

[2011]

**Report on resources, Bio-diversity, Status and utilization patterns
and potential by the Marine tourism industry on Marine Mammal
and Bar-reef at Kalpitiya**



ORCA

**Ocean Resources
Conservation Association**

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Marine Mammal and Bar-reef at kalpitiya**

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The Background

The ORCA received funds from SLNF on the 23rd February 2010 and initiated the work at Kalpitiya by carrying out a series of field surveys from first week of March to establish community links and collect data on people currently involved in whale watching and tourism based activities within the area. A series of field surveys were carried out to monitor and study the occurrence of Marine mammals and status of Coral reefs in the area.



Tourism is being promoted at a significant scale in the area and operations are expanding rapidly with many small scale hotel operations springing up throughout the area. The locals see the opportunity and are attempting to utilize the opportunity by adapting to the new situation as best they can and try not to be out competed by the outsiders who are making inroads fast.

The current survey was aimed at identifying the potential and carrying capacity of the natural resources and provide strengthening to the community members to be able to successfully compete and be in a strong position to be able to negotiate with the outside operators and self manage the resources in a sustainable way.

The survey includes three main components of study.

1. Marine Mammal resources in the area.
2. The Bar-reef coral reef status and utilization
3. Local marine tour operator community monitoring and training

1 Boats swarming in on the Dolphin pod



Constraints.

The marine survey component work of the project suffered many difficulties and setbacks in its implementation. The activation of La-Niña weather conditions in the early part of the year 2011 caused severe weather conditions throughout the western sea board and North-western Province. which lead to rough sea conditions prevailing through several months of the normally good season where most of the work was planned to be carried out. this caused much delays and obstructions to maintaining schedules as planned.

Several issues had to be faced at the initial project activities due to the restrictions issued by the Navy to the local boat operators and operation of boats. and despite securing security clearance from ministry of defense to carry out survey activities from Kalpitiya to Jaffna which was received in under one week the permission from DWLC continued to be delayed. though DWLC has made no objection to the activity the letter of permission seem to be lost somewhere between DWLC and NARA for the past 12 months.

The program was operated with significant difficulties as the SLNF continued to unduly interfere and disrupt many survey activities, unilaterally and arbitrarily changed budgets and work plans and Delaying and restricting payments and even attempted to completely cancel the survey activities of the program. This lead to many difficulties for ORCA and delays in continuing operations and also in securing the proposed specialized survey boat and equipping with all needed accessories and deploying in time to efficiently collect needed data. The team does not understand how a final reporting date of mid February was inserted in to the contract document at the final moment, while at the project planning the team clearly informed that the field activities will be carried out from January to April during the non-monsoonal season for the west coast in Sri Lanka. The error in the inserted date is further highlighted as SLNF had made errors in another activity date listed as scheduled for April 2012 several months after the termination of the project and also a major mistake in project inception dates.

Due to the constraints the program had to be operated with several restrictions and the present report includes the data that was collected under the available situation.



Area of survey

The geographic scope of the survey was to be the area of interest to the activities of the Kalpitiya peninsula Marine tourism community.

The survey was carried out of the Marine mammal occurrence, species diversity, composition, abundance, distribution patterns, behaviour and human interactions and impacts.

The survey also monitored the local tour boat operators their modes of operation and interactions with the Marine mammals, other boats and other Marine resources.

The survey zone included the coastal area between Norochhole to the southern areas of the Bar-reef Marine sanctuary located on the Kalpitiya coastal zone. The survey included marine areas from coastal to about 20km. from the shore. The depth regime within the area ranges from sub-tidal to meso-pelagic and continental slope areas ranging well over 600m. in depth.

Three main shallow water coral reef areas can be identified within the area, including the Kalpitiya Bar-reef, Kandakuliya reef and Talawila reef. All coral reefs in the area suffered massive mortality in the 1998 coral bleaching/mass mortality event. The reefs show different levels of recovery ranging from low to excellent.

The submarine geography / bathymetry

of the Kalpitiya seas is key to the high abundance and diversity of Marine Mammals in the area. On one side the carving in of the continental shelf in between the South Indian headland and North West Sri Lanka terminating below the Mannar land bridge brings in an effective deep oceanic water cove/ bay close to kalpitiya and Mannar area. The Continental shelf is very narrow around Talawila and Kandakuliya headland reaching in as close as 5km. from shore. The continental slope is also very steep in the area causing a sudden drop off allowing most Whales and Marine mammals to stay in the safety of the deep oceans and make quick forays over the shelf to feed in shallower seas. the steep continental slope walls can be expected to cause up welling of nutrient rich waters and food resource which may be an additional attraction for the marine mammals to gather within the area. The resident pods of spinners have been tracked to keep close to the margin of the continental shelf in their movements while there seem to be a point of aggregation of many species of larger and more oceanic species about 12-15 km. off shore from the Kandakuliya headland. Some species like the Spotted and Striped Dolphins do not approach the shelf and are found in the deeper oceanic areas only. Beyond the Kudiramale headland and Battalangundu Island the continental shelf widens abruptly and joins with the Indian sub-continent causing a vast plateau of shallow seas expanding throughout the Palk-straight and extending past Jaffna and along the Eastern Sea board of India containing extensive sea grass beds, reef systems, and sand and mud floors that are Ideal habitats for coastal species of Marine mammals such as the Dugong, Humpbacked Dolphin and the Finless Porpoise.

Marine mammals Survey

The survey was conducted using 19ft FRP dinghies of the type generally utilized by the fishing industry for coastal fishing purposes. the boats powered by OBMs ranging from 15-25Hp are very sea worthy and are capable of ranging over 20 km. from shore and some times as much as 40km. from shore. The boats were the same type that was used for the community based whale watching activities in the area.

The survey was conducted over a period of 17 months and 30 survey excursions were carried out using both the orca boat and hired crafts from the community.

The survey aimed at establishing the diversity, abundance and general behavioral traits including migration feeding and presence of young in the marine mammals populations within the area.

The geographic area of the survey is expected to roughly correspond with the areas of sea utilized by the target communities engaged in marine mammal watching operations and a buffer area surrounding it where future activities could expand in to. The current area of operations includes coastline from Talawila to Uchchimune and sea ward to over the southern section of the Bar reef sanctuary and out to the sea to a distance of around 15km. or the area of continental shelf drop-off. Additional surveys were carried out within the kalpitiya lagoon area between the Kalpitiya town to Uchchimune and Gange-wadiya area.

Preliminary field data on marine mammal populations in Kalpitiya is limited with the only significant data available coming from two surveys. The survey carried out by Illangakoon and Broker for IUCN (B&I) focused on the outer area of the Bar-reef marine sanctuary and followed a pre set transect. The survey recorded 8 species of marine mammals within the sample area. The geographic area of the above survey overlaps a section of the northern most part of the current study area.

The voyage of the Odyssey documented marine mammals off the North western coastline including areas off the Kalpitiya peninsula but the survey focusing on Sperm whales carried out its sampling within the deep water zones staying between the 1000 -2000 m. bathymetric contour lines and in off shore regions of the present survey area. During the survey 3 species of marine mammals including Sperm whale, spotted Dolphin and Fraser's dolphins were recorded from the sea areas off Kalpitiya peninsula.

All species recorded in the Odyssey survey are animals with a off shore, deep water distribution.

The EIA report on the "Three Dimensional Seismic Surveys for Oil Exploration in Block SL-2007-01-001 in Gulf of Mannar" prepared by NARA compiles a list based on A. Illangakoon and A. de Vos's work which includes 15 species of Marine Mammals for the area. the record of *Megaptera novangliae* in the area is reportedly limited to audio encounters and visual sightings have been documented in the West coast of Sri Lanka. (A single photo documented record of the species exists in 2011 in the East coast about 200km. East of Trincomalee possibly within the EEZ of Sri Lanka. The species *Delphinus delphis*, *Peponocephala electra* and *Pseudorca crassidens* is only recorded for the area in the NARA report and we have not received any additional or anecdotal references to verify these records.

Several field trips were carried out using the same boats used for tourism operations within the study area operated by different local community members who engage in marine mammal watching activities. The local knowledge of the communities and tourists engaged in marine mammal watching were collected and verified for accuracy and reliability. The community boat crews were assessed for their skills in tracking marine mammals, boat craft, rapport and behavior in engaging marine mammal encounters.

The current survey documented a total of 11 species of marine mammals including 4 species not recorded by any of the previous surveys. These included, Bryde's Whale, Risso's Dolphin, Rough tooth-Dolphin and Finless Porpoise. The Killer Whale which was previously considered an extremely rare species in Sri Lankan waters is now considered not rare in the area with 5 or more records of the species within the last year.

Marine Mammal Species recorded from the area.

Species	English name	B&I	OD	NARA	ORCA
1. <i>Balaenoptera musculus</i>	Blue Whale	1		1	
2. <i>Balaenoptera acutorostrata</i>	Minkie Whale	1		1	
3. <i>Balaenoptera edeni</i>	Bryde's Whale				1
4. <i>Megaptera novangliae</i>	Humpback Whale			1	
5. <i>Physeter macrocephalus</i>	Sperm Whale	1	1	1	1
6. <i>Kogia simus</i>	Dwarf Sperm Whale	1		1	
7. <i>Orcinus orca</i>	Killer Whale			1	1
8. <i>Lagenodelphis hosei</i>	Fraser's Dolphin	1	1	1	1
9. <i>Pseudorca crassidens</i>	False Killer Whale			1	
10. <i>Peponocephala electra</i>	Melon Headed Whale			1	
11. <i>Steno bredanensis</i>	Rough-toothed Dolphin				1
12. <i>Stenella longirostris</i>	Spinner Dolphin	1		1	1
13. <i>Stenella attenuate</i>	Spotted Dolphin		1	1	
14. <i>Stenella coeruleoalba</i>	Striped Dolphin			1	1
15. <i>Grampus griseus</i>	Risso's Dolphin				1
16. <i>Tursiops truncatus</i>	Bottle-nosed Dolphin	1		1	
17. <i>Sousa chinensis</i>	Indo-pacific Hump-back dolphin	1		1	1
18. <i>Delphinus delphis</i>	Common Dolphin			1	
19. <i>Neophocaena phocaenoides</i>	Finless Porpoise				1
20. <i>Dugong dugong</i>	Dugong	1		1	1
Number of species recorded per report		9	3	16	11

*NARA report is not a study in itself but compiles data sets from A.Illangakoon's and A.de Vos's reports which primarily data from Odyssey survey work including other un-published material.

It is interesting to note that the commonest marine mammal species in the area the spinner dolphin was recorded by B & I within the Bar-reef marine sanctuary only during the months from September to February while during the present survey pods of spinners were commonly encountered close to the shore on the southern part of the survey area between Talawila and Kandakuliya throughout the year suggesting a resident population.

The Species

The survey included over 30 number of field excursions initiating from boat landings at Talawila, Kandakuliya, Kudawa on the coast and within the kalpitiya lagoon. Sampling included an area stretching from Norochhole in the South to Uchchimune area of the Bar-reef marine sanctuary in the North. and ranging from shore to a distance of aprox 15km. from shore. a few excursions were carried out to a distance of about 20km. from shore to document off shore fauna and additional surveys were carried out within the Kalpitiya lagoon from the Kalpitiya town to Gange-wadiya in the North.

currently there are 20 species of marine mammals from the Kalpitiya area

The Spinner Dolphin, *Stenella longirostris* formed the most common and frequently observed species of Marine Mammal in the area. from the current observations it seem that there is a resident pod of Spinner Dolphins inhabiting the continental shelf margin areas of the Kalpitiya between Norochhole and Southern reaches of the Bar-reef. the pod may be composed of up to about 2000 individuals which may break up into smaller clusters or join other visiting pods to form larger groups of about 5000 individuals occasionally. The species seem to approach close to the shore than other species and is regularly encountered within the area forming the back bone of the local marine tourism industry.



The Spinners are often found in association with the schools of Yellow fin Tuna- *Thunnus albacares* (*Kenda*) and as fishermen hunting the fish have for years been used to tracking the Dolphin pods to find the Tuna and fishing for them within the pod of Dolphins they are relatively used to the presence of boats.

Within large pods mothers with infants and young calves have been observed indicating that this is a breeding

population.



The Indo-Pacific Humpbacked Dolphin *Sousa chinensis*

occur primarily in the lagoon and in the near shore areas of Kalpitiya; it is reported to range occasionally South along the coast down to Talawila. The medium sized rather ungainly Dolphin is observed singly or in small groups of up to 5-6 individuals. the local animals tend to be more pinkish white in color as adults with some of the smaller individuals tending more towards mottled plumbeous gray.

The observations of Indo-Pacific Hump-back Dolphins almost offshore of Kalpitiya coast within the lagoon pushes their distribution much lower and deeper inside the Kalpitiya lagoon than previously documented

The species seem to be comfortable around boats and would approach a stopped boat very close.

Several observations of **Bryde's Whale *Balaenoptera edeni*** was made within the area during the survey. the medium sized baleen whale is a active swimmer that seem to move around in small tight groups of up to about 5 individuals. the smaller size, rather high dorsal fin, the sharper head and the habit of diving without raising the fluke help in identifying the species from the Blue whale. The species frequents seas about 12km, offshore but have been recorded closer near the Southern margin of the Bar- reef Marine sanctuary. Brydes whales have been observed actively feeding on fish shoals and among schools of Tuna in the kalpitiya area.



The Sperm Whale *Physeter macrocephalus*

Is a species of large whale frequently observed in the area. they seem to form loose groups of up to about 4-5 animals which tend to stay beyond the continental shelf and about 12km from shore, there is at least one record of them approaching the shore much closer to shore possibly coming as close as 4-5 km from shore.



Killer Whale *Orcinus orca*

Though for long considered extremely rare in Sri Lankan waters this enigmatic species is now considered a regular visitor to the area with multiple sightings each year. The Killer whales travel in small hunting parties that seem to foray in to coastal waters in pursuit of its prey the Spinner Dolphins. The local fishermen are quite familiar with the species and many of them had observed attacks by Killer Whales on spinner Dolphins.

Fraser's Dolphin *Lagenodelphis hosei*

The species was observed about 12-14 km. off Kandakuliya shore. The pod consisted of over a 1000 dolphins and is expected to be not common in the area.



Rough-tooth Dolphin *Steno bredanensis*

This species is extremely rare in Sri Lankan waters and had been only recorded based on skulls in old museum collections and few dead specimens observed in Fish landing sites. A single sighting of the



species was made by the survey team in April 2011 about 15km. offshore. The pod consisted of about 50 individuals and showed remarkable and rarely documented variation in color ranging from dark gray to almost white. The species were photo documented both above and below water.

Risso's Dolphin *Grampus griseus*

Several records of the species is available in the area and the fishermen are very familiar with the species indicating that this is a common species found in deeper seas beyond the shelf. the local name for the species "Aali Mulla" refers to its preference for deeper seas.

Striped Dolphin *Stenella coeruleoalba* and **Pan-tropical spotted Dolphin** *Stenella attenuata*

These two species are recorded in far offshore areas of kalpitiya about 20km. from shore and are reported to be common by the fishermen. the two oceanic dolphin species could form very large pods of over 2000 animals. The species is referred to as "*Dangara Mulla*" by the locals a name used for spinner Dolphins in other parts of the country. Thease species also associate with schools of Yellow fin Tuna.

Fin-less Porpoise *Neophocaena phocaenoides*

A record was documented of a small Beak-less and finless Dolphin caught in gillnets close to Battalangunduwa Island by fishermen. The description fits perfectly with the current species. This species is known in Sri Lankan waters from only one record of a specimen caught off Wedge bank in Mannar seas. the current record becomes the second record of the species in Sri Lanka and supports the distribution data for the species as of the North-western sea coast. The locals refer to this species as the "*Gira Mulla*"

Dugong *Dugong Dugong*

The area is the southernmost region of the distribution of the most elusive and endangered Marine Mammal in Sri Lanka the Dugong. The large slow moving herbivore occurs frequents the extensive sea grass beds of the Palk straight and range from Kalpitiya to Pooneryn and across the land bridge to Southern India. The meat of this species is in high demand among the locals, Though the species is extremely rare and sightings are almost nonexistent. the species is still being caught in Gill nets

deployed for fining and rarely hunted with harpoon or dynamite. Within the survey period at least 4 records of Dugong kills were recorded between Pooneryn and kalpitiya. It is also observed that fishermen report seeing 2 live individuals close to the navy check point close to the kalpitiya town.

False Killer Whale *Pseudorca crassidens*, **Melon headed Whale** *Peponocephala electra*

Despite being recorded in the NARA report no observations or anecdotal referenced from fishermen of the occurrence in the area of any species of blackfish could be ascertained. no further data is added in to this group during current survey.

The other species recorded for the area including the **Hump-back Whale, Minke Whale, Dwarf Sperm whale, Common Dolphin** and **Bottle nosed Dolphin** was not recorded within the survey period.

Patterns and Potential

Currently the bulk of the marine mammal watching tours seek out a single pod of spinner dolphins frequenting the shores between Talawila and Kandakuliya. The general observations indicated that during March-April where surveys were conducted the pod would travel north along the shore coming about 5 km. from shore at Talawila on most days. The pod would move along the shore and seem to stop at a point about 2 km. South of the southern end of Bar-reef and hang out there till past noon. The pod is known to contain over a 1000-2000 animals on some days and on others the pod seem to split in to smaller groups. Or conversely it may truly be several separate groups that aggregate on occasion. Most of the tour operators would aim to find this pod as it is the most reliable sighting which could be marketed to the tourist. On weekends there may be more than 10 boats ganging up on this pod simultaneously causing traffic and possibly stressing out the animals.

On the positive side the Dolphins are used to boats as traditionally the fishermen seek out and fish among the Spinner Dolphin Pods to hunt the Yellow fin Tuna that the Dolphins usually associate with.

The Spinner Dolphins seem to keep close to and follow the continental shelf margin in their movements while most other species seem to keep to about 10-15 km off shore in deeper waters. The spotted Dolphin and the Striped Dolphin are strictly found in deeper further off shore waters about 20km. from shore and beyond. The Dugong is recorded within the Kalpitiya lagoon, and in the shallow seas north of Kalpitiya but with no records of it venturing south of Uchchimune on the coast. the Indo-Pacific humpback Dolphin is found in the lagoon and in areas very close to the shore and seem to be recorded down to about the Talawila area occasionally. the Lagoon population seem to be found regularly within the Kalpitiya lagoon. The level of observations is currently insufficient and with additional observations it will be possible to map seasonality of occurrence to be able to predict species availability in the area and offer and market specialized marine mammal tours and options to cater for special interest groups.

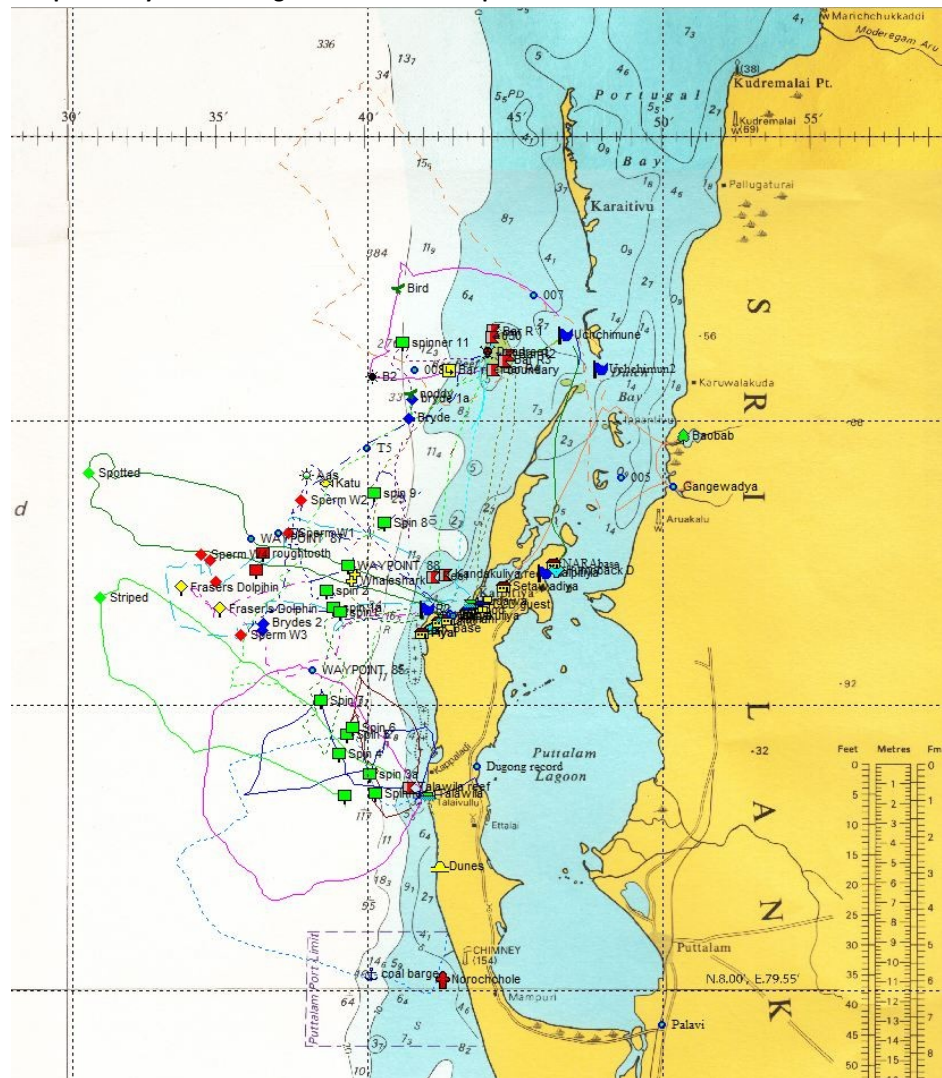
This will also reduce the pressure on the single pod of spinner dolphins as well as increase the financial benefits to the community.

Observations of other marine fauna.

In addition to the marine mammals observations were made of other marine fauna during the survey. These include many species of sea birds including turns, Gulls, shearwaters, petrels etc. including the first record in Sri Lankan waters of the Persian Shearwater (*Puffinus persicus*) observed about 12 km. east of Uchchimune point. other highlights include Whale sharks, Sea snakes (*Enhydryna schistosa*) , Olive Riddley Sea turtles etc.



Sample survey track tracings with locations of species observed



Monitoring and training of Marine Mammal tourism community

As a bonus the team carried out several traverses using the local tour boats and used local tour operators as boat men in all surveys. this allowed the team to engage the boatmen and monitor the techniques used by them in tracking, approaching and managing the encounters with the Marine Mammals. The opportunity was also used to educate and train them on best practices and general information and Identification of Marine mammals.

On a general note the local community based boat-operators followed Ideal methods in dealing with the Marine mammals exception being when many boats would aggregate on a single pod of Dolphins or a single Whale where the competition for best position often driven by the visitors caused them to break guide lines.

Concerns and recommendations

Based on current observations Most of the Marine mammal watching operations are carried out focused on a single pod of Dolphins resident around the shelf edge area in Kalpitiya. There is a need to broad base the operations and dissipate the stress of the aggregation of tour boats over a wide ocean area and over many dolphin/Whale watching opportunities. While significant data is already available more surveys need to be conducted to identify other marine mammal watching opportunities that provide reliable and quality observation opportunities for visitors to be able to predict locations and seasons of and market occurrence of other species of Marine mammals in the area. There was a need to improve the interpretation potential of the tour guides and also expand the visitor experience from marine mammal watching to include other aspects of marine wildlife including sea birds, turtles and snakes etc. A tour guide training activity was conducted in association with the SLTDA in July 2011 to facilitate this need. The data collected from the current survey provided a strong set of base line data that need to be further expanded to be able to provide a more complete picture of occurrence patterns and seasonality to be able to better predict and utilize marine mammal populations of the area in a more sustainable manner.

The need to bring in a code of conduct and a set of best practices to minimize the adverse impacts of the marine mammal watching tourism on the Dolphins and Whales is strongly felt. The delays in authorities establishing a legally required code is a set back and we can only promote a set of “Best Practices” without no binding need to comply. Trough project activity both hands on and lecture based training was provided to raise the awareness and skills to train the tour operators and to organize the community to be able to manage the industry and benefit by it while stressing the importance of ensuring the sustenance of the trade in the long term.

The community operator group coordination need to be improved to be able to have a consensus management of resource based on an agreed set of guide lines where self regulation within the members themselves will ensure the enforcement of best practices. Assistance and support of the

relevant agencies must be ensured to manage the resource including DWLC, Navy, Coast guard etc is essential to ensuring good management of the resource.

Coral reef survey



The coast line north of Talawila contain a series of discontinuous reefs past Kandakuliya, The Bar-reef and extending through Silawathurei, Vankalei, Pearl banks and presumed to extent to the islands in Jaffna. Unlike the southern reef most of these reefs are located on elevated sub-marine ridges set off from the shore. The reefs north of Kalpitiya Bar-reef has not been studied or documented except bare minimally within the recent times due to the war situation that persisted. many of these reefs are believed to be in good states of preservation based on the available information from local divers.

The coral reefs along the shores of the Kalpitiya peninsula were severely affected by the 1998 coral bleaching event and suffered severe coral mortality. The live coral cover on the Bar-reef was reduced to about 5% of the substrates. Despite the setback some sections of the bar-reef show a remarkable level of regeneration with some patch reefs regaining over 80% coral cover. Though significant recovery has been made in achieving a high percentage of live coral to non coral substrates on the reef the reefs are in an immature state as they are mostly extensive mono-typic strands of corals with a reduced diversity of faunal communities. The reefs have also undergone a major change in dominant reef structure from a Staghorn coral dominated environment to a table coral dominated environment.

The Talawila reef shows some recovery specially with massive, sub-massive, encrusting and foliaceous types of coral the fast growing *Acropora* species of the Bar-reef is rare on this reef the live coral cover is estimated to be about 20% the reef is subject to significant human impacts.

The Kandakuliya reef is in a very poor state with live coral cover less than 5% of the substrates.

It was proposed to conduct a significant study of the reef as part of the survey with the purview of proposing a management plan to DWC and other authorities as the reef was already being utilized by the marine tourism industry, which was offering tours for whale watching as well as the bar-reef.

Despite securing the permission from defense ministry to carry out surveys throughout the North western Sea board, it was not possible to secure the necessary clearance from DWC to carry out the survey. hence the study was limited to general visits and swims and recording visual observations of the status of the reef threats and the trends of use by the tourism community. It had been informed that NARA had taken up the responsibility of preparation of a detailed management plan for tourism of the area.

The post 1998 coral mortality event had caused massive death of coral areas with total reported live coral cover reduced to about 5% of substrates. at present most of the observed reef areas remain dead with heavy overgrowth of mixed algae.

In several reef patches the coral cover had made a remarkable recovery with some areas showing almost 100% substrate cover of live coral documented. The recovered sections of the Bar reef show a dominance of table forming *Acropora* species while the pre-1998 dominant *A. formosa* was not observed.

Bar-reef marine Sanctuary.

The Bar-reef consists of an assemblage of numerous coral “patch” reefs located over a raised sub marine ridge 2-6 km. offshore off Kalpitiya peninsula close to Uchchimune and the lagoon outflow. The reef areas range from very shallow tidally exposing reef crests to a depth of about 10 m. area also contain an extensive system of deeper sandstone reefs within the area ranging from 10-30 m. in depth.



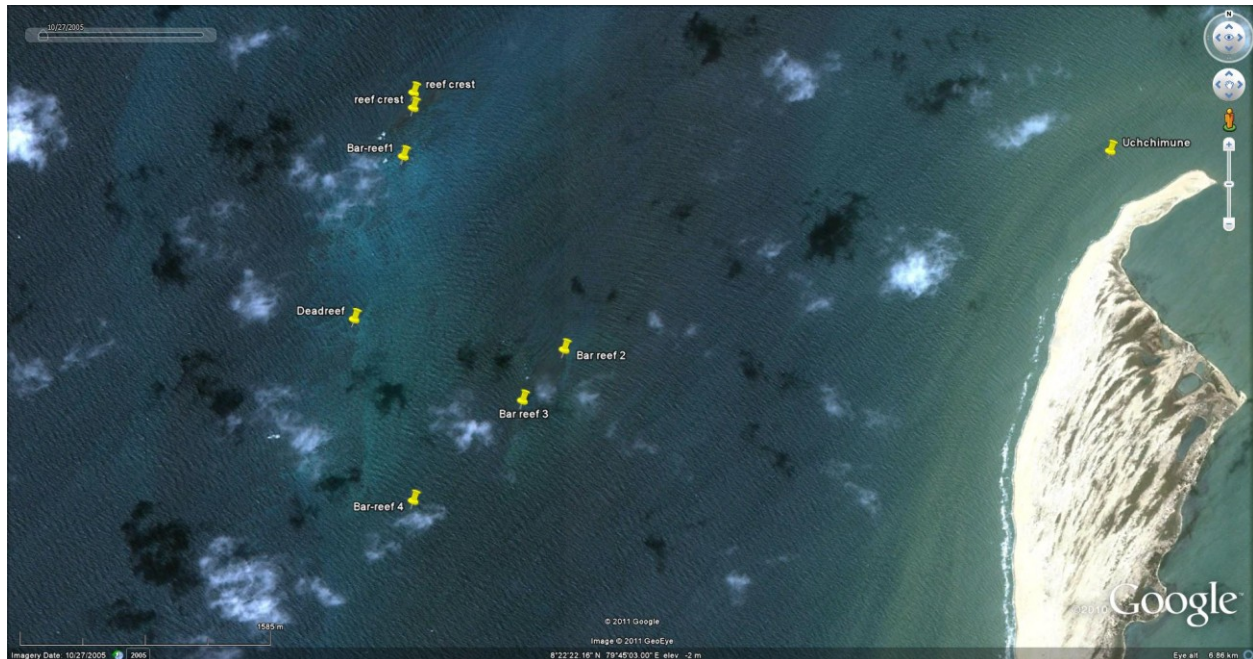
The extent of the Bar-reef Marine Sanctuary is 306.7 km². between its demarcated boundaries, The extent of the true coral area is about 25 km². and about another 50 km². contain scattered coral patches. The rest of the area consists of sandstone reefs and is a buffer zone around the reefs. (Rajasuriya)

Bar reef was declared a marine sanctuary under the fauna and flora protection ordinance in 1992 by the DWLC.

The Bar- reef was among the best coral reefs in the country with very high live coral cover and bio-diversity. The reef was severely affected by the 1998

coral bleaching event reducing the live coral cover to about 5%.

A decade after some sections of the reef show remarkable recovery with 80- near 100% live coral cover over some patch reefs within the Bar-reef complex. Though the corals have regained the sea substrates significant changes have occurred on the reef. The most profound of them being the almost complete replacement of the pre 1998 dominant Staghorn coral species by table forming *Acropora* species of Coral. The faunal assemblages seem still immature and the dominance of very large monotypic habitats tend to restrict diversity of the species observed on the reef.



There are a large number of discontinuous patch reefs scattered throughout the area which are in different states of restoration. there is no published data available to the restoration status of the reef that can be used to map out the current management needs. The preliminary surveys indicate that despite some reef patches have regained near 100% live coral over the overall pattern of recovery may not be significant throughout the reef. As the human impacts are comparatively low over the whole reef area the difference in recovery is mainly due to the density of surviving coral clusters that would affect re-colonization of habitats. No evidence was found of any large planktonic recruitment events taking place over the reef, though this would be inevitable in near future if the recovered sections of the reef is left intact for several more years.

Many snorkel dives were carried out at the bar-reef including about 2-2.5km. of diver tows to sample large areas of reef surface. with the available information it is clear that the restoration of the Ba-reef is patchy and highly variable ranging from 0%- almost 100%, Good coral areas were located on two general areas. at about 4.8 km. west of Uchchimune point on a long reef patch that forms a elevated inter-tidal reef crest running diagonal to the shore. the ridge is about 350m. long and 150m. wide with other smaller patch reefs extending up to 450m. from the crest. the area is dominated by table *Acropora* types and was in very good condition in 2010. it is now showing signs of degradation and increasing incidence of invasive species. The tour boats prefer to take visitors to this site and let them off the boats as the

area is shallow. this in turn lead to significant damage to the reef from coral trampling as significant number of the people entering the water are not skilled in swimming or snorkeling and opt to walk on the reef. the area also support a population of Black tip-reef sharks.

A second section of good coral is found about 1.6 km. South East of the reef crest zone and stretching diagonally to shore in a series of intermittent patch reefs to a point about 2.3 km. South of the reef crest zone. This reef is more extensive and is generally located deeper than the reef crest zone with an average depth of about 2m. If tourism is allowed on the BarOreef it is preferable to use this section of the reef as the areas where people could stand and break coral is minimal and if alighting is only allowed for snorkelers and divers the damage could be minimal and tourism could be carried out sustainably.

There is also the possibility of an intervention to replant corals in to the low density areas to affect faster re-colonization as the fully recovered areas have reached a state where there is no more room for expansion on the raised reef areas and the competition for space has become heavy between species of coral. There is a risk here that could also lead to the more successful species out competing and evicting the less competitive species over the reef areas in the process reducing both the species and habitat diversity of the reef. As the well grown reef areas consist of very fast growing species they have excellent capacity to provide live coral material to replant other reef areas with no impact to donor site. With the current trends in tourism and bad fishery practices there is already an abundance of broken coral units observed on the reef that can be used to replant and restore other reef patches that have low natural regeneration potential.

The reef shows damage from explosive fishing even over the best of the coral areas including recent activity. The team also found fresh dead fish left over on the reef that the blast would have occurred not more than hours before. The area is subject to bottom set nets and the dreaded Lila net. There are previous records of moxy net use and ornamental fish collection on the reef. The prevalence of this could not be established at the present. The harmful leila nets are also reportedly used on occasion close to the reef.

The reef also shows signs of invasive reef organisms affecting the reef and impacting live coral areas. The most significant of these was the occurrence of Algae *Halimeda* on the reef crest areas where tour boats land snorkelers' in regularly. As the prevalence of this algae in other areas of the reef was not observed it cannot be ruled out that there may be correlation between the prevalence of algae and petrochemical pollution of water by boat engine exhaust. The good coral areas are surrounded with large number of dead reef areas with almost 100% over growth of Algae. these can be potential threats as any trigger can assist them to spread in to the good coral areas with ease.

The tourist pressure on this reef is increasing rapidly focusing mainly on the shallower reef crest areas. And spreading to other slightly deeper areas by snorkelers. A management effort is urgently needed to keep visitor pressure in check and to prevent degradation of the critical sections of the reef. A

Kandakuliya reef

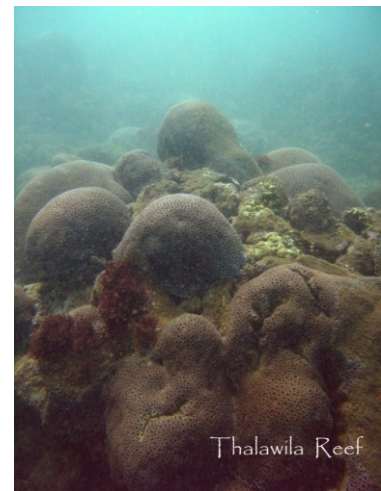


This reef shows the least level of recovery from the 1998 event. Though only limited sections could be checked on the preliminary survey of the area the area seem to contain less than 5% live coral and is dominated by algae.

Talawila reef

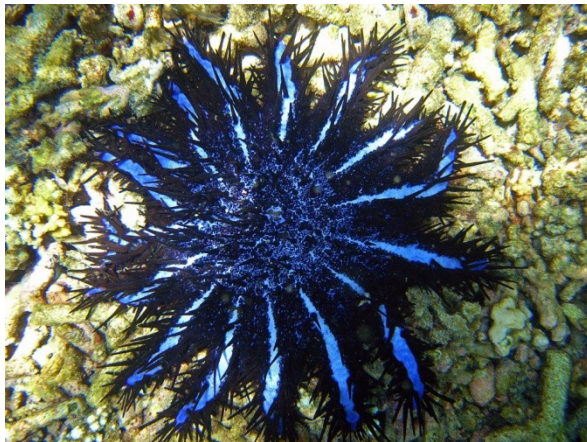
This reef shows a moderate level of recovery with about 20-30% live coral cover in sections of the reef. with massive, sub-massive, encrusting and foliaceous types of coral the fast growing *Acropora* species of the Bar-reef is rare on this reef. The reef is located about a km. off the boat landing at Talawila is located

The close proximity of the reef to the Talawila beach may allow some level of glass bottom boat use at the site, most reef areas are at about 1.5-3 m. depth and could be at a level that will prevent boat damage on the reef. The larger fishing boats heading out to sea regularly ply over the reef and the risk from a managed glass boat operation may not be significant.



Concerns and recommendations

Though many reef systems occur within the area only certain sections of the Bar-reef complex show good levels of restoration. these reefs have at the present time become nationally important reef areas for conservation of coral resources in Sri Lanka post to the 1998 coral bleaching event.



Within the restrictions imposed by the Navy during the war the reefs were spared the effects of human abuse on the Bar-reef complex allowing the reef to regenerate effectively. With the opening up of the area post to the war; a trend has emerged where many boats taking tourists on MM tours would take them to the Bar-reef as an additional attraction. The tourism focuses on the shallowest sections of the reef that form a semi-tidal reef crest. The average depth on this site ranges from less than a meter to

about 3 m. depth. The area is also one of the best recovering areas of the reef. The reef crest contain areas of abundant coral but conversely may consist of large areas where non-coral substrates are rare where a swimmer may safely stand up.

The current situation of the reef is that in reef patches where good coral cover is present it had already reached close to substrate saturation preventing further lateral growth and excessive competition among coral for space on the reef. while on adjoining reef patches the coral cover would be near zero with very low potential for natural recovery. This presents an Ideal situation where a planned coral restoration activity could be very beneficial as the saturated coral environments can easily provide donor material with minimal and fast recoverable impacts on donor sites with the removed coral to be replanted on selected dead reefs with human intervention to prepare the reef to reduce competition from algae and other invasive for the new recruits.

The team could not carry out the proposed extensive survey to facilitate the management plan due to delays caused by confusions caused by SLNF staff. and problems in securing permissions from the DWC. currently NARA has indicated that they will carry out the survey and prepare the tourism management plan.

The visitation to this reef need to be heavily regulated to ensure safety of the visitors and to preserve the regeneration potential of the reef.

1. re-map the status of reef areas in the present context with mini-zonation of areas must be set up within the broader Marine sanctuary boundaries.
2. A zonation plan must be introduced, demarcated and enforced to ensure that the Sensitive areas are protected from human use. Separate visitor areas can be allowed based on a compromise solution between conservation needs and visitor needs. NARA has undertaken this responsibility
3. Safe mooring points for boats must be established on the reef to prevent anchor damage on the reef.
4. If large numbers of boats congregate on the reef a system may need to be devised to keep the boats out of the main reef areas to prevent excessive pollution of the water from boat engine exhaust.
5. People entering the water must be strictly restricted to good snorkelers or divers capable of maintaining position in the water without undue need to stand up on the reef. The less experienced snorkelers' and swimmers can cause significant trampling damage on the reef.
6. Safety procedures must be enforced keeping well in mind that the reef is located on a exposed ridge over 4km. away from the nearest shore line and the possibility of freak waves washing off un-suspecting visitors away with little chance of finding way back ashore if not recovered by

boat.

7. The number of snorkelers from each boats must be limited and the boat crew must be vigilant of each individual and be responsible for them.
8. Boats deploying divers/ snorkelers' must have the necessary safety facilities including ladder, throw ring and a member capable of executing a rescue in an emergency.
9. Provision of special snorkeling safety vests must be considered for visitors entering the water which could be low inflated for general swimming with a safety inflation system for full floatation in an emergency. The normal life vests if used in the reef environment can cause damage to the reef as the buoyancy of the life vest is designed to keep the wearer in a vertical position forcing him to regularly step on the coral the vertical position will also restrict the wearers ability to observe the reef with a dive mask.
10. The reef contain potentially dangerous marine animals and the visitors must be made aware of the risks to avoid an accident either by direct contact with a dangerous sea animal or by panic reaction putting the individual in danger.
11. Deeper reef sections could be opened out for SCUBA divers based on a management plan for the area.
12. It is not recommended to initiate glass bottom boats at the site as the distance from the shore and the possibility of encountering rough seas could compromise the inherent weak construction of a glass hulled boat.
13. Enforcement of regulations must be ensured with the authority of the DWLC, Coast guard and the SL Navy with the participation of the community members to ensure that the resource is not compromised.
14. Where necessary training and strengthening must be promoted to enable the relevant enforcing agencies to maintain patrol of the reef areas and manage tourist activities.
15. The Initiation of a active Coral reef restoration program would greatly increase the survival potential and expansion of live coral areas at Kalpitiya.
16. reef keeping activities must be initiated to reduce impacts of visitors and fishermen on the reef.

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