Using sonobuoys and visual surveys to describe North Atlantic right whale acoustic ecology in the Gulf of St. Lawrence

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Passive Acoustic Monitoring (PAM) is an established method to identify the presence of vocally-active North Atlantic right whales (NARW). The appropriate use and interpretation of PAM data relies on knowledge of the NARW sound repertoire and how it varies relative to variation in RW behaviour in time and space. Such information is difficult to obtain given the challenges of collecting acoustic and visual data simultaneously. Further, such relationships have not been quantified in the Gulf of St. Lawrence (GSL) NARW habitat, an area of considerable management importance given the NARW mortality events in 2017 and 2019. To assess possible acoustic and behavioural relations we deployed sonobuoys in the presence of three or more aggregated NARWs during aerial and vessel-based photo-ID surveys in 2017 (n=8), 2018 (n=25), and 2019 (n>=40). Acoustic data from each sonobuoy deployment were manually reviewed for all known NARW vocalizations, including upcalls, gunshots, and various other tonal sounds. The identified NARW vocalizations were then quantitatively compared to NARW behavioral-state variables derived from visual observations and individual NARW photo-ID data in the southern GSL. This information was then used to determine how much of the acoustic repertoire variation may describe NARW seasonal, behavioral, and demographic variation. These results will aid in the interpretation of NARW PAM in the GSL and can help inform effective management in this high-risk habitat.

Using Sonobuoys and Visual Surveys to Describe NARW Acoustic Ecology in GSL

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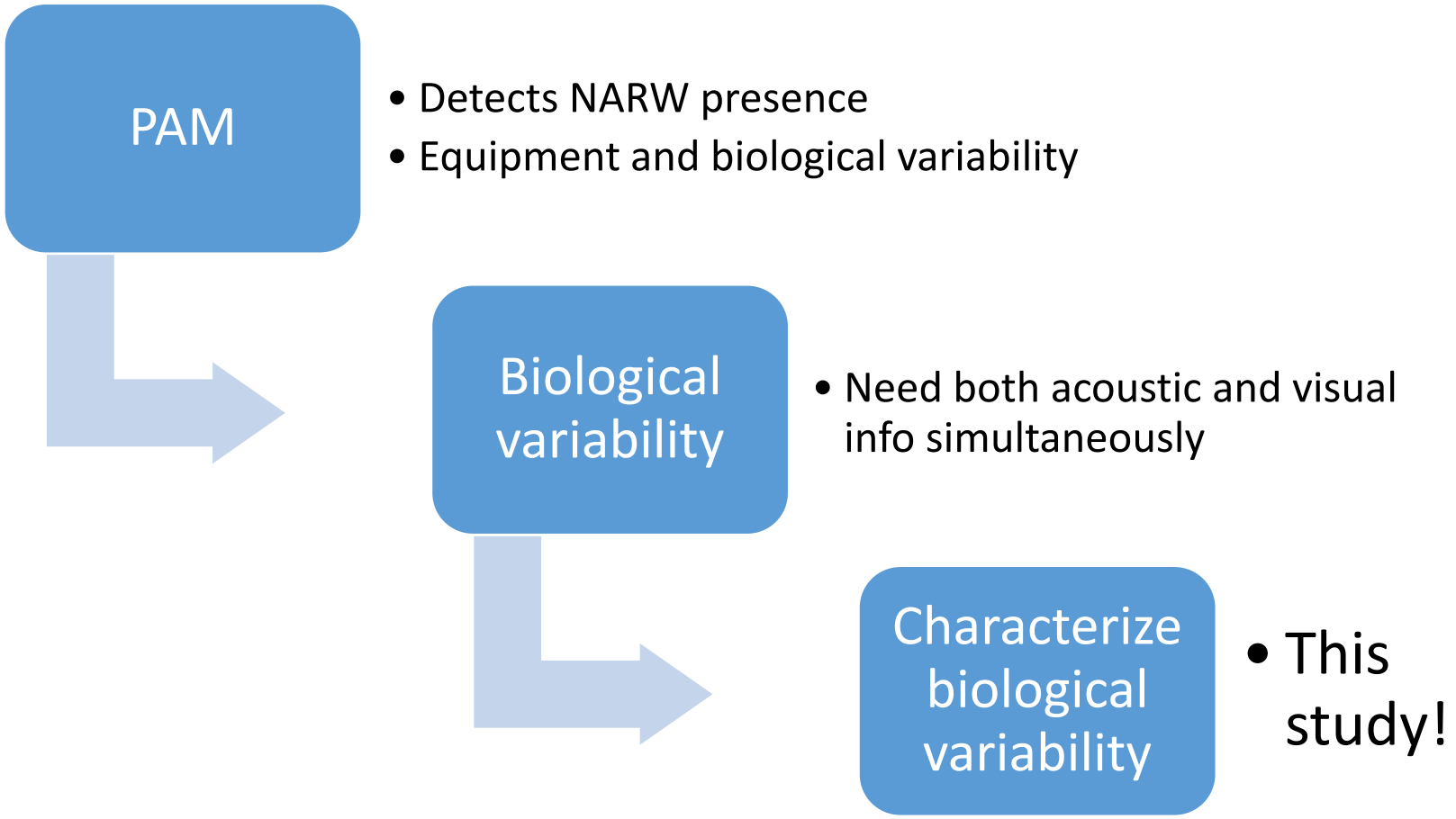
Introduction



GOAL:

Characterize NARW acoustic repertoire and quantify how it varies with respect to demography, behaviour and time in the southern Gulf of St. Lawrence

Methods

Step 1. Visual data collection

Step 2. Acoustic data collection

Step 3. Data analysis

Step 1. Visual Data Collection

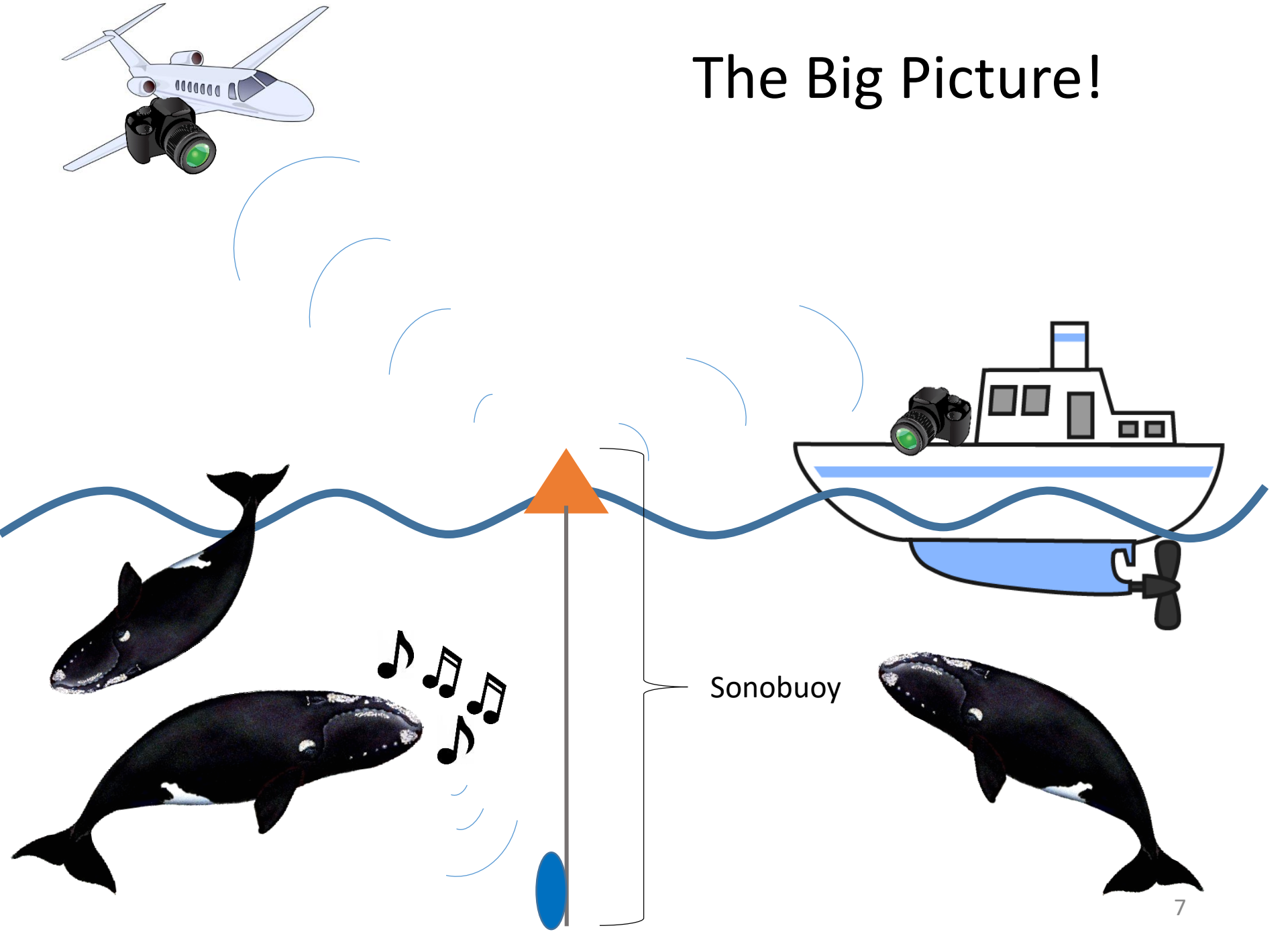
- NOAA aerial survey
- NEAq/CWI/Dal vessel survey via *F/V Jean Denis Martin*
- 3+ NARWs were seen
- Staying for >1 hr in the area

Step 2. Acoustic Data Collection

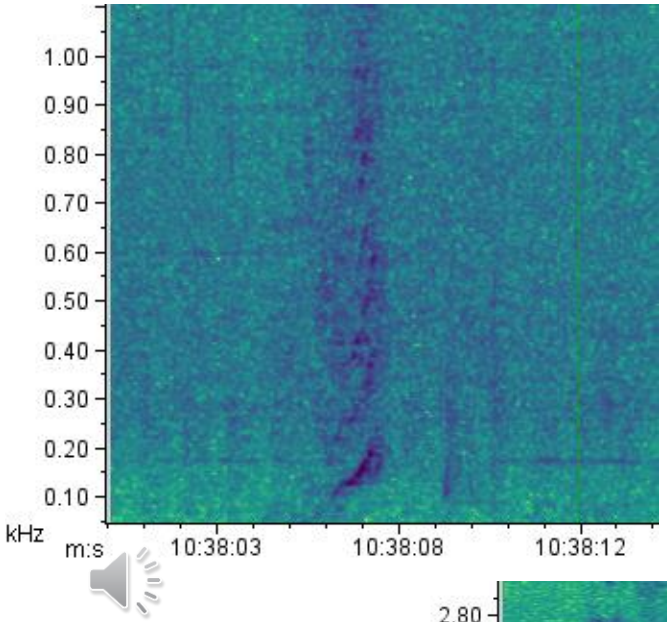
- Expired American and Canadian sonobuoys
  - sonobuoy contains a hydrophone and radio transmitter & transmit oceanographic sounds to a near by receiving platform
- Deployed ~0.5 to 1 km away from sighted whales
- Up to 8 hrs of recording time
  - Most were ~4 hours

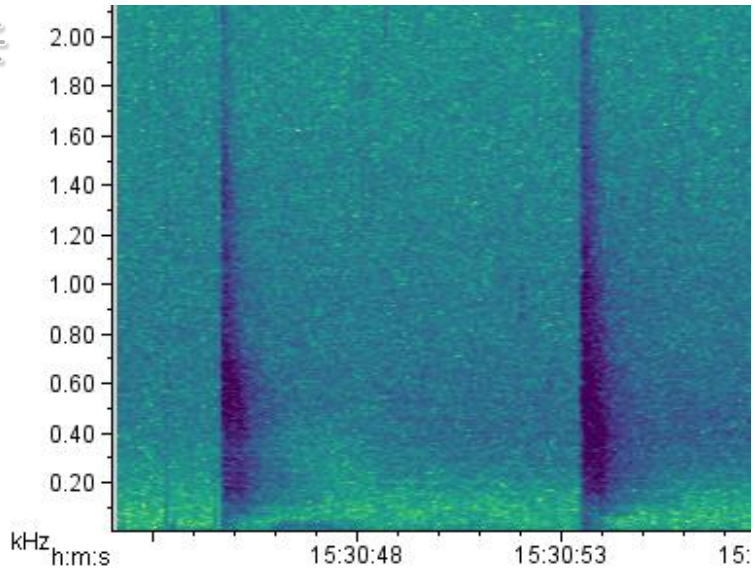

Credit: Nick Hawkins

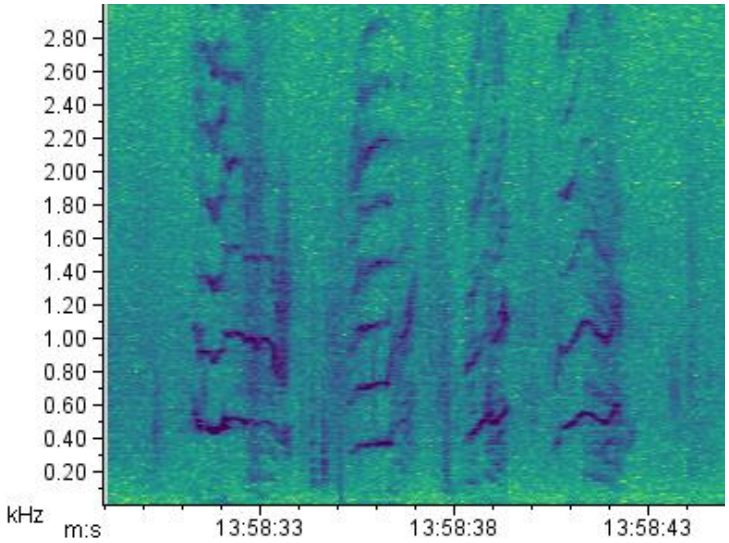
The Big Picture!



Step 3. Data Analysis - Acoustic





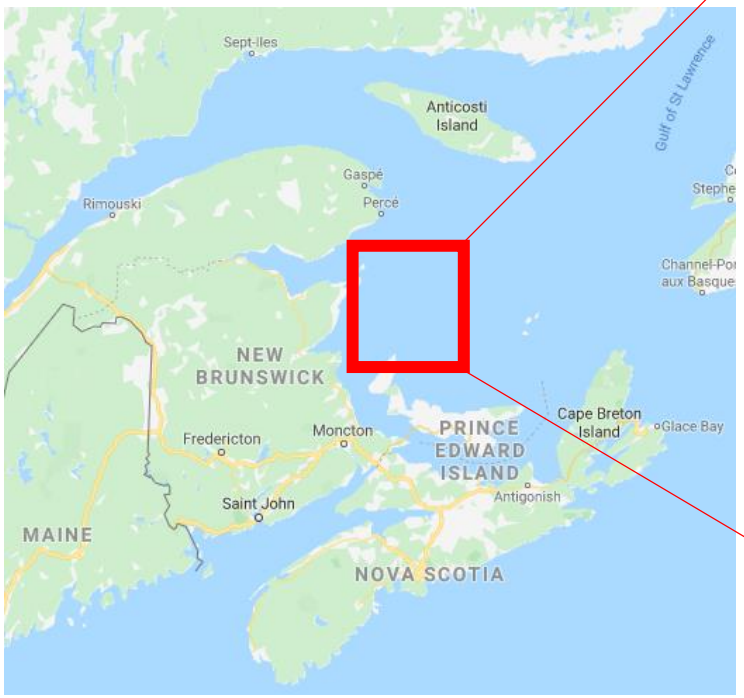


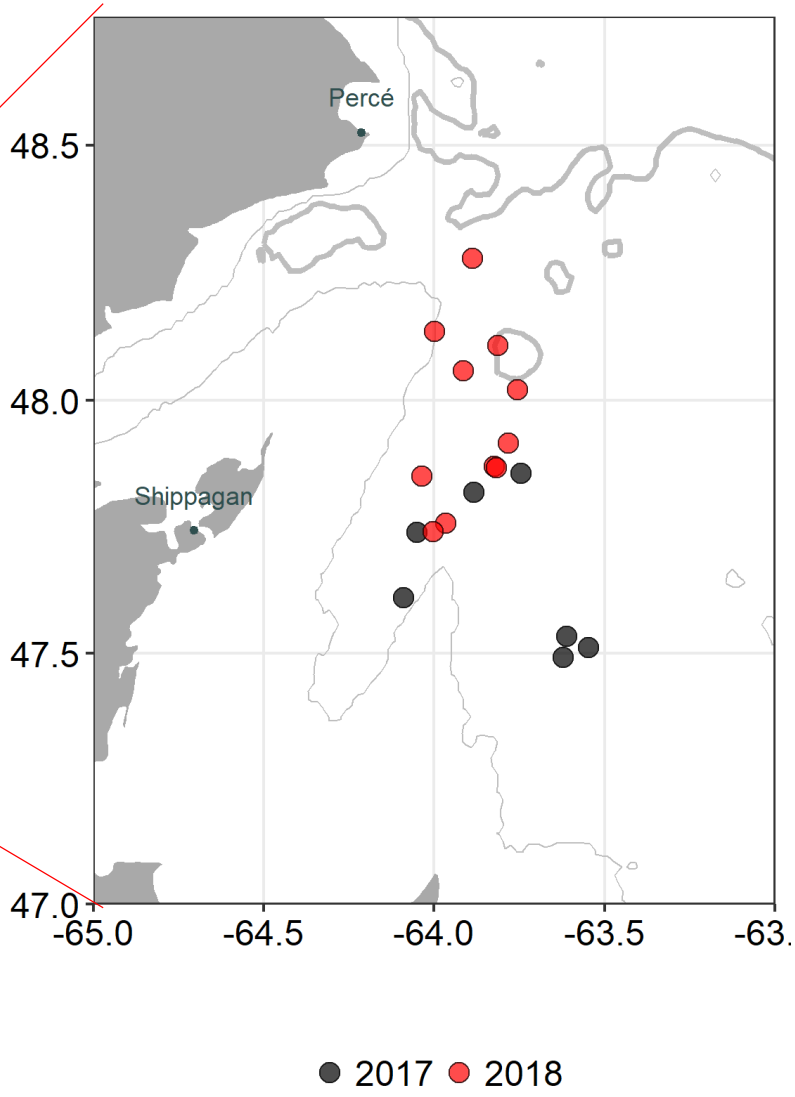
Number of Sonobuoys Deployed

Year	NOAA Plane	F/V *Jean Denis Martin*
2017	7	0
2018	11	12
2019	23	25

The red box indicates the deployments that I have completed that audio recordings for. The following slides are preliminary results from these recordings.

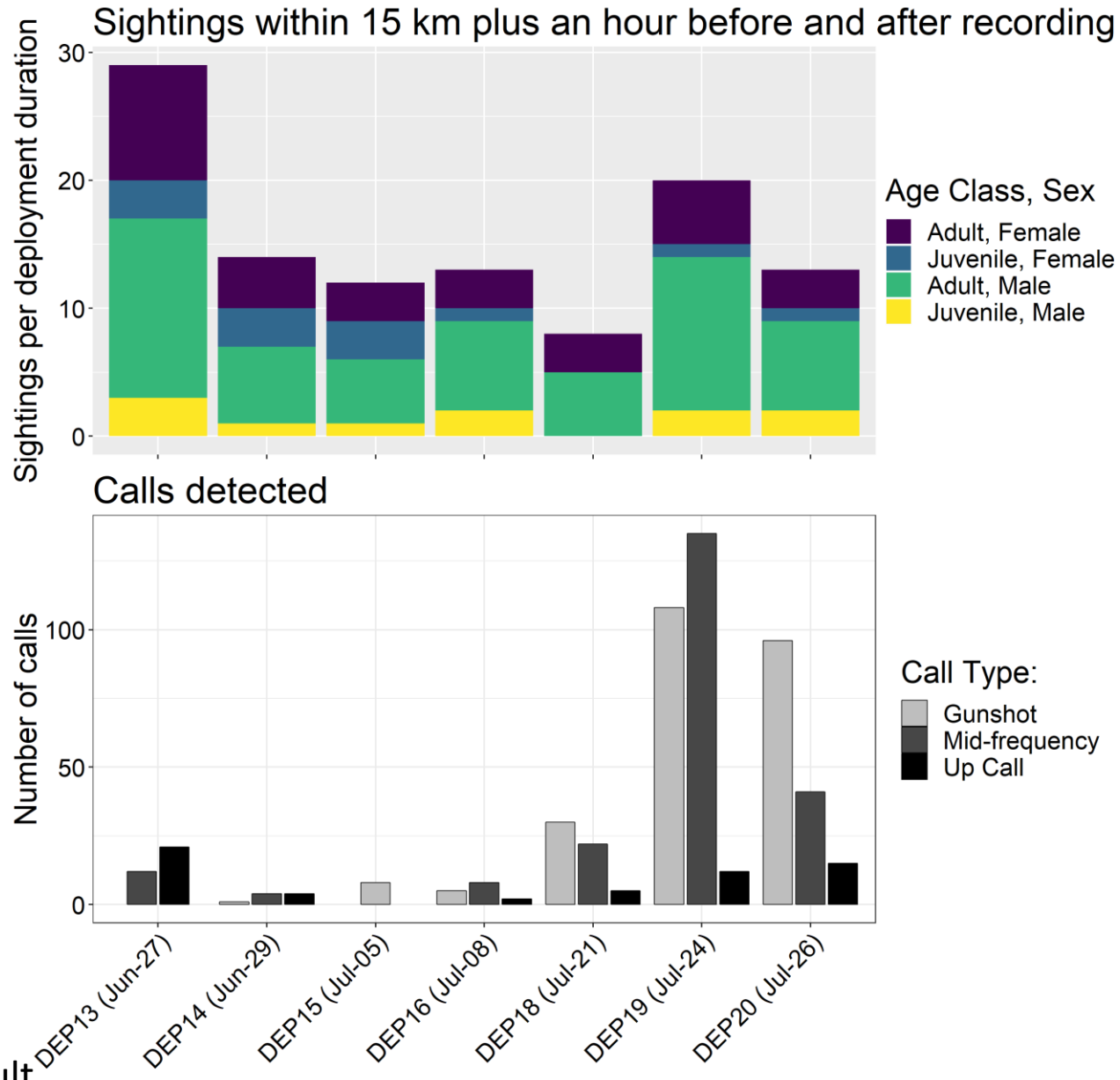
2017 and 2018 Aerial Survey Sonobuoy Deployments





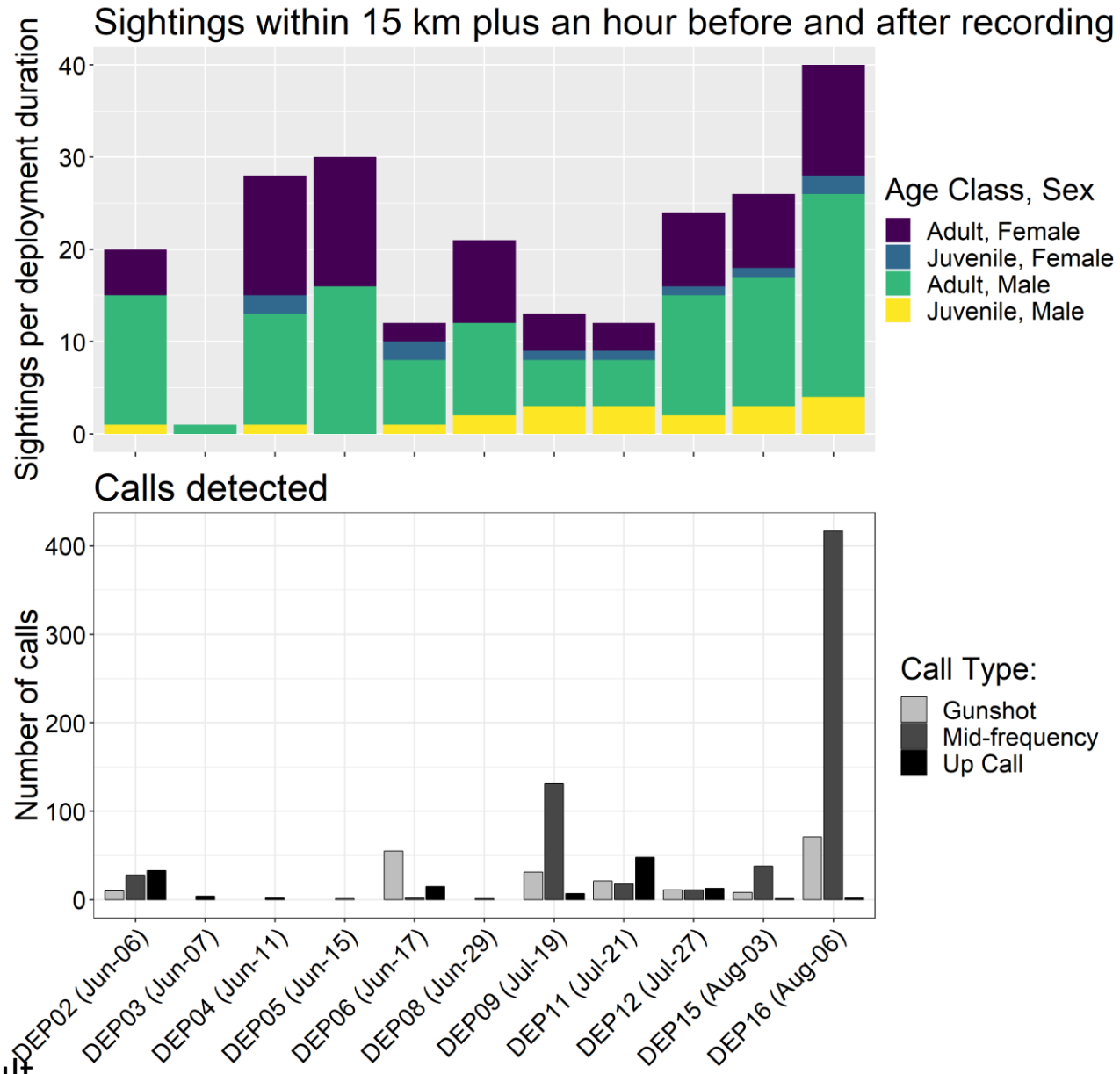
Preliminary Result

2017



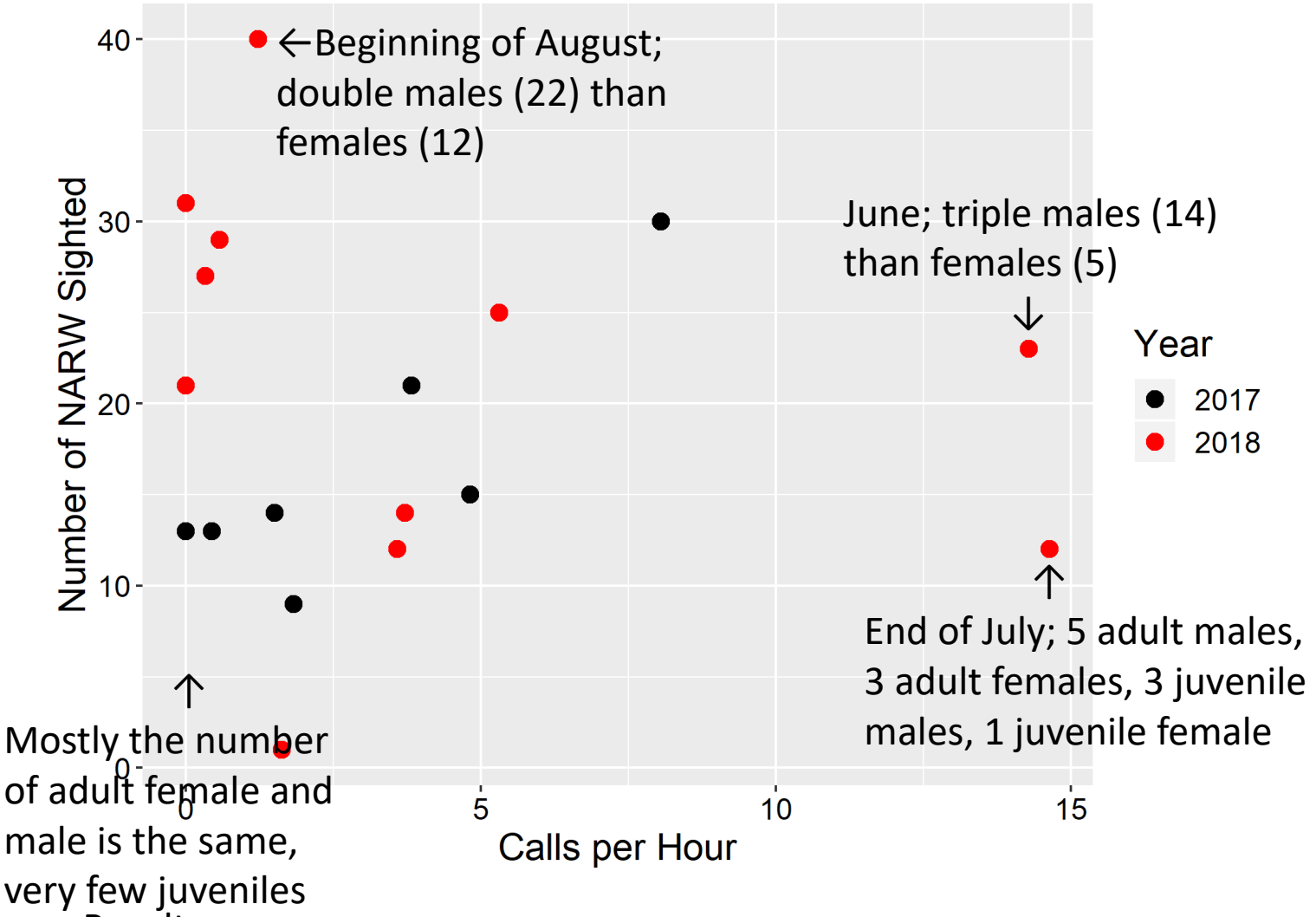
Preliminary Result

2018



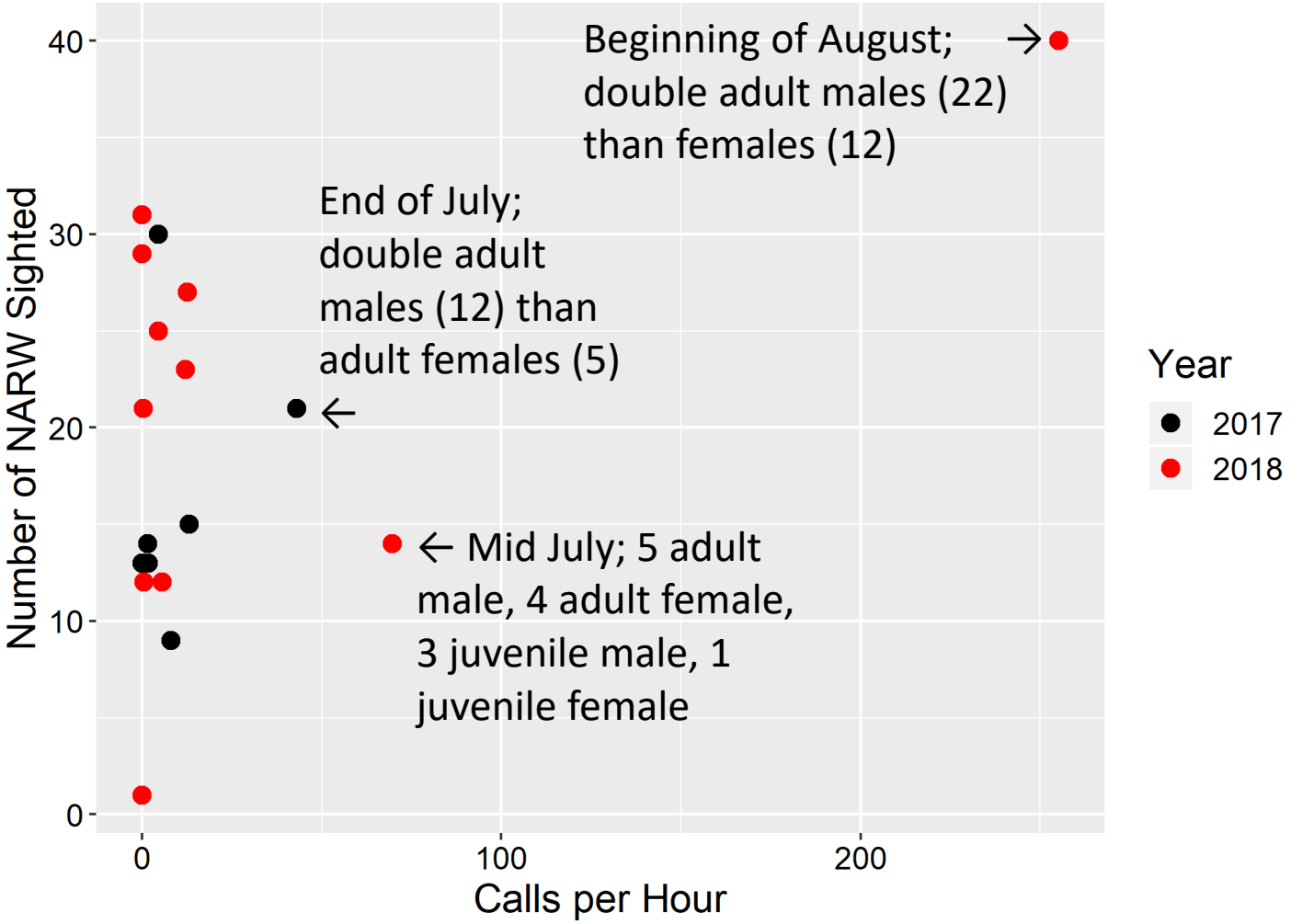
Preliminary Result

Up Calls



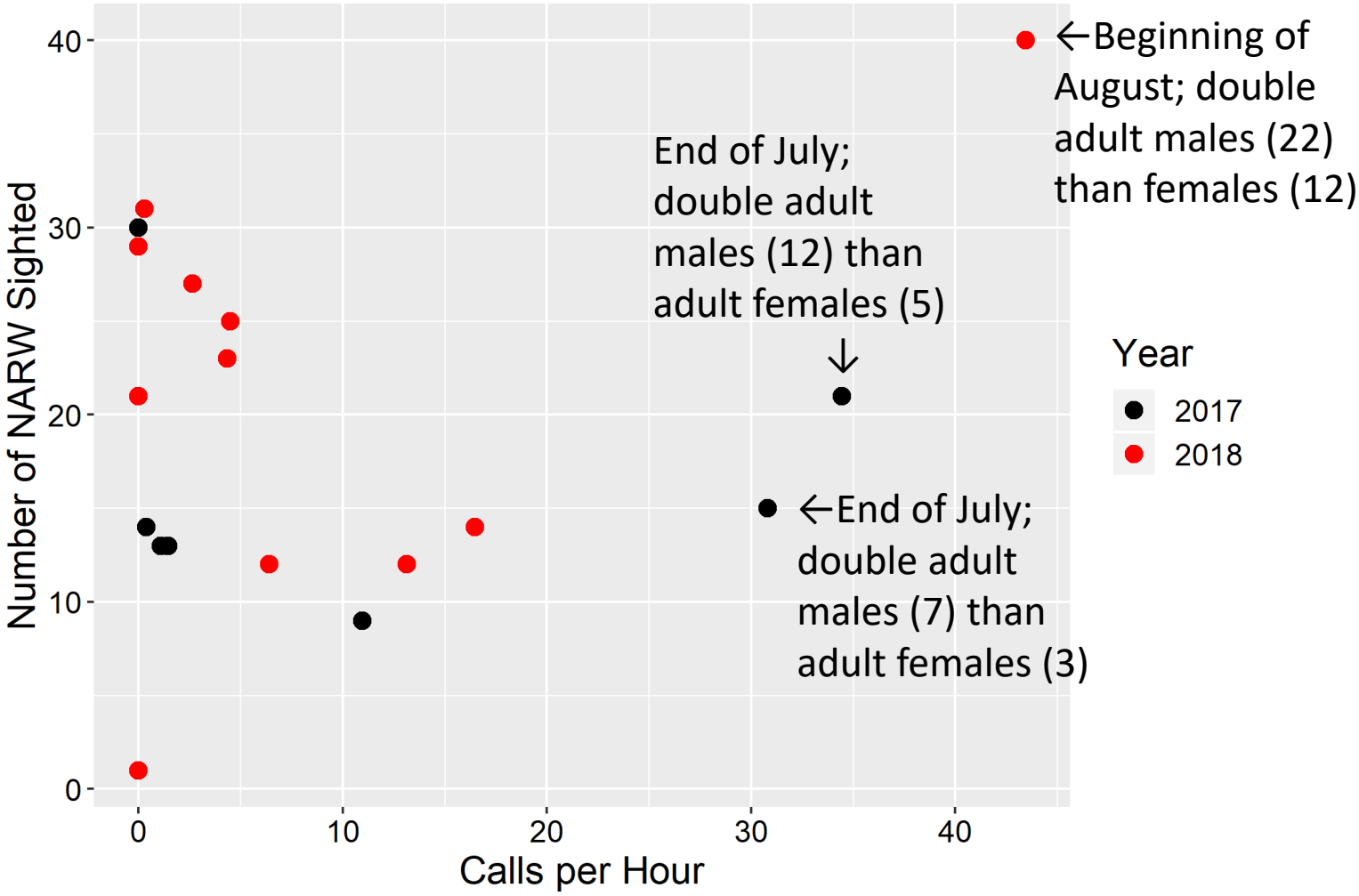
Preliminary Result

Mid-frequency Calls



Preliminary Result

Gunshot Calls



Preliminary Result

Conclusions, so far

- Sightings ≠ number of calls
- The larger the difference between number of males and females seen the more mid- frequency and gunshot calls appear
  - Male to Female ratio, is it important…?
- Next steps:
  - Completing the remaining datasets
  - Including behaviours to analysis
  - Generalized linear models
- In completion of this project, the results may help interpret and further advance PAM to be more than presence only tool

Acknowledgements

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