

Temporal and spatial acoustic occurrence of odontocetes on Canada's east coast

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Marine Mammals



At-Risk Odontocetes

Sowerby's Beaked Whale,
Special Concern



Harbour Porpoise,
Special Concern (COSEWIC)
Threatened (SARA)



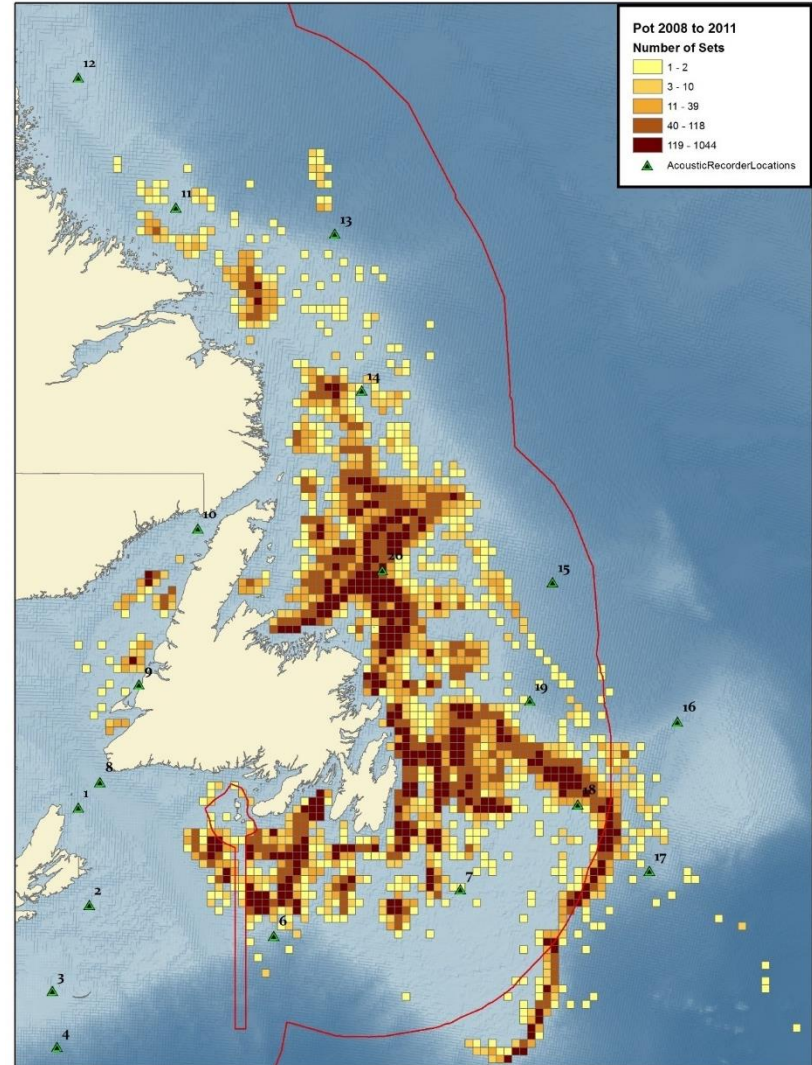
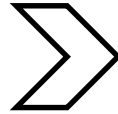
Northern Bottlenose Whale,
Endangered (Gully)
Special Concern (Labrador)



Canada's East Coast

Site of diverse human activities

Fishing

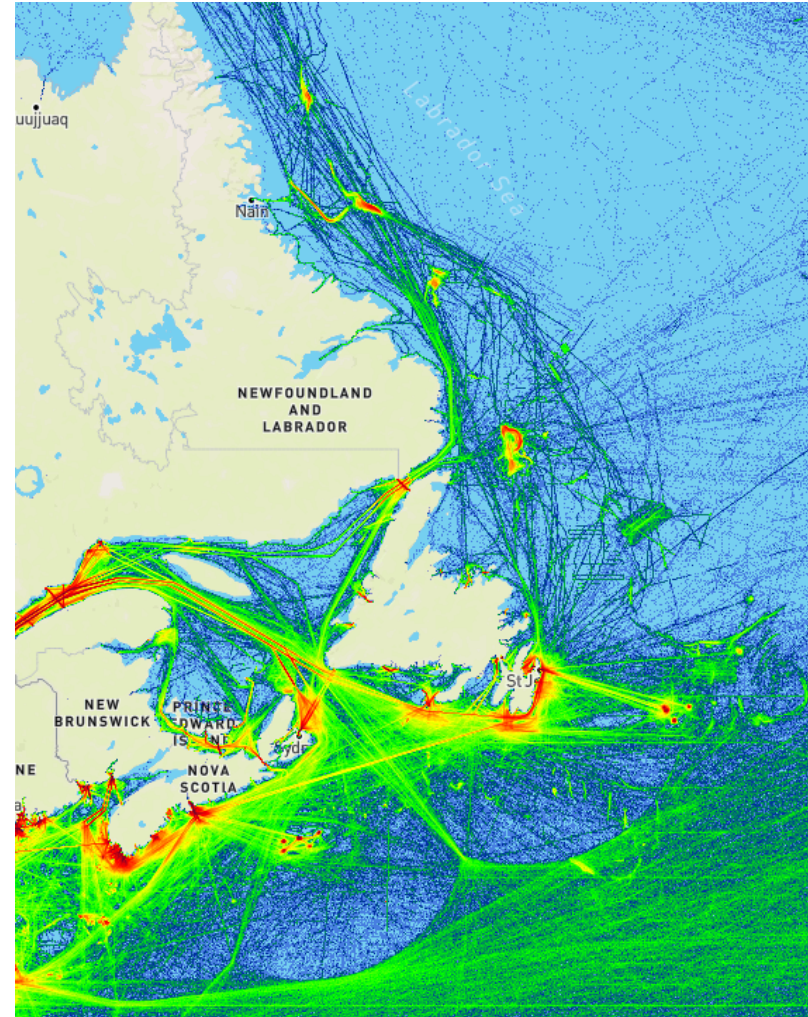
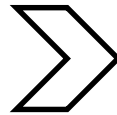


Canada's East Coast

Site of diverse human activities

Fishing

Shipping



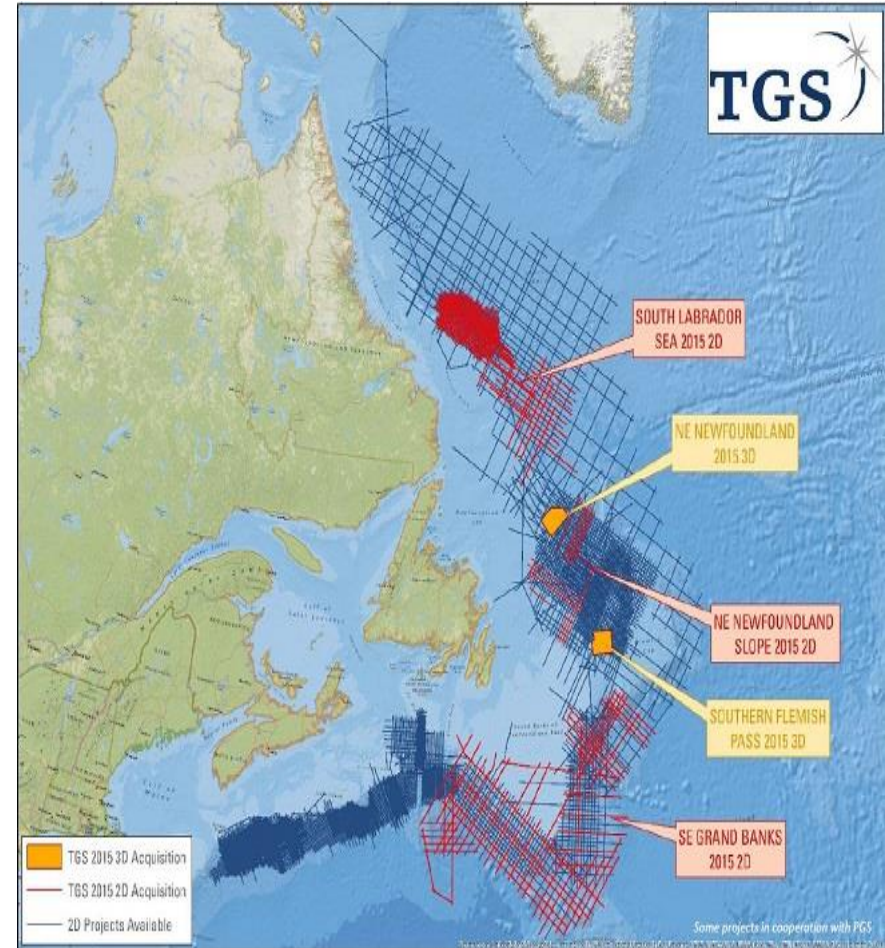
Canada's East Coast

Site of diverse human activities

Fishing

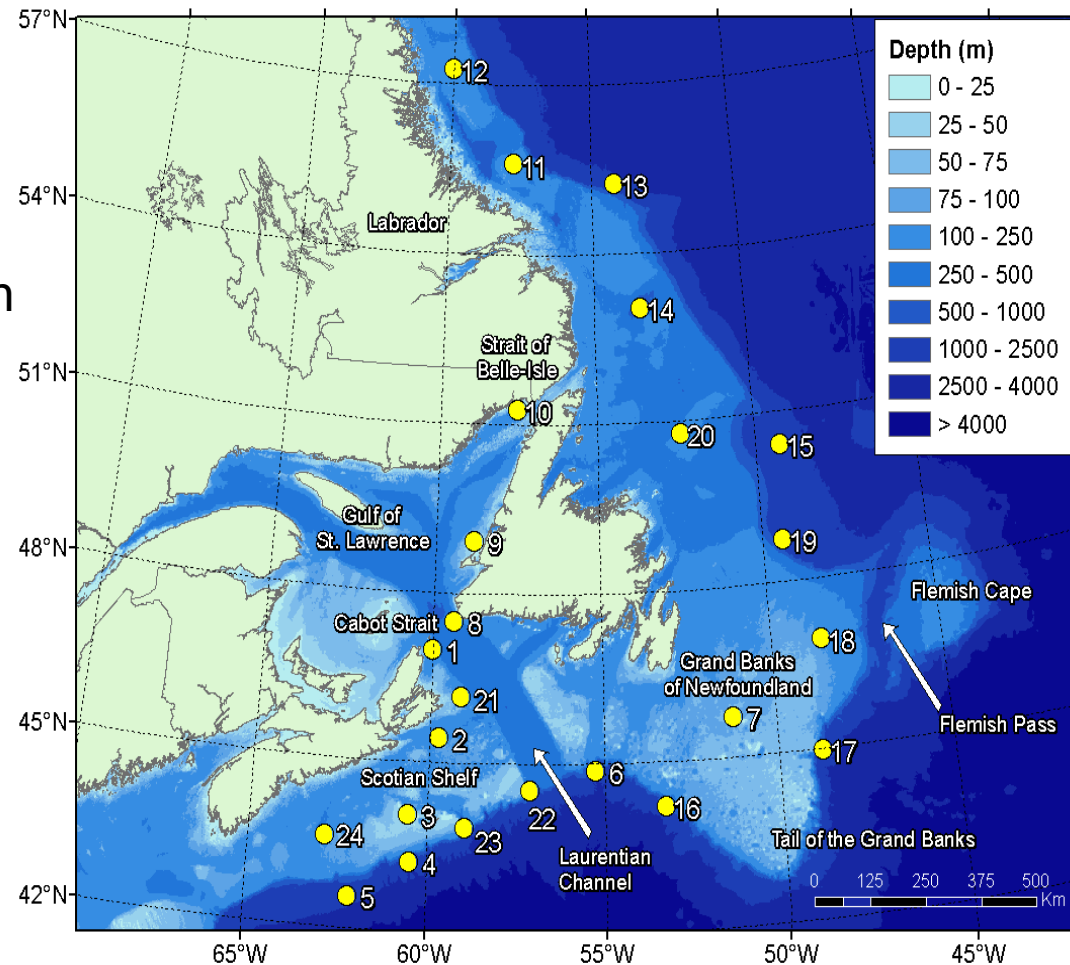
Shipping

Oil and gas activities



Study Objectives

- Year-long acoustic monitoring program:
 - Assess marine mammal occurrence in eastern Canada
 - Characterize the soundscape
- 24 recording sites
 - Approx. May 2015 – Jul 2016



Data Collection



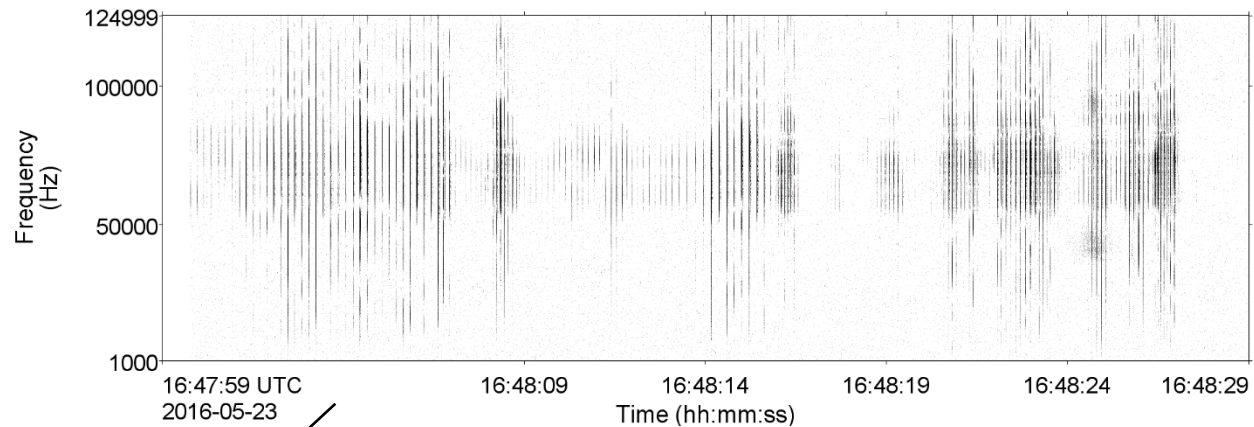
Duty Cycle: 1 min/20 @ 250 kHz

Photo by E. Maxner

Acoustic Identification of Odontocetes

Click detector/classifier

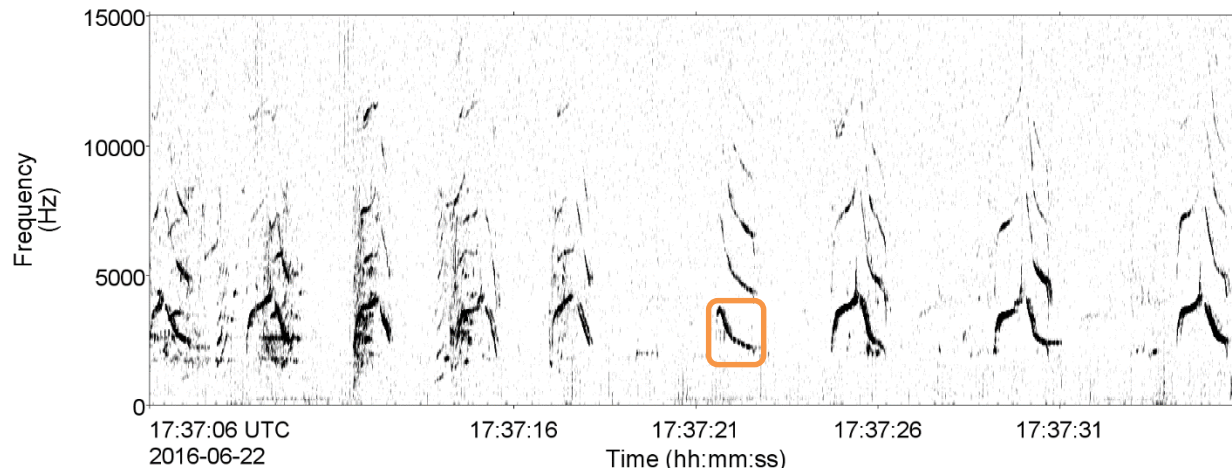
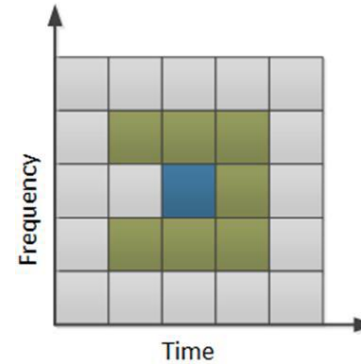
- Based on zero crossings in acoustic time series



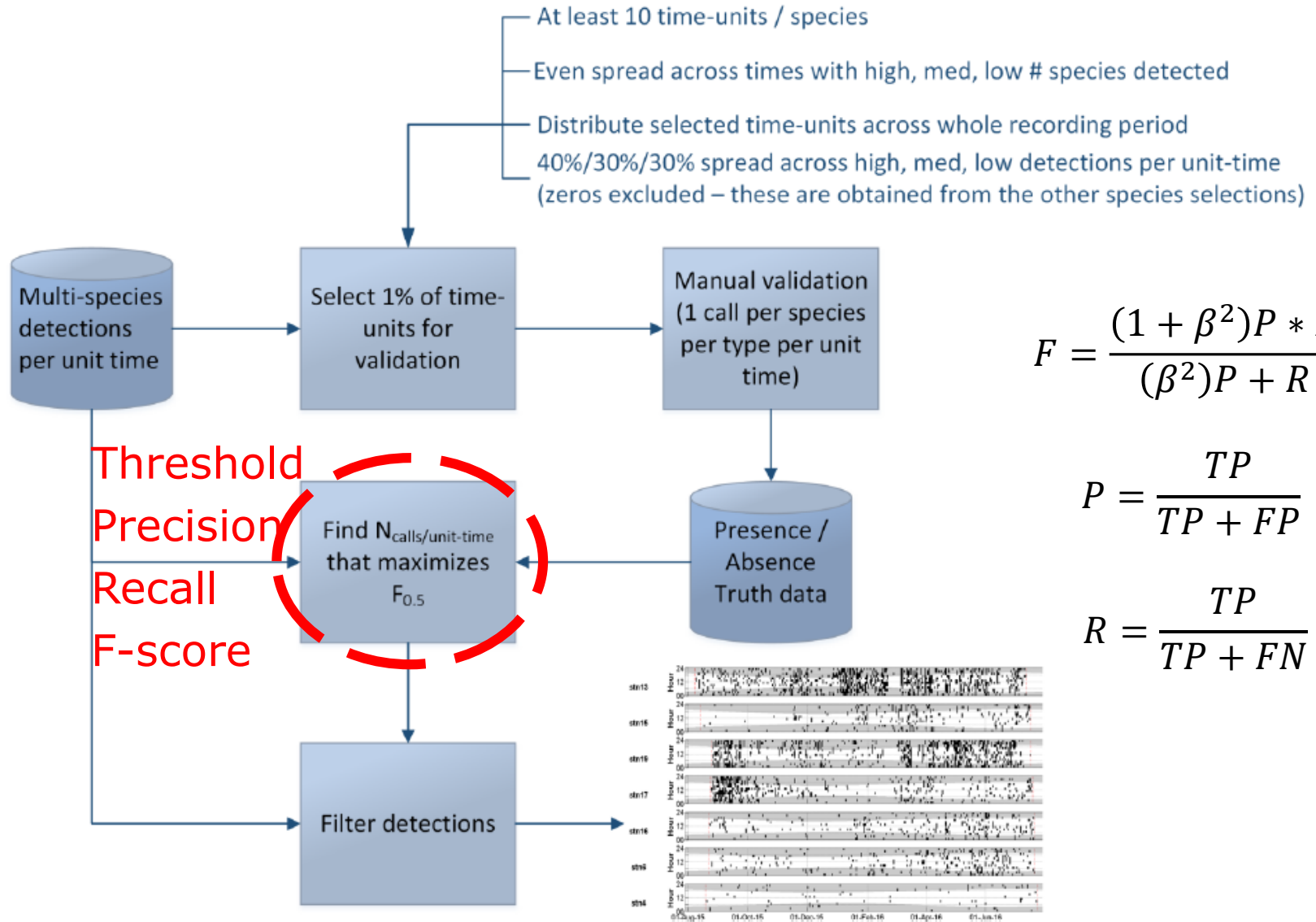
Acoustic Identification of Odontocetes

Tonal call detector

- Contour detector and sorter



Validation of Automated Detectors



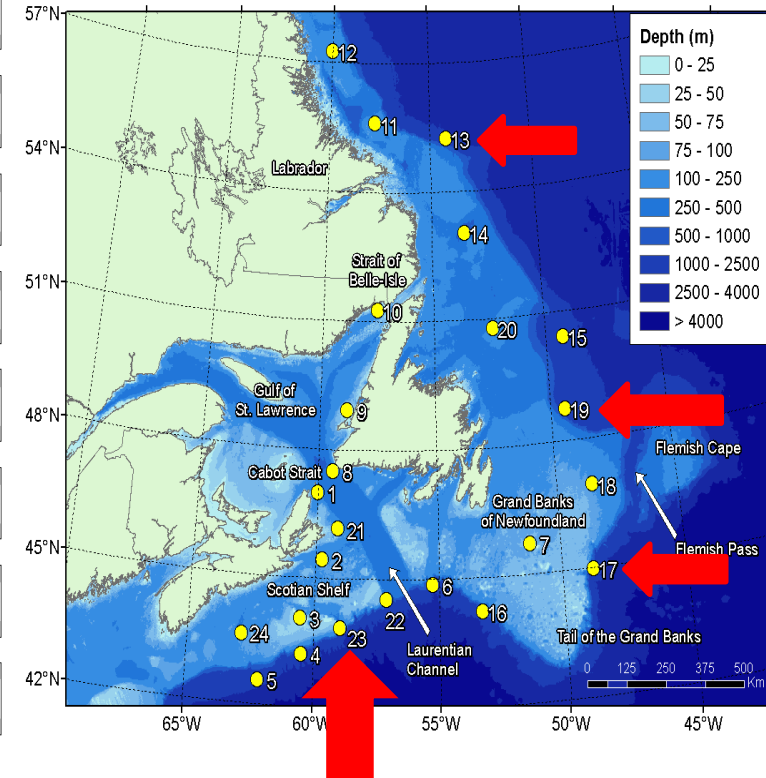
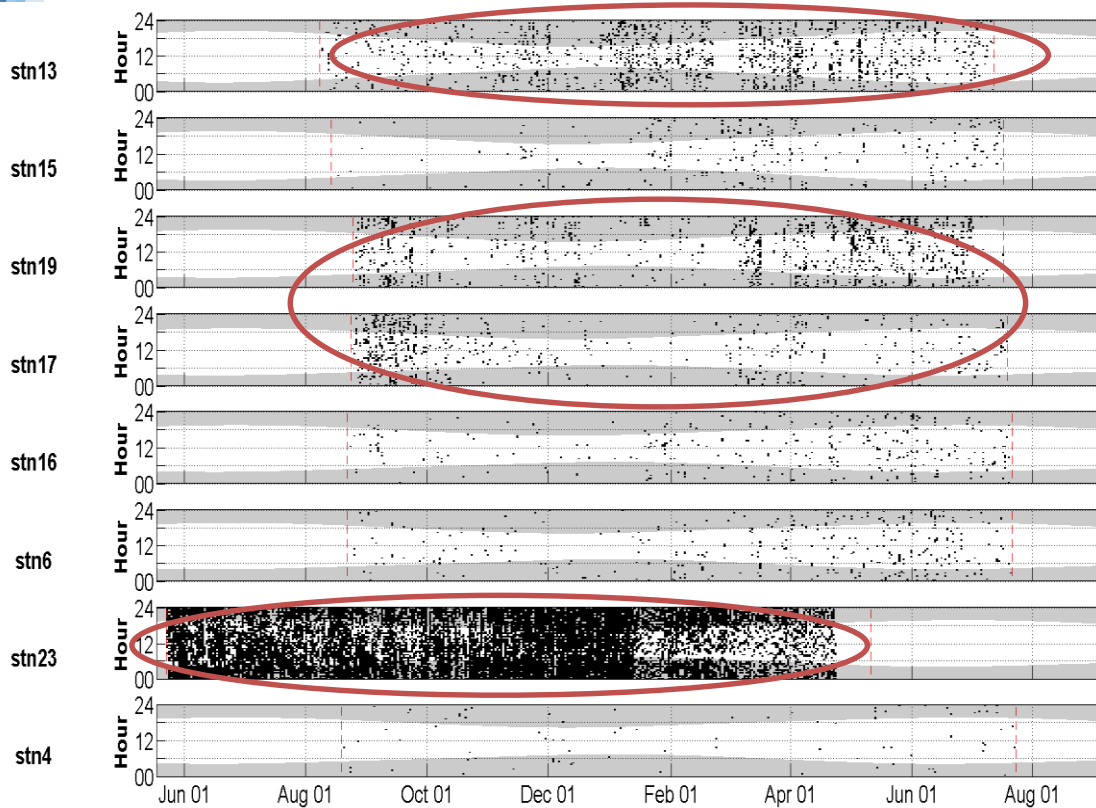
$$F = \frac{(1 + \beta^2)P * R}{(\beta^2)P + R}$$

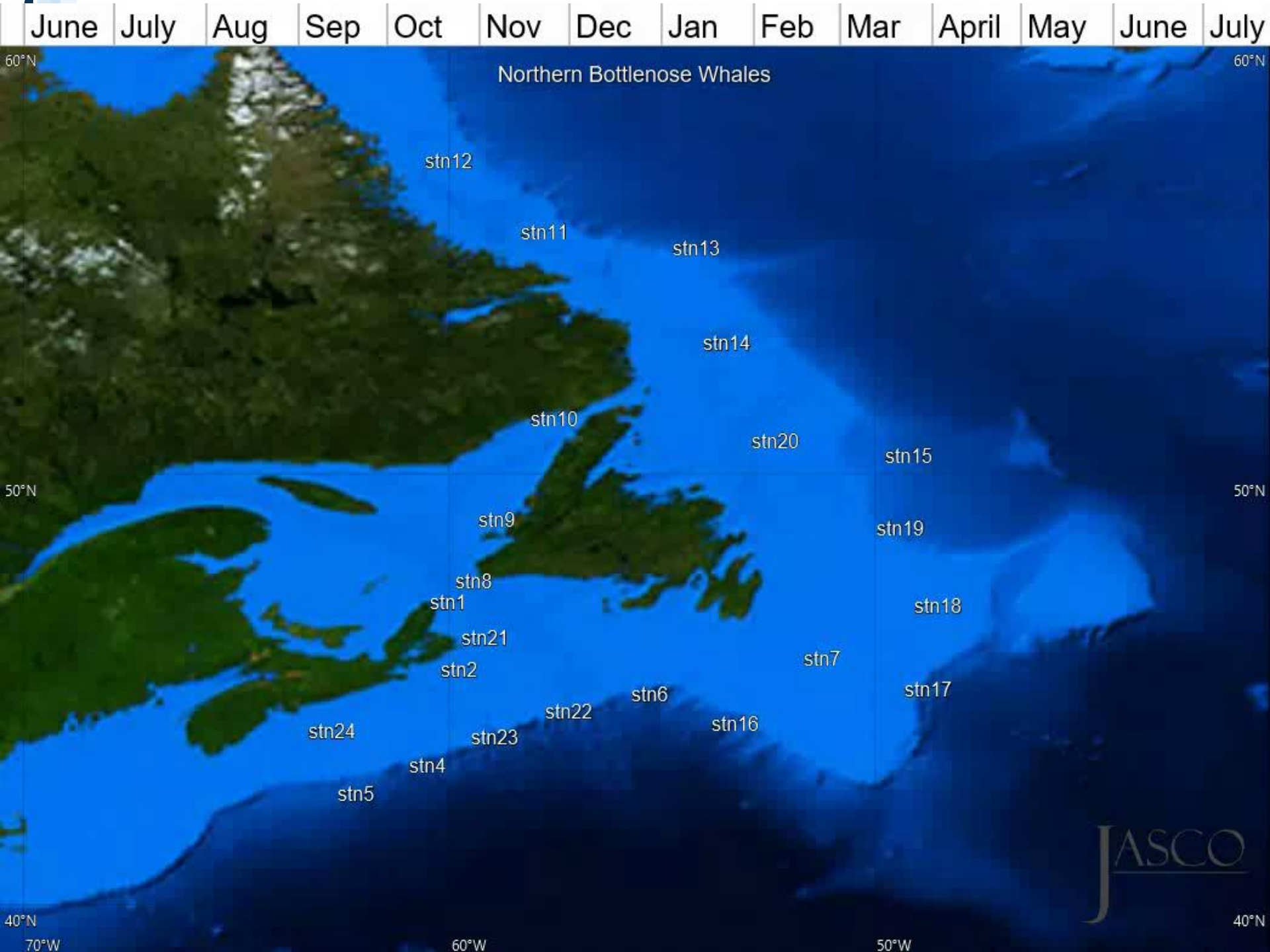
$$P = \frac{TP}{TP + FP}$$

$$R = \frac{TP}{TP + FN}$$

Northern Bottlenose Whales

Threshold	P	R	F
1	0.85	0.73	0.82





June July Aug Sep Oct Nov Dec Jan Feb Mar April May June July

Northern Bottlenose Whales

stn12

stn11

stn13

stn14

stn10

stn20

stn15

stn9

stn19

stn8

stn18

stn1

stn7

stn21

stn17

stn2

stn22

stn6

stn16

stn24

stn23

stn4

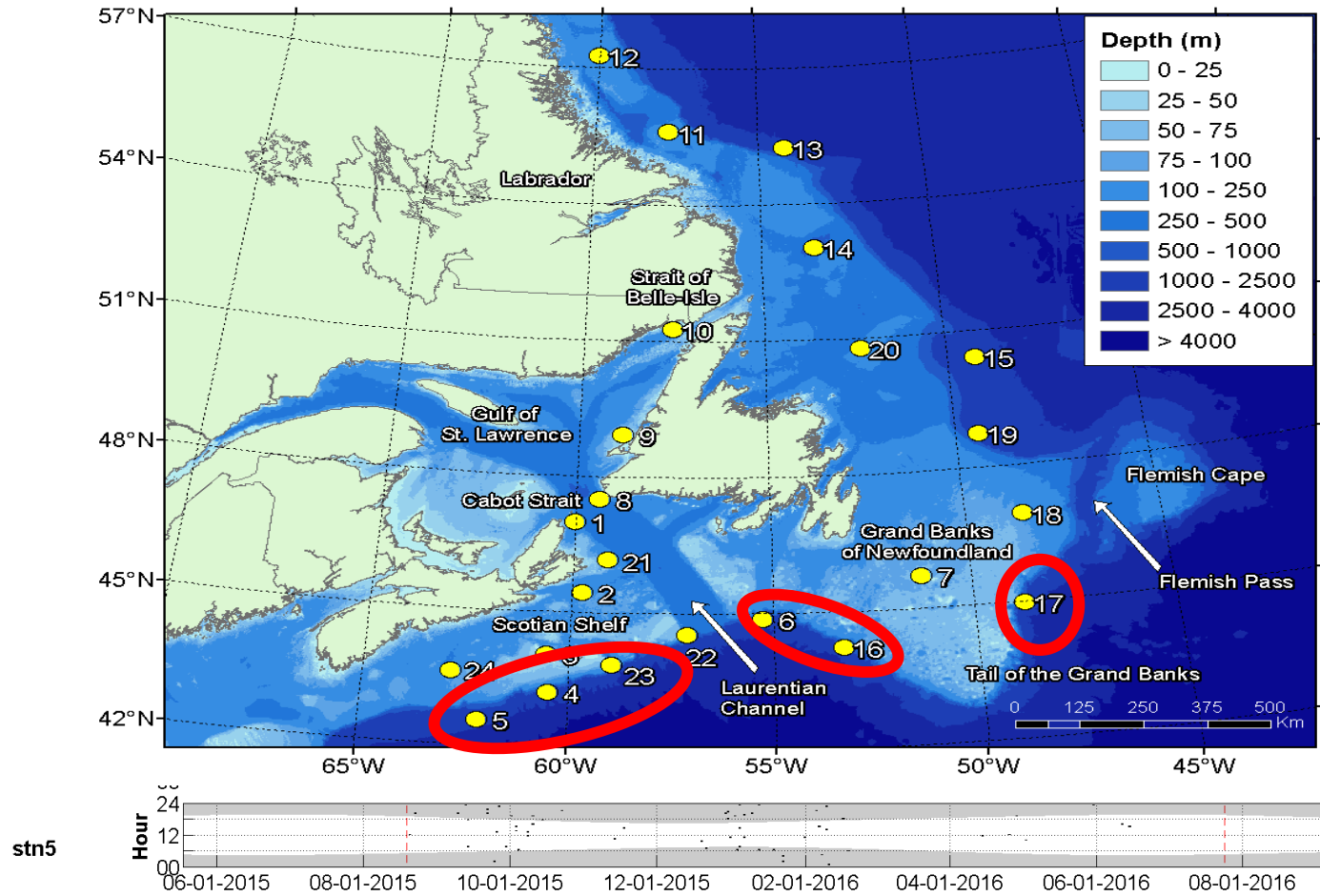
stn5



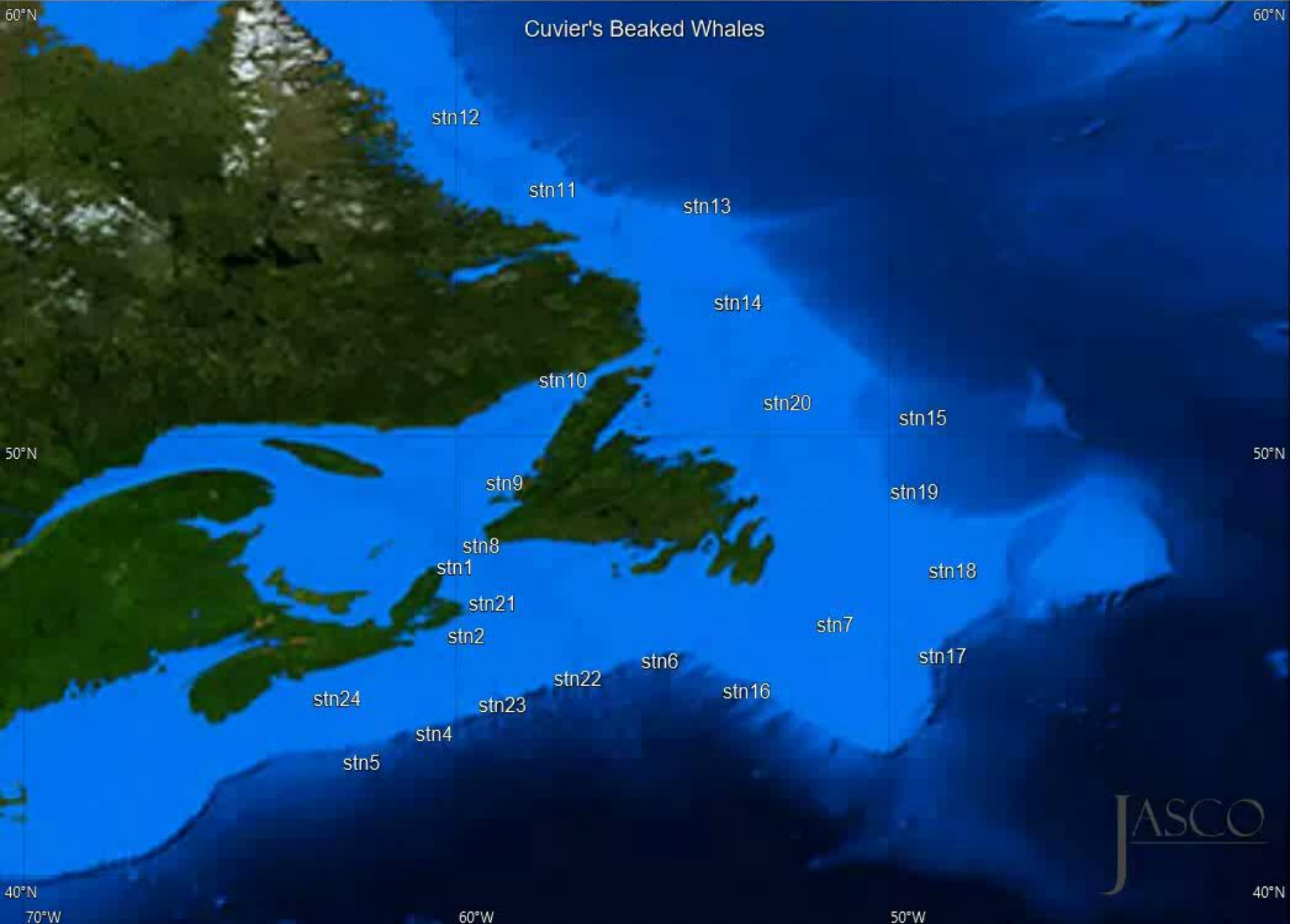
60°N 50°N 40°N 70°W 60°W 50°W

Cuvier's Beaked Whales

Threshold	P	R	F
9	0.85	0.31	0.63

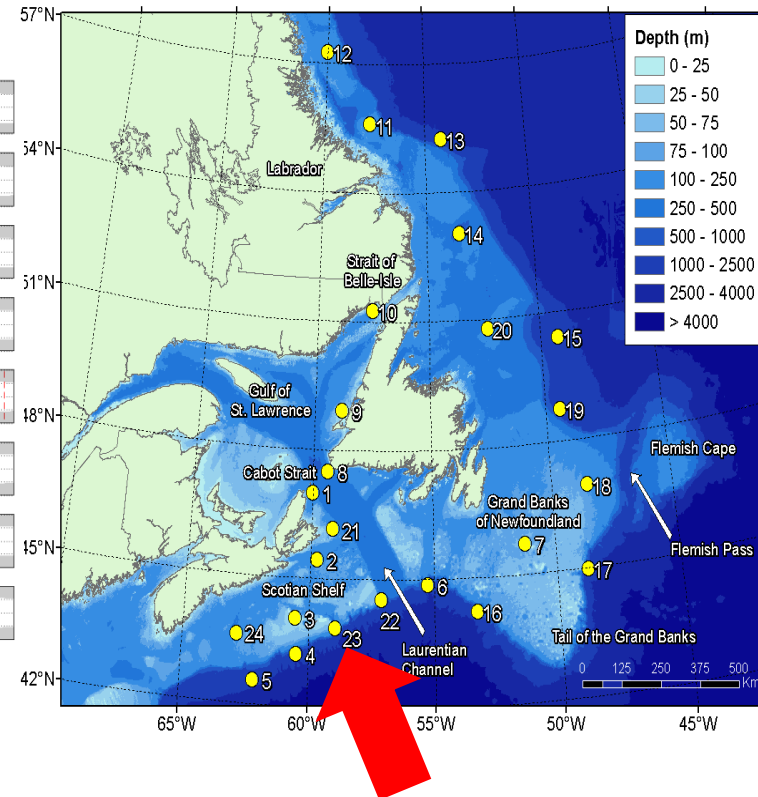
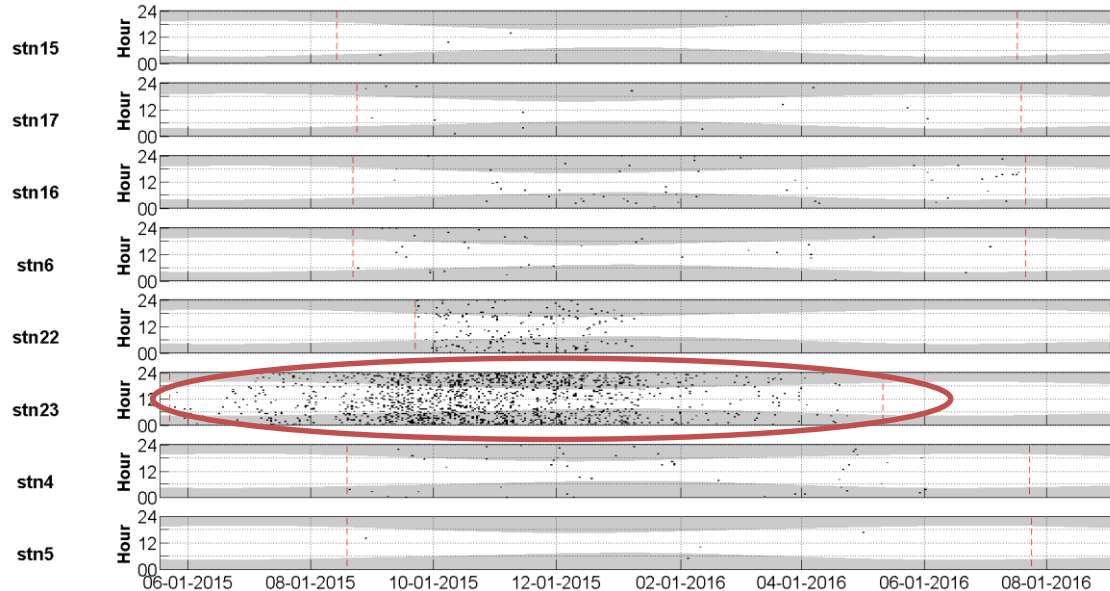


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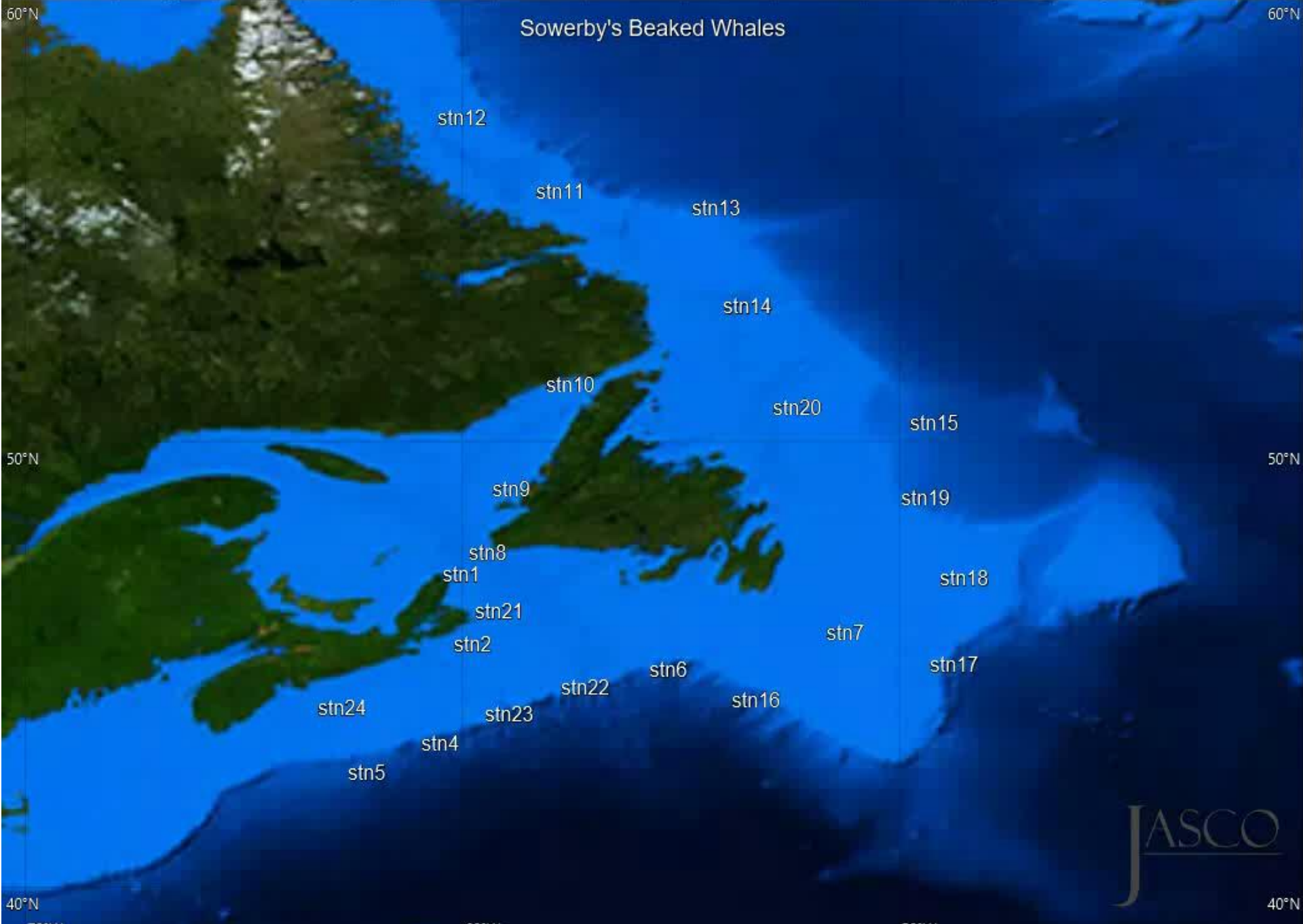


Sowerby's Beaked Whales

Threshold	P	R	F
2	1	0.94	0.99

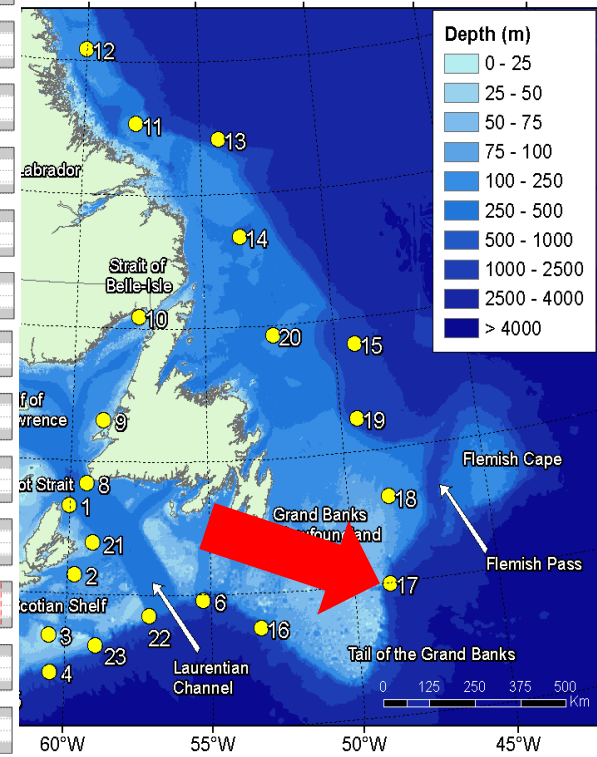
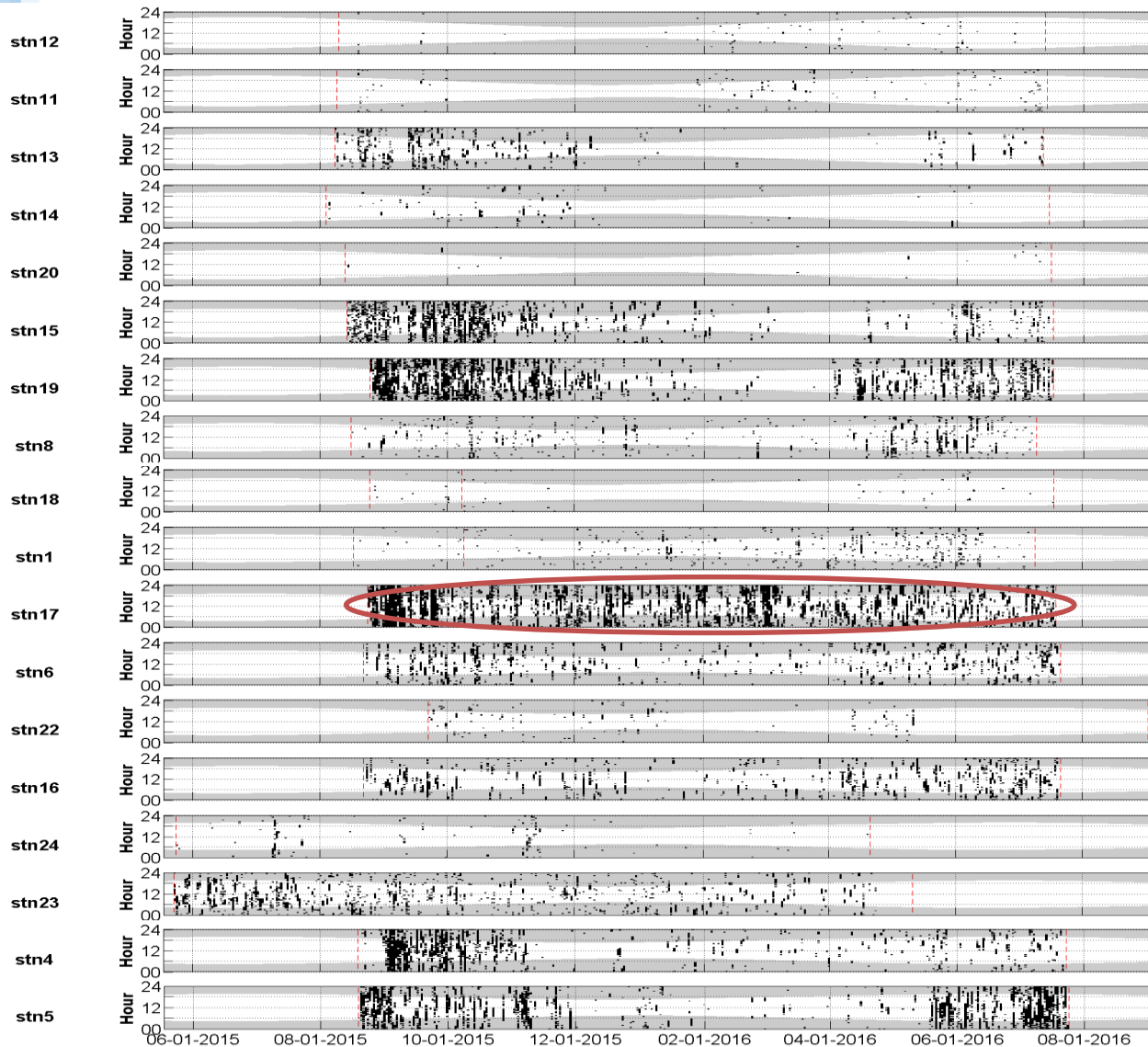


June July Aug Sep Oct Nov Dec Jan Feb Mar April May June July

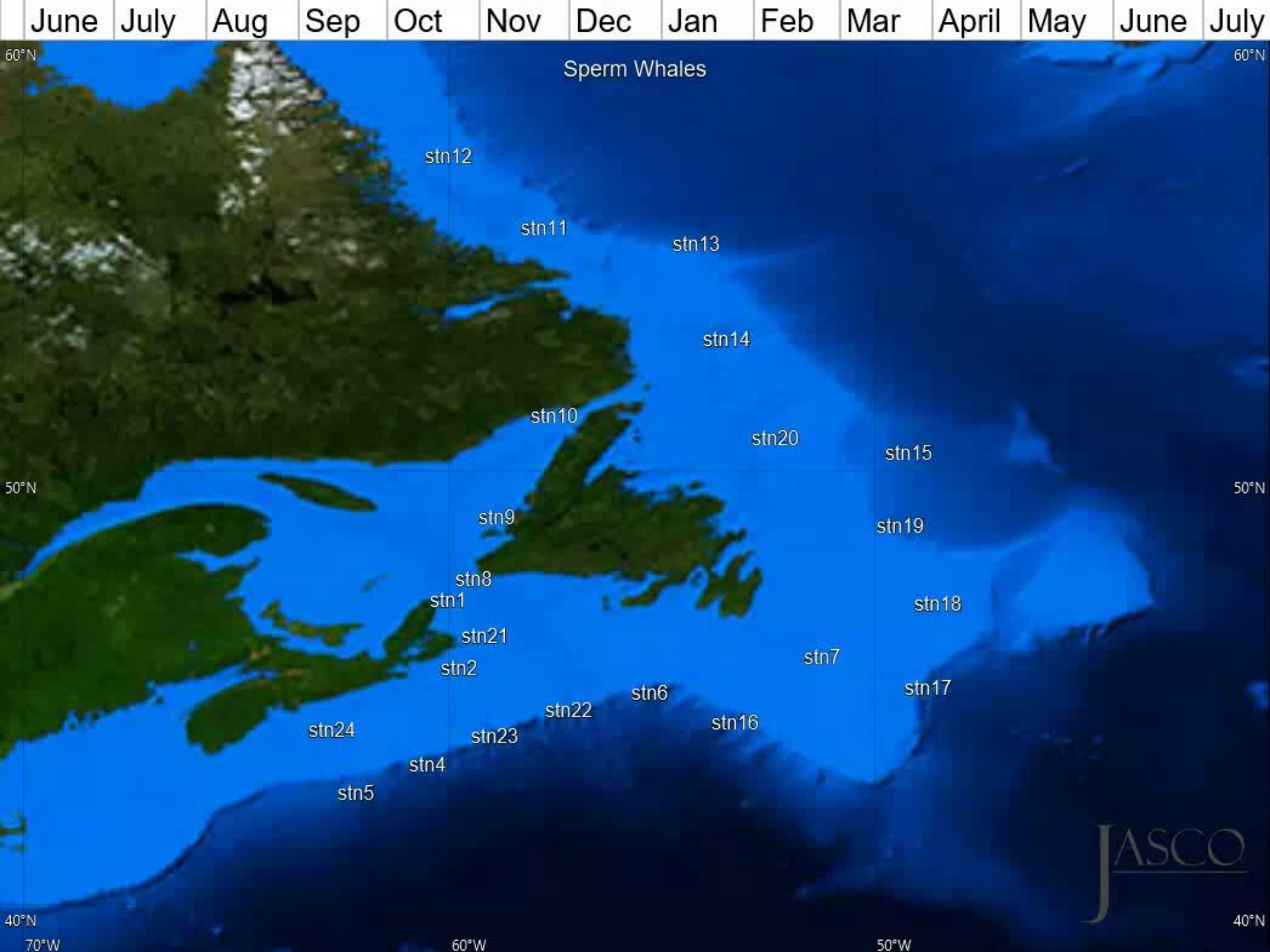


Sperm Whales

Threshold	P	R	F
4	0.67	0.41	0.60

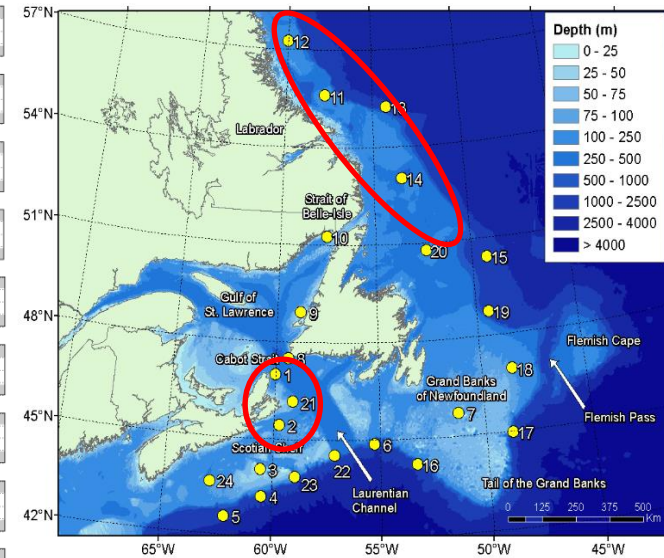
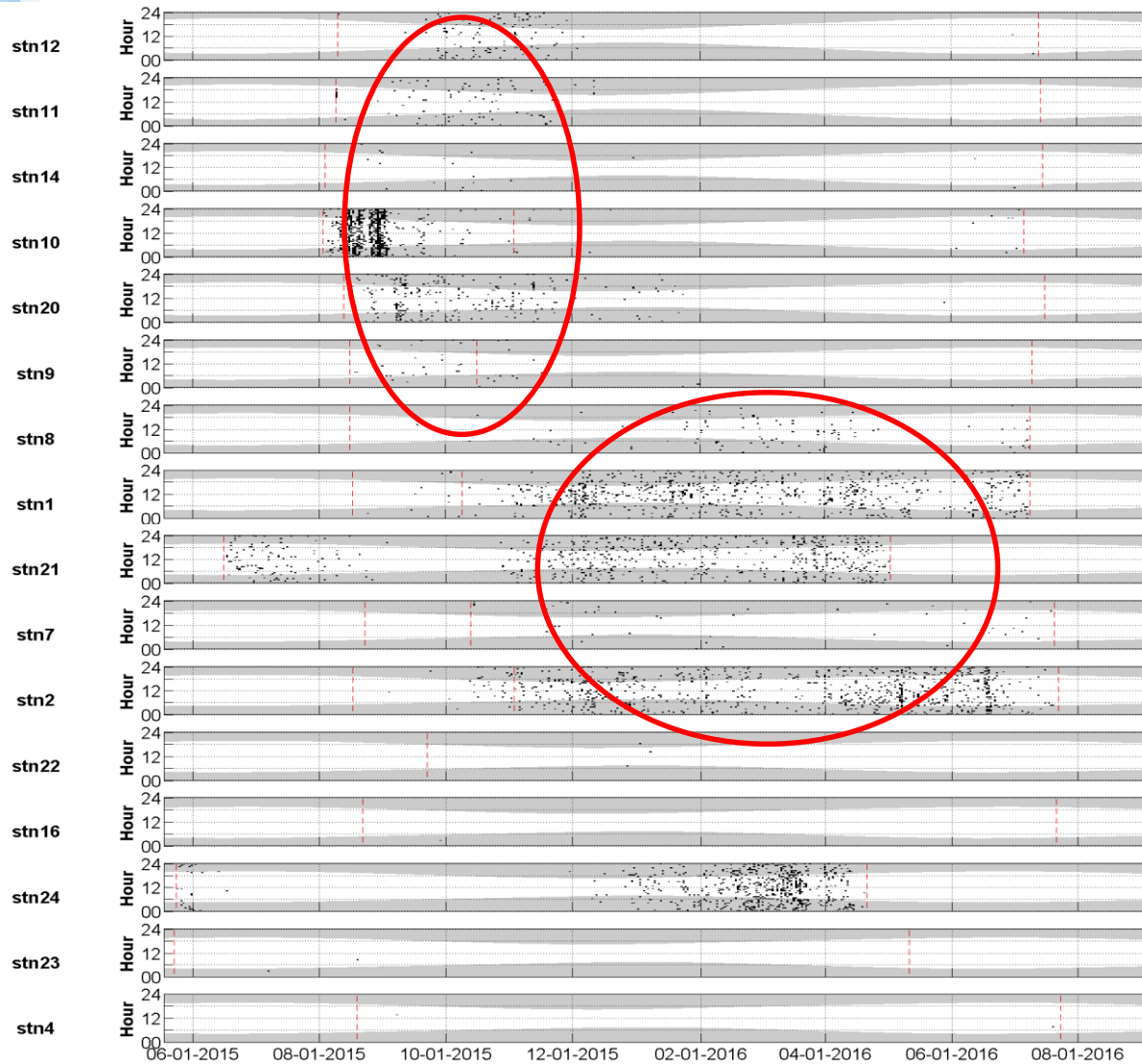


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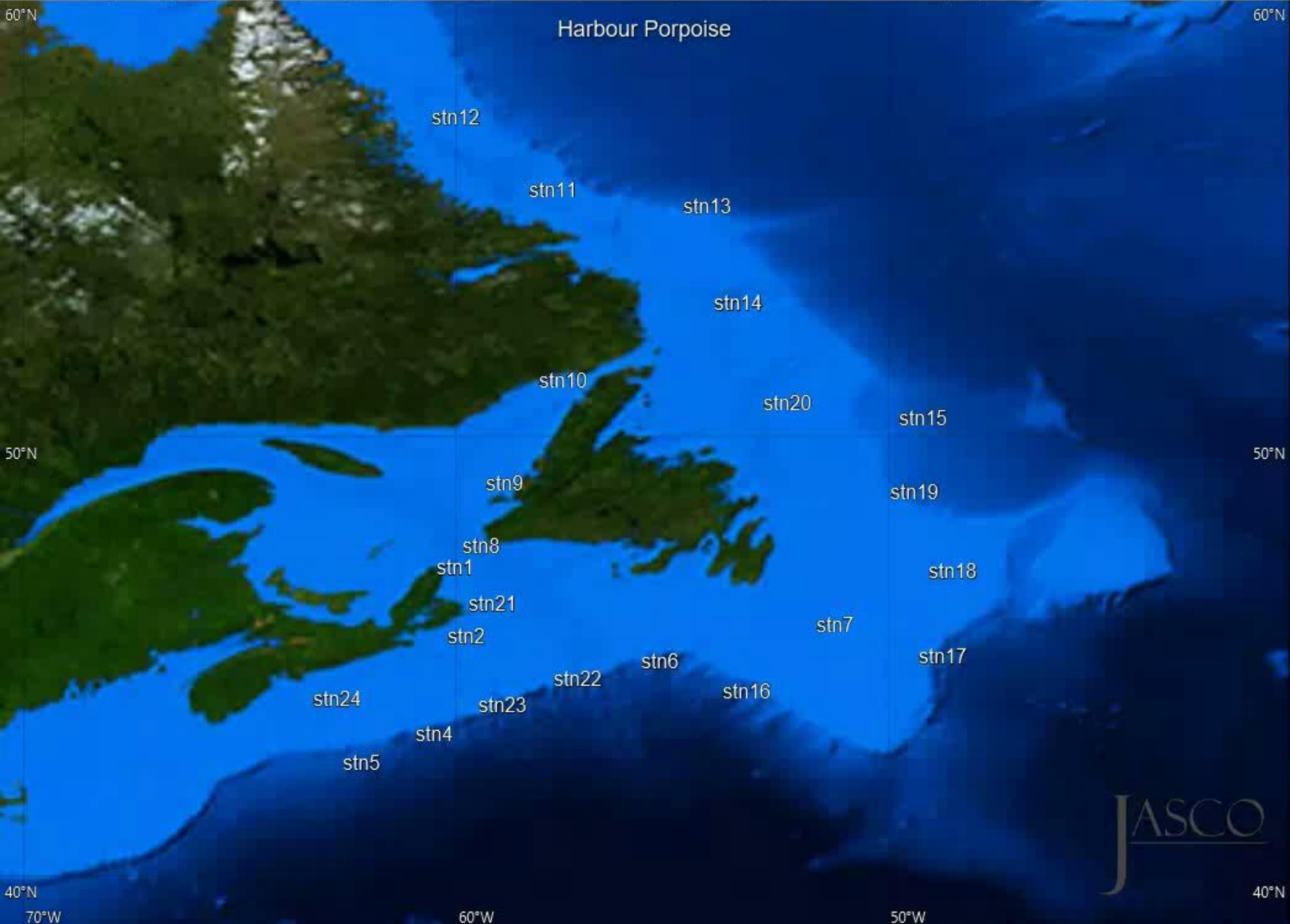


Harbour Porpoise

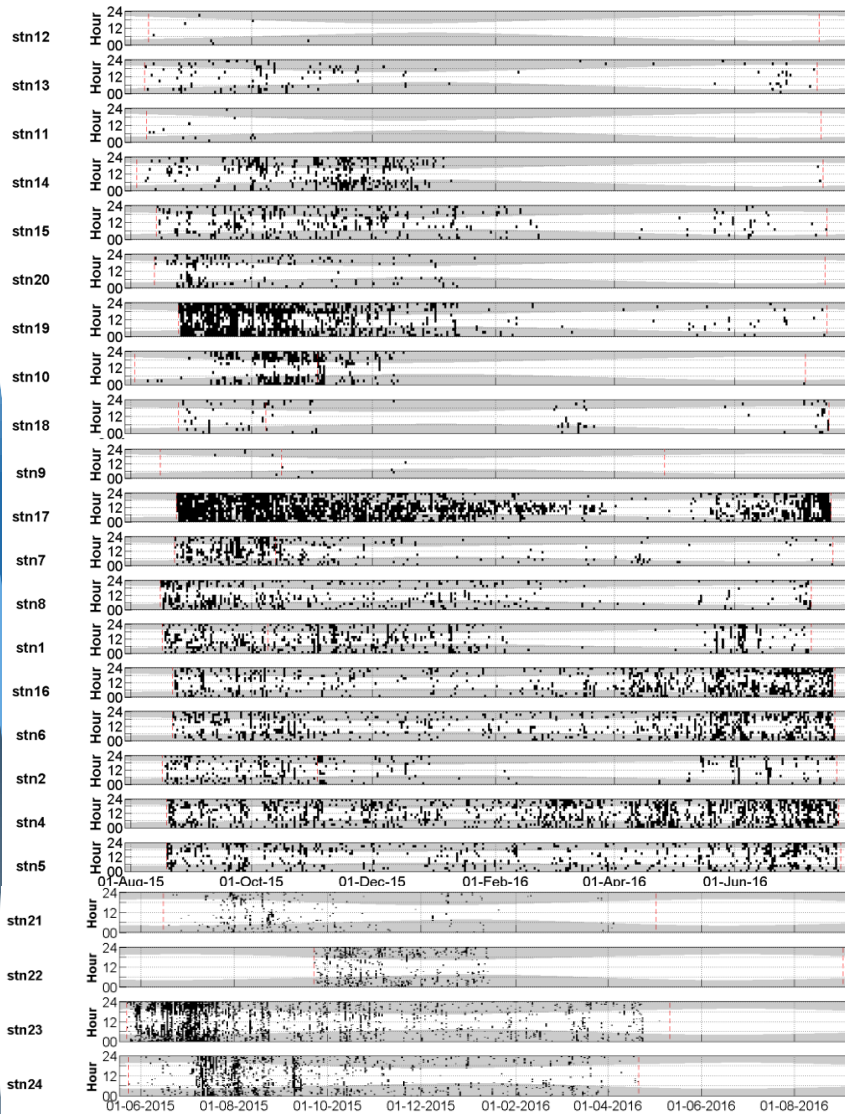
Threshold	P	R	F
3	0.93	0.63	0.85



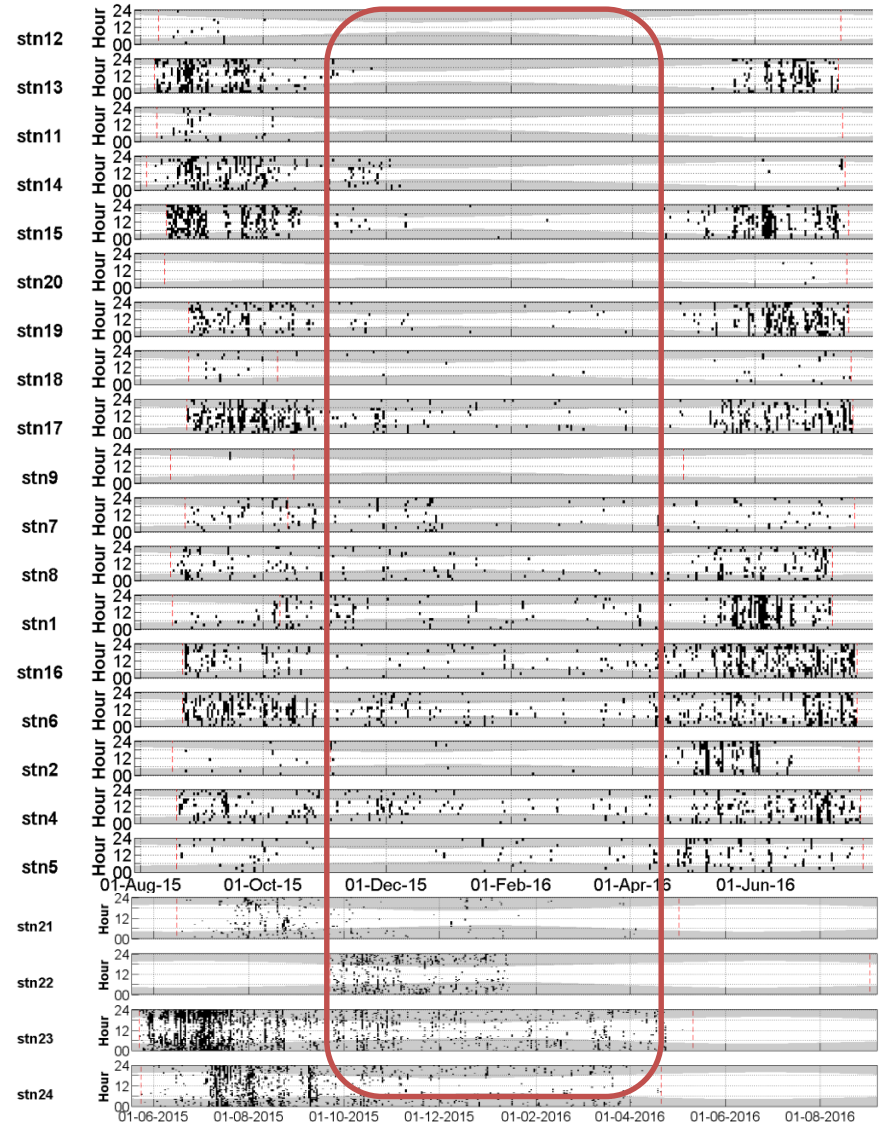
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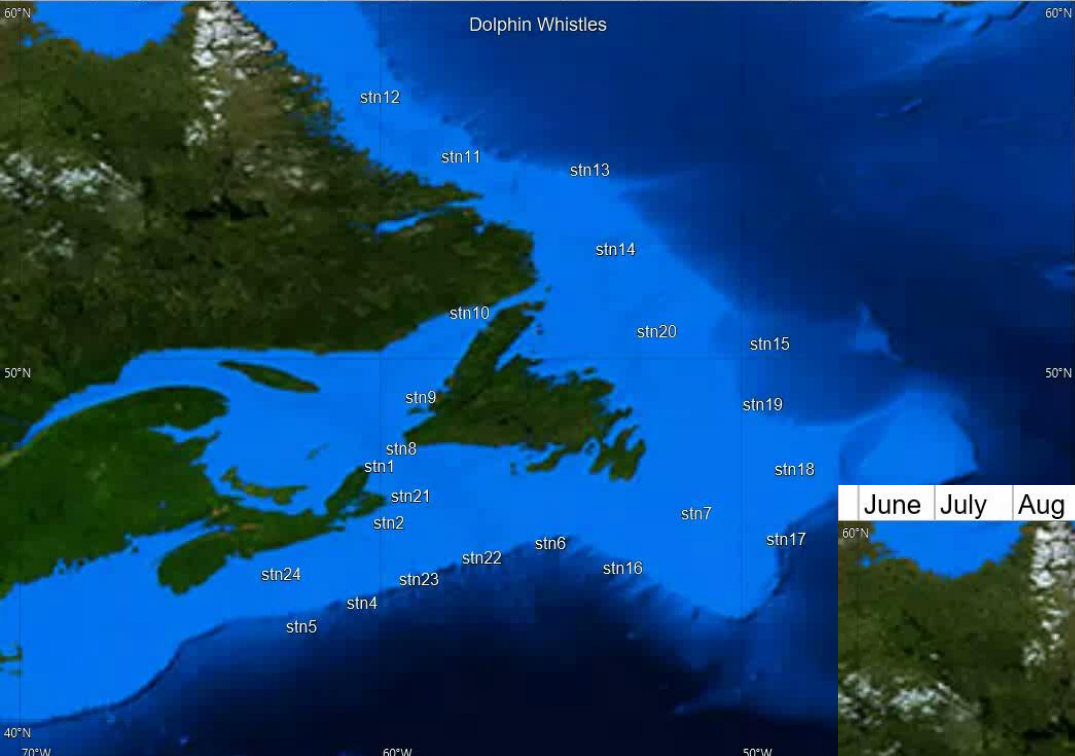
Dolphin Whistles



Pilot Whale Whistles



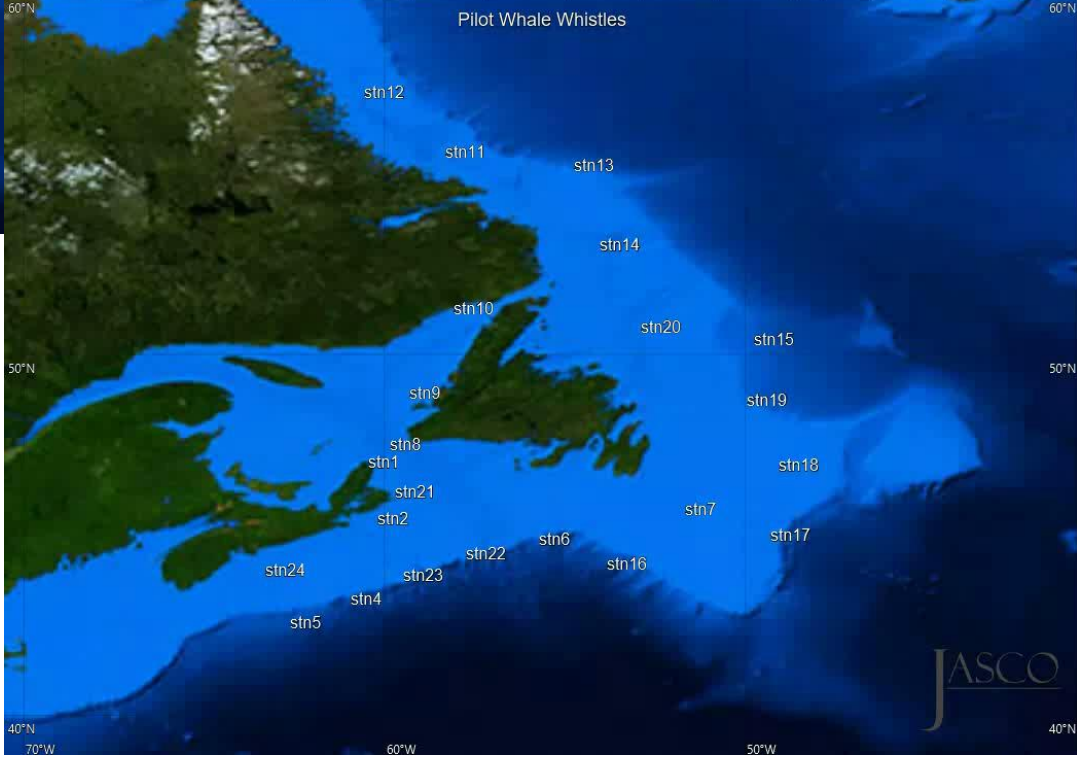
June July Aug Sep Oct Nov Dec Jan Feb Mar April May June July



Dolphin Whistles

Threshold	P	R	F
1	0.88	0.41	0.72

June July Aug Sep Oct Nov Dec Jan Feb Mar April May June July



Pilot Whale Whistles

Threshold	P	R	F
1	0.53	0.41	0.50



Conclusions & Future Work

- This study provides the first year-round multiple-species assessment of odontocetes acoustic occurrence in eastern Canada
 - Seasonal movements
 - Outer shelf bias
- Next steps:
 - Process 2016-17 data and assess potential annual variations in species occurrence and confirm observed trends
 - Provide results to the COSEWIC process
 - Focus on environmental factors (eg. sea ice)
 - Highlight regions of overlap with anthropogenic activities (eg. Flemish Pass)


Acknowledgements

- Funding and permission to present from Environmental Studies Research Fund (ESRF)
- Briand Gaudet, JASCO's field teams & the Masters and crews of all the vessels used in the ESRF program
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Questions?

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