Assessing Potential Impacts of Whale Watching on Humpback Whale Behavior in Juneau, AK

Dana Flcheringer¹, Ali Schuler², and Heidi Pearson²,³

University of San Diego¹, University of Alaska Fairbanks², University of Alaska Southeast³

Introduction

- Whale watching serves as an important industry in Juneau, AK during the summer when humpback whales (Megaptera novaeangliae) return to the abundant feeding grounds (Fig. 1).
- Since the success of whale watching depends on the abundance and health of the whales, assessing its potential impacts on whales is essential to creating a sustainable industry.
- Possible impacts may include increased respiration rates or dive durations, which may result in increased energy expenditure and long-term fitness decline [1, 2, 3, 7].

Objective

To demonstrate the short-term effects of whale watching vessel presence on humpback whale respiration rates and dive durations.

Methods

- Whales were observed if they surfaced within 5 km of the observation site (Fig. 2).
- Whale watching vessel presence was defined by boats that were within 500 m of a whale.
- Data were collected for whales in the presence and absence of whale watching vessels.

\[ \text{Respiration Rate} = \frac{\text{# of blows per surfacing}}{\text{time between the first and last blow of a surfacing}} \]

- Dive duration was defined as the time between a diving behavioral event (Fig. 3) and the subsequent surface behavior.

Results: Respiration Rate

![Figure 4: Box plot of whale respiration rates in blows/minute in the absence and presence of vessels. Horizontal lines in the boxes represent median values, and blue boxes contain 50% of the data. Error bars represent the minimum and maximum values.](image)

Table 1: Statistical analysis of respiration rate: Vessel absence (n=81) vs. presence (n=81) groups were compared with a Wilcoxon rank sum test (test statistic: W=3447, p-value: 0.5782).

<table>
<thead>
<tr>
<th></th>
<th>Vessel Absence</th>
<th>Vessel Presence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Respiration Rate (blows/minute)</td>
<td>2.95</td>
<td>2.92</td>
</tr>
<tr>
<td>Standard Deviation (blows/minute)</td>
<td>1.46</td>
<td>1.71</td>
</tr>
<tr>
<td>Standard Error of Mean (blows/minute)</td>
<td>0.16</td>
<td>0.19</td>
</tr>
<tr>
<td>Median Respiration Rate (blows/minute)</td>
<td>2.76</td>
<td>2.55</td>
</tr>
</tbody>
</table>

Results: Dive Duration

![Figure 5: Box plot of humpback whale dive durations in minutes in the absence and presence of vessels. Horizontal lines in the boxes represent median values, and blue boxes contain 50% of the data. Error bars represent the minimum and maximum values.](image)

Table 2: Statistical analysis of dive duration: Vessel absence (n=51) vs. presence (n=83) groups were compared with a Wilcoxon rank sum test (test statistic: W=2295, p-value: 0.6716).

<table>
<thead>
<tr>
<th></th>
<th>Vessel Absence</th>
<th>Vessel Presence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Dive Duration (min)</td>
<td>6.33</td>
<td>5.75</td>
</tr>
<tr>
<td>Standard Deviation (min)</td>
<td>3.66</td>
<td>2.67</td>
</tr>
<tr>
<td>Standard Error of Mean (min)</td>
<td>0.51</td>
<td>0.29</td>
</tr>
<tr>
<td>Median Dive Duration (min)</td>
<td>5.82</td>
<td>5.81</td>
</tr>
</tbody>
</table>

Discussion

- Humpback whale respiration rates and dive durations did not differ significantly in the presence versus absence of whale watching vessels in Juneau over the summer months of 2017 (Fig. 4 and Fig. 5).
- These results may be due to a lack of a true control group resulting from almost consistent boat traffic, reduction in whale response due to repeated boat exposure, small sample size, and/or short duration of the study.

Future Directions

- Further analysis is necessary to adequately determine if and how whale watching vessels affect whale behavior, in both the short and long-term.
- Other behavioral disturbances may include alteration in foraging patterns, aerial behaviors (Fig. 6), swimming speed and direction, resting patterns, group size and cohesion, and acoustic communication [1, 3, 4, 5, 6, 7].

Figure 6: Humpback aerial behaviors, from left to right: breath, tail breach, and chin slap. Photos by Ali Schuler and Heidi Pearson under NMFS permit #14122.

- Data collection on humpback whale populations prior to the high traffic conditions are necessary for a more defined control group to compare to higher traffic conditions.
- Residency patterns should be incorporated to determine how boat traffic affects the annual return of whales to the area.
- Increased analysis will aid in the development of conservation policy and help in the promotion of ideal practices for whale watching behavior.

Acknowledgements

I would like to thank my project mentors, Heidi Pearson and Ali Schuler, my USD mentor, Nathalie Reynolds, and the NOAA Hollings Scholarship Program, for their help, guidance, and support throughout this project.

Citations