Vessel regulations in Maui
Vessel presence and whale behavior: implementing voluntary guidelines

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Manuscript in prep - please do not use these data without contacting the authors first
There is a high potential for whale-vessel interactions in Hawai‘i.
Hawai‘i DPS of humpback whales

FIVEFOLD INCREASE

Hawaii Population Estimate

Sample Years

Darling et al. 1983; Baker and Herman 1987; Cerchio 1998; Mobley et al., 2001; Urban et al., 1999
Maintaining 100 yards

APPROACH LIMITS IN HAWAII

Hawai‘i humpback whale regulations:
• No approaching within 100 yards.
• No thrill crafts and parasail vessels off South and West Maui during whale season.
How are **whales** acting around **vessels**?

**THEODOLITE RESEARCH: 2016-2018**

**Objective:** To determine whether interactions with vessels affect whale behavior.

- Land-based observations remove the potential effects of a research vessel.
- Theodolite surveys conducted at two sites:
  - Papawai Point
  - Puʻu Olai
Time specific data collection

BEHAVIOR CHANGES OVER TIME

Pods were tracked for a minimum of 15 minutes and maximum of 2 hours before, during and after a vessel approached.

Recorded data on:
- Location of pod
- Number of blows and dives
- Pod number
- Date
- Vessel presence
- Vessel count
- Vessel distance to pod
Pod and vessel data collection

INFLUENCING FACTORS

Pod information:
• Composition
• Group size

Vessel information:
• Type (e.g. tourism vs. recreational)
• Motorized vs. non motorized

NMFS Research Permit # 16479
Defining encounter type

TESTING BEHAVIOR CHANGES

Before | During | After

Control | Impact | Residual

Before | During

Control | Impact
Pod behaviors investigated

DO VESSELS CHANGE:

Swim speed:
• Pod swim speed in km/h.

Dive time:
• Duration of dive in minutes.

Respiration rate:
• Number of blows/minute.

Directness index:
• Overall pod direction.
  – (0 - circular path; 100 - straight line)
Summary of Survey Effort

A total of 73 days were spent tracking humpback whales from 2016-2018.

We recorded data on:
- 316 pods
- 943 whales
- 472 vessel
Changes in swim speed

General Additive Model:
\[ \text{Speed} \sim \text{Pod composition} + \text{Distance to pod} + \text{day} \]
\[ GCV = 3.63; \text{Deviance explained} = 14.1\% \]

Swim speed was:
- Fastest when a vessel was 100-150 meters from a pod. 
  \( (edf = 6.143, rdf = 7.231, p\text{-value} < 0.01) \)
- Slower for pods with calves. 
  \( (MCE: t\text{-value} = -6.868, p\text{-value} < 0.001) \) 
  \( (MC: t\text{-value} = -2.384, p\text{-value} < 0.05) \)
Changes in respiration rate

General Additive Model:
Blows ~ Encounter type + Pod composition + Distance to pod + day

\[ GCV = 2.36; \text{Deviance explained} = 27.8\% \]

The number of blows per minute:
- Changed with distance to vessel
  \( (edf = 7.482, rdf = 8.413, p\text{-value} < 0.001) \)
- Decreased after an encounter with a vessel
  \( (t\text{-value} = -2.039, p\text{-value} < 0.05) \)

NMFS Research Permit # 16479
Changes in **travel direction**

General Additive Model:
Directness ~ Encounter type + Distance to pod + *day*

$GCV = 407.57; Deviance explained = 37.4\%$

The straightest line of travel occurred:

When a vessel was 100-150 meters from a pod

$(edf = 2.946, rdf = 3.591, p-value < 0.0001)$

During and after an encounter

(During: *t*-value = 3.800, *p*-value < 0.0001)
(After: *t*-value = 3.963, *p*-value < 0.0001)

NMFS Research Permit #19703
Changes in dive time

General Additive Model:
Dive time ~ Encounter type + Pod composition + Pod
$GCV = 24.17; Deviance explained = 29.0\%$

The shortest dive times occurred:
For mother-calf-escort pairs
($t$-value = -2.213, $p$-value < 0.05)

During and after an encounter
(During: $t$-value = -2.908, $p$-value < 0.01)
(After: $t$-value = -2.436, $p$-value < 0.05)

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When a vessel is at or approaching the 100 yards limit, humpback whales display a horizontal avoidance strategy:

Swim speed  
Dive time  
Travel Direction  
Blows per minute

Similar to previous reports investigating humpback whale responses to vessels.

*In some cases, whales change behavior to approach vessels.*
Recommendations
BUILD ON CURRENT REGULATIONS

Observed Trends:
There is a potential energetic cost from short-term responses.

Difficult to quantify population-level effects but they are thought to be minimal.

Possible Solutions:
Further guidance on methods of approach and how and where to maintain 100 yards.
Implement a voluntary code of conduct.

BE WHALE AWARE
Recommendations

Follow additional guidelines

Currently 7 vessels in Hawaii follow Be Whale Aware Guidelines

Slow Down, Whales Around

- Speed increases the risk of a collision.
- Reduce vessel speed to 15 knots or less November-December and April-May.
- Reduce vessel speed to 12.5 knots or less during the peak season of January-March.
- Reduce vessel speed to 6 knots or less when within 440 yards of whales.

Watching Whales

- Limit your viewing with whale groups containing calves to 30 minutes.
- No more than 3 vessels of any size or type should stop to watch a whale group.
Impacts of **Be Whale Aware**

**MINIMIZING BEHAVIOR CHANGE**

**Dive Time**

**Blows Per Minute**

**Travel Direction**

**Speed**
Thankyou for listening

QUESTIONS?

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