Impacts of whale watching vessels on humpback whales and compliance with voluntary guidelines in Skjálfandi Bay, Iceland

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ABSTRACT

A voluntary Code of Conduct was introduced by a group of Icelandic whale watching operators to promote sustainable whale watching practices and limit any harmful impacts on cetaceans. This study aims to identify impacts of whale watching vessels on the behaviour of humpback whales in Skjálfandi Bay and assess compliance with the voluntary Code of Conduct. Data were collected for three months onboard a whale watching vessel, including the vessel speed, the duration of encounters, the distance to any whale(s) and the number of vessels during encounters. Results show a significant relationship between directionality in whale movements and decreased time at the surface during encounters longer than 30 minutes. Directness index values indicate a change from whales swimming in a straight line to a more sinuous path during longer encounters. While whale watching vessels complied with the voluntary Code of Conduct to maintain the recommended distance from whales, the duration of encounters varied each month, with 60% of encounters in August lasting longer than the recommended 30 minutes. Ongoing education and stronger monitoring efforts could be applied to whale watching activities in Skjálfandi Bay to ensure sustainable practices throughout the summer season.

KEYWORDS: ICELAND; WHALE WATCHING; REGULATIONS; SUSTAINABILITY; HUMPBACK WHALE

INTRODUCTION

Since the 1950s, whale watching has seen exponential growth and development in coastal areas around the world, with an estimated revenue of 2.1 billion US dollars (O'Connor *et al*., 2009). In 1982, the International Whaling Commission (IWC) introduced a moratorium on commercial whaling, which helped lead to a profitable marine tourism sector and promote the sustainable use and conservation of whale species (O'Connor *et al*., 2009). Whale watching has transformed local economies in many coastal regions, including the small town Húsavík in northeast Iceland, close to Skjálfandi Bay, which has been called 'the whale watching capital of Europe' (O'Connor *et al*., 2009). In the last two decades, the number of whale watchers in Húsavík has increased from 29,000 in 2003 to 104,000 in 2019.[4] The growing demand for whale watching to boost the local economy coupled with abundant wildlife leads to a high co-occurrence of humpback whales (*Megaptera novaeangliae*) and vessels.

Studies have been conducted on the benefits of whale watching, including economic growth through employment and tourism, educational outreach through trained specialists on board whale watching vessels, and conservation efforts by locals, tourists and NGOs to ensure the protection of cetacean species (Hoyt, 2001; IFAW *et al*., 1997). Studies have suggested that, if done unsustainably, whale watching poses threats to whales,

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[4] *https://www.ferdamalastofa.is/en/recearch-and-statistics/numbers-of-foreignvisitors*

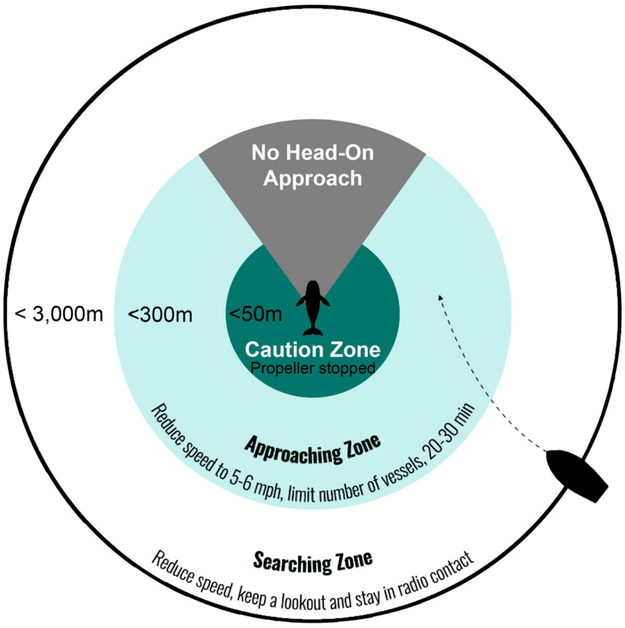

Figure 1. The Code of Conduct for responsible whale watching and recommended protocol, highlighting the Searching, Approaching and Caution Zones (https://icewhale.is/code-of-conduct/).

such as disturbances to feeding, diving, swimming patterns and social behaviour (Corkeron, 1995; Scheidat *et al.,* 2004; Christiansen *et al*., 2011; Parsons, 2012). To alleviate these impacts, Codes of Conduct have been introduced in various parts of the world where whale watching is common, including Australia, Canada and the USA, to reduce any potential harmful impacts. These Codes of Conduct include guidelines and recommendations for whale watching tours, including speed restrictions, safe distances and limits to the number of vessels around a whale at any given time.

The Icelandic Whale Watching Association (IceWhale) was formed in 2015 and developed a Code of Conduct built around three critical zones in relation to observed whales (Fig. 1): (1) the 'Searching Zone' is the area beyond 3,000 m from the whale, where vessels are advised to reduce speed and keep a lookout for whales; (2) the 'Approaching Zone' is the area beyond 300 m from the whale, where vessels are advised not to overcrowd any whales, to reduce speed to 4–5 kn and limit the length of encounters to 20–30 minutes; and (3) the 'Caution Zone' is the area beyond 50 m from the whale, where vessels are advised to shut off engines and maintain a minimum distance of 50 m.[5] Despite the introduction of these measures, the IceWhale Code of Conduct is voluntary and largely unregulated. In Skjálfandi Bay, where whale watching is well established, with at least five companies providing tours, questions about sustainability and adherence to the Code of Conduct raise concerns and facilitate discussions at public engagement sessions. Local people, researchers and whale watching guides and captains are encouraged to raise any concerns about safe and sustainable practices as whale watching continues to provide the main attraction in Húsavík.

This study aims to determine whether the presence of whale watching vessels affects the behaviour of humpback whales and to evaluate the compliance and efficacy of IceWhale's Code of Conduct for one whale watching operation.

MATERIALS & METHODS

Study area

Data were collected between 1 July – 25 September 2019 in Húsavík, Skjálfandi Bay, Iceland (66°02'N, 17°20'W) (Fig. 2). Located 70 km south of the Arctic Circle, Skjálfandi Bay supports a nutrient-rich ecosystem which provides food for fish, birds and cetaceans (Malinauskaite *et al*., 2021). Humpback whales are abundant in the Bay and

[5] *https://icewhale.is/code-of-conduct/*

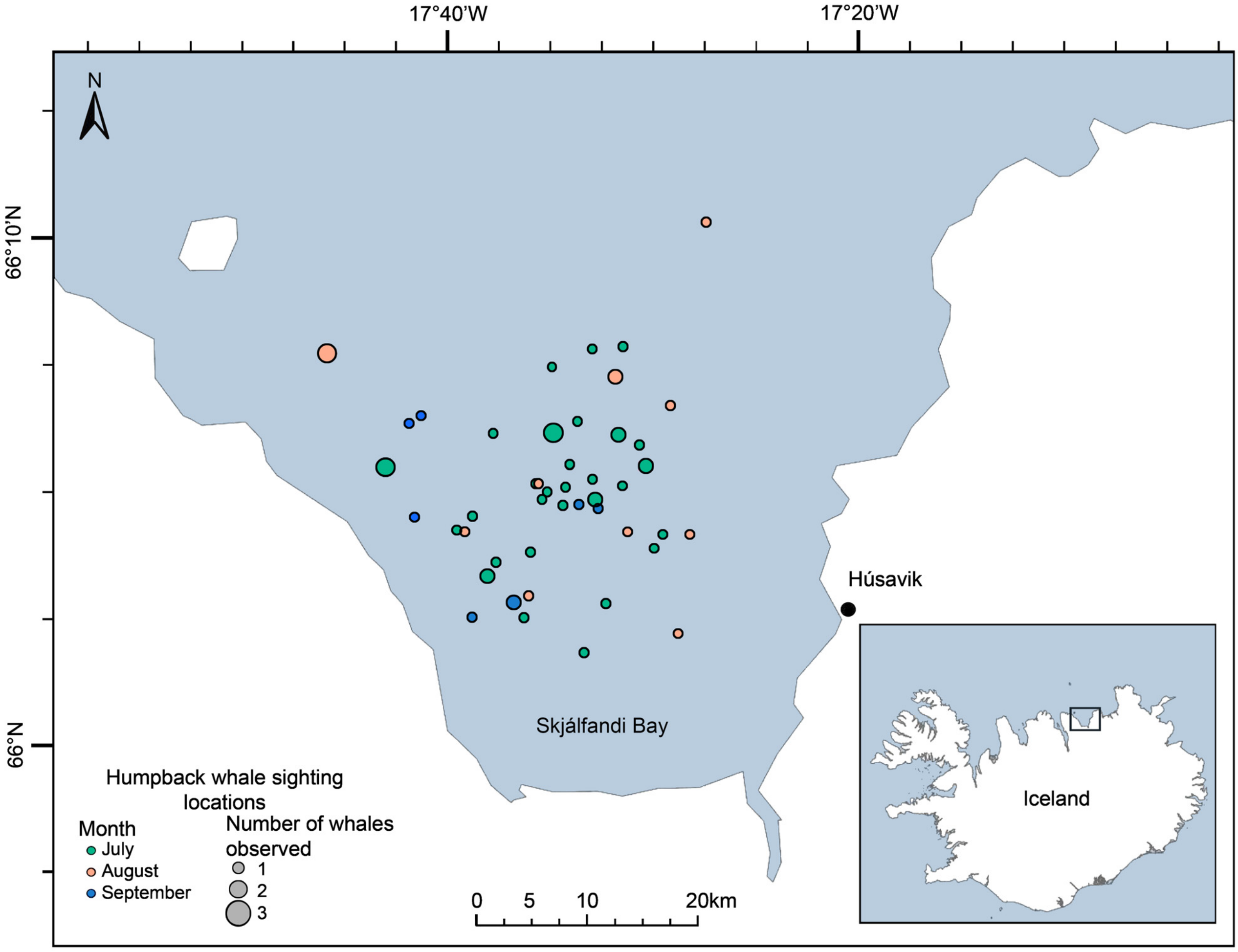

Figure 2. Study site location of Skjálfandi Bay, Iceland, with all humpback whale sightings for each month of data collection: July, August and September 2019. Size of points are representative of the number of whales observed at each sighting. Map created with ArcGIS Pro 3.3.0.

frequent the waters year-round, drawing attention to the area as a popular whale watching destination since its inception in the 1990s (Nicosia & Perini, 2016).

Data collection

Vessels operated by North Sailing (Húsavík, Iceland) were used as platforms to collect data during one or two tours per day between 09:00 and 21:00. Departure times were recorded. It took 30–60 minutes to locate the first whale(s). Whales were spotted with reference to their back, their spot, while surfacing to breathe, and/or their fluke, before a deep dive. The start time of encounters were recorded once a humpback whale was spotted within 900 m of the vessel, and the onboard guides had directed the passengers' attention to the whale. Throughout the encounter, a range of variables were monitored and recorded whenever the whale(s) surfaced. A mobile app called Boatspeed (Hans Joachim Herbertz, Germany) was used to record the vessel's GPS coordinates, the vessel speed, and the heading and angle from the bow to the whale. The number of whales and vessels present during the encounter was recorded. The following behaviours were also recorded: surfacing, resting, breaching, pectoral fin slaps, lobtailing, diving, lunge feeding and bubble feeding (Corkeron, 1995). The distance from the vessel to the whale was measured and recorded using a rangefinder (Bushnell Pro X2 Slope Edition) positioned close to the hump for consistent readings. The amount of time the whale spent on the surface or underwater was recorded by taking note of the time (hh:mm) when the whale surfaced to breathe and when it arched its back for a shallow dive or raised its fluke for a deep dive. Due to technical issues, recording dive and surface time only started on 23 August 2019. Time of the end of an encounter was noted when the captain decided to leave the whale to find another in the area or head back to land. Whales followed were chosen independently, meaning each new encounter followed a new whale that was completely random. For multiple encounters in a day, one whale was followed for one encounter, then a different whale at random for the next encounter.

Data analysis

The number of whale watching trips, the number of whale sightings, and the total number of hours spent on effort over the entire field season and by month, were calculated. The sightings per unit of effort (SPUE) value was calculated for the entire field season and for each month (Equation 1.1). One unit of effort was equal to one hour. The SPUE was calculated by dividing the total number of whale sightings by the hours spent on effort:

$$\text{Sightings per Unit Effort} = \frac{\text{Number of sightings}}{\text{Hours on effort}} \tag{1.1}$$

The locations of whales sighted were calculated using triangulation with the vessel coordinates, distance to the whale and angle from the vessel's bow to the whale. While the same instruments and platforms were used throughout the summer season, potential measurement errors, such as those measured in Christiansen *et al*. (2013), were not possible to account for in the calculation of the coordinates, as individual instrument errors were not recorded. The sighting coordinates in Skjálfandi Bay were plotted in ArcGIS Pro 3.3.0 (Fig. 2).

Vessel behaviour and Code of Conduct

To assess the impact of whale watching vessels, four variables were considered: duration (minutes), average distance to whale (m), maximum number of boats observed around the whale, and average vessel speed (kn). With these variables, we were able to assess the adherence to the Code of Conduct by the captain of the whale watching vessel for each encounter. We recorded whether the duration of encounters was within the 30-minute time limit and calculated the proportion of total encounters during the season which lasted more than 30 minutes. We calculated the proportion of time when the vessel was within 50 m–300 m of a whale at the time it surfaced. We also calculated the proportion of time when the vessel's speed was over 5.2 kn in the Approaching Zone.

Whale behaviour

To assess whether whale behaviour was affected by the whale watching activities, we explored whether there was an association between the number of times a whale surfaced, standardised by the encounter duration and the directness index (DI), and the four variables described above: duration, average distance to whale, maximum number of boats, and average vessel speed. The number of times surfaced per hour refers to the whale inter-breath interval, which was observed to be impacted by boat presence (Christiansen *et al*., 2011; Christiansen *et al*., 2013). There were not enough data about diving and surface time to include these variables.

The DI was calculated using the methods described in Scheidat *et al*. (2004) to determine the whale's swimming pattern (Equation 1.2). The DI is calculated by dividing the distances from the first to last known position (T) by the sum of the distances between known positions (d_1, d_2, d_3 ... d_x). The index ranges from 0 (whale swimming in a circle) to 1 (whale swimming in a straight line).

$$DI = \frac{T}{d_1 + d_2 + d_3 \ldots d_x} \tag{1.2}$$

We computed two linear regressions, testing all four variables against the number of surfacings per hour and the DI. The tested variables were first standardised and the assumptions for linear models were verified by plotting residuals versus fitted values, normal Q-Q plot, scale location and residuals versus leverage (Zuur & Ieno, 2016).

We also tested the behaviour variables against the guidelines of the Code of Conduct. After checking for normality (Shapiro-Wilk test) and compliance to its other assumptions, a Mann-Whitney U test was used to assess whether there was a difference in the threshold of the Code of Conduct, i.e., the duration of the encounter (more or less than 30 minutes), if the vessel approached within 50 m of the whale (at least once during an encounter or never), and if the vessel speed was higher than 5.2 kn in the Approaching Zone (at least once during an encounter or never). We also examined the presence of the vessels in the Approaching Zone or beyond (≤ 300 m or > 300 m) (only two encounters were on average closer than 50 m, so all encounters within 300 m were grouped together). Because the two behaviour variables were tested multiple times, a Bonferroni correction was applied to adjust the level of significance to 0.00625 (0.05/8 tests) and reduce the probability of Type I error.

RESULTS

Survey effort

Data were collected for 113 hours across 30 whale watching tours between 6 July–25 September 2019 (Table 1, Fig. 3). Two practice tours were carried out on 3 and 4 July – the data gathered on these days were not included in the results. Most sightings and effort occurred in July with 15 trips, 43 hours and 29 encounters (37 whales). In August, bad weather and unsafe sea conditions prevented data collection between 7–12 August, but otherwise resulted in a total of eight trips, 38 hours and 10 encounters (12 whales). The least number of sightings and time spent on effort was in September with seven trips, 32 hours and seven encounters (eight whales). Most trips were conducted in the afternoon during the field season (n = 23, 77%). Four trips were made in the morning (13%) and three in the evening (10%). The SPUE value for the season was 0.504. July had the highest SPUE of 0.860, indicating the most whale sightings this month. August had a SPUE of 0.316 and September had the lowest SPUE value of 0.250.

Table 1

Effort and observations from July to September 2019, including sightings per effort unit (SPUE).

Month	Number of whale watching trips	Number of hours on effort	Number of encounters	Number of whale sightings	SPUE
July	15	43	29	37	0.860
August	8	38	10	12	0.316
September	7	32	7	8	0.250
Total	30	113	46	57	0.504

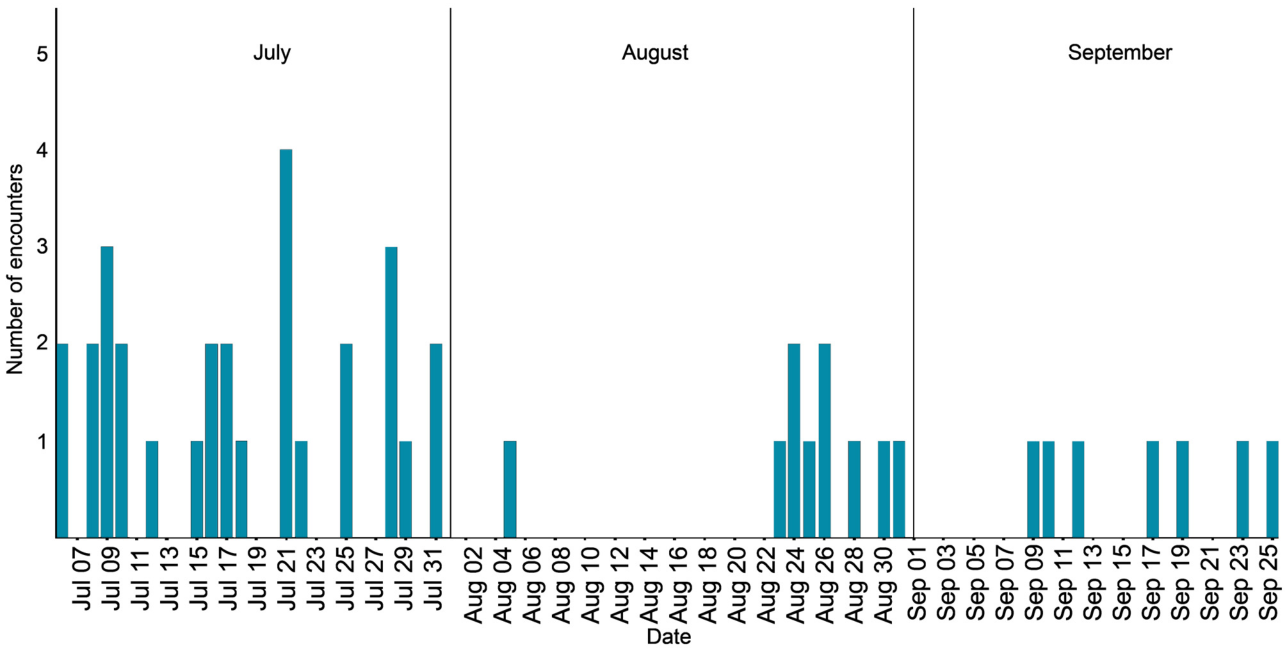

Figure 3. Number of whale encounters per day during each month of the 2019 field season.

Code of Conduct

North Sailing's compliance with the voluntary Code of Conduct is summarised in Table 2 and Figure 4. The average distance to the whale during each encounter was 197 m (SD = 96). Across all months, 76% of encounters occurred in the Approaching Zone (< 300 m to a whale). July showed the highest proportion of encounters in the Approaching Zone (84%), including the highest proportion of encounters within less than 50 m (8%). The minimum distance recorded when a whale was surfacing was 3 m. The maximum distance was 1,000 m. The

Table 2

Summary of compliance to the Iceland Code of Conduct by North Sailing Whale Watching during the summer of 2019, recorded each time a whale surfaced.

Compliance to Iceland whale watching code of conduct	July	August	September	Total
Proportion of time when a whale surfaced, and the boat was in the approaching zone	84% (*n* = 133)	64% (*n* = 49)	68% (*n* = 39)	75% (*n* = 221)
Proportion of time when a whale surfaced, and the boat was in less than 50m of a whale	8% (*n* = 12)	3% (*n* = 2)	7% (*n* = 4)	6% (*n* = 18)
Proportion of encounter of more than 30 min	10% (*n* = 3)	60% (*n* = 6)	57% (*n* = 4)	28% (*n* = 13)
Proportion of time when a whale surfaced, and the boat was going over 5.2 kn in the approaching zone	6% (*n* = 9)	12% (*n* = 9)	5% (*n* = 3)	7% (*n* = 21)

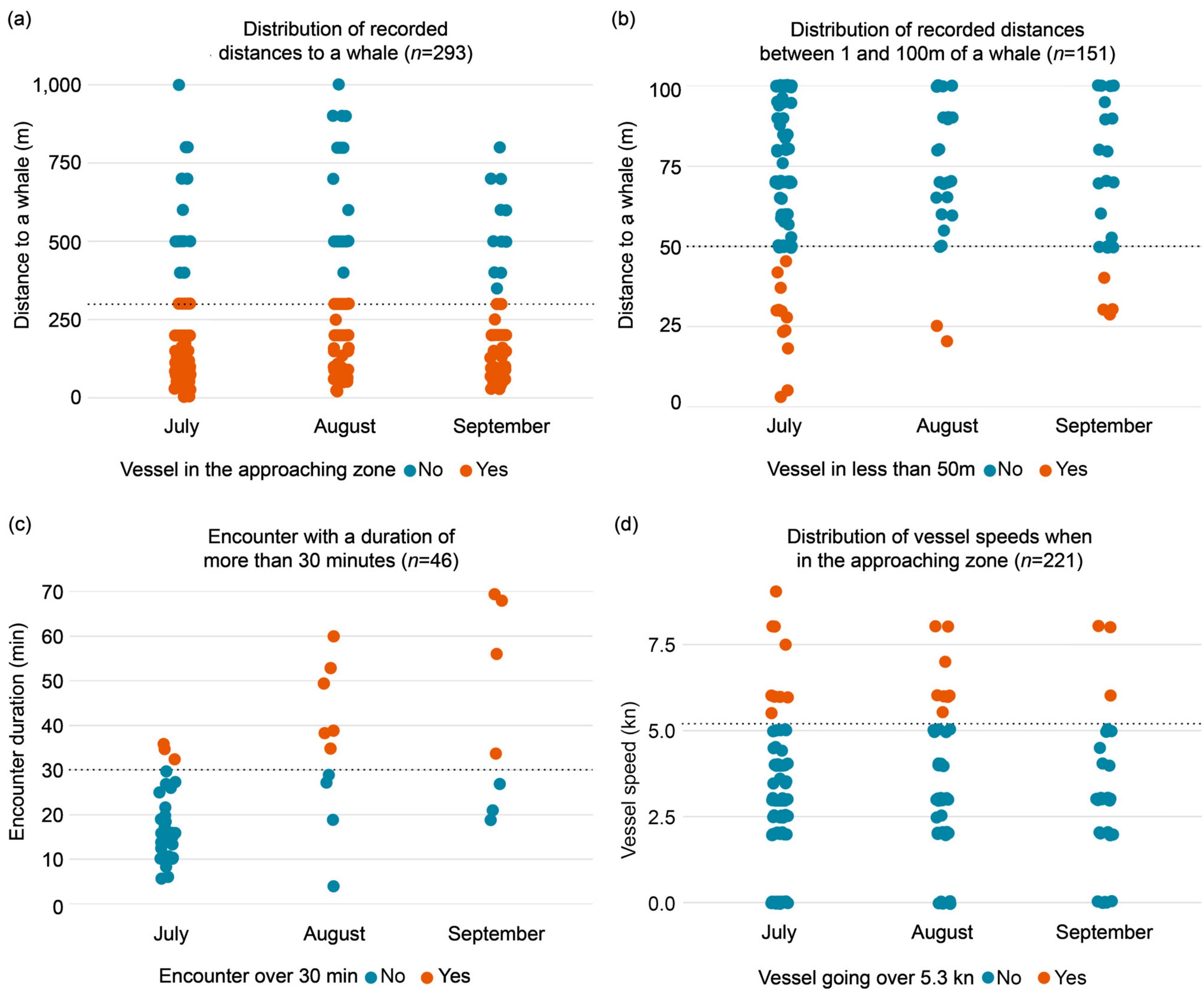

Figure 4. Evaluation of North Sailing's whale watching conduct from July to September 2019. (A) Distribution of the distances to the whale every time it surfaced, showing when the boat was in the Approaching Zone; (B) distribution of the distances to the whale ranging from 0 to 100 m every time it surfaced, showing when the boat was within 50 m; (C) duration of each encounter, showing encounters that lasted more than 30 minutes; and (D) distribution of vessel speed every time a whale surfaced in the Approaching Zone, showing speeds over 5.2 kn.

50 m minimum distance was adhered to 94% of the time, with only 6% of encounters getting closer than 50 m. All three months showed a similar proportion, however, encounters in July tended to come much closer to whales than in the other two months. Most encounters in August and September occurred in the Approaching Zone (64% and 68% respectively). A low proportion were made less than 50 m from the whale.

The average duration of encounters was 25.4 minutes (SD = 16.3), with a minimum time of four minutes and a maximum time of 69 minutes. The Code of Conduct's 30-minute threshold was adhered to 72% of the time across all three months, leaving 28% of encounters lasting more than 30 minutes. Compared with July, August and September showed an increase in encounters lasting more than 30 minutes (60% and 57% respectively). These encounters also lasted much longer (> 50 minutes) than those in July, which stayed under 40 minutes.

For all three months, the vessel speed exceeded 5.2 kn in the Approaching Zone during 7% of encounters, showing compliance with the Code of Conduct most of the time. August showed the highest proportion of higher vessel speeds in the Approaching Zone (12%), whereas July had the highest speed recorded during an encounter (9 kn). All months had at least one recording where the vessel speed was over 7.5 kn while in the Approaching Zone.

Whale behaviour

Whales surfaced on average 6.4 times (SD = 2.8) during encounters, ranging from two to 12 times. When standardised against the duration of encounters, the multiple linear regression only identified the duration of encounters as a significant predictor ($p < 0.001$). We therefore removed the three non-significant predictors and computed a linear regression with only the encounter duration. The linear regression between the number of times surfaced per hour and the log of the encounter duration showed a significant negative trend ($R^2 = 0.46$, $F_{1,44} = 38.84$, $p < 0.0001$) (Fig. 5A). The encounter duration was log-transformed to improve the normality of residuals, following the model validation. A whale surfaced fewer times when encounters lasted longer ($\beta = -7.671 \pm 1.231$ SE, $p < 0.0001$). When testing against the Code of Conduct's recommendations, only the encounter duration (more or less than 30 minutes) was significant ($W = 343.5$, $p = 0.0037$), which confirms that the duration of a vessel's presence can affect the whale's surfacing behaviour (Table 3, Fig. 6A).

The DI was calculated for 43 of the 46 encounters, as in three encounters, whales only surfaced one or two times. The average DI was 0.552 (SD = 0.294), with a range of 0.038 to 0.999. Similar to the surfacing time, the multiple linear regression only identified the encounter duration as a significant predictor ($p = 0.023$). Encounter duration was log-transformed to improve linearity and normality of residuals, following model validation. The linear regression was significant ($R^2 = 0.17$, $F_{1,41} = 9.344$, $p = 0.0039$) (Fig. 5B), indicating that longer encounter

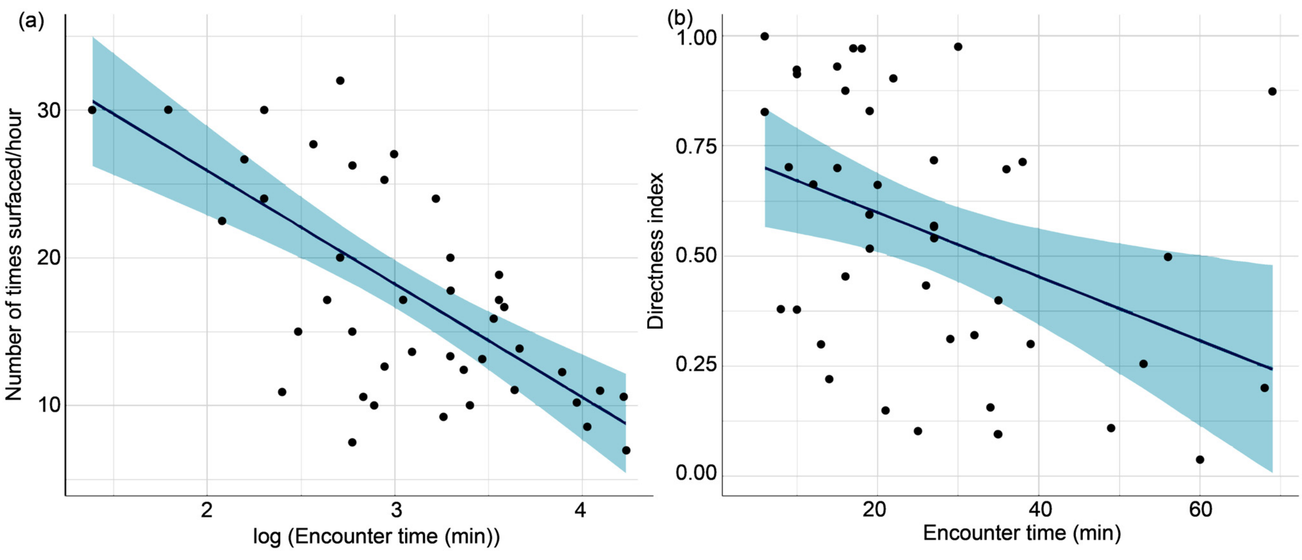

Figure 5. Linear regressions: (A) number of times surfaced per hour ($\beta = -7.671$) as a function of the duration of encounter (minutes) in log ($R^2 = 0.46$, $F_{1,44} = 38.84$, $p < 0.0001$); (B) directness index ($\beta = -0.0073$) as a function of duration of encounter (minutes) ($R^2 = 0.14$, $F_{1,41} = 7.913$, $p = 0.0075$).

Table 3

Results of the Mann-Whitney U tests, including the W values and p value. The two whale behaviour variables were tested against the Code of Conduct recommended threshold. Bolded values identify significant tests based on the Bonferroni correction (p < 0.00625).

Code of Conduct threshold	Mann-Whitney U-test	p
Encounter of less or more than 30min (‘less than 30 min’ or ‘more than 30 min’)		
Number of times surfaced/hour	W = 330.5	**0.0048**
Directness index	W = 302	**0.0039**
Boat within 50m of whale (‘never’ or ‘at least once’)		
Number of times surfaced/hour	W = 249.5	0.699
Directness index	W = 159	0.201
Boat speed over 5.2kn in the approaching zone (‘never’ or ‘at least once’)		
Number of times surfaced/hour	W = 165.5	0.236
Directness index	W = 170	0.522
Boat distance (≤ 300m or > 300m)		
Number of times surfaced/hour	W = 165.5	0.706
Directness index	W = 165.5	0.236

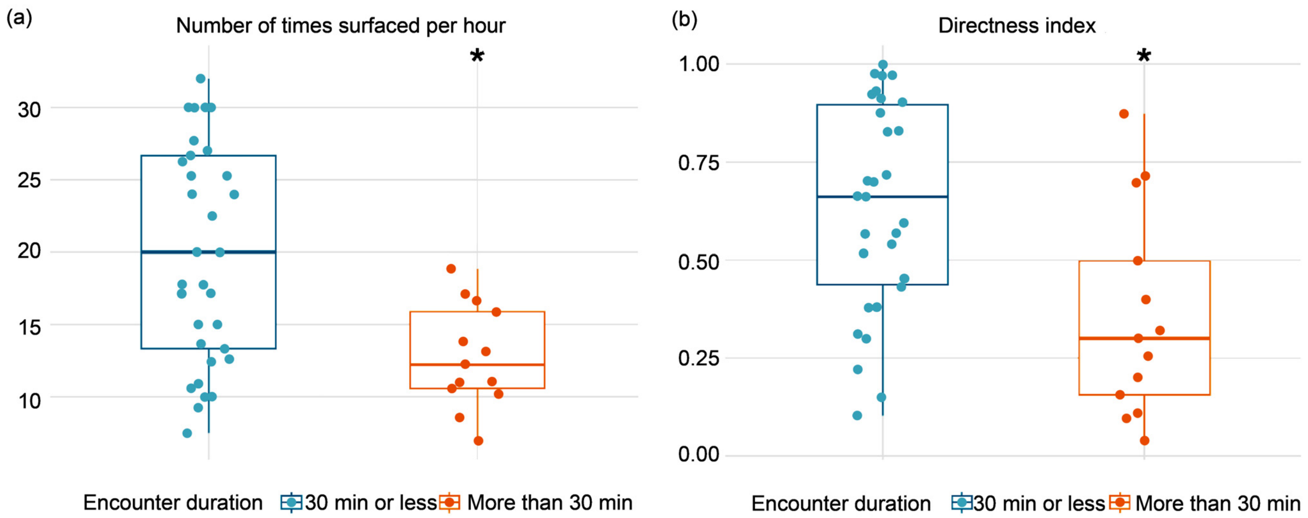

Figure 6. Selected results from the significant Mann-Whitney tests, based on the p value of the Bonferroni correction (p < 0.00625). (A) Number of times a whale surfaced per hour by the duration of the encounter; and (B) directness index of the whale by the duration of the encounter.

times led to lower directness index, or more unpredictable movement from the whale ($\beta = -0.202 \pm 0.066$, p = 0.0039). The Mann-Whitney test showed a significant difference between the DI and the encounters lasting more or less than 30 minutes (Table 3, Fig. 6B). Encounters longer than 30 minutes resulted in a lower DI, meaning the whales swam in a less straight direction.

DISCUSSION

Whale behaviour

When designing a Code of Conduct to ensure a sustainable tourist sector, it is important to quantify the impacts in order to evaluate if the measures are effective. Here, we collected data from North Sailing’s whale watching tours and the effect(s) on whales during one season. Humpback whales did not show consistent signs of disturbance or changes in behaviour were not statistically detected with the number of vessels present or with vessel speed. However, whales displayed more erratic path directionality the longer the encounter. As the encounter progressed, the directness index of the whales decreased, indicating a switch from a linear swimming path to a more circular one. These findings are consistent with studies showing cetaceans reducing time at the surface and increasing the length and depth of dives in the presence of vessels – behaviours associated with vertical avoidance (Nowacek *et al*., 2001; Lusseau, 2003). In addition, our results showed a reduction in surfacing rates during longer encounters. This type of behaviour can be associated with horizontal avoidance, i.e., altering directionality by making frequent path changes to outrun perceived threats (Williams *et al*., 2002). Behavioural responses to vessels, such as changes in movement and surfacing patterns, can be linked to how humpback whales evade natural predators in the wild (Curé *et al*., 2015). When killer whale (*Orcinus orca*) sounds were played in the vicinity of humpback whales in their North Atlantic feeding grounds, whales were found to stop feeding, change their diving pattern and display a clear horizontal path change from the speaker. Previous studies have demonstrated that responses to vessels are seen across cetacean species. Christiansen *et al*. (2013) found minke whales (*Balaenoptera acutorostrata*) in Faxaflói Bay, Iceland, responded to vessels by increasing sinuous movement. Similarly, humpback whales in Juneau, Alaska, displayed significant deviation from a straight-line path and higher swim speeds (Schuler *et al*., 2019; Peterson, 2001). A study looking at the behavioural responses of fin whales *(Balaenoptera physalus*) in Chile found that whales displayed more erratic movements in the presence of whale watching vessels and an increased swim speed after vessels had left the area (Santos-Carvallo, 2021). The findings of this study and others support the hypothesis that whales can display both vertical and horizontal avoidance behaviour in response to whale watching vessels.

Our results showed a change in humpback behaviour linked to the length of an encounter rather than either the number of vessels or vessel speed. However, this could be due to small sample sizes associated with a short season and small number of whales recorded. A longer study over multiple years could reveal more significant changes in behaviour patterns. Additionally, the inherent challenges of observing whale behaviour(s) when undisturbed, i.e., without the presence of boats, makes it challenging to identify shifts in response to whale watching activity compared with undisturbed behaviour. While the cliffs overlooking the bay are a potential location on land to detect and conduct cetacean surveys, it was not successful for this study as the whales were not close enough to describe behaviour and record accurate measurements. The use of a whale watching vessel was therefore the only other accessible method to conduct research. This methodology reduced the potential measurement bias between different platforms but eliminated the possibility of controlled behaviour in the absence of vessels. When interpreting the results which indicate potential behavioural responses to the research platform, it's essential to recognise that other vessels in the vicinity were present and likely to affect whale behaviour. Whales may have spent several hours surrounded by vessels prior to the documented encounter; responses to our vessel may be obscured or altered by the presence of other vessels. It is challenging to evaluate these impacts as we did not measure the encounter duration or distance to the whales of these other vessels. This can be partially accounted for by using AIS data to look at the presence of vessels (Grove, 2024) or acoustic tag data to monitor small-scale behaviour and impacts of boat noise on foraging and vocalisation (Ovide, 2017). Nevertheless, this study investigated the impacts of North Sailing's whale watching activities on humpback whales following the implementation of a voluntary Code of Conduct in this area.

Code of Conduct

In the marine tourism sectors, whale watching guidelines and codes of conduct are examples of voluntary or legal agreements to manage and reduce harmful anthropogenic impacts. Results from this study show that most aspects of the IceWhale voluntary Code of Conduct were followed by North Sailing. Vessel compliance was high for maintaining the 50 m distance to the whale and reducing vessel speed to less than 5.2 kn within 300 m. Only 6% of vessels approached closer than 50 m to a whale, and the vessel speed was over 5.2 kn in the approaching zone for only 7% of the encounters. In comparison, Martin 2012's study in Skjálfandi Bay prior to the implementation of the IceWhale Code of Conduct, using boat-based observations from North Sailing and Gentle Giants, found 60% of vessels approached humpback whales within 20–50 m, and 47% of vessels approaching humpbacks or other species were travelling at speeds of 5.4–8 kn within 100–300 m. While behavioural responses before and after implementation of the Code of Conduct can't be compared as part of this study, vessel compliance in the proximity of whales has greatly improved, with a 90% decrease in encounters closer than 50 m, and an 85% decrease in vessel speeds higher than 5 kn in the Approaching Zone. This reflects a positive change in captains' behaviour around whales at North Sailing. It is possible that our results show high compliance as the captains of these vessels may have been responding to the presence of a researcher onboard, creating an indirect bias that is difficult to measure. However, information collected on survey efforts can help contextualise the compliance of vessel captains throughout the whale watching season. Compliance was found to be lower regarding the duration of whale encounters, with encounters being shortest in the month of July (correlating with the highest number of whale sightings) and longest in the month of August (correlating with a decrease in whale sightings). The abundance of whales in Skjalfándi Bay each month appears to influence the length of time captains of North Sailing's vessels in Skjalfándi Bay decided to spend with a whale during a tour. Pressure on captains to provide tourists with memorable experiences has been studied and found to affect compliance with regulations. A study by Wiley *et al*. (2008) reviewing voluntary guidelines for whale watching in Stellwagen Bank National Marine Sanctuary, USA, found that, by interviewing various whale watching operators, guidelines were difficult to comply with when there were few whales in the area. Operators in this study expressed feeling pressure to provide a satisfying encounter while adhering to the company schedule.

In other parts of the world, there are strict laws and regulations in place regarding safe viewing of marine mammals. In Canada, an amendment to the Marine Mammal Regulations under the Fisheries Act in 2018 provided enhanced protection for at-risk species, including the beluga whale (*Delphinapterus leucas*) in the Gulf of St. Lawrence Estuary, and the Southern Resident killer whale in Southern British Columbia. Walker (2019) evaluated whale watching regulations in Canada and found that Federal Government funds conservation officers to enforce regulations in the St. Lawrence Estuary, with a team to monitor and perform compliance checks on the water. In Southern British Columbia coastal waters, vessels are required to maintain 400 m from Southern Resident killer whales and reduce speed to under seven knots. Failure to comply with these regulations can result in charges of up to $100,000 to the vessel operator.[6] In contrast to the St. Lawrence Estuary, enforcement on this scale is lacking on the Canadian west coast. Despite this, adherence to regulations dramatically increased with the presence of a local volunteer monitoring group (Seely *et al*., 2017). They also found that only 47% of vessel captains were aware of the guidelines and protocols surrounding safe and sustainable whale watching practices (Seely *et al*., 2017), highlighting the need for education and awareness.

CONCLUSION

While it is encouraging to see relatively high compliance with whale watching regulations in Skjálfandi Bay, there should be ongoing education and monitoring efforts to minimise disturbance to marine species. Given the findings of this study, the recommended length of encounters should be monitored and encouraged to reduce any possible detrimental disturbances to the whale being observed. There is currently no monitoring of vessel compliance to the Code of Conduct in Skjálfandi Bay to assess whether the voluntary measures are sufficient in the area. Funds could be allocated to periodic on-the-water monitoring and compliance checks, or regular reminders could be sent to whale watching companies of the regulations and their responsibilities. Ongoing outreach and education to whale watching companies and tourists will continue to be imperative in ensuring conservation of marine life in Skjálfandi Bay.

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