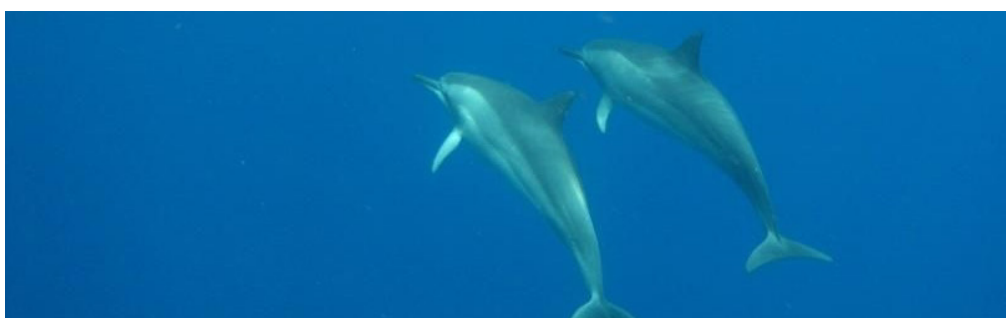


Cetaceans of Saba, Sint Eustatius & Sint Maarten: current knowledge and future monitoring

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Summary

In December 2012 IMARES conducted workshops on the identification of whales & dolphins in the Caribbean on the islands of Sint Maarten, Saba and Sint Eustatius. Apart from giving the workshops, on-going cetacean projects, future monitoring needs and possibilities for extending monitoring projects were discussed together with the staff of the marine parks, government representatives and other local stakeholders, as well as with international research groups active in the Caribbean.

This report gives an overview of the occurrence of cetaceans in Saba, Sint Eustatius and Sint Maarten and describes the results of the cetacean identification workshops and the considerations with the local stakeholders. It also provides examples of existing on-going monitoring projects and an overview of research approaches that could be implemented on a local scale, or on a larger (national and international) scale in the future.

One of the main priorities is to identify the monitoring needs for cetacean occurrence in the Dutch Caribbean, and to determine the most adequate monitoring methods. Current projects of cetacean monitoring (in particular on a local scale around the islands) should be further coordinated and extended where needed. At the same time efforts to participate in trans-boundary projects, such as larger scale international surveys or acoustic monitoring should be continued and extended. Finally, designing of specific risk assessment for cetaceans in the Dutch Caribbean waters would be advisable for the future.

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1. Introduction

In 2008, the Specially Protected Areas and Wildlife (SPAW) Protocol of the Convention for the protection and development of the marine environment of the Wider Caribbean (Cartagena Convention), the legal instrument of the Regional Seas Programme for the Caribbean of the United Nations Environment Programme (UNEP), adopted an Action Plan for the Conservation of Marine Mammals (MMAP) in the Wider Caribbean region. The main objective of the MMAP is to assist participating governments in the region in their efforts to develop and improve marine mammal conservation policies and practices. On 10 October, 2010, within the Dutch kingdom, Saba, Sint Eustatius and Bonaire have become special overseas municipalities, while Curaçao and Sint Maarten have become new autonomous overseas entities. The ultimate responsibility for the sustainable management and conservation of the marine biodiversity in the EEZ of Saba, Sint Eustatius and Bonaire, as well as the territorial waters of these islands now lies with the Ministry Economic Affairs of the Netherlands (EZ). In preparation for this expanded responsibility this ministry has been developing a management plan for the EEZ of the so-called Dutch Caribbean in consultation with all six Dutch Caribbean islands (Meesters *et al.* 2010).

In accordance with existing marine mammal sanctuaries in the Caribbean of the USA (adjoining waters of Puerto Rico and the U.S. Virgin Islands to the west of the windward Dutch EEZ), the Dominican Republic and France (AGOA, named after “Maï Agoa”, “Spirit of the sea” in the American Indians culture), the Dutch government is also in the process of designating a whale sanctuary (in the waters of Saba, St. Eustatius and Bonaire).

Debrot *et al.* (2011a) have described the need for dedicated and/or consistent marine mammal research efforts in the Dutch Caribbean. These efforts should focus on large scale, transboundary international survey efforts, as well as the improvement, expansion and coordination of local monitoring schemes. Several recent research projects have made important steps towards increasing our knowledge on cetaceans in the region. In October 2011, Lucke *et al.* (in prep.) have deployed a noise logger north-east of Saba Bank to record cetaceans. After being adrift for a while the device was found in Puerto Rico and has been safely returned for data analyses. Additionally, in October 2012, IMARES participated in the visual and acoustic monitoring surveys conducted by the French in the AGOA sanctuary, as well as in Dutch Caribbean waters.

In December 2012, IMARES conducted workshops on the identification of whales & dolphins in the Caribbean on the islands of Sint Maarten, Saba and Sint Eustatius. Apart from giving the workshops, on-going cetacean projects, future monitoring needs and possibilities for extending monitoring projects were discussed together with the staff of the marine parks, government representatives and other local stakeholders on the islands, as well as with international research groups active in the Caribbean.

The results of this work, as well as some previous efforts, are described in the following chapters of this report:

- Current knowledge on the occurrence of cetaceans in Saba, Sint Eustatius and Sint Maarten.
- Results of cetacean identification workshops on Saba, Sint Eustatius and Sint Maarten
- Examples of existing local monitoring projects
- Research approaches that could be / are implemented and/or incorporated into existing monitoring programs (national and international)
- Conclusions and outlook on what is needed in the future
- Annexes with guidelines for different monitoring techniques

2. Current knowledge on the occurrence of cetaceans in the waters of Saba, Sint Eustatius and Sint Maarten

At least 30 cetacean species occur in the Wider Caribbean area, mainly based on data of stranding events (Debrot et al. 2011b). For many of these species, the waters of the region serve as primary habitat for critical activities that include feeding, mating and calving. Although some species have been studied extensively elsewhere, data concerning the biology, life history, distribution and behaviour of most marine mammal populations in the Caribbean Sea remain sparse.

The International Fund for Animal Welfare (IFAW) has conducted research in the Eastern Caribbean during spring in 1995, 1996, 2000 and 2006. They used dedicated passive acoustic and visual surveys to investigate the distribution of cetaceans and encountered 15 different species (Boisseau et al. 2006). They conclude that due to the absence of survey data for much of the region and considering the long history of exploitation of some near-shore populations, there is much uncertainty regarding population structure, abundance and status, especially for small cetaceans in this area.

In the AGOA sanctuary in French waters and intermediate Dutch waters around St. Maarten, Saba and St. Eustatius several surveys have been conducted by the French in 2011 and 2012.

Debrot et al. (in press) reviewed the occurrence of cetaceans in the Dutch Caribbean of the islands of Saba, Sint Eustatius and Sint Maarten. The review includes both visual records and strandings until 2010 (table 1). The most frequently reported species is the Humpback whale (*Megaptera novaeangliae*). This species uses the north-eastern Caribbean as breeding areas and primarily occurs between November and May (Mignucci-Giannoni 1998). Sperm whales (*Physeter macrocephalus*) are the second large whale most commonly recorded (Figure 1). They normally occur in deeper waters and seem to have a seasonal occurrence with most records from October to March (Mignucci-Giannoni 1998). One beaked whale species, Cuvier's beaked whale (*Ziphius cavirostris*), has been identified from a strandings record. This species would normally occur in deeper waters and due to its prolonged dives and inconspicuous behaviour at the surface might be difficult to observe at sea. The Short-finned pilot whale (*Globicephala macrorhynchus*) has been reported numerous times from sightings for areas both to the west and east to Guadeloupe (Boisseau et al. 2006), as well as the nearby Anegada Passage (Mignucci-Giannoni 1998), Anguilla and Antigua (Mignucci-Giannoni 1996). For the Dutch Windward islands it has been confirmed on several occasions, the most recent being in 2011 where a stranding of three pilot whales was documented on Sint Eustatius (pers. comment Anna Maitz). The most common dolphin species in the area are probably the Long-snouted spinner dolphin (*Stenella longirostris*) (Figure 2) and the Bottlenose dolphin (*Tursiops truncatus*), both of which have been documented by sightings. Additionally to these identified species, several observations of unidentified dolphins have been made.

Based on the knowledge of the surrounding waters it is most likely that more species can (potentially) be found in the waters of Saba, Sint Eustatius and Sint Maarten. These include: Clymene's dolphin (*Stenella clymene*), Striped dolphin (*Stenella coeruleoalba*), Atlantic spotted dolphin (*Stenella frontalis*), Pan-tropical spotted dolphin (*Stenella attenuata*), Fraser's dolphin (*Lagenodelphis hosei*), Risso's dolphin (*Grampus griseus*), Orca (*Orcinus orca*), Rough-toothed dolphin (*Steno bredanensis*), Pygmy sperm whale (*Kogia breviceps*), Dwarf Sperm Whale (*Kogia simus*), Minke whale (*Balaenoptera acutorostrata*) and larger baleen whale species such as the Bryde's whale (*Balaenoptera edeni*), Sei whale (*Balaenoptera borealis*) and Fin whale (*Balaenoptera physalus*) (Debrot et al. in press).

It seems that strandings in this area are more rare, thus most records are based on sightings. Debrot et al. (in press) conclude that more dedicated efforts are needed to better document and understand cetacean species composition in this area. Even with the current knowledge being limited, it is clear that some species occur regularly in this area.



Figure 1. Sperm whale between Curacao and Bonaire (Royal Dutch Marines).



Figure 2. Long-snouted Spinner dolphin near Sint Eustatius (T. Bervoets).

Table 1: Overview of documented marine mammal records for Saba, Saba Bank, St. Eustatius and St. Maarten. Adapted from Debrot et al. 2011b (this data is based on records collected up to 2010; we updated this with information on: one stranding record from Short-finned pilot whales in 2011 and one likely visual observation in 2012 on Sint Eustatius* (STENAPA), one record of Killer whales sighted around Saba several decades ago** (Saba Conservation Foundation), and likely Spinner dolphins sighted around Saba in 2012*** (Saba Conservation Foundation). ¹Furthermore we added Minke Whale in the table; the presence of this species on Saba Bank will be determined from analysis of acoustic data from a popup that was deployed from October 2011-April 2012). ? = possibly present; S = stranded or found dead; V = (visual) sighted alive; B = stranded and visual record

Species	Scientific name	Saba / Saba bank	Sint Eustatius	Sint Maarten
Fin Whale	<i>Balaenoptera physalus</i>	?	?	?
Sei Whale	<i>Balaenoptera borealis</i>	?	?	?
Bryde's Whale	<i>Balaenoptera edeni</i>	?	?	?
Minke Whale ¹	<i>Balaenoptera acutorostrata</i>	?	?	?
Humpback Whale	<i>Megaptera novaeangliae</i>	V	V	V
Sperm Whale	<i>Physeter macrocephalus</i>	V	?	V
Pygmy sperm whale	<i>Kogia breviceps</i>	?	?	?
Dwarf sperm whale	<i>Kogia simus</i>	?	?	?
Cuvier's beaked whale	<i>Ziphius cavirostris</i>	-	-	S
Blainville's beaked whale	<i>Mesoplodon densirostris</i>	?	?	?
Gervais' Beaked whale	<i>Mesoplodon europaeus</i>	?	?	?
Killer Whale	<i>Orcinus orca</i>	V**	?	?
Short-finned pilot whale	<i>Globicephala macrorhynchus</i>	V	B*	S
False killer whale	<i>Pseudorca crassidens</i>	?	?	?
Pygmy killer whale	<i>Feresa attenuata</i>	?	?	?
Melonheaded whale	<i>Peponocephala electra</i>	?	?	?
Unidentified dolphin		V	V	V
Rough Toothed dolphin	<i>Steno bredanensis</i>	?	?	?
Risso's dolphin	<i>Grampus griseus</i>	?	?	?
Bottlenose dolphin	<i>Tursiops truncatus</i>	V	V	V
Pantropical spotted dolphin	<i>Stenella attenuata</i>	?	?	?
Atlantic spotted dolphin	<i>Stenella frontalis</i>	?	?	?
Spinner dolphin	<i>Stenella longirostris</i>	V?	V	V
Clymene Dolphin	<i>Stenella clymene</i>	?	?	?
Striped dolphin	<i>Stenella coarctata</i>	?	?	?
Long beaked common dolphin	<i>Delphinus capensis</i>	?	?	?
Fraser Dolphin	<i>Lagenodelphis hosei</i>	?	?	?

3. Cetacean identification workshops

Three workshops were held, providing an introduction to cetaceans, their identification and an overview on how to recognize local species. We are especially thankful for workshop material that was provided by IFAW (International Fund of Animal Welfare). This included laminated species guides in English and French as well as some educational material for children.

3.1 Sint Maarten, December 3rd 2012, Workshop on Sint Maarten at Nature Foundation Office

Attendants from Sint Maarten Nature Foundation, Dive operators from Saint Martin, SCCN Curacao

Main results from the discussions:

- Improve the communication between different groups and individuals interested in whales & dolphins in the Caribbean
- Organize the collection of Caribbean humpback whale photos (not just flukes, but mainly dorsal fins)
- Make a Facebook page to facilitate exchange of ideas and photos
- Nature Foundation boat would be available for research projects, such as genetic sampling of Humpback whales and acoustic monitoring.



Figure 3. View from potential observation point Sulphur Mine, Saba (M. Scheidat).



Figure 4. View from potential observation point Kelbey's ridge, Saba (S. Geelhoed).

3.2 Saba, December 4th to 7th 2012, Workshop held at Juliana's hotel (Dec. 5th)

Attendants from Saba Conservation Foundation Marine Park, interested locals, dive operators from Saba.

Main results from the discussions:

- Update the existing sighting protocol for sightings from land to use in the educational program with children
- Consider a more effort corrected land-based sighting scheme
- Investigated two potential observation points (Sulphur mine and above airport on Kelbey's Ridge) to collect visual observations of cetaceans, with Sulphur mine being more difficult to

reach but a wider view. Height of the spots is about 150m for Sulphur's mine (Figure 3) and 160m for Kelbey's Ridge (Figure 4). On both spots it would be possible to put an angle board and a tripod for binoculars.

- Discussion on the selection of species in the species identification guide, how useful is the guide, how is it used and how could it be improved
- Idea on using an iphone app to enter sightings online
- Idea to use hydrophones from boats (Saba Conservation Foundation or dive operators) with a standardized protocol (e.g. note down time listening and position and if whale was heard yes / no).
- Update sighting protocol for sightings from vessels of opportunity (ships dive operators, ferries)
- Importance if such project take place that feedback is given to the people involved, this includes the sending of the reports or any publications that come out of any work done on Saba; also it has to be very clear who will do what work

3.3 Sint Eustatius, December 8th to 11th, Workshop held at the STENAPA office (Dec. 9th)

Attendants from STENAPA (St Eustatius National Parks), dive operators from Sint Eustatius, interested locals, NuStar Terminals

Main results of the discussions:

- Interest in getting guidelines on how to do photo-identification of whales and dolphins
- Idea to put photos etc. on facebook or have a dropbox for such information to facilitate sharing
- Looked at footage from dive operators and at STENAPA of humpback whales, spinner dolphins and stranded pilot whales
- A new record for the stranding (and probable sighting) of short-finned pilot whales for Sint Eustatius
- Investigated three potential observation points: Batterij de Windt on the south-west side of Sint Eustatius (Figure 5), Botanical Garden on the south-east side of Sint Eustatius (Figure 6), and Great Bay at the east-side (Figure 7).



Figure 5. View from potential observation point Batterij De Windt, Sint Eustatius (S. Geelhoed).



Figure 6. View from potential observation point Botanical garden, Sint Eustatius (S. Geelhoed).



Figure 7. View from potential observation point Great bay, Sint Eustatius (S. Geelhoed).

3.4 Resulting actions:

- Made new protocols for land-based observations for Statia & photo-id guide (see annex A and B)
- Assembled acoustic recording sets for hand-held hydrophones and developed acoustic protocol (see annex C)
- made contact with AGOA organisers to discuss future options for cooperation and sharing of data

4. Examples of existing monitoring projects

4.1 Registration of cetacean sightings by the fishermen on Saba

Background & Method

This monitoring project was developed by extending the current sampling of fishing effort and catches of the Saba fishermen conducted by IMARES (M. de Graaf in lit). In this study 8 fishermen active on Saba, mainly Saba Bank, were interviewed when entering the port and they report in which of the 20 quadrants (Figure 8) they have fished. Since 10th of July 2012 an additional question was added to the interviews, asking the fishermen if dolphins or whales were sighted and if yes in which area. Fishermen were provided with a laminated guide of the most common cetaceans in the area to aide in identification of species.

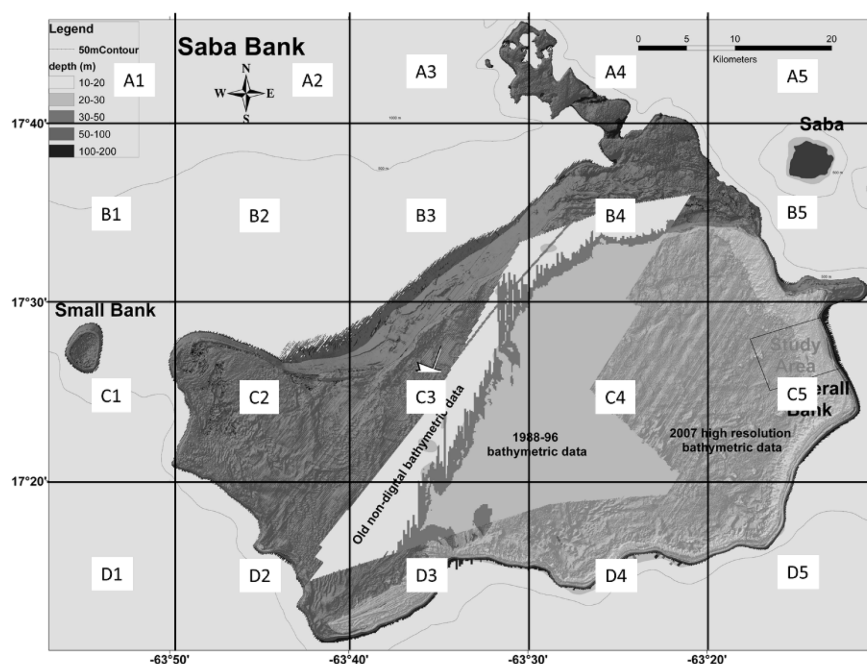


Figure 8. Study area with the 20 quadrants around the island of Saba.

Results

Effort

For this report the time period from 10th of July 2012 to 23rd of November 2012 were analysed. During 85 of these 137 days at least one of the eight fishermen was fishing in the area. Effort for this analysis is measured by the frequency each of the 20 quadrants is visited by the interviewed fishermen. This differs greatly between quadrants. During the study time 14 of the quadrants were visited a total of 264 times. The highest number of visits were in the eastern part of the Saba bank, in areas B3, B4, B5 and C3, C4, C5 (Figure 9).

Effort varied between months, with the highest effort in September (70 quadrant visits) and October (68 visits) (however, both July and November were not complete for analyses) (Figure 9).

Effort between the eight vessels was also not uniform, ranging from the lowest of 14 to the highest of 50 in the study time (average 33).

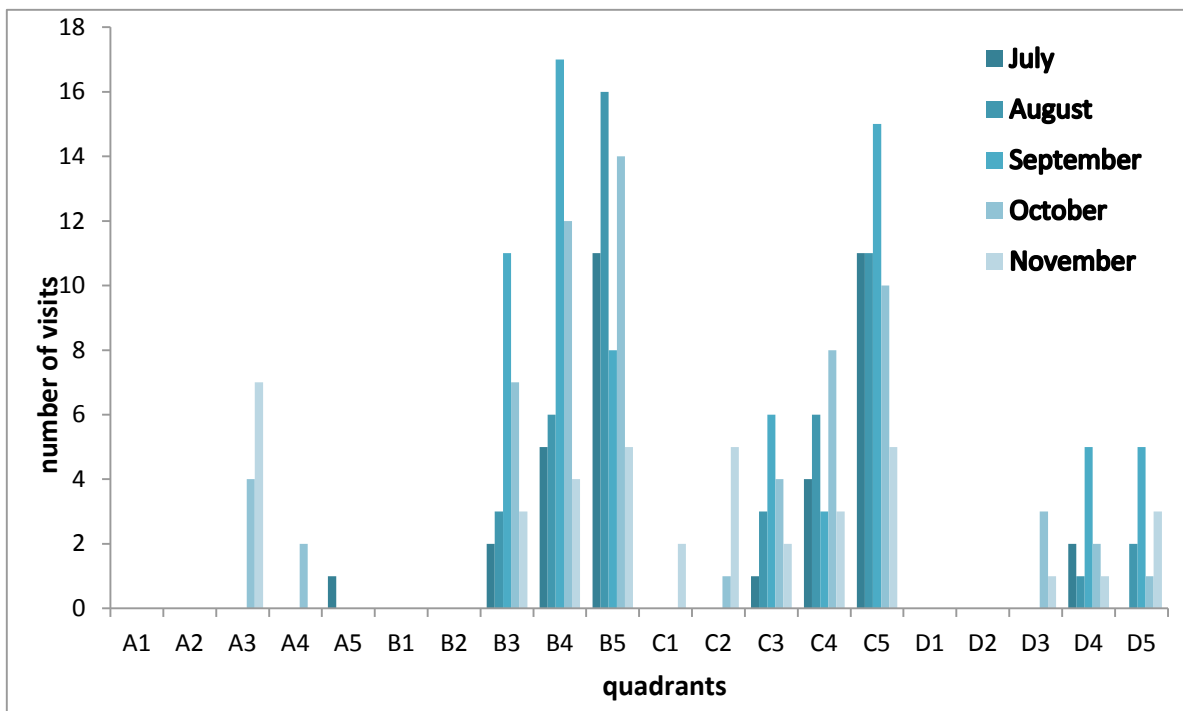


Figure 9. Overview of fishing effort (number of visits per quadrant per month) in the different quadrants over the study time (10th July to 23rd November 2012)

Cetacean sightings

During the study time all eight vessels have had a minimum of one and a maximum of four cetacean sightings in the study period. 20 dolphin sightings were registered, totalling 287 dolphins. Additionally two sightings of single humpback whales were made (both in quadrant A4). Four dolphin sightings were identified as bottlenose dolphins, two were described as dolphins resembling spinner dolphins in appearance and behaviour. During one sighting of a group of unidentified dolphins at least 5 calves were seen. Mean group size of all sightings was 14, with a range from 1 to 100 animals (Figure 10).

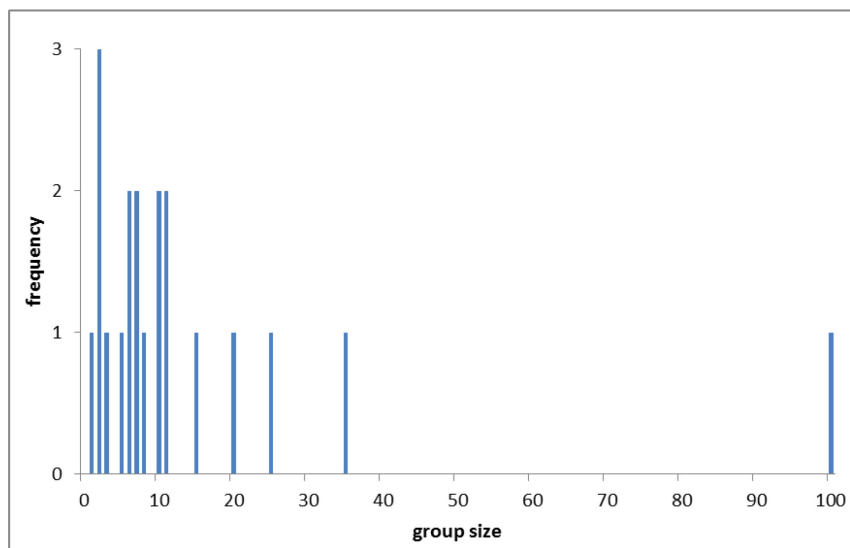


Figure 10. Distribution of group sizes of dolphin sightings (10th July to 23rd November 2012)

Effort related sightings

The relative occurrence of dolphins was calculated by dividing the number of dolphins sighted by the effort (number of visits in each quadrant). Figure 11 show the midpoint of the quadrants and if fishermen had visited the area (circle) or not.



Figure 11. Number of dolphins sighted per effort (visits in quadrant) by fishermen from Saba in the months of July (from 10th) to November (to 23rd) 2012.

Conclusions

This study gives an indication of the kind of data that can be collected within the existing fishery monitoring project. Identification of cetaceans on a species level, in particular dolphins, is most likely still on a low confidence level. Although effort is not equal over the study area, by collecting sightings data in relation to fishing effort, first information on the spatial and temporal distribution of dolphins and humpback whales can be obtained. This type of data can be used as a baseline for a long-term baseline as well as future (more dedicated) research work.

Acknowledgements:

Thanks to the crew of the following vessels that have provided the data: Briana Jami, Bridgette, Donna Mae, Lady Carolina, Navigator, New Beginning, Roselyn, Shuggie II. The fishermen were interviewed by Imke van Gerwen and Michelle Boonstra.

4.2 Registration of opportunistic sightings & strandings of cetaceans on Sint Eustatius

Sightings of cetaceans made from land or sea are recorded and collected at the STENAPA office. Information on each sighting is obtained by interviewing the observers and getting as much information as possible.

From March 2011 to December 2012, 18 sightings of cetaceans have been recorded. The information collected includes the observer, the observation site, date, time (first seen, last seen), position (if known as lat/long), species, certainty of species identification, group size (minimum and maximum), if photos or videos are available, group composition (numbers of adults/juveniles/calves), behaviour, associated sea birds, direction of movement, sea state, swell height, visibility and notes. An example of the sightings sheet used can be found in Annex A.

Four species have been identified: humpback whales, pilot whales, bottlenose dolphins and spinner dolphins. Group sizes for humpback whales varied from one to five, for bottlenose dolphins from one to 15 and for spinner dolphins from 3 to 20. Four observations were made from land, the rest from vessels. Figure 12 shows an overview of the sightings with their positions (note that for the four land-based observations the observation points and not the actual position of the sightings is marked).

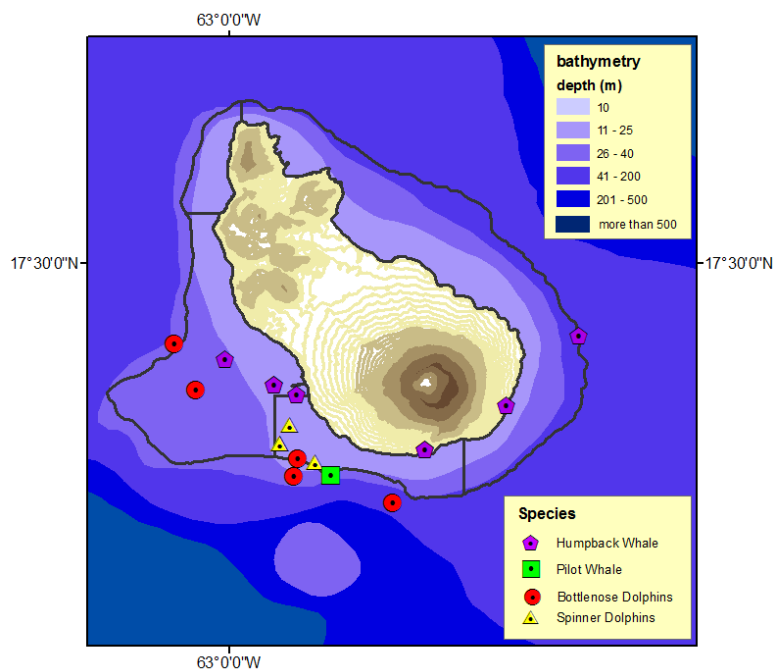


Figure 12. Overview of cetacean sightings made from and around Sint Eustatius (March 2011 to November 2012). For more information please contact Anna Maitz (anna.k.maitz@gmail.com).

Acknowledgements: Thanks to everybody that provided the data to STENAPA.

5. Research approaches for monitoring cetaceans

5.1 Introduction

There are many different approaches in how to monitor the occurrence, abundance and distribution of cetaceans. To obtain a first overview of the species that are occurring in an area, it is useful to conduct monitoring of strandings and so-called “opportunistic” sightings, either from land, air or sea. Species identification might sometimes be difficult, but the use of digital photography and videos often makes it possible to determine the species at a later stage. This type of data can be collected with a relatively low effort, but it does depend on continuous work to compile the data and enter it into a standardized database. If the effort is more or less consistent, it is even possible to obtain information on seasonal patterns. To determine the distribution and (relative or absolute) abundance of cetacean species, generally some kind of effort-corrected method is needed. This means that the effort (e.g. time spent: listening for whales, watching for whales, area covered watching) needs to be recorded, as well as any type of condition that could impact the chances of seeing a cetacean (e.g. sea state, wave height, fog, rain). Dedicated line transect surveys following distance sampling methodology can also address the problems that animals might not always be detectable, or might react to the platform. For some species, such as the humpback whale, mark-recapture methods can be applied by using photo-identification of individual whales to estimate abundance. Stationary acoustics are monitoring a limited spatial area, but can have a very high temporal resolution as they are normally deployed for a longer period of time, and record continuously. This way they can be used to not only look at seasonal changes, but also investigate changes in cetacean occurrence and acoustic activity with a detailed (temporal) resolution (Lucke, in prep.).

In the following we have listed a range of possible approaches for monitoring cetaceans in the waters around Saba, Sint Eustatius and Sint Maarten. For each method we have listed the platform and who could collect the data, how the data would be collected and the expected results. It should be emphasized that the best results will be obtained by combining several approaches. Furthermore, each approach will be more valuable when it is embedded in larger scale international projects using the same standardized methods.

5.2 Ship-based observations

5.2.1 Opportunistic sightings registration

Method used:

- Data could be collected by a wide range of vessels, such as: marine park vessels, fishermen, ferry boat operators, tug boat crew, dive operators, military, oil vessels, tourist vessels
- filling in forms on specifics of the sightings, such as position, species and group size.
- All the information needs to be checked for errors and collated in a common database.

Expected results:

- Indication of species occurrence
- Indication of seasonal occurrence
- Indication of spatial distribution (nearshore)
- Raising awareness about cetaceans

5.2.2 Designated near-shore (effort related)

Method used:

- Collection of data could be done by the marine park staff during designated transects. The collection of sightings from fishing vessels (using fishing effort as proxy of actual sighting effort) is also possible.
- Data quality could be improved by: designing representative track-lines in the study areas; adding continuous information on position of vessel, environmental (sighting) conditions and recording the distance of sightings to a track-line.

Expected results:

- Species occurrence
- Potential photo-identification photos
- Relative abundance (animals per effort)
- Potentially absolute abundance (if following distance sampling protocol)
- Spatial distribution (near shore)
- Raising awareness about cetaceans

5.3 Land-based observations

5.3.1 Opportunistic sighting and stranding registration

Method used:

- Any kind of observations that are made from land could be used, such as sightings made by tourists, locals or children (e.g. integrated in the current school program –on Saba- to record whale sightings)
- Ideally the position where the observation is noted as well as the (approximate) position of the sighting
- Any kind of observations of stranded animals. Ideally the stranded animal(s) should be collected and examined. Good photographs of the animal(s) are necessary to document the observation.

Expected results:

- Indication of species occurrence
- Indication of seasonal occurrence
- Indication of spatial distribution (nearshore)
- Raising awareness about cetaceans

5.3.2 Effort-corrected sighting registration

Method used:

- Effort corrected land-based observations are done by following a standard protocol. This protocol includes that observations are made from specific points, covering a specific search area for a certain time.
- Sightings are recorded with detailed information, such as position (e.g. determined by measuring the distance to the sighting and the angle to the sighting), group size, behaviour, presence of calves.

- if possible high powered binoculars are used on a permanent tripod
- groups of animals can also be tracked and information on behaviour (e.g. swimming speed, interactions with other animals or vessels) can be obtained

Expected results:

- Species occurrence
- Seasonal occurrence
- Relative abundance (animals per hour watched per defined area)
- Near-shore spatial distribution
- Behavioural data
- Raising awareness about cetaceans

5.4 Photo identification

Method used:

- photos of humpback whales or dolphins can best be made from vessels that can be easily navigated (not too large, good manoeuvrability)
- for every photo additional information should be collected (such as position, date, information on the sighting) (see annex B)
- useful photo identification shots should be stored in a central database and should also be included into larger scale international databases (such as the North Atlantic Humpback Whale catalogue)

Expected results:

- data on small-scale and large-scale movements and migration
- investigation of seasonal occurrence and residency
- social structure and behaviour
- Raising awareness about cetaceans

5.5 Point sampling with hand held hydrophone

Method used:

- the hydrophones are used following a specific protocol (see annex C), making underwater recordings for at least 10 minutes. The recordings are analysed at a later stage for the presence of whale or dolphin vocalizations
- to do this vessels are needed that can be stopped, ideally turning off the engine (e.g. marine park vessels, dive operator, but not ferries, tugboats etc)
- this method is also used (in a similar way) during the AGOA surveys

Expected results:

- Species occurrence (biodiversity)
- Seasonal occurrence of species
- Relative occurrence (species per effort)
- Raising awareness about cetaceans
- Analyses of humpback whale songs /dolphin calls when recorded

5.6 Acoustic monitoring network using popups

Method used:

- Various types of static acoustic monitoring devices (noise loggers); Continuous recordings of underwater sound can be conducted all year round
- Positioning of noise loggers in coastal waters, offshore in areas of special interest (marine protected areas) and/or as part of focal studies (e.g. on effect of shipping noise on occurrence of cetaceans in specific areas)
- Manual retrieval of data/information from noise loggers or online streaming of recordings to shore-based station (depending on chosen set-up)
- Data-sharing between all involved partners

Expected results:

- Species occurrence (biodiversity)
- Seasonal occurrence of species
- Strong synergy with visual sighting efforts
- Large scale monitoring (connecting to a Caribbean-wide network)
- Potentially: Effect of specific anthropogenic activities (e.g. shipping/ cruise ships) on occurrence and vocal behaviour of cetaceans in focal areas
- Potentially: Individual recognition of singing whales
- Potentially: Analyses of song structure in comparison to other areas (sister sanctuaries/ ocean-wide)

5.7 Line transect distance sampling surveys, both from airplane or vessel

Method used:

- For line transect distance sampling the track-lines are placed in a way that is representative for the area; to obtain estimates of the strip-width in which animals are counted the distance to the sightings are recorded; additionally several methods are available to estimate the proportion of animals that are not available to be recorded because they are diving, or that are missed by observers.
- AGOA surveys follow in principle line transect methodology and surveys could be designed to be comparable
- Both aerial or shipboard surveys would be possible

Expected results:

- Species occurrence
- Potential photo-identification photos (from boat)
- Absolute abundance
- Spatial distribution (near- and offshore)
- Potential for modelling spatial density and distribution

6. Conclusions & recommendations

- Define monitoring need

There is a strong need to define what kind of monitoring is needed for both the near-shore areas (e.g. marine parks) and offshore areas (e.g. EEZ, trans-boundary regions). The best type of monitoring depends on the scale (Marine parks vs EEZ vs Wider Caribbean), the aims (e.g. long-term monitoring; estimation of abundance, biodiversity or distribution; risk assessment and conservation) and the available funding.

- Coordinate and streamline current efforts

On a local scale cetacean monitoring has already started on the islands in different ways. The efforts range from the collection of any sightings made from land and water, to conducting effort related surveys in near shore waters. Some of these programs could be extended and coordinated between the islands. However, it is unlikely that the current staff would be able to do more than they are doing at the moment as they either need to have more staff or get long term assistance in the collection and analyses of the data.

A standardization of monitoring approaches between the different islands and the development and use of a common database would be helpful to allow the direct comparison of data. The new project idea to use handheld hydrophones on all three islands to monitor cetacean presence is a promising approach. However, close cooperation between local staff and IMARES and some long term funding is needed to ensure useful results will be obtained in the long run.

- Extend monitoring efforts to a larger scale

Several people of the local staff of all three islands have been involved in the French AGOA surveys. This has provided them with more knowledge on cetaceans in the area, insights in data collection methodology and has also provided data for the Dutch Caribbean waters on the occurrence of cetaceans. The current protocols of the AGOA could be adapted and expanded to better fit the needs (to be defined) of monitoring cetaceans in Dutch Caribbean waters. A standard protocol for all areas could be a first step for a common database which could then be analysed on a regular basis. Following a similar survey protocol one could extend the AGOA survey in Dutch waters.

To obtain absolute abundance estimates of cetaceans in the EEZs of Saba and Sint Maarten, it is necessary to conduct designated surveys in the Dutch Caribbean waters using survey vessels or airplanes.

- Risk assessment

In order to achieve an adequate conservation of the marine mammals in the Dutch Caribbean, information on species composition, distribution and abundance should be used for an assessment of the existing and potential threats to these cetaceans.

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Quality Assurance

IMARES utilises an ISO 9001:2008 certified quality management system (certificate number: 57846-2009-AQ-NLD-RvA). This certificate is valid until 15 December 2012. The organisation has been certified since 27 February 2001. The certification was issued by DNV Certification B.V. Furthermore, the chemical laboratory of the Fish Division has NEN-EN-ISO/IEC 17025:2005 accreditation for test laboratories with number L097. This accreditation is valid until 27 March 2013 and was first issued on 27 March 1997. Accreditation was granted by the Council for Accreditation.

Justification

Report number: C075/13

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BO-11-011.05-005

The scientific quality of this report has been peer reviewed by the a colleague scientist and the head of the department of IMARES.

Approved: Erwin Winter
Researcher

Signature:



Date: 25 April 2013

Approved: Floris Groenendijk
Department Head Maritime

Signature:

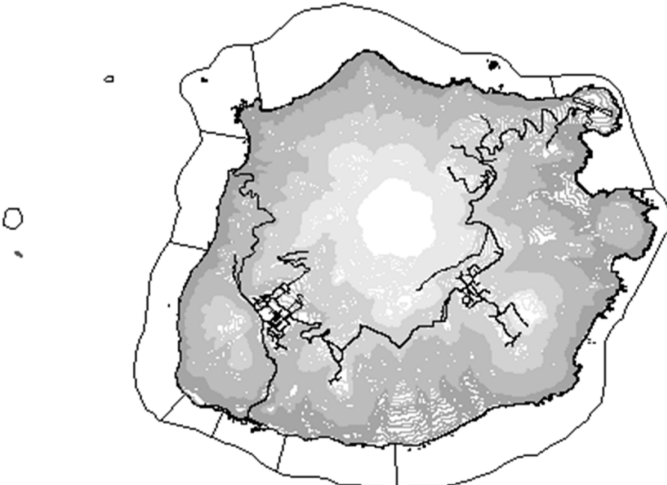



Date: 25 April 2013

Appendix A. land and ship-based observation forms

A.1 This form has been adapted from a form used on Sint Maarten to record whale and dolphin sightings. It especially aims at the work done with school children that are asked to watch for and record whales from Saba. Similar forms are used to obtain sightings from sea (e.g. ferry operators), but then the actual latitude and longitude are recorded also. Contact Susan Hurrell from Saba Marine Park (sabapark.marine@gmail.com) for more information.

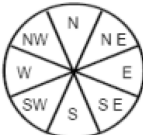
SABA whale & dolphin sighting form

DATE: ____/____/2013 TIME: _____(begin) _____(end) Circle: AM or PM Circle: AM or PM	
SPECIES:	
GROUP SIZE:	CALVES (in group):
LOCATION: describe and/ or mark on map your observation point and where you had the sighting 	
COMMENTS and OBSERVATIONS (behaviour):	
OBSERVER & CONTACT INFO:	



A.2 This form has been used on Sint Eustatius. It is normally filled in by interviewing the person that had the sighting. For more information contact Anna Maitz from Stenapa anna.k.maitz@gmail.com.

CETACEAN SIGHTING RECORDING FORM

Name:		Address:	
E-mail:		Telephone:	
Were you watching from: land <input type="checkbox"/> yacht <input type="checkbox"/> motorboat <input type="checkbox"/> fishing boat <input type="checkbox"/> ferry <input type="checkbox"/> oil rig <input type="checkbox"/> aircraft <input type="checkbox"/>			
Other vessel or platform (give details)			
SIGHTING DETAILS: Record as much as possible, but even partial data is helpful!			
Day/Month/Year		Time First Seen	
		Time Last Seen	
<small>Use 24-hr clock (1:20pm = 13:20); indicate if GMT or local time.</small>			
Latitude ° ' " N		Longitude ° ' " W <input type="checkbox"/> E <input type="checkbox"/>	
<small>Record as degrees (°), minutes (') and seconds (") or as degrees and decimal minutes</small>			
Location			
<small>OR if Lat/Long not available, give verbal description, distance to local landmarks or grid reference to pinpoint Lat/Long</small>			
Species		<input type="checkbox"/> Definite <input type="checkbox"/> Probable <input type="checkbox"/> Possible	
<small>Complete DESCRIPTION section below to help with species ID</small>			
Group size: best estimate		minimum maximum Photo/Video taken? Yes <input type="checkbox"/> No <input type="checkbox"/>	
No. Adults:		No. Juveniles (c. 75% Adult Size): No. Calves (c. 50% Adult Size):	
Behaviour (tick one or more):			
<input type="checkbox"/> Blow: only spout seen <input type="checkbox"/> Slow/normal swim: leisurely surfacing with no splash <input type="checkbox"/> Fast swim: rapid surfacing, poss. with white water around perimeter of circle <input type="checkbox"/> Feeding: prey seen in vicinity or animal changing direction as if in pursuit <input type="checkbox"/> Leap/Splashing: leaping out of the water, tail or fin slapping, <input type="checkbox"/> Bow-ride: coming to boat and riding bow wave <input type="checkbox"/> Rest/milling: lying motionless at surface or slow, synchronous surfacing <input type="checkbox"/> Sexual: males with erections, close body contact between animals <input type="checkbox"/> Other:			
Associated Seabirds:		Direction of movement: mark animals direction of travel (↑) and boat heading (●) separately <div style="text-align: center;">  </div> <input type="checkbox"/> Animal's Direction Variable	
SPECIES DESCRIPTION			
<small>Estimate body size, if appropriate by comparison with boat length. If seen, describe head shape and presence of beak. Note shape and position of dorsal fin relative to mid point of body. Note colour and any stripes or patterns. Describe blow if visible. Make sketches, if appropriate.</small>			
ENVIRONMENTAL DATA			
Sea State:			
0 <input type="checkbox"/> mirror calm 1 <input type="checkbox"/> slight ripples; no white water 2 <input type="checkbox"/> small wavelets; glassy crests, no whitecaps 3 <input type="checkbox"/> large wavelets; crests begin to break; few whitecaps 4 <input type="checkbox"/> longer waves; many whitecaps 5 <input type="checkbox"/> moderate waves of longer form; some spray 6 <input type="checkbox"/> large waves; many whitecaps everywhere			
Swell Height: <input type="checkbox"/> Light (<1 m) <input type="checkbox"/> Moderate (1-2 m) <input type="checkbox"/> Heavy (>2 m)			
Visibility: <input type="checkbox"/> <1 km <input type="checkbox"/> 1-5 km <input type="checkbox"/> 6-10 km <input type="checkbox"/> 11-15 km <input type="checkbox"/> 16-20 km <input type="checkbox"/> >20 km			

Appendix B. A short guide on how to take photos for photo-identification of whales & dolphins

Steve Geelhoed & Meike Scheidat meike.scheidat@wur.nl

Photo-identification is a method to identify individual whales or dolphins using characteristic markings on their body. This is especially useful for those species that occur in coastal waters and/or have distinct markings.

In the late 1960s, researchers discovered that there was enough variation in natural markings of (the underside of) humpback whale tail flukes (Figure 13) to distinguish between individuals, and began collecting photographs of individual whales and tracking those individuals over time. Identification of individual whales by means of fluke patterns can be used to investigate distribution, population size, behavior, ecology, and reproduction of whales. In principle the dorsal fin can also be used for photo-identification, but they are less distinct and it is harder to match a left and right side to one individual.

This method can also be used for for instance pilot whales or bottlenose dolphins, but then the dorsal fin is used (Figure 13). For these species this method has been used to find out more about the social structure, for example to investigate if the same individual animals stay in the same group.

How to take good photo-identification shots:

There are a few rules to follow to make sure photos are useful for a photo-identification catalogue:

Size: the image needs to be reasonably large to see any nicks or scratches. Thus a zoom lens of at least 200mm is generally needed.

Clarity: autofocus can be very useful to keep the fluke or dorsal fin in focus. However, it can also be a problem to keep smaller dolphin fins in focus. One option is to focus on the water surrounding the dolphins and then to return to the animals to take the picture. If the autofocus starts to “search” for a focus point it might be better to switch to manual focus.

Shutter speed: in principle you should try to go for the highest shutter speed possible (1/500 is advisable if you are on the boat). If your camera has the option it can be helpful to use fast shooting mode?

Light: lens hood for getting glare out; make sure light is on the animal (backlighting will take away all detail of scratches etc.). so, try to have the sun behind you.

Aspect: both for dorsal fin and fluke it is important to shoot the photo when the animal is parallel to you. It is best if the photo is shot at an angle which shows the largest area of fluke or fin. Photos taken from above (e.g. bowriding) are not ideal for photo-identification).

Flukes / fins: for humpback whales focus on the underside of the flukes, but if that is not visible go for the dorsal fin. For the dorsal fin it is ideal if you can get photos of left and right side, and even better if you can link those photos that are of the same animal!

Other information: when you take photos, please note down the date, time, location (some cameras now have gps and can link this directly to the photo) and the photographer. Also describe if possible something on the sighting, such as group size, presence of calves or behaviour.

Disturbance: when taking pictures for photo-identification take care not to disturb the animals. They should never be approached head-on, but from the rear or the side. Manoeuvres should be calm, without sudden or repeated changes in the speed or direction of vessels. The animals should be abandoned at any stage if they show signs of becoming disturbed or alarmed. Particular care should be taken when calves are present.



Figure 13. Examples of photos for Photo-identification. Top row: dorsal fin of Short-finned Pilot whale. Middle row: fluke underside of Humpback whales. Bottom row: dorsal fins of Bottlenose Dolphins. (Steve Geelhoed).

Appendix C. Protocol for acoustic monitoring with a hand-held hydrophone

This concise protocol is based in principle on the protocol used during the AGOA surveys. A more detailed protocol is available. For more information contact Gaëlle Vandersarren from the national park in Guadeloupe (gaelle.vandersarren.carspaw@guadeloupe-parcnational.fr).

For the current protocol (when necessary it will be adapted in the future), the hand-held hydrophone will be placed in the water when the vessel is stationary and ideally the engine is switched off. The full length of the hydrophone cable needs to be used to achieve the deepest possible position of the hydrophone in the water column. A minimum of 10 minute listening and recording (or more if possible or if animals are detected) will be made on the Tascam recorder, with the data being stored on a SD card. The person doing the monitoring needs to note down: number of recordings, time of recording (beginning / end), position (latitude / longitude), sea state, vessel name, recorder, was a cetacean heard when listening (yes/no) and any other comments. These comments could describe the environmental conditions, such as sea state, wave height, rain as well as observations of cetaceans or other vessels in the area.

A draft version of the protocol can be seen here:

date: / / 2013			boat name: _____				
# of recording	time begin recording	time end recording	latitude (N)	longitude (W)	recorder name	cetacean heard (yes/no)	comments (sea state, wave height, sightings, other boats in the area)
	: :	: :					
	: :	: :					
	: :	: :					
	: :	: :					
	: :	: :					
	: :	: :					
	: :	: :					