioned tourism activities, is a Schedule I protected species under the Wildlife Protection Act of India, 1972. But due to the current lack of jurisdictional clarity, tour operators are not required to obtain a 'No Objection Certificate' from the Forest Department, nor declare if they have the required knowledge or training to conduct dolphin watching activities, or coral based activities. Neither is any government department in Goa equipped to deliver the required training for sustainable coral and dolphin based tourism practices at present.
It is primarily these gaps, that have led to the rise in issues that have been identified, assessed and described in the previous chapters. WWF-India has put together a set of recommendations based on its findings in this study, to help address these gaps. The aim of these recommendations is to not only provide a way forward for the tour operators to improve their practices but also to create a conducive environment for policy change, that will allow for clear regulatory guidelines to be framed that can help monitor the marine tourism activities in the state. A collaborative approach between all stakeholders, government agencies, including the Forest Department is key to enabling sustainable tourism and better conservation for humpback dolphins and coral reefs in Goa.

Recommendations towards developing a Sustainable Tourism Strategy for Grande Island:

1. Implementation of a participatory management strategy for conservation and sustainable livelihoods:
    i. An inter-departmental committee of all direct stakeholders who use the site to be formed, such as the Forest Department of Goa, Tourism Department of Goa, Marine Police, Captain of Ports and the National Institute of Water Sports, in order to effectively address current gaps in governance and jurisdiction of island
    ii. Forest Department, Goa can monitor reef usage in the site by establishing itself as a penalty issuing body
    iii. Regulation of the number of operators and boats visiting and using sites around the island at any given time, is essential

   iv. A baseline study on the ecology of the reefs around the island is imperative. Based on such research, sites around the island can be zoned to accommodate activities that are being carried out specific to the capacity of the site
2. Implementation of a long term monitoring network of dive operators, Forest Department of Goa, relevant NGOs such as WWF and research organizations such as National Institute of Oceanography (NIO), can help monitor the health of the site over the years
3. Implementation of a strong and effective capacity building program for all boat operators directly using the site. This includes dive operators involved in SCUBA diving, and recreational boats conducting picnic or island trips, to enhance their capacity of using the site for sustainable tourist practices
4. Installation of a mooring buoy at heavily trafficked and visited sites to mitigate anchor breakage
5. Implementation of a regular patrolling system through collaborative effort between the Navy, Marine Police and the Forest Department of Goa. This system will help enable an effective means of monitoring tourist activities at the site and subsequent impact on the coral reef surrounding the island
6. Implementation of projects to study the impacts and advantages of incorporating a reef restoration initiative, integrated with an artificial reef program. This will help reduce diving pressure and subsequent impacts of picnic or island tours on the existing fragile reef system.
7. Implementation of studies to analyse and assess the economic evaluation of ecosystem services provided by the reefs. This will help inform awareness and sensitization within stakeholders using the site
8. Provisions must be made for the control and collection of garbage on all boat and jetties. Dustbins must be installed on every boat conducting picnic/island trips. This can be achieved, by setting up collection centres at the jetties through collaboration with the local Panchayats. Local NGOs such as Waste Wise, Vrecycle, Green Goa Works can collaboratively provide inputs and technical assistance to recycle bottles and plastic, which are the primary types of waste material generated by tourist boats. Boat owner associations at each jetty can be responsible for ensuring that tour boats bring back the trash accumulated during the boat trips. A public-private partnership model can be used to involve select corporates through the Corporate Social Responsibility approach to facilitate garbage collection and recycling. Awareness campaign to sensitize tourists, boat operators, relevant government agencies can be conducted collaboratively with local stakeholders and the aforementioned NGOs by organising volunteer clean-up drives, cultural programs focusing on marine conservation to mark relevant days, for example, World Ocean Day.

Recommendations towards developing Sustainable Dolphin-Watching Tourism Practices in Goa:

1. Implementation of a participatory management strategy for the conservation of the focal species – humpback dolphins and sustainable dolphin-watching tourism:
   i. Inter-departmental committee of all stakeholders involved in dolphin-watching tourism formed, such as, the Forest Department of Goa, Tourism Department of Goa, Marine Police, Captain of Ports and the National Institute of Water Sports, in order to effectively address current gaps in governance and jurisdiction of this tourism activity
   ii. Forest Department, Goa can monitor behaviour of dolphin-watching tour boats in the site by establishing itself as a penalty issuing body
   iii. Regulation of the number of operators and boats around the dolphins at any given time should be maintained at three, and restriction on speed of speed boats while passing

through the bay, is essential. Boats must maintain a minimum distance of 150 feet from the dolphin(s) at any given time.

2. Continual training and capacity building for all operators to follow dolphin-watching guidelines is crucial.
3. Inclusion of educational components as part of dolphin-watching trips, such as, signage on all boats and jetties, installation of an interpretation centre for providing information on the dolphins and their ecology, facilitating stronger awareness on marine conservation and issues alike
4. Provision for in-depth ecological studies on the focal species, as very little is known about them
5. Long-term monitoring of dolphins along the coast can be established with boat operators.
6. Provisions must be made for the control and collection of garbage on all tour boats and jetties. Tourism Department, Goa can approach relevant corporates to establish recycling initiatives to mitigate pollution and its subsequent impact on the animals and its habitat
7. Scope to develop alternate livelihoods by setting up souvenir shops at jetties advertising dolphin-watching trips, which can be managed by their own dolphin-watching associations at each location; thereby, providing alternate employment opportunities for boat operators/drivers, and reducing pressure on the dolphin-watching trips.

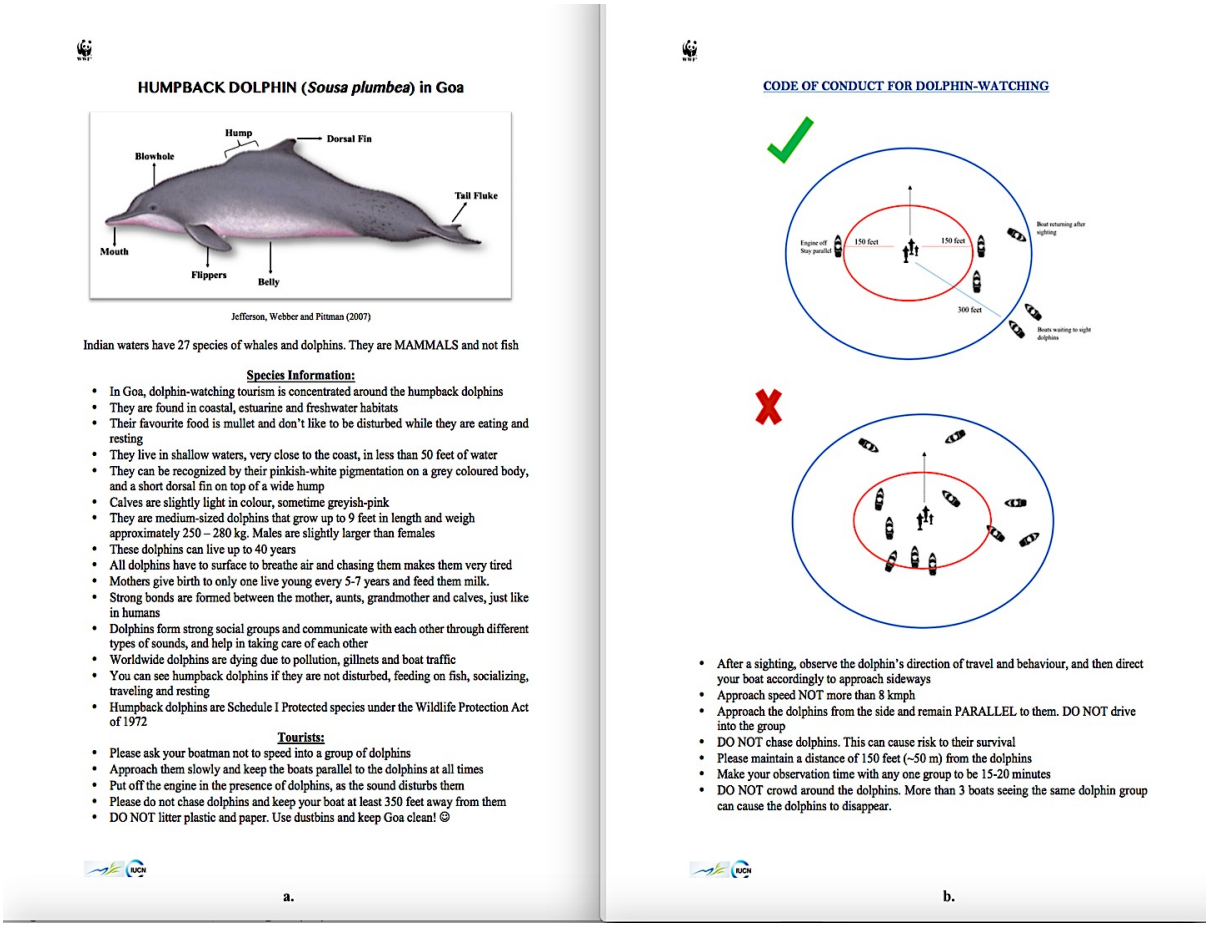


Figure 1: Information sheet provided to all attendees of the workshop

EDUCATION AND OUTREACH

WWF-India, Goa State office has presented awareness and informative talks on Goa's marine ecosystem heritage at schools and various organizations who, on their part have showed their support and eagerness to learn more and how they can help conserve our beautiful marine ecosystems. We have reached out to 900 people, on an average. Some of the talks and outreach events that were conducted are highlighted below:

Schools:

Our Lady of Health High School and Shiksha Niketan School:
These enthusiastic children learned about the beautiful dolphins and Goa's very own coral reef. Surprisingly, it was not known to many of them that such an amazing reef ecosystem is a part of our rich marine diversity. This instilled an eco-sensitivity in them and gave them more knowledge, and also on how they could be instrumental in protecting and conserving this precious ecosystem.

Kamleshwar Higher Secondary School and Government High School:
These students had little knowledge about the and its marine life. We shared more interesting facts and and inculcated awareness in each of them about the dolphins and coral reefs in Goa. Some participated readily in our quiz and were also very eager to have us over again for more such informative talks. They look forward to having their school organize a dolphin watching trip for them in their next field excursion. They were eager to be a part of WWF's project and a few of them submitted their names to us, to learn more and volunteer with us.

Other locations:

We also reached out to young adults and the elderly at various places namely, Gun Powder, Kokum Design Centre, Sararya Eco Resort and Vaayu Waterman's Village. Those who attended our talks at these venues, were very eco conscious, and are already doing their bit on "saving the environment". Coral reef restoration, conservation and marine tourism of dolphins of Goa were the main highlights. While the adults were engaged in our eco talks, we organized an "Ocean Art's table" for children and young adults. They painted their favourite sea animals, things they loved about the sea and just about used their imagination to create beautiful ocean theme pictures.

After each presentation we got the crowds engaged in interactive sessions, suggestions and thoughts were put together on how better we can all come together and collectively make a difference and be a part of protecting and saving Goa's marine heritage.

Figure 1: Kokum Design Center

Figure 2: Gun Powder

Figure 3: Gun Powder

Figure 4: Natti's Naturals

Figure 5: Saraya

Figure 6: Saraya

Figure 7: Saraya

Figure 8: Vaayu

Figure 9: Kamaleshwar Higher Secondary School

Figure 10: Government High School

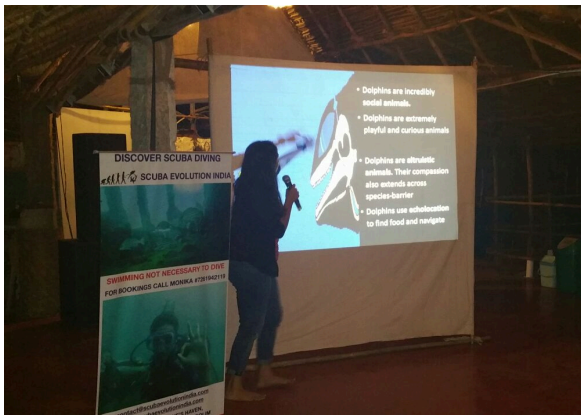


Figure 11: Vaayu

Figure 12: Our Lady of Health High School

Communication collaterals designed:

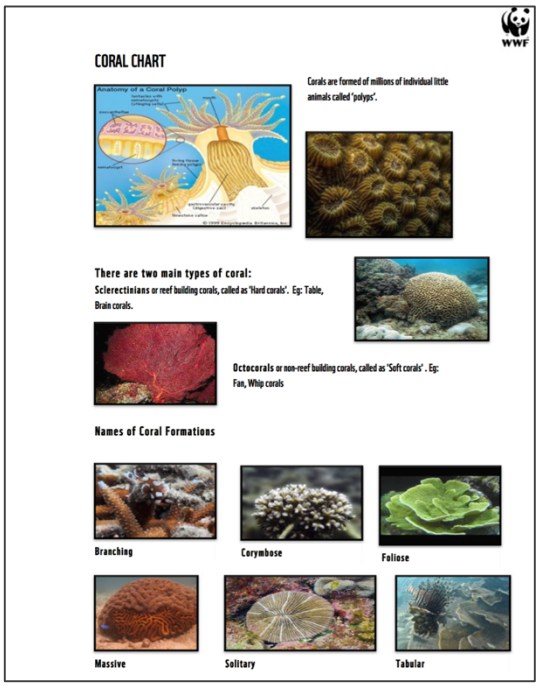


Figure 13(a): Fish and coral charts designed for all dive centres

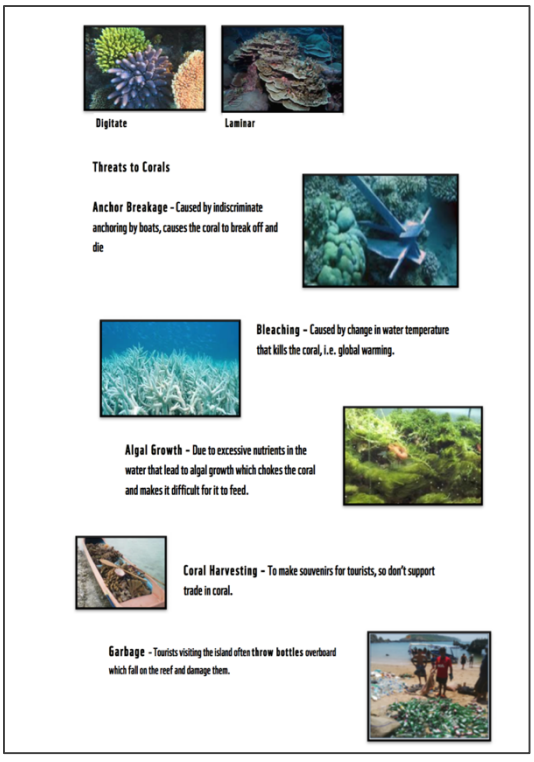


Figure 13(b): Coral chart designed for all dive centres

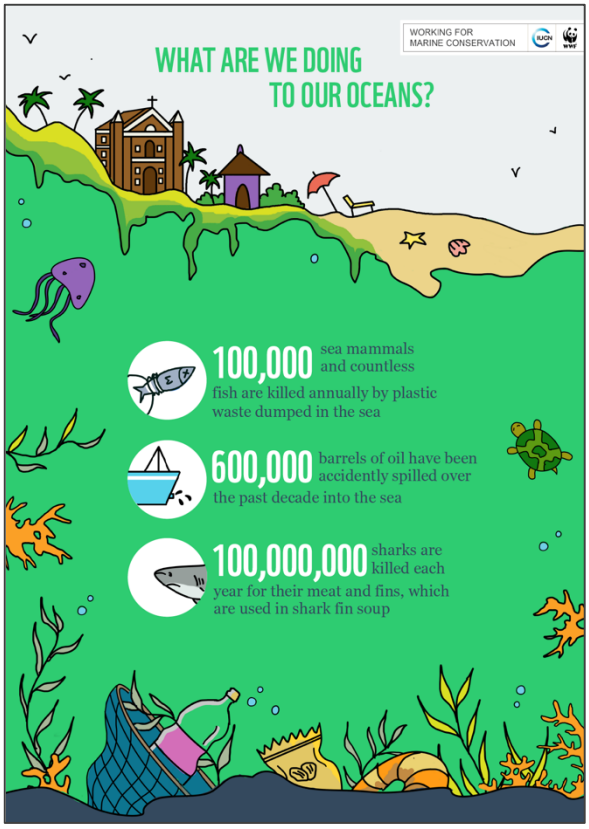


Figure 14: 'Trash' themed poster placed at all jetties and beaches

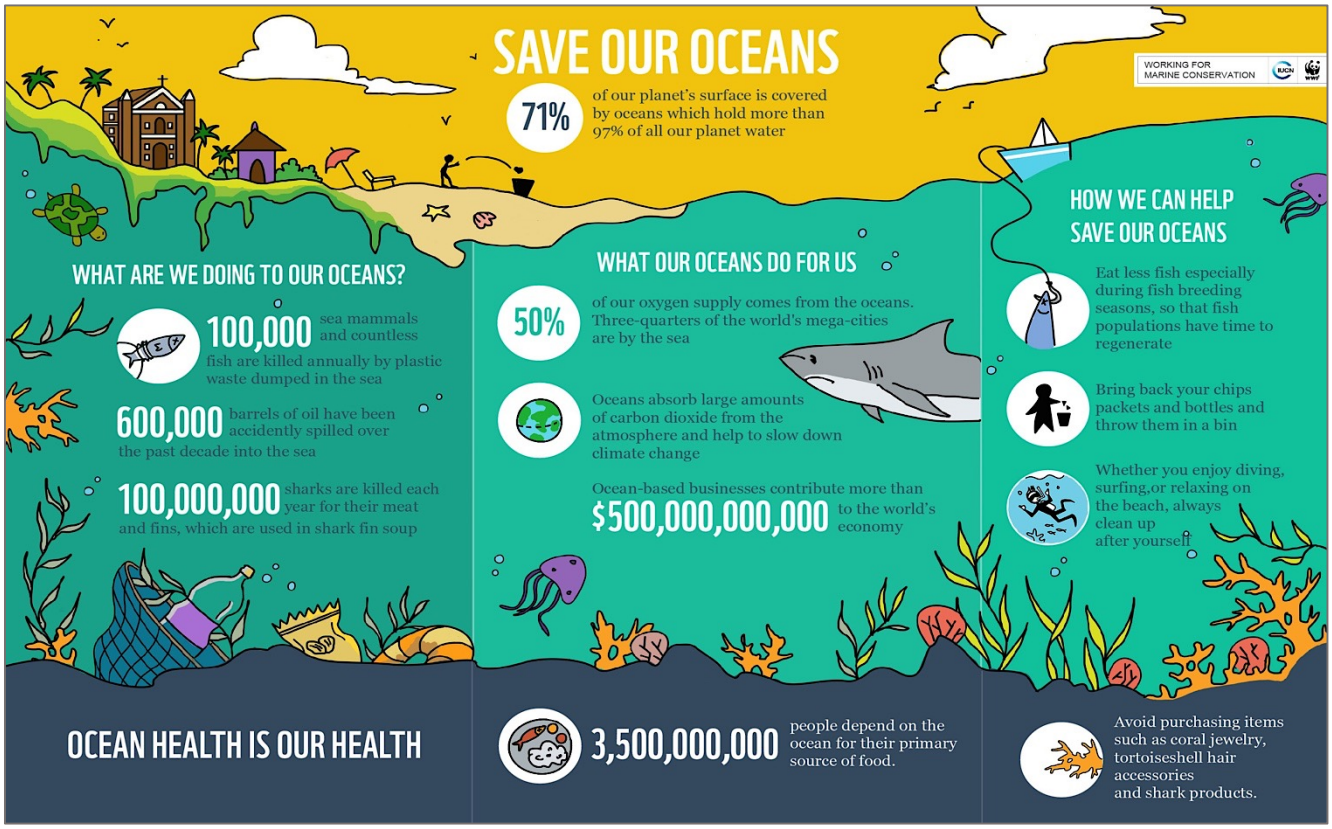


Figure 15: Infographic poster placed at all jetties

Figure 16: Brochure on humpback dolphins distributed to all jetties advertising dolphin-watching tours

Media coverage:

Goa's Corals, Dolphins, Mangroves Beginning of the End?

Posted by: Navhind Times June 7, 2015 in Panorama

Goa's coastline is always in the news; sometimes for the launch of seaplanes at other times for starting marinas. This fragile ecosystem, which besides being a means of livelihood for Goan fishermen supports the tourism industry, is under constant threat due to human intervention. NT NETWORK takes a look at Goa's marine life and the need to be careful when we enter the 'rainforests of the seas'

bY ARTI DAS | NT NETWORK

Goa for time immemorial has been associated with sun, sand and the sea. Our beaches are known across the globe for their shacks, swaying palm trees and water sports. But, unfortunately, we fail to pay heed to its marine life, that which contributes towards making our beaches unique.

Goan beaches fall in a very specific category, which only a few other beaches of our country are a part of. A few may know this, but our waters are home to a variety of corals, fish, whales, dolphins. Plus, the Olive Ridley turtles come here to lay their eggs. Furthermore, our backwaters have over 14 species of mangroves, crocodiles, water birds, etc.

But, neither the average tourist nor the local Goan is aware of this aspect of Goa's marine wildlife.

This biodiversity is changing rapidly purely on account of human interference. There are frequent reports of tar balls being found on our beaches and plastic being littered callously, actions that contribute to the destruction of our coast with each passing day.

Although these are some of the more direct impacts of human interference, there are some emerging issues that need urgent attention.

INTRUSION BY JOY BOAT TRIPS

In Goa, dolphin trips are one of the main attractions offered in packaged holiday deals. These trips are successful crowd pullers as tourists get an opportunity to see dolphins in their natural habitat. But, is it really that simple?

According to sources, it has been learnt that these boats are a threat to the lives of dolphins. Various boating trips are organised from Miramar Beach, Coco Beach and even from South Goa to visit the Sinquerim Bay, which is home to the Indo-Pacific humpback dolphins (frequently mistaken for the bottle nose dolphins by boat operators). When these dolphins come to the bay to feed, these boats (around 20 to 30 at a time) chase the animals so as to provide tourists the promised 'dolphin viewing'.

It is learnt that the Indo-Pacific humpback dolphins are found around 3 kilometres to 4 kilometres from the sea at a depth of 20 meters. Therefore, it is easy to find them near human habitat. This in turn poses a threat to their lives. Some of these boats play loud music. This noise hampers communication between fellow dolphins. Note: sound travels faster in sea. As they are constantly stalked (these boats operate from 8 a.m. to 6 p.m. during tourist season), the animals find it difficult to search for food, to procreate, socialise, etc.

Many experts believe that such trips are not bad, but the manner in which they are conducted needs to be regularised. "When such trips are organised there is a need for certain seriousness. We need to give an impression that it is not a party place but a wildlife area. Many a time, alcohol is served on such boats, which should be discouraged as then it leads to bottles and cans being dumped in the sea", says Pankaj Lad, who along with his associates conducts boating rides in Cumbharjua canals for bird watching. He further adds: "We get filtered clients; those who are interested in wildlife. We do not serve them liquor. We just give them information about wildlife, mangroves, birds, etc."

Talking about backwaters he says that they are under threat too due to human intervention. There are cases of mangroves being destroyed and a decline in the number of collared kingfishers. The latter is due to an increase in the population of crows, who eat these collared Kingfishers. Increased crow population is linked to garbage disposal and other human factors.

Lad further points that at times some tourists throw plastic bottles at crocodiles to check if they are awake or not. "This only shows how insensitive the boat operators are. Tourists are willing to listen and follow guidelines when we ourselves show seriousness about the issue", says Lad.

Being insensitive towards ecology

These 300 to 400-odd licensed boat operators have, unfortunately, not been provided any training with regard to information about marine wildlife and thus are unable to give any relevant information to the tourists. Also, not many are aware that there are corals found in the waters around Grand Island at Vasco. "Grand Island at Vasco is the only place where you will find a large distribution of corals in Goa. Corals are rarely found on the West coast of the country. They are found on the west coast of India in Goa, Malvan in Maharashtra, Netrani in Karnataka and in the Gulf of Kutch. Here in Goa we find fringing corals and table corals. Corals cover only 0.1 per cent of the earth's atmosphere, but they support 25 per cent of all marine life found. Corals are not rocks but microscopic animals that provide several fish species with a home, a safe space to breed and are essentially the 'rainforests of the seas'", says programme manager, WWF- Goa, Puja Mitra.

These trips are purely for fun and entertainment. Barbequed fish (caught fresh during the trip) and alcohol are served on these trips, but no information is being shared. All garbage is dumped into the sea and the boats are anchored right on the corals as the island is bordered with corals, which the boat operators are unaware of. This leads to the destruction of corals.

"I think the kind of nature-based tourism being operated for marine wildlife viewing, be it dolphin watching or island trips, is appalling! I have been divir off Grande Island since 1997 and am saddened by the way the area has degraded over the years. Ecotourism if carried out in its true sense can be a win-win situation benefiting conservation, while sustaining the livelihoods c the local stakeholders involved in this activities. What's happening now is a 'free for all' and largely unregulated situation, which is putting some of thes fragile ecosystems at risk, and is an impending threat for this very livelihoo that depends on this marine life. Ultimately, it turns out to be a bad tourism experience as well. We definitely need a solid plan for managing these activities in Goa", says marine ecologist (GIZ), Aaron Lobo.

Eternal threat to marine life

The coast of Goa, the very existence of this tiny state, is under constant threat. Experts believe that it is mainly due to the lack of political will and vested interest which is worsening the situation.

"There are no good maps of Goa's coastline available on a 1:2500 scale. Th data is hidden from public. The most important and ` 50 lakh-worth document – the HTL (High Tide Line) report for the whole of Goa, crucial fo regulation of coastal activity, prepared by National Institute of Oceanograp at state government's cost, is still kept secretive.

Goa government was emboldened to do anything in marine areas after a major blunder was made (oceanographically and hydrographically unprecedented in the world, in 1996) when GCZMP (Goa Coastal Zone Management Plan) was finalised and with a masterstroke the tidal bay of Marmagoa-Dona Paula-Siridao-Chikhalim-Sancoale-Bambolim was convert and classified as a 'river' to truncate the 500 m CRZ to 50 m to 100 m CRZ and automatically release thousands of hectares of prime and scenic land the north and south bank of the bay thereby creating a real estate market o more than 100 thousand crores. The fact is that in all Portuguese hydrographic records, the above is a bay, so one can see how manipulation take place in Goa regarding marine areas", says asst professor, Departmen of Botany, Goa University, Nandkumar Kamat.

Awareness is the key

WWF Goa is working on a programme to create awareness about Goa's marine biodiversity and the need for sustainable marine tourism on coral reefs and dolphins, which is supported through the IUCN-MFF Small Grants programme. "There is a need to put up signboards at all jetties that give relevant information about Goa's marine wildlife to help tourists understan they are entering a wild space; oceans are like forests that house wild animals. These facts need to be highlighted before tourists embark on a dolphin watching or island trip. It will also help to have guides that accompany boat operators to brief tourists about the do's and don'ts while watching dolphins and most importantly to establish that it is a wildlife experience and not a joy ride or party", says Puja. Lad says: "The Forest Department and other experts need to conduct a training and orientation programme for boat operators. Those who fail to attend these sessions shouldn't be given a license by authorities. If we are not serious about this, than we will lose our beaches and in turn tourism."

Figure 17: The Navhind Times, June 2015

Govt, WWF to host sessions to protect dolphins, coral reefs

TNN | Aug 31, 2015, 02.41 AM IST

PANAJI: In what is a major step forward in the protection of Schedule I protected species dolphins and coral reefs, World Wide Fund for Nature-India has prepared and submitted a report to the state government outlining the status of the vital marine ecosystem and recommendations on how it can be protected.

In a heartening move, the government has not only welcomed the report, which was submitted last week, but has also initiated steps to preserve the marine bio-diversity whose services to mankind is worth millions of rupees, state in charge WWF- India Puja Mitra said.

"The government has taken a positive step in addressing the concerns, in fact the captain of ports has called for an inter-department meeting of all stakeholders including the tour boat operators from North Goa to deliberate on the issue," Mitra said.

The government in collaboration with WWF - India will host a special training session for boat operators and diving schools to create awareness on sustainable marine tourism, including protection and preservation of dolphins and coral reefs.

Goa is home to two protected species, the finless porpoise and the Indo-Pacific humpback dolphin. While the finless porpoise is an elusive mammal, the Indo-Pacific Humpback dolphin is oft-sighted and sometimes chased by dolphin cruise operators.

"The main stressor for dolphins are the engine noises and loud music on picnic boats," Mitra said.

The humpbacked dolphins, contrary to expectations, prefers to live and hunt close to land and is sighted near the Aguada Bay.

There are at least 300 licensed boat operators and on an average there could be around 150 to 200 boats chasing and circling the two to three dolphins that attempt the hunt near the mouth of the river Mandovi.

The report submitted to the government recommends the framing of stringent guidelines for sustainable dolphin watching, a policy to manage trash, certification of trained operators and long-term monitoring of the coral reef's health.

Figure 18: The Times of India, August 2015

SOS of sorts: Tourists, locals alike urged to save our seas

TNN | Jan 30, 2016, 02.31 PM IST

Panaji: 'Bring back your trash from outings at sea.' 'Do not buy jewellery or decorative items made of corals or shells.' 'Avoid consuming endangered species like sharks.'

Such information displayed on boards installed at key jetties, Dona Paula, Miramar and Sinquerim, is drawing the attention of tourists and citizens alike.

Issues of ocean garbage and its catastrophic impact on marine animals, ecosystems, and livelihoods of fishermen and others residing in coastal areas, including Goa, are raising a concern.

A recent report by the Ellen MacArthur Foundation states that there will be more plastic than fish in the sea by the year 2050.

The foundation aims at inspiring a generation to re-think, re-design and build a positive future by way of a 'circular economy', which, essentially, is an industrial economy that generates no waste or pollution.

"It is an uphill struggle, and we need consistent awareness and capacity-building initiatives both, at the individual and state levels, to protect our fragile marine resources for the future," said World Wide Fund for Nature (WWF)-Goa programme manager, Puja Mitra.

WWF-India has installed the infographics as part of a state-centric 'ocean conservation' awareness campaign. This follows an earlier effort to promote sustainable marine tourism and marine conservation in Goa.

The organization had assessed the impact of tourism on Goa's humpback dolphins and coral reefs and had recommended sustainable tourism measures that could help improve conservation of these key Schedule I species.

The infographics bring out little-known facts about the ocean, such as, 'Fifty per cent of oxygen comes from the ocean' and 'Around 100 million sharks are killed annually.' They have begun to generate more interest, with the Calangute village panchayat requesting that such boards be installed at all key beaches and public spaces.

"It is imperative that we start addressing the enormous issue of ocean garbage," Mitra said.

Figure 20: The Times of India, January 2016

Studies dive into Goa's very own coral reefs

Newton Sequeira | TNN | Sep 3, 2015, 04.49 AM IST

PANAJI: Think coral reefs in India, think Andaman and Nicobar islands. That Goa is also home to the thriving, colourful underwater ecosystem was known to just a select group of marine biologists and avid divers. Till now.

The World Wide Fund (WWF) for Nature and the National Institute of Oceanography (NIO) are both studying the presence of coral reefs around Goa, especially around the Grande Island archipelago off the coast of Vasco.

The archipelago, approximately three kilometers away from Vasco, consists of two coastal islands which are fringed by coral reefs and are a popular site for scuba divers.

The site is one of the few coastal islands on the west coast of peninsular India where coral reefs have been documented. Studies have shown that the waters around the islands house patches of coral growth and small expanses of fringing reef which give way to a sandy seabed.

The WWF study has been funded by the International Union for Conservation of Nature-Mangrove for the Future.

The coral reefs, growing at a depth of 4-8 metres, around Grande Island and St George Island are home to 18 species of fish life, including parrotfish, butterfly fish, damselfish and fauna such as sea urchins and sea cucumbers.

Coral reefs serve as a protective barrier around coasts, they create and support living biomass and serve as an important food source for marine species. And of course, their spectacular beauty attracts divers and contributes to tourism.

"The most common form found are tabletop corals," says Baban Ingole, fisheries scientist at NIO, "We have been studying the corals since around a year or two ago."

Studies and NIO officials have repeatedly highlighted the immense contribution of coral reefs to marine life as well as humanity. "The aesthetic value of coral reefs has appealed to millions of people, but coral reefs also provide a place for fish to lay their eggs, breed, rest and hide from predators," says Puja Mitra, state director, WWF-India.

WWF recently undertook a pilot study to understand the type of corals present at Grande Island and the threats to their survival. "Turf algae were more abundant than any other type of coral at all the sites and among coral types, encrusting coral was found to notably exceed other types," adds Mitra.

Since the two islands are privately owned and with St George Island being used by the Indian Navy WWF was not able to undertake a thorough study. Yet, its study has found that unregulated dolphin boat tours and careless tourists are damaging this fragile ecosystem.

"Besides tourism, sewage flow and mining sediment have been found to be the main stressors," says Mitra.

Figure 19: The Times of India, September 2015

CONCLUSION

Travel and Tourism in Goa contributes a share of 6.8% to India's GDP. 3,76,640 foreign and 21,27,063 domestic tourists visited Goa in 2009. These numbers rose in 2010 to 4,41,053 and 22,01,752 foreign and domestic tourists respectively. While the majority of these tourists intend to holiday on the beaches of Goa, 2009-10 saw approximately 1,86,000 tourists, both foreign and domestic, exploring Wildlife Sanctuaries in the State. This number does not account for the tourists opting for marine eco-tourism activities such as dolphin watching and scuba diving.

As observed during the boat surveys conducted by the WWF-Goa team, there are approximately 150 boats being dispatched from Sinquerim Jetty and Coco Beach each and around 40 from Miramar. From these, some collectively conduct dolphin-watching and picnic/island boat tours, specifically from Sinquerim-Coco Beach, while those from Miramar conduct only dolphin-watching tours. During the peak season, each of these boats gets to go out into the sea at least once a day, meaning that there is a minimum of 700 boats encroaching dolphin habitat everyday between 9 a.m. and 5 p.m.

The coral reef around Grande Island is under threat from the activities of picnic/island boats in the area. Apart from the amount of garbage that is thrown into the water, anchor damage could be a serious problem, resulting in overturning and breakage of coral. The number of boats and the activities conducted at the island does not seem to be accounted for, and regulation needs to be enforced.

Responsible and sustainable tourism is of paramount importance to an economy that is heavily dependent on tourism, like that of Goa. The number of people opting for dolphin watching trips and scuba diving, indicates that marine eco-tourism, if managed properly, is a potentially lucrative field. The resources on which this type of tourism depends, are very fragile, and extra care needs to be taken to ensure that the humpback dolphin and coral reefs are protected. While the dolphin population may appear to be stable at the moment, we cannot assume that boat activity has no bearing on their reproductive rate and life expectancy. Stress caused by the unregulated number and activities of these boats can result in dwindling populations. Similarly, unregulated boat traffic around Grande Island can result in coral damage to the point where the reef has no time to recover.

If marketed in the right manner, marine eco-tourism can be given the respect it deserves. Tourists must be prepared for a wildlife-watching experience. By giving more attention to safety briefings and appropriate behaviour around marine species, the whole experience can be viewed as a privilege rather than just a party on a boat to which dolphin and coral viewing is incidental. This kind of tourism can also attract a different type of clientele, one that is willing to spend more to experience wildlife in its own habitat. This kind of tourism can potentially create a number of jobs especially for the youth of Goa. Employing people trained as guides and naturalists adds to the quality of the experience and a rise in ticket prices will be justified

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EDUCATION AND OUTREACH

Figure 17: The Navhind Times. June 2015. http://www.navhindtimes.in/goas-corals-dolphins-mangroves-beginning-of-the-end/

Figure 18: The Times of India. August 2015. http://timesofindia.indiatimes.com/city/goa/Govt-WWF-to-host-sessions-to-protect-dolphins-coral-reefs/articleshow/48736461.cms

Figure 19: The Times of India. September 2015. http://timesofindia.indiatimes.com/city/goa/Studies-dive-into-Goas-very-own-coral-reefs/articleshow/48780495.cms

Figure 20: The Times of India. January 2016. http://timesofindia.indiatimes.com/city/goa/Studies-dive-into-Goas-very-own-coral-reefs/articleshow/48780495.cms

THE WWF-INDIA TEAM IN GOA

Dr. Dipani Sutaria

Project Consultant

Dipani has been working in the marine and aquatic environment since 1998. She has studied olive Ridley turtles, smooth-coated otters, Irrawaddy dolphins, humpback dolphins and more recently sharks. Post her PhD in 2009, she has been independently building capacity of interested students to further their research or conservation aspirations in the field of marine species ecology, behavioural ecology and aquatic systems research.

Puja Mitra

Program Manager

Puja has completed her Master's in Biodiversity, Conservation and Management from the University of Oxford (Commonwealth Scholar). She has been working in the field of conservation since 2009. She has run a successful campaign to prohibit the establishment of dolphinaria in India, managing livelihood development programs for rural communities and as a researcher to mitigate human-elephant conflict in Assam as part of the Assam Haathi Project. She is now working in WWF-India, Goa as the State Program Manager handling conservation programs for the state.

Shreya Sanjeev

Project Scientist

Shreya completed her Masters in Marine Biology from James Cook University in 2013. After returning from Australia, she has worked as a researcher on projects assessing cetacean diversity and occupancy along the east and west coast of India, behavioural changes in killer whales to vessel traffic in San Juan Islands and is a certified PADI Rescue diver. She is currently pursuing a land-based study on observing behavioural changes in humpback dolphins towards vessel traffic along the west coast of India.

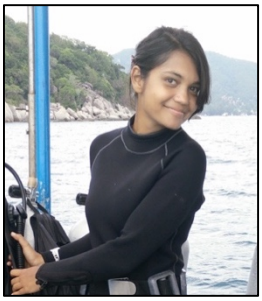
Abhishek Jamalabad

Project Assistant

Abhishek completed his Master's in Marine Biology from Karnatak University in 2013. His interests mainly in human-animal interactions and community-based wildlife management and conservation in the marine environment. He is currently engaged in independently studying interactions between cetaceans and coastal fisheries.

Gabriella D'cruz

Project Intern



Gabriella is a graduate in Environmental Science for Fergusson College. She has worked in the field of marine conservation and environmental protection, having previously interned with many conservation oriented organizations. Her passion is coral reefs and estuarine ecosystems and she has recently been certified as a conservation diver with New Heaven Dive School, Thailand. She is currently pursuing a diploma in Environmental Law from the National Law School of India University.

Manisha Rao

Project Volunteer

Manisha graduated from St. Xavier's, Mumbai with a Bachelor's degree in Zoology and Biochemistry. While animal welfare and conservation have always been of interest to her, the field of marine conservation was relatively new. Her participation in this project with WWF-India, Goa has augmented her decision to specialise in the field. She hopes to pursue a Master's degree in either Marine Biology or Coastal Management.

Roxanne Coutinho

Project Volunteer

Roxanne has a Master's Degree in Environmental Science from Bharathiar University, Coimbatore. She has been involved in sustainable waste management and rain water harvesting projects. She is passionate about animals and looks forward to taking her career ahead focused on her passion for the environment.

Jairam Harmalkar

Accounts Officer

Jairam has worked with WWF-India, Goa State Office for over 20 years. He was in charge of the project's finances and accounts.

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To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.

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