



The Whale Warning flag

Introducing a social prompt to improve boater behavior around the endangered Southern Resident killer whales.

Whale Warning flag:

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Final Report for the Marine Mammal Commission

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Summary

Species around the world are at risk because of human actions and behavior. The critically endangered Southern Resident killer whale presents an ideal case study with which to introduce and test innovative social marketing methods to address impacts from human behaviors that continue to limit the populations' ability to recover. Despite significant transboundary effort to educate boaters, vessel disturbance remains one of the core threats. In 2018 San Juan County introduced a whale warning flag as a prompt to alert boaters to the presence of whales with the goal of influencing boater's behavior and attitudes around whales. This is the first study to investigate the effectiveness of such a tool for marine mammal conservation. Flags were distributed to vessel operators starting in June 2018 and education and outreach campaign was initiated to amplify the flag's use. Data were collected through a combination of dedicated vessel counts and social surveys. Vessel count and vessel incident data were collected by the Soundwatch boater education program as part of their normal data collection protocols. Additional opportunistic vessel data were provided by a landbased theodolite team conducting behavioral response studies for Southern Resident killer whales on the westside of San Juan Island. Social surveys were distributed to individuals who received whale warning flags, to sailing and yacht clubs throughout the Puget Sound area, and made available on the San Juan County Marine Resources Committee website and social media platforms.

Based on the vessel count data there was no evidence that the introduction of, and use of the flag resulted in an increase in the number of boats observed near whales, this was a key result because it provides evidence that the flag does not attract vessels to whales. Flags use saw a marked increase in 2019 compared to 2018 in part because of the longer opportunity to distribute flags and in part, because the Pacific Whale Watch Association made flag use a requirement of their members. This increase in use was reflected in both Soundwatch's data and that of the land-based theodolite team who recorded a 6-fold increase in flag presence in their scan data in 2019. The data Soundwatch vessel count data also suggested that there may be some correlation between the presence of enforcement and the number of flags recorded in a boat count. While these data cannot be considered conclusive at this time the 2019 vessel data suggests that when enforcement is present the mean number of flags recorded increases.

Limited data were available to assess the impact of the flag on vessel compliance with the Be Whale Wise guidelines and regulations. During the pilot study all incidents were recorded when at least one whale warning flag was present because Soundwatch flew its flag at all times that whales were present. In 2019, There were 503 (67%) incidents recorded when there was at least one other flag besides the Soundwatch flag flown. Despite this effort, the vessel incident data in relation to the presence of the whale warning flags is still very limited and further years of effort will be required to perform a more comprehensive analysis of how the presence of the flag influences vessel incident rates. The preliminary data presented in this report suggests that fewer vessel incidents were recorded as the number of flags on scene increased. However, our data are not sufficient to determine if this is a true effect of the whale flag or if it was simply a function of there being fewer boat counts with higher numbers of flags.

The social survey data suggested that the majority of both residents and visitors understood the meaning of the flag and that it would influence their boating behavior to be mindful of the Be Whale Wise guidelines and regulations. The survey data also highlighted important knowledge gaps regarding best boating practices around whales, providing further support for addressing current outreach and education messages to the boating public. While this pilot study provided only preliminary data on the effectiveness of the whale warning flag as a social prompt the survey data and outreach efforts suggested that the boating public found this an engaging and potentially effective tool. Further data collection will allow us to better understand vessel incidents and whether or not the flag is effective at improving compliance. However, this pilot study has highlighted the fact that methods that create new social norms to address human behaviors must be added to our conservation toolboxes if we are to see success in our bid to recover at risk species.

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Introduction

The summer core critical habitat of the endangered Southern Resident killer whale (SRKW) is located in the heart of the Salish Sea encompassing the San Juan Islands, Washington State (NMFS, 2006). The population sits at a 40-year low and continues to decline (Center for Whale Research, 2019; Tennessen, et al., 2019) and concern has grown for the whales' health and well-being and the role humans play in ensuring their survival. Lack of prey, persistent toxic chemicals, and disturbance from anthropogenic noise and vessel presence have been identified as the key threats to this population (Krahn, et al., 2004). While lack of prey and contaminants both entail complex webs of international, Tribal, Federal and State management challenges reaching back more than a century, the human impacts related to small vessel traffic and noise can be more readily addressed at a local level. During the spring, summer and fall there are vessels within acoustic range of the SRKW virtually all the time (Shedd, et al., 2019). Vessel presence has been found to inhibit important behaviors necessary for survival such as foraging (Noren, et al. 2009; Lusseau, et al. 2009; Williams, Lusseau and Hammond 2006), and navigation, detecting increasingly scarce prey, and communication (Ferrera, et al., 2017; Holt, et al., 2009).

NOAA has identified the need to do more to provide greater protection for SRKWs from impacts related to vessels, including acoustical and physical impacts (Ferrera, et al., 2017). Southern Resident killer whales must navigate both physical and acoustic barriers resulting from the diverse and expansive vessel activity in their core habitat while in search of increasingly scarce Chinook salmon (listed as threatened under the Endangered Species Act) around the San Juan Islands (Lusseau, et al., 2009; Viers, et al., 2016; Joy, et al., 2019). Ocean going commercial and passenger vessel traffic in Canadian and Washington waters averaged 6,214 transits per year in 2018 (Ecology, 2019) and is expected to further increase with the recently approved Canadian Trans Mountain Pipeline project and the expanded Roberts Bank Terminal by the Fraser Port Authority (Gaydos, et al., 2015). In addition to commercial shipping traffic and regular ferry traffic, the San Juan Islands attract recreational boaters from all over the transboundary region (Figure 1.) Additionally, the diverse marine life (including six commonly encountered cetacean species —Southern Resident and Transient killer whales, humpback, minke, and gray whales, and harbor porpoise) has resulted in the region becoming known as a premier destination for whale watching with an estimated 500,000 people going whale watching with eco-tours and/or private recreational vessels in the transboundary waters annually (Seely, et al., 2017).

In 2018 there were 106 active eco-tour vessels operating in the US and Canadian Haro Strait region (Shedd, et al., 2019). This was the second highest number of active eco-tour vessels since a peak in 2016 (Shedd, et al., 2019). In addition to eco-tourism operators, many recreational boaters engage in whale watching. Of the recreational vessels contacted by the on-the-water boater education program, Soundwatch, in 2018, 41% reported their primary activity to be whale watching (Shedd, et al., 2019), and almost half of the vessels contacted by Soundwatch were unaware of the Be Whale Wise guidelines. According to Washington Department of Fish and Wildlife Enforcement Division, while local boaters are generally aware of SRKWs, visiting boaters often are not, and thus are more likely to violate the rules (R. Mullins, *Pers. Comm.*), though it is important to note that local boaters also violate the regulations but often for other reasons. The most effective prompt for boaters to comply with the vessel regulations has been the physical presence of enforcement vessels (Seely, et al., 2017; Ferrera, et al., 2017). However, because enforcements' ability to be with the whales is limited in time and space, it is up to the community to find additional measures to change boater behavior around SRKWs.

In this study, we employed community-based social marketing methods to explore how additional social cues or prompts (McKenzie-Mohr & Smith, 1999), peer pressure to conform, and/or knowledge of potential surveillance might alter boater behavior while in the presence of whales around the San Juan Islands. With recreational boaters, eco-tours, and fishers visiting the area from throughout Puget Sound and Canada from early spring to late fall, San Juan County is in a unique position to lead the way in encouraging behavior

modification to help reduce the impact of vessel presence on the whales. This study set out to use innovative social based marketing approaches as a means to influence boater behavior (McKenzie-Mohr & Smith, 1999). We introduced a social prompt in the form of a whale warning flag to alert boaters to the presence of whales in San Juan County and neighboring waters. The flag was introduced specifically to raise awareness of the endangered Southern Resident killer whales, however flag holders were requested to use the flag for all whale species they encountered (e.g. killer whales, humpback, gray or minke whales). The flag, as a social prompt was introduced to encourage a general shift in boater awareness concerning the presence of whales and the risks associated with encountering them for both boaters and animals. The flag concept was first introduced in British Columbia, Canada around northeast Vancouver Island in 2011 (NIMMSA, 2019), however, the effectiveness of this type of social prompt has yet to be assessed. Visual prompts have long been identified as an effective tool with which to remind people to engage in a more sustainable behavior as they remind us to carry out an activity that we might otherwise forget (McKenzie-Mohr & Smith, 1999), in this case reminding boaters to slow down and be on the lookout for whales.

The large-scale, ecocultural goals associated with this study included determining whether the use of a social prompt in the form of a flag improved boater awareness, compliance, and safety in waters frequented by the endangered SRKWs, thus increasing whale safety and well-being. The study also set out to begin to determine if the social prompt could shift public perceptions and attitudes towards whales, thus encouraging the formation of long-lasting, new social norms for vessel operators who frequent SRKW core critical habitat areas in the San Juan Islands and beyond.

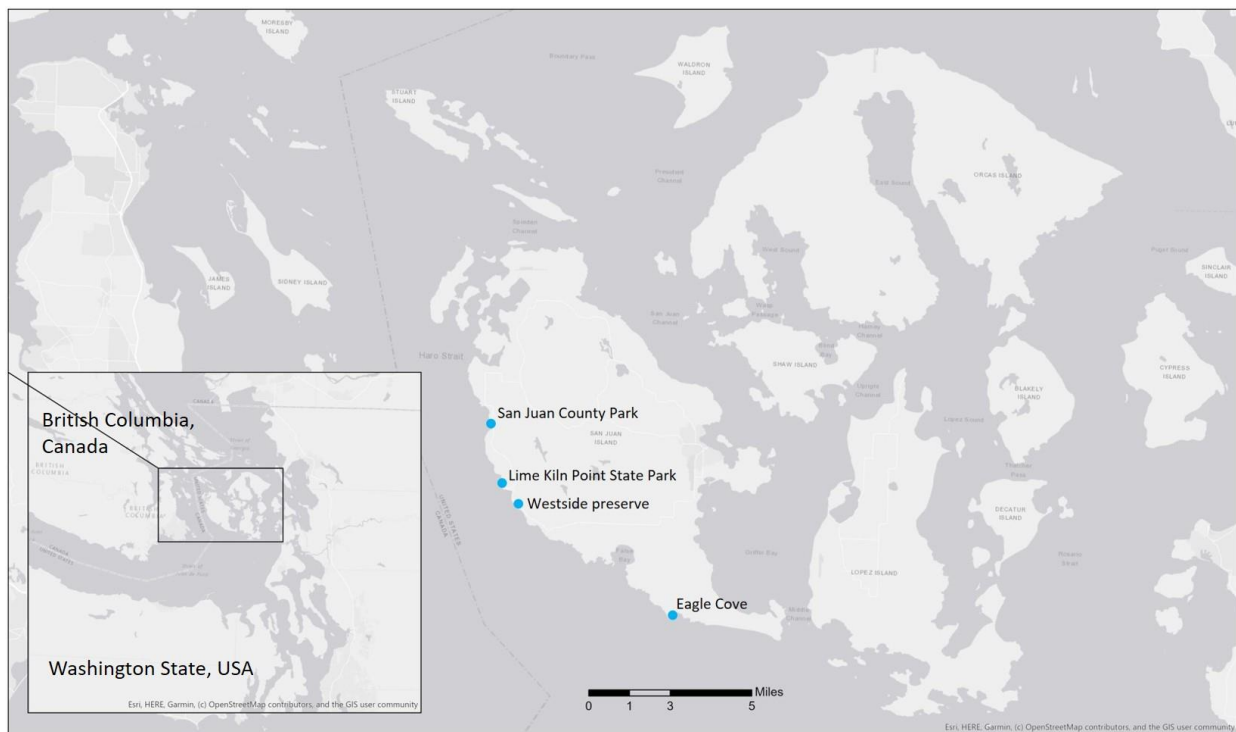


Figure 1. Location of the San Juan Islands within the Salish Sea region encompassing the inland waters of British Columbia, Canada and Northern Washington State, USA. The land-based locations where large flags were flown on the west side of San Juan Island are also shown.

Methods

The whale warning flag study was conducted during 2018-2019, encompassing two summer boating seasons. The study was implemented following three steps: 1) introduction and distribution of the whale warning flag, 2) introduction of an associated education and outreach campaign, and 3) assessing the effectiveness of the flag to raise compliance and increase awareness of the Be Whale Wise (Be Whale Wise, 2019) vessel regulations and guidelines for best boating practices around whales.

Introducing the social prompt:

Whale warning flags were introduced to boaters starting in June 2018. They were distributed to eco-tourism, enforcement, and research vessels, and to recreational boaters who frequented the transboundary waters in and around the San Juan Islands (Figure 1). The first 500 flags were distributed free of charge and subsequent flags were made available in 2019 for a nominal fee (to cover the costs of production). Those that accepted flags agreed to become a whale steward, or social leader. Flags were 24”x 16” in size with a distinctive design incorporating the warning colors red and yellow, and a black generic whale fluke (Figure 2). In 2019, a larger flag (2’ x 3’) was also made available with the first roll out at the Seattle Boat Show (January 25 – February 2, 2019). In addition to vessel-based flags, several land-based locations along the west side of San Juan Island were identified to display a large flag (3’ x 5’) to alert boaters from shore. These sites included San Juan County Park, Lime Kiln Point State Park, the Westside preserve and Eagle Cove (Figure 1).

The whale warning flag (Figure 2) was designed to function like the standardized diver down flag. Users were asked to fly the flag whenever they encountered or detected whales (killer whales or baleen whales) within approximately 1 km (or a 1/2 mile¹) of their boat or land station, and then take the flag down once the whales (or the boat) left the 1km / ½ mile area. As flag bearers, the boat operators were also asked to ensure that they slowed to 7 knots or less (this guideline subsequently became law for killer whales in Washington State in June 2019), ensure that they followed the Be Whale Wise guidelines (which include the federal and state regulations on minimum approach distances) and turned off their echosounders (if it was safe to do so). These instructions applied to encounters with all killer whale and baleen whale species boaters encountered. These actions describe the individual protections and social prompts designed to promote hazard awareness and compliance with speed reduction by boaters who may not have realized the whales where in the area.



Figure 2. The Whale Warning flag design adopted from British Columbia. Photo by the Marine Education and Research Society.

¹ 1km and one-half mile are used interchangeably within the transboundary region of the Salish Sea because Canada uses the metric system while the US still uses the imperial system. These general distances, while not exact translations are the most straightforward means of communicating the distances to boaters.

Education and outreach campaign

For the flag to be successful, it was necessary to ensure that others knew what the flags meant. Thus, to help raise awareness of the flag and how to use the flag we created a communication and outreach campaign. An instructional flyer was created and distributed with every flag. The flyer was also handed out with the standard Be Whale Wise material (Figure 3). The outreach materials were distributed via local enforcement and boater education programs (Soundwatch), as well as through local US Customs and Border agents at port entries on San Juan Island, made available at local ports and marinas and via eco-tourism companies. A full list of where the leaflets were placed or handed out is provided in Appendix 1.

In addition to the instructional flyer, posters and dockside signage (sandwich boards) were produced. The dockside signage were displayed at the main ports and marinas around San Juan County, including the Port of Friday Harbor, and San Juan County Park (San Juan Island), Fisherman's Bay Marina (Lopez Island), and Deer Harbor Marina (Orcas Island). These signs were displayed from late July through to September 30, 2018 and from June through October 15, 2019.

Dockside outreach efforts, public presentations, presence at regional boat shows, and local media publications comprised an additional aspect of the outreach and education campaign. Information on the program was also shared with wider audiences throughout the region, for example with the Washington State Governor's Orca Task Force and its Vessels Working Group, Communications Group, and with representatives of local Coast Salish Tribes. Finally, the whale flag material was added to the Be Whale Wise website and to the Kayak Education and Leadership Program (KELP) training course that all kayak guides and private kayakers and boaters launching from the San Juan County Park on San Juan Island must take.

This flag indicates whales are within 0.65 mile (1km) of the boat flying the flag, proceed with caution.

IF YOU SEE THIS FLAG

1. Slow down to 7 knots or less.
2. Be prepared to adjust course.
3. Follow the Be Whale Wise Guidelines to ensure you comply with the law and turn off depth sounders and fish finders.

IF YOU HAVE THIS FLAG

1. When you are within 0.65 miles (1 km) of whales, slow to stop, raise flag.
2. Follow the Be Whale Wise Regulations to ensure you comply with the law & turn off depth sounders and fish finders.
3. Lower flag once you or the whales have left the area.

Scan this code with your smartphone camera or go to bewhalewise.org for more information.

WHALE WARNING FLAG

San Juan County Marine Stewardship Area

This map is derived from San Juan County's Geographic Information System (GIS). It is intended for reference only and is not guaranteed to survey accuracy. The information represented on this map is subject to change without notice.

Whale and salmon sanctuary (voluntary no-go zone)
– Mitchell Point to Cattle Point, San Juan Island

- Offers a sanctuary from underwater noise and watercraft presence for sensitive marine species utilizing the area, including Southern Resident killer whales.
- Extends 1/4 mile offshore and 1/2 mile offshore around Lime Kiln Lighthouse.
- Encouraged for all watercraft, all year, at all times.
- Kayakers launching from San Juan County Parks follow the conditions of a special use permit program called K.E.L.P. (see bewhalewise.org)
- For more information about the San Juan County Marine Stewardship Area, go to sjcmrc.org.

KNOW THE ZONE

Figure 3. Examples of the outreach material produced for the Whale Warning flag campaign.

Quantifying the effectiveness of the social prompt

We assessed the effectiveness of the whale warning flag and boater behavior through a combination of vessel-based data collection, and social surveys aimed at measuring public perception of the whales, regulations and boaters' propensity to take an active part in the flag program.

Vessel data

The Soundwatch boater education program has collected information on boater behavior and compliance of whale related vessel regulations and guidelines for 20 years (Shedd, et al., 2019, Seely, et al., 2017). Despite their data pre-dating the implementation of the Be Whale Wise guidelines, they have established a standardized data collection format that provides a valuable longitudinal dataset of boater behavior, tracks the effects of changes in vessel regulations, and the introduction of new initiatives such as the Whale Warning flag.

Soundwatch operates vessel patrols to educate and monitor boaters approximately 6 days a week from May to September (Shedd et al., 2019, Seely et al., 2017). Their primary focus is on killer whales within the Salish Sea though they will also observe other species, e.g. humpback whales when killer whales are not present. When on scene with whales they conduct surveys of whale numbers and behavior, and record the numbers of vessels within 1 km (or a half-mile) of whales every 30 minutes. These data are recorded for all species of whales that Soundwatch are with using a set of standardized vessel activity definitions as well as whale attributes agreed upon by U.S. and Canadian researchers (for references please see Seely et al., 2017). To determine the numbers of vessels within 1 km of whales Soundwatch personnel use a suite of range finding tools such as laser range finders, electronic radar and chart plotters, and high-powered binoculars to determine the distance of the vessels (Seely et al., 2017). Vessels are categorized by type and activity, e.g. transiting, whale orientated, fishing, research, enforcement. In addition to the vessel count data, Soundwatch also records vessel incidents. An incident is when a vessel is out of compliance with the local, state, or federal guidelines, state regulations, and U.S. federal or Canadian regulations. This incident reporting is essentially a behavioral audit of boater behavior with respect to the whales. For this pilot study, Soundwatch amended its data collection protocol to capture data on flag use; this included recording how many vessels were flying the flag within 1 km of the whales and what type of vessel was flying the flag. For instances where Soundwatch recorded a vessel incident they also recorded how many flags were present in the vicinity and whether or not the vessel in question was flying a flag.

For the purposes of this study Soundwatch provided data on vessel counts, including the mean and maximum number of vessels recorded per vessel count. The data collected during 2018 and 2019 were compared to vessel count data collected from 2015 – 2017, defined as pre-flag years to determine whether the flag was an attractant and resulted in more boats near whales. Summary statistics were used to provide a preliminary review of the annual vessel incident data recorded by Soundwatch in 2019.

To supplement the Soundwatch vessel data we obtained vessel count data from a land based survey team operating during July through September in 2018 and 2019 on the west side of San Juan Island (Figure 1.). This unrelated project conducted a scan sampling protocol in addition to capturing tracks of individual whales using a theodolite. The team recorded vessels flying the whale warning flag in each of their scan samples. In 2018, this survey team was collecting data for the Port of Vancouver's shipping slow down trial (Williams, et al., 2019), and in 2019 for Washington Department of Fish and Wildlife to monitor vessel and whale behavior with respect to the revised Washington State vessel regulations –introduced in 2019 (Williams, unpublished data, 2019) .

Survey data

We used a series of social surveys to collect data on general boater knowledge related to whales and the regulations, and related to their behavior relative to whales. Surveys are a useful means of uncovering information surrounding the barriers and benefits for the behavior one wishes to promote (McKenzie-Mohr

& Smith, 1999). We conducted four surveys over the course of the study, two prior to the busy boating months (pre-season surveys) and two at the end of the boating season (post-season surveys). Participants were recruited using a database of flag recipients (i.e., those that received a flag in 2018 or 2019 agreed to take part in the surveys), and through online social media platforms. During the pre-season sampling period, we also collected survey data during dockside outreach efforts in San Juan County.

Summary statistics were used to analyze the survey data. Only the responses of participants who responded to one of the four surveys were retained for analysis ensuring a database of unique survey responses, i.e. if respondents indicated in their answers to the post-2018, pre-2019, or post-2019 surveys that they had completed a previous survey those samples were not retained for analysis. The majority of the survey data were pooled across the survey periods to allow for comparisons between participants that identified as resident to San Juan County, or as visitors. For survey questions related to the Be Whale Wise guidelines data were pooled from the pre- and post-2018 surveys and for the pre-2019 survey. However due to the revision of the State vessel regulations in June 2019 additional questions were composed to capture data on awareness of the new regulations, thus Be Whale Wise related survey questions were analyzed separately for the post-2019 survey.

Results

Introducing the social prompt:

The distribution of whale warning flags began in late June 2018. Flags were made available for free to anyone with a boat who was willing to participate in the pilot study as a whale steward. Flags were distributed to eco-tour operators in both Washington and British Columbia, made available at the San Juan County Public Works office and advertised through the Marine Resources Committee website and social media platforms. Over the course of 2018, approximately 237 flags were distributed. In 2019, a further 788 flags were distributed, including the new larger sized 2'x3' flag, resulting in 1,025 flags being provided to boaters. Land-based flags were flown opportunistically when whales (and flag operators) were present at Lime Kiln Point State Park lighthouse, San Juan County Land Bank's Westside Preserve, Eagle Point and San Juan County park on the west side of San Juan Island (Figure 1). The San Juan Island Naturalists program flew the flag at their summer outreach station in the Westside preserve during 2018 and 2019, and they expect to expand in 2020 increasing the locations from which they fly the flag and engage with island visitors about the whales and flag initiative.

The land-based site at which the flag was most consistently flown was Lime Kiln lighthouse where researchers and naturalists are present 9am-5pm each day throughout the summer and early autumn. When whales (either SRKW, Transient killer whales, humpbacks or even on occasion that a minke whale) were present within 1km of the lighthouse shore station the flag was displayed. The flag was flown on 26 days from July 12 to October 3, 2018 and during 34 days from June to November in 2019; Southern Resident killer whales were present on 19 days during 2019, other cetacean species (Transient killer whales, humpbacks or minke whales) were present on the remaining 15 days.

Education and outreach campaign

Dockside outreach efforts were conducted during June, July, and August during 2018 and 2019. These efforts were conducted in partnership with Soundwatch and San Juan County Stranding Network, the San Juan County Marine Resources Committee, and the Youth Conservation Corps, allowing outreach to be conducted on three of the four ferry served islands: San Juan, Orcas, and Lopez Islands. These efforts resulted in outreach to over 3000 individuals over the two summer seasons. In addition to dockside outreach during the summer months, we were also given the opportunity to participate in the two regional boat shows in 2019 –The Seattle Boat Show (January 25 – February 2) and the Anacortes Boat Show (May 16-19). In 2019, the Seattle Boat Show attracted ~45,000 attendees and the Anacortes Boat Show >5,000 attendees.

In addition the Northwest Marine Trade Association invests in substantial media advertising –all of which included the Be Whale Wise logos. This collaboration with the Boat Show organizers greatly extended the reach of our boater education efforts.

Outreach and education materials were distributed throughout 2018 and 2019. During the 2018 season, ~8,000 flag leaflets and Be Whale Wise leaflets were distributed in San Juan County and to neighboring counties with the help of the Northwest Straits Commission and other Marine Resources Committees (Appendix 1). Due to changes in vessel regulations in both Canada and Washington State, new Be Whale Wise material was produced in 2019, but this only became available for distribution mid-way through the summer season. As a result, numbers of leaflets were not tracked as closely, but we estimate that a further 2,000 were distributed through the boat shows, dock-talks, at other public events such as the San Juan County Fair, and by other whale related outreach and education organizations such as the San Juan Islands Naturalist program.

In addition to direct outreach to boaters at ports, marinas and boat shows, we gave a series of public presentations highlighting the flag program. These included the San Juan Island Naturalist training program in both 2018 and 2019, the Whale Museum’s summer lecture series, at the Northwest Strait’s Initiative 20th Annual Marine Resources Committee Conference in 2018, community workshops, local sailing and yacht clubs, and at the 27th BC Marine Mammal Symposium in 2019.

Quantifying the effectiveness of the social prompt

Vessel data

The introduction of the whale warning flag in 2018 did not lead to an increase in the numbers of boats observed in near whales (killer whales and baleen whales); Soundwatch data continues to show a downward trend in the average number of boats recorded per boat count (Figure 5.). In 2018, Soundwatch spent an average of 6 days per week on the water from May through September, totaling 87 days (547.2 hrs) on the water with marine wildlife between May 24, and September 26. Killer whales were present on 65 days of which 34 days were with SRKW and 31 with Transients, and Soundwatch spent an average of 7.1 hours per day with them (Shedd et al. 2019). In 2019, Soundwatch spent 74 days (771 hrs) on the water with marine wildlife between May 12, and September 25. Killer whales were present on 66 days, of which SRKW were only present on 15 days while Transients were present on 51 days, and Soundwatch spent an average of 6.6 hours per day with them. The locations of the Soundwatch vessel count surveys in 2018 and 2019 are shown in Figure 4.

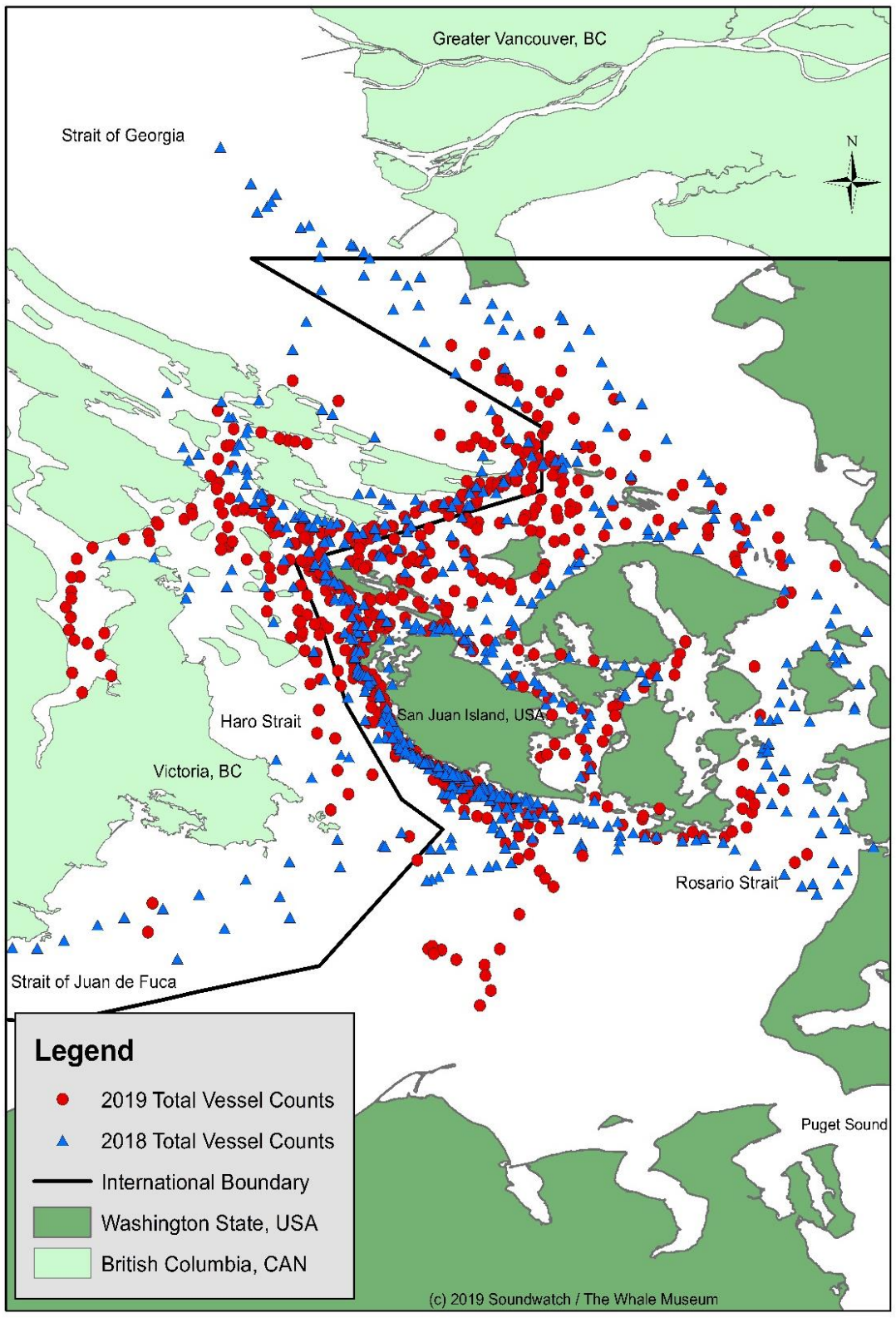


Figure 4. Total vessel count locations from 2018 and 2019, displaying differences in survey locations and distributions, Shedd 2020)

Vessel Count Data

Soundwatch conducted 570 vessel counts in 2018 and recorded an average of 10 (SD = 6.08) vessels per count, this dropped to an average of 9 (SD = 4.42) vessels per count in 2019 (Figure 5, Appendix 2). In 2019, Soundwatch conducted 648 vessel counts. Soundwatch have recorded a decreasing trend in the average number of vessels recorded in a vessel count since 2014 (Shedd, et al., 2019). The maximum number of vessels recorded in a count in 2019 occurred in July and was 29. The highest vessel count for private vessels was 26, however on average there were only 2.4 private recreational vessels per count in 2019. Eco-tour boats averaged 4.7 (maximum = 18) per vessel count, with the highest numbers recorded in June and July (Appendix 2). Enforcement vessels were only present in 13% of the 2019 vessel counts due to reduced presence of the Southern Residents, increased presence of multiple groups of Transient killer whales within the Salish Sea, and coordinated effects to spread out education and enforcement operations.

In 2018, Soundwatch only recorded nine vessels displaying the whale warning flag, just 3.8% of the flags distributed during the first year of the pilot study. This led to an immeasurable presence of the whale warning flags and an inability to analyze their effectiveness through the vessel count or vessel incident data. By 2019, the use of the flag had increased. Soundwatch recorded an average of 2.45 (SD = 1.45, max = 10) flags per vessel count during 2019; eco-tour boats were the most commonly recorded users with an average of 1.92 (SD = 1.1, max = 7) eco-tour boats flying a flag per vessel count. Similar to 2018, very few private boats were recorded with a whale warning flag (average = 0.73, SD = 0.57, max = 2 per vessel count). The whale warning flag was also regularly flown by other vessels, these included other monitoring and research vessels; Soundwatch, always flew a whale warning flag when on scene with whales, as a result there is a negative relationship between number of whale warning flags present and the frequency at which they were seen. Meaning that in 30% of boat counts Soundwatch was the only vessel flying a whale warning flag (Figure 6).

The vessel count data collected by Soundwatch during 2018 and 2019 continue to show a declining trend in the numbers of vessels within 1 km of whales (Table 1, Figure 5). While these data should be considered preliminary the counts, along with the observations of the Soundwatch crew reporting that transiting vessels tended to move away or slow down as they proceeded through an area where there were whales and whale warning flags in use suggests that the presence of the flag did not attract vessels to the whales.

Table 1. Summary of Soundwatch effort, vessel count data and vessel incident data for all whales and, where available, just Southern Resident killer whales. Vessel incidents are provided as a total number of incidents recorded and the mean incident rates (number of incidents per hour) for all whales. For the pre-flag (2015-2017) and flag (2018-2019) years the mean boat counts per year, mean number of boats per count, and the mean number of recorded incidents, and mean incident rates are also provided.

Year	Total hours on water/year	Days with killer whales (SKRW)	Total boat counts	Boat counts with killer whales (SRKW)	Mean boats/count All whales (SD)	Mean boats/count killer whales (SD)	Total Number of vessel incidents	Mean incident rate (all whales)
2015	393	83 (27)	804	758 (701)	15 (11.07)	18 (11.46)	1,635	1.17
2016	451	75*	695		13 (10.9)		1,847	1.33
2017	689	84 (21)	709	674 (202)	12 (7.13)	12 (7.16)	2,257	6.67
Average pre-flag		81 (24)	736	-	13	-	1,913	1.39
2018	547.2	65 (34)	570	548 (341)	10 (6.08)	9 (5.95)	1,117	1.15
2019	771	65 (14)	648	562 (155)	9 (4.42)	8 (4.23)	748	2.63 [^]
Average with flag		65 (24)	609	555 (248)	9.5 (0.5)	8.5 (0.5)	933	1.89

*There are some data gaps for the 2016 Soundwatch data: killer whale ecotypes were not distinguished, and boat count data specific to SRKW are not available for 2016.

[^] increased incident rates in 2019 are likely due to the reduced presence of Southern Resident killer whales in the Salish Sea and the updated Washington State vessel regulations which increased approach distances to 300 yards and instilled a slow zone under 7 knots within a half mile of SRKWs.

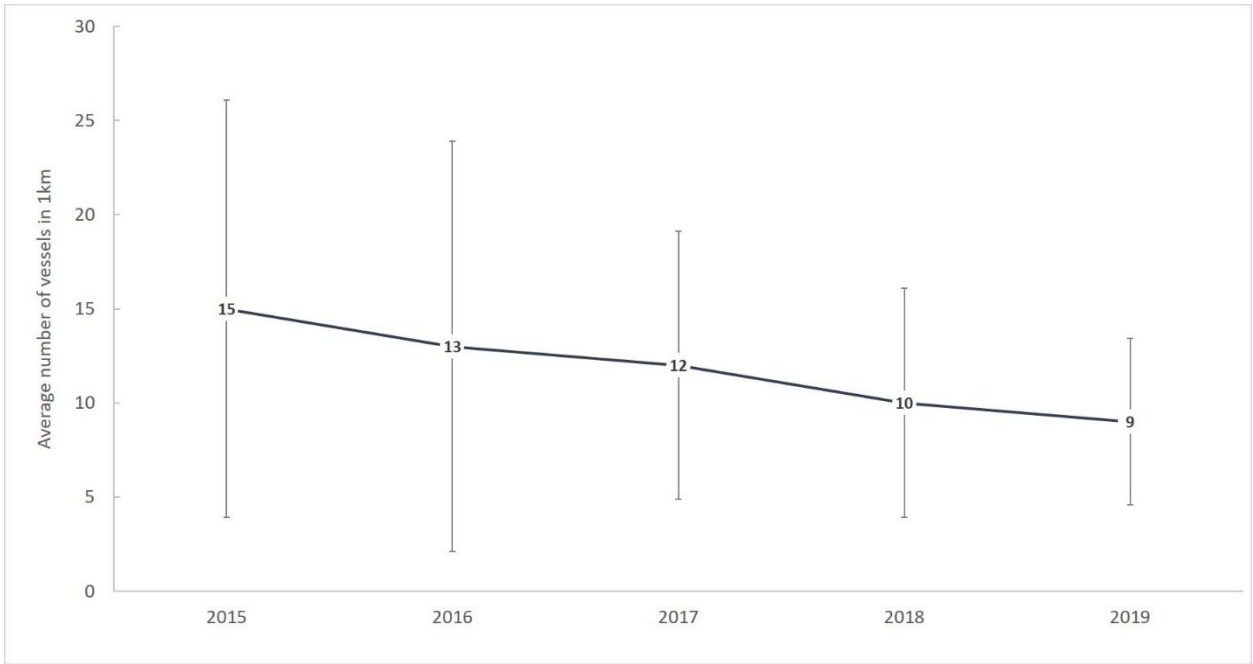


Figure 5. Mean number, and associated standard deviation, of vessels within 1 km of all whales per vessel count conducted by Soundwatch from 2015 – 2019. The whale warning flag was introduced in June 2018.

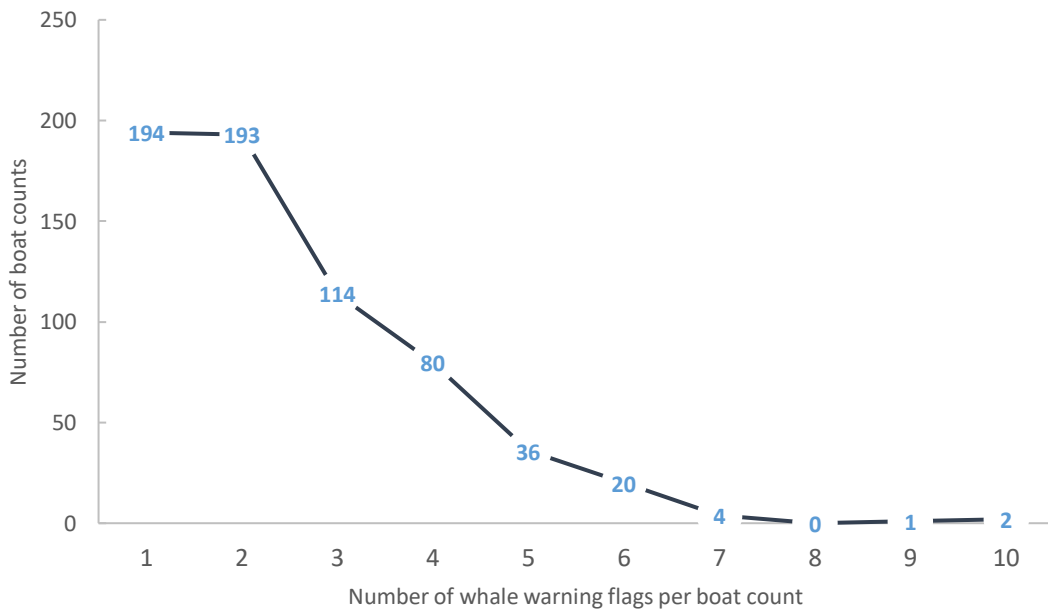


Figure 6. Number of vessel counts with number of whale warning flags present in 2019, based on Soundwatch data. The total number of counts are included for each flag number category.

The 2019 vessel count data also allowed us the opportunity to take a cursory look at the presence of enforcement with respect to flag use. During 2019, Soundwatch recorded 542 vessel counts for all whales when no enforcement was present and only 106 where at least one enforcement boat was present. The Soundwatch data suggests that there may be some correlation between the presence of enforcement and the number of whale flags recorded in a boat count. While these data cannot be considered conclusive at this time the 2019 vessel data suggests that when enforcement is present the mean number of flags recorded increases (Figure 7).

In addition to the Soundwatch vessel-count data, a land-based survey team tracking vessel and whale behavior operated from July 12 to September 24, 2018, and from July 1 to September 30, 2019 (Williams, et al., 2019). In 2018, this team recorded the vessels flying the flag in 88 of 2,970 scans (3%) recording observed vessel traffic within 1km of Southern Residents (Williams, et al., 2019). In 2019, this team recorded vessels with flags in 258 of 1,266 scans (20%), a 6-fold increase in observed use over the pilot period (Williams, unpublished data, 2019). While vessels with a flag could have been included in multiple scans due the regularity at which scans were conducted (every 5 minutes), the researchers conducting this study stated that there was no reason to think that the samples were biased with respect to whether boats were flying a flag.

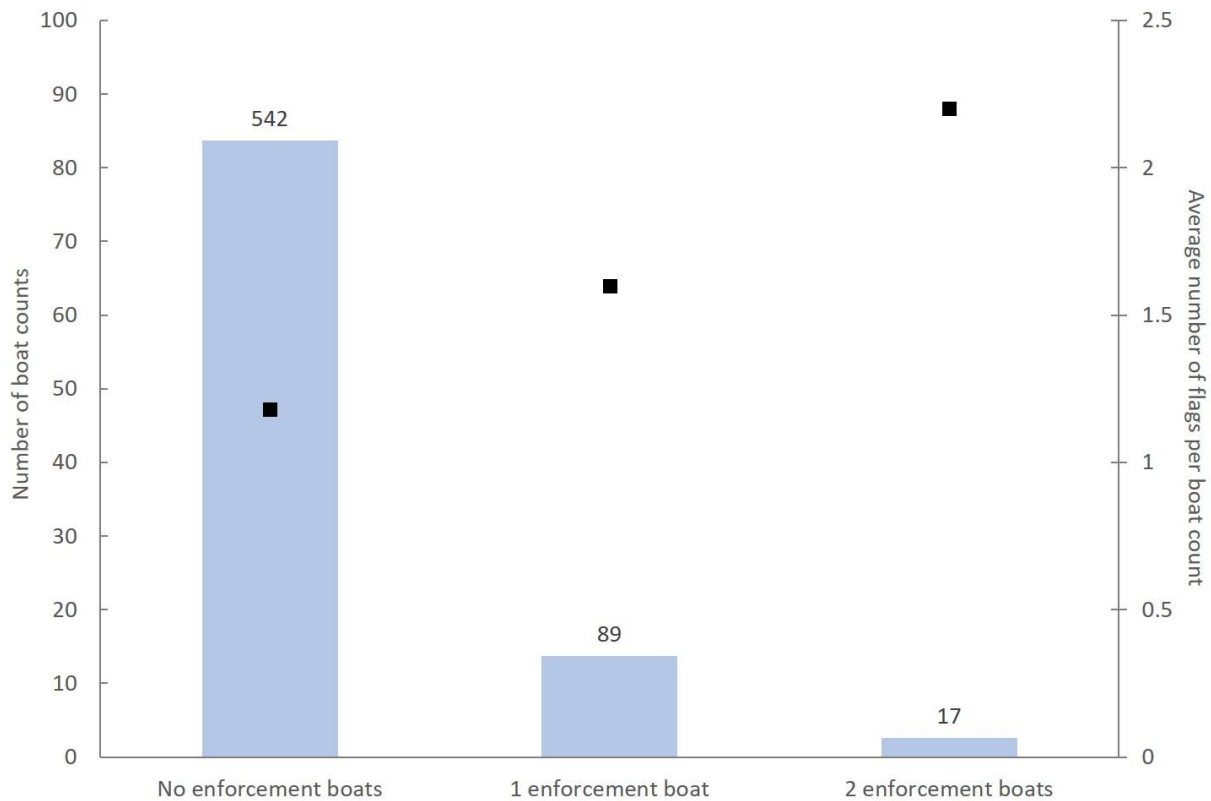


Figure 7. A summary of the percentage of boat counts (where the total number is shown above each bar) without enforcement vessel present, with one enforcement vessel present and with two enforcement vessels present, and the average number of whale warning flags recorded per count for each category.

Vessel Incident Data

Limited data were available to assess the impact of the flag on vessel compliance with the Be Whale Wise guidelines and regulations. Recorded vessel incidents have averaged 1,521 per year since 2015; in 2018, Soundwatch recorded 1,117 incidents with a mean incident rate of 1.15 incidents/hour, while in 2019 the total number of vessel incidents was 749, with a mean vessel incident rate of 2.63 incidents/hour (Table 1). Of the vessel incidents recorded by Soundwatch in 2019, 72% of all incidents were committed by private/recreational motor vessels, 6% private sailing vessels, 7% commercial kayaks, 5% Canadian commercial vessels, 5% U.S. commercial vessels and 2% by commercial fishing vessels (Appendix 2). The increased incident rates in 2019 were likely due to the reduced presence of Southern Resident killer whales in the Salish Sea and the updated Washington State vessel regulations which increased approach distances to 300 yards and instilled a slow zone under 7 knots within a half mile of SRKWs.

During the pilot study all incidents were recorded when at least one whale warning flag was present because Soundwatch flew its flag at all times that whales were present. In 2019, There were 503 (67%) incidents recorded when there was at least one other flag besides the Soundwatch flag flown. Despite this effort, the vessel incident data in relation to the presence of the whale warning flags is still very limited and further years of effort will be required to perform a more comprehensive analysis of how the presence of the flag influences vessel incident rates. The preliminary data presented in this report suggests that fewer vessel incidents were recorded as the number of flags on scene increased. However, our data are not sufficient to determine if this is a true effect of the whale flag or if it was simply a function of there being fewer boat counts with higher numbers of flags.

When plotted, the negative relationship of number of vessel counts and vessel incidents is comparable with similar negative slopes ($number\ of\ incidents = -29.48x + 236.93$ and $boat\ counts = -23.55x + 193.9$) and strong trends ($R_{number\ of\ incidents} = 0.77$ and $R_{boat\ counts} = 0.84$, Figure 8). This further suggests that the reduction in vessel incidents as number of whale warning flags increase is due to the smaller sample size of boat counts with >6 whale warning flags present.

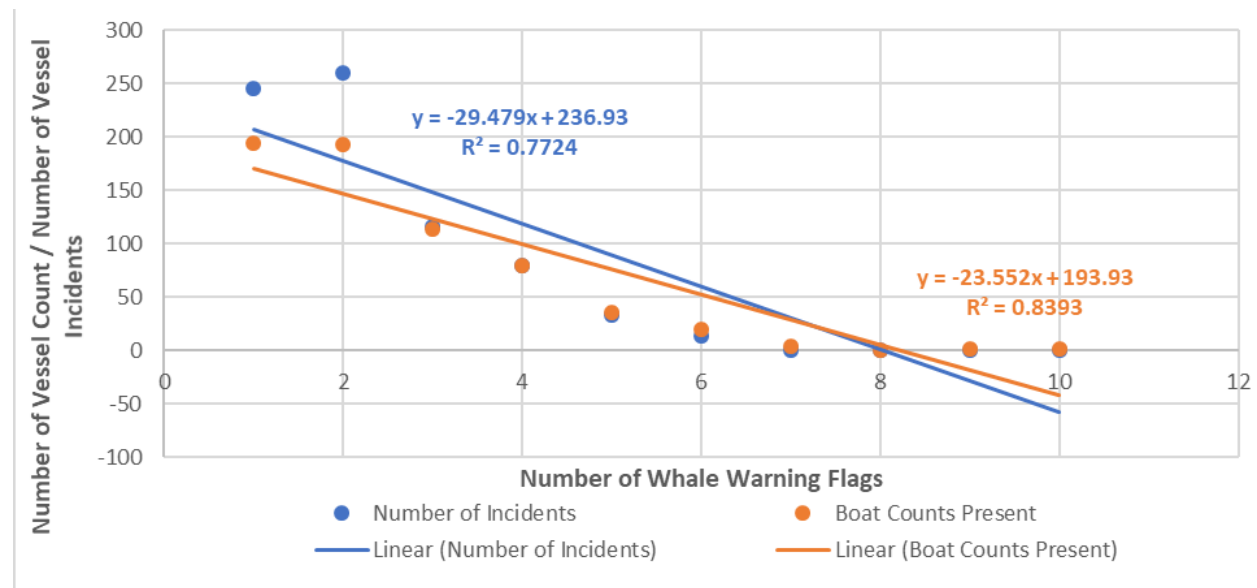


Figure 8. Trends of vessel incidents and vessel counts in relation to the number of whale warning flags recorded per boat count, (Soundwatch 2019, Appendix 2).

Commercial whale watch vessels were generally less likely to violate regulations and were more likely to fly whale warning flags (Appendix 2). Therefore, commercial whale watch vessels were only rarely observed violating regulations while flying whale warning flags. Out of the 749 incidents recorded by Soundwatch in 2019, 78 were committed by commercial eco-tour vessels, and of those 18 were flying whale warning flags (Figure 9). However, based on the incident shown in figure 9, it is clear that further outreach is required even for those most familiar with the regulations and guidelines. Soundwatch only recorded one case in which a private vessel flying a whale warning flag was observed in violation (Table 2), though this is likely an under-representation because Soundwatch observed few recreational boats flying the flags during the 2019 season.

Table 2. 2019 Vessel incidents recorded in which the vessel in question was flying a whale warning flag.

Vessel Type	No. of Incidents	Type of Incident
Commercial - USA	5	Inshore of Whales
Commercial - USA	3	Over 7 knots within Half Mile
Commercial - USA	2	400 in the Path
Commercial - USA	1	100 Yards Under Power
Commercial - USA	4	200 Yards Under Power
Commercial - USA	1	SJI No-Go-Zone
Commercial - USA	2	300 Yards Under Power
Private motor	1	Over 7 knots within Half Mile



Figure 9. An example of a vessel incident in which commercial eco-tour operators flying the whale warning flag were all recorded within 300 yards of Southern Resident killer whales in 2019.

Survey data

Pre-season and post-season surveys were distributed during 2018 and 2019. Surveys were emailed to boaters that were participating in the flag program and had provided contact details, in addition surveys were emailed to yacht and sailing clubs throughout the Puget Sound region, conducted in person during dockside outreach efforts and made available via the San Juan County Marine Resources webpage and facebook page. Overall, 402 unique surveys were available for analysis, a summary of these data is provided in Table 3. Data were pooled across sampling periods and comparisons were made for boat owners that identified as resident to San Juan County or as visitors. Examples of these surveys are included in the appendices (Appendix 3).

During 2018, there were approximately equal responses from residents and visitors, while in 2019 >70% of unique respondents were visitors to San Juan County (Table 3). The majority of respondents reported owning or operating a boat. For those that reported their main boating activities the vast majority of unique respondents reported recreation (e.g. visiting other islands) as their main activity (Table 3, Figure 10), and this trend held true for both local (n=88, 63.3%) and visitor (n=198, 81.1%) boaters, however visitors more often reported recreation as their main boating activity than locals (Figure 10). The majority of non-resident respondents were from the Seattle/South Puget Sound area, followed by ‘a neighboring county’ (total unique surveys from Seattle/South Puget Sound, n = 117, from a neighboring county, n = 61, Table 3), and this trend occurred across all survey periods (Table 3).

Table 3. Summary of unique survey data sample sizes, including the percentage (in parentheses) of boaters that were local and visitors, a breakdown of where visitors reported being from, and a breakdown of the primary boating activities reported by boaters.

	Pre 2018	Post 2018	Pre 2019	Post 2019	Total
	Jun 8 – Jul 16	Oct 7 – Dec 10			
	(%)	(%)	(%)	(%)	(%)
Unique Samples	126	66	140	70	401
Boat owner/operator	116	64	134	69	383 (95.51)
<i>Local</i>	61 (53)	28 (44)	38 (28)	12 (17)	139 (36)
<i>Visitor</i>	55 (47)	36 (56)	96 (72)	57 (83)	244 (64)
Boat operator visitor origin:					
<i>Neighboring County</i>	16 (29.09)	10 (27.78)	17 (17.71)	18 (31.58)	61 (25)
<i>Seattle/South Puget Sound</i>	23 (41.82)	18 (50.00)	52 (54.17)	24 (42.11)	117 (47.95)
<i>Outside WA State</i>	5 (9.09)	0 (0)	8 (8.33)	4 (7.02)	17 (6.97)
<i>Canada</i>	9 (16.36)	3 (8.33)	16 (16.67)	10 (17.54)	38 (15.57)
<i>Another Country</i>	1 (1.82)	0 (0)	0 (0)	0 (0)	1 (0.41)
<i>Other</i>	1 (1.82)	5 (13.89)	3 (3.13)	1 (1.75)	10 (4.10)
Boat operator primary activities:					
<i>Recreation</i>	73 (62.9)	47 (73.4)	110 (82.1)	56 (81.2)	286 (74.7)
<i>Recreational fishing</i>	18 (15.5)	4 (6.3)	7 (5.2)	5 (7.2)	34 (8.9)
<i>Recreational whale watching</i>	7 (6.0)	1 (1.6)	1 (0.7)	1 (1.4)	10 (2.6)
<i>Commercial whale watching</i>	7 (6.0)	8 (12.5)	5 (3.7)	4 (5.8)	24 (6.3)
<i>Commercial fishing/diving</i>	4 (3.4)	0 (0)	0 (0)	0 (0)	4 (1.0)
<i>Research</i>	1 (0.9)	2 (3.1)	4 (3.0)	1 (1.4)	8 (2.1)
<i>Work</i>	2 (1.7)	1 (1.6)	4 (3.0)	1 (1.4)	8 (2.1)
<i>Other/left blank</i>	3 (2.6)	1 (1.6)	3 (2.2)	1 (1.4)	9 (2.3)

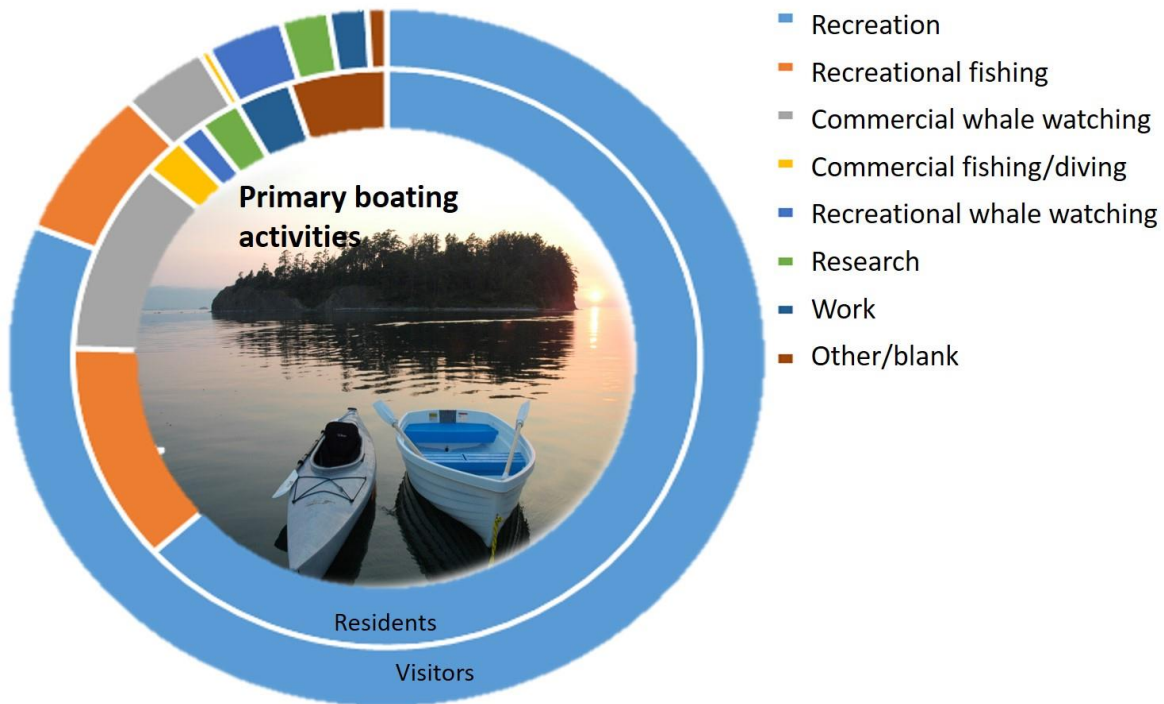


Figure 10. The breakdown of primary boating activities reported by survey respondents during 2018 and 2019 that identified as resident to San Juan County (inside pie) or visitors (outside pie). Recreational boating, e.g. visiting other islands was the primary activity report by all boating respondents.

Survey respondents' knowledge of whale and boating behavior

The majority of respondents recognized common signals of potential whale presence, safety risks of boat-whale collisions, and that they should adjust their boating behavior to protect themselves and the whales. Seventy-seven percent (n=295) of respondents that identified as owners or operators of boats agreed that groupings of boats on the water could signify that whales were present. Fewer recognized the importance of bird activity as a signal that whales might be present (59.3%, n = 227). Of those that recognized the significance of bird activity and/or groupings of boats 90% (n =274) of respondents answered that they would adjust their boating to follow the Be Whale Wise guidelines (Figure 11).

The majority of respondents also recognized that boat-whale collisions would be dangerous to whales (97%, n =370) and people (89%, n= 342), however only 50% (n = 191) were aware that there have been collisions in the Northwest Straits in recent times. Overall >90% of the respondents felt a sense of guardianship of whales regardless of whether they were local or visitors.

For those who identified as boat owners or operators we also assessed their overall attitude towards whales. Almost all (95%, n = 364) indicated that they do enjoy watching whales when out boating and 83% (n = 319) agreed that they should change their boating behavior when whales were nearby. This response held true for both residents of San Juan County (90%, n = 125) and visitors (80%, n = 194). However, the majority of boat owners and operators indicated that when they are out boating and they find out whales are nearby they continue rather than seek them out, this trend held for residents and visitors. However, respondents also indicated that if they were boating and whales were nearby then they do hope that the whales come closer and/or do something spectacular such as breach, tail slap or spyhop (mode = 1, where the scale ran from 1-Always to 5-Never, mean = 2.43). Visiting boaters identified that this is something they hope for marginally more than residents did.

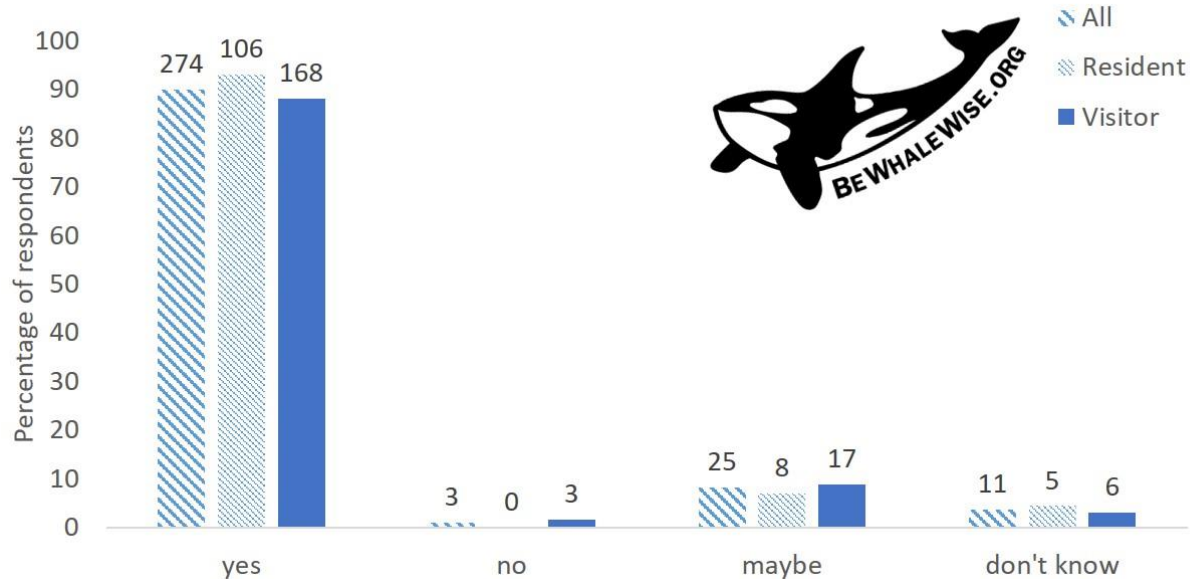


Figure 11. Percentage of survey respondents that recognized the significance of birds or groupings or boats as a means to alert them to the presence of whales that suggested they would adjust their boating behavior to ensure they were in compliance with whale related guidelines and regulations.

Survey respondents' awareness and knowledge of the Be Whale Wise guidelines

Survey respondents were asked a series of questions regarding the Be Whale Wise guidelines, including whether or not they were familiar with them, if they thought they could follow them and what distance they were required to keep from whales. Due to changes in the regulations introduced by Washington State in 2019, the post-2019 data were analyzed separately.

The vast majority of unique boating respondents from 2018 and pre-2019 sampling periods reported being familiar with the Be Whale Wise guidelines (85-94%) and thought that they would be able to follow them (88 – 93%, Figure 12). The same trend was evident regardless of whether the respondents were resident or visiting boaters (Figure 12).

While the majority of these boaters indicated that they were aware of the Be Whale Wise guidelines and that they could follow them if they encountered whales, only ~60% were able to provide the correct core Federal distance regulation of 200 yards (pre 2019 regulations, Figure 13), or 300-400 yards (new 2019 regulations, Figure 13). This general trend held regardless of whether the boaters were resident (2018: 61%, n = 52; 2019: 69%, n = 34) or visitors (2018: 48%, n = 40; 2019: 58%, n = 73).

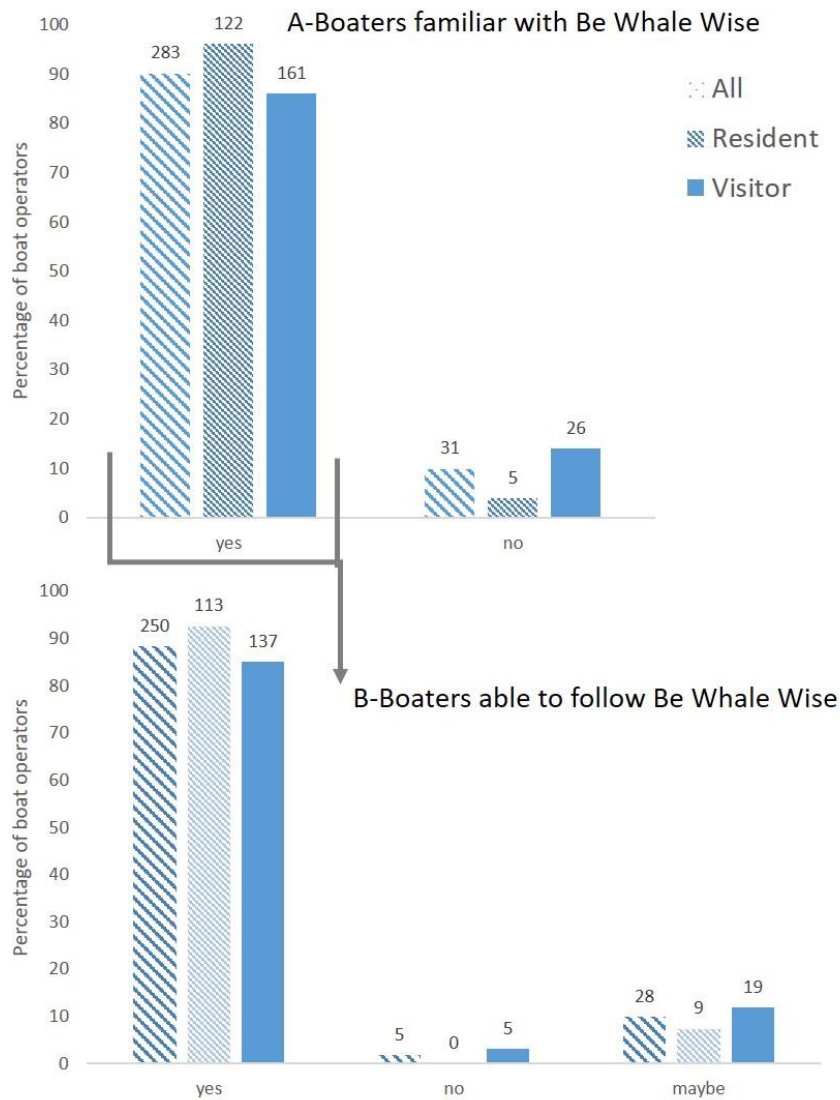


Figure 12. Percentage of respondents that reported being familiar of the Be Whale Wise Guidelines in 2018 and during the 2019 pre-season sampling period (A, top) and if yes, were asked if they thought they would be able to follow the guidelines (B, bottom). Sample sizes are shown above each column.

In 2019, the regulations designed to reduce the impacts of small vessels on whales were revised in Washington State, and an interim order providing temporary emergency measures was introduced by Canada. With these changes coming into effect at the start of the boating season we included an additional set of questions for the final survey conducted in October 2019 to assess respondents' awareness of these new regulations. Sixty-nine unique surveys from those that identified as boat owners or operators were available for analysis. Of these only 12 identified as resident of San Juan County and all of these respondents reported that they knew the regulations had changed, and 10 respondents reported that they knew what the new regulations were, of which 6 were able to list at least two of the new requirements (Figure 14). A similar pattern was observed among those respondents that identified as visitors (Figure 14).

Those respondents that reported knowing that regulations had changed were also asked where they had learned about the change. Those that identified as residents indicated dockside signage the most (33%, n = 4), while visitors indicated the media most often (40%, n = 18, Table 4).

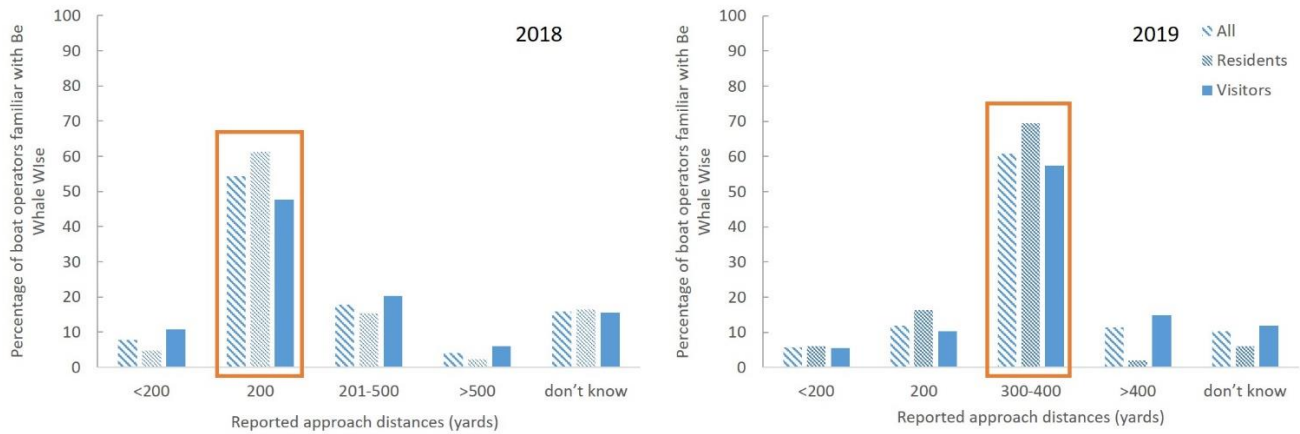


Figure 13. Survey respondents who reported being familiar with the Be Whale Wise guidelines and regulations were asked to provide the distance that boats should keep from killer whales. Because of the change in regulations in Washington State and Canada in 2019 these data were summarized separately. In 2018, 169 survey respondents that identified as boaters indicated a distance, the majority of both residents (61%, $n = 52$) and visitors (48%, $n = 40$) provided the correct distance of 200 yards, (or a combination of 200 yards and 400 yards in front of the whales). This same pattern was evident in 2019 where 69% ($n = 34$) of residents provided the correct new distances (300-400 yards), and 58% ($n = 73$) of visitors provided the correct new distances.

Table 4. Summary of where post-season 2019 survey respondents reported learning about the new vessel regulations. Dock signage was often reported by residents (33.3%) while the media was reported most often by visitors (40%).

	Resident boat owners/operators		Visitor boat owners/operators		All boat owners/operators	
	#	%	#	%	#	%
Anacortes Boat Show	0	0.0	2	4.4	2	3.5
Dock talks in San Juan County	0	0.0	3	6.7	3	5.3
Signage at docks	4	33.3	4	8.9	8	14.0
Public presentation	1	8.3	4	8.9	5	8.8
Through the media	3	25.0	18	40.0	21	36.8
Through social media	2	16.7	8	17.8	10	17.5
From Soundwatch or WDFW enforcement	1	8.3	8	17.8	9	15.8
Through the bewhalewise.org website	0	0.0	10	22.2	10	17.5
Other	2	16.7	6	13.3	8	14.0

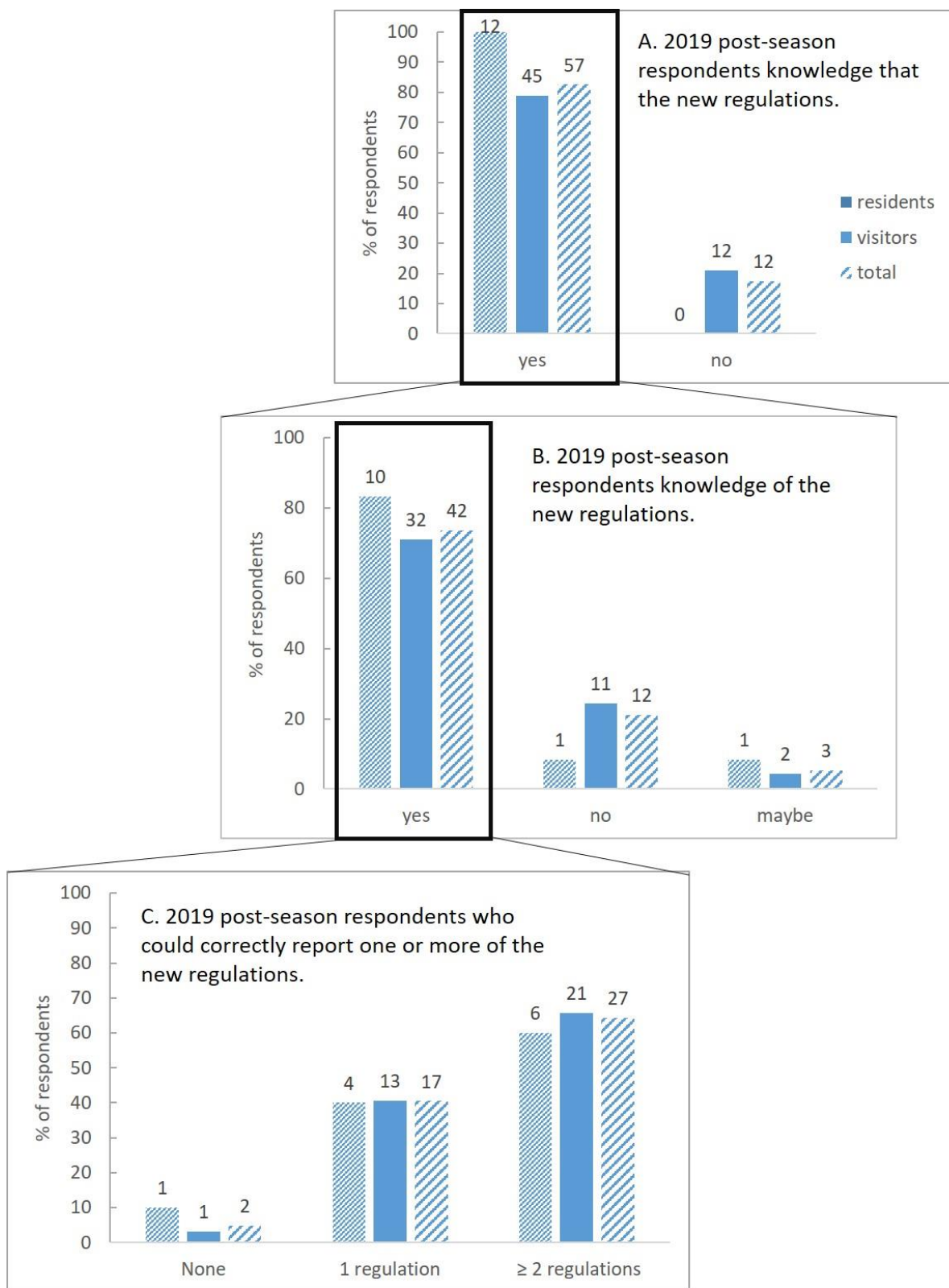


Figure 14. A summary of the unique responses of those that identified as boat owners or operators during the post-2019 survey that reported their knowledge of the revised vessel regulations (A), and for those that did whether they knew what the revised regulations were (B), and for those that did report knowing these regulations how many that could correctly report one or more of the new regulations (C). The sample sizes available are shown above each column.

Survey respondents' assessment of the whale warning flag and knowledge of the flag

The majority of unique survey respondents regarded the flag as a warning sign (residents: 82.4%, n = 126; visitors: 74.2%, n = 184). Moreover, an overwhelming majority suggested that they would know what the flag meant (mode = 1 - *yes - no on a scale of 1-5*) if they encountered it. The majority thought that seeing the flag would influence their boating behavior every time (mode = 1 - *every time - never on a scale of 1-5*), and if they had a flag they would be 100% likely to use it (mode = 1 - *100% likely - never on a scale of 1-5*, Figure 15). The same trend was observed for both residents and visitors. However, only 33% (n=51) of residents and 28% (n=70) of visitors thought that the introduction of the flag would make a difference in how boaters behave around the whales. A common concern was that the flag would act to attract boats to whales and thus increase the impacts of vessels on the whales.

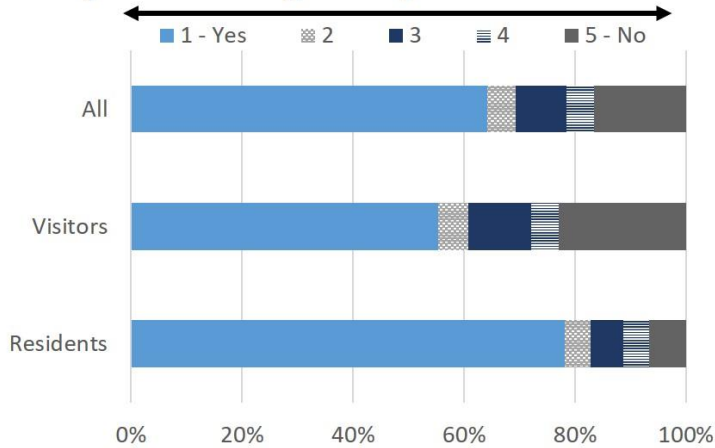
Whale warning flag use

Over the course of the pilot study 57% (n = 152) of unique survey respondents who identified as boaters (post-2018 to post-2019) reported either seeing or knowing about the whale warning flag. More residents (76%, n = 59) than visitors (49%, n = 93) reported knowing about the flag. Of these 267 respondents only 32% (n = 84) reported that they had a whale warning flag but 49% (n = 131) reported encountering whales in 2018 or 2019. For those that received a flag and encountered whales 52% (n = 24) reported that they flew the flag, this usage reporting rate was almost equal between residents and visitors (Table 5.). Very few (n = 12) reported that they found the flag hard to use.

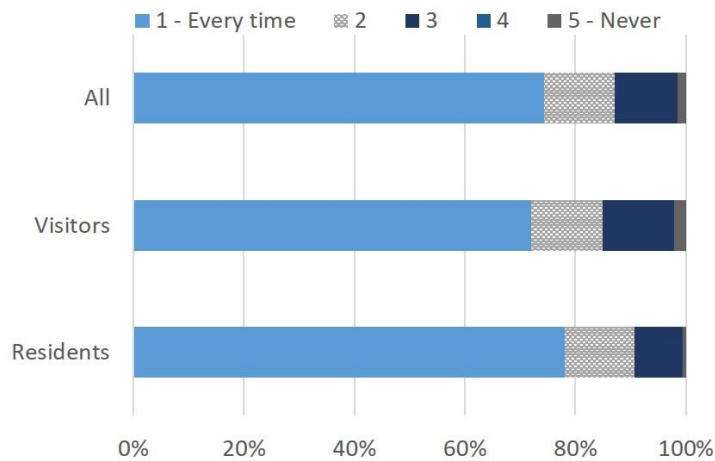
Table 5. Summary of unique survey responses collected from the post-2018, pre-2019, and post-2019 survey periods and their awareness and use of the whale warning flag.

		Did you see this flag flying / do you know about the flag? (%)	Did you receive a flag in 2018 or 2019? (%)	Did you encounter whales when boating in 2018 or 2019? (%)	If yes, did you fly the flag? (%)
Residents					
Yes	#	59 (75.6)	40 (51.3)	37 (47.4)	11 (47.8)
No	#	14 (17.9)	26 (33.3)	26 (33.3)	7 (30.4)
Visitors					
Yes	#	93 (49.2)	44 (23.3)	94 (49.7)	13 (56.5)
No	#	82 (43.4)	121 (64.0)	65 (34.4)	10 (43.5)
All					
Yes	#	152 (56.9)	84 (31.5)	131 (49.1)	24 (52.2)
No	#	96 (36.0)	147 (55.1)	91 (34.1)	17 (37.0)

A – If you saw the flag would you know what it means?



B – If you saw the flag would it influence how you boat?



C – Would you raise the flag if you had one?

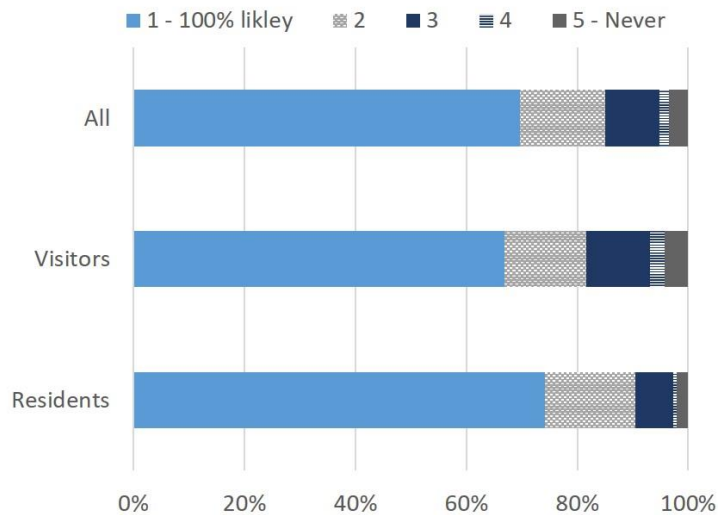


Figure 15. Summaries of the responses regarding awareness of the flag (plot A), and whether respondents thought that the flag could influence their actions (plot B), as well as whether they would raise this flag if they had one (plot C).

Discussion

The whale warning flag was introduced in San Juan County in 2018, this report provides a summary of the results of the two-year pilot study. This study is the first to attempt to assess the effectiveness of a novel social marketing approach to addressing an anthropogenic impact on an endangered marine mammal species.

Flag use and vessel behavior

Whale warning flags were first distributed to boaters that regularly use San Juan County and neighboring waters in 2018. The 2018 social survey data identified a need for a larger sized flag, based on this feedback, additional flags were produced and made available (for a small fee) through 2019 resulting in over 1025 flags being distributed over the two years. Both Soundwatch and an independent land-based Southern Resident killer whale survey team observed a marked increase in the number of flags being used between 2018 and 2019. When not including the Soundwatch boat (who flew the flag all times they were with whales) the flag was recorded in 69.4% of boat counts conducted over the course of the 2019 season, with a mean of 2.45 flags per boat count. Similarly, the land-based team reported a 6-fold increase in flag presence within 1km of whales in their scan data (Williams, unpublished data, 2019). While their scan samples were collected every 5 minutes, and thus the same vessel was likely to have been included in multiple scans Williams et al., (2019) were confident that the sample was not biased with respect to whether the boats were flying flags.

Land-based flags were more consistently used over the two-year pilot study, especially at Lime Kiln Point State Park where the flag was used when whales were present during the lighthouse' operational hours (8am-5pm), and at the Westside preserve, when whales were observed by volunteer naturalists. While anecdotal, volunteers reported that the flag was effective at causing boats to slow down. These anecdotal reports are consistent with the observations from around Northeast Vancouver Island (J. Hilderling, *pers comm.*).

There was no evidence that the use of the flag resulted in more boats around whales. Boat counts conducted by Soundwatch throughout the season (Shedd, et al., 2019; Seely, et al., 2017) have been dropping since 2015, if not before. The average number of boats around whales in 2018 was 10, and in 2019 dropped further to 9, the lowest since 1998 (Shedd, et al., 2019). However, in 2019 Southern Resident killer whales spent the least amount of time in the inland waters of the Salish Sea since Soundwatch began recording vessel trend data in 1998. In addition, the commercial eco-tour boats made an extra effort to limit their time with the SRKW when they were present, choosing instead to spend time with transient killer whales, humpback whales, or other species present in the region. This change in whale presence and in the viewing behavior of the eco-tour companies likely resulted in the lower number of boats/count.

Despite these potentially confounding factors, neither Soundwatch nor other observers reported vessels being attracted to the whales when a flag was present. In 2019, Soundwatch crews noted that transiting vessels tended to move away or slow down as they proceeded through an area where the flag was being flown. Similar observations were shared by observers based at the Lime Kiln Point State Park lighthouse, who reported vessels slowing down or even stopping in response to the flag at the lighthouse (J. Hyde, *pers comm.*). Around the San Juans boaters who do seek out whales already know where to find them or simply follow eco-tour vessels from their port (Shedd *pers comm.*). Our social survey data also support these observations with most boaters reporting that they continued with their activity rather than detour to see the whales when they detected them, or saw groups of eco-tour vessels.

The late implementation and less consistent use of the flag by boaters in 2018 resulted in limited data collection on vessel numbers and compliance levels by Soundwatch. Additionally, 2018 saw two unusual SRKW crises that resulted in two high-profile mortalities for J-Pod (J35's newborn calf and J50), These events likely led to an increased focus from research and eco-tour vessels to respond to these whales than place a priority on flying the flag (Shedd, et al., 2019). In 2019, members of the Pacific Whale Watch

Association (PWWA) were required to fly their flags when present with whales –this proactive measure by the association contributed to a marked increase in flag use on the water by the commercial fleet.

With greater flag use recorded in 2019, we have been able to undertake a preliminary analysis of the available vessel incident data collected by Soundwatch in relation to the flag. The vessel incident data is limited by how it is collected and by the fact that temporal, spatial, and whale related variables are not currently accounted for in the data. Despite this, these kind of behavioral audit data are valuable in providing more reliable data on peoples' behavior, and importantly a greater understanding of people's performance of the behavior you are interested in influencing (McKenzie-Mohr & Smith, 1999). The basic incident rate (number of incidents recorded per hour) data collected by Soundwatch provided us the opportunity to conduct some preliminary analysis of boater compliance in relation to the flag. There was some suggestion that the number of incidents may have declined as the number of flags on scene increased –perhaps suggesting the flag resulted in a herd mentality resulting in the group of vessels exhibiting the kind of social conformity sought by introducing the flag (McKenzie-Mohr & Smith, 1999). However, it should also be noted that the eco-tour vessels were the boats most likely to be recorded with a flag and thus the apparent relationship between the number of flags and the incident rate evident in the Soundwatch data may be confounded by the fact that fewer incidents are recorded from eco-tour boats than from private boats. This pilot study has highlighted the need for further analyses of the vessel incident data; in particular to determine if there are particular times or locations that would benefit from increased outreach to the boating public regarding boating behavior around whales and the whale warning flag. This limitation in the data highlights the need for further seasons of data collection, further efforts to distribute flags to recreational boaters in the area, and more in depth analyses of the data.

With only a preliminary analysis of incident data from one season, we were unable to draw clear conclusions on the ability of the flag to improve compliance among boaters. However, our survey data indicated support for the flag, and roughly half of the boaters who have flags reported using them. Additionally, further anecdotal observations and conversations with boaters over the study period suggest that the introduction of the flag, and its concept have been well received by boaters. Shedd et al. (2019) noted that transiting vessels at high speeds and close ranges are the vessels that have the greatest impact and threat to the whales and that these vessels will benefit the most from the whale warning flag program. We will continue to monitor vessel presence and incident rates over the coming seasons to continue to assess the influence of the flag as a social prompt to remind boaters to alter their behavior and remain in compliance with the Be Whale Wise guidelines and regulations.

[Assessing the knowledge and behavior of boaters through social surveys.](#)

The social survey data collected during 2018 and 2019 enabled us to take a deep dive into understanding respondents' knowledge of whales, the guidelines and regulations that are in place, and also gauge their reaction to the whale warning flag. Overall, the data supported the vessel data collected by Soundwatch regarding boater demographics (i.e. whether they were resident or visitors, and if visitors where they were from). The majority of visiting boaters reported being from the Seattle/South Puget Sound region, similar to that reported by Soundwatch (Shedd, et al., 2019). However, while Soundwatch data suggests that >40% of recreational boaters they contact are there to whale watch, less than 3% reported whale watching as their primary boating purpose with most reporting general recreation such as visiting other islands as their primary purpose. This disparity is likely because Soundwatch records data from vessels on scene with whales, while our surveys targeted a more general audience. Washington State Department of Fish and Wildlife (WDFW) report that in general more incidents are recorded by non-residents in San Juan County. For this reason, we split the survey data between residents and visitors to draw comparisons between the two groups.

Encouragingly, the majority of respondents, both residents of San Juan County, and visitors recognized the common signals of potential whale presence, the safety risks associated with collisions, and why they should adjust their boater behavior. However, only 50% of respondents were aware that whale collisions have occurred in the Northwest Straits region highlighting a greater need to communicate the dangers of

collision –to both whales and boaters throughout the region. While boaters indicated that they did not deliberately seek out whales it was clear that they enjoyed seeing the whales up close or doing something ‘spectacular’, emphasizing the amazement that the whales appear to illicit in humans.

Survey respondents were asked a series of questions that assessed their level of awareness and knowledge of the Be Whale Wise Guidelines (BWW). Due to changes in the regulations introduced by Washington State in 2019, the post-2019 data were analyzed separately. Surprisingly high numbers of survey respondents answered that they were aware of the BWW guidelines and that they could follow them and this pattern was consistent for both residents and visitors and across sampling periods. This result contrasts with the data collected by Soundwatch who reported 44% of contacted recreational vessels were unaware of the guidelines in 2018 (Shedd et al., 2019). However, because surveys are often more likely to be completed by those with more interest in the survey topic, there may be opportunity for bias in these results with a number of respondents reporting that they were aware of the regulations than would be expected of the average boater (McKenzie-Mohr & Smith, 1999). In order to determine respondents actual knowledge we asked them to provide the distances that the law requires them to stay away from the Southern Resident killer whales. Only ~60% were able to provide the correct distance (or combinations of distances). This indicates that while boaters may be generally aware (or think that they are aware) of the guidelines far fewer indicated that they would be able to implement and thus comply with them.

The revision of vessel regulations in Washington State and Canada in 2019 introduced additional challenges to boaters’ ability to comply with regulations. Increased set back distances in Washington state (300 yards parallel and 400 yards ahead and behind) and British Columbia (400 meters all around) resulted in greater communication complexity and potentially more confusion from boaters. However, both the post-season 2019 survey data and the Soundwatch incident data suggest that there was greater awareness of the revised regulations than anticipated. We caution this with the fact that the SRKW were only in inland waters for 19 days over the 2019 summer season, and the eco-tour operators self-managed their presence to ensure fewer boats with a group of whales. This will have greatly reduced the potential for interactions with vessels – which was reflected in the vessel incident numbers. In addition, the post-2019 survey data available were limited with only 12 unique resident respondents and 57 visitor respondents.

Our social surveys gave us valuable insights into how boaters perceived the flag and whether they thought it would influence their boating behavior if they saw it. Encouragingly the majority of respondents saw the flag as a warning, and that if they saw it reported that they would adjust their boating behavior, however only a third thought that it would make a difference to how boats behave around whales with a common concern being that the flag would only serve to attract boaters to whales. The results of vessel data suggest that this is not the case and neither Soundwatch nor land based observers reported an increase in vessels around whales with the use of the flag.

Despite the biases inherent with social surveys, and the limitations of the vessel data, the flag has the potential to help create new social norms that address the human behaviors affecting the endangered SRKW. If we are to see success in our bid to recover this at-risk species, and others, then utilizing such prompts in a dedicated social-marketing framework must become part of our conservation toolbox.



Figure 16. A composite of images of the Whale Warning flag in action taken by San Juan Island resident and naturalist Jeanne Hyde.

Limitations

There were a number of lessons learned during this pilot study. These included challenges surrounding the distribution of flags, changes in the behavior and presence patterns of the Southern Resident killer whales, limitations to the education and outreach campaign, and acknowledging the inherent biases involved in social survey data.

- In 2018 we were unable to initiate flag distribution until mid-June. This meant that it was challenging for some user groups, particularly the whale watch fleet to incorporate the flag use into their operations mid-season. Getting used to having to fly the flag also takes some practice and thus the late distribution of the flags may have impacted captains' and crews' ability to change their behavior accordingly in a systematic fashion. This was also likely the reason that so few of the recreational boaters that received flags were observed using them.
- We then focused on getting flags to those individuals that boat within the operational area of the Soundwatch Boater Education Program (Shedd, et al., 2019) to increase the chances of Soundwatch being able to collect vessel count related data. However, due in part to this late acquisition and distribution of the flags the participation of boaters was lower than anticipated and less consistent. The participation of boats increased in 2019 but the majority of vessels using the flag were eco-tour boats, despite a much greater effort to get flags to private boaters also.

- The education and outreach campaign needs to be expanded, particularly to the Seattle/South Puget Sound region where the majority of private recreational boaters are coming from. A need for broader media attention of the effort was also identified –particularly with the current spotlight on the plight of the SRKW.
- A number of dockside efforts were undertaken around San Juan County during the summer boating seasons, however these efforts were limited due to capacity of volunteers. No dockside efforts were conducted in the fall and this was reflected in the numbers of post-season surveys completed in both 2018 and 2019.
- The scope of this pilot study only allowed for preliminary analysis of both the vessel data and the survey data. The Soundwatch vessel count and incident rate data provide opportunities for further multivariate analyses that would allow us to both account for confounding factors and address some of the temporal and spatial questions surrounding the vessel data. Similarly, the survey data also provides additional opportunity for more comprehensive analyses. The summaries provided in this preliminary study do not provide any information on the relative importance of factors that lead individuals to engage in the boating behaviors that they do (McKenzie-Mohr & Smith, 1999). Further analysis would allow us to better identify barriers to behavioral changes.

Recommendations going forward

- Continue to make the flags available to all boaters that would like to sign up as whale steward. We have been challenged in our ability to make ordering, particularly from Canada easy due to the limitations placed on local government infrastructure regarding online purchasing of the flags.
- Continue to strengthen partnerships around the region to expand and strengthen the flag program. This includes working with eco-tour operators in the transboundary region to ensure that they continue to operate as stewards; coordinating efforts through the Be Whale Wise partnership and ensure that the flag has a presence at key boating events such as the regional boat shows.
- Work to integrate the use of the flag into Washington State’s Commercial Whale Watch Licensing program requirements.
- Introduce the flag to members of the Northwest Indian Fisheries Commission –our Coast Salish people are the first stewards of the whales and the Salish Sea and they have much to teach us as we move forward with these novel initiatives to reduce stressors on the endangered whales.
- Build on the outreach campaign to spread the word and encourage more boaters to participate throughout WA State inland waters –and even further afield.
- Develop a means of gaining true commitments from flag bearers to be “whale stewards”. Currently we have been provided verbal commitments; however, written commitments are known to be far more effective. A database or website allowing individuals to sign a public pledge to be a whale steward may also contribute to the behavioral change we seek to instill in boaters around the region.
- Continue to monitor the use of the flag on vessel numbers and incident rates.

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 - Northwest Straits Foundation Opportunity Fund that allowed us to purchase the first batch of flags to seed the system.
 - The Marine Mammal Commission
 - San Juan County
- The idea for the project was introduced by the Marine Resources Committee who continue to champion the use of the flag. We were graciously given permission to use the same design as introduced around northeast Vancouver Island by the Marine Ecology and Research Society and the North Island Marine Mammal Stewardship Association, thank you to both these groups and especially to Jackie Hilderling.
- Thank you to Carol Anderson of Seattle Flags who rushed our first orders through and didn't blink when we ordered 1000 more flags! It has been a pleasure working with you and we hope to continue.
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Appendices

Appendix 1. Locations and numbers of whale warning flag outreach material and Be Whale Wise leaflets distributed by San Juan County MRC and San Juan County Environmental Resources staff.

<i>Location/Distributor</i>	<i>Number distributed</i>
<i>Whatcom Marine Resources Committee</i>	600
<i>Skagit Marine Resources Committee</i>	600
<i>Port of Anacortes</i>	2,000
<i>Soundwatch / Whale Museum</i>	2,000
<i>Washington Fish and Wildlife Enforcement</i>	300
<i>WDFW catch monitoring crew – Port of Friday Harbor</i>	10
<i>Department of Fisheries and Oceans, Canada</i>	100
<i>Port of Friday Harbor</i>	100
<i>Roche Harbor</i>	50
<i>Snug Harbor</i>	25
<i>US Customs</i>	100
<i>County Park</i>	150
<i>Lime Kiln Point State Park</i>	200
<i>Visitors Bureau Friday Harbor</i>	10
<i>County Licensing</i>	50
<i>Ace Hardware</i>	25
<i>Kings Marine</i>	50
<i>Victoria Clipper</i>	28
<i>Individuals*</i>	2,570
Total	8,968

*Included those given out with flags, and those taken by individuals for distribution on other islands (e.g. Orcas, Waldron and Lummi Islands) and events (e.g. Port Townsend Wooden Boat Festival, Seattle Boat Show and Anacortes Boat Show).

Appendix 2. Whale Warning Flag 2018-2019 Soundwatch Final Report



PROMOTING STEWARDSHIP OF WHALES AND THE SALISH SEA ECOSYSTEM THROUGH EDUCATION AND RESEARCH

Whale Warning Flag 2018-2019 Soundwatch Final Report

Project Title: San Juan County Agreement for Professional Services The Whale Museum: Soundwatch SKRW019

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Contract Number: SJC Agreement No. 19E.N.012

Contract Date: The Agreement shall be in effect from September 10, 2019 until March 21, 2020

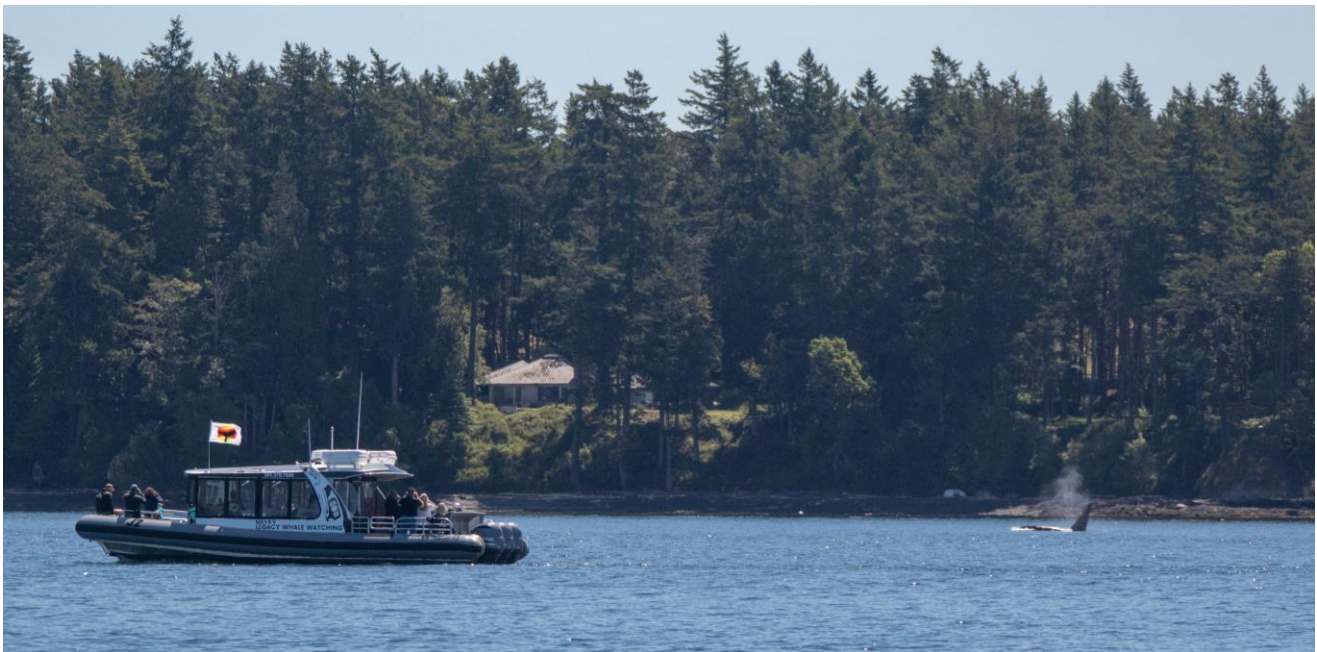


Image by Hillary Shedd Photography under NMFS authorization Permit 21114 of Transient killer whale > 200 yards inshore of commercial whale watching vessel flying the Whale Warning Flag off Henry Island, WA.

Introduction

Soundwatch has been operated as the on-the-water education and research department of The Whale Museum on San Juan Island since 1993. The goal of the program is to monitor and research whale behavior and vessel trends with a particular focus on the critically endangered Southern Resident killer whales. Since 1998, Soundwatch has maintained a standard data collection protocol and National Marine Fisheries Service Research Permit and National Oceanic and Atmospheric Administration Research Contract. From May – September Soundwatch conducts observational surveys of whale behavior and vessel counts within a half mile of whale's present. Throughout presence on scene with whales Soundwatch records vessel incidents and violations of local regulations concerning approach distances of whales, as well as contacting recreational vessels to education them on said regulations. For more information please view the Annual Soundwatch Reports available at: <https://whalemuseum.org/pages/soundwatch-boater-education-program>.

In 2018, Soundwatch partnered with San Juan County to assist in the distribution, education and research on the Whale Warning Flag. This program was brought into the central Salish Sea for northern Vancouver Island where the flag was developed in part of the See A Blow Go Slow campaign to reduce vessel interactions with humpback whales. The flag design and methodology were kept consistent so that the program was synonymous across the transboundary area of the Salish Sea.

The goal of this monitoring and research was to determine the effectiveness of the Whale Warning Flag around killer whales, a larger commercial whale watch fleet, and greater presence of recreational vessels. Utilizing this data, we try to determine if the flag attracts additional recreational vessels to the presence of whales and if incident rates decrease due to presence of the Whale Warning Flag.

Section I: Summary of Activities

From May – September 2019, Soundwatch operated vessel patrols to educate and monitor boaters an average of six days per week under National Marine Fisheries Service (NMFS) research issued permit no. 21114. Soundwatch staff and volunteer crews conducted a total of *114* days of activity, of which a total of *74* days were on the water with marine wildlife between May 12, 2019 and September 25, 2019, totaling *771.0* on the water hours and traveling *4687.7* nautical miles. Killer whales were present on *66* days (*15* days with SRKWs and *51* days with Transients), for *289.8* hours, averaging 6.6 hours per day of on the water effort.

In 2019, *648* Vessel Count/Whale surveys were conducted on a variety of cetacean species, the majority being Transient (Bigg's) killer whales *63%* (*407* counts), then Southern Resident killer whales *24%* (*155* counts), and Humpback Whales *13%* (*86* counts) in the Haro Strait Region of Washington State, U.S. and Southern Vancouver Island, British Columbia, Canada (Figure 1). Soundwatch observed more Transient killer whale groups in the Haro Strait region than in past years. As a result, vessel monitoring was spread over a larger region in the space of a single day. Additional educational outreach included *101.5* hours of dedicated off the water dock talks, reaching approximately *1,796* guests at local harbors and marinas, and *75* local guides taking and passing the Kayak Education Leadership Program (K.E.L.P.).

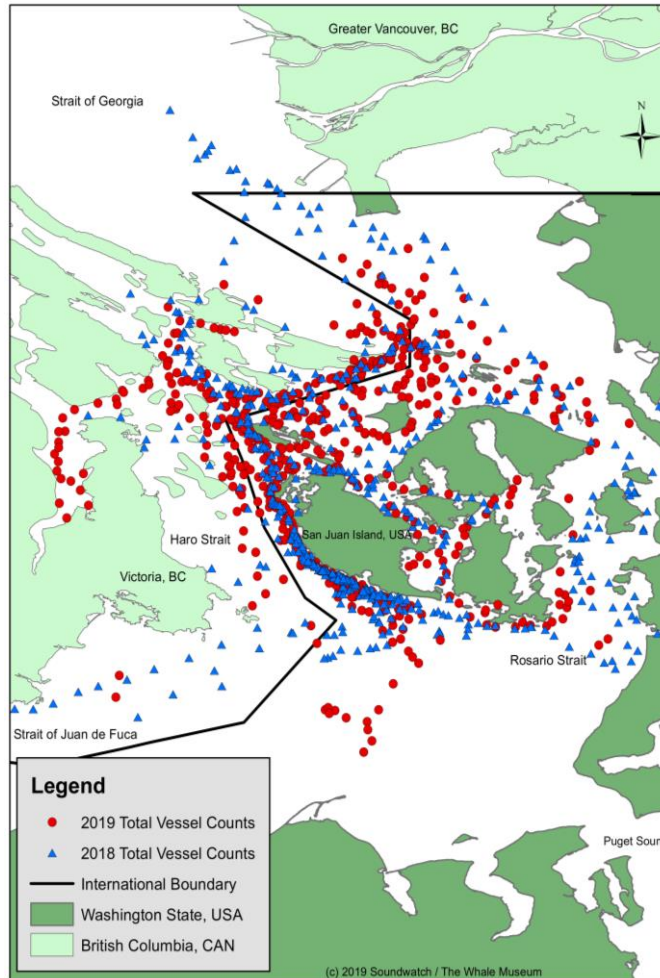


Figure 1: Total Vessel Count locations from 2018 and 2019, displaying differences in survey locations and distributions.

Section II: Summary of Vessel Data

Soundwatch totaled 70 vessel/whale days and 648 vessel counts. U.S. ecotour (commercial wildlife tours) vessels were observed 70 days and in 542 vessel counts, recreational 68 days and 496 counts, Canadian ecotour 64 days and 424 counts, research 28 and 142 counts, enforcement 22 days and 85 counts, and kayaks (ecotour and recreational) 19 days and 32 counts. Enforcement vessels were only present in 13% of Soundwatch vessel counts due to reduced presence of the SRKWs, increased presence of multiple groups of Transient killer whales within the Salish Sea, and coordinated effects to spread out education and enforcement operations

U.S ecotour and recreational vessels had the greatest presence around whales with Canadian ecotour coming in third highest. Numbers of Canadian ecotour vessels decreased throughout the summer, potentially due to the Transport Canada Interim Order and greater number of groups of Transient killer whales closer to vessel home ports. Eco tour vessel category accounted for 56% and recreational accounted for 17% of vessels ‘whale oriented’ in 2019 Soundwatch vessel counts (Figure 2). Soundwatch and Straitwatch accounted for the second highest presence (after combined U.S. and Canadian ecotour vessels) in vessel counts, an increase from 2018 showing how much effort the monitoring programs put in during the season, and potential decreases in other types of vessel presence.

Vessel presence was 68% whale oriented and transiting was recorded at 22% of vessel activity within one-half mile of the whales.

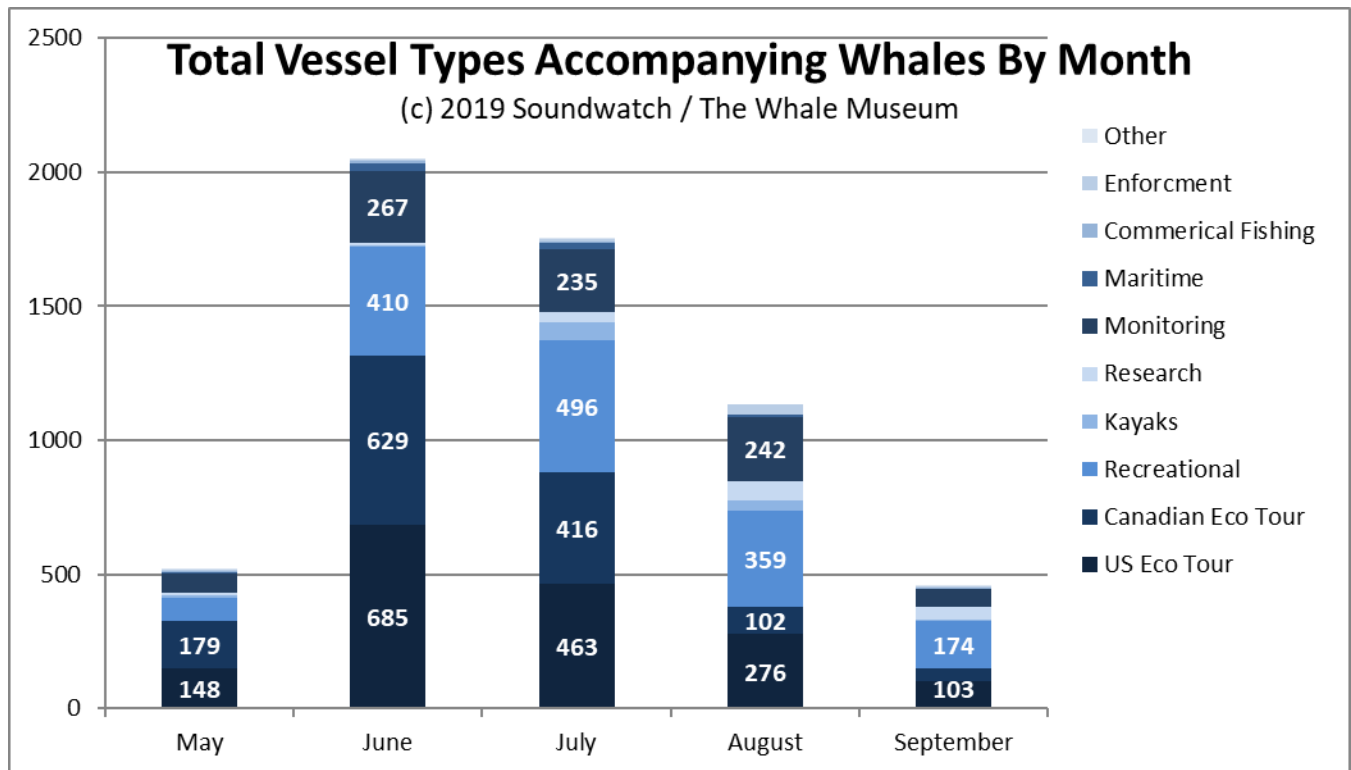


Figure 2: Total number of observed vessels by vessel type and month recorded in 2019. Vessel categories listed in legend are represented in ascending order per the graphic representation.

Section III: Summary of Vessel Incident Data

In 2019, through recommendations made by Governor Inslee’s Orca Recovery Task Force, Washington State revised its vessel regulations by increasing the separation distance from vessels and Southern Resident killer whales (SRKW) from 200 yards to 300 yards, restricting vessels within 400 yards in front or behind the whales, and requiring vessels to under 7 knots within one half mile of SRKWs. The revised regulations were signed into law May 8th and effective July 28, 2019 in the middle of the boating season. Similarly, Canada increased vessel approach distances from 200 meters to 400 meters of all killer whales in SRKW Critical Habitat through a Transport Canada interim order effective June 1 – October 31, 2019. Included in the interim order was an agreement signed by most commercial whale watching companies allowing those companies to approach Transient killer whales to 200 meters if they did not approach Southern Resident killer whales within their Critical Habitat. A total of 749 vessel incidents were recorded by Soundwatch in 2019. Of the incidents recorded 35% were U.S. Vessel Regulation violations; **Vessels Within 300 Yards of Whales** were 23% and **In the Path of Whales** were 12%. The greatest number of incidents recorded was under the new Washington State Law of **Under 7 knots within a half mile of SRKWs** at 30%. In 2019, 72% of all incidents were committed by private/recreational motor vessels, 6% private sailing vessels, 7% commercial kayaks, 5% Canadian commercial vessels, 5% U.S. commercial vessels and 2% by commercial fishing vessels (Table 1.).

Table 1: Table of All Incidents by Type of Incident and Vessel Type Reported by Soundwatch in 2019.

Incident Type	EC	EK	EU	MF	MM	PK	PM	PS	Total
100 yards under power	2		6	1			22	5	36
200 yards under power	6		6	1		3	42	8	66
300 yards under power (SRKW WA)		10	4	1		1	52	10	78
400 yards under power (T CAN)							10	1	11
400 yards in the path	9	10	7	1		1	54	11	93
inshore of whales	3	10	7	2		2	30		54
drone violation							3		3
fast approach within 400 yards			1				8	3	12
fast departure within 400 yards	3		1				15	1	20
over 7 kts within half mile of whales	8		6	7	3		195	2	221
fishing within 100 yards							10		10
fishing within 200 yards				2			25		27
paddling within 100 yards of whales		13				7			20
shutdown within 100 yards	1						2	1	4
shutdown within 200 yards	2	1					3		6
SJI No-Go-Zone	1	3	3				46	1	54
spread out kayaks with whales		7							7
traveling behind whales 100-400 yards	1						12	4	17
within eighth mile of shore							1		1
within half mile of Lime Kiln Lighthouse	1						6		7
within 200 yards of a Wildlife Refuge	1						1		2
Total	37	54	41	15	3	14	537	47	749

EC= EcoTour Canada, EK= Ecotour Kayak, EU= EcoTour US, MF= Commercial Fishing, MM= Monitoring/Enforcement, PK= Private Kayak, PM= Private Motor, PS= Private Sail

Section IV: Whale Warning Flag Data

In 2018, flags were mainly handed out to research, monitoring and highly motivated private boaters. Flags were provided to commercial whale watch vessels in 2018 in mid-June, after the start of the boating season, so use of flags was limited by these boaters. This led to an immeasurable presence of whale warning flags and inability to analyze their effectiveness. Throughout the winter 2018 and before the summer season in 2019 the commercial whale watch fleet, enforcement vessels and more private boaters were outfitted with whale warning flags. The education and outreach of the flag was also increased so that boaters were aware of the meaning behind the flags.

Over the past six years there has been an overall decrease in average and max number of vessels presence with whales (Figure 4). This could be due to decreased presence of SRKWs, increased presence of multiple groups of Transient killer whales, heightened awareness of the plight of the

SRKWs, and other factors. This data also suggests that the Whale Warning Flag did not act as an attractant to recreational vessels to draw them to the presence of whales. Observational Soundwatch crew noted that transiting vessels tended to move away or slow down to continue to proceed through the area when witnessing the Whale Warning Flag versus stopping to view the whales. However, there are cases of recreational vessels arriving on scene with whales when Whale Warning Flags are present and observational this seemed to be vessels that were seeking whales out anyway, and were not drawn to the scene solely by the flag.

In 2019, the average number of whale warning flags within a half mile of all whale species was 2.45 flags with a max of 10 flags. Ecotour (Canadian and US commercial wildlife vessels) had the highest average and max of any vessel type at 1.92 and 7 flags, respectively. Recreational vessels flew an average of 0.73 flags and a max of 2 flags, and other vessels averaged 1.25 flags and max of 4 (Figure 3). Other vessels include Soundwatch, which always flew a whale warning flag and National Marine Fisheries Service research permit flag when on scene with whales, and other monitoring and research vessels. There is a negative relationship between number of whale warning flags present and the frequency at which they were seen. Meaning that in 30% of boat counts Soundwatch was the only vessel flying a whale warning flag (Figure 5).

As stated earlier, Soundwatch recorded 749 vessel incidents in 2019. Since Soundwatch flew a whale warning flag at all times when present with whales, all incidents recorded were when a flag was present. There were 503 (67%) incidents recorded when there was at least one other flag besides Soundwatch flown. When vessel incidents are displayed graphically against number of whale warning flags present one might assume that as more flags are present there are less incidents. This may be true, but when compared to boat counts by number of flags present the trend is very similar in that there are less vessel incidents when there are more flags due to the fact there were fewer boat counts with higher numbers of flags (Figure 6). When plotted, the negative relationship of number of vessel counts and vessel incidents is comparable with similar negative slopes (-29 and -24) and strong trends ($R=0.77$ and $R=0.84$) (Figure 7). This further suggests that the reduction in vessel incidents as number of Whale Warning Flags increase is due to the smaller sample size of boat counts with >6 Whale Warning Flags present.

However, when there were greater than 6 flags present no incidents were recorded. This could be due to higher recognition and awareness of whale's presence by boaters due to the sheer number of vessels present with a majority being commercial ecotour vessels. As well, when there are greater numbers of Whale Warning Flags this is due to ecotour vessels flying those flags and these vessels are less likely to commit vessel incidents (Figure 8).

Overall, total number of vessel incidents have decreased over the past two years, but over the past six years total number of vessel incidents have been ever changing (Figure 9). This is due to many variables; hours on scene with killer whales, presence of SRKWs, location of killer whale sightings, and other factors. This is why total number of vessel incidents is not used to compare years and create long

term trends. Another metric to utilize is the rate of vessel incidents (Figure 10). This is calculated by vessel incidents recorded per hour, but its also vulnerable to all the same variables listed above for total number of incidents.

Commercial whale watch vessels are in general less likely to violate regulations and are more likely to fly Whale Warning Flags (Table 1 and Figure 5). Therefore, only in rare cases were commercial whale watch vessels flying Whale Warning Flags observed violating regulations. Out of the 749 incidents recorded by Soundwatch, 78 were committed by EcoTour vessels and of those 18 were flying Whale Warning Flags. There was only one case in which a private vessel flying a Whale Warning Flag was observed in violation (Table 2).

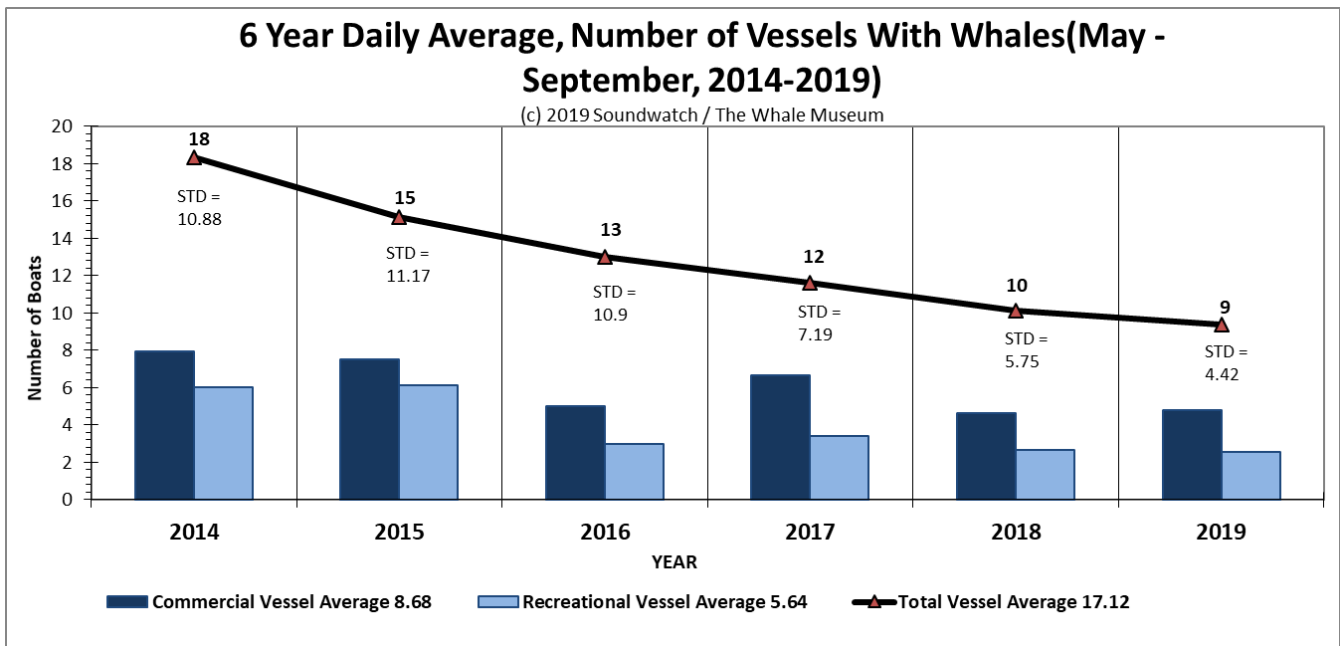


Figure 4: Average number of vessels with whales from 2014 – 2019 displaying a 6-year decreasing trend in average number of vessels with whales, suggesting the Whale Warning Flag did not impact or draw vessels towards the presence of whales.

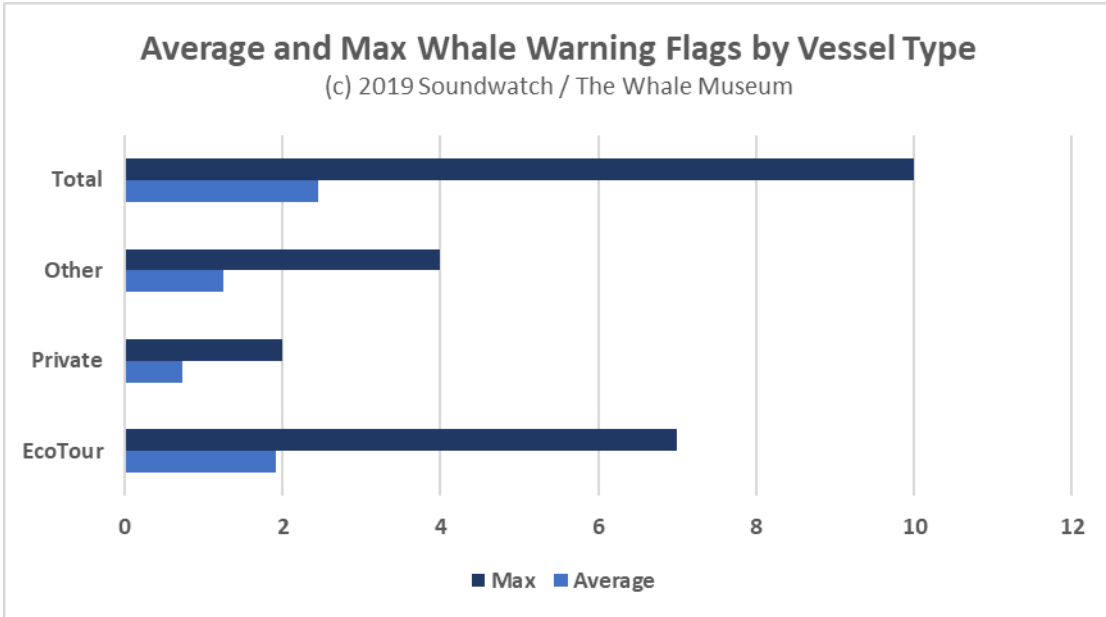


Figure 5: Average and max of Whale Warning Flags within a half mile of whales by vessel type in 2019.

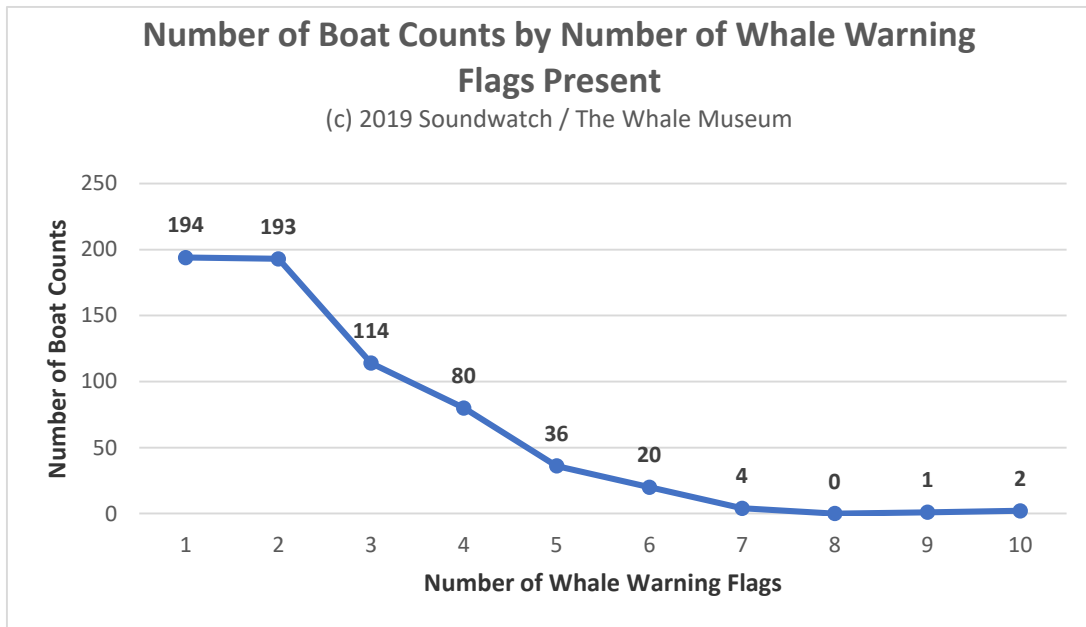


Figure 6: Number of Boat Count with number of Whale Warning Flags present.

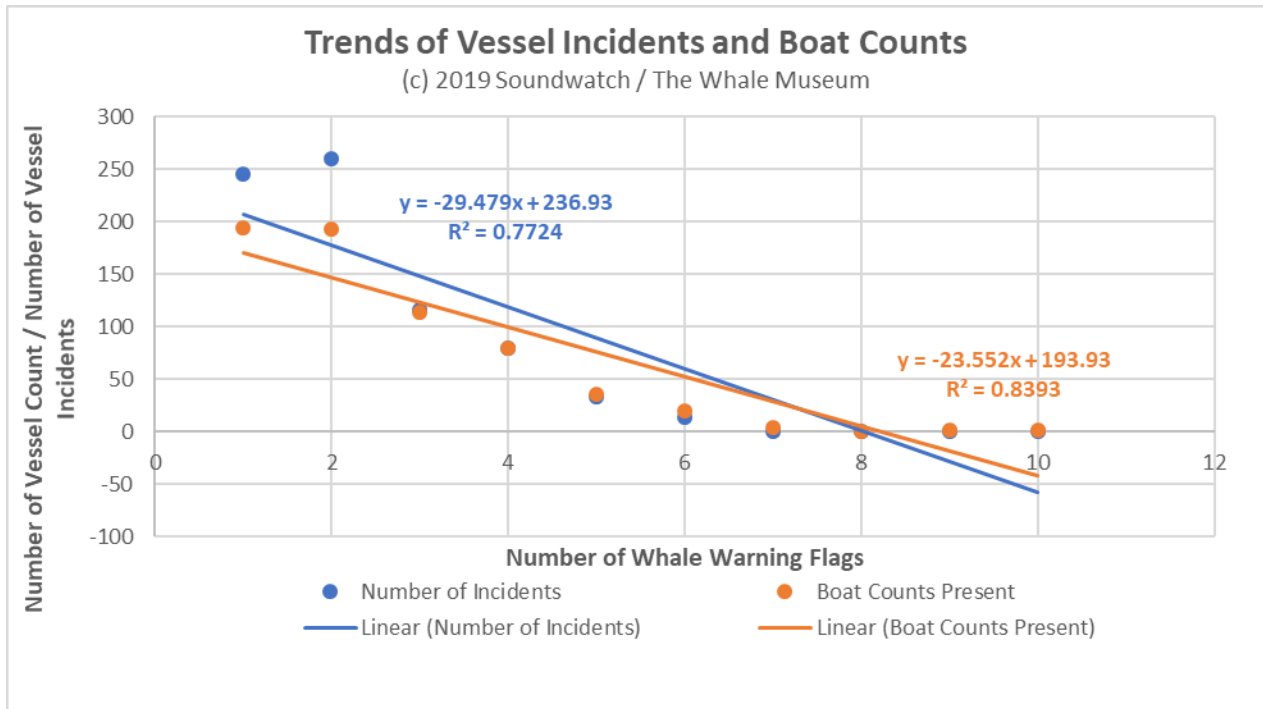


Figure 7: Displays the negative trends of vessel incidents and boat counts as related to number of Whale Warning Flags present.

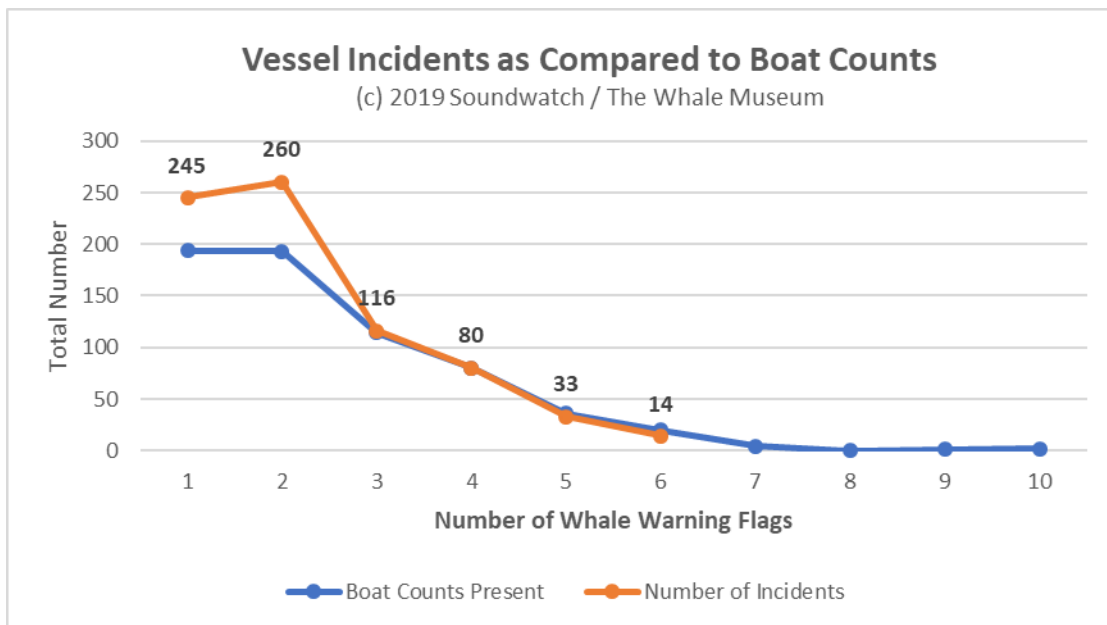


Figure 8: Number of Vessel Incidents and Boat Count by number of WWFs present.

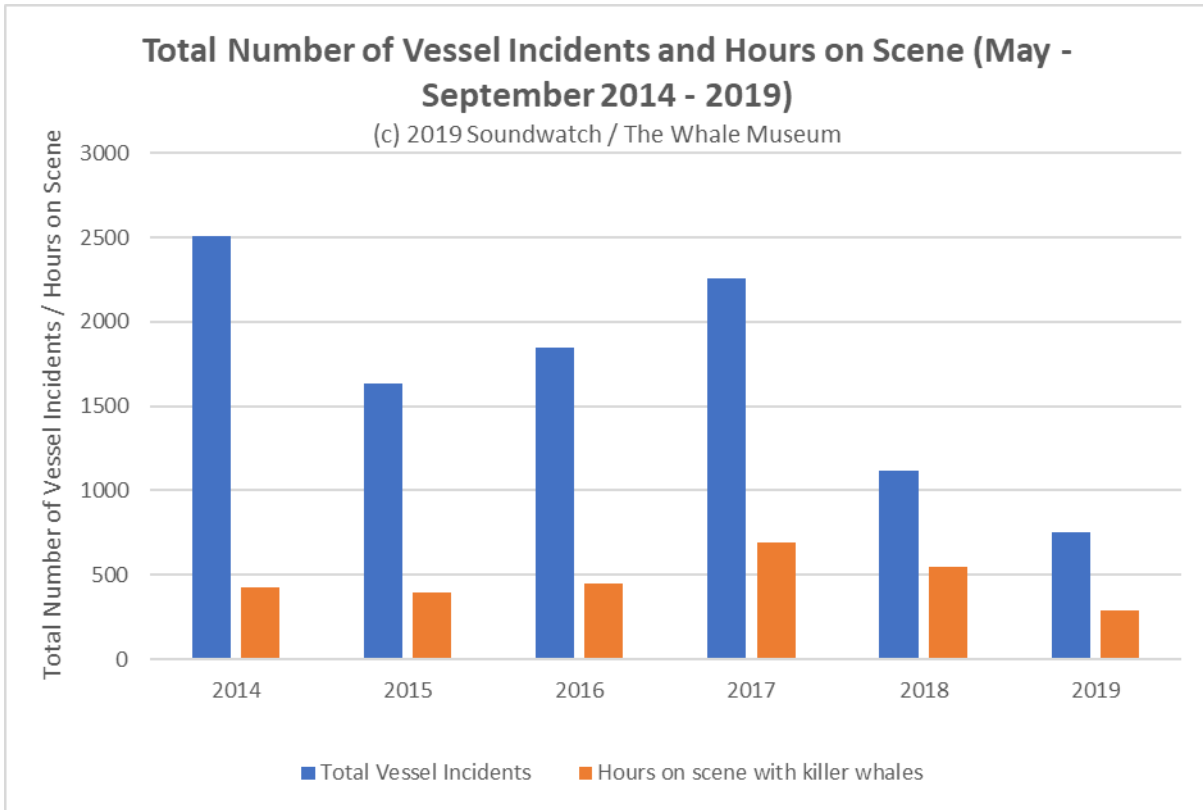


Figure 9: Displays total number of vessel incidents recorded in a year and hours on scene with killer whales during that year.

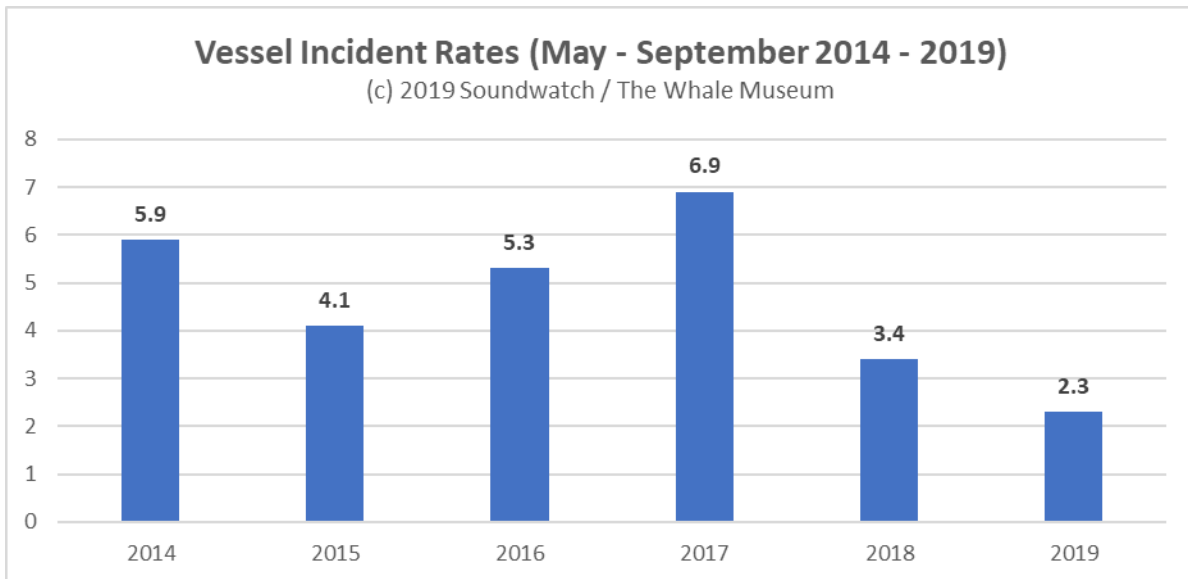


Figure 10: Displays the average vessel incident rate per hour over the past six years.

Table 2: Incidents recorded in which the vessel in question was flying a Whale Warning Flag.

Vessel Type	Number of Incidents	Type of Incident
EU	5	Inshore of Whales
EU	3	Over 7 knots within Half Mile
EU	2	400 in the Path
EU	1	100 Yards Under Power
EU	4	200 Yards Under Power
EU	1	SJI No-Go-Zone
EU	2	300 Yards Under Power
PM	1	Over 7 knots within Half Mile

Section V Discussion

In 2018, when the flag was first introduced Soundwatch did not record any usable data due to the lack of presence of the flag out on the water.

Deployment methods for the flag appeared to one of the challenges faced by flag recipients at first. Many commercial operators were either slow to utilize their flags or did not utilize their flags because they reported issues with flying the flag (Figure 9). In 2019, under agreement with the Pacific Whale Watch Association (PWWA) members were “required” to fly their flags when present with whales. This is what really contributed to the presence of flags out on the water.

Based solely on observations and conversations with boaters the flag seemed to be wanted and well received by private boaters. One concern is that the flag will act as a means to attract vessels to the whales. However, Soundwatch did not observe this behavior and got the sense that vessels that want to see whales will find the whales and vessels that are transiting will see the flag and avoid the area to continue on. Transiting vessels at high speeds and close ranges are the vessels that have the greatest impact and threat to the whales. These vessels can also benefit the most from the Whale Warning Flag program (Figure 10).



Figure 9: Image of commercial whale watch vessel incorrectly flying their Whale Warning Flag upside down. They were made aware of the situation and corrected the issue.



Figure 10: Image of Soundwatch vessel flying Whale Warning Flag while contacting a boater. Photo by Jeanne Hyde of The Whale Museum.

THE WHALE MUSEUM

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Appendix 3. 2018 (pre- and post-season) surveys and 2019 (pre- and post-season) surveys.

2018 pre-season survey: Boating with Whales in the Salish Sea

The core critical habitat of the endangered Southern Resident killer whale is located in the heart of the Salish Sea within the San Juan Islands. When Southern Residents are present in the Salish Sea during the spring, summer and fall there are vessels within acoustic range of the whales virtually all the time hindering their ability to navigate, detect increasingly scarce prey, and communicate. In an effort to address vessel impacts around the San Juan Islands the County and the San Juan County Marine Resources Committee are piloting the use of a Whale Warning flag this summer. This survey is part of this pilot study. The survey aims to measure public knowledge, attitude and actions related to boating with whales in the Salish Sea and surrounding the use of a Whale Warning flag. The survey is anonymous and open to all interested in participating, but particularly those who are residents and visitors to San Juan County.

Thank you for your time. The survey is in 3 sections and should take approximately 5 minutes to complete.

1) *Are you a resident of San Juan County?* Yes, No

2) *If you are a visitor where are you visiting from?*

- A neighboring County (e.g., Whatcom, Skagit, Islands, Jefferson)
- Seattle and South Puget Sound
- Outside Washington State
- Canada Another Country
- Other:

3) *Do you own a boat?* Yes, No

4) *If yes, what kind of boat do you own?*

- Small non-motorized (e.g., kayak or row boat) Private small open motorized
- Private medium cabin motorized Private large motorized
- Sail Boat
- Eco-tour kayak Eco-tour - vessel
- Government Agency / Enforcement
- Research Commercial Fishing Tribal Fishing
- Other:

5) *How long have you been boating in the San Juans?*

- 0-1 years
- 2-5 years
- 6-10 years
- 11-20 years
- 21- 30 years
- 31 - 40 years

- 41 - 50 years
- >50 years

6) *What is your main boating purpose?*

- Recreation (e.g., visiting other islands)
- Recreational whale watching
- Recreational fishing
- Commercial fishing
- Tribal fishing
- Commercial whale watching & wildlife Tours
- Research
- Government work (e.g., County, State or Federal)
- Other:

Section 1: Knowledge/Perception

This section asks questions related to your awareness, and the information that you possess about boating around whales in the Salish Sea.

WHALE WISE BOATING

7) *Are you familiar with the Be Whale Wise Guidelines and regulations? Yes, No*

7a) *If yes, do you think you are able to follow them? Yes, No, Maybe*

7b) *If yes, what are the most important Be Whale Wise Guidelines and Regulations a boater can follow? (long answer)*

8) *When you see a grouping of boats on the water, could that mean whales are present? Yes, No, Maybe*

9) *If you see a bait ball, or birds swooping in one area could that mean whales might be in the area? Yes, No, Maybe*

10) *If you answered yes to Questions 8 and/or 9, do you adjust your boating to follow the guidelines? Yes, No, Maybe*

11) *If you are in the vicinity of whales how many yards should you maintain between you and the whales? (long answer)*

DANGERS

12) *To the best of your knowledge, have boats collided with whales in this general area in recent times? Yes, No, Don't know*

13) *Do you think boat-whale collisions are dangerous to whales? Yes, No, Don't know*

14) *Do you think boat-whale collisions are dangerous to people? Yes, No, Don't know*

Section 2: Attitudes towards whales

This section addresses the wider sociocultural orientations boaters have – consciously or not – about whales, and their relations with whales, in the water.

15) *When you are boating and whales are in the area, do you seek them out or continue on your way?*
Seek out, Continue on

16) *Do you enjoy watching whales when you are boating?* Yes, No

17) *Do you think you should change your boating behavior when whales are nearby?* Yes, No, Maybe, Don't know

18) *When you are boating, is your first concern the task you are out to accomplish - such as fishing, or getting from point A to point B?* Yes, No, Sometimes

18a) *If yes, do whales being in the area ever get in the way of your task?*

1 (Every time) 2 3 4 5 (Never)

19) *When you are boating near whales, do you hope they will come close or do something spectacular (like breach or tail slap or spyhop)?*

1 (Always) 2 3 4 5 (Never)

20) *Do you feel a sense of guardianship over whales (e.g., do you go out of your way to keep them safe when you are boating)?* Yes, No, Don't know

Section 3: The Whale Warning flag

This section addresses your propensity, as a boater, to take an active part in the Whale Warning flag Program.

WHALE WARNING FLAG



21) *If you saw a boat flying this flag, do you know what it would mean?*

1 (Yes) 2 3 4 5 (No)

22) *If you saw a boat flying this flag, would you see the flag as a warning?* Yes, No, Maybe

22a) *If no, please explain briefly what this flag indicates to you? (long answer)*

23) *Would seeing the flag make you want to slow down?* Yes, No, Maybe, Don't know

24) *If you saw another boat fly a whale warning flag, would this have any effect on how you are boating?*

1 (Every time) 2 3 4 5 (Never)

25) *If you had/have a Whale Warning flag on your boat, would you raise the flag when you are in the vicinity of whales*

1 (100% likely) 2 3 4 5 (I would not)

26) *Do you think the introduction of a Whale Warning flag will make a difference in how boaters behave around whales?* Yes, No, Maybe, Don't Know, Other:

Thank you for your time in completing this survey, Any final comments

2018 post season survey: Boating with Whales in the Salish Sea

The core critical habitat of the endangered Southern Resident killer whale is located in the heart of the Salish Sea within the San Juan Islands. When Southern Residents are present in the Salish Sea during the spring, summer and fall there are vessels within acoustic range of the whales virtually all the time hindering their ability to navigate, detect increasingly scarce prey, and communicate.

In an effort to address vessel impacts around the San Juan Islands the County and the San Juan County Marine Resources Committee are piloting the use of a Whale Warning flag.

This post-season survey is part of this pilot study. The survey aims to measure public knowledge, attitude and actions related to boating with whales in the Salish Sea and the use of the Whale Warning flag. The survey is anonymous and open to all interested in participating, but particularly those who are residents and visitors to San Juan County.

Thank you for your time. The survey is in 3 sections and should take approximately 5 minutes to complete.

1) *Did you complete the pre-season survey in 2018?* Yes, No

2) *Are you a resident of San Juan County?* Yes, No

3) *Did you visit San Juan County during the spring, summer or fall of 2018 and partake in boating activities?* Yes, No

4) *If you visited, where did you visit from?*

- A neighboring County (e.g., Whatcom, Skagit, Islands, Jefferson)
- Seattle and South Puget Sound
- Outside Washington State Canada
- Another Country Other:

5) *Do you own a boat?* Yes, No

6) *If yes, what kind of boat do you own?*

- Small non-motorized (e.g., kayak or row boat) Private small open motorized
- Private medium cabin motorized
- Private large motorized Sail Boat
- Eco-tour kayak Eco-tour - vessel
- Government Agency / Enforcement Research
- Commercial Fishing Tribal Fishing

7) *How long have you been boating in the San Juans?*

- 0-1 years
- 2-5 years

- 6-10 years
- 11-20 years
- 21- 30 years
- 31 - 40 years
- 41 - 50 years
- >50 years

8) *What is your main boating purpose?*

- Recreation e.g., visiting other islands Recreational whale watching Recreational fishing
- Commercial fishing Tribal fishing
- Commercial whale watching & wildlife Tours Research
- Government work (e.g., County, State or Federal)

Section 1: Knowledge/Perception

This section asks questions related to your awareness, and the information that you possess about boating around whales in the Salish Sea.

WHALE WISE BOATING

9) *Are you familiar with the Be Whale Wise Guidelines and regulations? Yes, No*

9a) *If yes, do you think you are able to follow them? Yes, No, Maybe*

9b) *If yes, what are the most important Be Whale Wise Guidelines and Regulations a boater can follow? (long answer)*

10) *When you see a grouping of boats on the water, could that mean whales are present? Yes, No, Maybe*

11) *If you see a bait ball, or birds swooping in one area could that mean whales might be in the area? Yes, No, Maybe*

12) *If you answered yes to Questions 8 and/or 9, do you adjust your boating to follow the guidelines? Yes, No, Maybe*

13) *If you are in the vicinity of whales how many yards should you maintain between you and the whales? (long answer)*

DANGERS

14) *To the best of your knowledge, have boats collided with whales in this general area in recent times? Yes, No, Don't know*

15) *Do you think boat-whale collisions are dangerous to whales? Yes, No, Don't know*

16) *Do you think boat-whale collisions are dangerous to people? Yes, No, Don't know*

Section 2: Attitudes towards whales

This section addresses the wider sociocultural orientations boaters have – consciously or not – about whales, and their relations with whales, in the water.

17) *When you are boating and whales are in the area, do you seek them out or continue on your way?*
Seek out, Continue on

18) *Do you enjoy watching whales when you are boating?* Yes, No,

19) *Do you think you should change your boating behavior when whales are nearby?* Yes, No, Maybe, Don't know

20) *When you are boating, is your first concern the task you are out to accomplish - such as fishing, or getting from point A to point B?* Yes, No, Sometimes

20a) *If yes, do whales being in the area ever get in the way of your task?*

1 (Every time) 2 3 4 5 (Never)

21) *When you are boating near whales, do you hope they will come close or do something spectacular (like breach or tail slap or spyhop)?*

1 (Always) 2 3 4 5 (Never)

22) *Do you feel a sense of guardianship over whales (e.g., do you go out of your way to keep them safe when you are boating)?* Yes, No, Don't know

Section 3a: The Whale Warning flag

This section addresses your knowledge of the Whale Warning flag.

WHALE WARNING FLAG



23) *Did you see this flag flying this summer?* Yes, No

23a) *If yes, did you think the flag was it of sufficient size?*

1 (Yes I could see it clearly on other boats) 2 3 4 5 (IT was too small and I could not see it clearly on other boats)

24) *If you saw a boat or land station flying this flag, do you know what it means?*

1 (yes) 2 3 4 5 (no)

25) *If you saw a boat or land station flying this flag, would you see the flag as a warning?* Yes, No, Maybe

25a) *If no, please explain briefly what this flag indicates to you?* (long answer)

26) *What are the 3 key things you should do if you see the flag?* (long answer)

27) *If you saw a boat or land station flying a whale warning flag, would this have any effect on how you are boating? e.g. would you slow down?*

1 (Every Time) 2 3 4 5 (Never)

28) *If you had a Whale Warning flag on your boat, would you raise the flag when you are in the vicinity of whales?*

1 (100% likely) 2 3 4 5 (I would not)

29) *Do you think the introduction of a Whale Warning flag will make a difference in how boaters behave around whales?* Yes, No, Maybe, Don't Know, Other:

Section 3b: Using the Whale Warning flag

This section is for those that received a Whale Warning flag in 2018

30) *Did you receive a flag this summer?* Yes, No

31) *Did you encounter whales when boating this summer?* Yes, No

31a) *If yes, did you fly the flag?* Yes, No

32) *If you did encounter whales but did not fly the flag why not?*

- Unable to rig the flag on my boat
- Forgot to raise the flag
- Did not want to raise the flag
- Other

33) *Did you find the flag challenging to use?* Yes, No, Maybe

34) *Should there be different size flags available depending on the size of your vessel?* Yes, No, other:

35) *In the future would you be willing to pay a small fee for the flag?* Yes, No, Maybe

36) *Do you have additional comments to share regarding the Whale Warning flag? e.g. Can we improve the flag? Where else should we share the information on the flag?*

Thank you for your time in completing this survey. Any final comments

2019 pre-season survey: Boating with Whales in the Salish Sea:

The core critical habitat of the endangered Southern Resident killer whale is located in the heart of the Salish Sea within the San Juan Islands. When Southern Residents are present in the Salish Sea during the spring, summer and fall there are vessels within acoustic range of the whales virtually all the time hindering their ability to navigate, detect increasingly scarce prey, and communicate.

In an effort to address vessel impacts around the San Juan Islands the County and the San Juan County Marine Resources Committee are piloting the use of a Whale Warning Flag.

This post-season survey is part of this pilot study. The survey aims to measure public knowledge, attitude and actions related to boating with whales in the Salish Sea and the use of the Whale Warning Flag. The survey is anonymous and open to all interested in participating, but particularly those who are residents and visitors to San Juan County.

Thank you for your time. The survey is in 3 sections and should take approximately 5 minutes to complete.

1) *Did you complete any surveys in 2018?*

- Yes - pre-season survey only
- Yes - post-season survey only
- Yes - pre- and post-season surveys
- No

2) *Are you a resident of San Juan County?* Yes, No

3) *If you visited, where did you visit from?*

- A neighboring County (e.g., Whatcom, Skagit, Islands, Jefferson)
- Seattle and South Puget Sound
- Outside Washington State
- Canada
- Another Country

4) *Do you own a boat?* Yes, No

5) *If yes, what kind of boat do you own?*

- Small non-motorized (e.g., kayak or row boat)
- Private small open motorized
- Private medium cabin
- motorized Private
- large motorized
- Sail Boat
- Eco-tour kayak
- Eco-tour - vessel
- Government Agency / Enforcement
- Research
- Commercial Fishing
- Tribal Fishing

6) *How long have you been boating in the San Juans?*

- 0-1 years
- 2-5 years
- 6-10 years
- 11-20 years
- 21- 30 years
- 31 - 40 years
- 41 - 50 years
- > 50 years

7) *What is your main boating purpose?*

- Recreation e.g., visiting other islands
- Recreational whale watching
- Recreational fishing
- Commercial fishing
- Tribal fishing
- Commercial whale watching & wildlife Tours
- Research
- Government work (e.g., County, State or Federal)

Section 1: Knowledge/Perception

This section asks questions related to your awareness, and the information that you possess about boating around whales in the Salish Sea.

WHALE WISE BOATING

- 8) *Are you familiar with the Be Whale Wise Guidelines and regulations?* Yes, No
- 8a) *If yes, do you think you are able to follow them?* Yes, No, Maybe
- 8b) *If yes, what are the most important Be Whale Wise Guidelines and Regulations a boater can* (long answer)
- 9) *If you are in the vicinity of whales how many yards should you maintain between you and the whales?* (long answer)
- 10) *When you see a grouping of boats on the water, could that mean whales are present?* Yes, No, Maybe
- 11) *If you see a bait ball, or birds swooping in one area could that mean whales might be in the area?* Yes, No, Maybe
- 12) *If you answered yes to Questions 10 and/or 11, do you adjust your boating to follow the guidelines?* Yes, No, Maybe

DANGERS

- 13) *To the best of your knowledge, have boats collided with whales in this general area in recent times?* Yes, No, Don't know
- 14) *Do you think boat-whale collisions are dangerous to whales?* Yes No, Don't know
- 15) *Do you think boat-whale collisions are dangerous to people?* Yes, No, Don't know

Section 2: Attitudes towards whales

This section addresses the wider sociocultural orientations boaters have – consciously or not – about whales, and their relations with whales, in the water.

- 16) *When you are boating and whales are in the area, do you seek them out or continue on your way?* Seek out, Continue on
- 17) *Do you enjoy watching whales when you are boating?* Yes, No
- 18) *Do you think you should change your boating behavior when whales are nearby?* Yes, No, Maybe, Don't know
- 19) *When you are boating, is your first concern the task you are out to accomplish - such as fishing, or getting from point A to point B?* Yes, No, Sometimes
- 19a) *If yes, do whales being in the area ever get in the way of your task?*
- 1(Every time) 2 3 4 5 (Never)
- 20) *When you are boating near whales, do you hope they will come close or do something spectacular (like breach or tail slap or spyhop)?*
- 1(Always) 2 3 4 5(Never)
- 21) *Do you feel a sense of guardianship over whales (e.g., do you go out of your way to keep them safe when you are boating)?* Yes, No, Don't know

Section 3a: The Whale Warning Flag

This section addresses your knowledge of the Whale Warning Flag.

WHALE WARNING FLAG

22) *Do you know about the Whale Warning Flag?* Yes, No

23) *Do you know what it means if a boat is flying the flag?*

1(Yes) 2 3 4 5(No)

24) *What are the 3 key things you should do if you see the flag?* (long answer)

25) *If you saw a boat or land station flying this flag, would you see the flag as a warning?* Yes, No, Maybe

25a) *If no, please explain briefly what this flag indicates to you?* (long answer)

26) *If you saw a boat or land station flying a whale warning flag, would this have any effect on how you are boating? e.g. would you slow down?*

1(Every time) 2 3 4 5(Never)

27) *If you had a Whale Warning Flag on your boat, would you raise the flag when you are in the vicinity of whales?*

1(100% Likely) 2 3 4 5 (I would not)

28) *Do you think the introduction of a Whale Warning Flag will make a difference in how boaters behave around whales?* Yes, No, Maybe, Don't Know Other:

Section 3b: For those that used the Whale Warning Flag in 2018

This section is for those that received a Whale Warning Flag in 2018

29) *Did you receive a flag in 2018?* Yes, No

30) *Did you encounter whales when boating in 2018?* Yes, No

30a) *If yes, did you fly the flag?* Yes, No

31) *If you did encounter whales but did not fly the flag why not?*

- Unable to rig the flag on my boat Forgot to raise the flag
- Did not want to raise the flag
- Afraid it would draw attention to the whales
- Other

32) *Did you find the flag challenging to use?* Yes, No, Maybe

33) *Do you have additional comments to share regarding the Whale Warning Flag? e.g. Can we improve the flag? Where else should we share the information on the flag?*

Thank you for your time in completing this survey. Any final comments

2019 post-season survey: Boating with Whales in the Salish Sea:

The core critical habitat of the endangered Southern Resident killer whale is located in the heart of the Salish Sea within the San Juan Islands. When Southern Residents are present in the Salish Sea during the spring, summer and fall there are vessels within acoustic range of the whales virtually all the time hindering their ability to navigate, detect increasingly scarce prey, and communicate.

In an effort to address vessel impacts around the San Juan Islands the County and the San Juan County Marine Resources Committee are piloting the use of a Whale Warning Flag.

This final post-season survey is part of this pilot study. The survey aims to measure public knowledge, attitude and actions related to boating with whales in the Salish Sea and the use of the Whale Warning Flag. The survey is anonymous and open to all interested in participating, but particularly those who are residents and visitors to San Juan County. Thank you for your time. The survey is in 3 sections and should take approximately 5-10 minutes to complete.

1) *Did you complete any surveys in 2018 or 2019?*

- Yes - 2018 pre-season survey only
- Yes - 2018 post-season survey only
- Yes - 2018 pre- and post-season surveys
- Yes- 2019 Pre-season survey
- Yes 2018 and 2019 surveys
- No
- Other:

2) *Are you a resident of San Juan County? Yes, No*

3) *If you visited, where did you visit from?*

- A neighboring County (e.g., Whatcom, Skagit, Islands, Jefferson)
- Seattle and South Puget Sound
- Outside Washington State
- Canada
- Another Country

4) *Do you own a boat? Yes, No*

5) *If yes, what kind of boat do you own?*

- Small non-motorized (e.g., kayak or row boat)
- Private small open motorized
- Private medium cabin motorized
- Private large motorized
- Sail Boat
- Eco-tour kayak
- Eco-tour - vessel
- Government Agency / Enforcement
- Research
- Commercial Fishing
- Tribal Fishing
- Other:

6) *How long have you been boating in the San Juans?*

- 0-1 years
- 2-5 years
- 6-10 years
- 11-20 years
- 21- 30 years
- 31 - 40 years
- 41 - 50 years
- > 50 years

7) *What is your main boating purpose?*

- Recreation e.g., visiting other islands
- Recreational whale watching
- Recreational fishing
- Commercial fishing
- Tribal fishing
- Commercial whale watching & wildlife Tours
- Research
- Government work (e.g., County, State or Federal)

Section 1: Knowledge/Perception

This section asks questions related to your awareness, and the information that you possess about boating around whales in the Salish Sea.

WHALE WISE BOATING

8) *Are you familiar with the Be Whale Wise Guidelines and regulations? Yes, No*

8a) *In 2019 the Be Whale Wise regulations changed in Washington State (and Canada), did you know the regulations had changed? Yes, No, Maybe*

8b) *Do you know what the new regulations are? Yes, No, Other:*

8c) *If yes, can you list the two key regulations that you must now follow in Washington state (long answer)*

8d) *Where did you find out about the new regulations (click all that apply)? Check all that apply.*

- Anacortes Boat Show
- Dock talks in San Juan County
- Signage at docks
- Public presentation
- Through the media
- Through social media
- From Soundwatch or WDFW enforcement
- Through the bewhalewise.org website
- Other:

9) *If you are in the vicinity of whales how many yards should you now maintain between you and the whales (with the new 2019 regulations)?* (long answer)

10) *When you see a grouping of boats on the water, could that mean whales are present?* Yes, No, Maybe

11) *If you see a bait ball, or birds swooping in one area could that mean whales might be in the area?*
Yes, No, Maybe

12) *If you answered yes to Questions 10 and/or 11, do you adjust your boating to follow the guidelines?*
Yes, No, Maybe

DANGERS

13) *To the best of your knowledge, have boats collided with whales in this general area in recent times?*
Yes, No, Don't know

14) *Do you think boat-whale collisions are dangerous to whales?* Yes, No, Don't know

15) *Do you think boat-whale collisions are dangerous to people?* Yes, No, Don't know

Section 2: Attitudes towards whales

This section addresses the wider sociocultural orientations boaters have – consciously or not – about whales, and their relations with whales, in the water.

16) *When you are boating and whales are in the area, do you seek them out or continue on your way?*
Seek out, Continue on

17) *Do you enjoy watching whales when you are boating?* Yes, No

18) *Do you think you should change your boating behavior when whales are nearby?* Yes, No, Maybe, Don't know

19) *When you are boating, is your first concern the task you are out to accomplish - such as, fishing, or getting from point A to point B?* Yes, No, Sometimes

19a) *If yes, do whales being in the area ever get in the way of your task?*

1(Every time) 2 3 4 5(Never)

20) *When you are boating near whales, do you hope they will come close or do something spectacular (like breach or tail slap or spyhop)?*

1(Always) 2 3 4 5(Never)

21) *Do you feel a sense of guardianship over whales (e.g., do you go out of your way to keep them safe when you are boating)?* Yes, No, Don't know

Section 3a: The Whale Warning Flag

This section addresses your knowledge of the Whale Warning Flag.

WHALE WARNING FLAG

22) *Do you know about the Whale Warning Flag?* Yes, No

23) *Do you know what it means if a boat is flying the flag?*

1(Yes) 2 3 4 5(No)

24) *What are the 3 key things you should do if you see the flag? (long answer)*

25) *If you saw a boat or land station flying this flag, would you see the flag as a warning? Yes, No, Maybe*

25a) *If no, please explain briefly what this flag indicates to you? (long answer)*

26) *If you saw a boat or land station flying a whale warning flag, would this have any effect on how you are boating? e.g. would you slow down?*

1(Every time) 2 3 4 5(Never)

27) *If you had a Whale Warning Flag on your boat, would you raise the flag when you are in the vicinity of whales?*

1(100% Likely) 2 3 4 5(I would not)

28) *Do you think the introduction of a Whale Warning Flag will make a difference in how boaters behave around whales? Yes, No, Maybe, Don't Know, Other:*

Section 3b: For those that used the Whale Warning Flag in 2018 and/or 2019

This section is for those that received a Whale Warning Flag in 2018

29) *Did you receive a flag in 2018 or 2019? Yes, No*

30) *Did you encounter whales when boating in 2018 or 2019?*

- Yes - 2018 only
- Yes 2019 only
- Yes 2018 and 2019
- No

30a) *If yes, did you fly the flag? Yes, No*

31) *If you did encounter whales but did not fly the flag why not?*

- Unable to rig the flag on my boat
- Forgot to raise the flag
- Did not want to raise the flag
- Afraid it would draw attention to the whales
- Other

32) *Did you find the flag challenging to use? Yes, No, Maybe*

33) *Do you have additional comments to share regarding the Whale Warning Flag? e.g. Can we improve the flag? Where else should we share the information on the flag?*

Thank you for your time in completing this survey. Any final comments

Appendix 4. Photographs of the flag in action and outreach efforts from dockside efforts to the Seattle Boat Show.



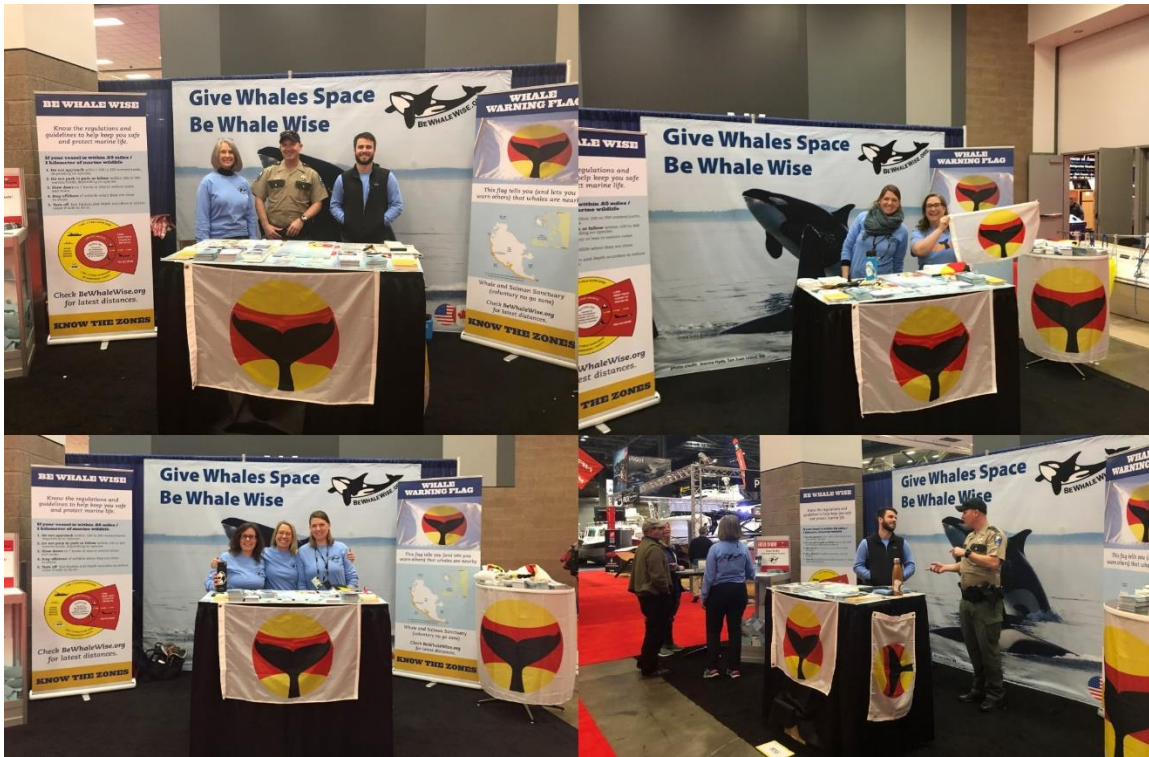
Example of the dockside signage located at the Port of Friday Harbor.



Examples of vessels flying the whale warning flag. Photos courtesy of Jeanne Hyde, The Whale Museum, John Boyd, and Five Star Whale Watching.



Examples of the whale warning flag in action at Lime Kiln Point State Park, photos courtesy of Jeanne Hyde.



Photos of the outreach effort at the Seattle Boat Show, volunteers included members of Soundwatch, San Juan County, The Governor's Orca Task Force, NOAA, WDFW and non-profits Orca and Whale Scout.



Examples of the dockside outreach efforts conducted on San Juan Island during summer 2018.