

Underwater Sounds around Saba Bank

Saba Symposium Den Helder 2016-12-08

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Marine mammal data input

- Visual observations
 - Aerial survey's
 - Fishermen's logs
- PAM (Passive Acoustic Monitoring)
 - Autonomous noise recorders
 - Hand-held deck systems

Saba bank research

■ Aims:

- Spatial and temporal distribution of marine mammals
- Other marine fauna vocalisations
- Sources producing impact (man-made noise)



Management of endangered species

Saba bank acoustic research

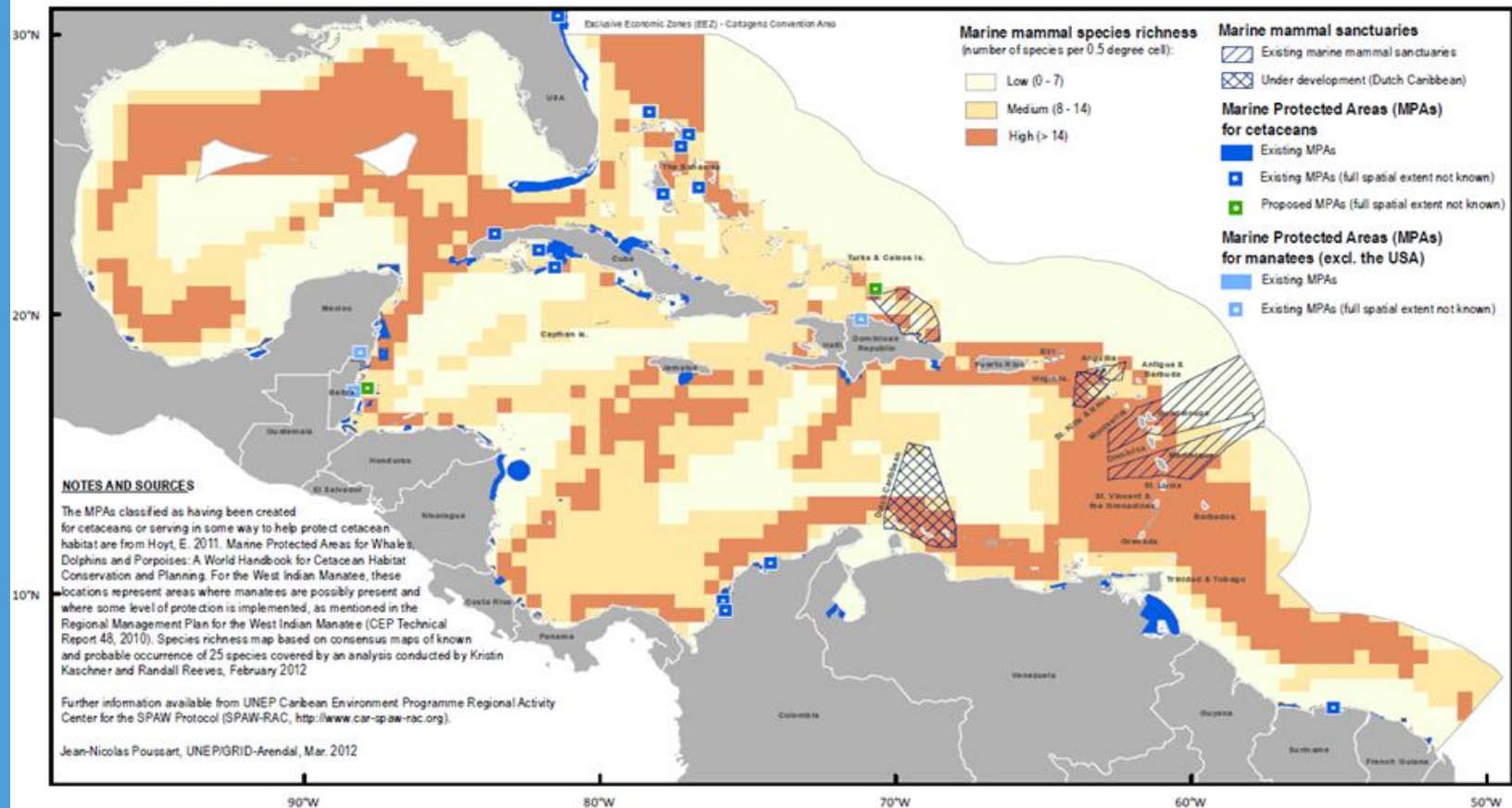
■ Participants & Funding:

- Commissioned by Dutch Ministry EZ (Economic Affairs);
- In cooperation with Saba Conservation Foundation (SCF).
- International Network (SAMS, NOAA, US)

Marine protected Area's

Marine Mammal Protection and Species Richness

in the Wider Caribbean Region



Project "Broad-scale marine spatial planning of mammal corridors & protected areas in Wider Caribbean & Southeast & Northeast Pacific" (2010-2012)

Seasonal list Windwardside species

Species	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
<i>Likely residents</i>												
Bottlenose dolphin	?	X	?	X	X	X	?	X	?	X	?	?
Spinner dolphin	?	?	X	X	X	X	?	?	?	?	?	?
Atlantic spotted dolphin	?	?	?	?	?	?	?	?	?	?	?	?
Short-finned pilot whale	?	?	X	?	X	?	?	?	?	?	X	?
Cuvier's beaked whale	?	?	?	?	?	X	?	?	?	?	?	?
<i>Seasonal presence</i>												
Humpback whale	X	X	X	X	X	X	-	-	-	X	?	?
Common minke whale	-	X	X	X	-	-	-	-	-	-	-	-
Sperm whale	X	X	X	?	?	?	?	?	?	?	?	?
West Indian manatee	?	?	?	?	?	?	?	?	?	?	?	?

?: Likely occurrence; X: reported sightings/observations; -: unlikely occurrence

Impact of Anthropogenic Noise

Wider Caribbean Species

■ Whale & dolphin Categories

- Baleen & toothed whales: LF-range 10 Hz-31 kHz;
- Dolphin species: MF-range 150 Hz to 160 kHz.
- (Richardson et al., 1995; Southall et al., 2007)

Interfering noise

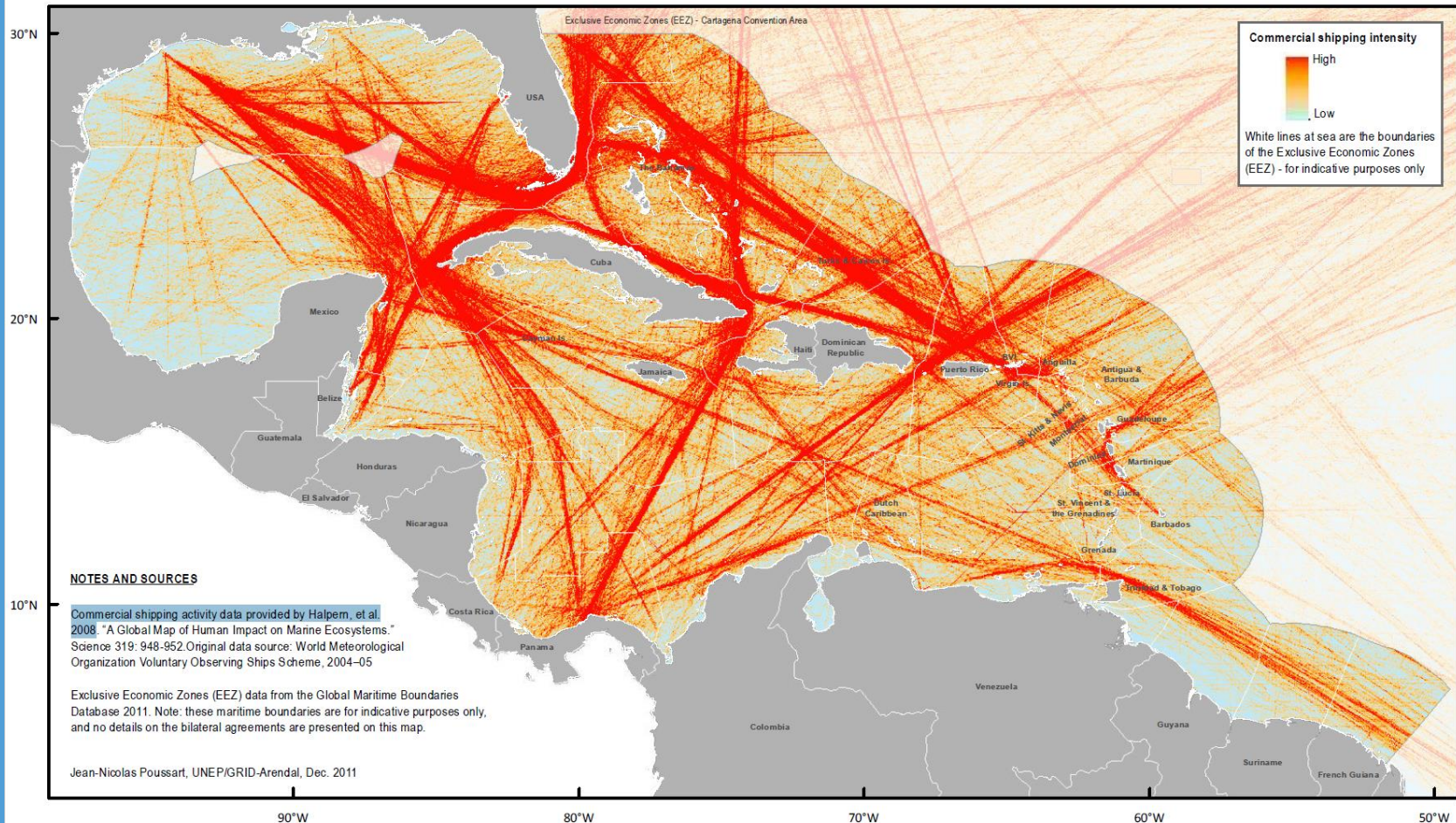
Background Noise

- Ambient “Natural” noise
 - Wind and tidal conditions aggregating sea waves
- “Anthropogenic” or man-made noise sources:
 - Merchant ships and leisure crafts
 - Seismic operations & pile driving
 - LFAS Naval LF sonar operations

Shipping Contribution Caribbean

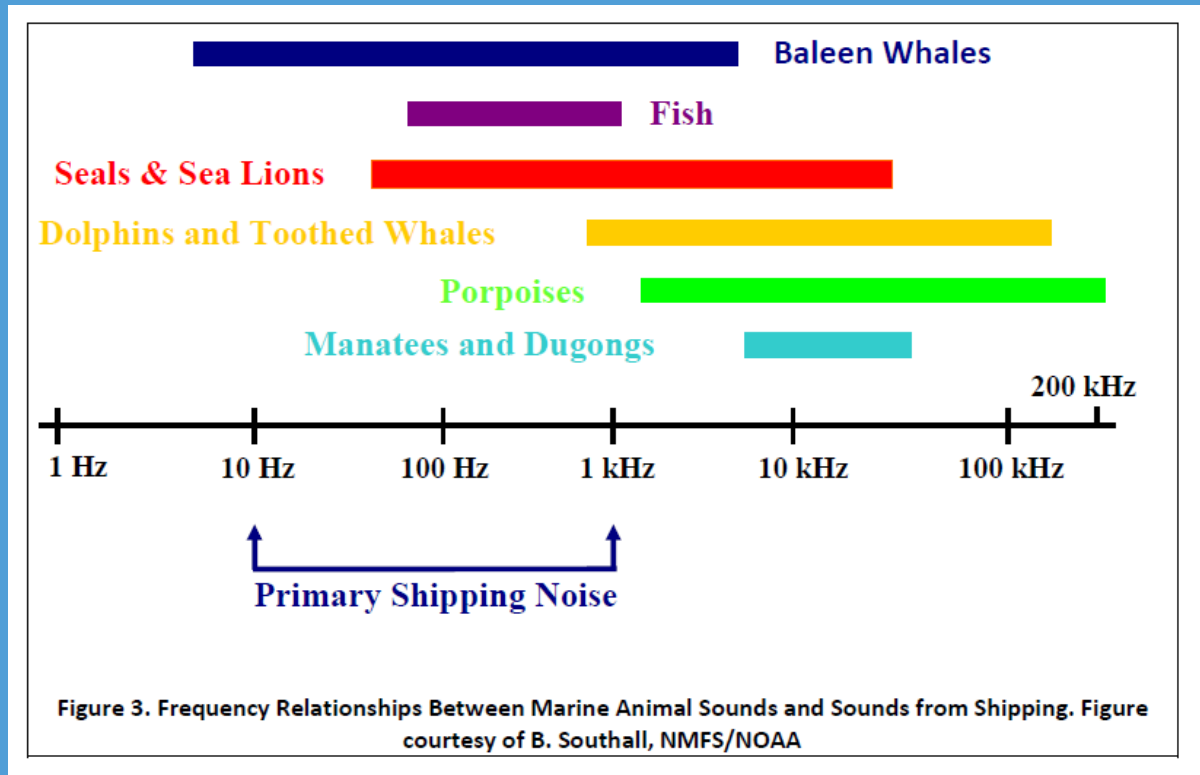
Commercial Shipping Intensity

in the Wider Caribbean Region

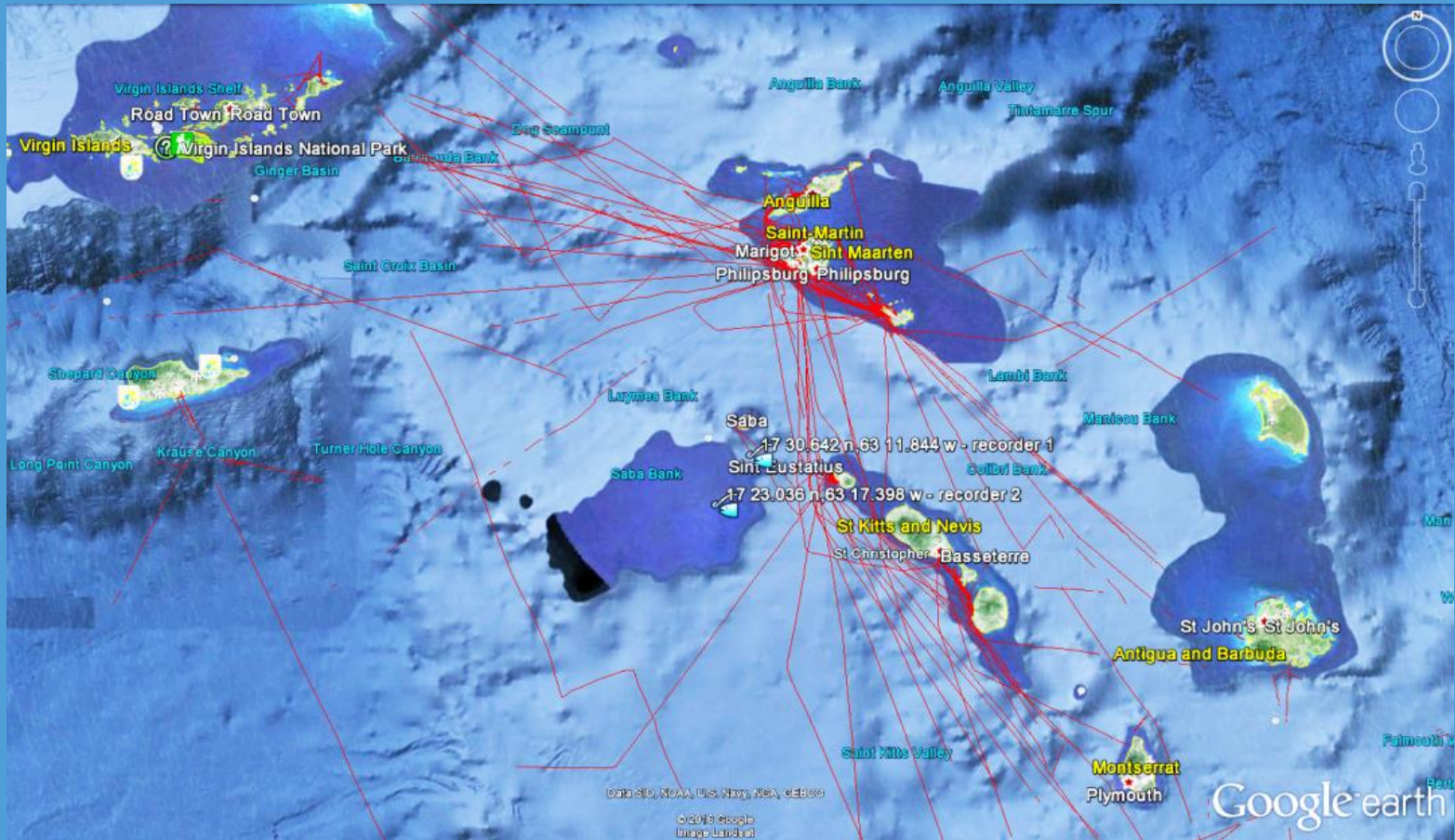


Background Noise

Relationship between Marine Animal Sound ranges and shipping noise
(courtesy of B. Southall, NMFS/NOAA)



AIS Detection Sample

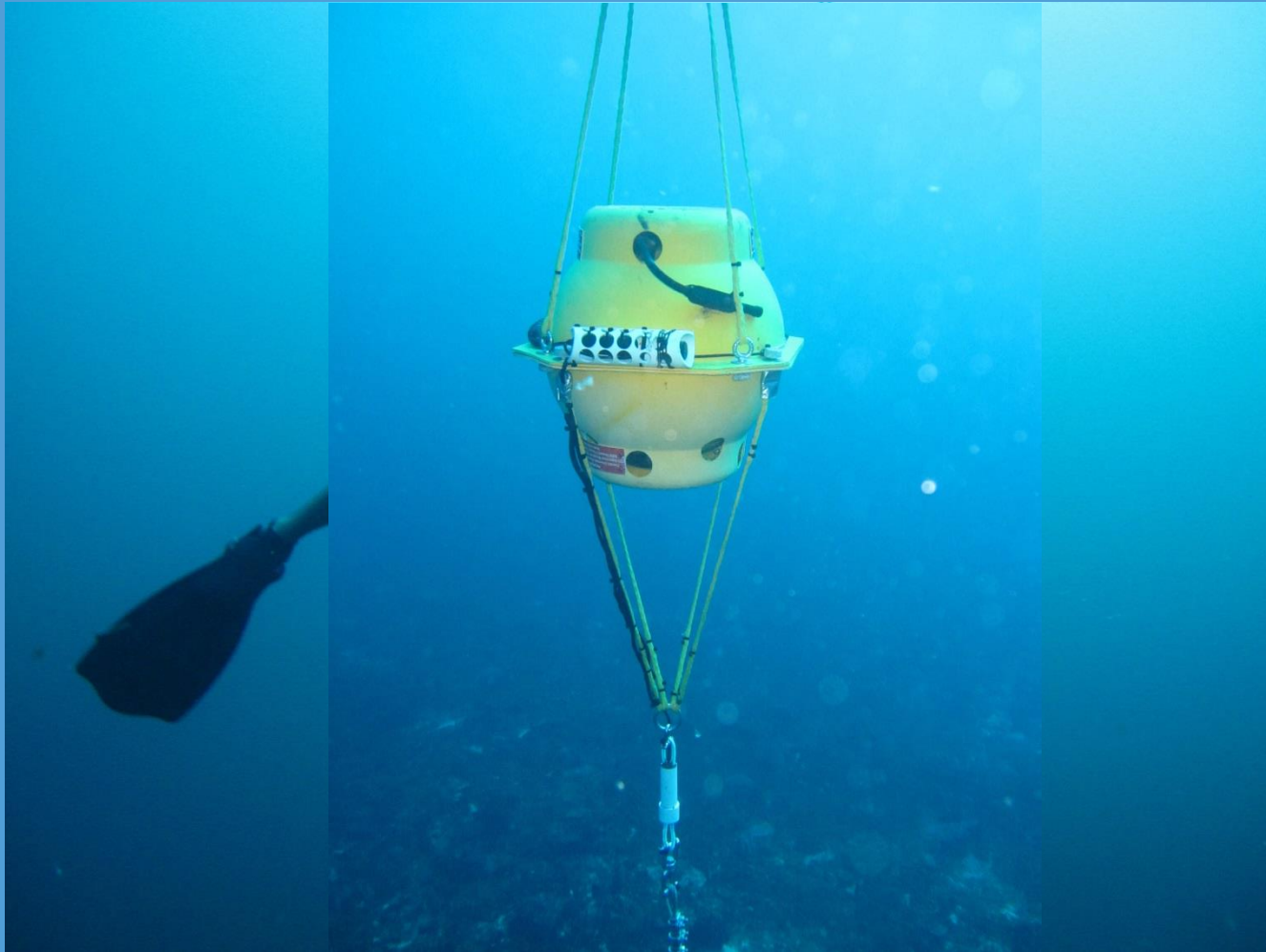


AIS 24 hr sample of shipping received on Mnt Scenery in the fall of 2015

Acoustic Monitoring

- 2011 A single MARU noise-logger
 - 2014 4 Hand-held hydrophone systems
 - 2015-11 Start Period 1 with 2 AMAR noiseloggers
 - 2016-04 Start period 2
 - 2016-12 Start period 3
- Additional loggers deployed by NOAA (Lesser Antilles, Guadeloupe, St Maarten)

Deployment MARU Logger



Saba bank acoustic research

- Two Amar noise loggers after recovery



Deployment AMAR 2015-11

- Rigging Details

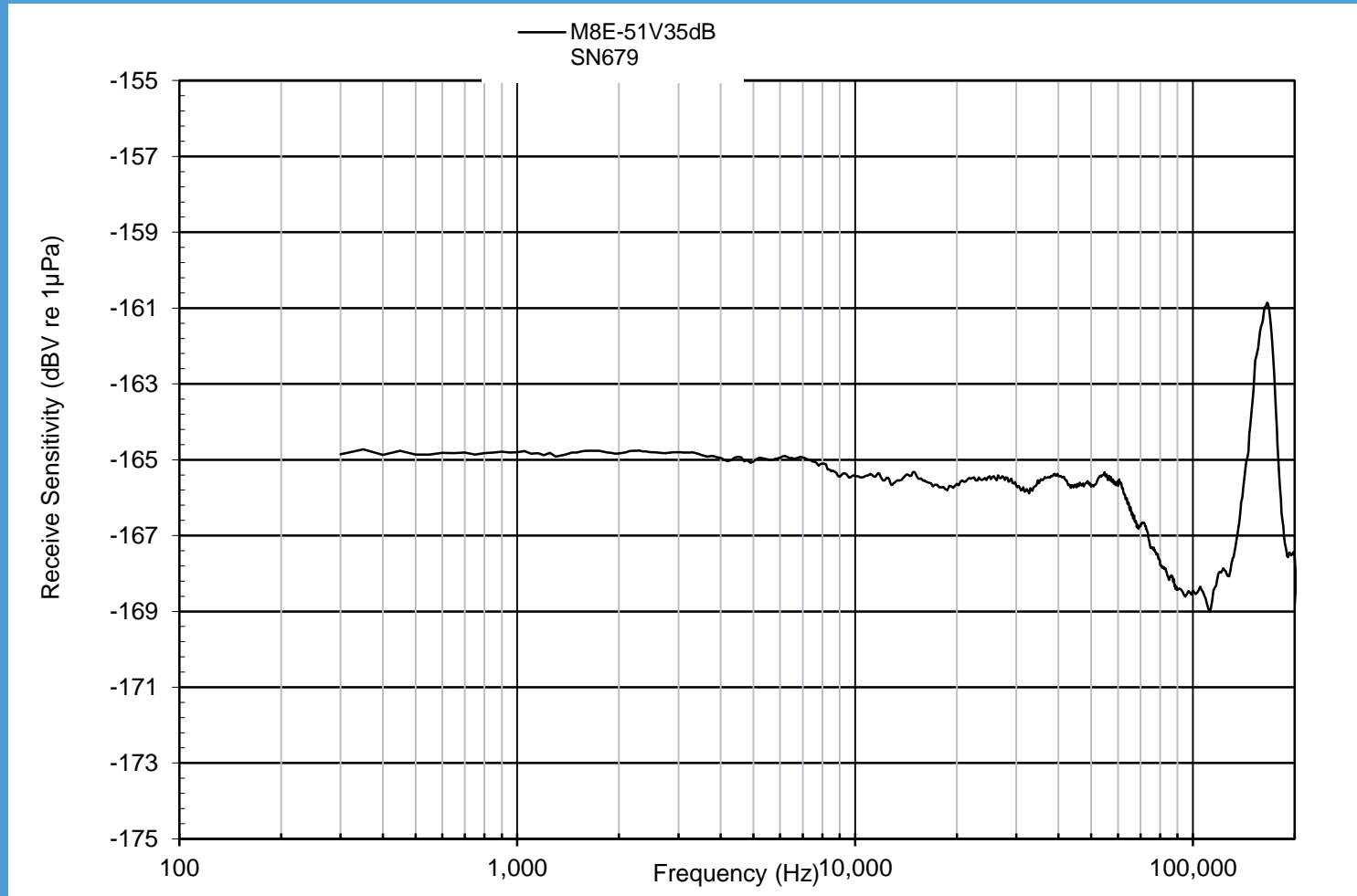


Acoustic data background

Performance	MARU	AMAR
Accuracy	Cal Estimate	Real Calibration
Duty Cycle	25%	100%
Bandwidth	10Hz-8 kHz	10Hz-24kHz
Resolution	12 bits	24 bits
Internal clock	Not reported	+/- 10 s ½ year

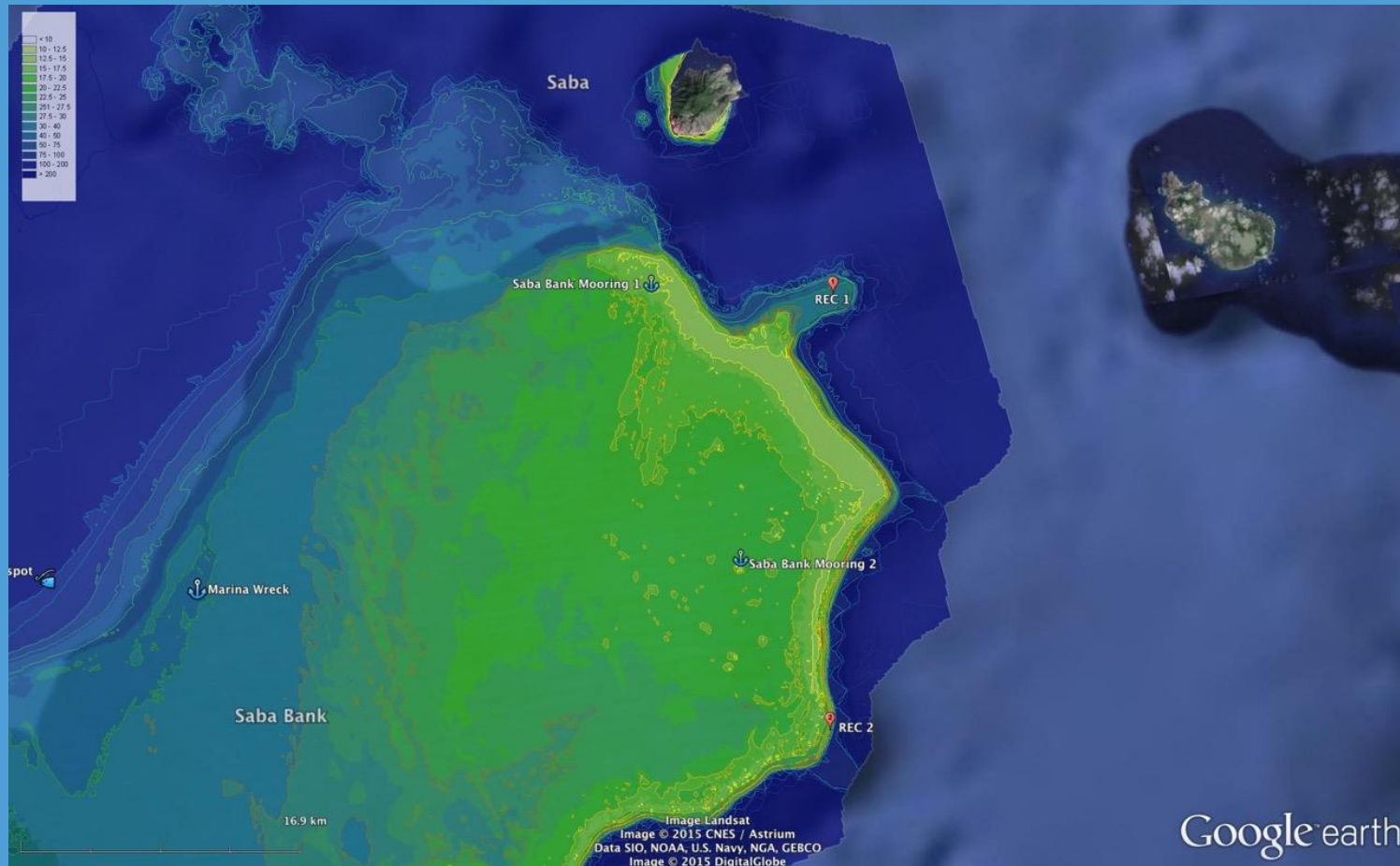
Acoustic validation

Hydrophone calibration with a reference source



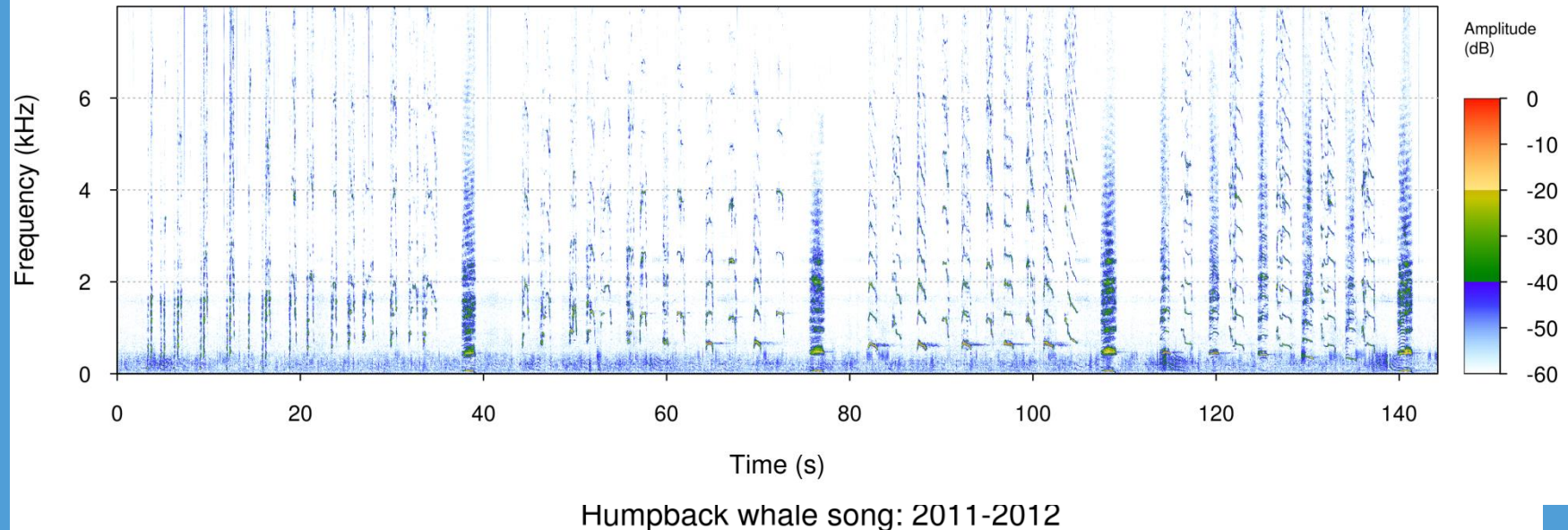
Measured Positions

MARU & AMAR noise-logger positions



Pilot results 2011-2012 (MARU)

Humpback Whale Vocalisations

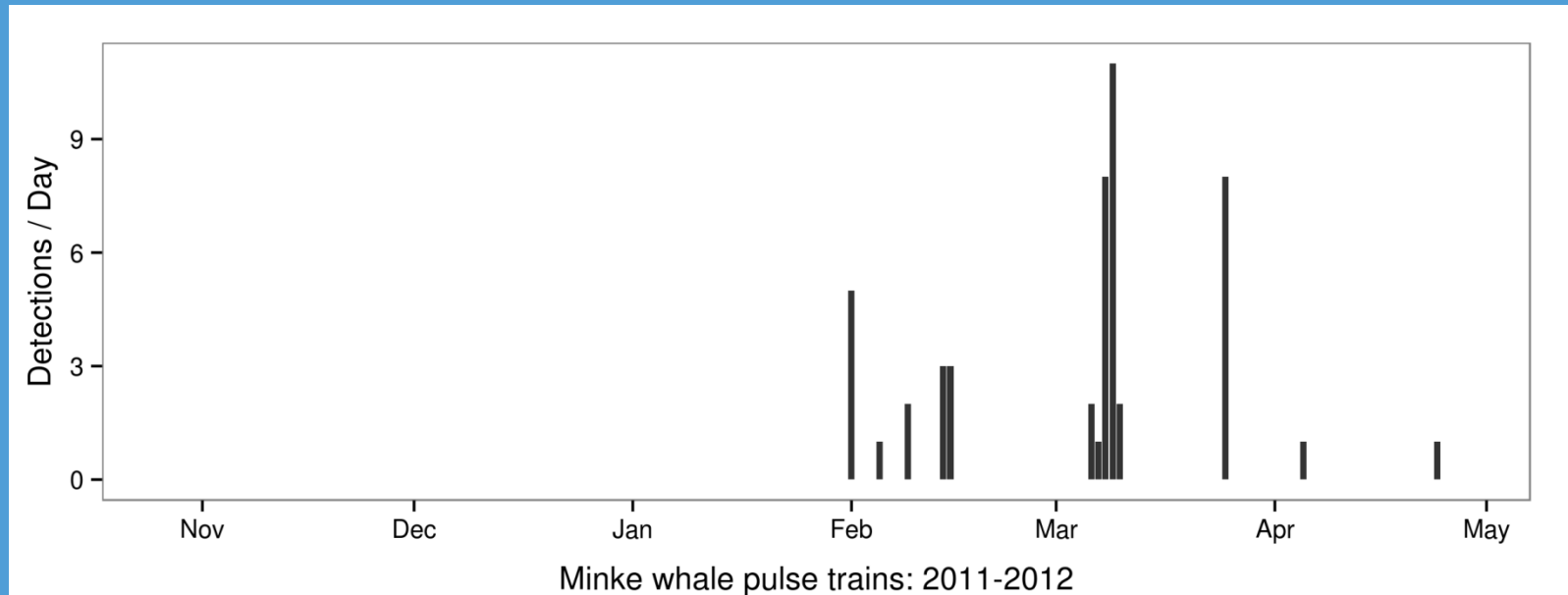


Humpback and minke whale acoustic presence with reference to fish sounds and ambient noise levels at Saba Bank, Caribbean Windward Dutch Islands

Authors: Risch & de Haan (2016) IMARES Rapport C067/16

MARU results 2011-2012

Minke Whale Vocalisations



Life sound presentations

- Humpback song
- Minke Whale calls
- Fish calls of grouper spp.,
squirrelfish or damselfish

Conclusions & recommendations

■ Results:

- Presence and temporal aspects clearly shown;
- AMAR loggers support 100% duty cycle incl. dolphin ranges with calibrated long-term noise levels

Limitations :

- Only humpbacks males are singers;
- Migration routes require multiple logging locations over a wider area;
- Participation in other programmes over a wider area;
- PAM-data to link to aerial monitoring

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