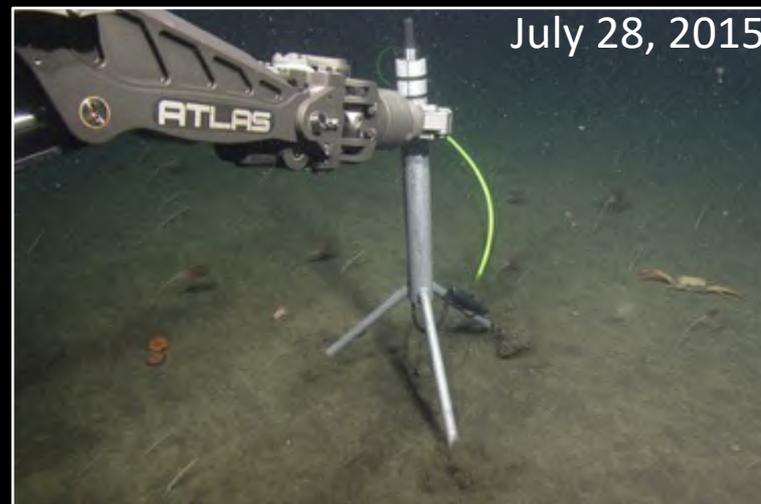
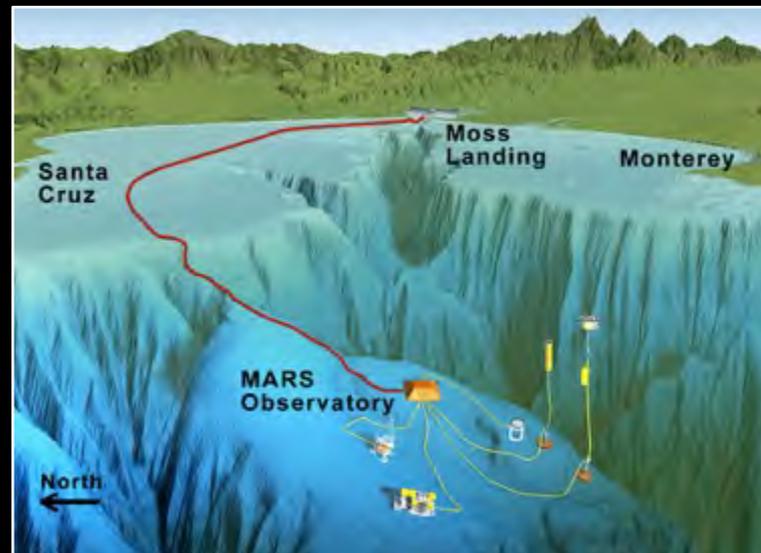
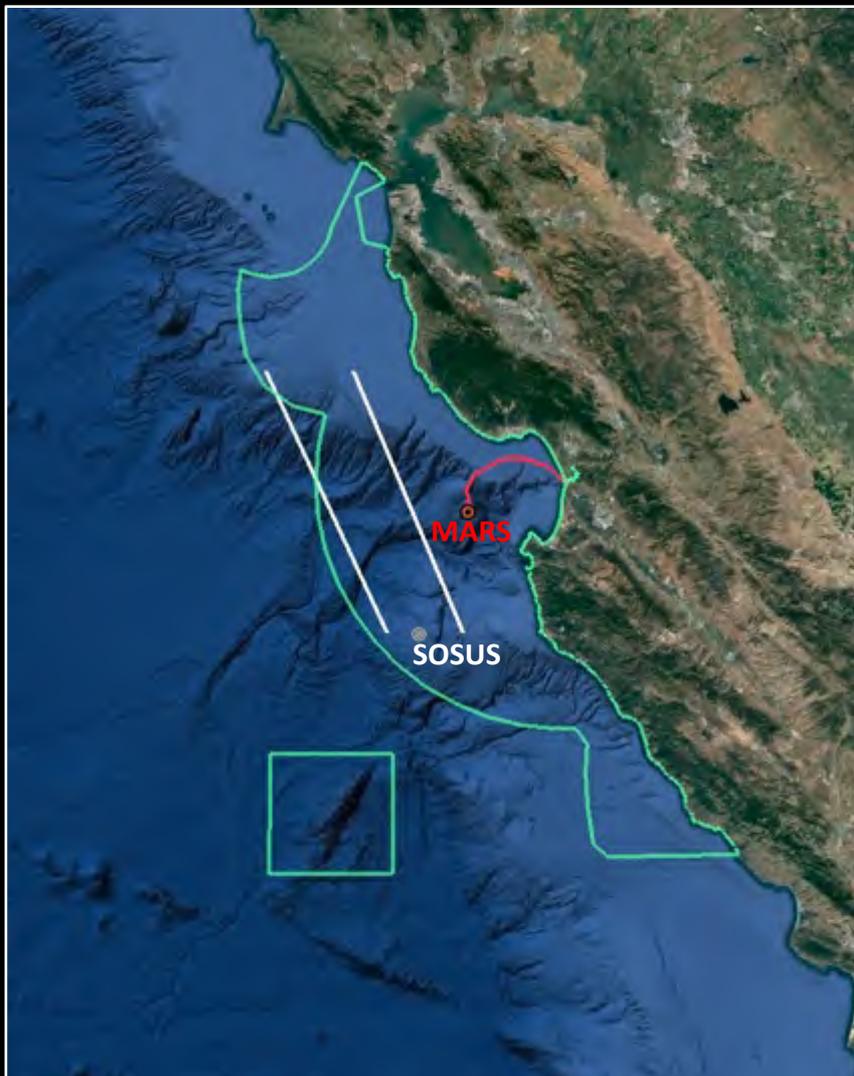


Acoustic Monitoring in MBNMS, @ MARS



John Ryan
MBARI

Project team



Danelle
Cline



Craig
Dawe



David
French



Kevin
Gomes



George
Matsumoto



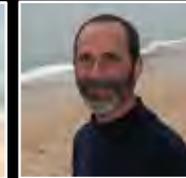
Paul
McGill



Ben
Raanan



Carlos
Rueda



John
Ryan



Yanwu
Zhang



Hopkins Marine Station: Jeremy Goldbogen, Dave Cade, Will Oestreich

Moss Landing Marine Laboratories: Alison Stimpert

Naval Postgraduate School: John Joseph, Tetyana Margolina

NOAA/MBNMS: Andrew DeVogelaere, Karin Forney, Lisa Uttal, Chelsea Prindle, Nicholas Ingram

Scripps: Simone Baumann-Pickering, Anna Krumpel, Jennifer Tricky

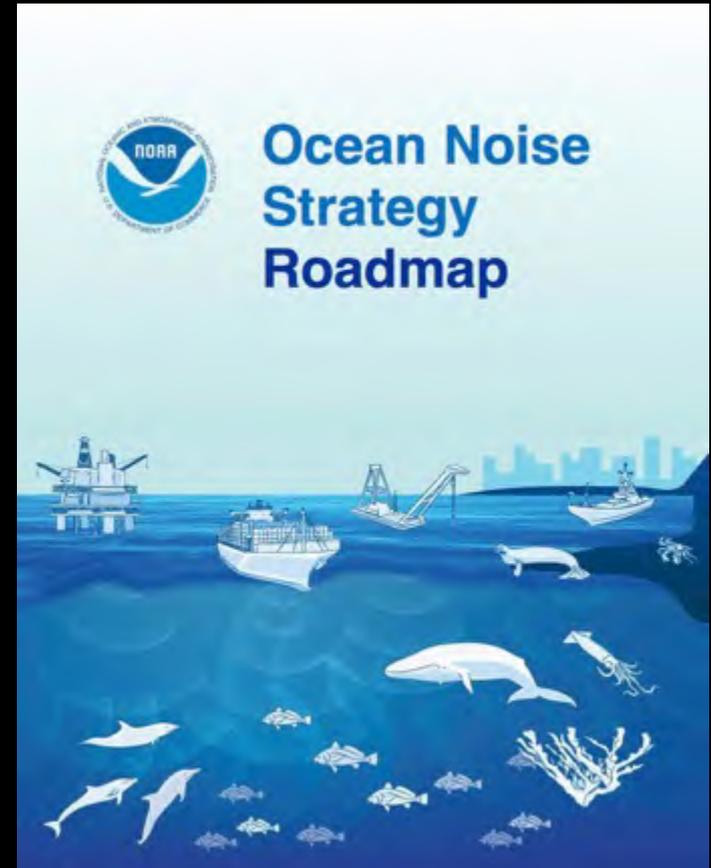
UCSC / SEA: Brandon Southall, Jarrod Santora, Raphael Kudela

Project goals



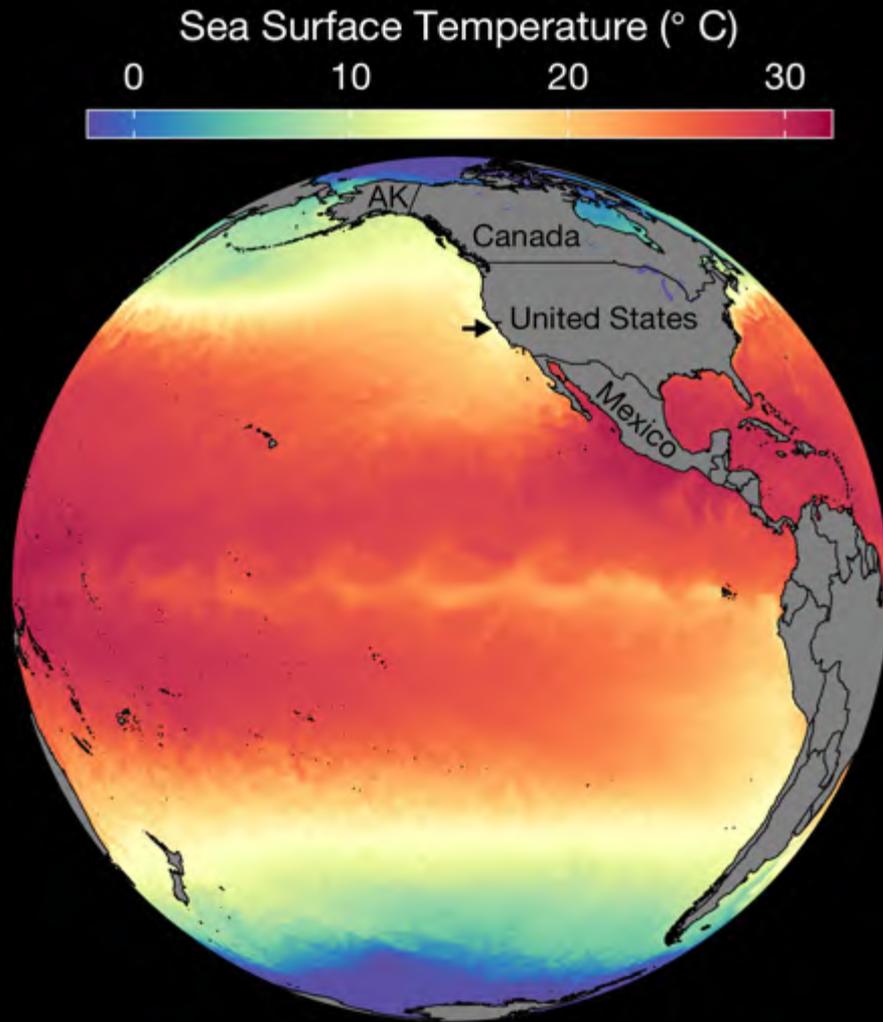
- ❖ **Research:** Understand (a) the presence and activity of marine mammals, (b) relationships to ecosystem variation, and (c) the nature and consequences of anthropogenic noise.
- ❖ **Education:** Enrich educational programs with Sanctuary Soundscape recordings and associated content.

Why listen?



- Auditory masking, impairment
- Behavioral disturbance
- Acute / chronic stress
- Physiological damage

A great location to listen



Updates

- Sound recording infrastructure
- Whale behavioral ecology
- Education & outreach
- Anthropogenic noise

Sound recording infrastructure

MBNMS AC working group recommendation

We recommend collaboration with and support for the MBARI real time cable hydrophone and adding additional nodes so it can precisely locate sounds.

Sound recording infrastructure

Directional hydrophone deployed @ MARS
January 31st 2019



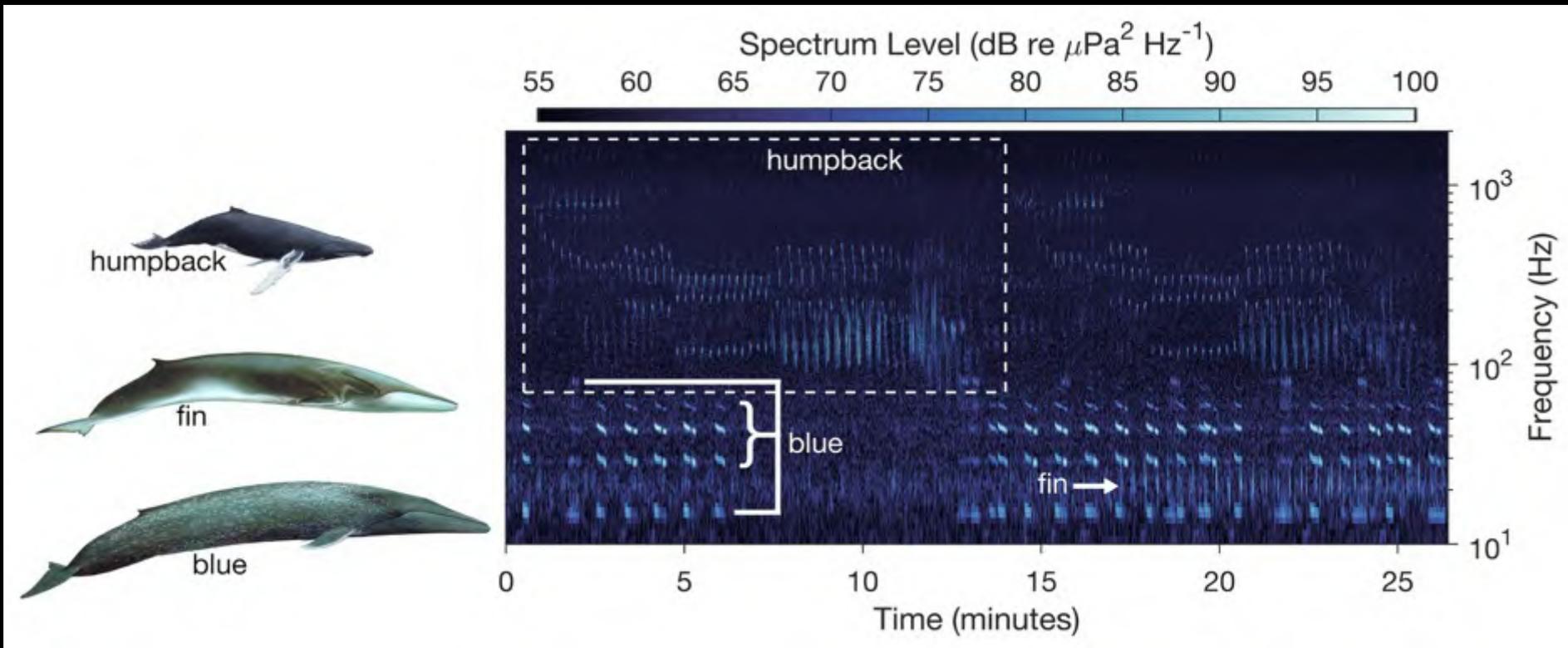
Kevin Smith
John Joseph
Paul Leary

Whale behavioral ecology

MBNMS AC working group recommendation

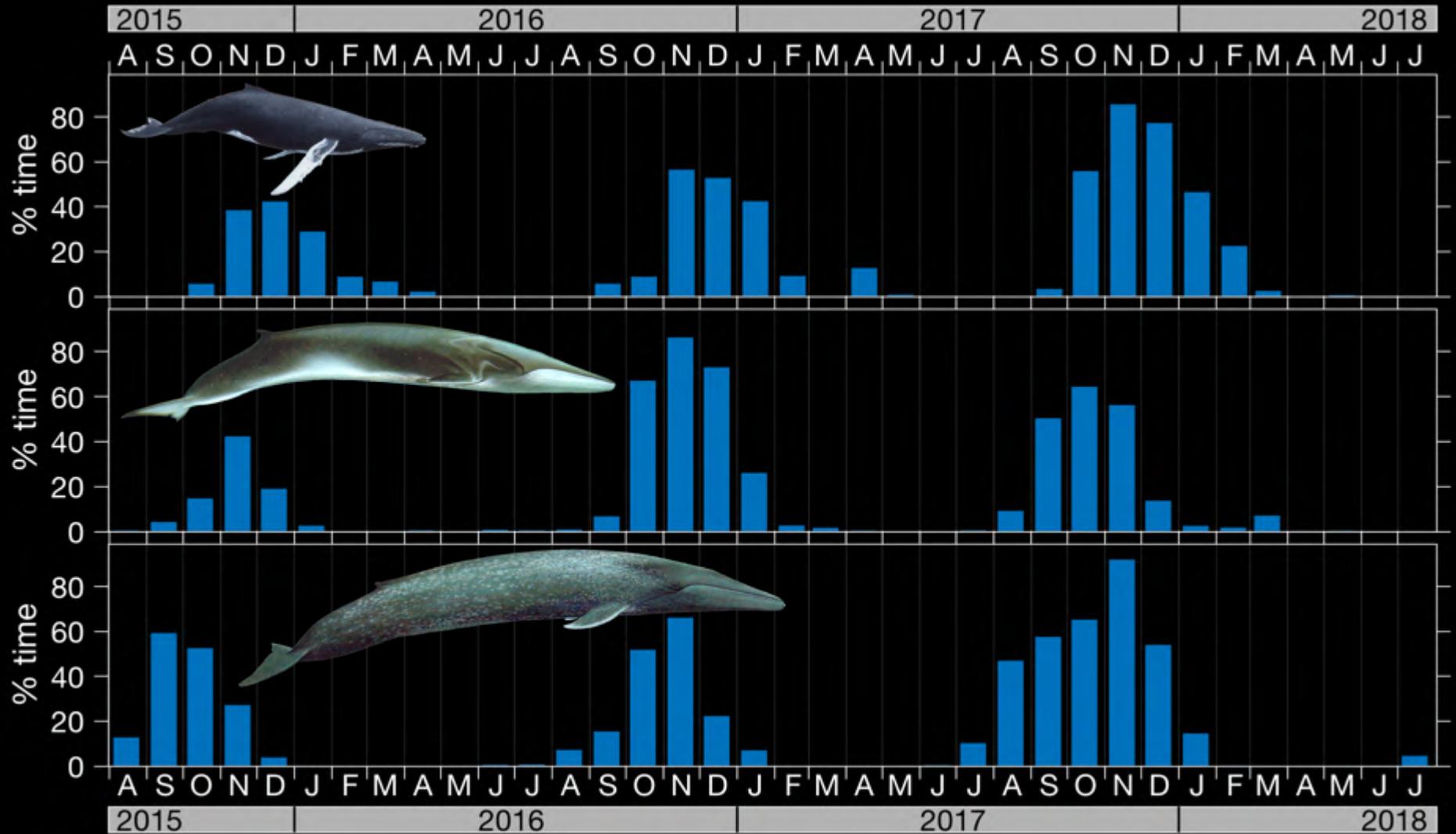
We recommend increasing research efforts, including CeNCOOS (Central and Northern California Ocean Observing System) monitoring sound as a core variable tracked over time.

Whale behavioral ecology



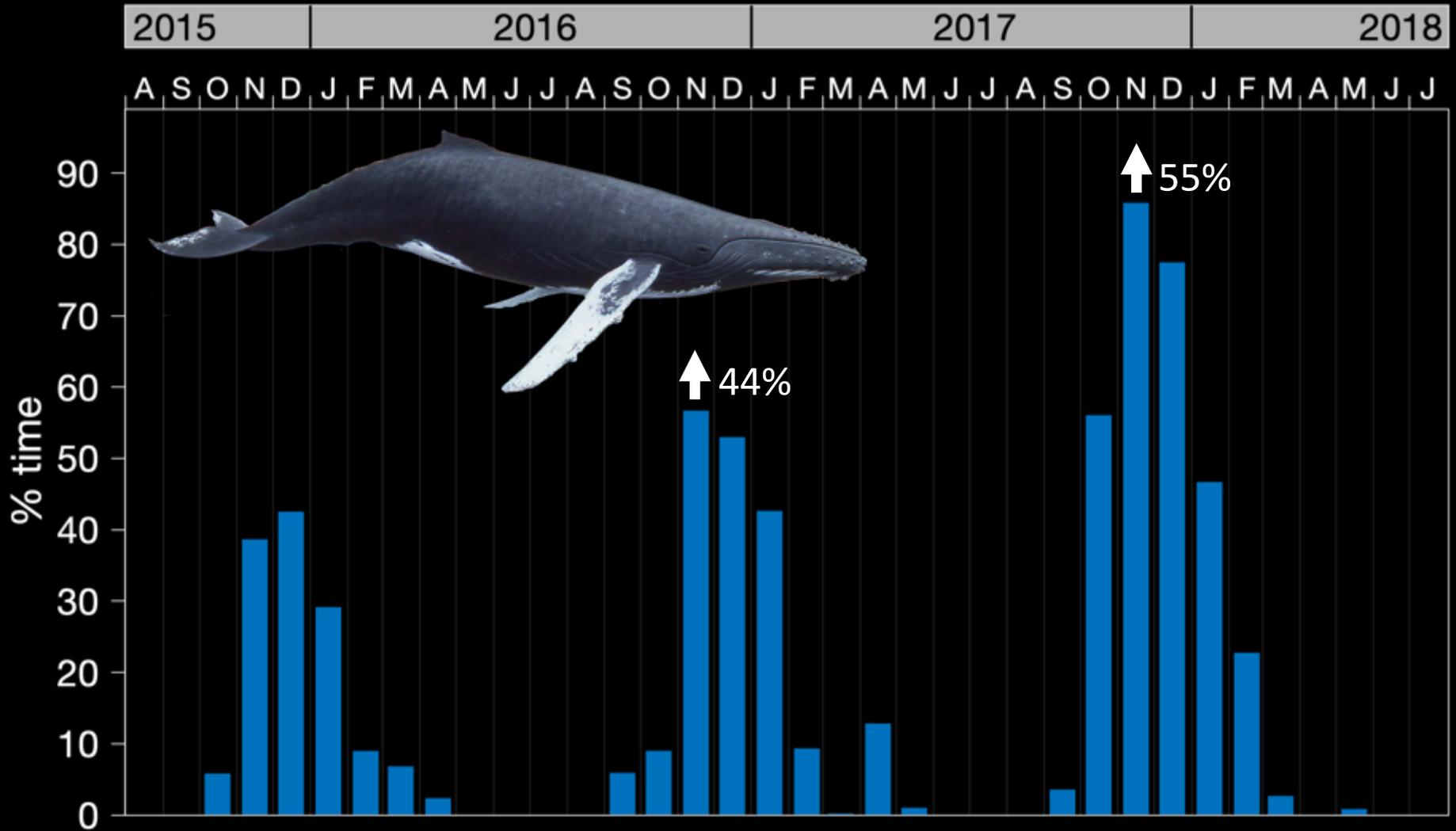
Whale images by Larry Foster

Whale behavioral ecology



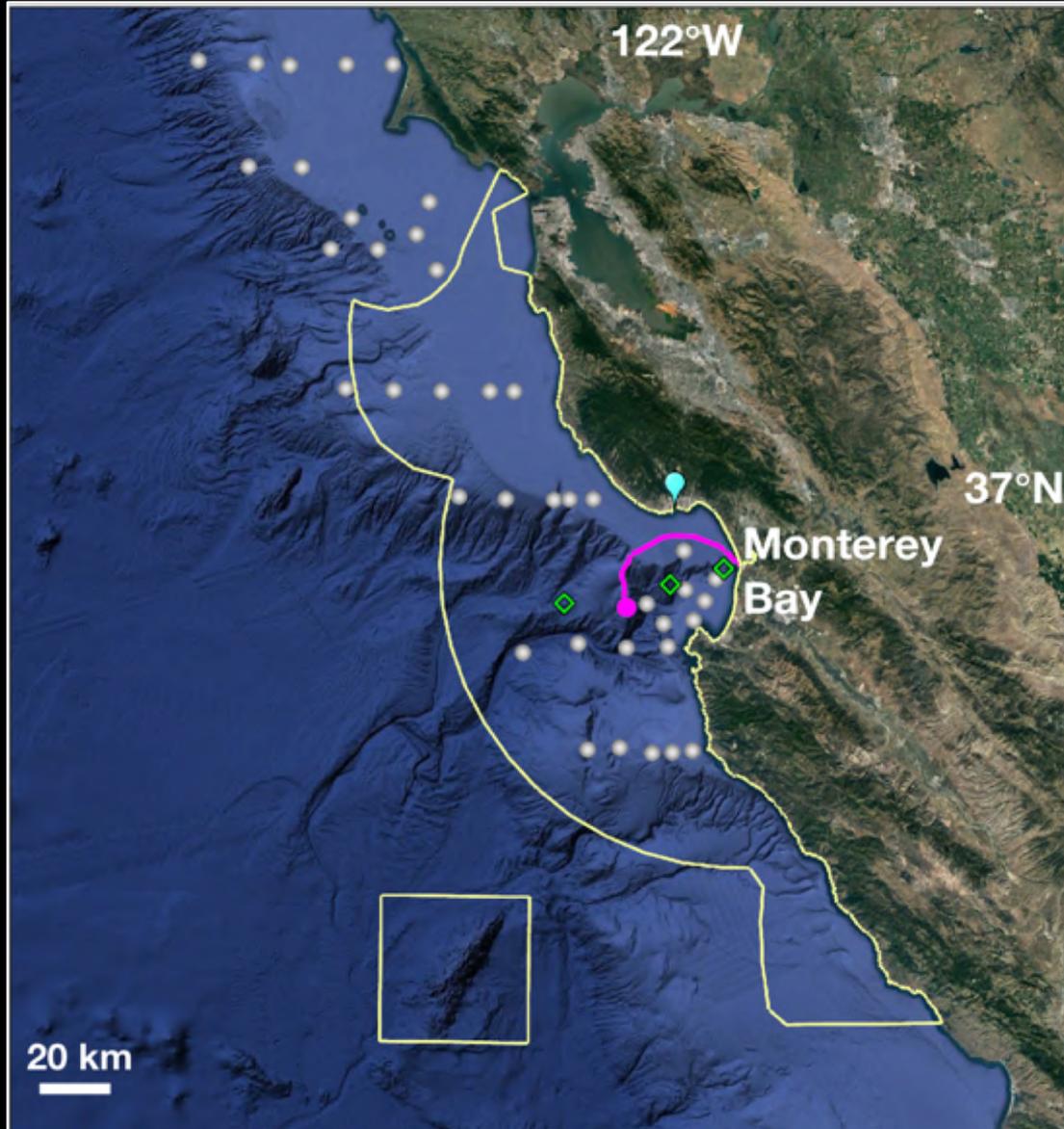
Whale images by Larry Foster

Whale behavioral ecology



Humpback whale image by Larry Foster

Whale behavioral ecology



Whale sighting data:
Nancy Black, MBWW
Karin Forney, NOAA/MLML

Sea level: NASA

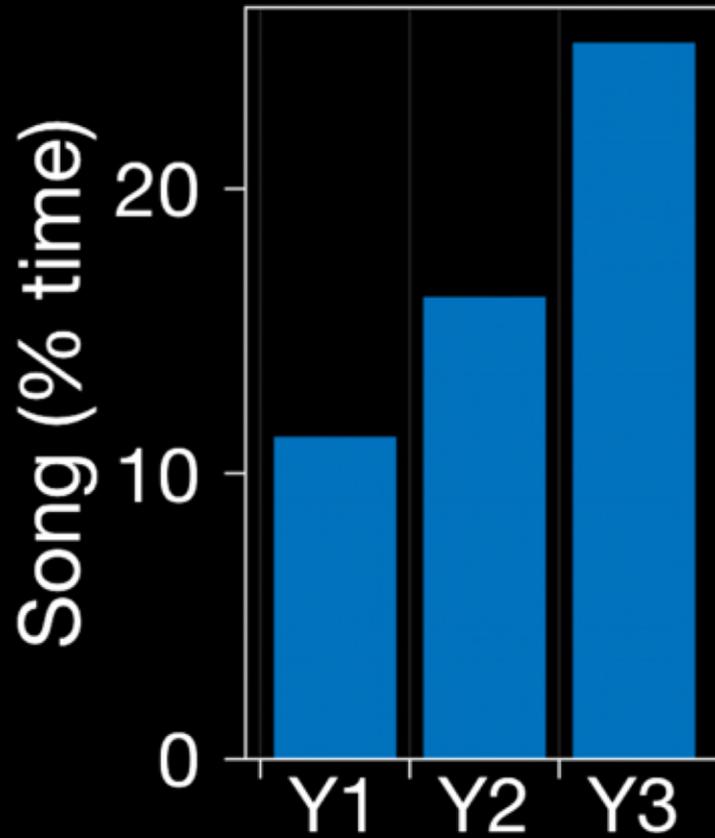
Winds: NOAA

Primary productivity:
Francisco Chavez, MBARI

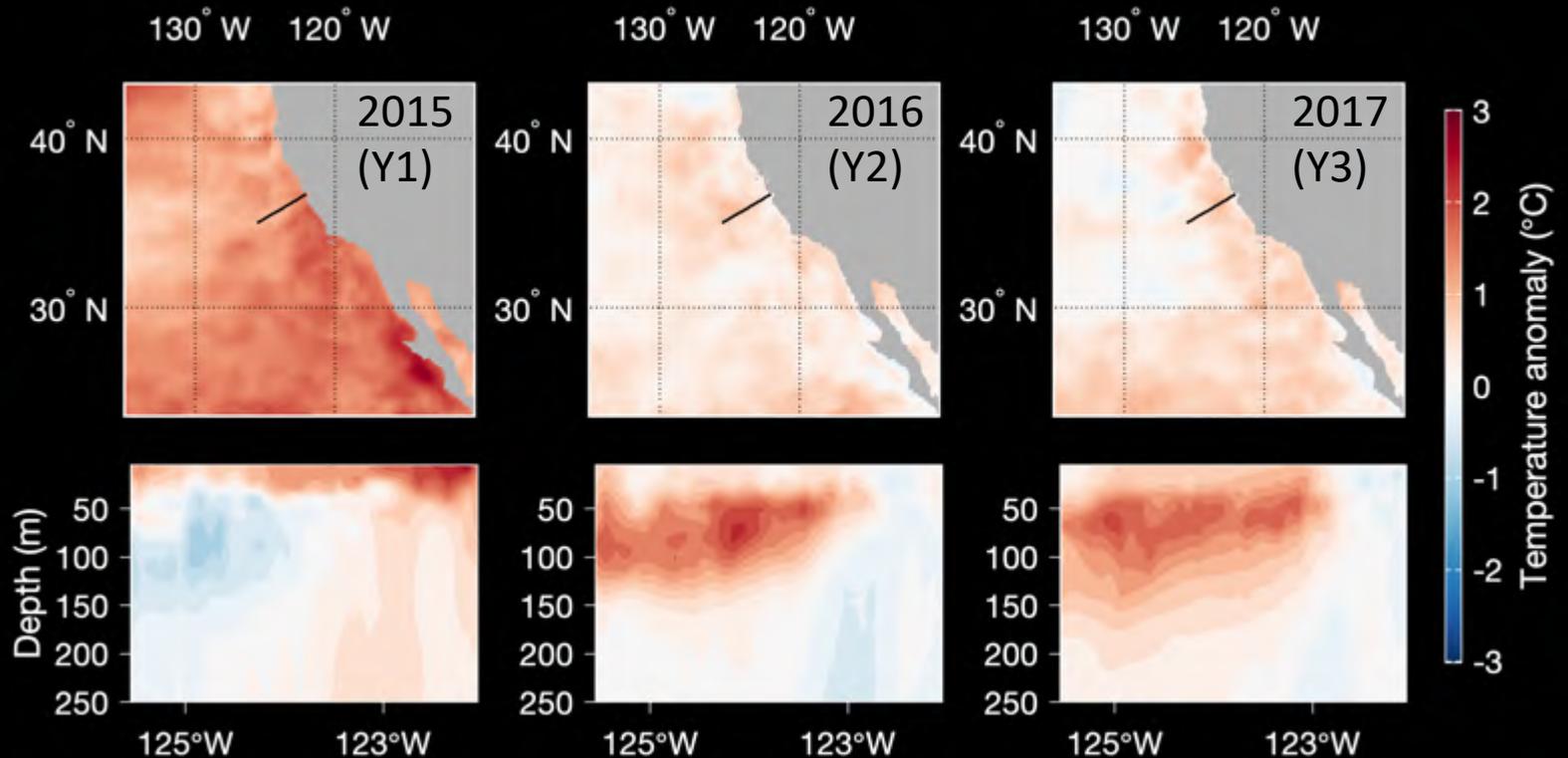
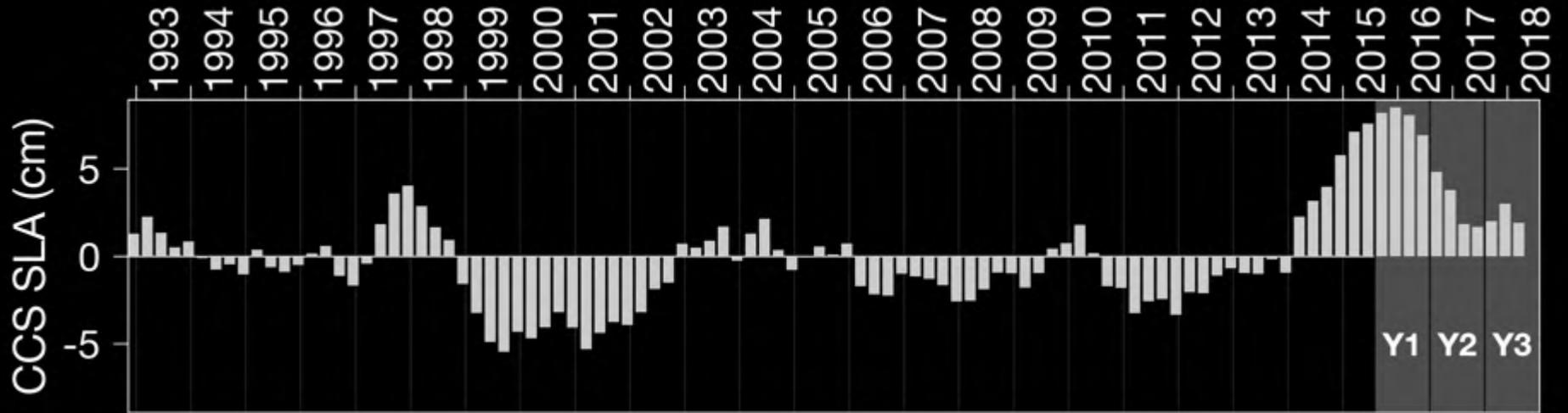
Algal toxins:
Raphael Kudela, UCSC

Forage species:
Jarrod Santora, UCSC

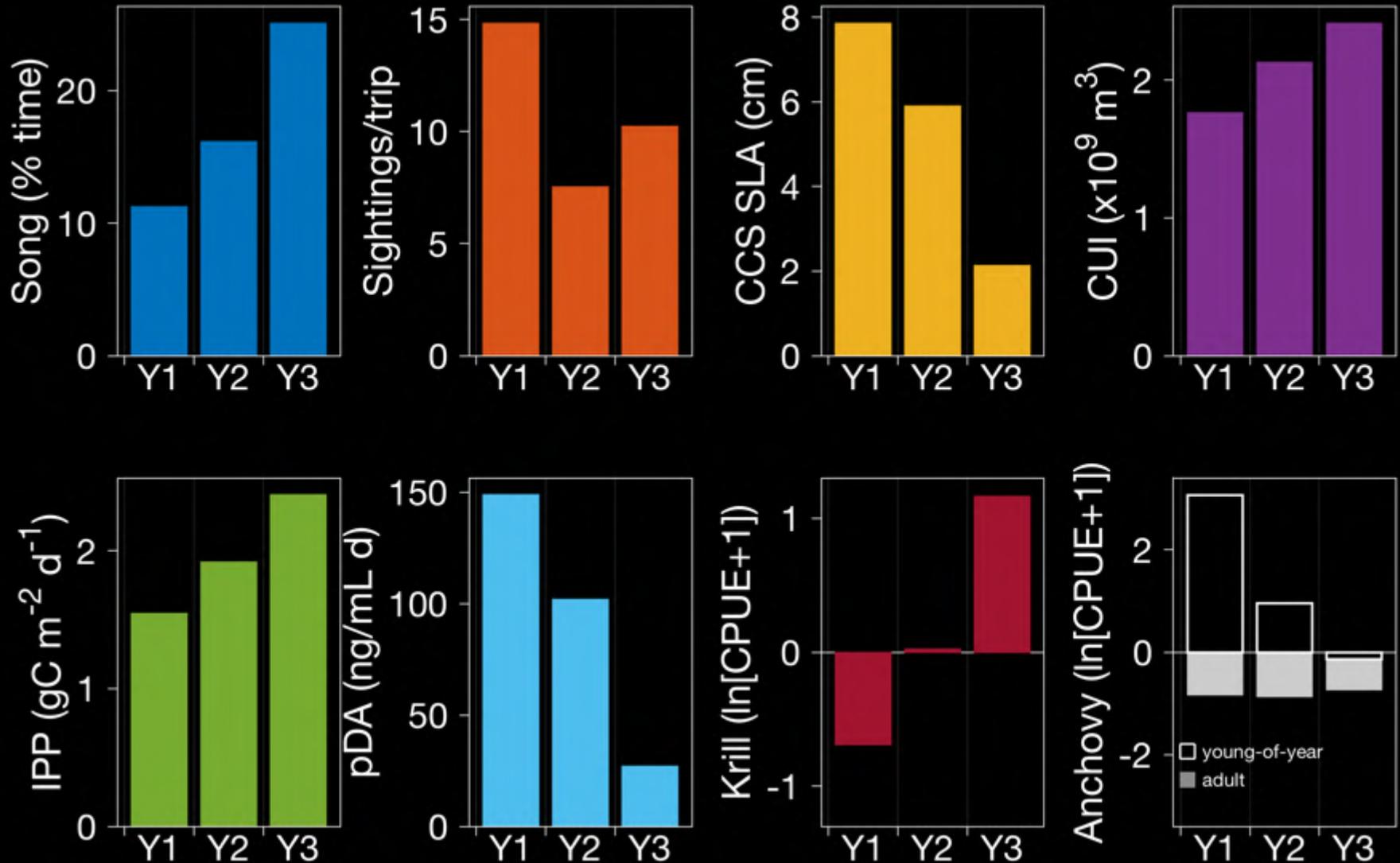
Whale behavioral ecology



Whale behavioral ecology



Whale behavioral ecology



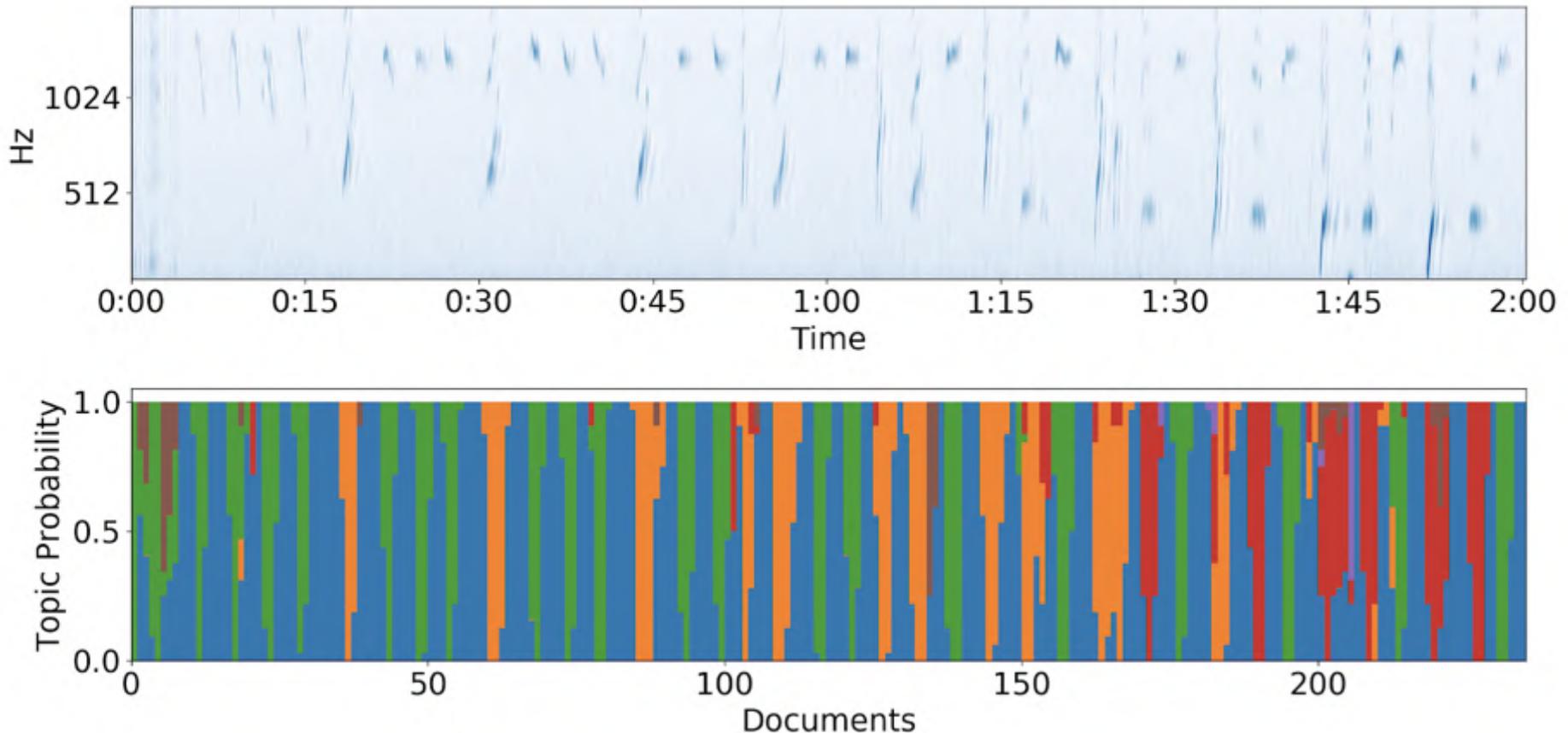
Whale behavioral ecology

2015	Shellfish Harvest and Fishery Closures with Maximum Domoic Acid Values
7-May	Quinault tribe razor clam harvest closure (WA)
8-May	Commercial, tribal & recreational razor clam harvest closure (WA)
9-May	Razor clam harvest closure (northern OR)
14-May	State wide razor clam harvest closure (OR)
15-May	Shellfish harvest closure (BC Canada)
29-May	Anchovy viscera maximum 1671 ppm (CA)
1-Jun	Anchovy, sardine fishery closure (CA)
3-Jun	Dungeness crab maximum 65 ppm (WA)
5-Jun	Dungeness crab fishery closure (WA)
3-Jul	Anchovy, sardine, mussel, & clam closures expanded to southern CA
11-Sep	Dungeness crab maximum 140 ppm (northern CA)
27-Oct	Razor clam maximum 170 ppm (southern OR)
3-Nov	Dungeness crab & rock crab warning for recreational harvest (CA)
6-Nov	Commercial rock crab fishery closed (CA)
8-Nov	Dungeness crab maximum 70 ppm (southern OR)
11-Nov	Dungeness crab & rock crab recreational & commercial fishery closure (CA)
22-Nov	Dungeness crab maximum 270 ppm (northern CA)
23-Nov	Rock crab maximum 1000 ppm (southern CA)
23-Nov	Delayed opening of commercial Dungeness crab fishery (WA, OR, CA)
9-Feb-2016	CA seeks federal disaster declaration for commercial crab fishery



2015: Largest geographic extent of DA detection in marine mammals ever recorded globally (McCabe et al., 2016)

Whale behavioral ecology



- ❖ Topic modeling: discover themes in textual and genetic data, images, social media.
- ❖ Adaptation: discover themes in the features of acoustic data segments

Education & Outreach

MBNMS AC working group recommendation

We recommend sound be featured in the Sanctuary's visitors centers – utilizing exhibits, events and outreach programs describing sound in the marine environment that will reveal how sound is used by animals in the ocean and that manmade sound can have impacts.

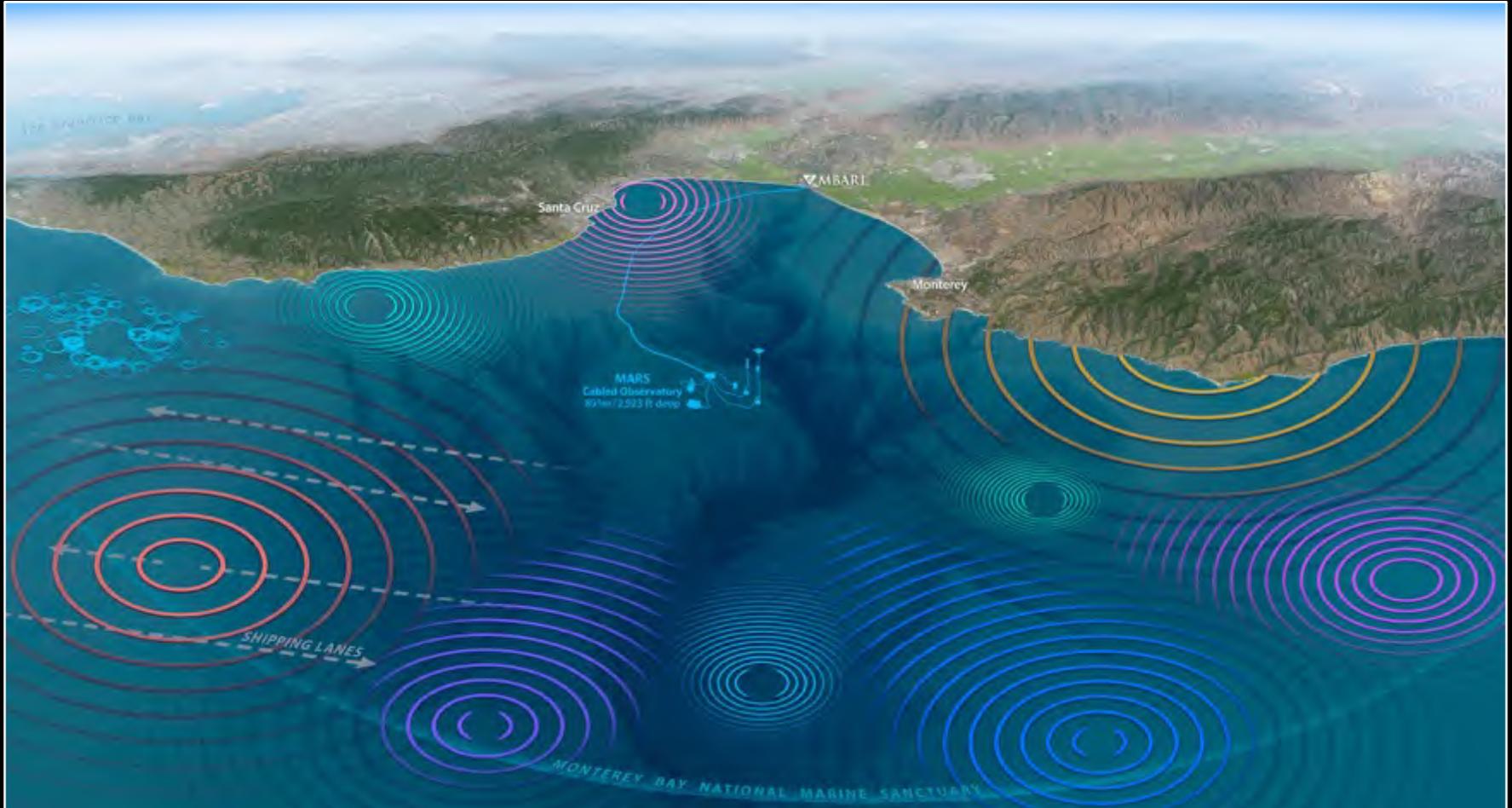
Education & Outreach



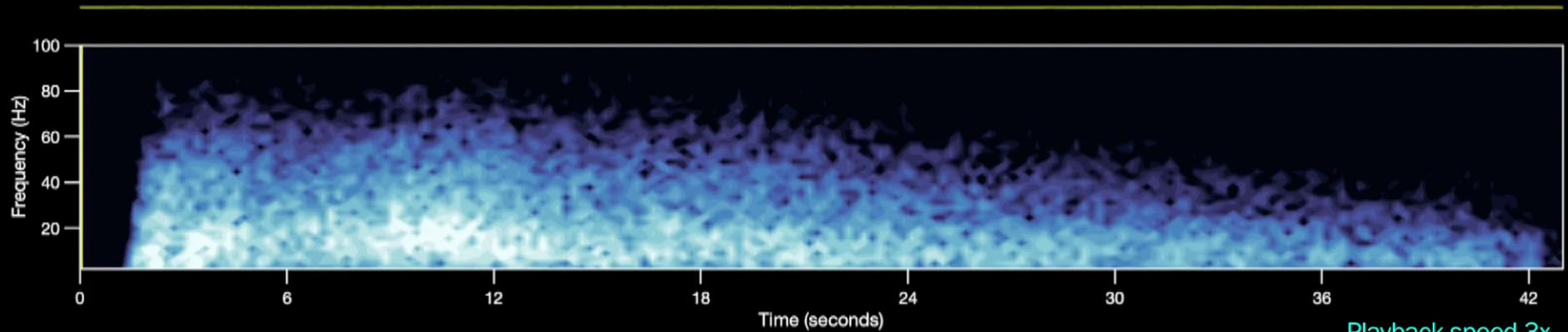
Education & Outreach



Education & Outreach

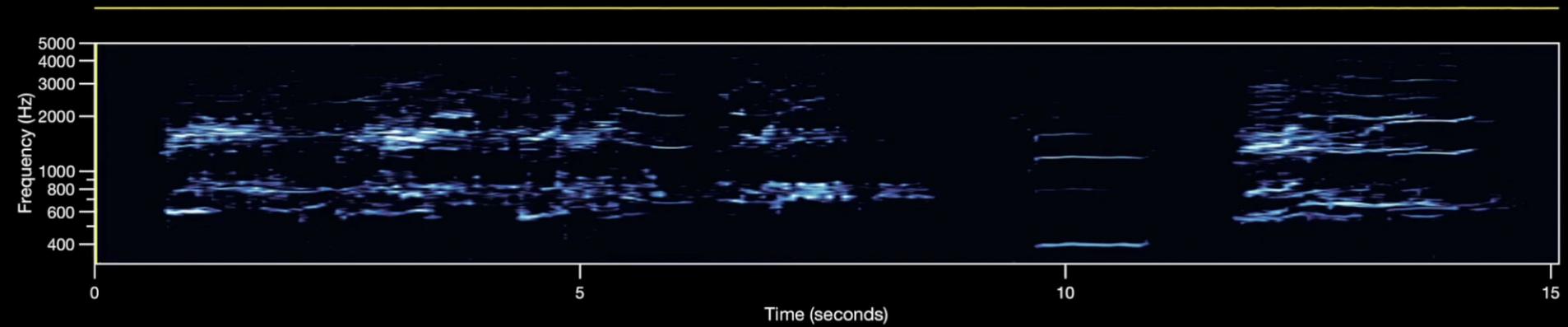


Education & Outreach

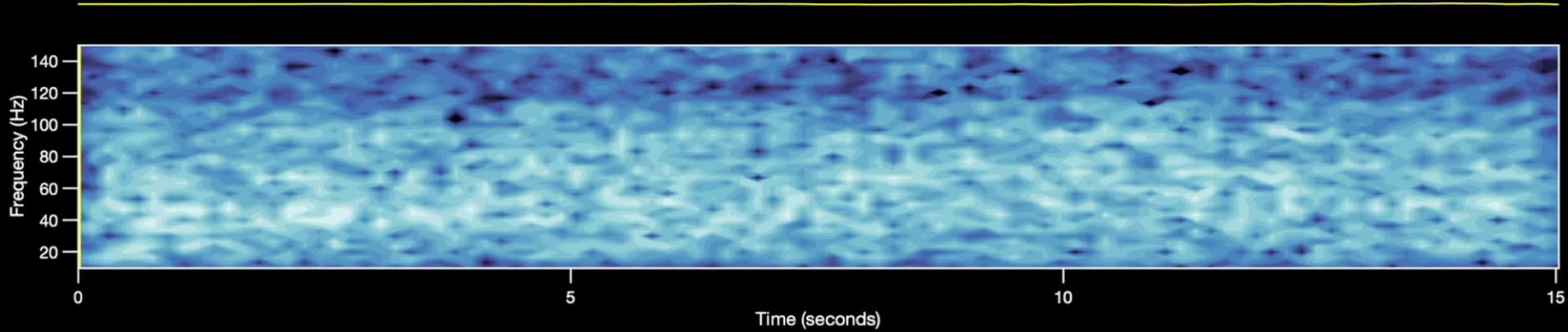


Playback speed 3x

Education & Outreach



Education & Outreach



Anthropogenic noise

MBNMS AC working group recommendation

We recommend Sanctuary staff consult with appropriate agencies and fishing industry representatives to catalog current uses of seal bombs and where applicable encourage continued enforcement by appropriate agencies.

We recommend the Sanctuary convene collaborative groups of stakeholders with the goal of developing strategies to both minimize future seal bomb use and developing effective alternatives in the Sanctuary.

Anthropogenic noise

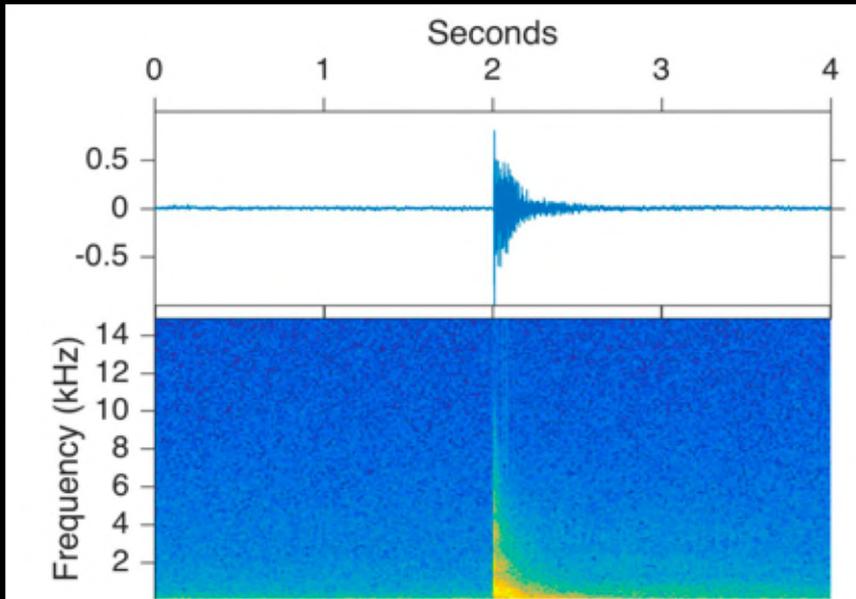
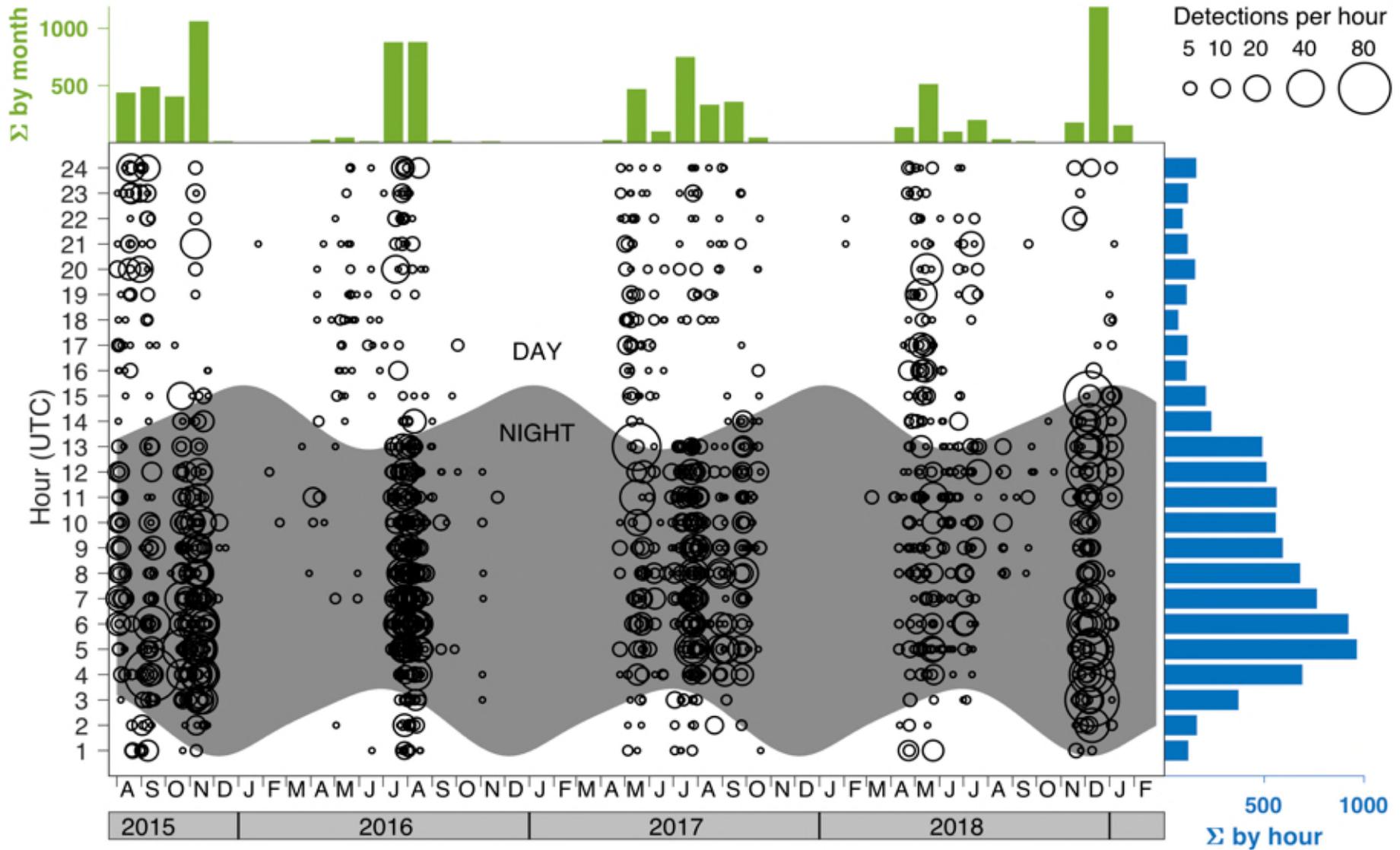


Fig. 9. Anthrophony: acoustic detection of a fishery explosion ('seal bomb'), represented as waveform (top) and the log of power spectral density (bottom).



Anthropogenic noise



Questions?

