Movement and Surface Active Behavior of Southern Resident Killer Whales (*Orcinus* orca) in Response to Current Velocity and Salinity

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Question: Does whale travel and surface active behavior change due to current and salinity?

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Hypothesis

1. Physical factors, specifically current, salinity, and temperature, are constantly in flux and effect whale travel direction and energetics.
- SRKWs travel mostly in the same direction of the current.
- Surface active behaviors (SABS) increase when moving with the current.

Figure 1: Breaching southern resident killer whale

Background

Southern resident killer whales (SRKW) are an endangered sub-species of killer whales commonly inhabiting regions of the Salish Sea. A number of studies suggest currents may influence marine mammal behavior by reducing energy expenditures in hunting and migration. Haro Strait, an important foraging habitat for the SRKW, has a unique bathymetry and may have distinctive water characteristics that influence the behavior and travel of killer whales.

Figure 2: Southern resident fluke slap

Methods

- Archived Data: collected from 2004-2010
- Field Data: collected within and around Haro Strait from Sept 19-Oct 13, 2011
  - *Study sites:* Far North - Turn Point, North - Kellett Bluff (KB), Mid North - Orca Sound and Lime Kiln, Mid South - Hannah Heights, Pile Point and False Bay, South - Eagle Point and Salmon Bank (SB)

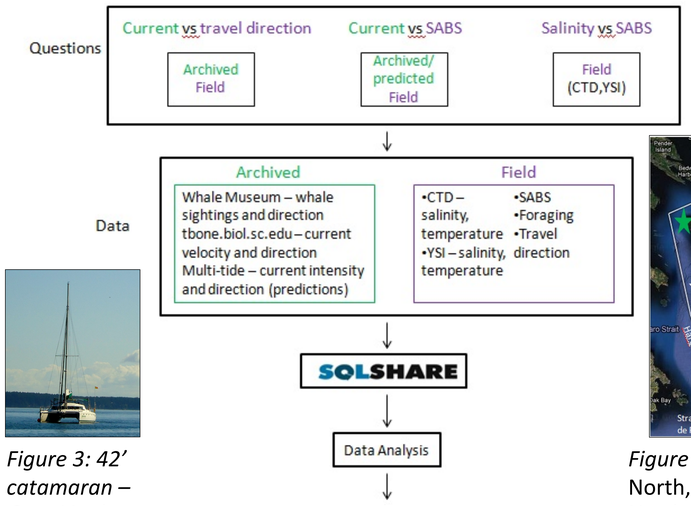

Figure 3: 42' catamaran – Gato Verde

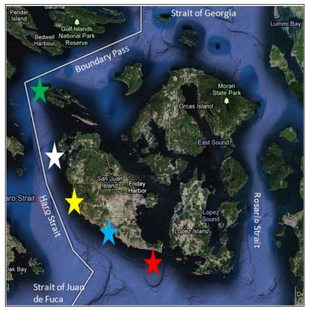

Figure 4: Study sites; green-Far North, white-North, yellow-Mid North, blue-Mid South, red-South

Conclusion

- **Current vs whale direction**: short term data analysis shows whales traveling with the current, however, long term analysis shows whales more frequently traveling against the current.
  - May have human error and different methods for recording.
  - Perpendicular travel not due to foraging or location.
- **Current vs SABS**: trend suggests greater SAB frequency when SRKWs travel with the current.
- **Halo/thermocline vs SABS**: no relationship between cline and SABS, however, sample size was small n=5. Outlying point is the only mixed stratification while others are standard.
- **Δ salinity/Δ temperature vs SABS:** no relationship between Δ salinity/Δ temperature and SABS, however, two outlying points have a large effect due to small sample size (n=9, 3 at SB and 6 at KB).

*Additional research and data is needed to investigate trends for statistical significance.

Figure 11: Recording data on J27 at Lime Kiln.

Results - After much statistical examination results showed no statistical relationships, however, various trends were found.

Current vs whale travel direction

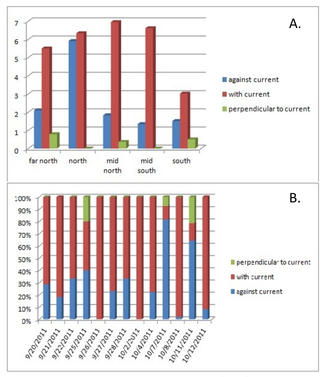

Figure 4: SRKWs traveled more with the current than against or perpendicular. Graph A illustrates current vs whale direction by location and graph B by date.

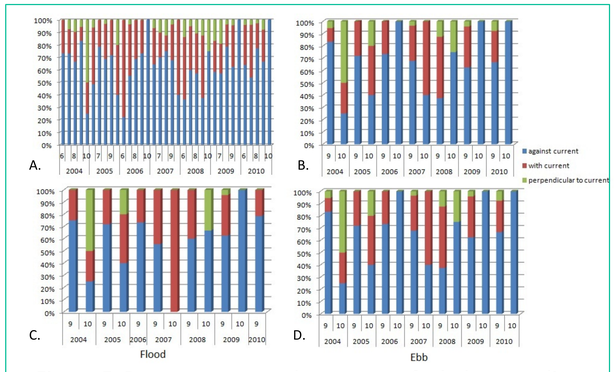

Figure 5: Percent per month per year of whales traveling with, against, and perpendicular to current direction resulting in more time traveling against the current. Graph A is Jun-Oct from 2004-2010 and B is Sept-Oct 2004-2010 at Pile Point. C shows current and travel direction on flood while D illustrates direction on an ebb.

SABS vs travel direction

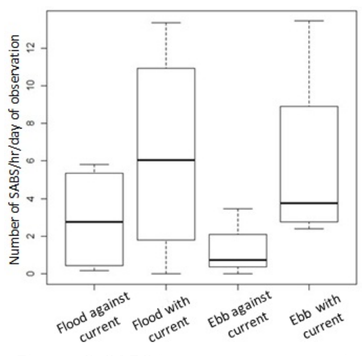

Figure 6: SABS by current type and travel direction. Trend occurring with higher SAB frequency when traveling with the current(flood and ebb against p=0.6857, flood and ebb with p=1).

SABS vs halo/thermocline

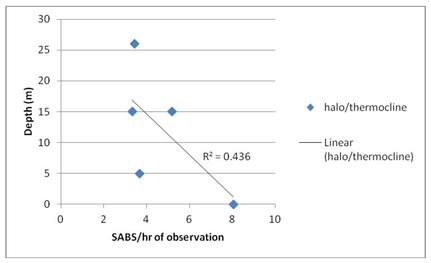

Figure 7: No significant relationship between SABS and depth of the halo/ thermocline in the water column.

Figure 8: example of SABS-Left picture is a spy hop and right is a SRKW porpoising.

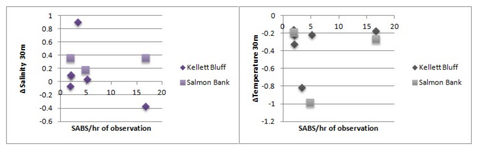

Figure 9: No affect of Δ salinity or Δ temperature down to 30m depth on SABS. Pattern down to 60m depth is similar to that at 30m.

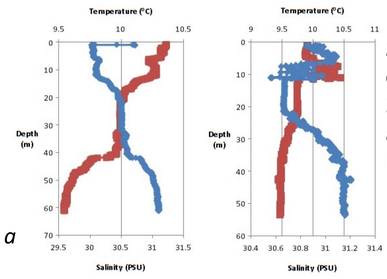

Figure 10: CTD cast on Sept 24 (graph A) and 27 (graph B) on a flood.