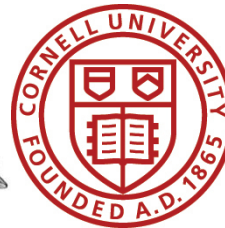


False killer whales

(but not pilot whales or melon-headed whales)

mimic MFA sonar

Stacy DeRuiter, Ian Boyd, Diane Claridge,
Christopher Clark, David Moretti,
Brandon Southall, and Peter Tyack



Behavioral Response Study 2007-2008



Project Goal: Investigate the behavioral responses of beaked whales and other cetaceans to MFA sonar sounds



Photo: SDR under NMFS permit to PLT

Behavioral responses of beaked whales and other cetaceans to controlled exposures of simulated sonar and other sounds

Brandon Southall, Peter Tyack, David Moretti, Christopher Clark, Diane Claridge, and Ian Boyd.

17:00 on THURSDAY 15 Oct



Photo: G. Hastie

Analysis of a Blainville's beaked whale movement response to playback of orca calls

Ann Allen, Ari Shapiro, Andrew Solow, Peter Tyack, Ian Boyd, Diane Claridge, Christopher Clark, David Moretti, and Brandon L. Southall

Poster (Tues./Thurs.)

Behavioral Response Study 2007-2008



Project Goal: Investigate the behavioral responses of beaked whales and other cetaceans to MFA sonar sounds

Mimicry Analysis:

2007

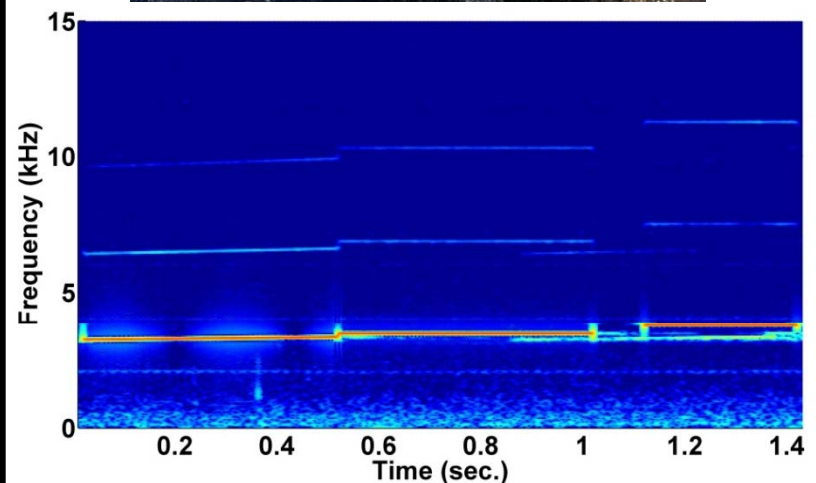
1 of 2 groups of pilot whales

2008

1 group of pilot whales

2 groups of false killer whales

1 group of melon-headed whales



Behavioral Response Study 2007-2008



Project Goal: Investigate the behavioral responses of beaked whales and other cetaceans to MFA sonar sounds

Mimicry Analysis:

2007

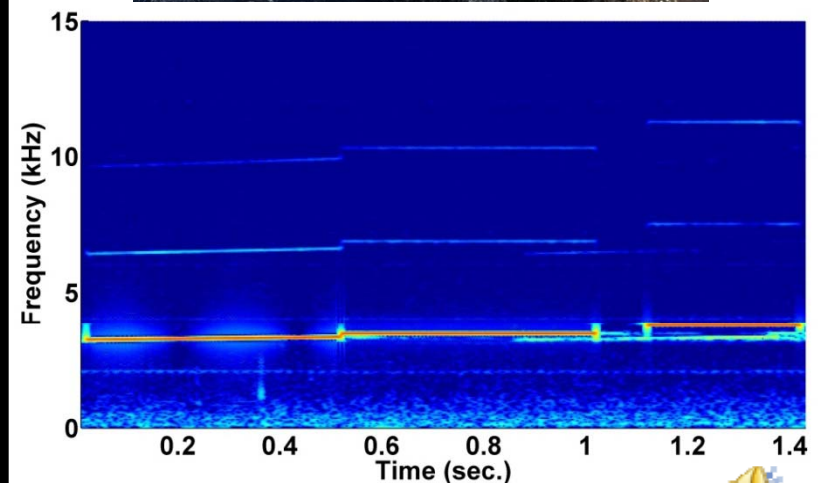
1 of 2 groups of pilot whales

2008

1 group of pilot whales

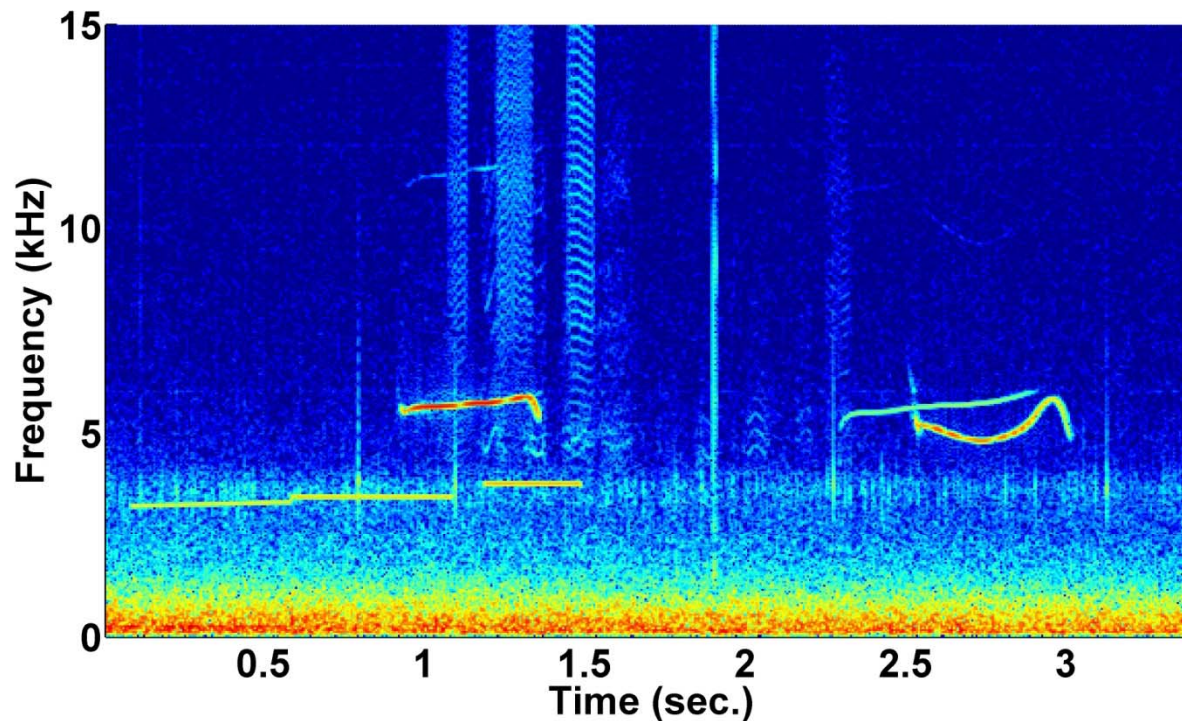
2 groups of false killer whales

1 group of melon-headed whales



Field Observations:

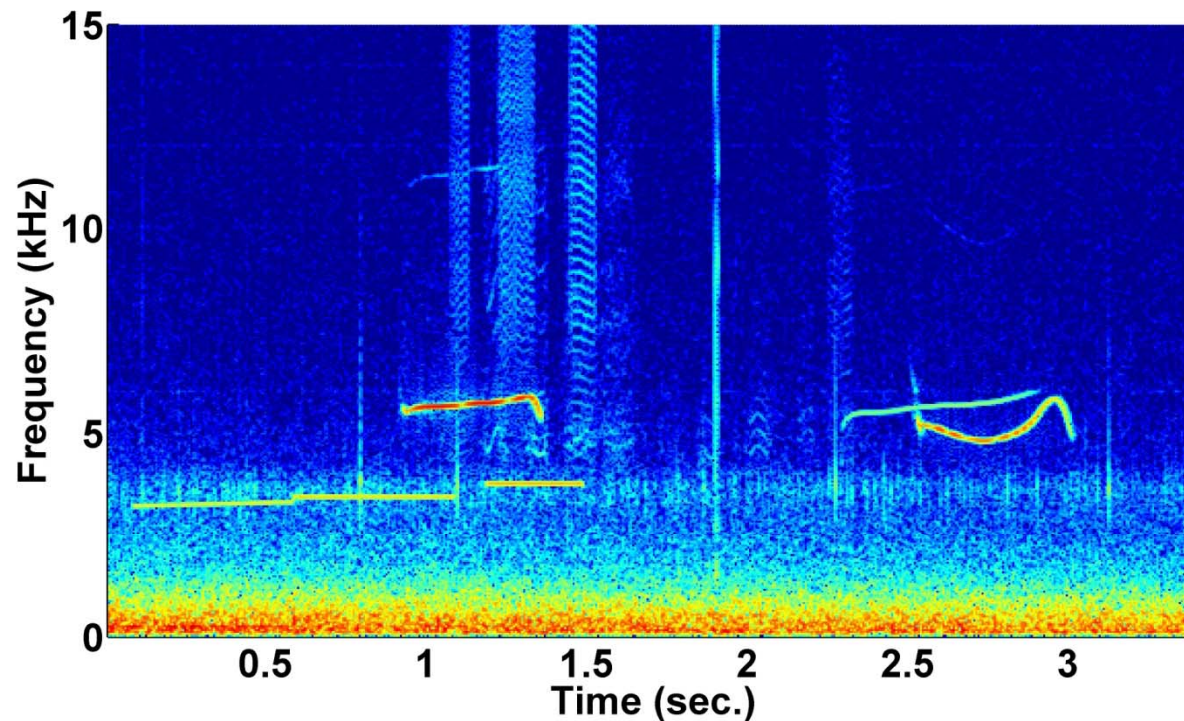
Do delphinids mimic MFA sonar?



- **VOCAL RESPONSE** = increase whistle production rate immediately after mfa sound
- **MIMICRY** = respond vocally with whistles that are similar to the mfa sound

Field Observations:

Do delphinids mimic MFA sonar?



- **VOCAL RESPONSE** = increase whistle production rate immediately after mfa sound
- **MIMICRY** = respond vocally with whistles that are similar to the mfa sound



Methods: Data Processing

- Mark whistle start times (in time since last mfa transmission)
- Trace whistle contours (custom-written semi-automated matlab script)
- Quantify similarity of whistle contours and mfa contour

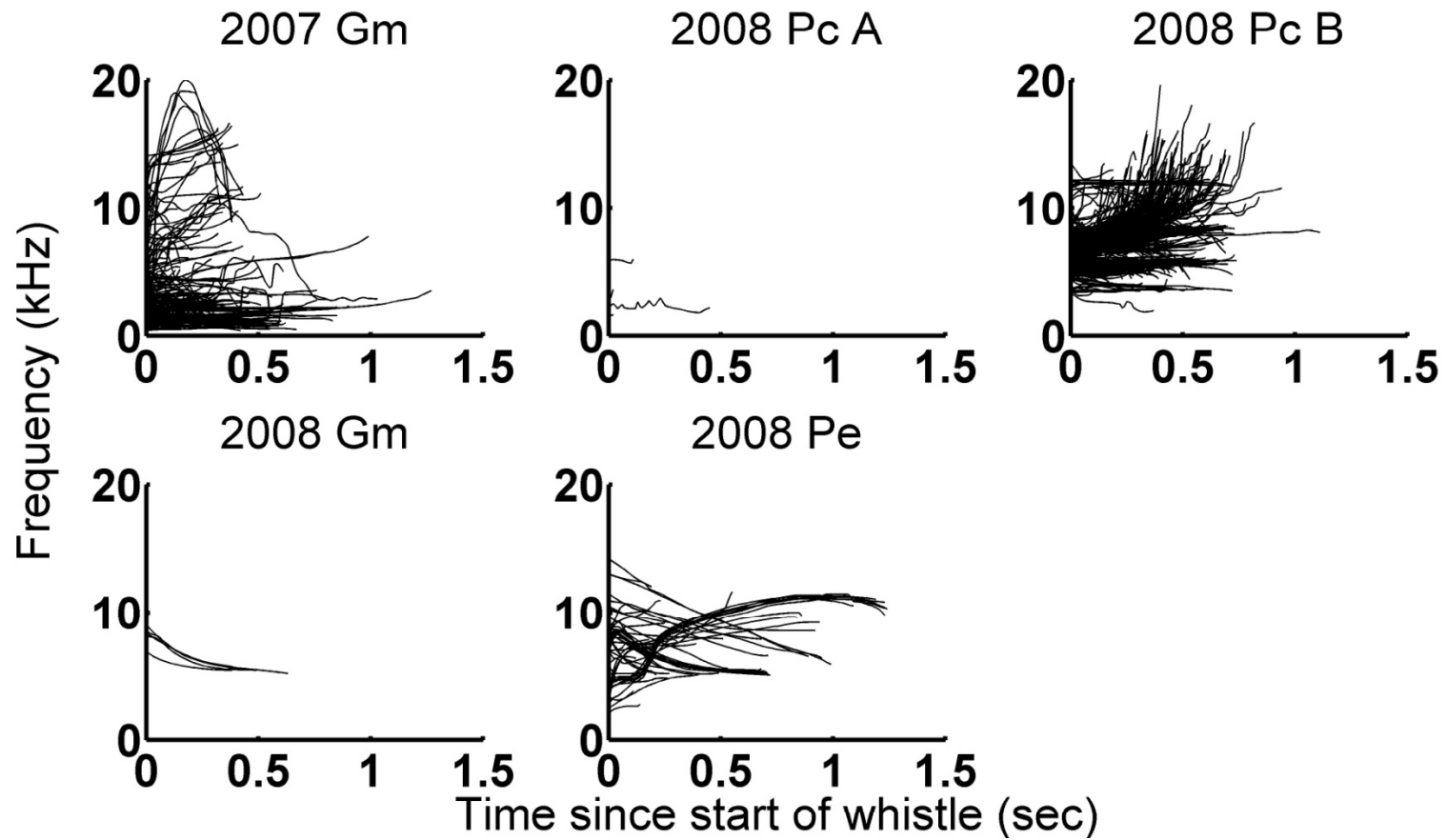
SI = duration + median freq. + freq. range + flatness

Whistles above 80th percentile for SI = “mfa-like”

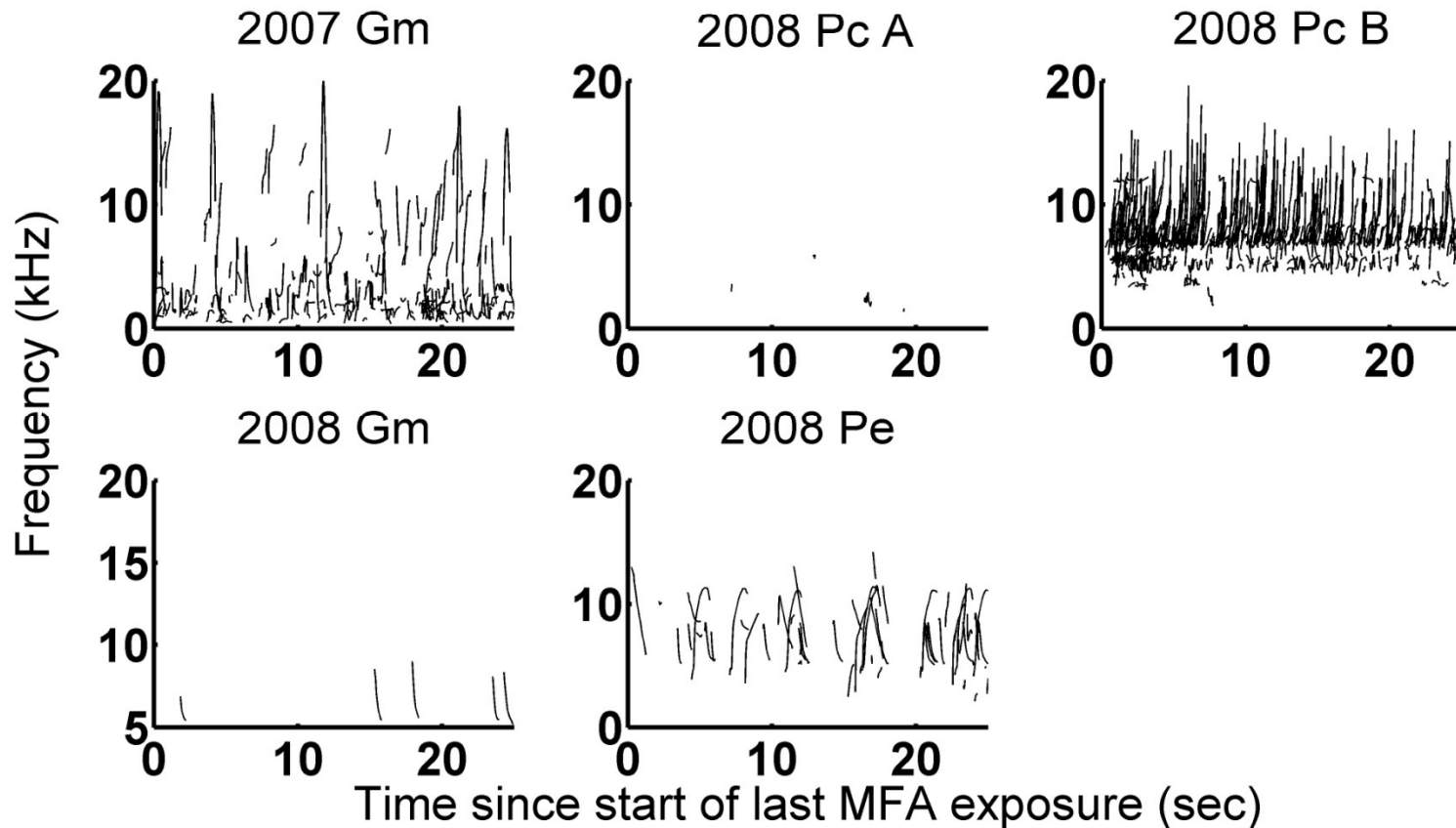
Reference (whistle flatness):

J. L. Miksis, P.L. Tyack, and J. R. Buck. 2002. *JASA* 112, 728-739.

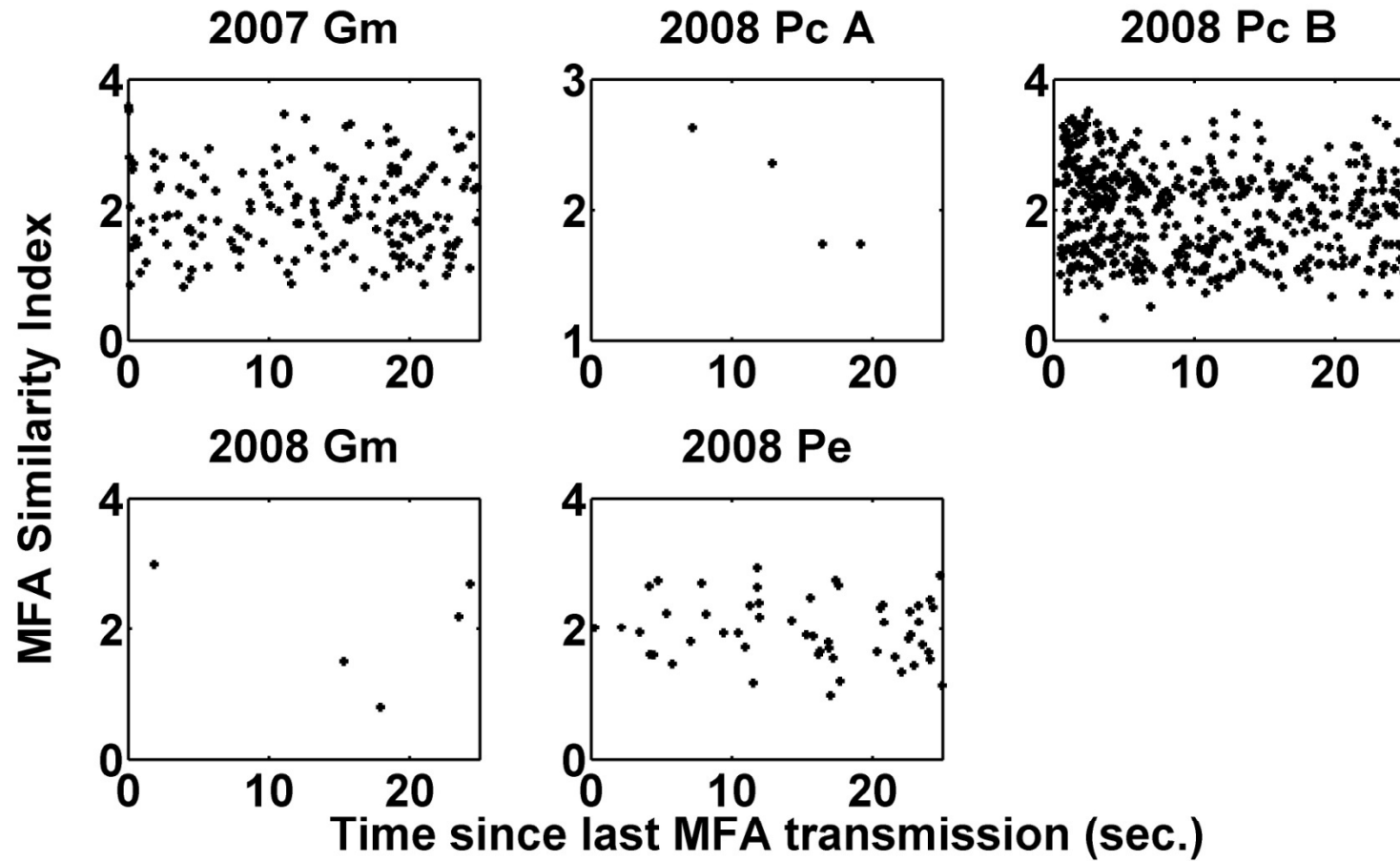
Whistle Contours



Whistle Contours

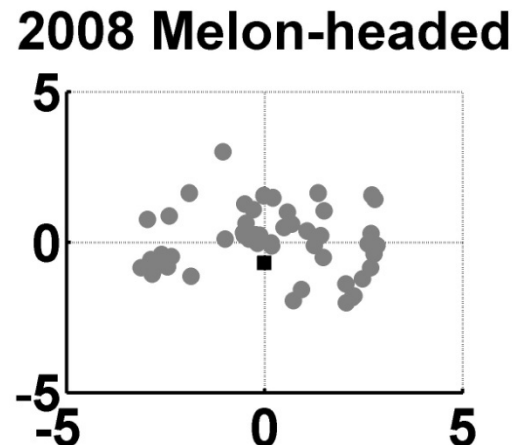
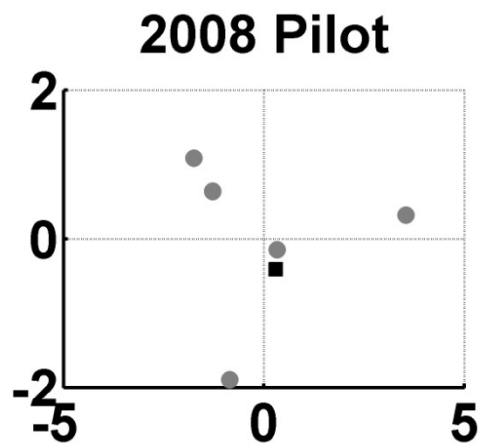
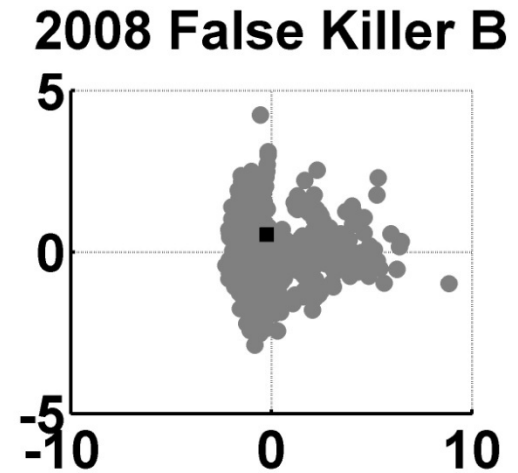
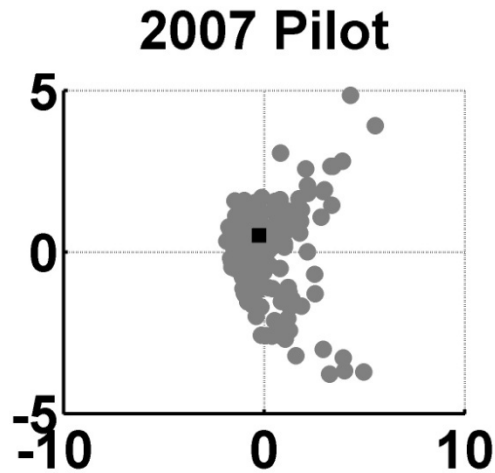


Similarity Index

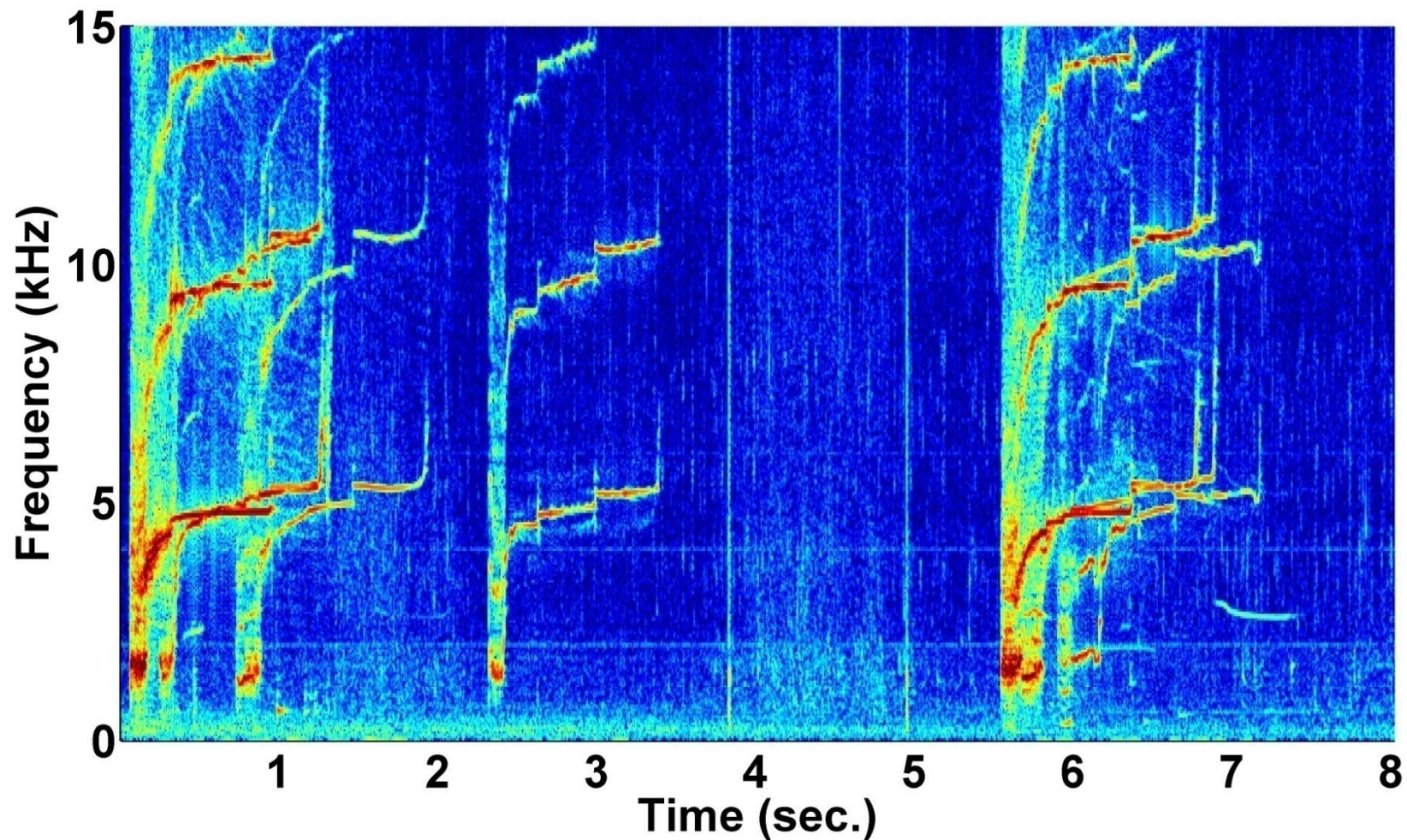


Why a Similarity Index?

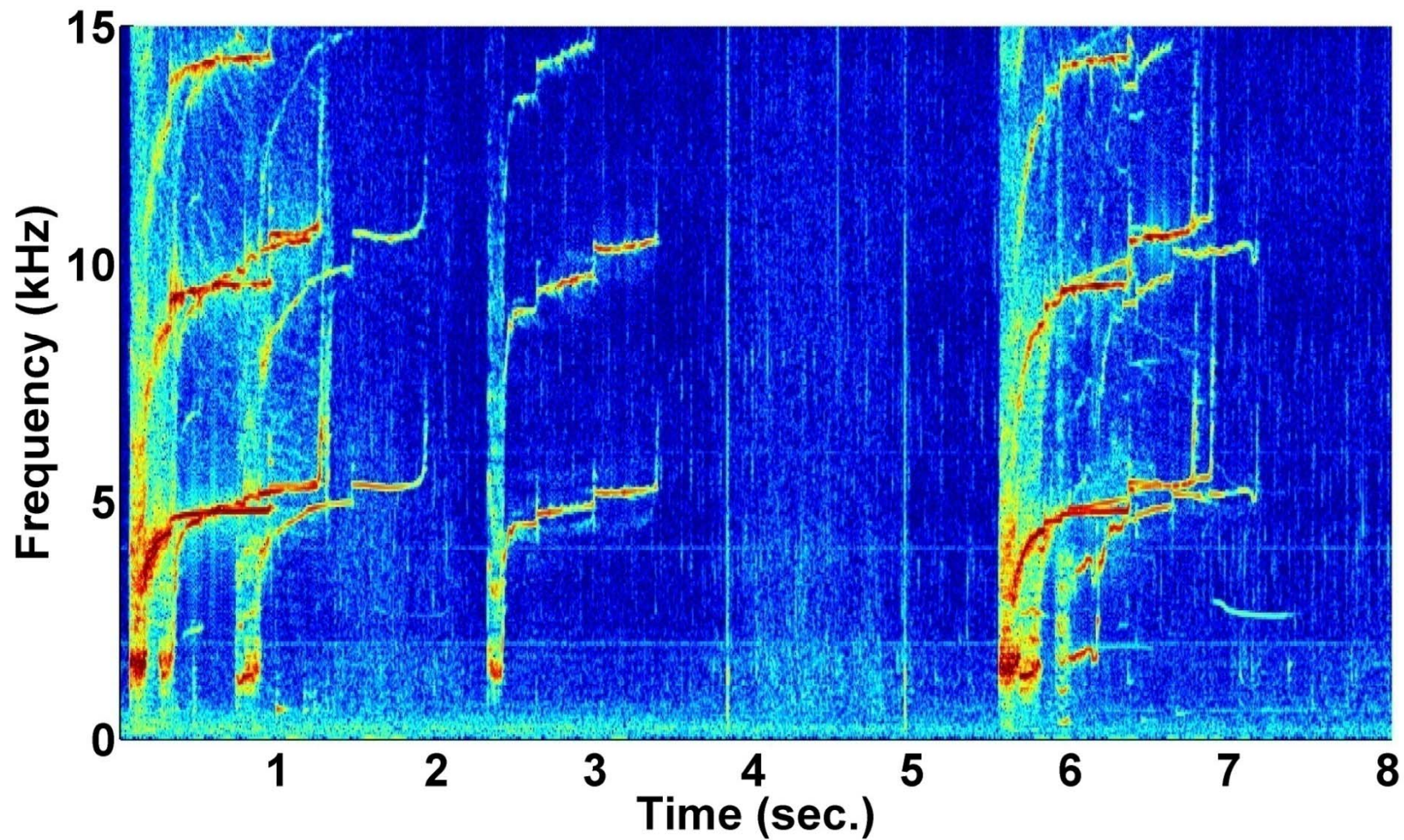
Aren't "mfa-like" whistles unusual?



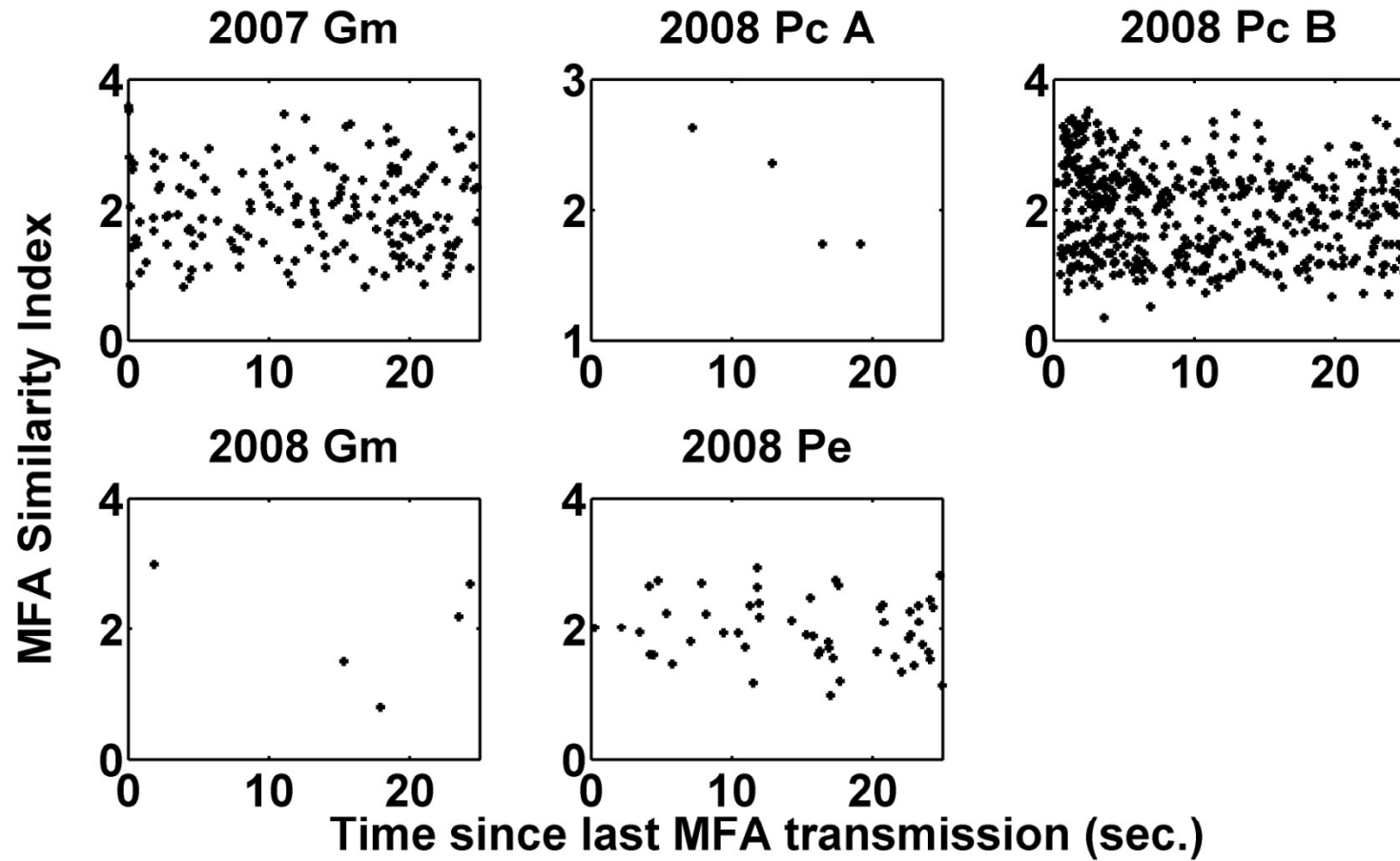
Aren't “mfa-like” whistles unusual?



Aren't "mfa-like" whistles unusual?



Similarity Index



Statistical Analysis: Rotation Test

Test:

- Do whistle start times cluster around mfa start times?
- Are whistles more similar to mfa sounds within the first 5 seconds after an mfa sound?

Disadvantages:

- Power, 5-second rule

References (rotation test):

DeRuiter & Solow 2008 (An. Behav. 76: 1429-1434), Miller et al. 2004 a & b (Proc. Roy. Soc. B 271: 2239-2247 & An. Behav. 67: 1099-1107), Schulz et al. 2008 (An. Behav. doi:10.1016)

Statistical Analysis: Point Process Method

Test:

- Is whistle probability inversely related to time since MFA?
- Is “mfa-like” whistle probability inversely related to time since MFA?

Advantages:

- Model conditional intensity function \sim time-dependent probability of an event
- No binning of data
- Account for autocorrelation & history-dependence
- Test for dependence on covariates (e.g. time since MFA)
- Fit model using tools developed for GLMs

Reference: W. Truccolo, U.T. Eden, M.R. Fellows, J.P. Donoghue, and E.N. Brown. 2005. *J Neurophysiol* 93:1074-1089.

Statistical Results

Group	Response?	Mimicry?
2007 Pilot whales	X	X
2008 False killer whales	✓✓	✓✓
2008 Melon-headed whales	↓	X

✓✓ = $p < 0.001$, inverse relation between whistles and time since MFA

↓ = $p < 0.01$, direct relation between whistles and time since MFA

X = No significant relationships

Conclusions

- Whistling false killer whales respond vocally to MFA sonar transmissions and mimic them
- Whistling pilot whales' whistle rates and MFA-like whistle rates are not related to time since last MFA transmission
- Whistling melon-headed whales are less likely to whistle immediately following MFA transmissions, and do not mimic them
- Vocal responses vary with species and behavioral context
- Delphinids do not change between low and high overall whistle rate in response to MFA exposure

Discussion: Why mimic? And why mimic MFA sonar?

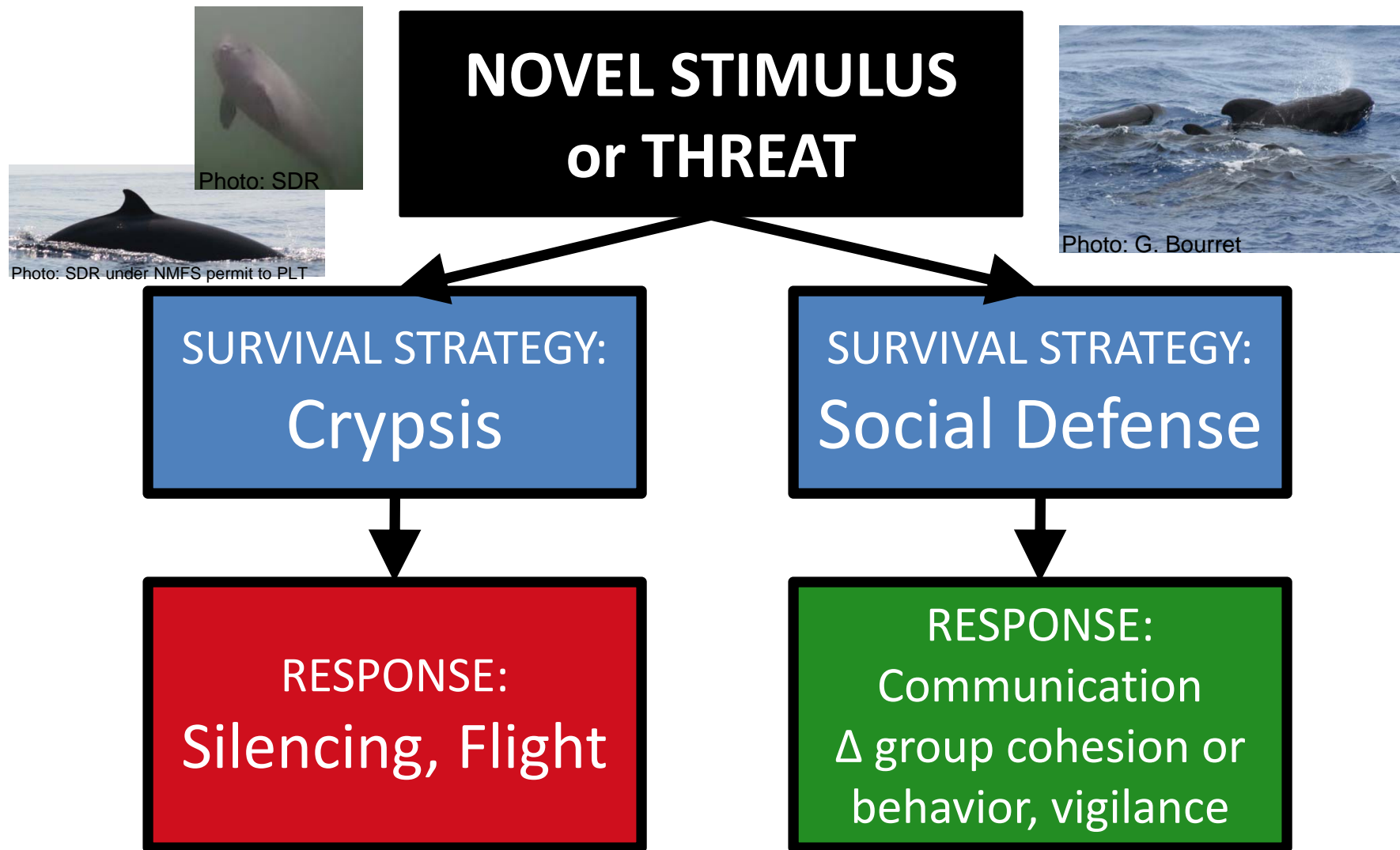
ROLES OF MIMICRY

- Development of varied repertoires
- Use of learned calls to indicate identity or group membership
- Building and maintaining social relationships
- Alerting conspecifics to the presence of a predator

POSSIBLE EXPLANATIONS OF MFA MIMICRY

- Affiliative response
- Aggressive display
- Alarm calls/predator avoidance response

Speculation: What does it all mean?



Merci, *BRS 07-08 Sponsors and Participants*



SERDP
Strategic Environmental Research
and Development Program



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Florida State University: Lou St. Laurent; Ken Decoteau; Eric Howarth

Marine Acoustics, Inc: Adam Frankel, Chuck Gagnon; *Clay Spikes**, Kathy Vigness, Kimberly Skrupky; Mark Wilson

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University of La Laguna: Yara Bernaldo de Quirós

** BRS test coordinators (Spikes: 07; D'Amico: 08)*