

B.C. Invasive Mussel Defence Program: 2022 Final Report



Ministry of
Water, Land and
Resource Stewardship

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ACKNOWLEDGEMENTS

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EXECUTIVE SUMMARY

This document reports on the successes and program improvements for the 2022 season. The post-season collection of information and analysis results in a reporting delay, however, all seasonal statistics are immediately available on the program website: www.gov.bc.ca/invasivemussels.

Since 2022, the Ministry of Water Land and Resource Stewardship (WLRS) provides the cross-Ministry lead for the Invasive Mussel Defence Program's (IMDP) and the program continues to be implemented in collaboration with the Ministry of Environment and Climate Change Strategy's Conservation Officer Service (COS). The IMDP would like to recognize the 2022 funding and support provided by BC Hydro, the Columbia Power Corporation, Fortis BC, the Columbia Basin Trust, Fisheries and Oceans Canada, Habitat Conservation Trust Foundation as well as the B.C Ministry of Agriculture and Food (AF) that makes this program possible.

During the 2022 season, stations were operational from March 25 to October 28, 2022 (with some additional inspections through the rest of the year), with 32 aquatic invasive species (AIS) inspectors operating across six inspection stations and two roving stations (Figure 1). The Program continued to implement the roving inspection crews based on lessons learned from the 2021 season. The roving inspection crews support the program's capacity to respond to the high-risk watercraft notifications coming from other inspection stations in B.C. (such as Golden), other jurisdictions (AB, SK, ID, OR, MT, WA) and CBSA. These crews are re-deployed as needed to help cover necessary border crossings.

The Program performed approximately 20,100 inspections during the 2022 season and crews interacted with approximately 36,400 people to promote Clean, Drain, Dry. Of the total watercraft inspected, 122 were identified as high-risk, 66 decontamination orders were issued, and 29 watercrafts were issued quarantine periods to meet the required 30-day drying time. Provincial inspectors decontaminated a total of 65 watercraft.

Of the 20,200 inspections performed, 13 watercrafts were confirmed to have adult invasive mussels. These watercrafts came from Ontario (11), Quebec (1), and Manitoba (1) and were destined for the Lower Mainland (5), Okanagan (4), Vancouver Island (2), and Thompson Nicola (2). The Program received advanced notification on seven of the thirteen mussel fouled boats either from another jurisdiction (e.g. AB, MT, ID, WA) or by Canada Border Services Agents (CBSA).

In June 2022, the Program received advanced notification from several western provinces about a large mussel-fouled barge being transported from Lake Ontario, destined for use in a Lower Mainland waterway. It was the largest, most significant discovery and decontamination of zebra mussels on a watercraft since IMDP's inception in 2015. The successful decontamination of the barge before it reached B.C. waters highlights the effectiveness of tackling the threat of invasive species through a coordinated approach with our neighbouring provinces.

The average compliance across all the inspection stations for the 2022 season was 89.6%, which is consistent the 2021 season (88%). Of the watercraft that failed to stop at the inspection station, 82.6% were non-motorized watercraft such as canoes, kayaks, and paddleboards.

Overall, Conservation Officers issued 63 violation tickets and 66 warnings to motorists for failing to stop at inspection station(s), which is mandatory when transporting watercraft in B.C. Watercraft operators who fail to stop at an inspection station are reported to the Report All Poachers and Polluters (RAPP) hotline and full-time conservation officers respond and follow up.

A total of 830 water samples were collected from 78 priority waterbodies as part of the early detection lake monitoring program in partnership with the Habitat Conservation Trust Foundation and community organization. In addition, 52 artificial substrate samplers were also deployed in 2022 to monitor for invasive mussels. All samples came back negative for the presence of invasive mussels.

Another highlight from 2022 was the registration by Health Canada for the use of Potash to control for zebra and quagga mussels in open waters in western Canada. This represents a significant milestone in advancing the tools available for invasive mussel control in western Canada. It was a direct result of the substantial resources invested by the Government of Alberta who led the application submission.

GLOSSARY

Abbreviation / Acronym	Definition
AF	Ministry of Agriculture and Food
AIS	Aquatic invasive species
CAS	Controlled Alien Species Regulation
CBSA	Canada Border Services Agency
CBT	Columbia Basin Trust
CDD	Clean, Drain, Dry
CO	Conservation Officer
COS	Conservation Officer Service
DFO	Fisheries and Oceans Canada
AEB	Aquatic Ecosystems Branch
ENV	Ministry of Environment and Climate Change Strategy
FOR	Ministry of Forests
IMISWG	Inter-Ministry Invasive Species Working Group
TRAN	Ministry of Transportation and Infrastructure
NAD	North American datum
RAPP	Report All Poachers and Polluters; refers to a toll-free number used to report suspected poachers, polluters, or other infractions of the <i>Wildlife Act</i> .
RCMP	Royal Canadian Mounted Police
WLRS	Ministry Water, Land and Resource Stewardship
ZQM	Zebra and Quagga mussels
Term	Definition
AIS Passport	A system for local watercraft users that frequently operate in Alberta and/or B.C. lakes, and regularly stop at inspection stations. The goal of the passport is to expedite the inspection process at the mandatory watercraft inspection station. It is still mandatory for all passport holders to stop at all inspection stations in B.C. and Alberta; it is not a free pass.
Clean, Drain, Dry	Is a preventative step that all boaters should practise when moving any watercraft or water equipment between waterbodies to prevent the spread of aquatic invasive species. This includes boats that are just moving between lakes in B.C. to prevent the spread of species, such as Eurasian watermilfoil, already present in some lakes but not in others.

Decontamination	Is applied when there is an identified risk that a conveyance (either watercraft or water equipment) may be transporting AIS. The Provincial auxiliary conservation officers are trained at identifying and treating the risk of transporting AIS through specified decontamination procedures. For zebra and quagga mussels, decontamination procedures involve hot water with specific contact times to kill the mussels and high pressure to remove them and no chemicals are used.
Decontamination order	A written, legal instrument issued by conservation officers requiring parties to take measures (through written instruction) to remove confirmed or suspected invasive mussels before a watercraft can be launched in any B.C. waters.
Quarantine period	A drying time of 30 days that is required to ensure that confirmed (adult mussels) or suspected invasive mussels (microscopic veligers) are dead before a watercraft is considered free to launch in B.C. waters. This is based on the biology of dreissenid mussels that can survive as adults out of the water for up to 30 days under suitable temperature and humidity levels and the microscopic veliger stage, which could be present in standing water for three to four weeks.
Watercraft seal	A wire seal that is affixed to the watercraft in such a way that the seal would be broken if the watercraft were to be launched. Seals are used to monitor compliance with decontamination orders.
High-risk watercraft	A high-risk watercraft may be any of the following: <ul style="list-style-type: none">• Any watercraft or equipment that has been launched in any waters of a province or state known or suspected of having zebra or quagga mussels in the past 30 days; or• Any watercraft or equipment that is coming from or is registered in a state or province that has zebra or quagga mussel infestations and that is not clean, and to the extent practical, drained, and dry; or• Any watercraft that is dirty, crusty, or slimy with the potential risk of transporting other AIS.

1. BACKGROUND

1.1 HISTORY

The presence of zebra and quagga mussels (ZQM) can result in substantial economic, environmental, and social impacts. These impacts include increased maintenance costs to infrastructure such as hydropower, waterworks and irrigation, and degradation of native ecosystems, thereby affecting fisheries, recreation, and tourism. Unlike B.C.'s native mussels, ZQM attach to hard surfaces, allowing them to be moved between water bodies by boats and equipment. While not present in B.C., ZQM could survive in B.C. freshwater systems and would cause devastating impacts to B.C.'s lakes and streams.

The introduction of these two aquatic invasive species (AIS) could lead to serious impacts on our native salmon populations and could affect the viability of important commercial, recreational, and cultural fisheries. In 2015, it was estimated that the costs associated with failing to prevent an invasion of invasive freshwater mussels (dreissenids) in the Pacific Northwest states and western Canadian provinces would exceed C\$500 million annually.¹ Zebra and quagga mussels pose significant economic risks due to their impacts on infrastructure and waterbodies. A previous 2013 study estimated the costs of a zebra and quagga mussel invasion in B.C. would be \$43 million annually (\$53.4 million in 2022 CAD). The 2013 study looked at impacts to hydropower, agricultural irrigation, municipal water supplies and recreational boating. B.C. has since updated the 2013 estimate to include additional sectors such as tourism and property values and the updated results have been published in the 2023 report "Potential Economic Impact of Zebra and Quagga Mussels in B.C.". The updated annual cost estimates if zebra and quagga mussels were to be introduced into B.C. range from \$64 to \$129 million.

The Program was launched in 2015 and has since adapted operationally and geographically each year based on lessons learned from past seasons and to maximize available resources. This document reports on the logistics, activities, and findings of the Program's 2022 season for the operational period of March 25, 2022, to October 28, 2022. More information about previous seasons, including annual reports, is available on the Program website².

1.2 REGULATORY AND JURISDICTIONAL FRAMEWORK

The Program is designed to mitigate the risk of ZQM introduction into B.C. by intercepting and inspecting watercraft travelling into or through B.C.

The Program consists of three main components:

- **Watercraft inspection and decontamination** to detect and respond to high-risk watercraft potentially transporting ZQM into B.C.

¹ Source: *Advancing a Defense Against Invasive Mussels: A Report Prepared by the Pacific Northwest Economic Region and Pacific States Marine Fisheries Commission.*

http://www.pnwer.org/uploads/2/3/2/9/23295822/advancing_a_regional_defense_against_dreissenids_in_the_pacific_northwestfinal_1.pdf

² <https://www2.gov.bc.ca/gov/content/invasive-mussels>

- **Lake monitoring** to assess for the continued absence of ZQM in B.C. waters; and
- **Outreach and education** to promote the message of Clean, Drain, Dry to the boating community, in collaboration with our partners including the Invasive Species Council of B.C. and regional invasive species organizations.

The continued success of the Program is a direct result of:

- Integrating science, education, and enforcement through a unique joint delivery between the Conservation Officer Service and WLRS.
- Multi-agency collaboration (within B.C.) for the delivery of Program operations.
- Cross-jurisdictional collaboration to coordinate inspection locations, training, policy and procedures, lake monitoring, and immediate notification of high-risk boats; and
- Stakeholder engagement to work collaboratively with the boating industry to prevent the introduction of ZQM into B.C.

Inspectors are trained to deliver the watercraft inspection program and have been designated as auxiliary conservation officers under the *Environmental Management Act*. This designation provides powers to intercept, stop, inspect, question, obtain information and issue decontamination orders. See *the Zebra and Quagga Mussel Early Detection and Rapid Response (ZQM EDRR) Plan* for more information on the Controlled Alien Species (CAS) Regulation as it pertains to ZQM (available at www.gov.bc.ca/invasive-species).

Provincial legislation authorizes B.C. to take action on ZQM. The CAS Regulation under the *Wildlife Act* is the principal legislation that defines, lists, and affords provisions to regulate invasive mussels in B.C. Under the CAS Regulation, prohibitions apply in relation to any mussel listed in Schedule 4 (zebra, quagga, and conrad's false mussel). Specifically, it is illegal for a person to:

- possess, breed, ship, or transport prohibited mussels in B.C.
- release prohibited mussels into B.C. waters; or
- allow a prohibited mussel to be released or escape into B.C. waters.

In June 2015, the Aquatic Invasive Species Regulation, under the federal *Fisheries Act*, was brought into force. This regulation prohibits the importation, possession, transportation, release, and introduction of ZQM in the western provinces.

1.3 JURISDICTIONAL COORDINATION

Ongoing coordination with other jurisdictions in Canada and the U.S. has been essential for the overall success of the Program. Outside of B.C., the Program shares research, procedures, and notifications of high-risk boats with, but not limited to Alaska, Arizona, California, Idaho, Montana, Nevada, Oregon, Washington, Wyoming, Alberta, Manitoba, Saskatchewan, and the Yukon. This is part of B.C.'s ongoing commitment as a signatory to the trans-boundary *Columbia River Basin Inter-Agency Invasive Species Response Plan: Zebra Mussels and Other Dreissenid Species*³. As a signatory, B.C. receives notifications of high-risk watercraft from neighbouring states, and is provided access to professional advice on risk

³ Source: https://docs.wixstatic.com/ugd/0e48c2_7c4f1faa1538443da76593b2e8a827b8.pdf

management and training opportunities. B.C. is also a member of the Western Regional AIS Panel and in 2022 took on the role as co-chair of the invasive species working group for the Pacific Northwest Economic Region (PNWER).

The *Inter-Provincial-Territorial Agreement for Coordinated Regional Defense Against Invasive Species* was signed in late 2015 by B.C., Yukon, Alberta, Saskatchewan, and Manitoba. One of the primary objectives under this agreement is to develop and address shared priorities for invasive species with an initial focus on invasive mussel prevention and coordination.

2. PROGRAM LOGISTICS

2.1 OPERATIONS

Operations of the watercraft inspection stations continued to be delivered by the Ministry of Environment and Climate Change Strategy (ENV) in 2022. The officer in charge (OIC), three sergeants and the auxiliary conservation officers represented the COS and oversaw the field operations of the watercraft inspection stations. The Aquatic Ecosystems Branch within the Ministry of Water, Land and Resource Stewardship led the science, policy, national and international coordination aspects of the program including the lake monitoring program and research collaborations detailed in sections 5 and 6. The delivery of outreach and education and partnerships was shared between the COS and Aquatic Ecosystems Branch.

Hours of Operation

During the 2022 season, stations were operational from March 25 to October 28, 2022, with 32 AIS Inspectors operating across six stations—Dawson Creek, Mt. Robson, Golden, Radium, Olsen and Osoyoos—and two roving crews in the Lower Mainland and Penticton (Figure 1). Each team had its own mobile decontamination units. The program continued to implement roving inspection crews in Penticton and the Lower Mainland for the 2022 season. When they were not responding to high-risk watercraft notifications the Penticton crew rotated between setting up stations at alternate locations (e.g. Pacific, Keremeos, Hwy 97C and Greenwood). Both roving crews conducted inspections and outreach at boat launches throughout the Okanagan and the Lower Mainland.

In addition to conducting watercraft inspections at established stations, the inspection crews responded to high-risk watercraft notifications received from within B.C. and from other jurisdictions. The Program worked very closely with neighboring jurisdictions to send and receive notifications of high-risk boats either destined for B.C. or travelling to other jurisdictions.

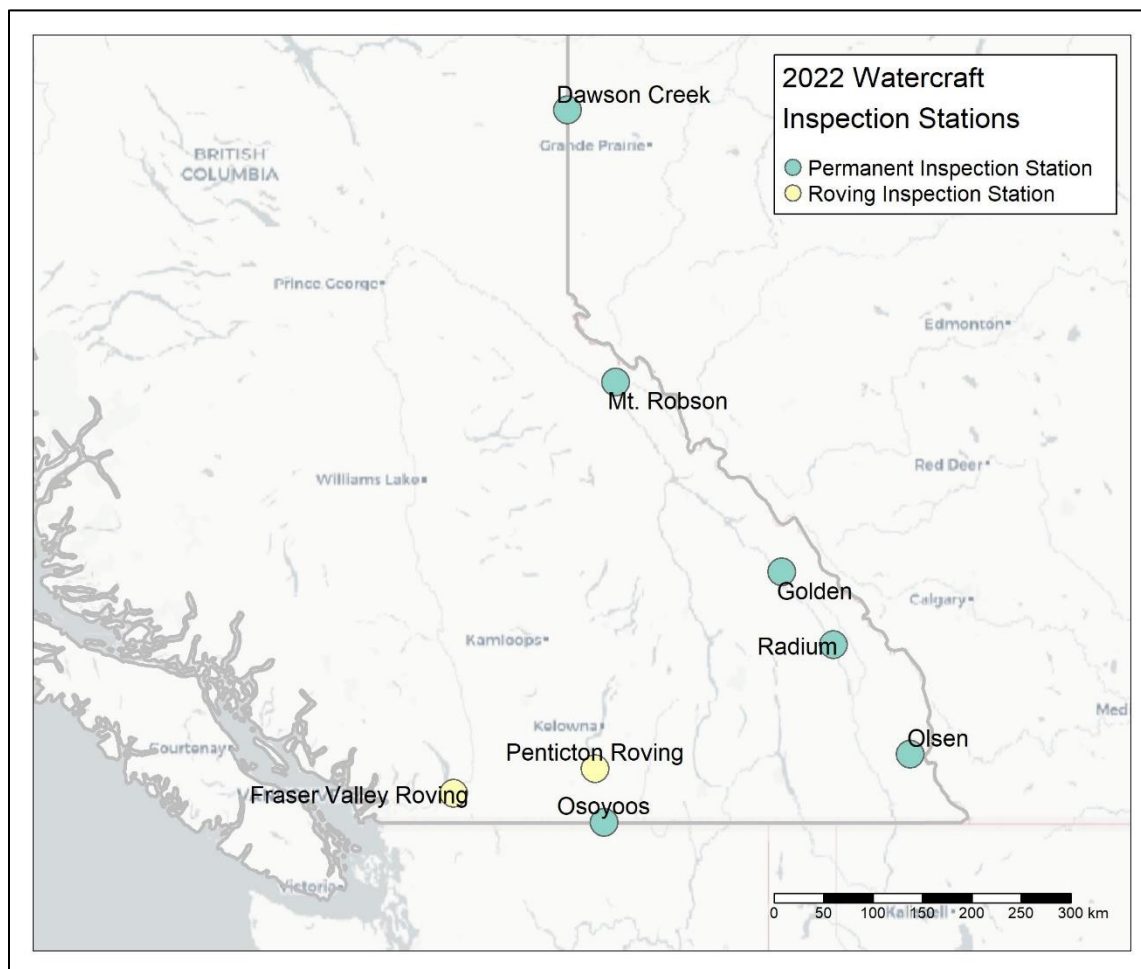
Inspection Station Locations

Data and lessons learned from past inspection seasons were used to optimize program operations for the 2022 season. The locations and hours of operations were assessed for suitability based on encounter frequency (watercraft encounters divided by effort), safety or communication, direction of traffic targeted, the source location of boaters (percent coming from outside B.C.) and the number of high-risk and mussel fouled watercraft intercepted.

In addition to conducting watercraft inspections at established stations, the inspection crews responded to high-risk watercraft notifications from within B.C. and from other jurisdictions. The Program worked very closely with neighboring jurisdictions to share notifications of high-risk boats either destined for B.C. or traveling to other jurisdictions.

The COS Report All Poachers and Polluters (RAPP) hotline (1-877-952-7277) was used by the public to report any suspected invasive mussels, and notifications received were sent to watercraft inspectors. High-risk watercraft notifications from other jurisdictions were sent through an email distribution list to all inspectors and senior program leads. A response was then coordinated based on the location and availability of inspectors.

Figure 1. Watercraft inspection station locations for the 2022 season.



2.2 INSPECTION CREW TRAINING (AUXILIARY COs)

New inspectors were selected based on the candidate’s education and background from a recognized compliance and enforcement or natural resource management program. These positions are excellent opportunities for senior students and recent graduates of environmental science and enforcement

programs to gain hands-on experience and training towards a potential career in enforcement or environmental management. This is the standard protocol used for inspection and decontamination across the Pacific Northwest.

2.3 WATERCRAFT RISK ASSESSMENT

All motorists coming through watercraft inspection stations were asked a series of questions to determine if the watercraft was of high or low risk. Data were recorded electronically.

Two key questions asked by inspectors to determine watercraft risk were:

1. Where was the watercraft in the last 30 days?
2. How long has the watercraft been out of the water?

Any watercraft or equipment that has been launched in any waters of a province or state known or suspected of having zebra or quagga mussels in the past 30 days is considered high-risk. Any watercraft or equipment that is coming from or is registered to a state or province that is known or suspected of having zebra or quagga mussels and is not clean, and to the extent determined as practical by inspectors has not been drained and dried is considered high-risk, even if it has been out of the water for over 30 days. Any watercraft that is dirty, crusty, or slimy with the potential risk of transporting other aquatic invasive species is considered high-risk. Watercrafts that have only been used within British Columbia or other non-contaminated provinces or states within the last 30 days and are found to be clean, drain, dry and free of mud, debris, plants, or any other AIS are considered low risk.

The inspectors verified information provided by watercraft owners through detailed watercraft inspections, and if required, through follow-up with third parties to confirm information obtained during interviews. Other circumstances may trigger a high-risk inspection such as unknown history of the watercraft; for example, if the owner of a recently purchased used boat does not know where the boat was last in the water, it would be considered high risk.

2.4 PROGRAM FUNDING AND BUDGET

Overall Program Costs

The overall program costs for the operational delivery of the 2022 season from April 1, 2022, to March 31, 2023, was \$2.737 million from a total potential budget of \$2.775 million (see Table 2). The program budget outlined in Table 2 includes funding from the program partners and Government of B.C. funding (ENV, WLRS and AF). This includes salary, travel, vehicle, training, lake monitoring, educational, and miscellaneous equipment and maintenance costs as described below. Under the Provincial budget, \$250,000 went to WLRS to cover salary, research priorities, program reporting, inspection App maintenance, and lake monitoring sample analysis. Internal ministry resources across both WLRS and the COS went towards the design and delivery of the Program.

The COS operational budget covered salary, travel, vehicle, training, lake monitoring, educational and miscellaneous equipment, and maintenance costs. Non-capital equipment and maintenance costs included highway signs, uniforms, and safety equipment. Salary costs included the 32 auxiliary conservation officers operating from either April to October or May to September. It also included the

salary for the officer in charge, three sergeants, and one administrative coordinator. Education and awareness costs include the production of various outreach or education materials that were distributed by the inspectors at the watercraft inspection stations.

Table 1. Summary of 2022 operating budget and the actuals as of March 31, 2023.

2022-2023	2022-2023 Total Program Budget	2022-2023 Program Actuals (as of March 31st)
Salary	\$2,039,500	\$1,726,544
Travel & Training	\$77,300	\$70,296
Corporate Overhead	\$80,000	\$80,000
Vehicle	\$200,000	\$250,599
Education/ Awareness/ Research	\$88,000	\$136,952
Non-capital equipment/ maintenance	\$185,200	\$207,724
Lake Monitoring	\$75,000	\$168,253
Equipment Amortization	\$10,000	\$43,920
Total Operations	\$2,755,000	\$2,684,288
Capital Equipment	\$20,000	\$53,058
Total	\$2,775,000	\$2,737,345

3. WATERCRAFT INSPECTION SUMMARY FOR 2022

3.1 ALL WATERCRAFT ENCOUNTERS

During the 2022 season, the Program performed about ~20,100 inspections, and the crews interacted with approximately 36,400 people to promote Clean, Drain, Dry. Of the total watercraft inspected, 122 were identified as high risk, 66 were issued decontamination orders, and 29 were issued quarantine periods to meet the required drying time. Of the total watercraft inspected, 13 were confirmed to have adult invasive mussels.

The remainder of this section discusses the watercraft inspection data collected by the crews at each station across the entire season. Data have been summarized in several ways, including an assessment of total watercraft encounters (total number of watercrafts inspected), and total effort (total operational hours when the stations are open). The ratio of watercraft encounters to effort was calculated as the encounter frequency to quantify the frequency at which watercraft came through the inspection stations. The encounter frequency was assessed across several different temporal scales (by month, day, and hour) as illustrated in Figures 3 through 10.

3.1.1 Watercraft Inspection Summary by Station

Watercraft inspections (Figure 2) were highest at the Golden station (9,102), the Olsen station (4,315), the Radium station (3,061) and the Mt. Robson station (1,343). All the aforementioned stations saw slight to moderate decreases in the number of inspections relative to the 2021 season. Other factors that may have contributed to the overall decrease in the number of inspections in 2022 relative to 2021 was the unseasonably cold and wet spring weather in 2022 that may have led to a decrease in boater traffic.

The encounter frequency (watercraft encounters divided by effort) across each inspection station showed that the busiest inspection stations were Olsen, Radium, Golden, and Mt. Robson (Figure 3). The stations with the lowest frequencies of boater traffic were Osoyoos and the Pacific Border, though the latter had the highest percent of high-risk boats. This is consistent with past seasons (prior to the pandemic) with the Pacific station typically having a lower total volume of traffic but a higher percent of high-risk boats. Finally, it is important to note that the encounter frequency only represents boater traffic during operational hours.

Figure 2. Total inspections by station location for the 2022 season.

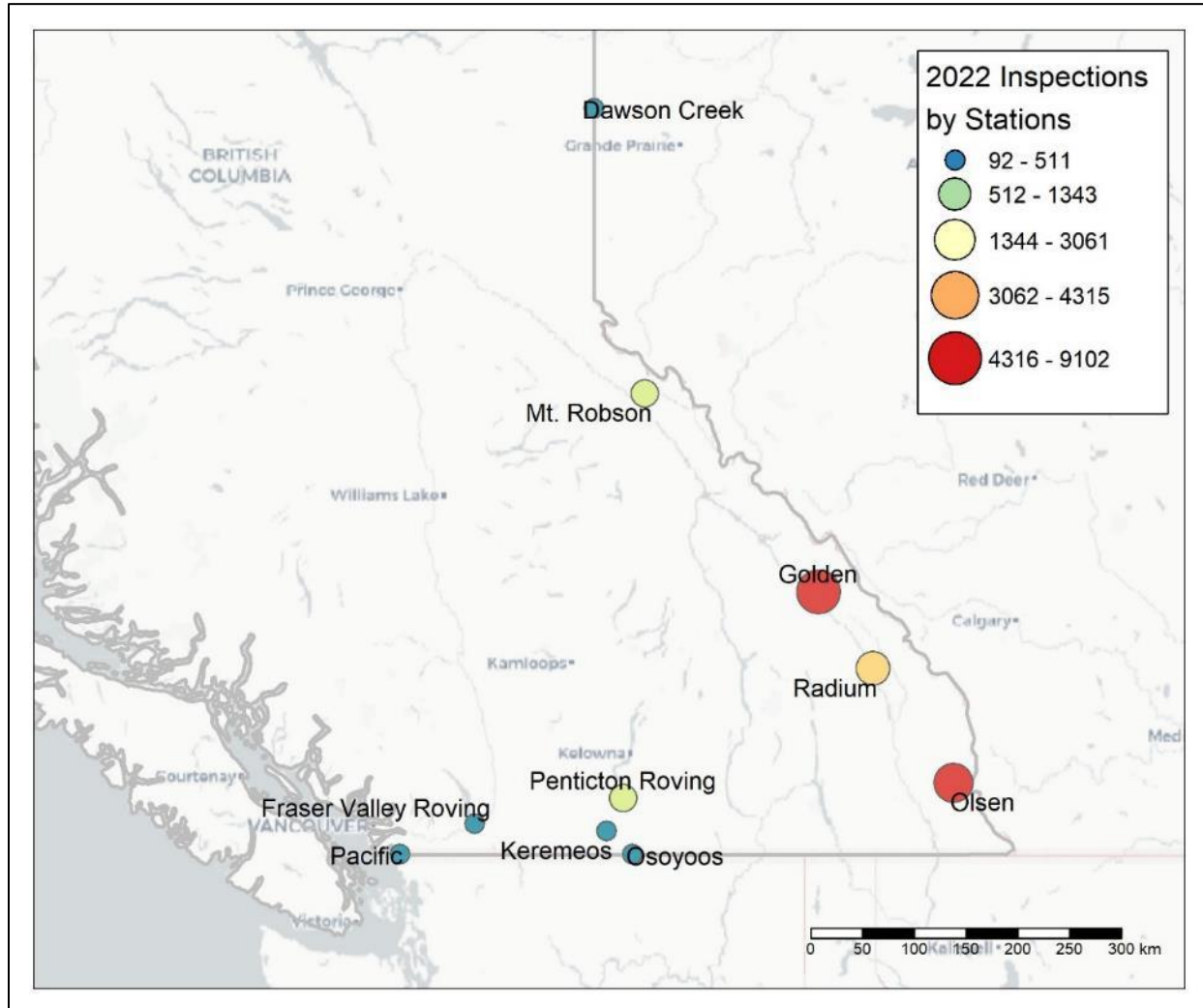
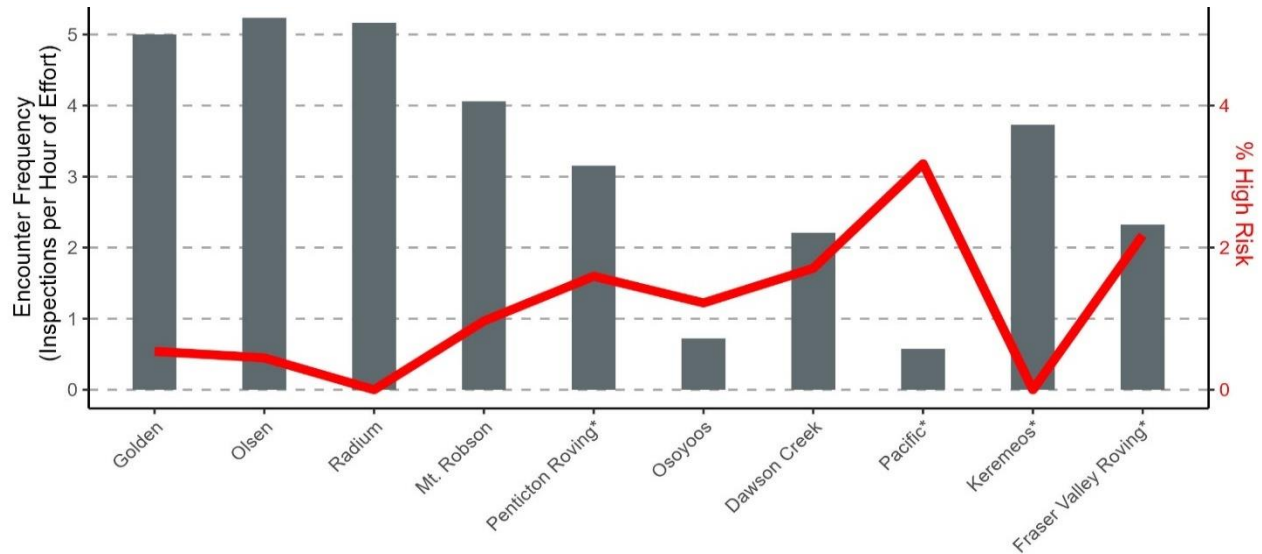


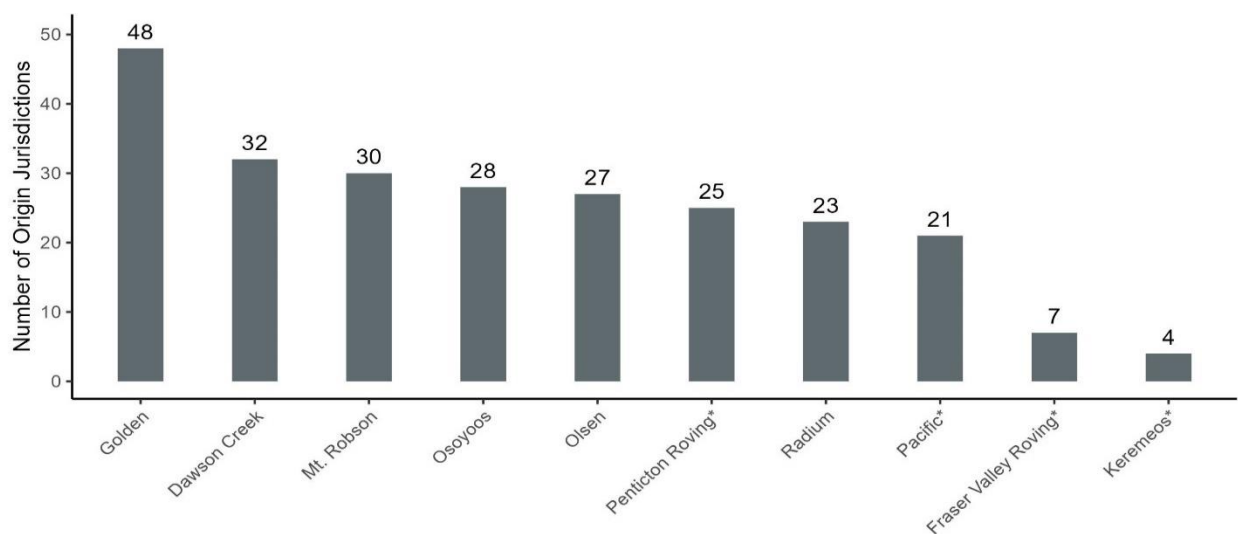
Figure 3. Encounter frequency (bars) by inspection station in comparison to percent of high-risk boats (line) per inspection station, from March to December 2022.



*Denotes the roving inspection stations.

Watercraft inspection data were also used to quantify the boats coming from different jurisdictions— province or state (Figure 4). The Golden station inspected boats coming from 48 different provinces and states which represents an increase from 37 in the 2021 season. The increase in number of jurisdictions that boats were coming from suggests that boaters are traveling longer distances and is more consistent with pre-pandemic travel patterns.

Figure 4. Total number of jurisdictions (province/state) from which boats were coming that were intercepted at each inspection station for the 2022 season.



*Denotes the roving inspection stations.

3.1.2 Watercraft Inspection Summary by Month and by Day of the Week

Highway inspection stations were operational from April to late October 2022, and the program continued to respond to watercraft notifications from other jurisdictions over the winter. The inspection station’s total effort (operational hours) increased over the spring months (May and June), peaking in July and August (Figure 5). These data are consistent with previous seasons.

Figure 7 shows the total watercraft encounters and total effort by days of the week across the 2022 season, with peaks on Fridays, Saturdays and Thursdays and were lowest on Mondays and Tuesdays. This is consistent with the data from previous seasons. Total effort was similar across all days of the week, except Mondays, Tuesdays, and Wednesdays, when it was slightly reduced by operational circumstances that required some stations to be closed on those days (Figure 7). Statutory holidays were included in the data; however, peaks in the volume of boats were typically seen on the Thursday, Friday, and Saturdays of long weekends at the inspection stations along the eastern border. This reflects those stations intercepting out-of-province boaters travelling into B.C. for holiday long weekends.

Figure 5. Total inspections (left) and total effort (right) by month across inspection stations in 2022.

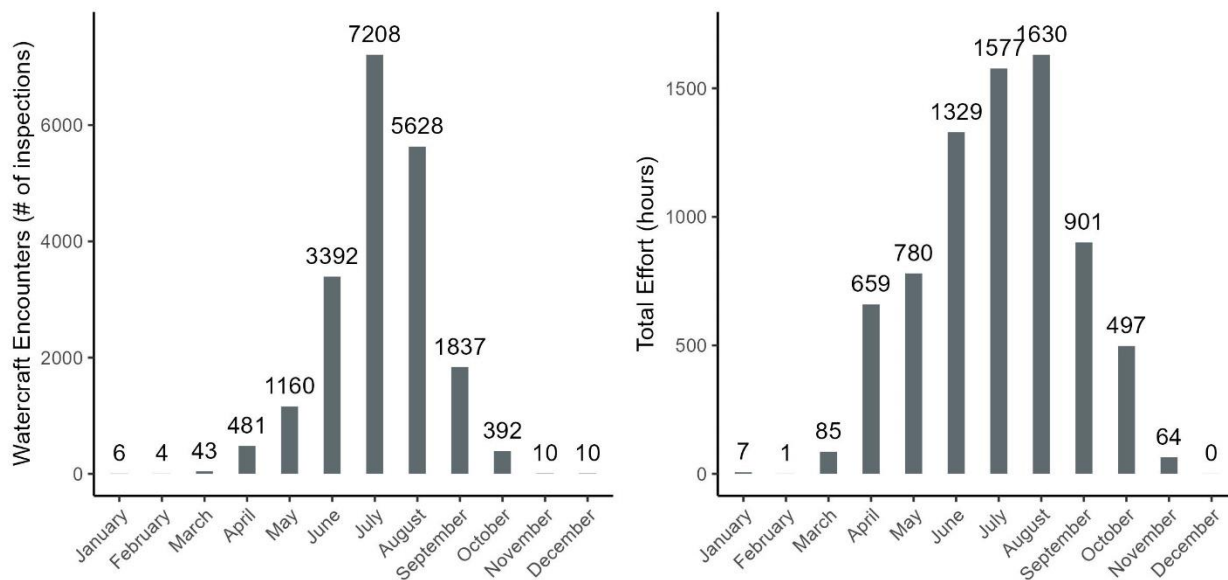


Figure 6. Encounter frequency by month across all inspection stations (error bars illustrate the standard error).

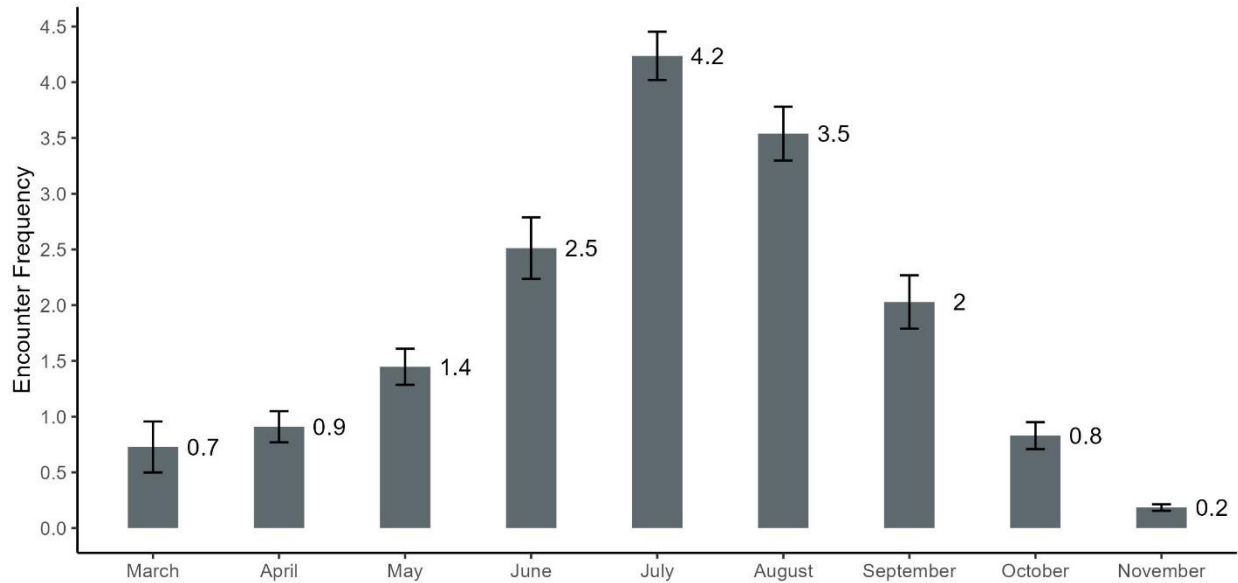


Figure 7. Total inspections (left) and total effort (right) by day of the week across inspection stations. Statutory holidays were included in the analyses.

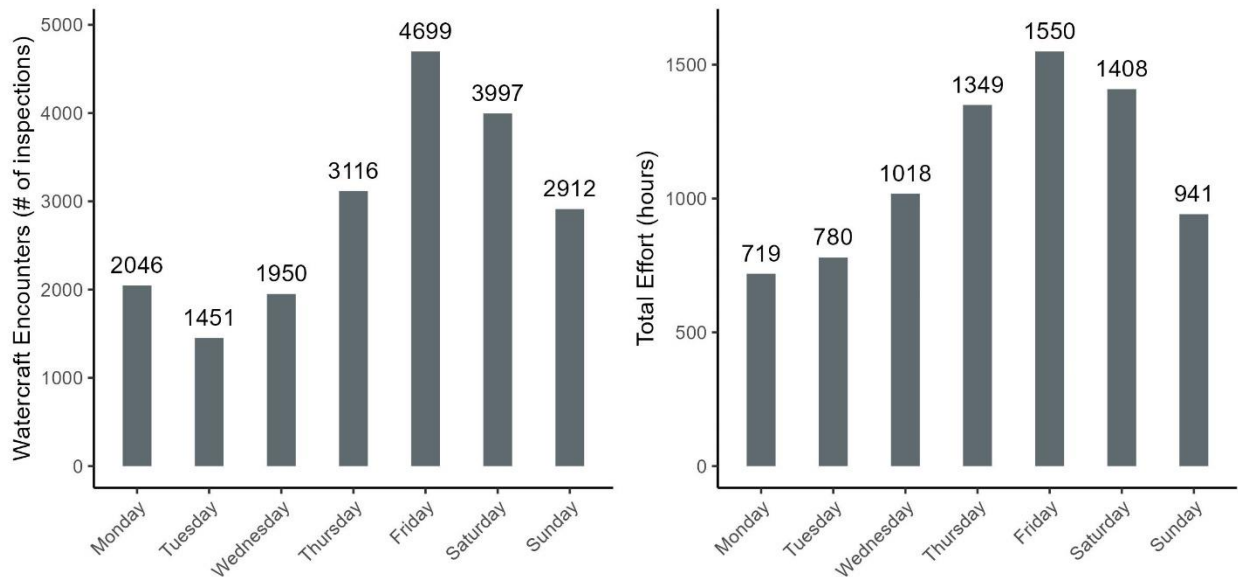
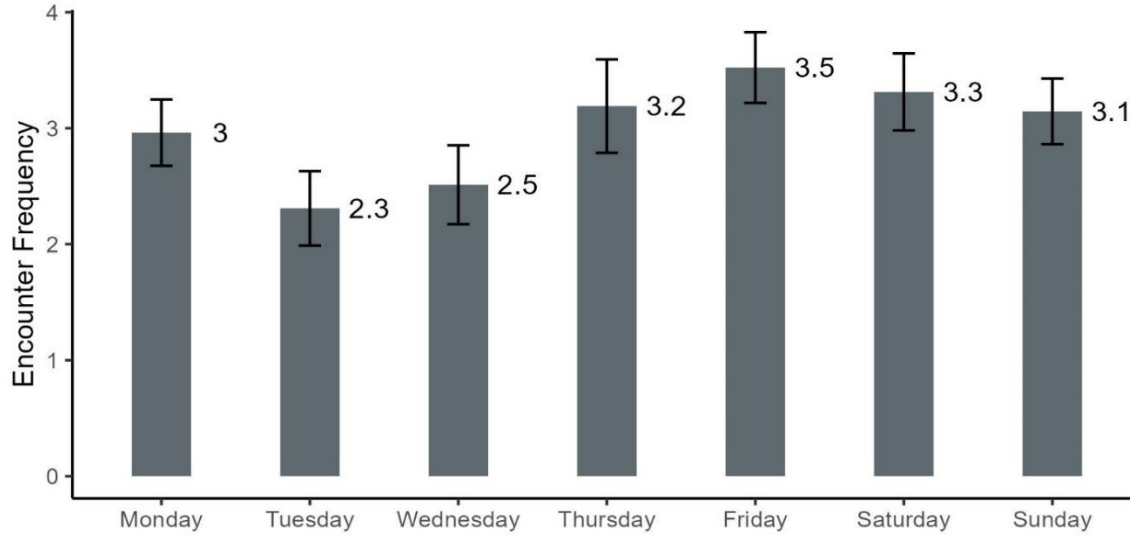


Figure 8. Encounter frequency by day of the week from March to December 2022, across inspection stations. Bars illustrate the standard error. Statutory holidays were included in the analyses.



3.1.3 Watercraft Inspection Summary by Hour of the Day

Inspectors recorded the time of the inspection for every watercraft, and Figure 9 and Figure 10 illustrate that the volume of boater traffic was normally distributed across all inspection stations, peaking in the middle of the day. Figure 11 and Figure 12 show the total and high-risk inspections by time of day for the Golden station. A total of 172 inspections occurred between 10:00 p.m. and 6:00 a.m. at the Golden station and no high-risk inspections occurred during this time.

Figure 9. Total inspections by time of day across all inspection stations for the 2022 season.

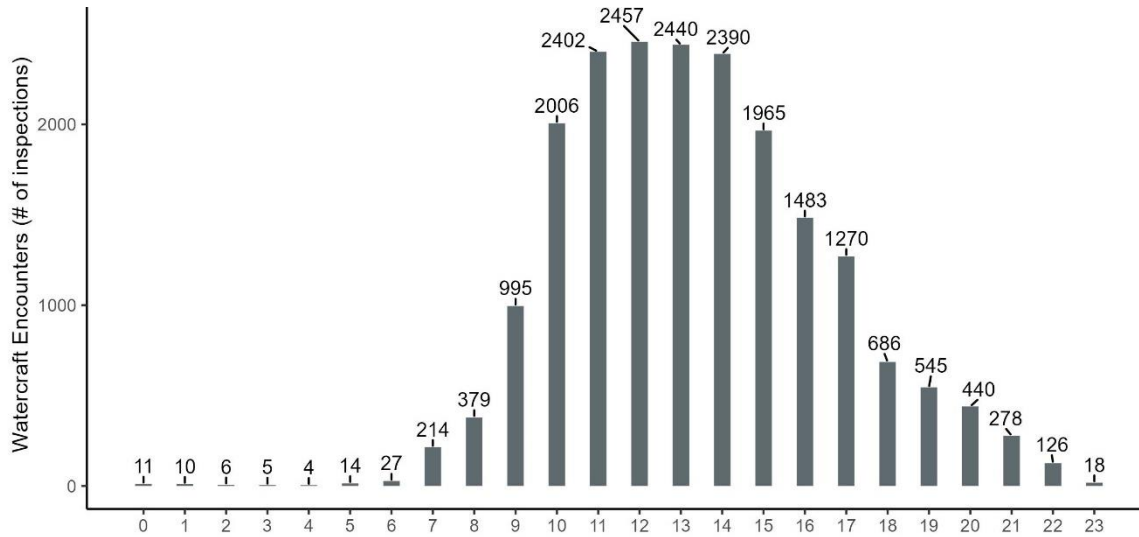


Figure 10. High-risk inspections by time of day across all inspection stations for the 2022 season.

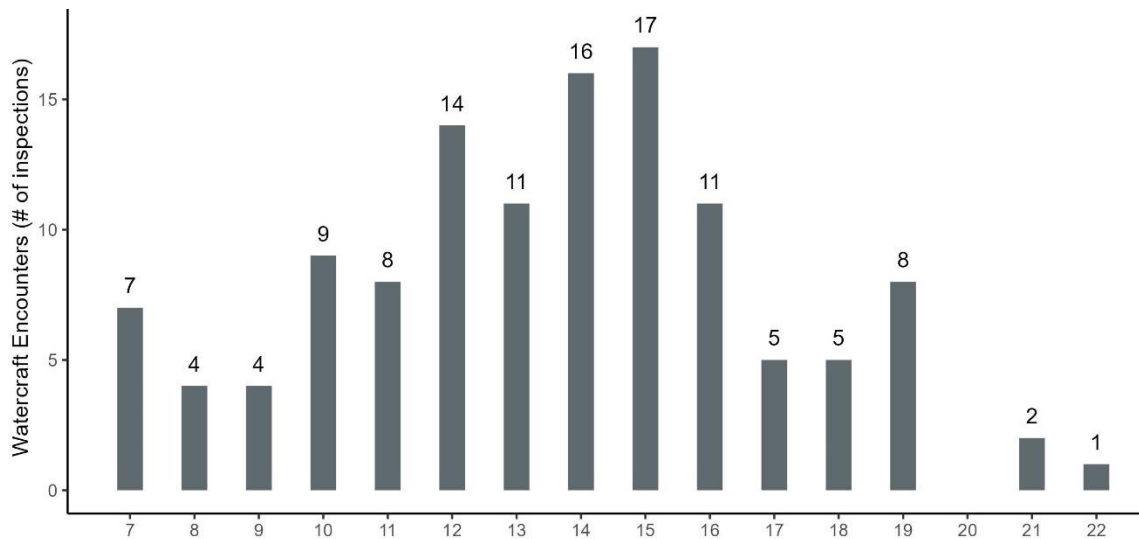


Figure 11. Total inspections by time of day for the Golden station for the 2022 season.

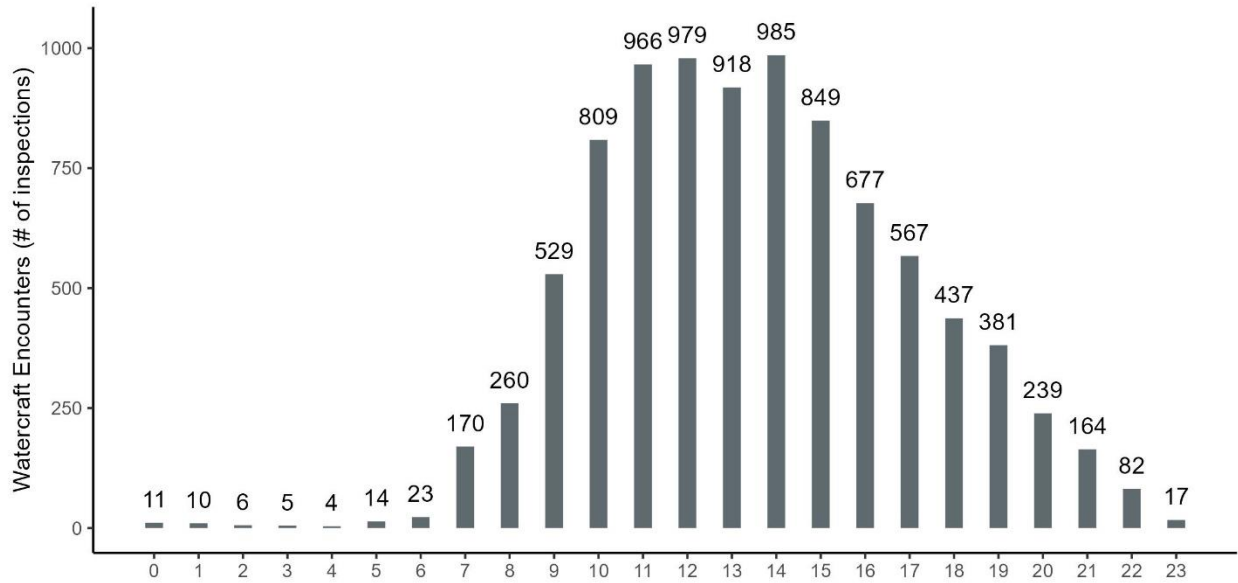
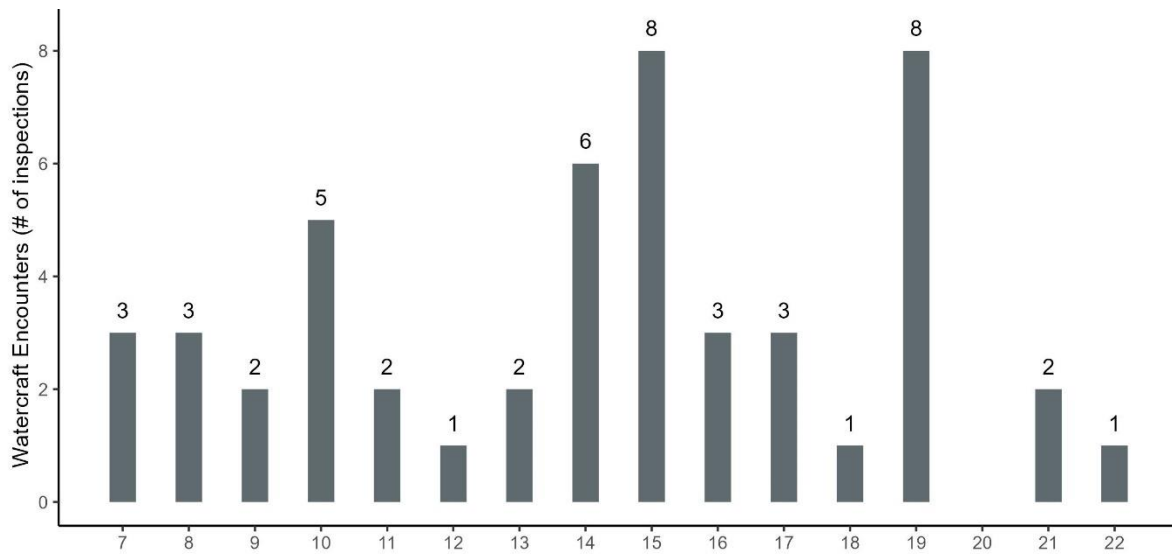


Figure 12. High-risk inspections by time of day for the Golden station for the 2022 season.



3.1.4 Source and Destination Locations

The most common destination waterbodies within B.C. for all watercraft inspections were Shuswap Lake (15.0%), Lake Kootenay (10.3%), Okanagan Lake (10.3%), Windermere Lake (7.0%), the Pacific Ocean (4.8%), Kootenay Lake (2.7%), Mara Lake (2.3%), and Kalamalka Lake (2.1%) (Figure 13). Figure 14 shows the home residence for all watercraft inspections and this corresponds to the province or state where the watercraft is most commonly located or stored throughout the year. The home residence does not always correspond to where the watercraft was last launched. The majority of watercraft were travelling within B.C. or coming from Alberta, followed by other provinces (Saskatchewan, Manitoba, Ontario, and Quebec).

Figure 13. Fifteen top destination waterbodies by percent of all inspections during the 2022 season.

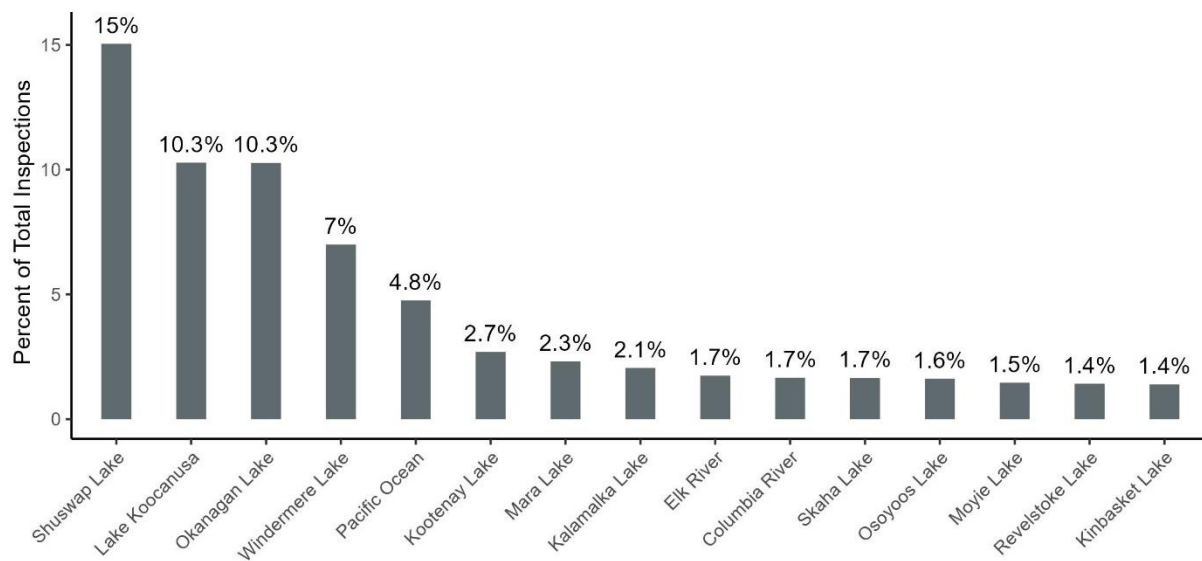
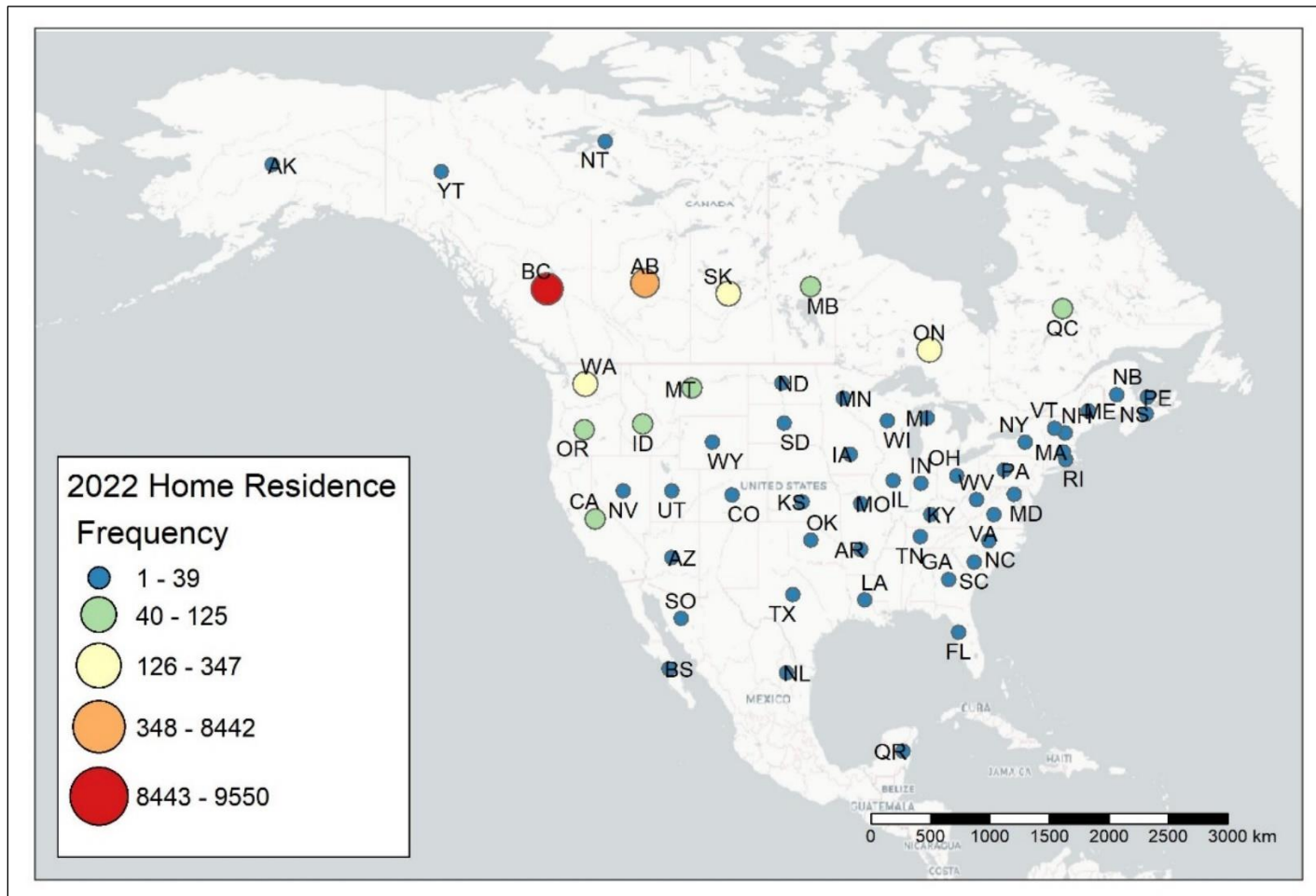


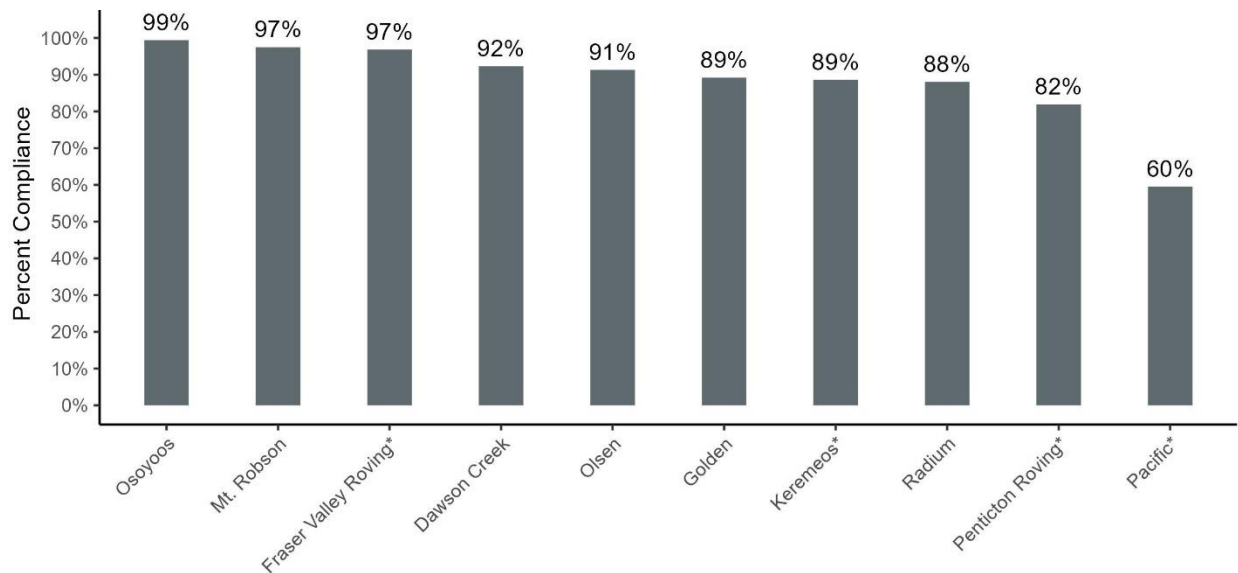
Figure 14. Home residence by province or state of all inspections during the 2022 season.



3.1.5 Compliance

During each shift, inspectors recorded watercraft that failed to stop at the inspection station and this data is used to measure compliance rates at the inspection stations. The compliance rate for a shift was calculated as the number of watercrafts that stopped divided by the total number of boats that went by an inspection station. The average compliance across all the inspection stations for the 2022 season was 89.6%, which represents a slight increase from 88.8% in 2021.

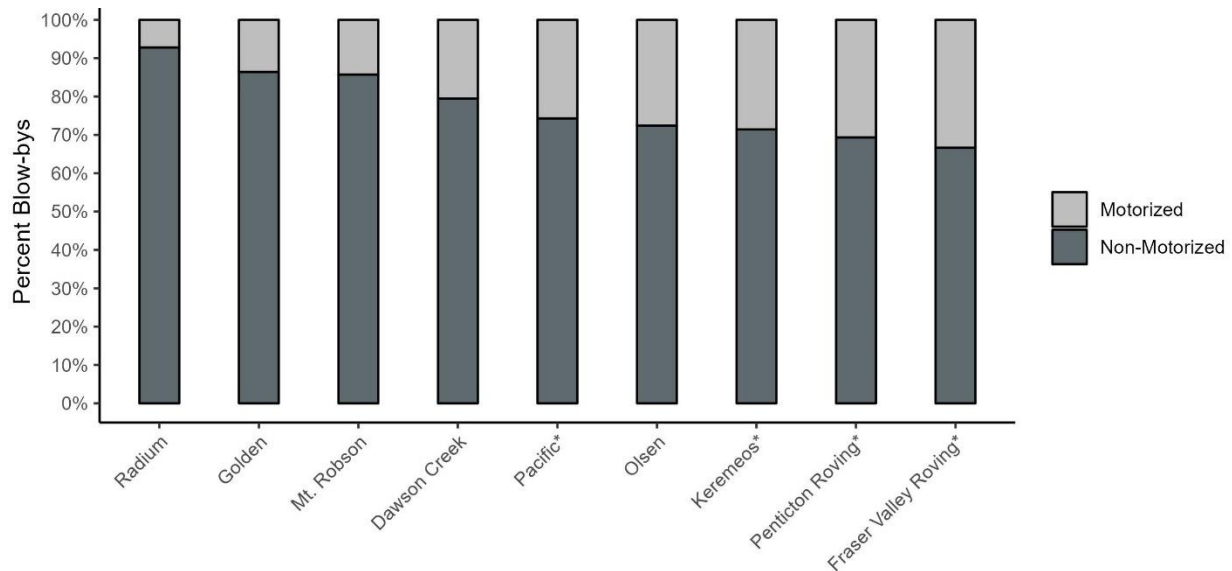
Figure 15. Percent compliance by inspection station for the 2022 season.



*Denotes the roving inspection stations.

During the 2022 season, inspectors also recorded whether the watercraft that failed to stop were motorized or non-motorized. Figure 16 shows that, on average across all the months, 82.5% of the watercraft that failed to stop were non-motorized. This represents a decrease from the 2021 season of 86.2% non-motorized watercraft that failed to stop. This shows that continued outreach and education to the non-motorized boating community are necessary to help raise awareness that inspection stations are mandatory for all types of watercrafts. It is also important to note that at some of the inspection stations such as Golden, a large proportion of the non-motorized watercraft that fail to stop at the inspection station are local boaters and low risk for transporting invasive mussels. While these boaters are not exempt from stopping at stations, it does indicate reduced risk for the majority of the non-motorized watercraft that fail to stop at the stations. However continued outreach and education is important to raise awareness with the local boating community that it is mandatory to stop at any open inspection station in B.C.

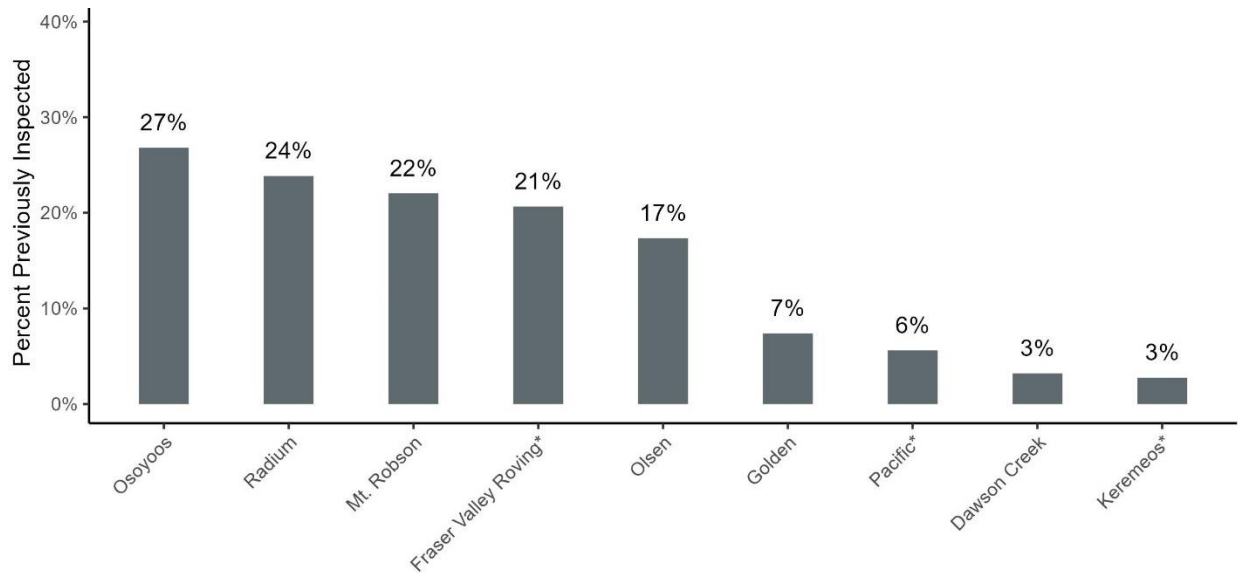
Figure 16. Percent of non-compliant watercraft (“blow bys”) broken down by the watercraft type for each inspection station.



*Denotes the roving inspection stations

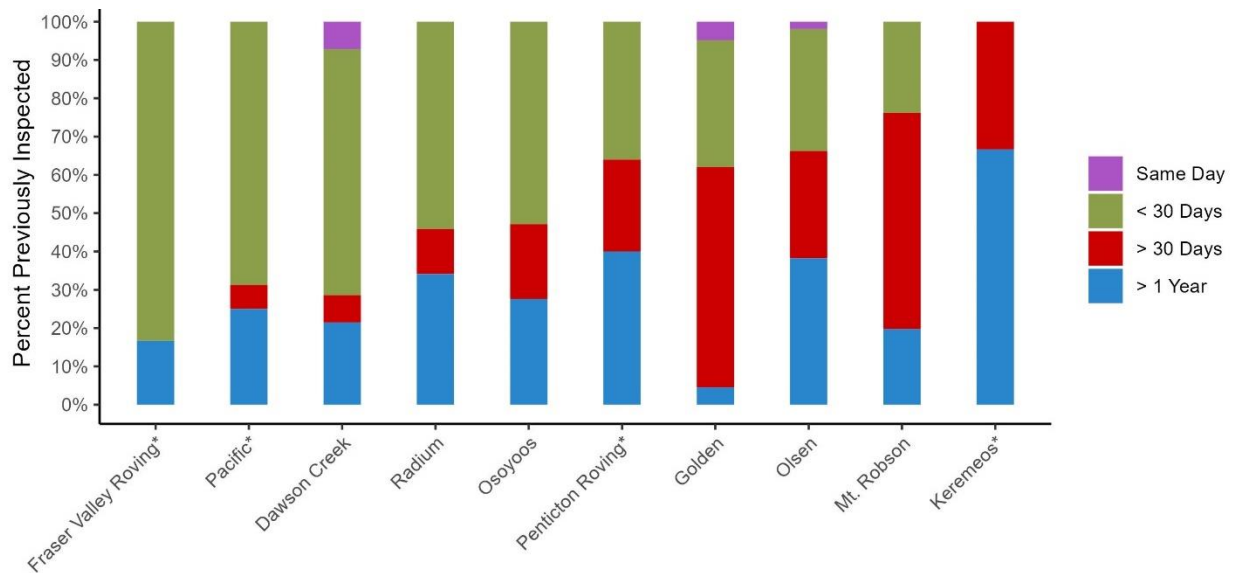
The inspectors also recorded when and if each watercraft coming through a station had been through a previous inspection in B.C. or elsewhere. Figure 17 shows the percentage of boats that stopped at multiple inspection stations. The highest percentages of previously inspected watercraft by station occurred at Osoyoos (27%), Radium (24%), Mt. Robson (22%), Fraser Valley Roving (21%), and Olsen (17%). The timing of when the boater had been through a previous inspection was also recorded at each station. Of the previously inspected watercraft across all stations, 25.7% had been through over one year prior, 33.2% had been through within the last year but more than 30 days prior, 39.3% had been through within 30 days and 1.79% on the same day (Figure 18). This represents a large decrease from 2021 (10%) in the number of boats that were previously inspected on the same day. These data are looked at closely to assess program efficiencies and to minimize redundancies of same-day inspections with the placement of inspection stations.

Figure 17. Percent of watercraft intercepted by inspection station that had been previously inspected (either in B.C. or another jurisdiction).



*Denotes the roving inspection stations.

Figure 18. Frequency of watercraft previously inspected at another watercraft inspection station (either in B.C. or another jurisdiction).



*Denotes the roving inspection stations.

3.2 HIGH-RISK WATERCRAFT ENCOUNTERS

Watercraft can be identified as high-risk for several different reasons based on the information obtained by the inspectors during the inspection and interview process. High-risk watercrafts are identified as any watercraft or equipment that meet the following criteria:

- Launched in any waters of a province or state known or suspected of having zebra or quagga mussels in the past 30 days and is not clean, and to the extent practical, drained, and dry.
- Coming from or is registered to a state or province that has zebra or quagga mussel infestations and is not clean, and to the extent practical, drained, and dry.
- Appear dirty, crusty, or slimy with the potential risk of transporting other AIS.

3.2.1 By Station and Month

The number of high-risk inspections was higher in 2021 (244) relative to 2022 (122) (Figure 19). This is consistent with the overall decrease in inspections observed in the 2022 season. In 2022, the peak number of high-risk inspections occurred in June, July and August which is fairly consistent with previous years which typically see peaks during the summer months.

Figure 19. Total high-risk inspections by month across the 2020–2022 seasons.

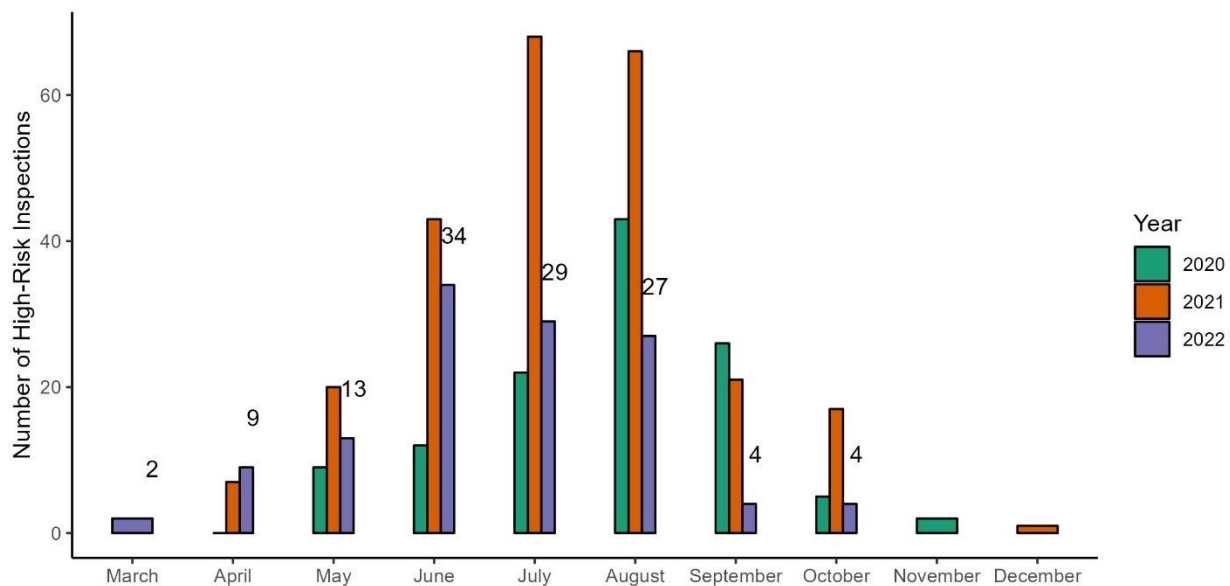
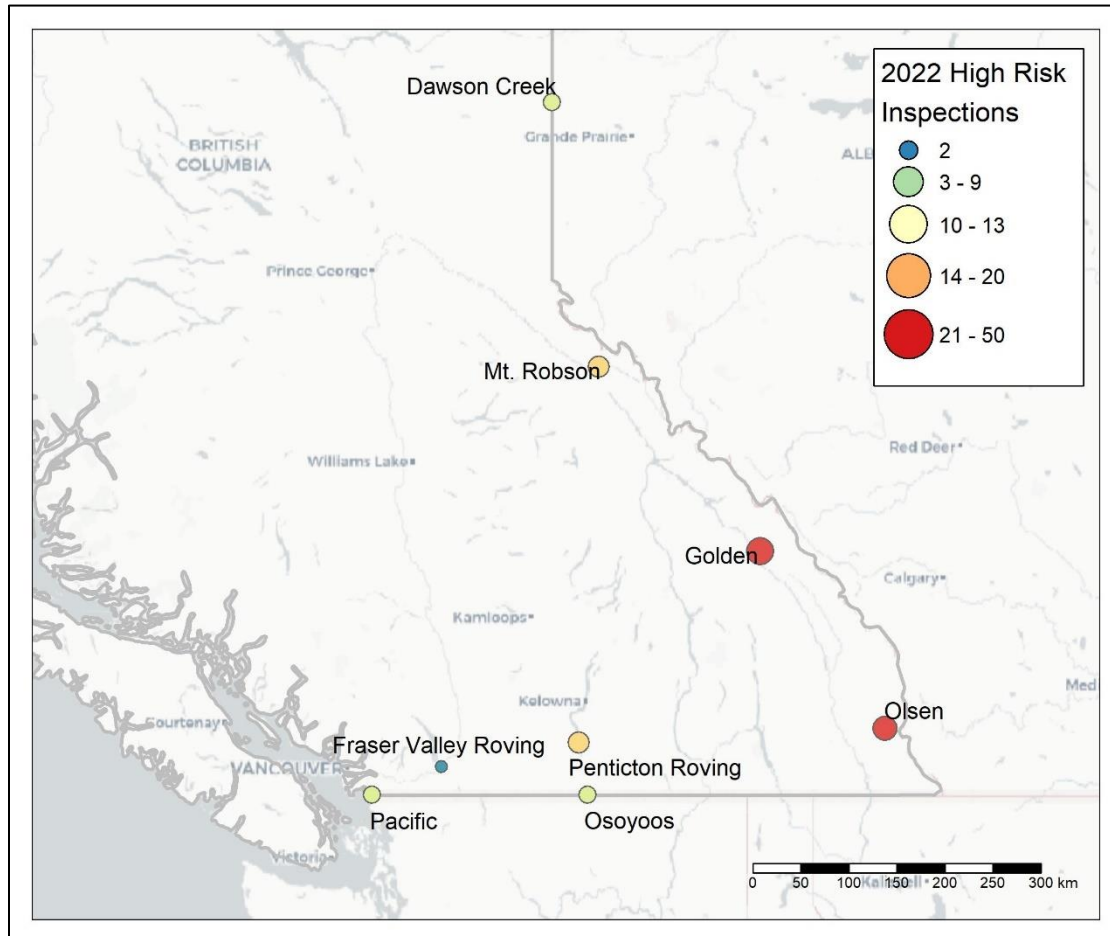


Figure 20 illustrates the number of high-risk inspections by station. The Golden station intercepted the most high-risk watercraft (50), followed by Olsen on Highway 3 (20), Mt. Robson (13) and Penticton Roving (13). No high-risk watercraft were intercepted at the Radium inspection station during the 2022 season.

Figure 20. The number of high-risk inspections by inspection station for the 2022 season.



3.2.1 High-risk Inspection Findings

Of the 122 high-risk watercrafts inspected, 64 were decontaminated, 63 were issued a decontamination order and 29 had associated quarantine periods to allow for sufficient drying time. Not all high-risk watercrafts can be decontaminated at the time of inspection and will be issued a decontamination order that requires a decontamination to be completed at the destination by trained inspectors.

Not all watercraft that were decontaminated required a decontamination order and quarantine period. Quarantine periods are issued when: standing water or mussels are found, and the boat has been out of the water less than 30 days; if inspectors cannot confirm the history of the boat at the time of inspection; or if a full decontamination cannot be completed at the time of inspection. Quarantine periods were enforced by applying wire seals to the boats and inspectors followed up at the end of the quarantine period to ensure the seals were still intact prior to the boat being launched.

Inspectors also record other findings during inspections: three inspections found aquatic plants and four inspections found marine mussels or barnacles. Inspectors routinely offer to clean the watercraft to ensure they are free of aquatic plants and Clean, Drain, Dry before leaving an inspection station.

In addition to the 122-watercraft identified as high-risk for either dreissenid mussels or other AIS, 99 watercrafts were identified as coming from an area in Alberta of high-risk for whirling disease (*Myxobolus cerebralis*). Inspectors were equipped with outreach and education resources on whirling disease to share with watercraft owners and conveyed the importance of Clean, Drain, Dry for boats and gear to prevent the spread of the disease.

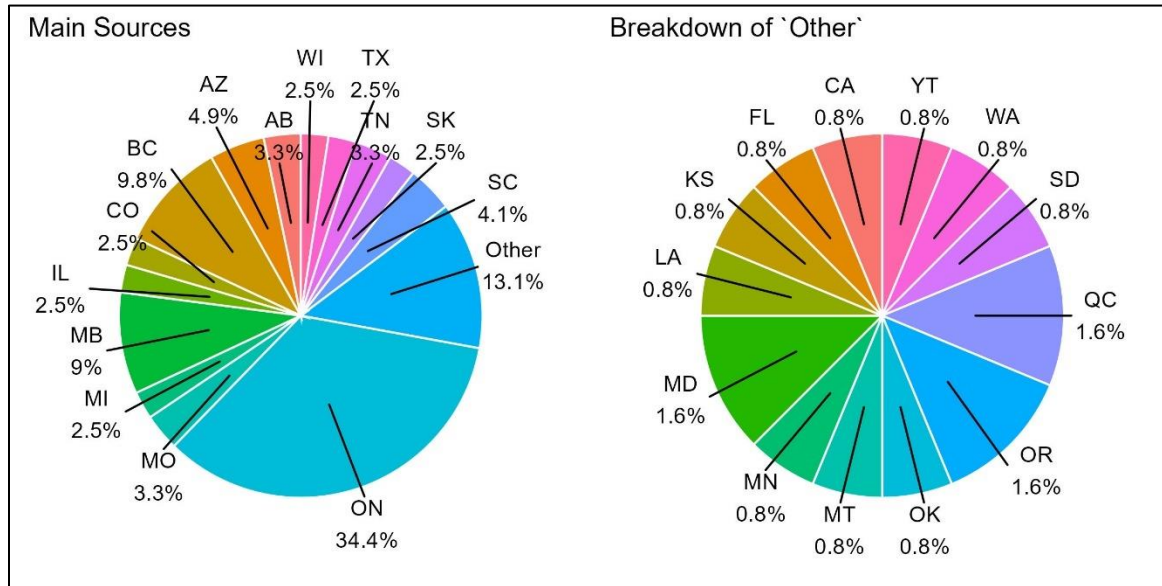
A total of 38 of the 122 high-risk watercraft (31.1%) had been through a previous inspection station within either B.C. or another jurisdiction. This represents a decrease from the 2021 season with 39% of the high inspections previously inspected. Collectively, these results still highlight the importance and effectiveness of the perimeter defence approach. Having multiple inspection stations across jurisdictions intercepting high-risk boats coming from the east and for educating the boating public is critical to mitigate the risk of ZQM to B.C.

3.2.2 Source and Destination Locations

Of the 122 high-risk watercrafts identified by inspection crews, 42 came from Ontario (35.6%), 12 from B.C. (10.2%), 11 from Manitoba (9.3%), 6 from Arizona (4.2%), 5 from South Carolina (4.2%), and 46 (36.4%) came from other provinces and states (Figure 21). It is important to note that a watercraft may be low risk for dreissenid mussels but high-risk for other AIS if they are not found to be Clean, Drain, Dry. Therefore, if a watercraft coming from Alberta or traveling within B.C. is not Clean, Drain, Dry it will be considered high-risk if further action such as decontamination is required.

Of the high-risk watercraft inspected, 21.3% were destined for waterbodies in the Lower Mainland, 18.0% for waterbodies in the Okanagan region, 9.0% for the Pacific Ocean, 9.0% for the Kootenay region, 5.7% for Vancouver Island, 4.9% for Thompson-Nicola, 2.5% for the Skeena, 1.6% for outside B.C., and 0.8% for the Cariboo, Peace and Omineeca regions; 25.4% were unclear on their destination waterbody (Figure 22). The destination waterbody could have been unknown for a variety of reasons such as the commercial hauler does not know where it will be launched, or the owner does not know the specific waterbody where they plan to launch it next. If a watercraft was still considered high risk following inspection and decontamination, the destination jurisdiction (other provinces, territories, or US states) was notified.

Figure 21. Source locations of the high-risk inspections identified during the 2022 season.



The abbreviations for the left portion of the figure, counterclockwise, are as follows: Alberta (AB), Arizona (AZ), British Columbia (B.C.), Colorado (CO), Illinois (IL), Manitoba (MB), Michigan (MI), Missouri (MO), Ontario (ON), South Carolina (SC), Saskatchewan (SK), Texas (TX), and Wisconsin (WI). For the right portion of the figure, the abbreviations, counterclockwise, are as follows: California (CA), Florida (FL), Kansas (KS), Louisiana (LA), Maryland (MD), Minnesota (MN), Montana (MT), Oklahoma (OK), Oregon (OR), Quebec (QC), South Dakota (SD), Tennessee (TN), Yukon (YT) and Washington (WA).

Figure 22. Destination regions of all high-risk inspections identified during the 2022 season.

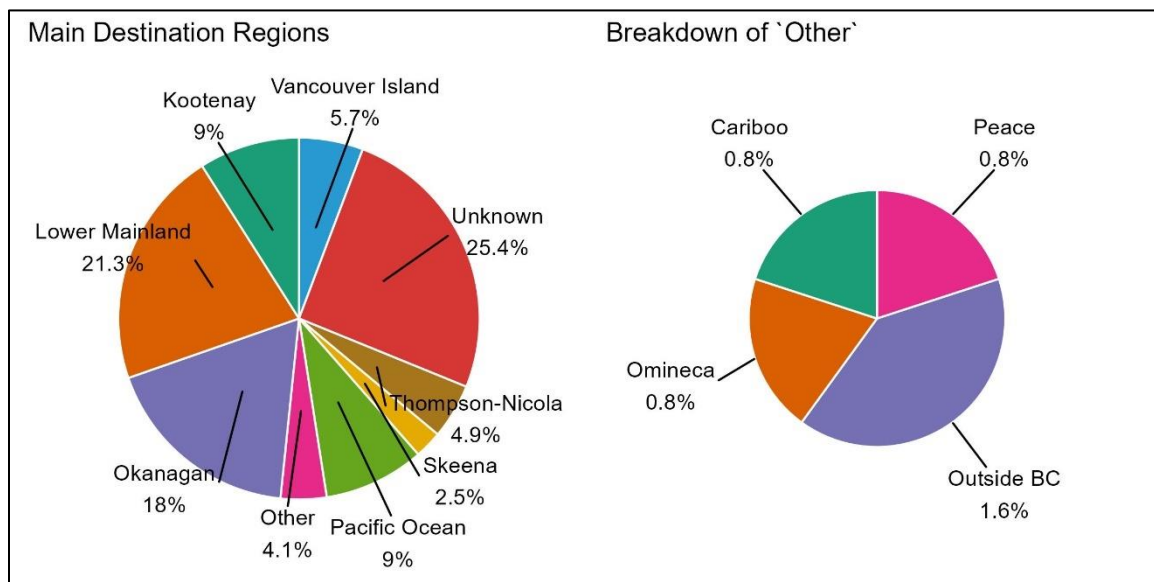


Figure 23. Source locations of the high-risk watercraft inspected during the 2022 season. This includes watercraft that are either high risk for dreissenid mussel or other AIS. If it is not Clean, Drain, Dry it will be considered high-risk if further action such as decontamination is required.

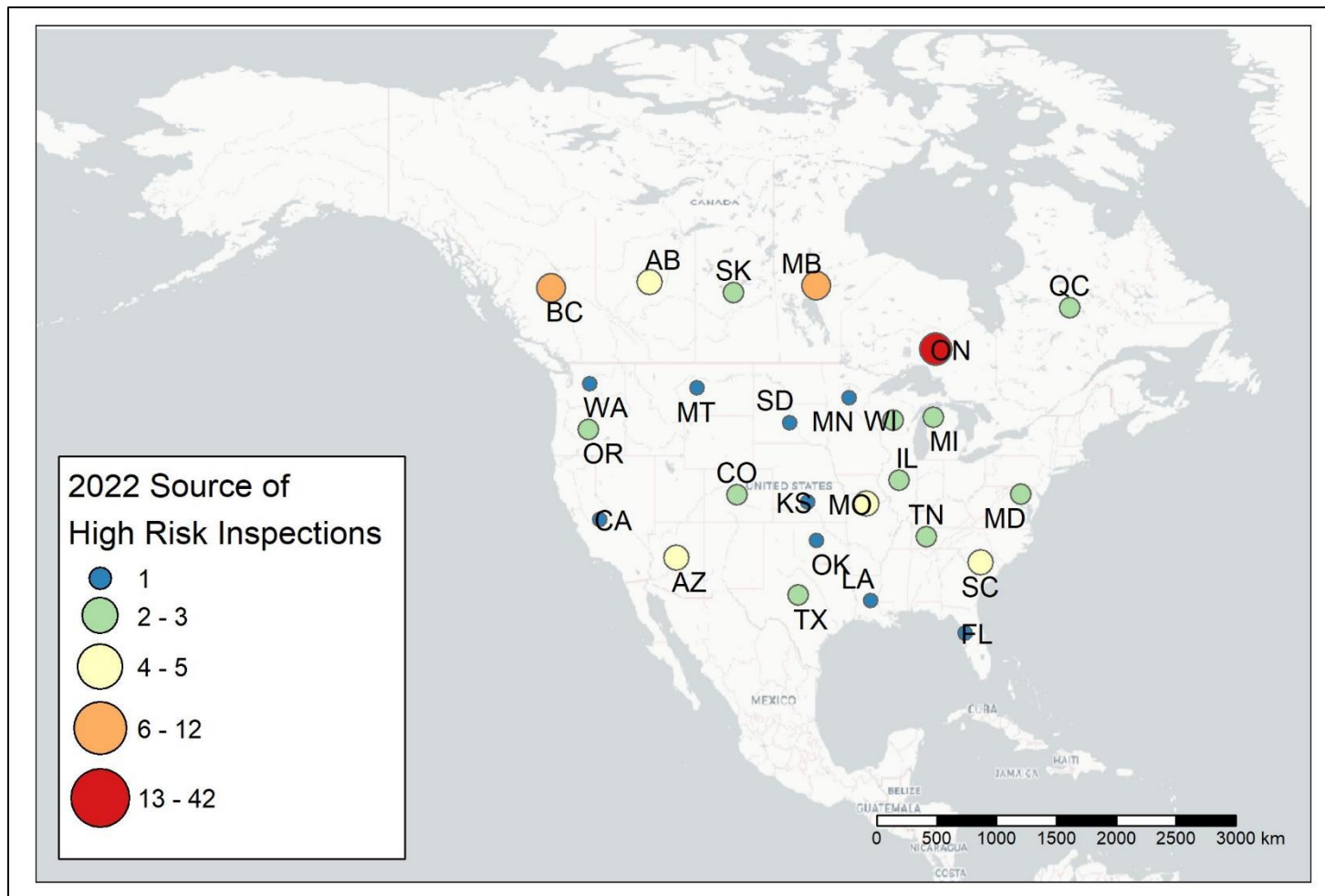
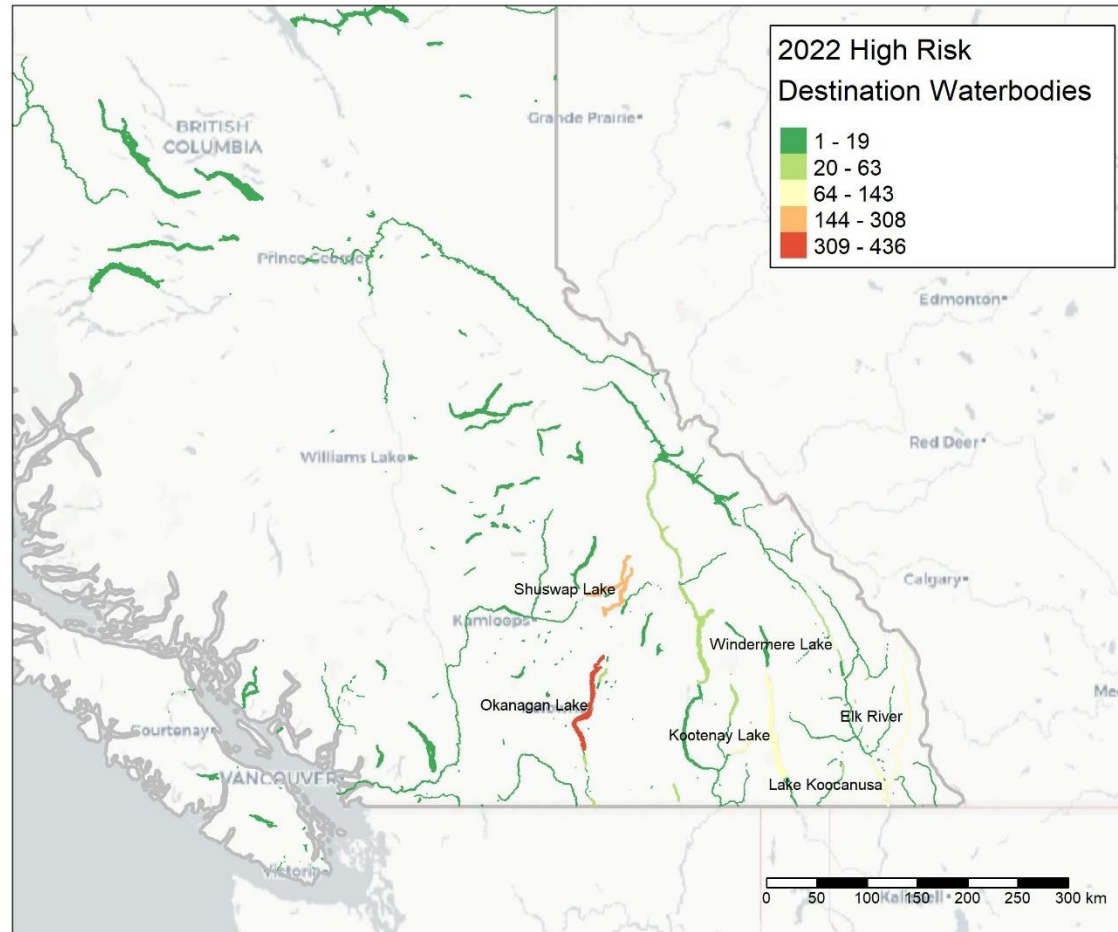


Figure 24. Destination locations of the high-risk inspections identified during the 2022 season, all waterbodies in third bin (yellow) to fifth bin (red) are labelled.



3.2.3 Watercraft Types

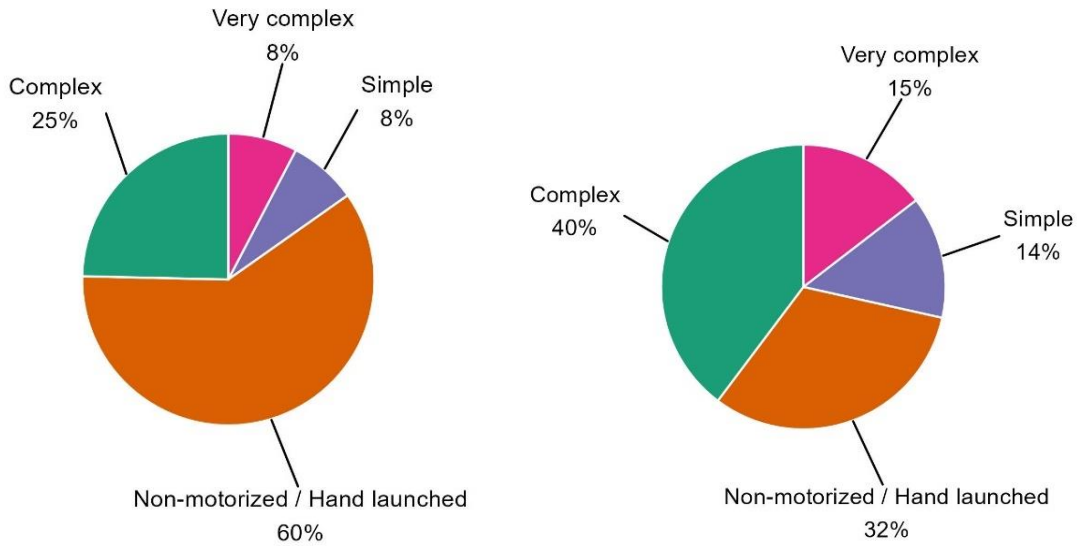
During the 2022 season, the type of watercraft was recorded for all inspections and grouped into four categories:

- **Non-motorized or hand launched:** boats that are not transported by trailers and do not have motors or engines. Examples include canoes, kayaks, paddle boards.
- **Simple watercraft:** A boat with an open hull and no containers or interior compartments and a single outboard motor. This is a hand-launched boat that is either launched from a trailer or adds a motor. Examples include car toppers (with engine), aluminium runabouts, open hull fishing boats (no live wells).
- **Complex watercraft:** A boat that has interior compartments or a closed hull or more than one motor. Examples include fishing boats, speed boats and jet boats.
- **Very complex watercraft:** A complex watercraft with more than one internal water system—e.g. generator, air conditioners, sea strainers, swamp coolers— or other sources of unverifiable water (e.g. ballast tanks). Examples include cabin cruisers, wakeboard boats, houseboats, and larger sailboats.

Non-motorized watercraft comprised the highest percentage (60.1%) of the total watercraft inspected in 2022, followed by complex (24.6%), very complex (7.7%) and simple watercraft (7.6%) (Figure 25). This is consistent with the 2021 data with 64% of total inspections being non-motorized watercraft. While very complex watercraft only made up 7.6% of the total inspections, they represented 15.0% of the high-risk inspections (Figure 25). Similarly, complex watercraft made up 24.7% of the total inspections but represented 38.8% of the high-risk inspections.

Generally, the results are consistent with very complex watercraft posing greater risk for transporting invasive mussels or other AIS as there are more crevices and hidden places that cannot be visually inspected. However, canoes, kayaks and small sailboats can still pose a risk of transporting standing water with potentially viable invasive mussel larvae as they are more commonly moved between waterbodies from multiple jurisdictions in short periods of time.

Figure 25. Total watercraft inspected by watercraft type (see above for explanation of each category) for all watercraft inspections (left) and high-risk inspections (right) for the 2022 season.

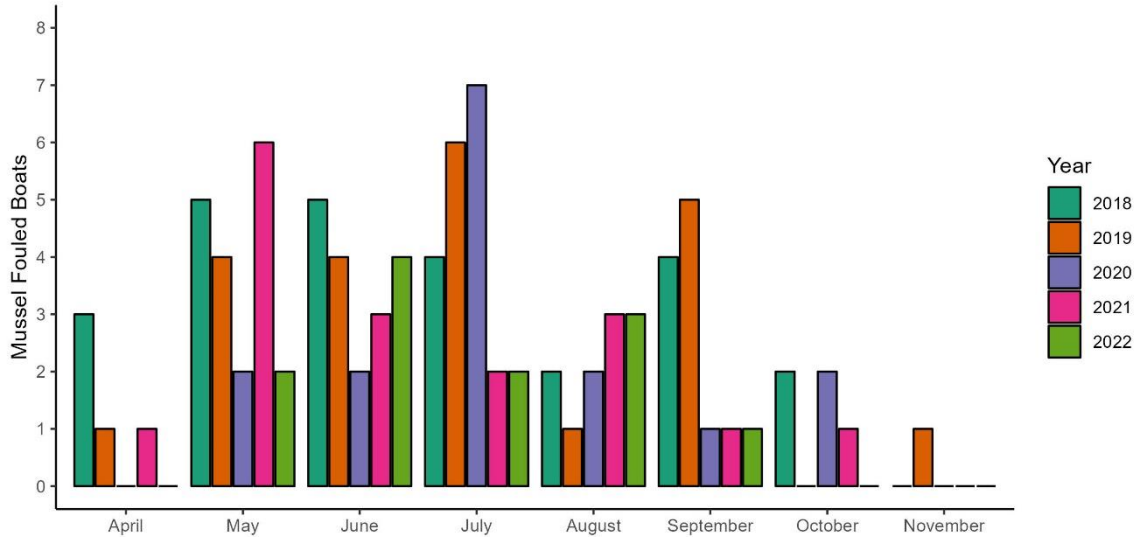


3.3 MUSSEL-FOULED WATERCRAFT

A total of 13 mussel-fouled watercraft were encountered, of which B.C. received advance notification for seven. These notifications came from another jurisdiction (in Canada or U.S.) or the Canadian Border Services Agency (CBSA). This represents a decrease from previous seasons when advance notifications were received for over 50% of the mussel-fouled boats. There was a decrease in the number of mussel fouled boats intercepted in 2022 relative to 2021 which saw 17 mussel fouled boats. This is consistent with the overall decrease in the total number of inspections in 2022 relative to 2021.

As illustrated in Figure 26, June saw the most mussel-fouled boats intercepted with four. This is fairly consistent with most years' data that saw peaks in the number of mussel-fouled boats in the spring and summer months (Figure 26).

Figure 26. The number of mussel-fouled watercraft intercepted by month across all seasons of the Program (2018–2022).



The 13 mussel-fouled boats were coming from Ontario (11), Manitoba (1), and Quebec (1) (Figure 27). The proportion of mussel-fouled boats that came from eastern or Great Lakes jurisdictions in the 2022 season was 92%, which is a noticeable increase from the 2021 season (76%). This is consistent with previous years where the majority of the mussels fouled boats have come from the Great Lakes jurisdictions in eastern Canada.

Figure 27. Source provinces and states of the 13 mussel-fouled watercraft intercepted during the 2022 season.

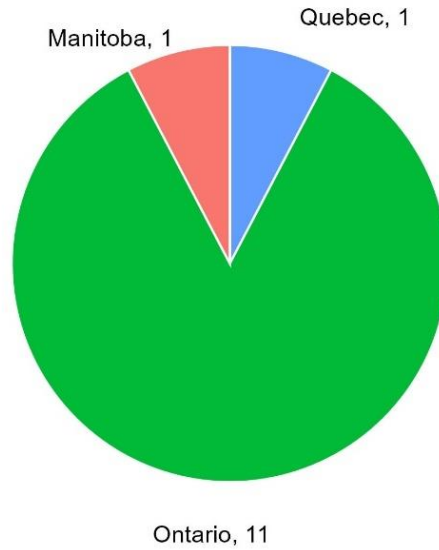
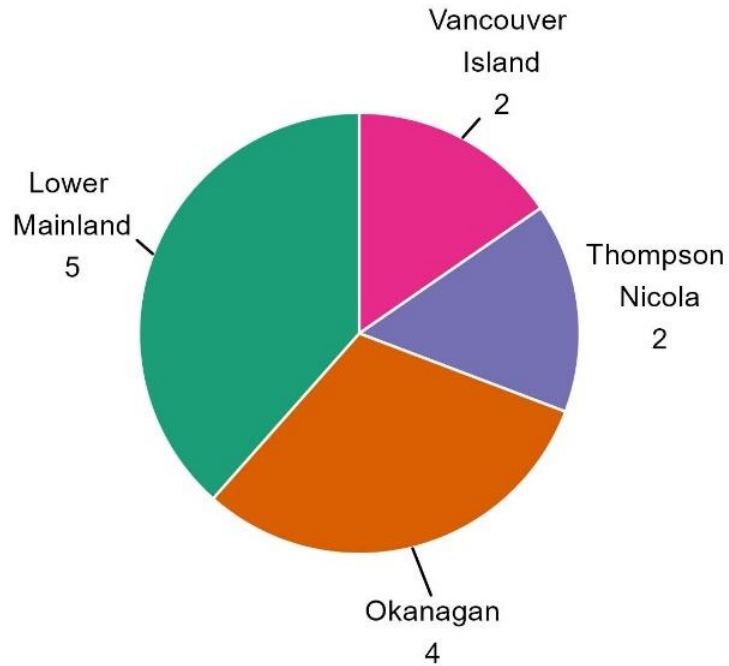
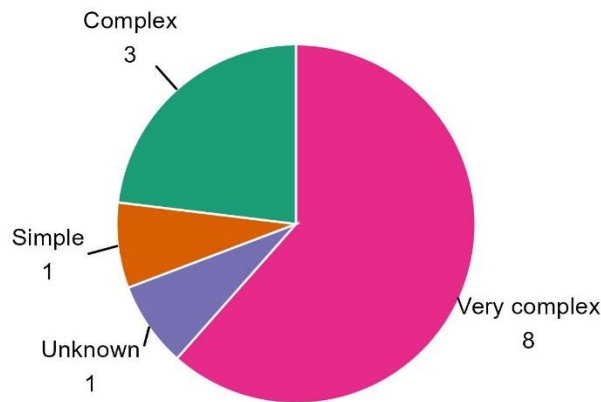


Figure 28. Destination regions in B.C. of the 13 mussel-fouled watercraft intercepted during the 2022 season.



The destination of the mussel-fouled boats by region was the Lower Mainland (5), the Okanagan (4), the Thompson-Nicola region (2), and Vancouver Island (2) (Figure 28). Of the 13 mussel-fouled watercraft, eight (62%) were very complex watercraft, three (23%) were complex watercraft, one was a simple watercraft (8%) and one (8%) was of unknown complexity (Figure 29).

Figure 29. Watercraft type of the 13 mussel-fouled watercraft intercepted during the 2022 season.



3.4 COMMERCIALY HAULED WATERCRAFT

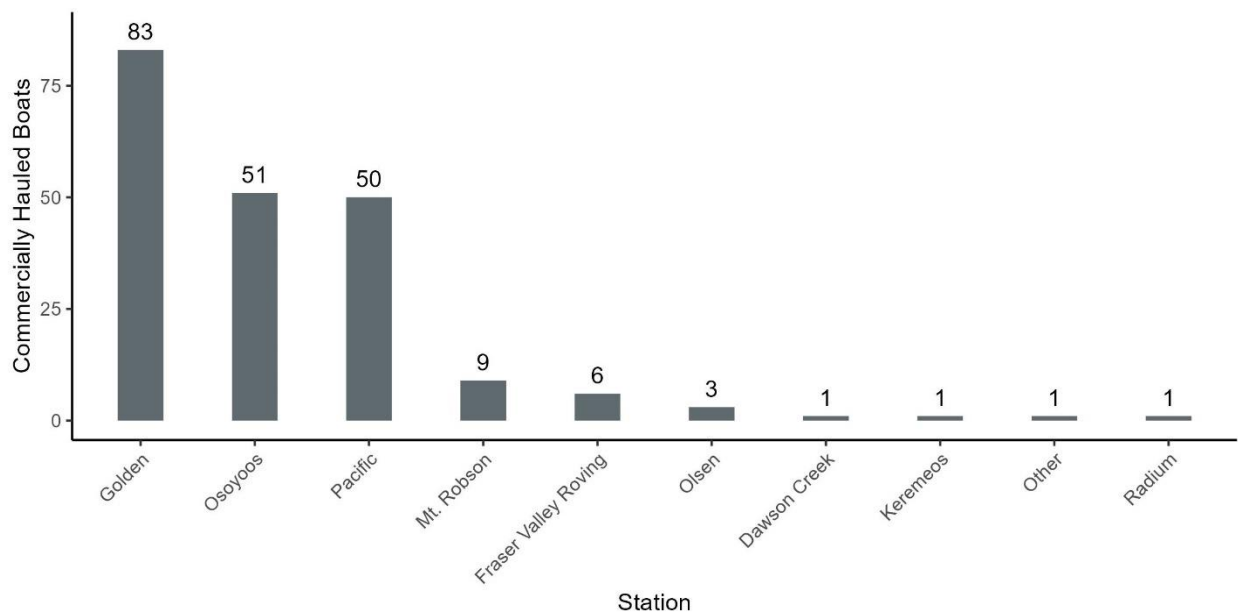
Of the total watercraft inspected (20,100), 222 were commercially hauled, representing around 1% of the total boats inspected. Commercially hauled watercraft represent a low percentage of total watercraft inspected; however, they demonstrate a disproportionately high-risk of carrying invasive mussels: 19.7% of high-risk watercraft were commercially hauled and 23.1% of the mussel-fouled watercraft (3 of the 13 boats) were commercially hauled.

The Golden station intercepted the highest number of commercially hauled watercraft (83), followed by Osoyoos (51), the Pacific Border (50), Penticton Roving (16), Mt. Robson (9), Fraser Valley Roving (6), and Olsen (3) (Figure 29). These data are consistent with the 2019, 2020 and 2021 seasons, which also saw the Golden and Pacific stations intercepting the most commercially hauled boats. This is expected as the Pacific border crossing is one of the main crossings in the lower mainland that permits commercial traffic. The Trans-Canada Highway, where the Golden station is located, is another primary travel route for commercially hauled watercraft. Despite the East Kootenay inspection station (Olsen) having high watercraft encounter frequency, they only saw 3 commercially hauled watercraft, indicating Highway 3 is not a major route for commercial haulers during the operating hours of the inspection stations.

The most common source locations for commercially hauled boats outside of B.C. were Washington, Alberta, Ontario, Tennessee, Indiana, Florida, and Texas (Figure 30). Commercially hauled boats include a combination of new boats being shipped from manufacturers to marinas or dealers and used boats purchased privately but are too large to be transported recreationally. New boats from manufacturers in the U.S. are frequently transported to Alberta and then shipped to B.C. (typically the Okanagan). Common locations of boat manufacturers in the U.S. include Florida, Indiana, Texas, and Washington.

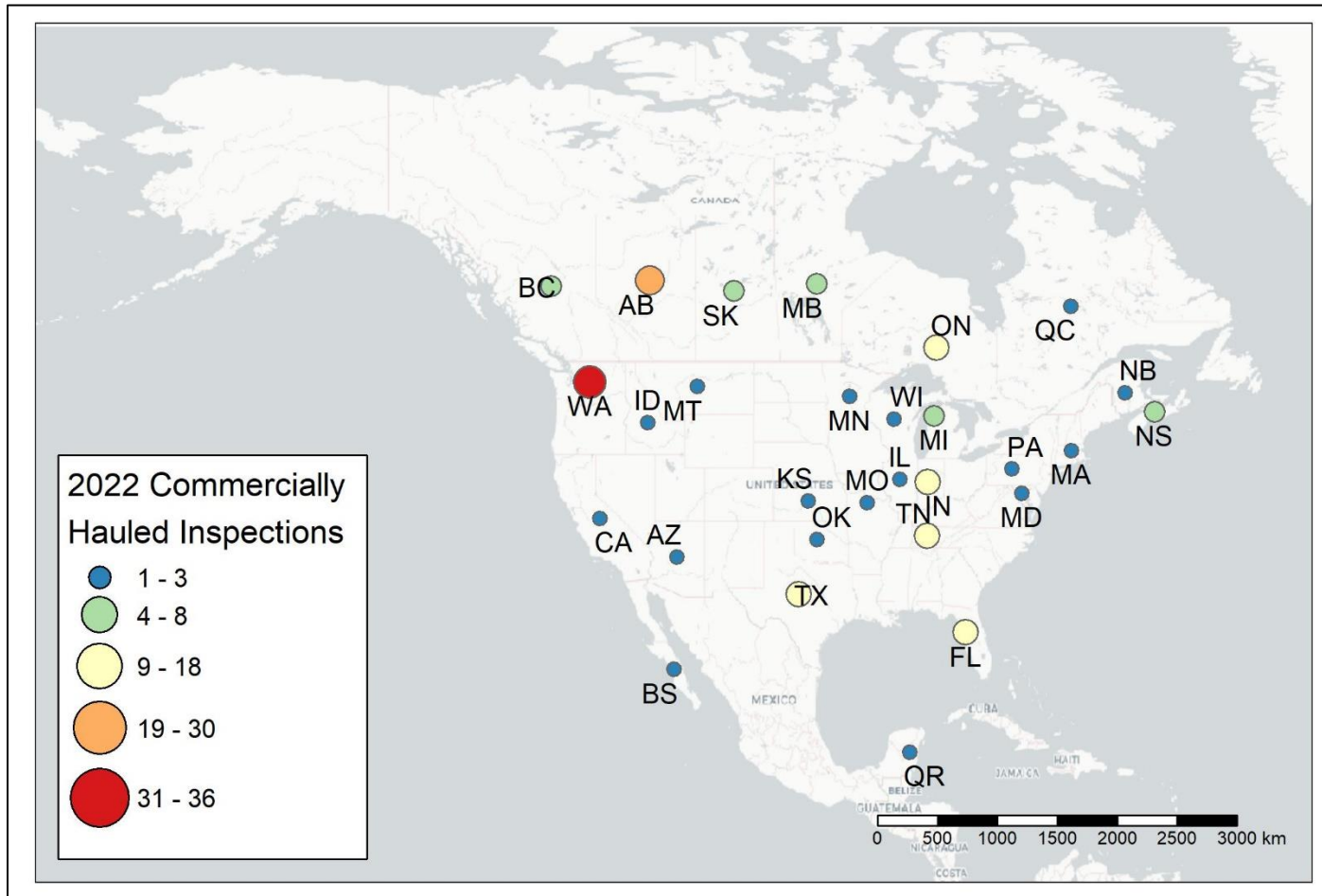
Some shipments of new boats are tested in high-risk waterbodies prior to be transported into B.C. and pose a risk of transporting standing water that could contain invasive mussels. Therefore, some shipments of new boats require follow up by AIS inspectors when they arrive at the destination. Used boats being commercially hauled from mussel-infested jurisdictions pose the highest risk for transporting invasive mussels and a common source location is the Great Lakes (Figure 30). Scheduled inspections at the destination are typically required for commercially hauled boats as they are typically plastic wrapped and inaccessible for inspection and decontamination during transport.

Figure 29. Number of commercially hauled boats intercepted at the watercraft inspection stations during the 2022 season (Penticton Roving excluded).



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Figure 30. Source location of commercially hauled watercraft.



3.5 AIS PASSPORT

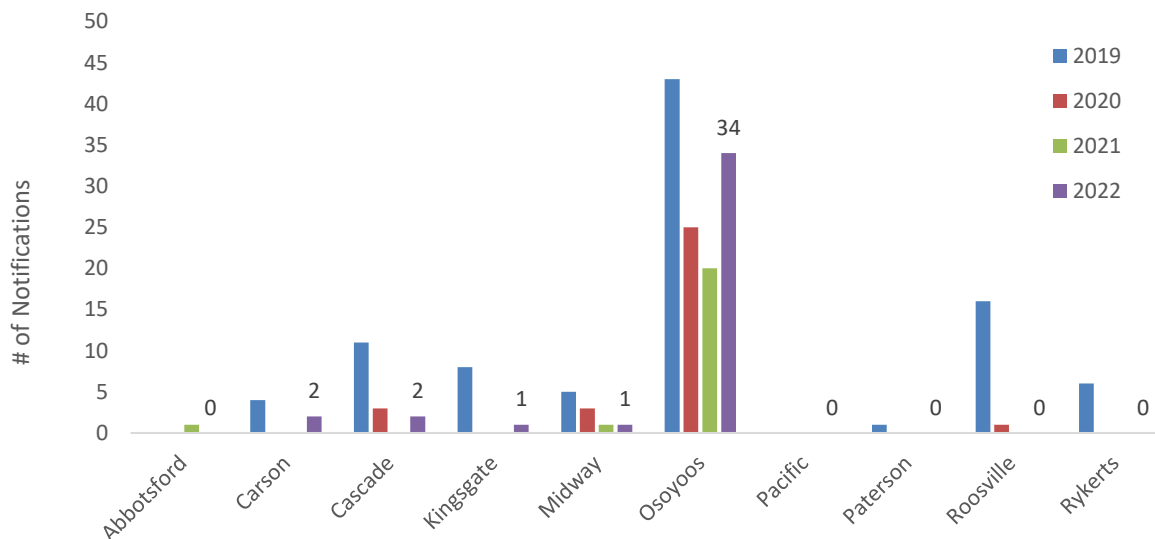
B.C. and Alberta launched a joint AIS passport in 2017 that is intended for watercraft travelling frequently through B.C. and Alberta. When the AIS passports are issued, boaters sign a commitment to practice Clean, Drain, Dry and stop at all inspection stations. It is still mandatory for all passport holders to stop at inspection stations, but the inspection process is quicker. The AIS passport is stamped each time a boater goes through an inspection station. The AIS passport serves as a record of past watercraft inspections.

Of the roughly 20,100 total inspections for the 2022 season, 1,324 (6.55%) were AIS passport holders. These boaters are asked a reduced number of questions during the inspection process. If the watercraft has not been launched outside of B.C. or Alberta in the last 30 days and the boat is found to be Clean, Drain, Dry, then the AIS passport is stamped, and the watercraft is released.

3.6 CANADA BORDER SERVICES AGENCY NOTIFICATIONS

During the 2022 season, the Program worked directly with CBSA to receive notifications of watercraft at the southern border crossings. For the 2022, season, the Program received 40 notifications from CBSA at several different border crossings that inspectors responded to (Figure 31). This represents an increase from the notifications received from CBSA in 2021 (25). These numbers reflect all the notifications that were received through the Program’s email throughout the year. When the Program receives notifications during the winter months, they are followed up by the AIS sergeants in the COS.

Figure 31. CBSA notifications received across southern US border crossings for the 2018 to 2022 seasons.



3.7 K9 INSPECTIONS

The Program launched the AIS K9 Unit in 2017 with the training of B.C.'s first multi-purpose detection dog (K9), Kilo and in 2020, a second detection K9 Major, joined the Program. Sergeant Dan Bartol has been the handler for Kilo since 2020 and they are based in Golden. Sergeant Denny Chretien has been the handler for K9 Major since fall 2021 and they are based out of Cranbrook.

Both K9 teams conducted inspections at the various watercraft inspection stations throughout the 2022 season. In addition, they typically attend various outreach or education events throughout the year. The K9s also support various enforcement-related inspections and searches for the Conservation Officer Service. A significant amount of time is required by the handlers each year for ongoing training and off duty care and maintenance of the K9s.

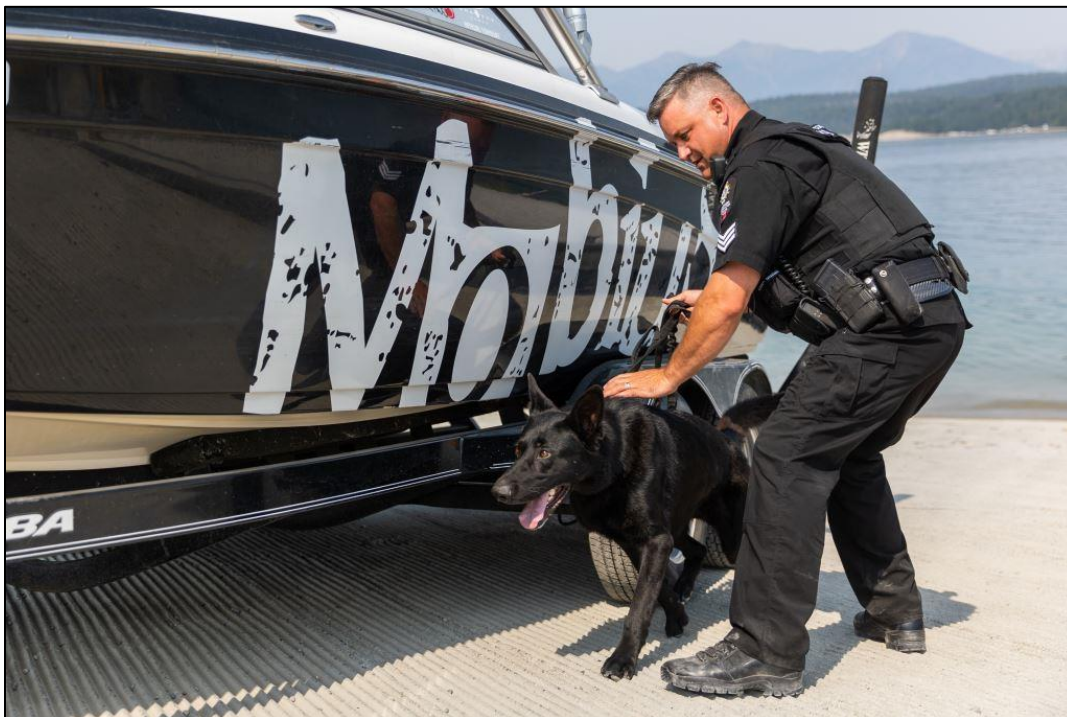


Figure 32. Sergeant Chretien and K9 Major conducting a search of a watercraft.



Figure 33. Sergeant Bartol and K9 Kilo searching a kayak at the Golden inspection station.

4. OUTREACH AND EDUCATION ON CLEAN, DRAIN, DRY

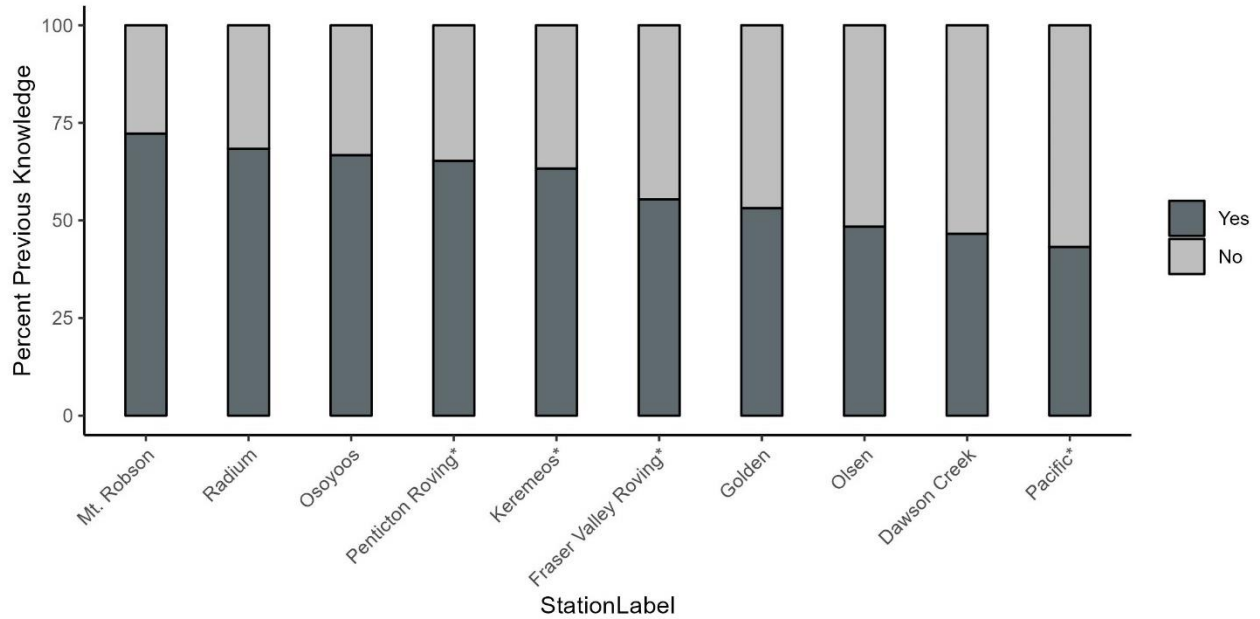
4.1 INSPECTION STATIONS

Inspection crews had approximately 36,400 interactions across all the inspection stations during the 2022 season to promote the message of Clean, Drain, Dry (CDD). Inspectors recorded whether the watercraft owner had any previous knowledge of AIS or CDD as a measure of efficacy of the Program to educate the public about AIS and CDD.

For the 2022 season, watercraft owners having previous knowledge of AIS and CDD averaged 56%, which is consistent with the 2021 season (57%) and the 2020 season (61%). Figure 34 shows the breakdown of previous knowledge by watercraft inspection station with Mt. Robson the highest at 72%. Figure 35 shows that the top source of previous knowledge was a visit to a previous inspection station in B.C. (72%), followed by visits to inspection stations outside of B.C. (12%), personal experience (12%), other sources (3%), and word of mouth (1%). Of the 12% of inspection stations outside B.C., 8% were from Alberta and the remaining 4% were from other jurisdictions.

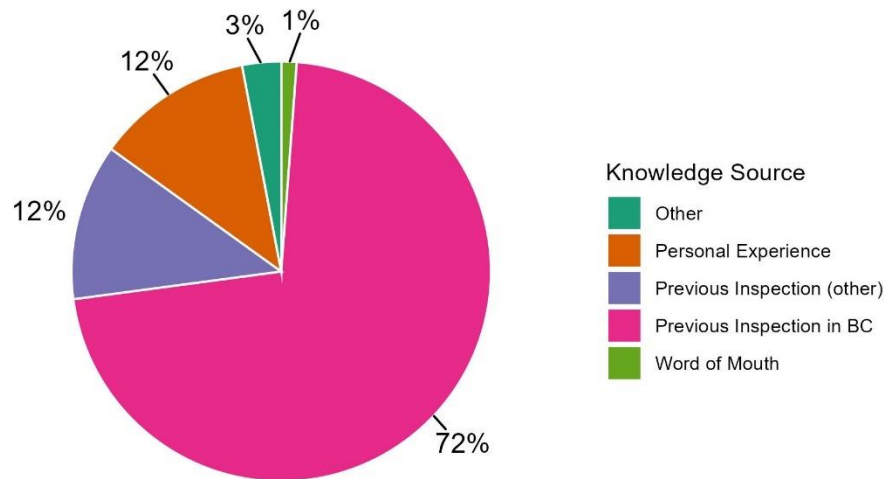
Other sources of knowledge include, but are not limited to, provincial government TV advertising or news, provincial government, signs at boat launches, US–Canada border inspection, highway billboard signs, regional invasive species groups, radio, internet, TV advertising or news and social media. Data were collected from boaters attending inspection stations. These data provide important information to effectively target the boating community to raise awareness about AIS and CDD in future years of the Program.

Figure 34. Watercraft owners' previous knowledge of aquatic invasive species and/or Clean, Drain, Dry by watercraft inspection station for 2022.



*Denotes the roving inspection stations.

Figure 35. Primary sources of previous knowledge of aquatic invasive species or Clean, Drain, Dry.



The Program also received 117 public inquiries over the 2022 season through its email (COS.Aquatic.Invasive.Species@gov.bc.ca), which is monitored by all the inspectors and senior Program leads. These emails included reports of suspected invasive mussels, which were immediately followed up on; there were no confirmed reports of invasive mussels. Most emails were from boaters bringing their boats into B.C. and contacting the Program about the watercraft inspection stations and necessary steps to take. The Program saw a slight decrease in the number of public inquiries (117) relative to 2021 season (135) but similar levels as the 2020 season (118).

4.2 OUTREACH EVENTS

While provincial inspection stations are the first priority of the Program, in past seasons when time permitted, inspection crews also attended local events to provide education about CDD, invasive mussels, and other high-risk AIS. Some of the events that were attended in 2022 included the Kelowna Boat Show, the Kelowna Sportsman Show, and Osoyoos Lake Water Quality Society Watercraft Demonstration. The Okanagan and Lower Mainland roving crews also conducted inspections and outreach at several boat launches throughout the summer months. The crews also continued to provide outreach materials and promote Clean, Drain, Dry at the inspection stations throughout the season.

5. LAKE MONITORING

Monitoring is critical for early detection of new invasive species incursions in B.C. and is an important first step in the *Provincial Early Detection Rapid Response (EDRR) Plan*⁴. B.C. has been conducting lake monitoring for ZQM since 2011. B.C. is one of many jurisdictions across North America conducting monitoring and active prevention efforts for invasive mussels.

The *British Columbia Dreissenid Mussel Lake Monitoring Field Protocol*⁵ was updated and published in December 2021 for the 2022 sampling season. It details the provincial protocols used for lake monitoring for invasive mussels. As a signatory of the *Columbia River Basin Inter-Agency Invasive Species Response Plan: Zebra Mussels and Other Dreissenid Species*, B.C. has committed to following the accepted standards for the collection, preservation, and analysis of invasive mussel veliger samples. As such, B.C. uses a specified cross-polarized microscopy method, which is done through a designated lab to ensure the provincial standards are met. Waterbodies are prioritized for sampling based on best available science and data to optimize use of available resources. Available resources must be allocated for both the number of priority waterbodies to be sampled and the frequency of sampling within an individual waterbody. The frequency of sampling includes both the number of sample sites within the waterbody and frequency with which they are sampled throughout the season. Large priority waterbodies (e.g., Shuswap and Okanagan Lakes) are prioritized for sampling at multiple locations

⁴ Source: https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/invasive-species/guidance-resources/final_imiswg_bc_is_edrr_plan_nov_2014.pdf

⁵ Source: https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/invasive-species/invasive-mussels/2021_invasive_mussel_field_protocol_final.pdf

throughout the sampling season. Table 2 provides a summary of the total number of samples collected and the number of waterbodies sampled by year since the Program started in 2015. The total number of waterbodies sampled decreased slightly since the 2017 season as resources have been allocated to balance both the number of priority waterbodies sampled and the frequency in which they are sampled. More information about the criteria used to prioritize waterbodies for sampling can be found in the provincial field protocol referenced above.

Table 2. Total number of plankton tow samples collected, and waterbodies sampled by season since the Program started in 2015.

Year	Total Samples	Total Waterbodies
2015	161	58
2016	233	98
2017	402	109
2018	800	90
2019	892	79
2020	954	89
2021	900	75
2022	830	78

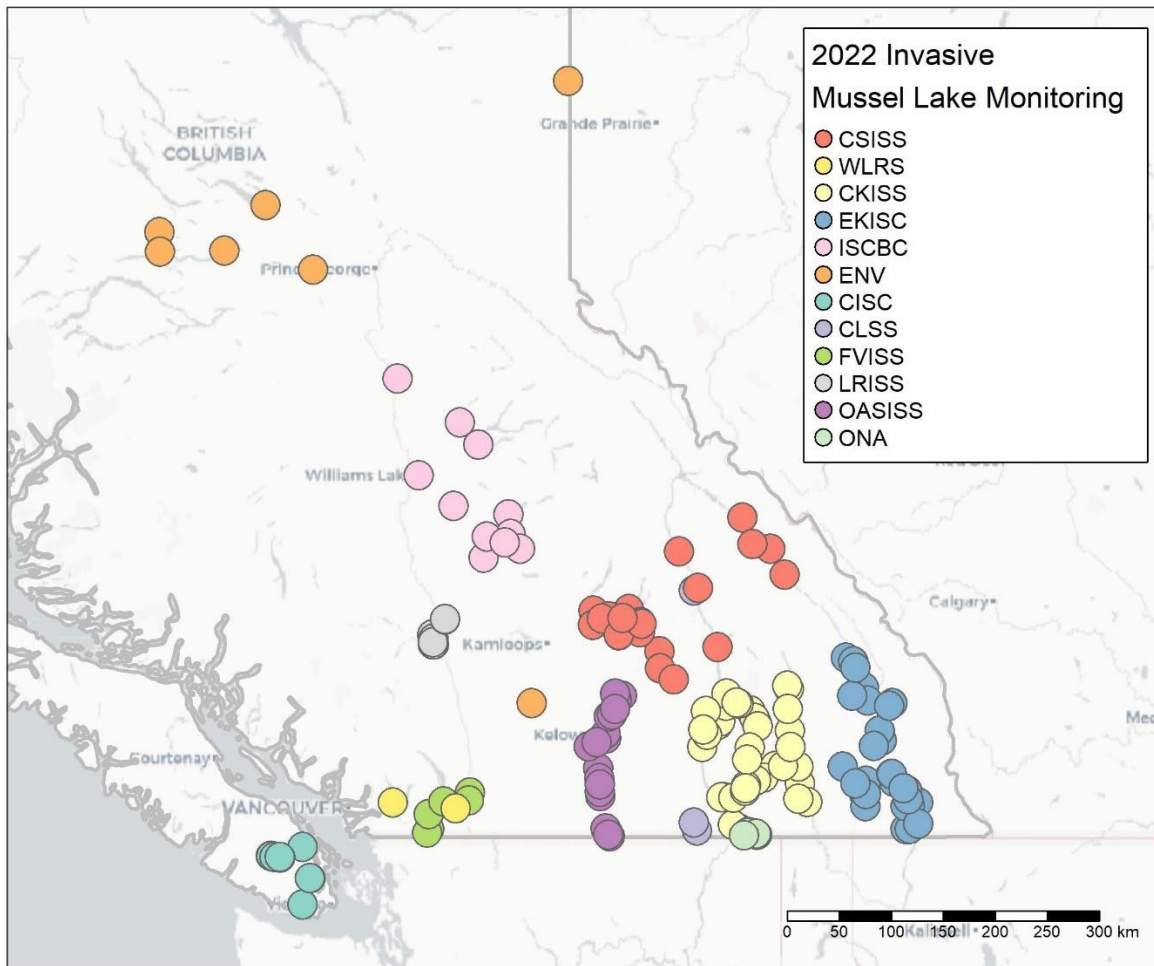
The Habitat Conservation Trust Foundation (HCTF) announced a new granting program in 2018 in partnership with WLRS designed to fund community efforts to monitor lakes in B.C. for the presence of invasive freshwater mussels. More information about the program is available at <https://hctf.ca/grants/invasive-mussel-monitoring-grants/>

For the 2022 season, sampling was carried out by both partner organizations and Ministry staff from early June to October. A total of 9 grants were administered by the Habitat Conservation Trust Foundation with funding provided by the Ministry of Water, Land and Resource Stewardship and Fisheries and Oceans Canada for the collection of water samples in priority waterbodies across B.C. The grant recipients were: Coastal Invasive Species Committee (CISC), Central Kootenay Invasive Species Society (CKISS), Christina Lake Stewardship Society (CLSS), Columbia-Shuswap Invasive Species Society (CSISS), East Kootenay Invasive Species Council (EKISC), Fraser Valley Invasive Species Society (FVISS), Invasive Species Council of British Columbia (ISCBC), Lillooet Regional Invasive Species Society (LRISS), and the Okanagan and Similkameen Invasive Species Society (OASISS). Samples were also collected by MOE (ENV) and WLRS regional staff.

B.C. was successful in receiving four years of federal funding in 2019 under the Canada Nature Fund for Aquatic Species at Risk to support invasive mussel lake monitoring activities within the Fraser and Columbia River Watersheds. More information about the Canada Nature Fund for Aquatic Species at Risk is available at <https://www.dfo-mpo.gc.ca/species-especes/sara-lep/cnfasar-fnceap/index-eng.html>

A total of 830 plankton tow samples were collected across 78 priority waterbodies and 52 substrate samples were deployed (Figure 36) during the 2022 season. All samples tested negative for the presence of invasive mussels. A complete list of waterbodies sampled in 2022 can be found in Appendix B.

Figure 36. 2022 Lake monitoring plankton tow sampling locations, please see above for the names of the sampling agencies.



6. PARTNERSHIPS AND COLLABORATIONS

Partnerships are the foundation of the Program and below is a summary of several of the many partnerships that the Program is involved with.

CROSS-BORDER:

Within Canada, B.C. is an active participant on several Federal/Provincial/Territorial invasive species committees including the Invasive Alien Species National Committee and the National Aquatic Invasive Species Committee (NAISC). B.C. is also a signatory of the *Interprovincial Territorial Agreement for Coordinated Regional Defence Against Invasive Species*. Through this agreement B.C. collaborates with Alberta, Yukon, Saskatchewan, and Manitoba on enhanced coordination for preventing and managing AIS; the initial emphasis is on zebra and quagga mussels. A central component of this work is coordination of the watercraft inspection programs to enhance the perimeter defence approach across western Canada.

An example of this coordination across western Canada was observed in June 2022 when several western provinces notified the IMDP about a large, contaminated barge traveling from Ontario to B.C. The 40ft mussel-fouled barge was being transported from Lake Ontario and destined for industrial use in a Lower Mainland waterway. It was the largest, most significant discovery and decontamination of zebra mussels on a watercraft since IMDP's inception in 2015.

COS aquatic invasive species inspectors quickly mobilized from the Okanagan and the Lower Mainland to decontaminate the barge. Using specialized equipment, teams removed thousands of invasive mussels over two days. Many of the mussels were viable, meaning they were capable of establishing and subsequently invading B.C. waters if given the chance. The barge was issued a mandatory 30-day quarantine period, which ended early July 2022. The successful decontamination of the barge before it reached B.C. waters highlights the effectiveness of tackling the threat of invasive species through a coordinated approach with our neighbouring provinces.

Another highlight from 2022 was the registration by Health Canada for the use of Potash to control for zebra and quagga mussels in open waters in western Canada. This represents a significant milestone in advancing the tools available for invasive mussel control in western Canada. It was a direct result of the substantial resources invested by the Government of Alberta who led the application submission.

Ongoing coordination with other jurisdictions in Canada and the U.S. has been essential for the overall success of the Program. Outside of B.C., the Program shares research, procedures, and notifications of high-risk boats with Idaho, Montana, Washington, Oregon, Wyoming, Nevada, Arizona, California, Alaska, Yukon, Saskatchewan, Manitoba, and Alberta. This is part of B.C.'s ongoing commitment as a signatory to the trans-boundary *Columbia River Basin Inter-agency Invasive Species Response Plan: Zebra Mussels and Other Dreissenid Species* (available for download [here](#)). As a signatory, B.C. receives notifications of high-risk watercraft from neighbouring states, and is provided access to professional advice on risk management and training opportunities. B.C. is also a member of the Pacific Northwest

Economic Region (PNWER) invasive species working group and in 2022 took on the role as technical co-chair of the working group.

The Program continued to work directly with CBSA to receive notifications of watercraft at the southern border crossings, including 24-hr coverage along several of the southern border crossings. The watercraft notification procedure is outlined within CBSA's [Memorandum D19-8-5 Import Prohibitions and Requirements for Commercial Importers of Aquatic Species and for Travellers Under the Aquatic Invasive Species Regulations](#). The Program receives notifications for all types of watercrafts including canoes, kayaks, and river rafts. Program staff follow up on each CBSA notification and then coordinate action when required (e.g., additional inspections and decontaminations).

EXTERNAL PARTNERS:

At the provincial level, the Program works on outreach and education messaging directly with the non-governmental community, including the Invasive Species Council of BC and regional invasive species committees. B.C. appreciates the ongoing support provided by invasive species groups to help educate British Columbians on the threat of invasive mussels and promoting the consistent messaging of Clean, Drain, Dry. B.C. annually contributes funding to many invasive species organizations across the province to support the invasive mussel lake monitoring sampling.

7. SUMMARY OF LESSONS LEARNED AND IMPROVEMENTS

At the end of each season, the Program undergoes an annual review that considers ongoing feedback from the AIS inspectors, partners, and the public, as well as lessons learned from other jurisdictions across western Canada and the United States. This report summarizes lessons learned from the 2022 season, which were considered in the planning and implementation of the 2023 season.

7.1 GENERAL OPERATIONS

Building on the success of having two roving crews during the 2021 season, the Program continued to implement both the Okanagan and Lower Mainland roving crews for the 2022 season. The roving crews were able to respond to high-risk watercraft notifications and conduct outreach at local boat launches as time permitted. The Okanagan and Lower Mainland receive the highest volume of high-risk watercraft. The roving crew's build the Program's capacity in these regions to respond to the high-risk watercraft notifications coming from other inspection stations in B.C. (such as Golden), other jurisdictions (Alberta, Saskatchewan, Idaho, Oregon, Montana, Washington and CBSA). Watercraft cannot always be decontaminated during transportation at a roadside inspection station and may therefore require follow-up upon arrival at the destination. When the watercraft is intercepted at the B.C. inspection station, it is issued a decontamination order that requires it to report to an inspection crew for decontamination upon its arrival. When they weren't responding to high-risk watercraft notifications, the Penticton crew rotated between setting up stations at alternative locations (Keremeos, Kaleden, Greenwood, and Hwy 97C) due to the Osoyoos border crossing being closed for most of the season. The roving crew also conducted inspections and outreach at boat launches throughout the Okanagan region.

There were no high-risk watercrafts intercepted at the Radium inspection station during the 2022 season. This is consistent with past seasons which have typically seen a very high proportion of local boaters being intercepted at the Radium station. The Program continues to explore and maximize incremental improvements to Program operations and processes to increase efficiencies in Program delivery and the effectiveness of the Radium inspection station will be evaluated for the 2023 season.

7.2 INSPECTION STATIONS

Recruitment and retention of AIS inspector positions at the northern inspection stations in particular (Dawson Creek and Valemount) has always been a challenge since the Program started. However, since the pandemic and the current competitive job market, recruitment at these locations has become much more difficult. The Program will continue to look for new and innovative ways to address these hiring challenges and will continue to work closely with other neighbouring jurisdictions that are facing similar issues.

7.3 COMPLIANCE

The average compliance across all the inspection stations for the 2022 season was 89.6%, which is consistent the 2021 season (88%). Of the watercraft that failed to stop at the inspection station, 82.6% were non-motorized watercraft such as canoes, kayaks, and paddleboards, which pose a much lower risk than motorized watercraft.

A total of 63 violation tickets and 66 warnings were issued by Conservation Officers to motorists for failing to stop at inspection stations. This is similar to the 2021 season (85 tickets and 45 warnings). When full-time Conservation Officers were not on site to issue tickets and warnings to motorists, the inspectors reported all high-risk boats that failed to stop to the RAPP line. RAPP line notifications were circulated to all the full-time Conservation Officers within the region. The Program also received support from local RCMP with apprehending motor vehicles transporting watercraft that failed to stop at the inspection stations.

APPENDIX A 2022 WATERCRAFT INSPECTION STATION DETAILS

Station Name	Hwy #	Region	Type	Traffic Direction
Dawson Creek	2	Peace	Permanent	Westbound
Lower Mainland	n.a.	Lower Mainland	Roving crew	n.a.
Golden	1	Kootenay	Night Inspection	Westbound
Mt. Robson	16	Omineeca	Permanent	Westbound
Olsen (Hwy 3)	3	Kootenay	Permanent	Westbound
Osoyoos	176 Ave	Lower Mainland	Permanent	Northbound
Penticton	n.a.	Okanagan	Roving crew	n.a.
Radium	95	Kootenay	Permanent	Southbound

APPENDIX B 2022 LAKE MONITORING SAMPLING DETAILS

Waterbody	Region	Sampling Group/Agency	Zebra/Quagga mussels veligers
Adams Lake	Thompson-Nicola	CSISS	no
Alouette Lake	Lower Mainland	WLRS	no
Arrow Lake, Lower	Kootenay	CKISS	no
Arrow Lake, Upper	Kootenay	CKISS	no
Arrow Lake, Upper	Kootenay	CSISS	no
Baynes Lake	Kootenay	EKISC	no
Bridge Lake	Cariboo	ISCBC	no
Bull River	Kootenay	EKISC	no
Burns Lake	Skeena	ENV	no
Canim Lake	Cariboo	ISCBC	no
Cedar Lake	Kootenay	CSISS	no
Charlie Lake	Peace	ENV	no
Chemainus Lake	Vancouver Island	CISC	no
Christina Lake	Kootenay	CLSS	no
Christina Lake	Okanagan	CLSS	no
Clucluz Lake	Omineeca	ENV	no
Columbia Lake	Kootenay	EKISC	no
Columbia River	Kootenay	CKISS	no
Columbia River	Kootenay	CSISS	no
Cowichan Lake	Vancouver Island	CISC	no
Cowichan Lake	Vancouver Island	ENV	no
Cultus Lake	Lower Mainland	FVISS	no
Deka Lake	Cariboo	ISCBC	no
Dragon Lake	Cariboo	ISCBC	no
Duncan Lake	Kootenay	CKISS	no
Elk River	Kootenay	EKISC	no
Enid Lake	Kootenay	EKISC	no
Francois Lake	Skeena	ENV	no
Fraser Lake	Omineeca	ENV	no
Fraser River	Lower Mainland	FVISS	no
Fraser River	Thompson-Nicola	LRIS	no
Green Lake	Cariboo	ISCBC	no
Harrison Lake	Lower Mainland	FVISS	no
Horse Lake	Cariboo	ISCBC	no
Horsefly Lake	Cariboo	ISCBC	no
Jim Smith Lake	Kootenay	EKISC	no
Kalamalka Lake	Okanagan	OASISS	no
Kawkawa Lake	Lower Mainland	FVISS	no

Waterbody	Region	Sampling Group/Agency	Zebra/Quagga mussels veligers
Kinbasket Reservoir	Kootenay	CSISS	no
Koocanusa Lake	Kootenay	EKISC	no
Kootenay Lake	Kootenay	CKISS	no
Kootenay River (Nelson)	Kootenay	CKISS	no
Lac La Hache	Cariboo	ISCBC	no
Lazy Lake	Kootenay	EKISC	no
Little Shuswap Lake	Thompson-Nicola	CSISS	no
Loon Lake	Kootenay	EKISC	no
Mabel Lake	Okanagan	CSISS	no
Mara Lake	Thompson-Nicola	CSISS	no
Monroe Lake	Kootenay	EKISC	no
Moyie Lake	Kootenay	EKISC	no
Nicola Lake	Thompson-Nicola	ENV	no
Norbury Lake	Kootenay	EKISC	no
Okanagan Lake	Okanagan	OASISS	no
Osoyoos Lake	Okanagan	OASISS	no
Pavilion Lake	Thompson-Nicola	LRISS	no
Pend d'Oreille River	Kootenay	ONA	no
Premier Lake	Kootenay	EKISC	no
Quesnel Lake	Cariboo	ISCBC	no
Revelstoke Reservoir	Kootenay	CSISS	no
Rosen Lake	Kootenay	EKISC	no
Shawnigan Lake	Vancouver Island	CISC	no
Sheridan Lake	Cariboo	ISCBC	no
Shuswap Lake	Thompson-Nicola	CSISS	no
Silver Lake	Lower Mainland	FVISS	no
Skaha Lake	Okanagan	OASISS	no
Slocan Lake	Kootenay	CKISS	no
Slocan River	Kootenay	CKISS	no
St Mary's	Kootenay	EKISC	no
Stuart Lake	Omineeca	ENV	no
Sugar Lake	Okanagan	CSISS	no
Summit Lake	Kootenay	CKISS	no
Suzanne Lake	Kootenay	EKISC	no
Swan Lake	Peace	ENV	no
Tie Lake	Kootenay	EKISC	no
Wahleach	Lower Mainland	WLRS	no
Wasa Lake	Kootenay	EKISC	no
Whatshan Lake	Kootenay	CKISS	no
White Lake	Thompson-Nicola	CSISS	no

Waterbody	Region	Sampling Group/Agency	Zebra/Quagga mussels veligers
Whiteswan Lake	Kootenay	EKISC	no
Whitetail Lake	Kootenay	EKISC	no
Williams Lake	Cariboo	ISCBC	no
Windermere Lake	Kootenay	EKISC	no
Wood Lake	Okanagan	OASISS	no

**Please see section 5 for the full names of the sampling groups or agencies.*