PACIFIC WHALE WATCH ASSOCIATION

2023 SIGHTINGS & SENTINEL ACTIONS

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Credit: Sara Shimazu, Maya's Legacy

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PWWA guests view a humpback whale. *Credit: Shaun Parniak, Ocean EcoVentures*

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INTRODUCTION

A PWWA vessel views Bigg's killer whales from a distance. *Credit: Erin Gless, PWWA*

The Pacific Whale Watch Association

The Pacific Whale Watch Association (PWWA) is a community of ecotourism professionals with a shared commitment to education, conservation, and responsible wildlife viewing in Washington state and British Columbia. PWWA member companies educate and inspire roughly 400,000 guests each year.

Established in 1994 as the Whale Watch Operators Association Northwest (WWOANW), the PWWA was originally formed by local whale watch operators to share wildlife sightings and establish voluntary whale watch guidelines before the existence of formal laws. Since that time, vessel regulations have been implemented in both Washington and British Columbia, many based on the PWWA's original recommendations.

The PWWA's functions have since evolved beyond simply sharing wildlife sightings and promoting sustainable whale watch practices. The PWWA now actively contributes toward Salish Sea wildlife research, participates in conservation advocacy efforts, and conducts educational outreach both on and off the water.

While whales can be seen year-round in local waters, due to weather conditions, peak season for PWWA whale watch activity is typically March through October. Some PWWA operators offer wildlife tours in winter as conditions permit. The PWWA fleet comprises a variety of vessel types including rigid hull inflatable boats (RHIB's), sailboats, monohull vessels, catamarans, and kayaks. Tours vary in length from a few hours to full-day specialty excursions or even overnight expeditions.

Whale watching activity within the PWWA is highly collaborative, with open sharing of information among members. PWWA operators communicate whale sightings, sentinel actions (detailed later in this report), and other pertinent information with each other using a variety of exclusive tools. These tools include an encrypted UHF radio channel and the private PWWA App.

Other benefits of PWWA membership include resources to stay current with evolving whale watching regulations and best-available marine mammal science. These resources include annual driver and naturalist training sessions, access to private PWWA social media groups, bi-weekly membership newsletters, and an online literature library of relevant peer-reviewed scientific articles.

During the 2023 whale watch season, there were **30** PWWA member companies departing from **24** different locations throughout Washington and British Columbia. **14** PWWA member companies were based in British Columbia, and **16** member companies were based in Washington.

2023 British Columbia PWWA Members

- BC Whale Tours
- Eagle Wing Whale & Wildlife Watching Tours
- Five Star Whale Watching
- Ocean EcoVentures
- Orca Spirit Adventures
- Prince of Whales Whale Watching
- Salt Spring Adventures
- Sidney Whale Watching
- Sooke Whale Watching
- SpringTide Whale Watching & Eco Tours
- Steveston Seabreeze Adventures
- Vancouver Whale Watch
- White Rock Sea Tours
- Wild Whales Vancouver

2023 Washington PWWA Members

- All Aboard Sailing
- Anacortes Whale Watching Tours
- Blue Kingdom Tours
- Deception Pass Tours
- Deer Harbor Charters
- FRS Clipper
- Island Adventures Whale Watching
- Maya's Legacy Whale Watching
- Outer Island Excursions
- Puget Sound Express
- San Juan Cruises
- San Juan Excursions
- San Juan Outfitters
- San Juan Safaris
- Spirit of Orca Whale & Wildlife Tours
- Western Prince Whale & Wildlife Tours

Map of 2023 PWWA departure locations.
Credit: Google Maps

THE PWWA APP

Bigg's killer whale T65A "Artemis". *Credit: Sam Murphy, Island Adventures Whale Watching*

The PWWA App

One of the most important tools used by PWWA operators is the PWWA App. This private app was developed by Johannes Krieger, co-owner of PWWA member company San Juan Excursions, in the summer of 2018. Designed to more effectively share and record wildlife sightings, and to better coordinate the PWWA fleet's viewing efforts, the PWWA App allows authorized users to receive and report real-time wildlife sightings, sentinel actions, and important navigational alerts on their Apple or Android devices.

The PWWA App has revolutionized whale watching operations in the Salish Sea and northern Vancouver Island regions. Since 2018, the PWWA App has expanded its userbase beyond members of the PWWA to also include whale watch operators with the North Island Marine Mammal Stewardship Association (NIMMSA) and Campbell River Association of Tour Operators (CRATO).

In addition to these professional whale watching organizations, the PWWA has also granted PWWA App access to a growing number of non-whale watch users including researchers, commercial vessel pilots, ferry captains, marine mammal observers, emergency responders, educators, the Canadian Coast Guard's Marine Mammal Desk, and the new United States Coast Guard's Cetacean Desk. The PWWA App provides complimentary access to qualified users who can demonstrate that their access would benefit local whales.

PWWA App Reporting Procedures

All users of the PWWA App are expected to contribute real-time wildlife sightings. In addition to wildlife sightings, PWWA App users also report sentinel actions and relevant navigational alerts as they occur.

PWWA operators are advised, at minimum, to log in the PWWA App when they first arrive on scene with whales and when they depart. Creating additional update logs throughout each encounter is encouraged. Operators are asked to log all whale sightings, even if another vessel has already reported a whale or group of whales. This keeps the fleet updated on whale locations, IDs, and interesting behavioral notes. Wildlife entries in the PWWA App are not ***unique*** sightings. The same animal or group of animals may be reported multiple times in a day. The primary goal of the PWWA App is to provide real-time sightings of cetaceans and other notable wildlife, not to estimate wildlife abundance.

Providing frequent updates of the same whale or group of whales also helps PWWA operators to voluntarily regulate the number of professional vessels in the vicinity of whales at any given time.

Most entries in the PWWA App are ***GPS*** entries. GPS entries include the time and date of each sighting and the GPS coordinates of the reporter at the time the entry is logged. If a user is in a remote area with poor cellular reception, the details and location of the sighting will be saved at the time the entry is made and uploaded once reception is restored. This ensures that the details of the sighting are accurately captured.

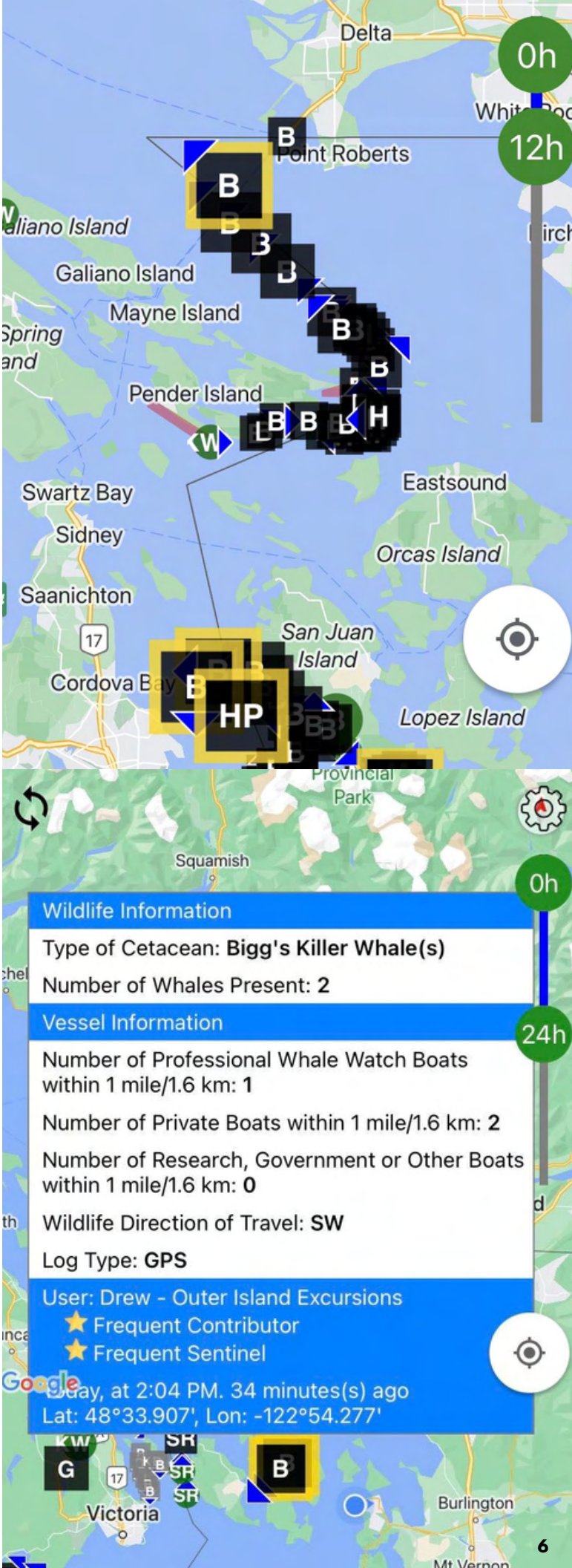
PWWA App users may also create ***manual*** entries by selecting an approximate location on a map. Manual entries are used to share secondhand or shore-based sightings. Users are encouraged to make manual entries only if they come from a reliable source, or if they themselves are viewing animals from shore. These reports are distinguished in the PWWA App from GPS reports by the shape of icon that appears on the screen (square for GPS, circle for manual).

Reporting Wildlife Sightings

The majority of entries in the PWWA App are wildlife sightings. While larger cetaceans (killer whales, minke whales, humpback whales, and gray whales) are the predominant species reported, smaller cetaceans, such as Dall's porpoise, harbor porpoise, and Pacific white-sided dolphins, or other noteworthy marine mammals, such as sea otters and elephant seals, are also reported when appropriate. Reports of uncommon birds are also encouraged in the PWWA App.

For wildlife reports to the PWWA App, some of the details collected include:

- Type of wildlife
- Approximate number of animals present
- Individual IDs of animal(s) if known
- Travel direction of animal(s)
- Interesting behavioral notes
- Number of vessels within 1 mile



Screenshots of the PWWA App showing wildlife sightings.
Credit: PWWA App

Reporting Sentinel Actions

Sentinel actions are defined by the PWWA as protective actions taken by professional whale watchers during the course of a tour to benefit whales and other wildlife. Examples of sentinel actions include:

- Stopping other vessels from speeding in the vicinity of whales
- Proactively warning vessels of whales nearby so they can adjust speed and alter course
- Reporting sick, injured, or entangled animals to proper authorities
- Removing harmful debris from the water

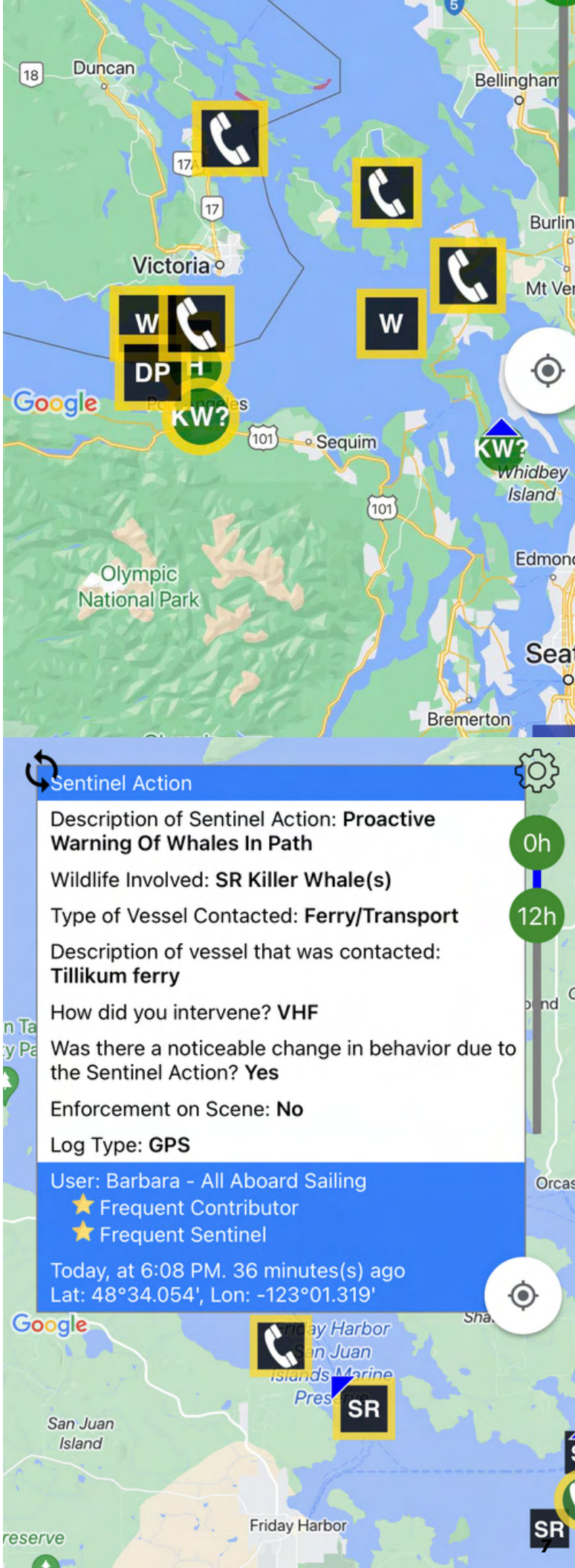
For sentinel action reports, some of the information collected by users includes:

- Description of the sentinel action
- Reason that intervention was necessary
- Species nearby (if vessel-related)
- Means of contact used
- Whether a positive change in behavior was observed as a result of the intervention
- Description of the vessel(s) contacted (if vessel-related)

Reporting "Important" Alerts

The final type of report that can be logged in the PWWA App are "important" alerts. These are miscellaneous notifications that are of urgent interest to the fleet. Examples of "important" alerts include:

- Logs or other hazards in the water
- Swimmers or divers in the vicinity
- Fishing gear set in high-traffic areas
- Advisories of scheduled military exercises
- Notifications of research or rescue activities
- Locations of entangled or injured animals



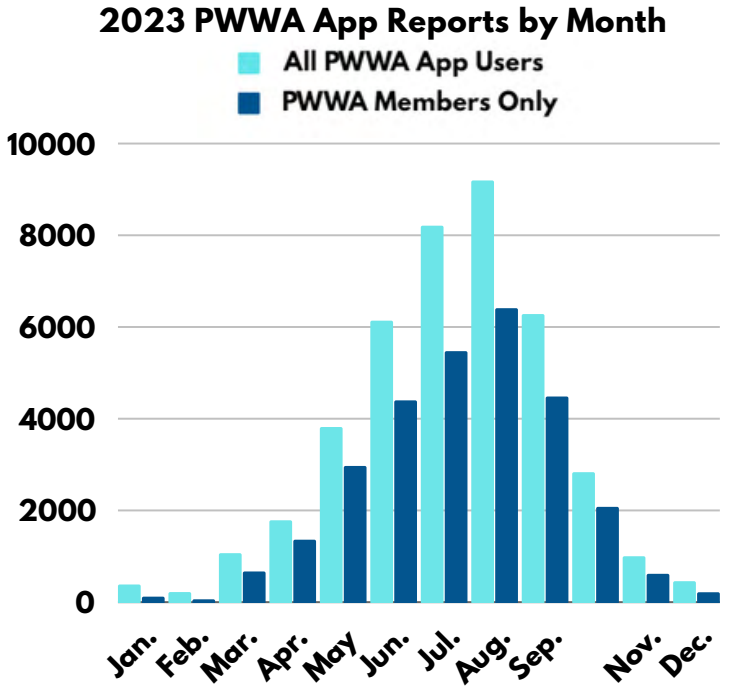
Screenshots of the PWWA App showing sample sentinel actions.
Credit: PWWA App

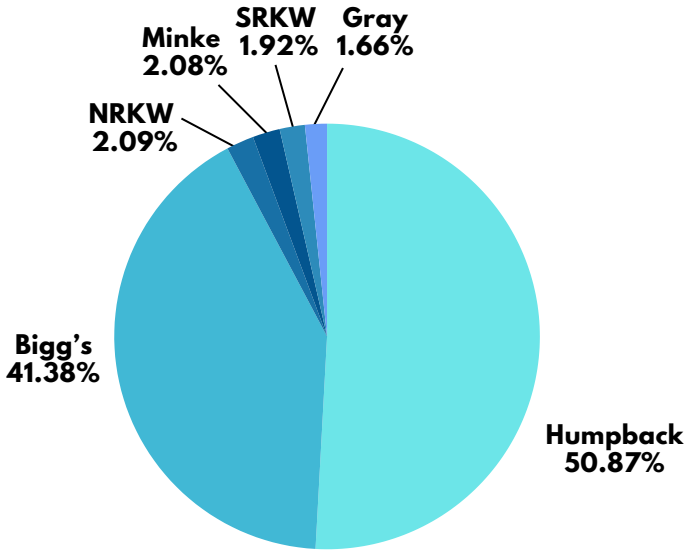
WILDLIFE SIGHTINGS

A surfacing humpback whale. *Credit: Allison Montgomery, FRS Clipper*

2023 PWWA App Usage

In 2023, a total of **41,393** logs were entered into the PWWA App by all PWWA App users. This was an **18%** increase over 2022's total of **35,039** PWWA App entries. Of all logs entered into the PWWA App in 2023, **28,862** (**70%**) were created by PWWA captains, naturalists, crew members, and support staff and **12,531** entries (**30%**) were made by non-PWWA authorized users of the PWWA App. These authorized users included operators with NIMMSA and CRATO as well as qualified members of the research, education, commercial shipping, marine transportation, and emergency response sectors of Washington and British Columbia. The majority of reports to the PWWA App were made during the spring, summer, and fall months. Relatively few reports were made during winter months due primarily to inclement weather and reduced operating schedules.





2023 PWWA App Reports by Species

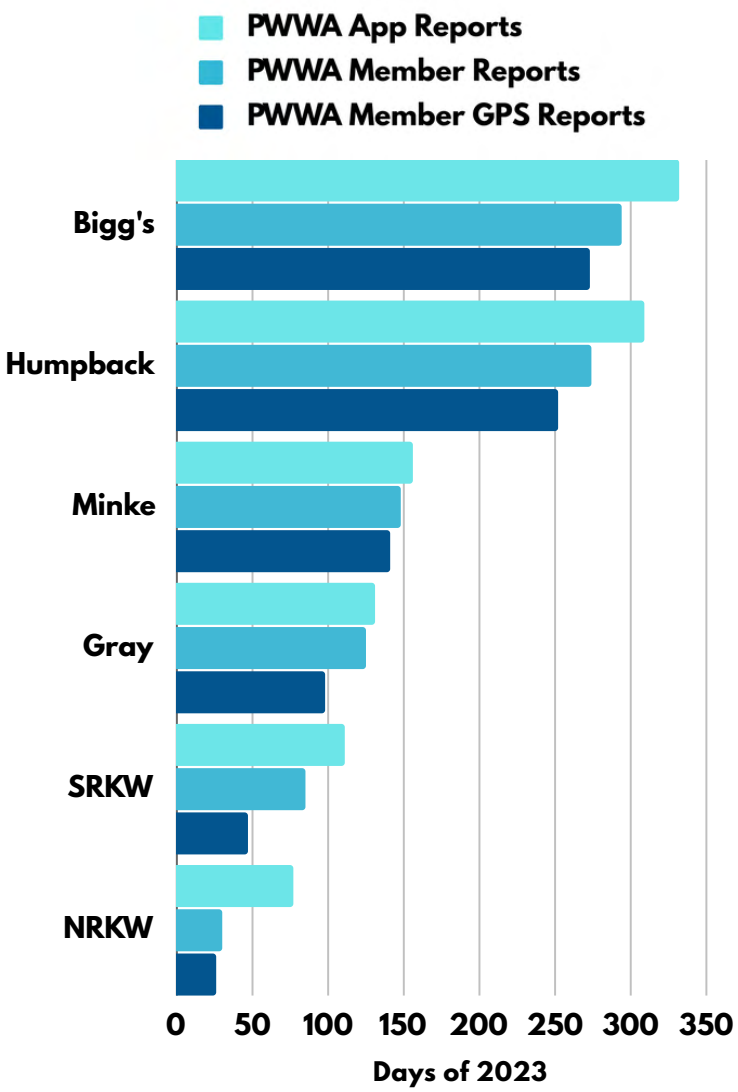
39,814 (**96%**) of PWWA App entries in 2023 were reports of whales or other wildlife. The remaining **1,579** reports (**4%**) were of sentinel actions or important safety notifications for the fleet. **33,673** reports were of the region's six primary whale species/ecotypes. Of these reports, **17,128** (**50.87%**) were of humpback whales, **13,935** (**41.38%**) were of Bigg's killer whales, **705** (**2.09%**) were of Northern Resident killer whales (NRKW), **699** (**2.08%**) were of minke whales, **645** (**1.92%**) were of Southern Resident killer whales (SRKW), and **561** (**1.66%**) were of gray whales.

2023 Whale Presence

Bigg's killer whales were reported to the PWWA App on more days of 2023 than any other whale type, reported on **332** days. Humpback whales were reported on **309** days, followed by minke whales on **156** days and gray whales on **131** days. Resident (fish-eating) killer whales were reported least frequently, with Southern Resident killer whales (SRKW) reported to the PWWA App on **111** days and Northern Residents (NRKW) reported on **77** days. It is important to emphasize that whales may have been present on more days of the year than were reported to the PWWA App.

When examining only PWWA App entries made by PWWA captains, naturalists, and crew members, Bigg's killer whales were reported on **294** days, humpback whales on **274** days, minke whales on **148** days, gray whales on **125** days, SRKW on **85** days, and NRKW on **30** days.

If including only GPS-based PWWA App entries made from aboard PWWA vessels during the course of a professional whale watch tour, Bigg's killer whales were encountered on **273** days, humpback whales on **252** days, minke whales on **141** days, gray whales on **98** days, SRKW on **47** days, and NRKW on **26** days.



Bigg's killer whales surfacing near Steller sea lions. *Credit: Cal Ekstrom, Sidney Whale Watching*

BIGG'S KILLER WHALES

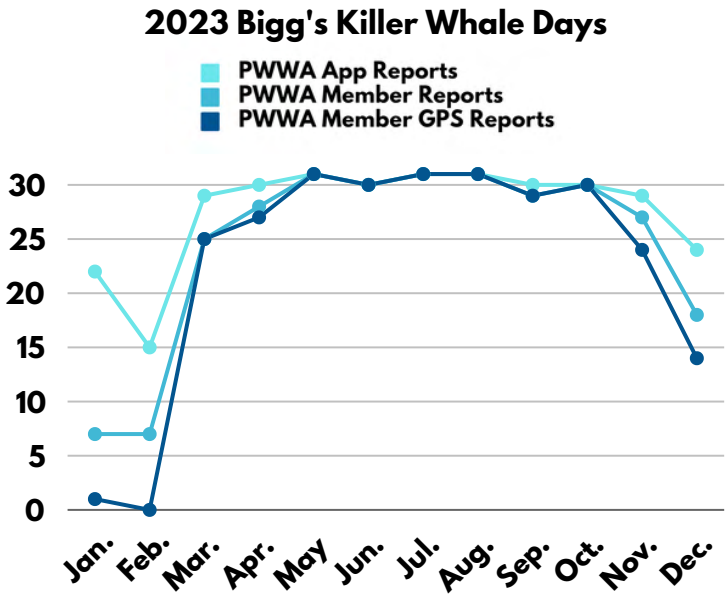
Bigg's killer whale mom and calf. *Credit: Andrew Lees, Five Star Whale Watching*

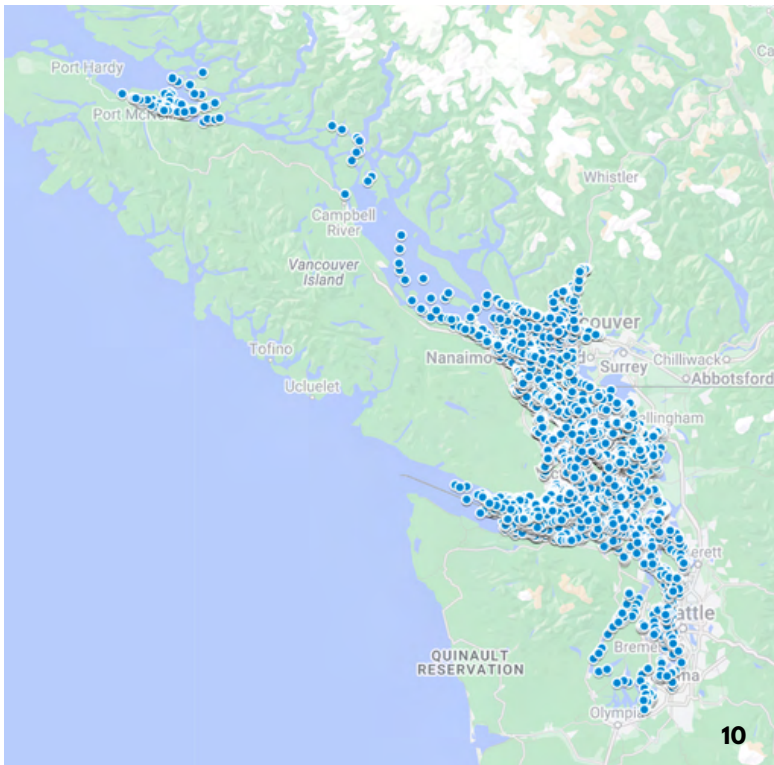
Bigg's Killer Whales

The PWWA App received **13,935** logs of Bigg's killer whales (*Orcinus orca*) in 2023. **11,993** (**86%**) of those entries were made by PWWA members, and **11,199** (**80%**) were firsthand GPS entries made aboard PWWA vessels during whale watch tours. Bigg's killer whales were reported to the PWWA App on **332** days in total, were reported by PWWA members on **294** days, and were encountered during PWWA whale watch tours on **273** days of the year.

Bigg's killer whales were present during all 12 months of the year, were reported every day April through September, and were reported almost daily March through November. The decline in PWWA App reports of Bigg's killer whales in winter was largely due to reduced whale watching effort rather than reduced whale presence. Orca Behavior Institute, an independent research organization that compiles whale sightings from professional whale watch vessels, regional sightings groups, and shore-based observers, reported that Bigg's killer whales were confirmed to be present in the Salish Sea on **344** days of 2023 (**94%** of days).

According to research group Bay Cetology, the coastal Bigg's population officially added **17** calves in 2023 — 12 born in 2023 and five born previously but not confirmed until 2023. There are approximately **380** individuals in the coastal Bigg's killer whale population currently.





Map of 2023 PWWA GPS entries for Bigg's killer whales. *Credit: PWWA App and Google Maps*

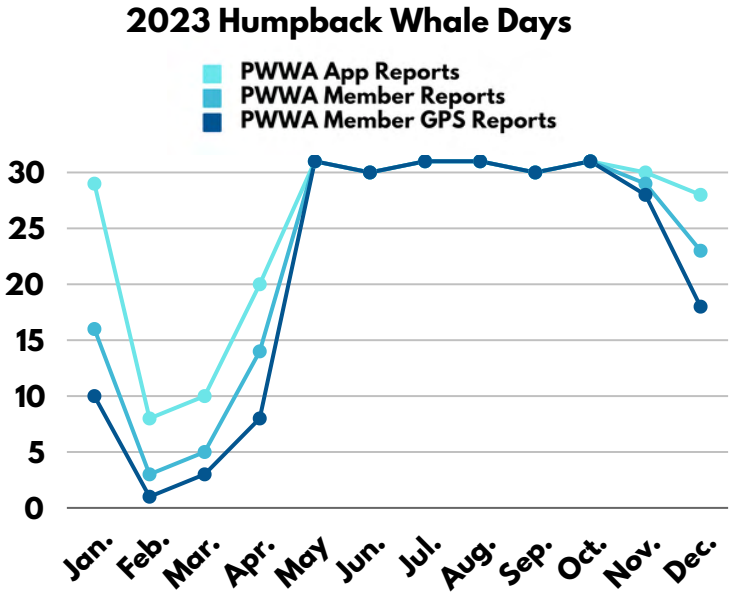
HUMPBACK WHALES

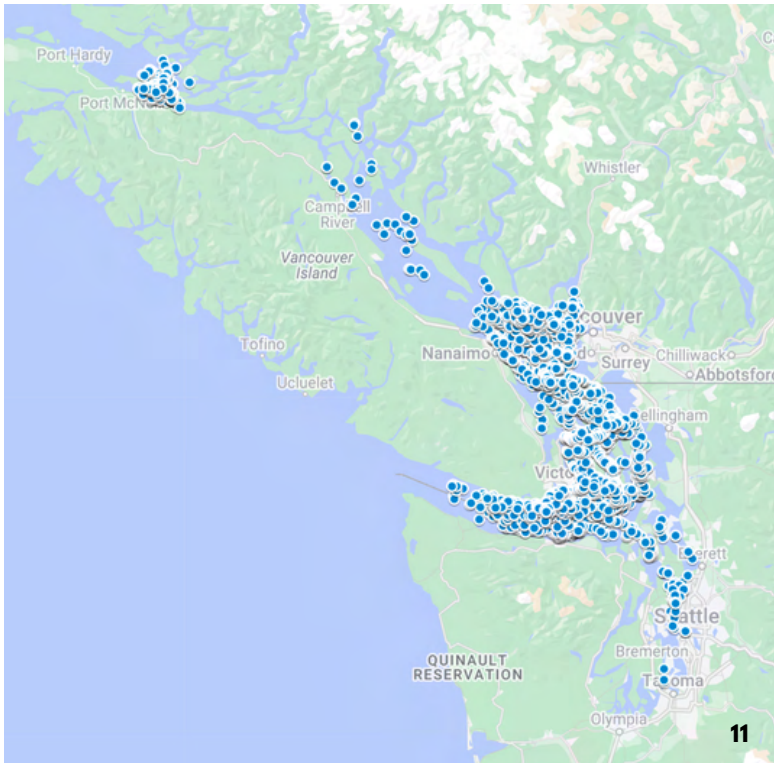
A pair of humpback whales. *Credit: Tyson Cross, SpringTide Whale Watching*

Humpback Whales

The PWWA App received **17,128** logs of humpback whales (*Megaptera novaeangliae*) in 2023. **11,101** (**65%**) of those entries were made by PWWA members, and **9,867** (**58%**) were GPS reports made from PWWA vessels during whale watch tours. Humpbacks were reported to the PWWA App by all app users on **309** total days in 2023. PWWA members reported humpback whales on **274** days, and humpback whales were encountered during PWWA whale watch tours on **252** days. Humpbacks were reported to the PWWA App at least once during every month of the year, and were observed every day during the months of May through November.

Salish Sea humpbacks are migratory, traveling to breeding grounds in Hawai'i, Mexico, and Central America in winter. The reduction in days of observed Salish Sea presence reported to the PWWA App during winter months is therefore not unexpected. While not exclusive to the Salish Sea, a recent publication shared that of **1,835** unique individual humpback whales documented in Canadian Pacific waters, **1,176** individuals (**64.1%**) were matched to Hawai'i only, **608** individuals (**33.1%**) were matched to Mexico only, and **three** individuals (**0.2%**) were matched to Central America only. In addition, **37** individuals (**2.0%**) were sighted in both Mexico and Hawai'i, and **10** (**0.5%**) were matched to both Mexico and Central America in winter (McMillan et al. 2023).





Map of 2023 PWWA GPS entries for humpback whales. *Credit: PWWA App and Google Maps*

MINKE WHALES

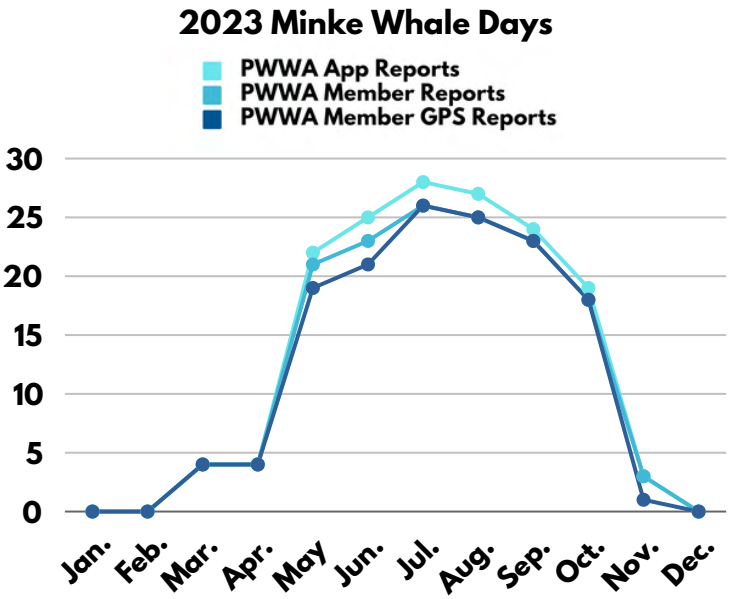
Surfacing minke whale. *Credit: Barbara Howitt, All Aboard Sailing*

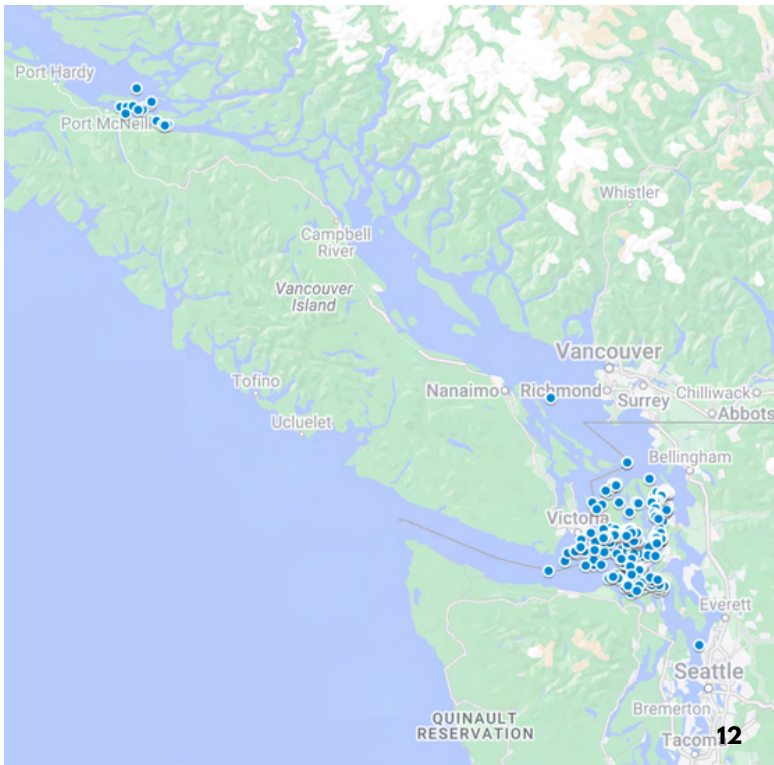
Minke Whales

The PWWA App received **699** logs of minke whale (*Balaenoptera acutorostrata*) in 2023. **663** (**95%**) of those entries were made by PWWA members, and **610** (**87%**) were firsthand GPS reports from aboard PWWA vessels during whale watch tours. Minke whales were reported to the PWWA App on **156** days in total. Minkes were reported by PWWA members on **148** days, and encountered during PWWA whale watch tours on **141** days. The PWWA App received reports of minke whales during each month from March through November, but sightings were most frequent between May and October.

The Salish Sea is a seasonal feeding ground for a small but consistent group of minke whales. The Northeast Pacific Minke Whale Project has identified **44** different Salish Sea minke whales between 2005-2020, and believes there are approximately 10-12 individual minke whales present in the Salish Sea during any given year.

On November 13, 2023, an adult minke whale, known locally as “Clone”, was killed by Bigg's killer whales in Boundary Pass. Clone had been known to the Salish Sea since at least May 2013 and, based on scarring, had survived previous killer whale attacks. Earlier in 2023, Clone was observed in what seemed to be poor physical condition, possibly attributing to its inability to escape pursuit by killer whales.





Map of 2023 PWWA GPS entries for minke whales.
Credit: PWWA App and Google Maps

GRAY WHALES

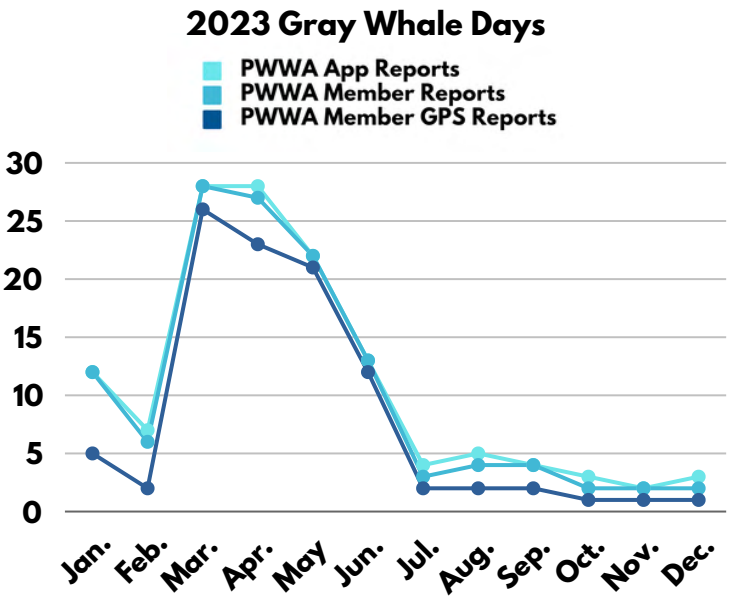
Gray whale. *Credit: Kyla Bivens, Puget Sound Express*

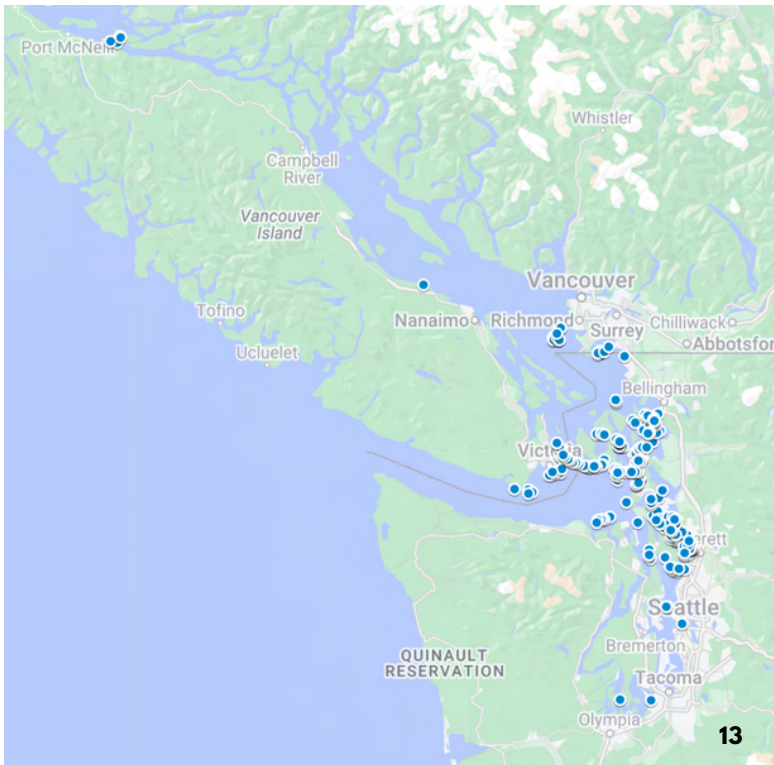
Gray Whales

The PWWA App received **561** logs of gray whales (*Eschrichtius robustus*) in 2023. **536** (**96%**) of those entries were made by PWWA members, and **417** (**74%**) of PWWA member entries were firsthand GPS reports made from PWWA vessels during whale watch tours. Gray whales were reported to the PWWA App on **131** days of 2023 in total, were reported by PWWA members on **125** days, and were encountered during PWWA whale watch tours on **98** days.

Between December 17, 2018 and November 9, 2023, Eastern North Pacific (ENP) gray whales experienced an Unusual Mortality Event (UME) throughout their range of Alaska to Mexico. During the UME, there were **690** gray whale strandings (**347** in the United States, **316** in Mexico, and **27** in Canada). The National Oceanic and Atmospheric Administration (NOAA) determined the UME was associated with localized ecosystem changes in the whales' Subarctic and Arctic feeding areas which led to malnutrition, decreased birth rates, and increased mortality. NOAA has since declared the UME to be over.

Gray whales were reported to the PWWA App on **38%** fewer days in 2023 than in 2022 (**131** days vs. **212** days). In this case, a decline in days of presence may be a ***positive*** change, and hopefully indicates less reliance on the Salish Sea as an emergency food source for gray whales who more typically feed in the Arctic during summer months.





Map of 2023 PWWA GPS entries for gray whales. *Credit: PWWA App and Google Maps*

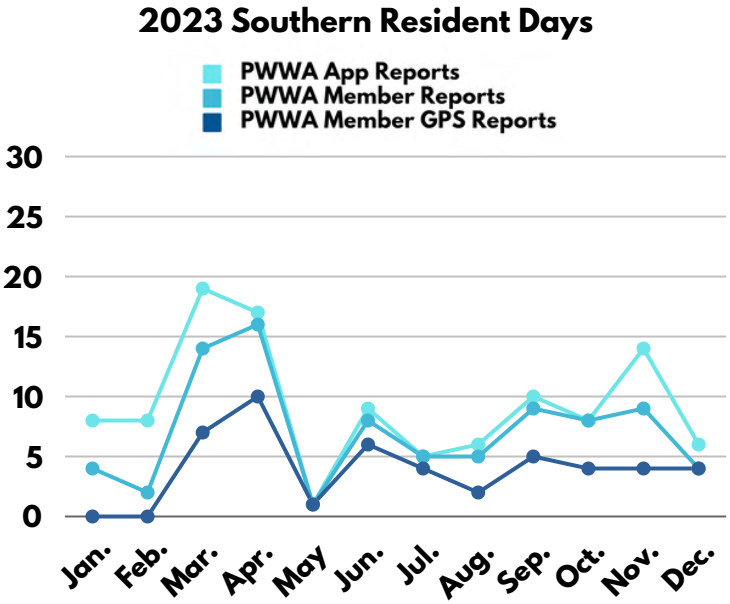
SOUTHERN RESIDENTS

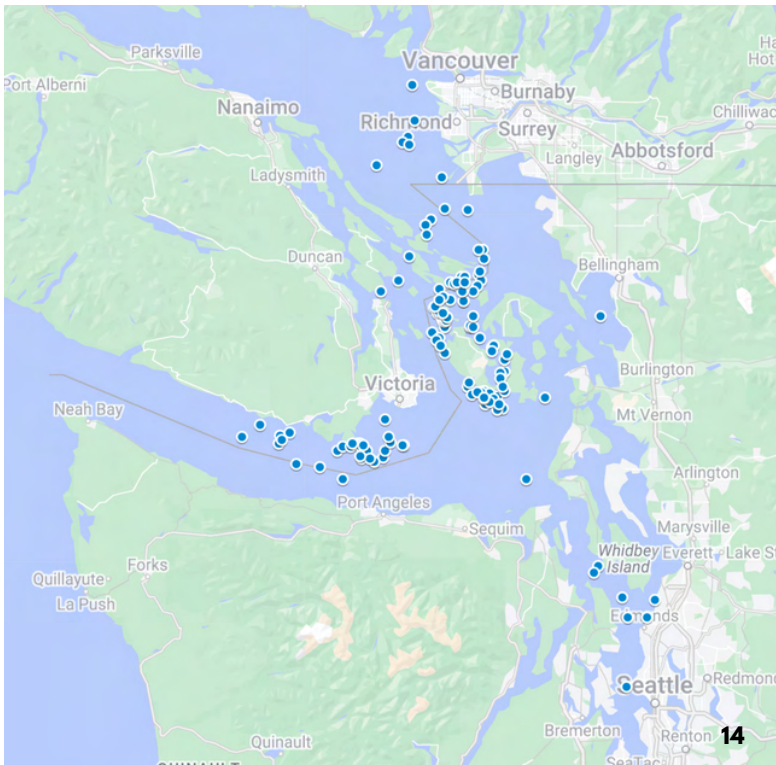
L94 and her calf new L127. *Credit: Melisa Pinnow, San Juan Excursions (taken from shore)*

Southern Resident Killer Whales

There were **645** total Southern Resident killer whale (SRKW) entries logged into the PWWA App across **111** days of 2023. Of those, **259** entries (**40%**) were made by PWWA members on **85** days. Due to restrictions on professional viewing of SRKW through the Sustainable Whale Watchers Authorization (SWWA) in BC and Commercial Whale Watching License Program (CWWLP) in Washington, it's important to note that only **126** (**20%**) of all SRKW logs to the PWWA App were firsthand GPS entries made from aboard PWWA vessels during **47** days of 2023. Most PWWA member GPS entries were made during unintentional encounters with SRKW, or were made from a distance of greater than 1,013 yards in Washington waters. **519** (**80%**) of SRKW reports were either secondhand or shore-based reports logged by PWWA members, or GPS-based reports logged by researchers, boater education groups, or other authorized users of the PWWA App outside of the PWWA.

Per Center for Whale Research, there were **74** Southern Resident killer whales as of January 2024. This count included two new L Pod calves, L126 (male) and L127 (female), both born in June 2023. A male calf, J60, was born to J Pod in late December 2023, but was sadly declared missing in January 2024. Southern Resident killer whales remain nutritionally stressed due to a decline of Chinook salmon within their core habitat (Couture et al. 2022).





Map of 2023 PWWA GPS entries for Southern Resident killer whales. *Credit: PWWA App and Google Maps*

Sustainable Whale Watchers Authorization

Since 2019, as part of an interim order by Transport Canada intended to protect SRKW, the viewing distance for ***all*** killer whales was increased from 200 meters to 400 meters in BC waters between Campbell River and Ucluelet. Transport Canada's Sustainable Whale Watchers Authorization (SWWA) allows professional whale watch operators to continue viewing non-Southern Resident killer whales from a distance of 200 meters if they agree to not intentionally view Southern Resident killer whales in BC waters. Vessels that have been granted authorization must display an authorized vessel flag, must report incidental SRKW encounters, and are required to utilize an onboard Automatic Identification System (AIS).

2023 authorized vessel flag. *Credit: Erin Gless, PWWA*

Commercial Whale Watching License Program

In 2021, Washington Department of Fish and Wildlife (WDFW) implemented the Commercial Whale Watching License Program (CWWLP) requiring any tour operator that views marine mammals in inland Washington waters to obtain a commercial whale watching license. The program requires that licensed vessels utilize AIS, that captains complete mandatory annual driver training, and that crew members report any encounters with SRKW from closer than 1/2 nautical mile (1,013 yards).

During the 2023 season, the CWWLP prohibited commercial viewing of SRKW from closer than 1/2 nautical mile except during the months of July, August, and September between the hours of 10:00 AM to 12:00 PM or 3:00 PM to 5:00 PM. The program also prohibited viewing any SRKW's deemed "vulnerable" by WDFW.

In June 2023, WDFW released their 2023 list of "vulnerable" individuals based on criteria developed by WDFW and Sealife Response, Rehabilitation, and Research (SR3). The list included two calves under the age of one year old (L126 and L127), one pregnant individual (J36), and 10 individuals deemed by SR3 to be "vulnerable" based on body condition (J16, J39, J44, J49, J53, J56, K38, L90, L110, and L117).

WDFW's licensing program not only prohibits viewing "vulnerable" individuals within the SRKW population, but also prohibits viewing any individual within one mile of those "vulnerable" individuals. As a result, WDFW's licensing rules essentially preclude professional viewing of Southern Resident killer whales in Washington from a distance of closer than 1/2 nautical mile (1,013 yards) for the entire year. These restrictions currently apply only to licensed whale watching vessels and do not apply to other classes of vessel.

In spring 2023, the Washington State Legislature passed a law to increase the SRKW approach distance from 300 yards to 1,000 yards in Washington waters. Since licensed whale watch operators, with few exceptions, have been required to maintain this distance since 2021, the significance of this new legislation is that recreational vessels will now ***also*** be subject to the 1,000 yard distance requirement. The new law will take effect on January 1, 2025 (Protection of Southern Resident orca whales 2019).

NORTHERN RESIDENTS

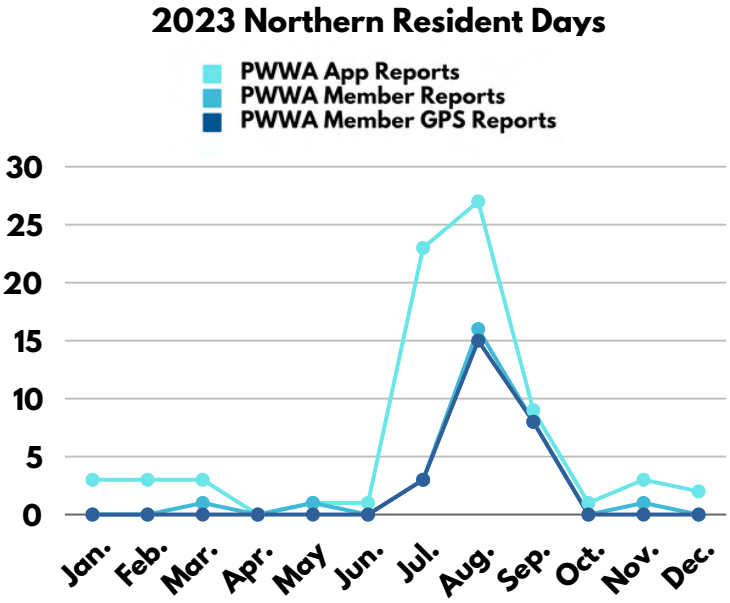
Northern Resident killer whales. *Credit: Valérie Messier, Prince of Whales*

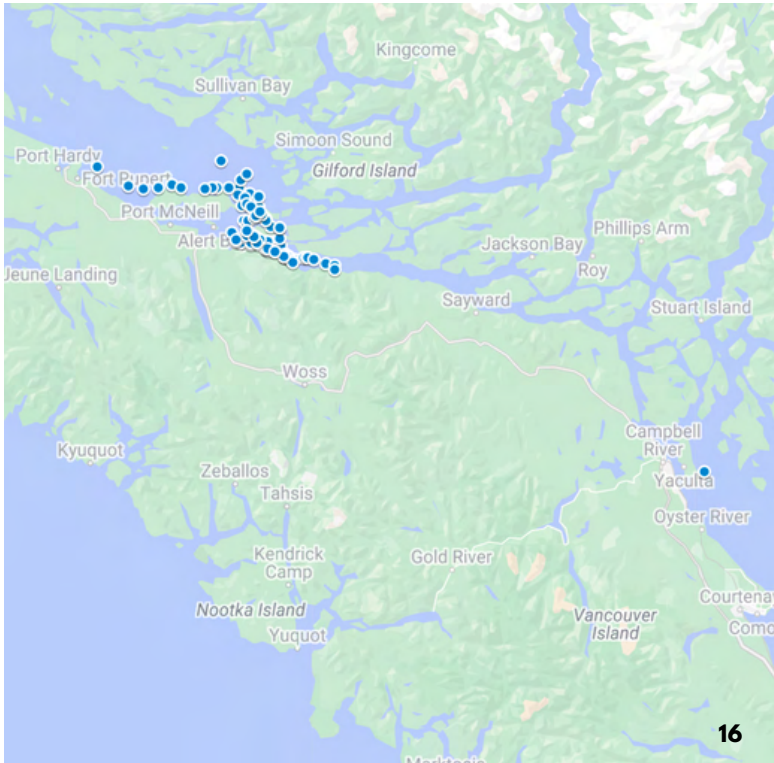
Northern Resident Killer Whales

The PWWA App received **705** entries for Northern Resident killer whales (NRKW) in 2023 across **77** days. Of those, only **124** entries (**18%**) were made by PWWA members on **30** days, and only **100** (**14%**) across **26** days were GPS-based reports made from PWWA vessels during whale watch tours.

NRKW sightings typically occur north of the PWWA's core Salish Sea operating region. In 2023, all PWWA member reports of NRKW came from a single PWWA company with a seasonal departure location in Telegraph Cove, BC on north Vancouver Island.

While the number of days NRKW were reported to the PWWA App in 2023 was slightly higher than the previous year (**77** days in 2023 vs. **75** days in 2022), the number of days NRKW were encountered by PWWA vessels specifically was significantly lower (**27** days in 2023 vs. **53** days in 2022). Whale watchers reported that NRKW spent less time near north Vancouver Island in 2023 and more time near Campbell River, a region rarely utilized by PWWA vessels. Most logs of NRKW to the PWWA App in 2023 came from members of North Island Marine Mammal Stewardship Association (NIMMSA) and Campbell River Association of Tour Operators (CRATO), two organizations that operate near Campbell River at the northern boundary of the Salish Sea.





Map of 2023 PWWA GPS entries for Northern Resident killer whales. *Credit: PWWA App and Google Maps*

SEA OTTERS

A sea otter eating a clam. *Credit: Trevor Derie, Outer Island Excursions*

Sea Otters

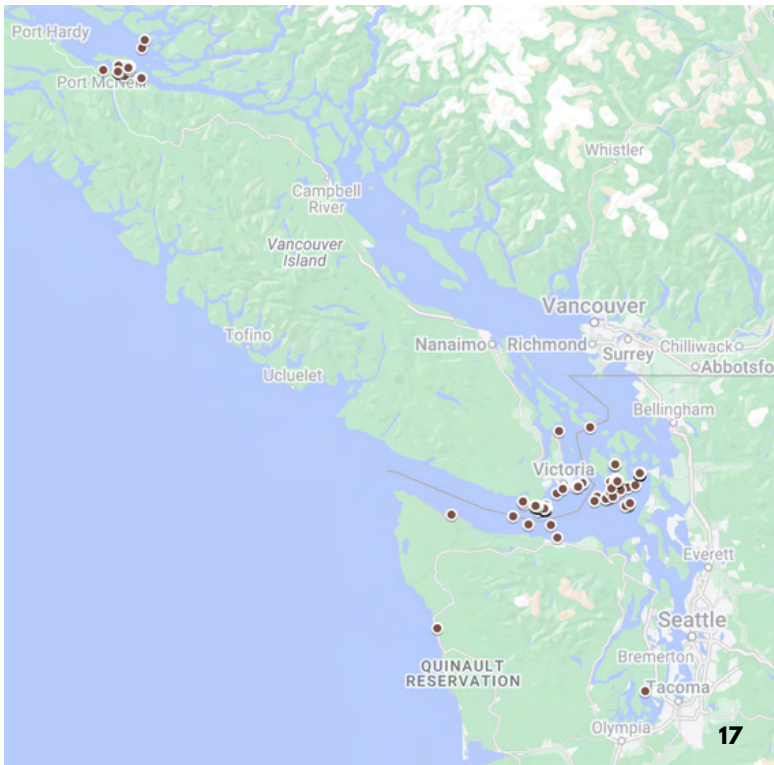
Sea otters (*Enhydra lutris),* were once commercially hunted to the brink of extinction due to demand for their dense fur coats. Thanks to reintroduction and conservation efforts, sea otters are now seen regularly on the outer coast of Washington and British Columbia as well as near north Vancouver Island. Until recently, however, sea otter sightings within the Salish Sea were rare.

In 2023, PWWA members documented **422** sightings of sea otters in the PWWA App. Of those, **366** (**87%**) of the reports were within the Salish Sea. As sea otter sightings are common near north Vancouver Island, operators in that region typically only report large rafts of sea otters to the PWWA App. It should be assumed that sea otters are encountered more frequently in that area than is reported to the PWWA App.

At least **130** (**36%**) of Salish Sea sea otter sightings were assumed or confirmed to be "Ollie", a lone male sea otter that took up residence near Race Rocks Ecological Reserve in 2015. For years, Ollie was the only sea otter known to PWWA members. In recent years, additional sea otters have appeared in inland waters, with a few establishing some level of residency. At least **56** (**15%**) Salish Sea reports in 2023 were of "Waldo", an otter first seen in Juan de Fuca Strait in 2021. At least **48** (**13%**) Salish Sea reports were of an individual known as "Dexter"/"Otis", first seen in 2022 and observed regularly in the southern San Juan Islands. These otters can be distinguished from each other by markings on their noses. For the remaining **132** (**36%**) sea otter reports made within the Salish Sea, no individual ID was provided by the reporting party.

On July 28, 2023, PWWA members observed a sea otter mother and pup southwest of Victoria, BC. This was the first and only time the PWWA has documented a sea otter pup in the Salish Sea since the association's inception in 1994. Video footage collected during the encounter was shared with scientists for WDFW and US Fish and Wildlife Service. There were no subsequent sightings of the pair.

Map of 2023 PWWA sea otter reports (manual and GPS).
Credit: PWWA App and Google Maps



SENTINEL ACTIONS

Bigg's killer whales surface in the Strait of Georgia. *Credit: Sara Shimazu, Maya's Legacy*

PWWA Sentinel Actions

Professional whale watch vessels can positively influence the behavior of other nearby boats in the vicinity of whales. This has been observed firsthand by PWWA operators as well as by independent researchers (Shields 2022).

Since 2020, PWWA members have used the PWWA App to document "sentinel actions". Sentinel actions are defined by the PWWA as actions taken by professional whale watchers during the course of a tour to protect or benefit whales and other wildlife. Similar to wildlife sightings, sentinel action reports include timestamps and GPS coordinates of each protective action.

PWWA operators help model proper operating behavior and routinely communicate with ferries, cargo ships, military vessels, and recreational boaters to alert them of whale presence. These exchanges frequently result in other vessels slowing down and/or changing course in the vicinity of whales.

Passive Sentinel Actions

The following analysis of sentinel activity does not account for any possible ***passive*** sentinel actions, or dangerous boating incidents that may have been prevented due to the mere visible presence of a PWWA vessel.

Since 2018, PWWA vessels have been encouraged to display the brightly colored Whale Warning Flag within 1 kilometer (0.62 miles) of whales. Outreach campaigns in both British Columbia and Washington encourage boaters to slow to a speed of 7 knots or less if they see a vessel flying the Whale Warning Flag.

Additionally, the PWWA App is utilized by an increasing number of authorized third-party users such as military marine mammal observers, commercial vessel pilots, ferry and water taxi captains, cetacean researchers, and the Canadian Coast Guard's Marine Mammal Desk. As of late 2023, the PWWA App is also being utilized by the newly-created United States Coast Guard's Cetacean Desk. It's likely that precautions are taken by these user groups in the vicinity of whales as a result of their direct access to real-time sightings through the PWWA App without the need for additional communication with PWWA operators. Unfortunately there is not a way to quantify that effect at this time.

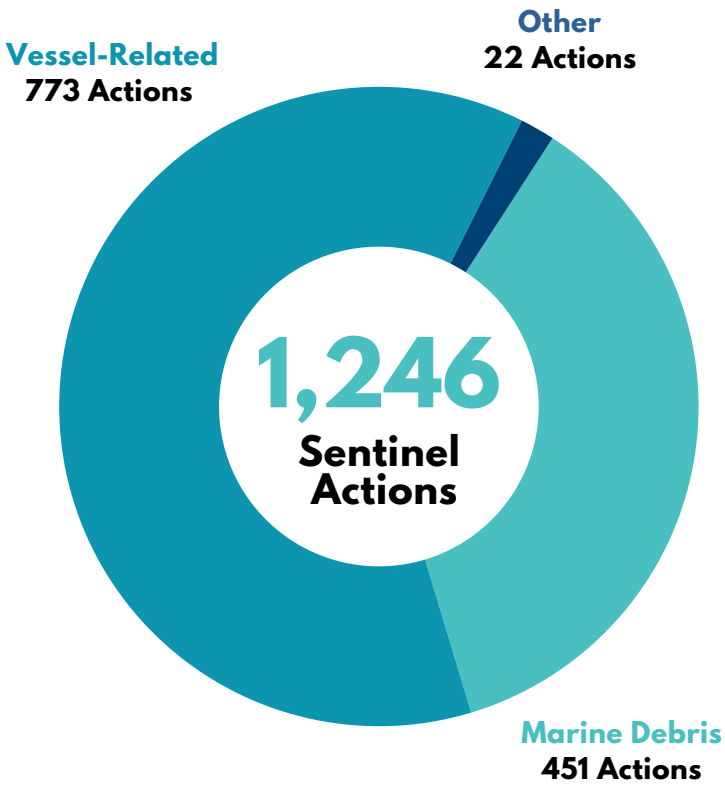
2023 Sentinel Action Summary

In 2023, PWWA captains, naturalists, and crew members documented a total of **1,246** sentinel actions during professional whale watching tours.

Vessel-related sentinel actions were the most common type of intervention documented, with **773** actions (**62%** of total sentinel actions reported). These included **407** ***reactive*** sentinel actions (**33%** of total sentinel actions reported) and **366** ***proactive*** sentinel actions (**29%** of total sentinel actions reported).

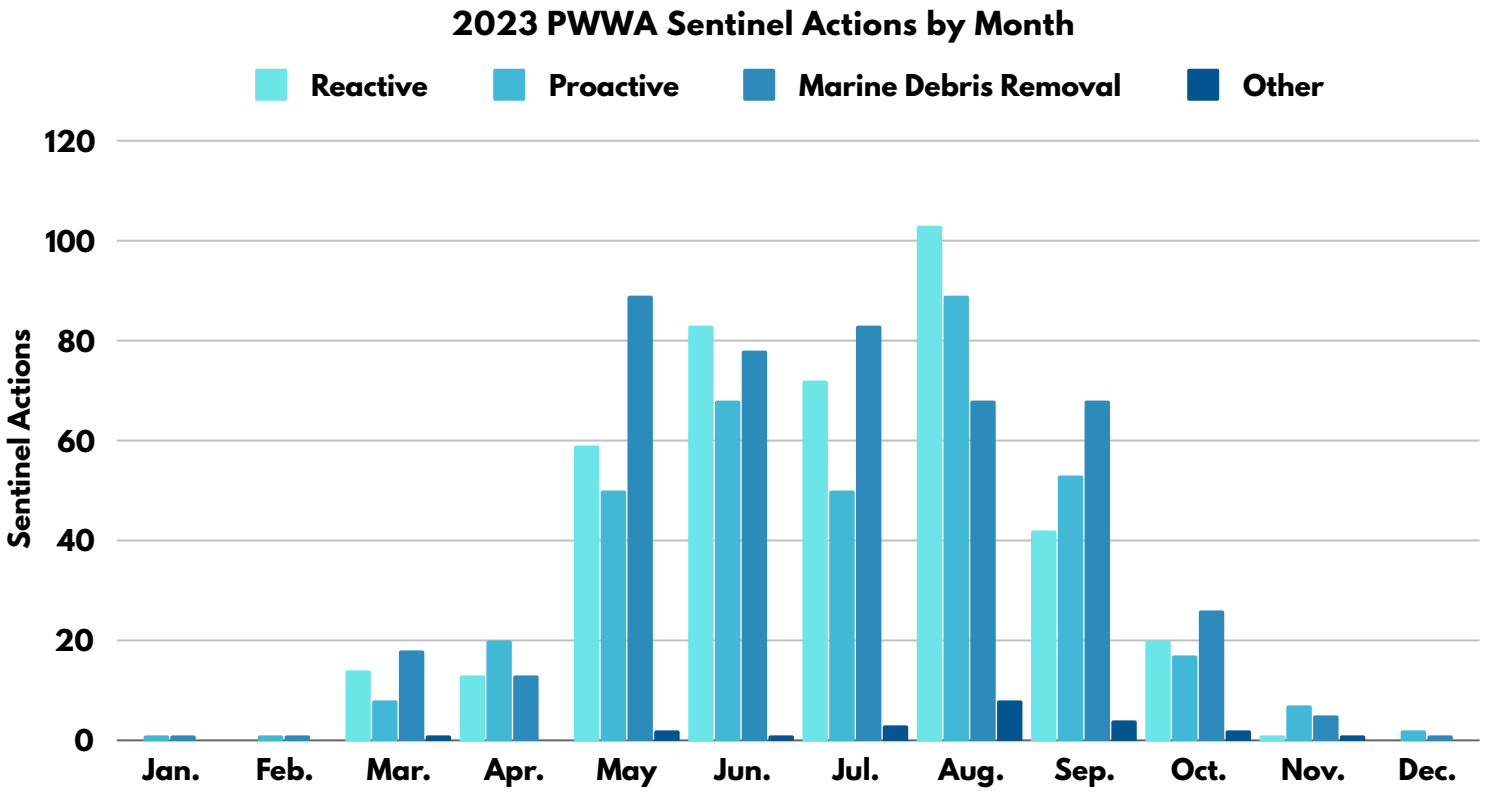
Reactive sentinel actions involve direct contact with other vessels that are traveling too fast in the vicinity of whales and/or too close to whales. Communication during reactive sentinel actions often occurs via VHF radio, a quick blast of a ship's horn, or the waving of arms or the Whale Warning Flag. *Proactive* sentinel actions involve contacting vessels before they enter the immediate vicinity of whales. Proactive communications tend to occur primarily over VHF radio.

451 sentinel actions (**36%**) involved ***marine debris removal***. Examples of harmful marine debris include balloons, Styrofoam, derelict fishing gear, plastic bags, bottles, rubber tires, and other miscellaneous garbage.



There were **20** sentinel actions (**2%**) categorized as ***"other"*** during 2023. Examples of "other" sentinel actions included reporting injured or entangled wildlife to authorities, reporting oil spills, or assisting boaters in distress.

A Bigg's killer whale in busy Juan de Fuca Strait. *Credit: Prince of Whales*



2023 Sentinel Actions by Month

The majority of 2023 PWWA sentinel actions were documented during the months of May through September. This peak in sentinel action activity corresponds directly with the peak of PWWA whale watching activity. While some PWWA member companies offer limited tour schedules in winter as weather permits, most operate only during the months of March or April through October or November. It stands to reason that more sentinel actions are logged when more PWWA vessels are on the water, and less sentinel actions are logged in wintertime when there are fewer PWWA vessels in operation.

Summer is also the season with the most recreational boating traffic, the highest amount of ferry activity throughout Washington and British Columbia, and the highest density of whales. An increased number of whales and vessels means increased potential for encounters that require a sentinel intervention, whether proactive or reactive.

August saw the most sentinel actions of any month, with **268** documented actions. This total includes **103** reactive interventions, **89** proactive warnings, **68** marine debris removals, and **eight** sentinel actions categorized as "other". August saw more reactive, proactive, and “other” sentinel actions than any other month in 2023.

The highest number of marine debris removals in a single month occurred in May with **89** retrievals.

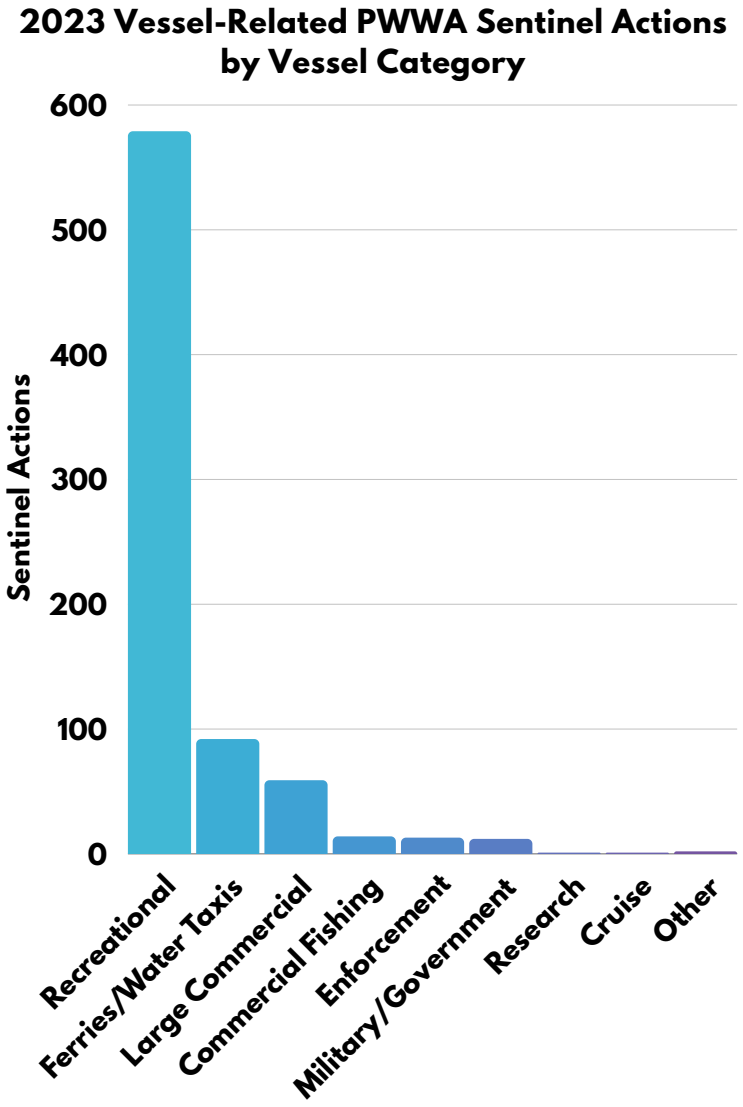
A PWWA vessel displays the Whale Warning Flag on scene.
Credit: April Ryan, Maya's Legacy Whale Watching

A private boater views Bigg's killer whales. *Credit: Andrew Lees, Five Star Whale Watching*

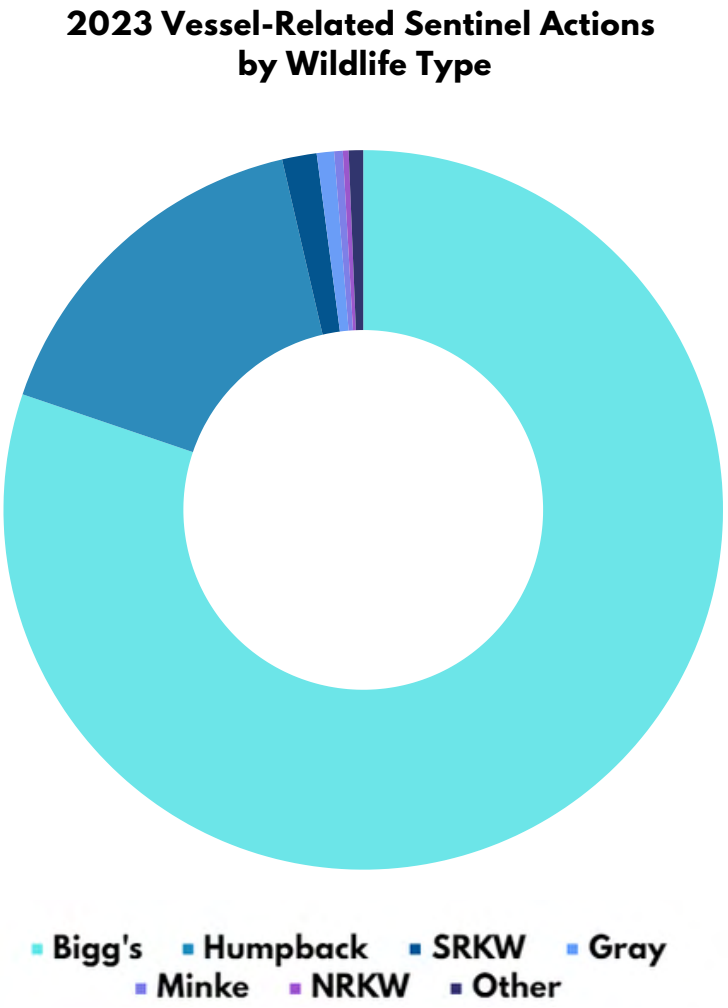
Vessel-Related Sentinel Actions

Of the **1,246** sentinel actions reported to the PWWA App in 2023, **773** (**62%**) involved interactions with other vessels. PWWA members observed a positive change in behavior following **601** (**78%**) vessel-related interventions (detailed on page 25 of this report). Contact with other vessels was typically made through VHF radio, a ship's horn, or waving of a flag or arms. **407** (**53%**) of vessel-related actions were ***reactive*** sentinel actions involving vessels in the immediate vicinity of whales. **366** (**47%**) were ***proactive*** interventions warning vessels of whales in their eventual path.

Recreational vessels were the vessel category contacted most frequently, accounting for **579** vessel-related sentinel actions (**74.9%**). Ferries and water taxis were the second most frequently contacted category with **92** sentinel actions (**11.9%**). Large commercial vessels such as container ships, tankers, and tugs were contacted during **59** sentinel actions (**6.9%**) and commercial fishing vessels were contacted **14** times (**1.8%**). Law enforcement vessels were contacted **13** times (**1.7%**) and military or other government vessels were contacted **12** times (**1.6%**). **One** (**0.13%**) research vessel, **one** (**0.13%**) cruise ship, and **two** (**0.3%**) vessels categorized as "other" were also contacted.



Vessel-Related Actions by Wildlife Type



The majority of the **773** vessel-related PWWA sentinel actions in 2023 involved Bigg's killer whales with **620** sentinel actions (**80.2%**). Humpback whales were present during **125** vessel-related sentinel actions (**16.2%**). **12** vessel-related sentinel actions involved Southern Resident killer whales (**1.66%**), **six** involved gray whales (**0.78%**), **three** involved minke whales (**0.39%**), and **two** involved Northern Resident killer whales (**0.26%**). There were also **five** (**0.65%**) vessel-related sentinel actions involving other species, such as pinnipeds, or during which the reporter did not record the species involved.

It is not surprising that most PWWA sentinel actions involved Bigg's killer whales and humpback whales, as these were the two types of cetacean most frequently encountered during the 2023 season. In fact, the relative proportion of sightings involving Bigg's killer whales or humpback whales and the proportion of sentinel actions involving Bigg's killer whales or humpback whales were virtually the same, with **94%** of all GPS-based cetacean sightings logged by PWWA members in the PWWA App involving either Bigg's killer whales or humpback whales, and **96%** of all vessel-related PWWA sentinel actions involving either Bigg's killer whales or humpback whales.

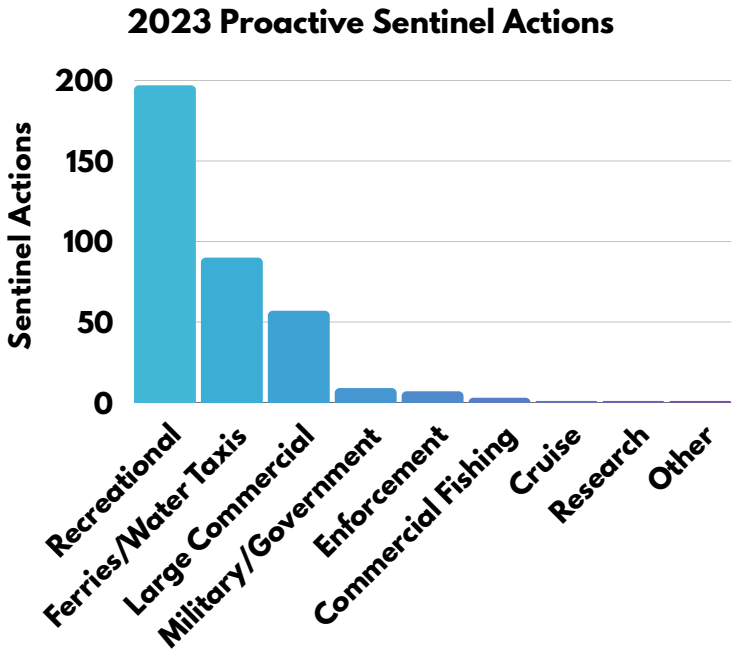
Humpback whales in the Strait of Georgia. *Credit: Ashley Keegan, Wild Whales Vancouver*

A Bigg's killer whale and Washington State Ferry. *Credit: Sara Shimazu, Maya's Legacy*

Proactive Sentinel Actions

Of the **366** *proactive* sentinel actions documented in 2023, recreational vessels were the most frequently contacted vessel type. Recreational vessels were contacted during **197** proactive sentinel actions (**53.8%**). Ferries and water taxis were contacted during **90** sentinel actions (**24.6%**), and large commercial vessels such as tankers, cargo ships, and tugboats were contacted during **57** proactive sentinel actions (**15.6%**). Other vessels contacted proactively included **nine** military and government vessels (**2.5%**), **seven** law enforcement vessels (**1.9%**), **three** commercial fishing vessels (**0.8%**), **one** cruise ship (**0.3%**), **one** research vessel (**0.3%**), and **one** vessel characterized as "other" (**0.3%**).

Together, ferries, water taxis, tankers, cargo ships, and tugboats contribute at least **92.7%** of regional underwater noise in the Salish Sea (MacGillivray et al. 2016). Vessel speed has been shown to be the most important predictor of noise levels received by whales (Houghton et al. 2015), therefore temporary reductions in speed of those vessel categories are likely to result in a meaningful decrease in underwater noise exposure for whales in the immediate vicinity.



In 2023, the most common method of communicating with other vessels during proactive sentinel actions was over public VHF radio channels, accounting for **221** (**60.4%**) proactive interventions. This was followed by the waving of arms or the Whale Warning Flag during **98** actions (**29.2%**), and, if necessary, using a short blast of the ship's horn during **39** interactions (**10.7%**).

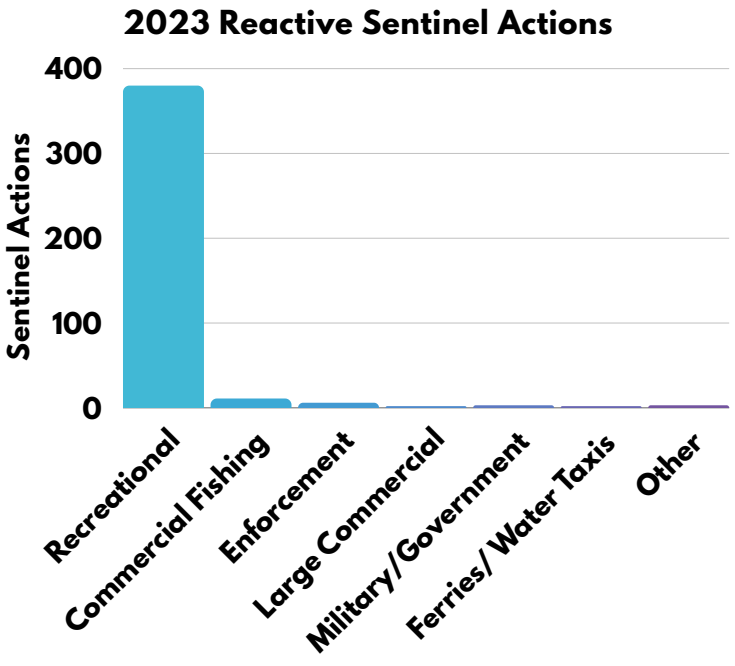
A recreational vessel travels at speed near whales. *Credit: Val Shore, Eagle Wing Tours*

Reactive Sentinel Actions

Of the **407** *reactive* sentinel actions documented by PWWA members in 2023, **360** (**88%**) involved contacting other vessels traveling at high speed near whales and **47** (**12%**) involved contacting vessels traveling too close to whales but at slow speed. Vessels traveling at high speed in the vicinity of whales can pose an imminent threat to whales, as high-speed vessels generate more underwater sound (Houghton et al. 2015), and pose a greater risk of striking a whale.

While recreational vessels were contacted in **74.9%** of *total* vessel-related sentinel actions in 2023, **380** (**93%**) *reactive* sentinel actions involved recreational vessels whereas only **197** (**53.8%**) of *proactive* sentinel actions involved recreational vessels. It's likely that there are less opportunities to contact recreational vessels proactively about whales in the vicinity because they typically travel at faster speeds relative to large commercial vessels like ferries, tankers, tugs, and cargo ships.

According to the boater education group Soundwatch, awareness of whale watch guidelines among recreational boaters is increasing, but there is still room for improvement. **31%** of recreational boaters contacted are still unaware of current guidelines (Frayne et al. 2023).

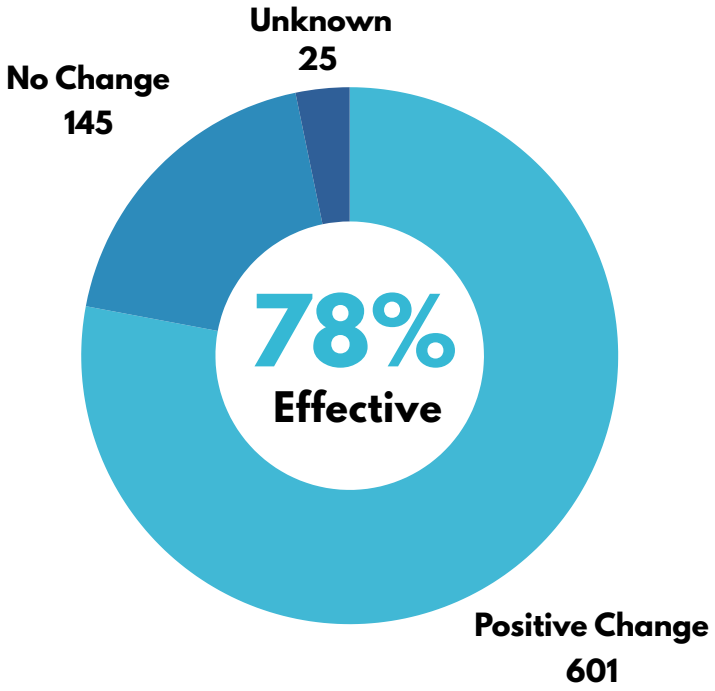


The most common means of communicating with other vessels during reactive sentinel actions in 2023 was by waving arms or a flag. This method was used during **351** interventions (**86%**). This was followed by using quick horn blasts during **204** interactions (**50%**), and VHF radio during **65** proactive sentinel actions (**16%**). **191** proactive sentinel actions (**47%**) utilized more than one means of communication in an attempt to contact the vessel(s) involved.

Change in Vessel Behavior After Contact

Of the **773** vessel-related sentinel actions the PWWA documented in 2023, PWWA crew members observed a positive change in vessel behavior following **601** interventions (**78%**). A positive change in behavior was characterized by the contacted vessel stopping, slowing, and/or diverting after communication with the PWWA operator. There was no noticeable change in behavior after **145** incidents (**19%**). It was unknown whether there was a positive change in behavior after **25** sentinel actions (**3%**). For *proactive* sentinel actions, such as hailing ferries or cargo vessels to alert them of whales in their path, PWWA members are sometimes not able to remain in the area long enough to confirm whether behavior was modified or not, accounting for an unknown result.

Of the **407** *reactive* incidents that specifically involved vessels traveling toward whales at high speed and/or inappropriate distances, PWWA operators were successful in achieving a positive behavior change in **278** cases (**68%**). Of the **366** *proactive* sentinel actions documented in 2023, PWWA operators were successful in positively modifying the behavior of vessels contacted during **324** interactions (**89%**).



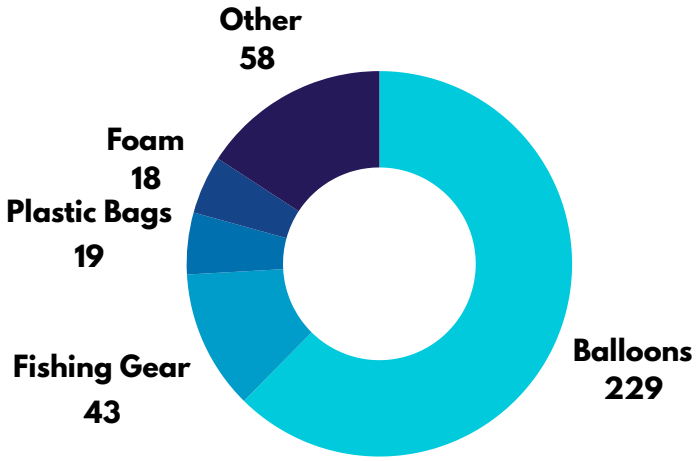
The higher rate of effectiveness during proactive sentinel actions compared to reactive sentinel actions is not surprising. Proactive sentinel actions are more likely to involve slow-moving vessels in the distance who have ample time to receive warnings and alter speed and course accordingly. Large commercial vessels are also more likely to monitor their VHF radios than recreational vessels.

PWWA crew members wave the Whale Warning Flag. *Credit: Ellie Sawyer, Maya's Legacy*

Whale watch guests hold up a Mylar balloon. *Credit: Val Shore, Eagle Wing Tours*

Marine Debris Removal

Retrieval of potentially harmful marine debris was documented by PWWA crew members **451** times in 2023. Crew members were asked to record the specific type of debris collected when possible. The type of marine debris removed was reported during **367** of the debris-related sentinel actions (**81%**).



Balloons were the most common items retrieved in 2023, removed during **229** debris-related sentinel actions (**51%**). In many instances, clusters of balloons, rather than single balloons, were retrieved, meaning the total number of balloons removed from local waters was greater than 229. Derelict or discarded fishing gear was collected during **43** sentinel actions (**10%**), plastic bags were removed in **19** sentinel actions (**4%**), and polystyrene foam products were collected during **18** sentinel actions (**4%**). Items categorized as "other" were collected during **58** sentinel actions (**13%**). Some of the miscellaneous items collected included fenders, buckets, plastic bottles, clothing, car tires, and discarded furniture.

PWWA crew members retrieve marine debris. *Credit: Island Adventures Whale Watching*

Bigg's killer whale T65A5 "Indy" entangled in fishing gear. *Credit: Ken Rea, Spirit of Orca*

Other Sentinel Actions

Sentinel actions not involving vessel contacts or marine debris removal are logged in the PWWA App as "other". The PWWA documented **22** such sentinel actions in 2023. **11** "other" sentinel actions (**50%**) involved reporting sick, injured, or entangled animals to proper authorities. Additional sentinel actions categorized as “other” included reporting small oil spills and shipwrecked vessels, contacting a drone operator illegally flying over marine mammals in Canada, and rescuing capsized kayakers in distress.

A Steller sea lion with flasher in its mouth.
Credit: Paul Pudwell, Sooke Whale Watching

One particularly noteworthy sentinel action occurred on the morning of July 5, 2023. NOAA’s Large Whale Entanglement Response Program received word of a killer whale possibly entangled in a crab pot in Washington’s Saratoga Passage. PWWA vessels in the area identified the individual as Bigg’s killer whale T65A5 “Indy” and, along with a commercial tugboat, *M/V Michael Uhl*, offered to monitor the whale at a safe distance while waiting for professional responders from NOAA Fisheries, Cascadia Research Collective, and SR³ - Sealife Response, Rehabilitation & Research. Staff from the non-profit organization Orca Network monitored the whale’s location from shore.

Around 5:00 PM the same day, the entangled whale traveled into shallow water, allowing the crab pot to sit on the bottom and creating slack in the line. The whale was able to then freely swim away from the gear without the need for emergency intervention. Entanglement in fishing gear is a threat most often associated with larger, slower-moving baleen whale species, such as humpback whales and gray whales. This incident served as a poignant reminder that killer whales are also at risk of becoming entangled.

RESEARCH COLLABORATION

A harbor porpoise in glassy seas. *Credit: Ashley Keegan, Wild Whales Vancouver*

Research Collaboration

Washington and British Columbia are home to numerous research organizations dedicated to studying the marine environment and its inhabitants. Funding and resource constraints, however, often limit marine scientists to spending just a few weeks in the field each year. The PWWA is fortunate to have a year-round presence on the water, and consistently collaborates with marine researchers whose work benefits from access to PWWA sightings, behavioral observations, and/or visual assets.

To assist with photo-identification and cataloging efforts, PWWA crew members contribute a significant volume of photographs to local researchers each year. For example, Bigg's killer whale photographs are submitted to Bay Cetology, humpback whale photographs to Humpback Whales of the Salish Sea, Happywhale.com, and the Canadian Pacific Humpback Collaboration, gray whale photographs to Cascadia Research Collective, and minke whale photographs to the Northeast Pacific Minke Whale Project.

In addition to routine catalog submissions, the PWWA supports several targeted research projects by providing funding and/or sightings data. Detailed here are some noteworthy research efforts the PWWA contributed toward in 2023.

Tufted Puffin Monitoring

Tufted puffins (*Fratercula cirrhata)* are found throughout upper latitudes of the North Pacific. Unfortunately, the species is experiencing steep declines in parts of their range, including the Salish Sea. Tufted puffins are currently listed as endangered in Washington state. The Salish Sea School (TSSS), a local non-profit organization, has

A tufted puffin.
Credit: Trevor Derie, Outer Island Excursions

shared tufted puffin observations with Washington Department of Fish and Wildlife since 2020. To assist with their efforts, PWWA members provide reports of tufted puffins to TSSS through the PWWA App. The PWWA App received **141** reports of tufted puffins in 2023.

Large Harbor Porpoise Aggregations

Harbor porpoises are typically seen in small groups of 1–3 individuals, with large aggregations (20 or more individuals) treated as rare events. In early 2021, the PWWA began collaborating with scientists from Cascadia Research Collective, Pierce College, Pacific Mammal Research, and Sea View Marine Sciences to document large harbor porpoise aggregations in the Salish Sea. Between February 2021 and December 2022, PWWA members reported **146** large aggregations of harbor porpoises to the PWWA App, including **20** reports of groups of 100 or more individuals. By combining observations from PWWA and other research partners, a scientific article was published in August 2023 demonstrating that large harbor porpoise aggregations may be more common in the Salish Sea than previously thought. It's likely these aggregations serve as important foraging and social gatherings for harbor porpoises (Anderson et al. 2023).

Humpback Whale Prey Analysis

The specific diet of Salish Sea humpback whales is not well understood. Using whale-borne tag data, acoustic prey mapping, and fecal sub-sampling, local scientists successfully documented humpback whale BCY0983 "Aerie" feeding on walleye pollock in Juan de Fuca Strait, indicating that pollock may be an important prey species for local humpbacks. A publication detailing their findings was released in March 2023 (Reidy et al. 2023). The PWWA helped fund this study.

Shifting Southern Resident Presence

Southern Resident killer whales (SRKW) historically had a monthly presence in the Salish Sea, with peak abundance May through September. In recent years, due at least in part to shifting prey abundance, SRKW habitat usage has changed. In July 2023, a new publication detailed SRKW presence in the Salish Sea during 2018-2022 based on data from several sources, including the PWWA. This work documented the first ever absences of SRKW in the months of May, June, and August, as well as a continued overall decline in presence during spring and summer (Shields 2023). This is an important shift to recognize, as several regulatory protections for SRKW in the Salish Sea are seasonal, implemented during summer months.

Humpback whale "Aerie" feeding on fish. *Credit: Tomis Filipovic, Eagle Wing Tours*

ENFORCEMENT & EDUCATION

A law enforcement vessel on patrol. *Credit: John Boyd, Western Prince Whale Watching*

Law Enforcement

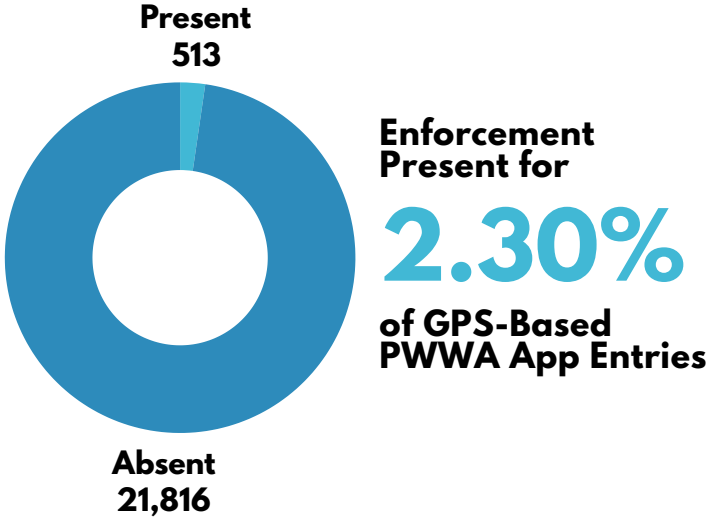
Numerous agencies have been tasked with enforcing whale-related vessel regulations in and around the Salish Sea. These agencies include the National Oceanic and Atmospheric Administration (NOAA) and Washington Department of Fish and Wildlife (WDFW) in Washington, and Transport Canada, Fisheries and Oceans Canada (DFO), Royal Canadian Mounted Police (RCMP), and Parks Canada in British Columbia.

The Salish Sea is expansive, and it is not uncommon to have multiple whales or groups of whales distributed throughout the region on any given day. This poses challenges for the law enforcement agencies responsible for protecting whales and enforcing vessel laws in their vicinity. Current resources do not allow for law enforcement officers to be present with all whales at all times.

To internally document law enforcement activity and trends, PWWA App users are asked to note whether or not enforcement is present during GPS-based wildlife encounters. At this time, the PWWA App does not record which specific agency or agencies are present, simply whether or not there is a visible law enforcement vessel or aircraft in the vicinity during each wildlife encounter.

Law Enforcement Presence

Of the **22,329** GPS-based whale entries logged by PWWA members in the PWWA App during 2023, law enforcement was noted as being present in **513** entries (**2.30%**). While PWWA App entries do not document which specific law enforcement agency was present, mapping of these entries indicates a balanced presence on either side of the US/Canadian border. It's important to emphasize that this percentage is based solely on observations of PWWA operators during whale watch tours and does not necessarily capture all law enforcement presence on the water.



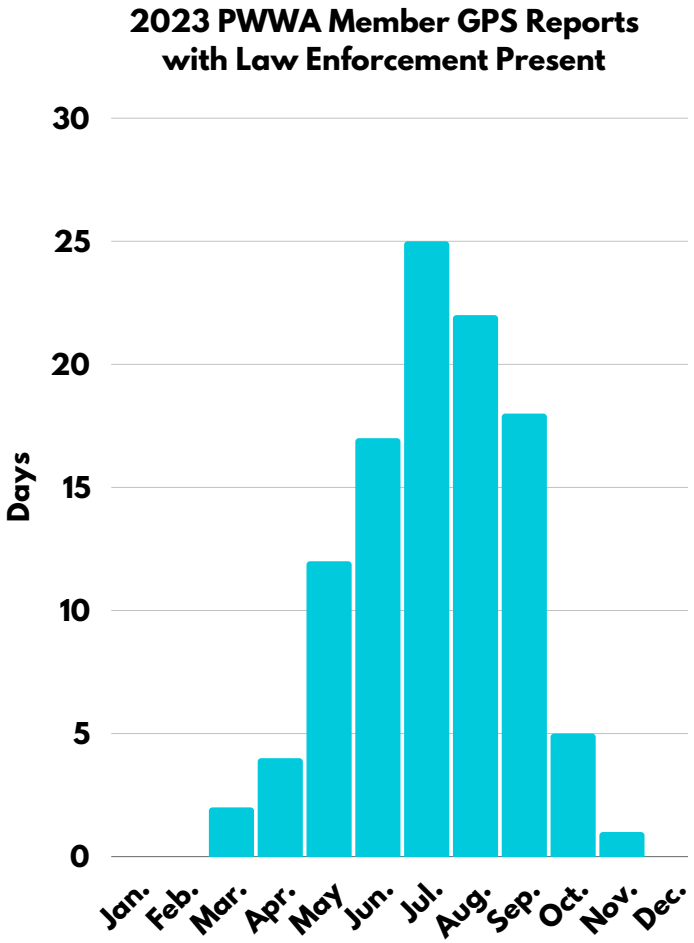
2023 PWWA Member GPS Reports with Enforcement Present

Whale Type	Total PWWA GPS Entries	Law Enforcement Present	% Presence
Northern Resident Killer Whales	101	9	8.91%
Southern Resident Killer Whales	126	5	3.97%
Bigg's Killer Whales	11,199	445	3.97%
Gray Whales	417	4	0.96%
Humpback Whales	9,867	49	0.50%
Minke Whales	610	1	0.16%

Law Enforcement Presence by Species

Based on GPS-based PWWA App entries, law enforcement was reported most frequently during encounters with Northern Resident killer whales, present during **8.91%** of entries. Law enforcement was reported in **3.97%** of PWWA App logs for both Southern Resident killer whale and Bigg's killer whales. Law enforcement was least likely to be present with the region's baleen whale species: gray whales (**0.96%**) humpback whales (**0.50%**), and minke whales (**0.16%**).

It is important to note the small sample sizes with regards to encounters with the region's two populations of resident (fish-eating) killer whales. Northern Residents are typically seen beyond the PWWA's core operating range, resulting in relatively few PWWA encounters, and professional whale watching restrictions in both BC and Washington limit the number of PWWA encounters with Southern Residents. It's possible law enforcement was present with resident killer whales more frequently in 2023 and there were simply no PWWA vessels present to observe them.



Days of Law Enforcement Presence

While on scene with whales, PWWA operators documented the presence of law enforcement on **106** days of 2023. This was more than the **95** days reported in 2022, an increase of **12%**. Law enforcement was most likely to be present with whales during the summer months, reported on **17** days in June, **25** days in July, **22** days in August, and **18** days in September.

Reduced whale watching effort during winter months should be taken into account. A lack of PWWA App reports noting law enforcement presence does not necessarily mean that law enforcement was absent from the water, simply that they were not observed by PWWA operators during whale watch tours.

A Soundwatch vessel monitors boating activity near whales. *Credit: Ellie Sawyer, Maya's Legacy*

Boater Education

There are two prominent boater education groups in Washington and British Columbia: Soundwatch (WA) and Straitwatch (BC). These groups monitor vessel activity in the vicinity of whales and educate boaters of proper boating behavior. Soundwatch and Straitwatch do not have the authority to enforce vessel regulations, but they *are* able to document and report vessel infractions to appropriate law enforcement agencies if necessary.

A Straitwatch vessel proactively approaches a boater. *Credit: Erin Gless, PWWA*

While Soundwatch and Straitwatch observe vessel behavior around all whales, priority is typically given to Southern Resident killer whales due to their status as an endangered population. To help Soundwatch and Straitwatch best carry out their duties on the water, the PWWA has provided both organizations with access to the PWWA App's Southern Resident killer whale sightings since 2022. These real-time sightings come from PWWA operators, local researchers, and reliable shore-based observers authorized to use the PWWA App.

In addition to receiving sightings of Southern Residents, Soundwatch and Straitwatch crew are also asked to log their own Southern Resident killer whale sightings in the PWWA App. These updates allow PWWA vessels to avoid accidental encounters with Southern Residents and remain compliant with the terms of BC's Sustainable Whale Watchers Authorization and Washington's Commercial Whale Watching License Program.

Between May 31 and September 10, 2023, Soundwatch and Straitwatch reported a combined total of **111** Southern Resident sightings to the PWWA App across **21** different days.

SUMMARY

A PWWA vessel departs after viewing a humpback whale. *Credit: Mollie Cameron, Sooke Whale Watching*

2023 Summary

When combining entries from all users, Bigg's killer whales were reported to the PWWA App on more days than any other whale type, documented on **332** days of 2023. Humpback whales were reported on **309** days, minke whales on **156** days, gray whales on **131** days, Southern Resident killer whales on **111** days, and Northern Resident killer whales on **77** days. When including only GPS-based entries made from aboard PWWA vessels, Bigg's killer whales were reported on **273** days, humpbacks on **252** days, minke whales on **141** days, gray whales on **98** days, Southern Resident killer whales on **47** days, and Northern Resident killer whales on **26** days.

During 2023, PWWA captains, naturalists, and crew documented a total of **1,246** sentinel actions. The most common sentinel actions documented were vessel-related sentinel actions, with **773** interventions reported (**62%** of total sentinel actions). This included **407** *reactive* interactions with vessels in the immediate vicinity of whales and **366** *proactive* interventions with other vessels nearby. Marine debris removals accounted for **451** sentinel actions (**36%**). Incidents classified as "other", such as reporting entangled or potentially injured marine life, made up the remaining **22** sentinel actions (**2%**).

For the **773** sentinel actions involving interactions with other vessels, PWWA members observed a positive change in the other vessel's behavior after **601** interventions (**78%**). Recreational vessels were the most frequently contacted category of vessel, involved in **579** sentinel actions (**74.9%**). Most vessel-related sentinel actions occurred in the vicinity of Bigg's killer whales, with Bigg's killer whales present during **620** encounters (**80.2%**). August was the busiest month for sentinel actions in 2023, with **268** sentinel actions documented.

Law enforcement was present during at least one PWWA whale encounter on **106** days of 2023. Of **22,329** GPS entries made by PWWA members, law enforcement was reported as being present during **513** entries (**2.30%**). Law enforcement was most likely to be present with Northern Resident killer whales (present during **8.91%** of encounters), followed by Southern Resident killer whales and Bigg's killer whales (**3.97%** of encounters for each). Law enforcement was least likely to be present during encounters with baleen species such as gray whales, humpback whales, and minke whales, present during **0.96%, 0.50%,** and **0.16%** of encounters respectively. Law enforcement was most likely to be present during whale encounters in the summer months.

A PWWA vessel views a Bigg's killer whale. *Credit: Sara Shimazu, Maya's Legacy*

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