

B.C. Invasive Mussel Defence Program: 2019 Final Report



Ministry of
Environment and
Climate Change Strategy

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GLOSSARY

Acronym	Definition
AGRI	Ministry of Agriculture
AIS	aquatic invasive species
BISS	Boundary Invasive Species Society
CAS	Controlled Alien Species Regulation
CBSA	Canada Border Services Agency
CBT	Columbia Basin Trust
CDD	Clean, Drain, Dry
CLSS	Christina Lake Stewardship Society
CO	Conservation Officer
COS	Conservation Officer Service
CSISS	Columbia Shuswap Invasive Species Society
DFO	Fisheries and Oceans Canada
EKISS	Eastern Kootenay Invasive Species Society
ENV	Ministry of Environment and Climate Change Strategy
FLNRORD	Ministry of Forests, Lands, Natural Resource Operations and Rural Development
IMISWG	Inter-Ministry Invasive Species Working Group
TRAN	Ministry of Transportation and Infrastructure
NAD	North American datum
NWIPC	Northwest Invasive Plant Council
OASISS	Okanagan and Similkameen Invasive Species Society
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
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 program 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 practice 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 already present in some lakes but not others such as Eurasian watermilfoil.
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. 30 days 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 could be present in standing water for 3-4 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	<p>A high-risk watercraft may be any of the following:</p> <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 / province that has zebra or quagga mussel infestations and 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.

EXECUTIVE SUMMARY

In 2019, the Invasive Mussel Defence Program had another busy and successful season through both the watercraft inspection stations and lake monitoring activities. The 2019 season marked the second year of the joint delivery of the program between the B.C. Conservation Officer Service (COS) and Ecosystems Branch (EB) within the Ministry of Environment and Climate Change Strategy (ENV). The COS oversaw the operations of the 12 watercraft inspection stations that were staffed by 64 auxiliary conservation officers from April to October of 2019.

For the 2019 season, over 52,000 watercraft were inspected and crews had approximately 95,000 interactions with the public to promote Clean, Drain, Dry and raise awareness about aquatic invasive species. Of the total watercraft inspected, 1,290 were identified as high-risk, 86 decontamination orders were issued, and 79 watercraft were issued quarantine periods to meet the required 30-day drying time.

Of the more than 52,000 watercraft inspected, 22 were confirmed to have adult invasive mussels. These came from Ontario (16), Michigan (3), Utah (2) and North Carolina (1) and were destined for the Lower Mainland (9), Vancouver Island (4), Okanagan (3), Kootenays (3), Thompson-Nicola (1), Skeena (1) and Alaska (1). The program received advanced notification on 17 of the 22 mussel fouled boats either from another jurisdiction (e.g., Alberta, Montana, Idaho, Washington or by Canada Border Services Agency (CBSA)).

Average compliance at the inspection stations for the 2019 season was 83% and represents a 2% increase from the 2018 season (81%). Conservation officers issued a total of 116 tickets and 114 warnings to motorists for failing to stop at inspection stations. 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 are responding and following up.

In 2019, approximately 892 water samples were collected, and 83 substrate samplers were deployed across 79 lakes to monitor for invasive mussels. All samples came back negative for the presence of invasive mussels.

A lesson learned from the 2018 season was the need for increased supervisory and operational oversight resulting in the 2019 hiring of an additional Sergeant to supervise the Golden, Valemount, and Dawson Creek inspection stations. During the 2018 season, the program also welcomed K9 Major as the newest addition to the team. Major and his handler Sergeant Mann completed their training in November 2018 and were deployed at several inspection stations during the 2019 season.

The program would also like to thank our funding partners for their ongoing support (BC Hydro (\$1.25M/yr.), Columbia Basin Trust (\$250,000/yr.), Columbia Power Corp (\$250,000/yr.) and Fortis BC (\$250,000/yr.).

1. BACKGROUND

1.1 HISTORY

The presence of Zebra and Quagga mussels can result in substantial economic, environmental, and social impacts. These impacts include increased maintenance costs to infrastructure such as hydropower, water-works, irrigation, and degradation of native ecosystems, thereby affecting fisheries, recreation, and tourism. Unlike B.C.'s native mussels, Zebra and Quagga 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 Aboriginal 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 **\$500 million** annually¹. An economic risk assessment specific to B.C. estimates annual costs of C\$43 million if ZQM are introduced to B.C. This assessment does not include impacts to tourism, fisheries or property values.

The program was launched in 2015 and has since adapted and expanded operationally and geographically each year through additional funding. This document reports on the logistics, activities, and findings of the program's 2019 season for the operational period of April 1, 2019 to March 31, 2020. More information about previous seasons, including annual reports, is available on the program [website](#).

1.2 REGULATORY AND JURISDICTIONAL FRAMEWORK

The program is designed to prevent the spread of ZQM by intercepting and inspecting watercraft travelling into or through B.C.

The program consists of three main components:

- **A watercraft inspection program** to detect and respond to high-risk watercraft potentially transporting ZQM in B.C.;
- **Lake monitoring** to assess for the continued absence of ZQM in B.C. waters; and

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

- **Outreach and education** to promote the message of CLEAN, DRAIN, DRY to the boating community, in collaboration with the Invasive Species Council of B.C. and regional invasive species committees.

Program success depends on:

- 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 gives the Province authority to take action on ZQM. The CAS Regulation under the *Wildlife Act* is the principle 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;
- release prohibited mussels into B.C. waters; or
- allow a prohibited mussel to be released or escape into B.C. waters.

In February 2017, following the detection of invasive mussel veligers in Tiber Reservoir, Montana in fall 2016, Schedule 5 of the CAS was amended to include Montana as a contaminated U.S. state. This enabled inspectors to issue decontamination orders and quarantine periods for watercraft coming from Montana. Saskatchewan was also added to Schedule 5 of the CAS as a contaminated province. While there are no confirmed detections of ZQM in Saskatchewan, invasive mussels were detected in Cedar Lake, Manitoba which flows directly into Saskatchewan waters. Due to the direct connectivity with infested waters in Manitoba, all watercraft coming from Saskatchewan were treated as high-risk during the 2019 season.

In June 2015, the Aquatic Invasive Species Regulation, under the Federal *Fisheries Act*, was brought into force. This regulation prohibits the import and transportation of ZQM in the western provinces and empowers Canada Border Services Agency (CBSA) staff to detain high risk boats at the Canada/U.S. border.

1.3 JURISDICTIONAL COORDINATION

Ongoing coordination with other jurisdictions in Canada and the U.S. has been critical 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; 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 [Western Regional AIS Panel](#) and an active participant in the Pacific Northwest Economic Region (PNWER) invasive species working group.

In late 2015, the *Inter-Provincial-Territorial Agreement for Coordinated Regional Defense Against Invasive Species* was signed 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 mussel prevention and rapid response.

2. PROGRAM LOGISTICS

2.1 OPERATIONS

In 2019, program operations were administered by ENV. The officer in charge (OIC), three sergeants and the auxiliary conservation officers were staffed through the COS and oversaw the field operations of the watercraft inspection stations. EB staff within ENV led the science and policy aspects of the program including the lake monitoring program and research collaborations which are outlined in more detail in sections 5 and 6. The delivery of outreach and education and partnerships was shared between the COS and EB staff.

Hours of Operation

All the watercraft inspection stations were staffed with 64 trained auxiliary conservation officers (CO) equipped with mobile decontamination units. Four of the inspection stations (Laidlaw, Yahk, Radium, and Olsen (Hwy 3)) had six inspectors for dawn to dusk operations seven days a week. The dawn to dusk stations were operational until late October. Six inspection stations (Pacific, Osoyoos, Salmo, Cutts (Hwy 93), Mt. Robson, and Dawson Creek) were staffed with four inspectors for 10 hrs per day operations seven days a week. The Cascade inspection station was staffed by two inspectors and operated Thursday to Sunday during peak traffic. The Dawson Creek inspection stations closed in late August and the Mt. Robson inspection station was operational until late September. The Golden inspection station had twelve inspectors for 24-hr coverage seven days a week from mid-May to September and operated dawn to dusk with six inspectors during the shoulder seasons in the spring (April/May) and fall (September to late October).

Inspection Station Locations

Data from the 2018 boating season and inspection locations were used to adjust program operations for the 2019 season (Figure 1). The locations and hours of operations were assessed for suitability based on encounter frequency (watercraft encounters/effort), safety/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 received from within the province 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 traveling to other jurisdictions.

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



Figure 1. Watercraft inspection station locations for the 2019 season.

2.2 INSPECTION CREW TRAINING (AUXILIARY COs)

Inspector positions are selected based on education and background from a recognized compliance and enforcement or natural resource management program. These positions provide an opportunity for recent graduates of enforcement programs to gain hands-on experience and training towards a potential career in enforcement or environmental management.

Inspectors were trained in watercraft inspection and decontamination following the [Uniform Minimum Protocols and Standards for Watercraft Interception Programs for Dreissenid Mussels in the Western United States](#) (updated 2016). 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 was 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?

In accordance with ENV's watercraft risk assessment, if any watercraft or piece of equipment was in waters of any province or U.S. state known or suspected of having ZQM in the previous 30 days, it was considered high-risk. Any watercraft or equipment coming from a state or province that has quagga or zebra mussel infestations and was not clean to the satisfaction of inspectors, and had not been drained and dried, was also considered high-risk, even if it had been out of the water for over 30 days. Low-risk watercraft are those that have been used solely within B.C. or other non-contaminated provinces or states within the previous 30 days.

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 budget for 2019 consisted of \$2M from the four program partners (BC Hydro (\$1.25M/yr.), Columbia Basin Trust (\$250,000/yr.), Columbia Power Corp (\$250,000/yr.) and Fortis BC (\$250,000/yr.), \$1M of dedicated funding in the provincial budget, and an additional \$500,000 of provincial funding for a total of \$3.5M. There was an additional \$250,000 of risk managed provincial funding for the 2019 season of which \$106,093 was spent (indicated by the total variance in Table 1).

Ecosystems Branch (EB) Budget

Of the \$1M in dedicated provincial funding, \$250,000 went to the EB to cover staff salary time for travel to meetings, program reporting, supporting the COS, outreach materials & partnerships, and overseeing the lake monitoring program. Staff time for the lake monitoring program includes the annual review and update of the provincial protocol and chairing the technical committee for reviewing the Habitat Conservation Trust Foundation (HCTF) grant proposals. Over the winter of 2019/20 EB staff were also heavily involved in supporting the development of the new watercraft inspection App.

The lake monitoring costs were for the lab analysis of all water samples collected during the 2019 season. The cost of the lab analysis is separate from the grants administered by the HCTF which covers the collection, preservation and shipping of the samples. These costs were split across the EB and COS budgets.

COS Budget

The COS operational budget outlined in Table 1 covered salary, travel, vehicle, training, lake monitoring, educational, and miscellaneous equipment and maintenance costs. Capital equipment costs included the purchase of three pressure washer generators and two secure storage containers. Non-capital equipment and maintenance costs included uniforms, monthly subscriptions for electronic devices (iPhones, iPads, satellite messengers, and software licenses), highway signs, and safety equipment.

Salary costs included the 64 auxiliary conservation officers operating from either March to October or May to September. It also included the salary for the officer in charge, three sergeants, and one administrative coordinator.

Vehicle costs include rental vehicle lease and fuel for inspection crews along with any maintenance and repairs for the rental vehicles. Ministry fleet vehicles could not be obtained for the 2019 season.

Education/awareness costs include the production of various outreach/education materials (rack cards, wallet cards, stickers, resin blocks, chamois, key floats, sunglass straps, and whistles) that were distributed by the inspectors at the watercraft inspection stations.

2019 INVASIVE MUSSEL DEFENCE PROGRAM FINAL REPORT

 Table 1. Summary of 2019 operating budget broken down by the COS and EB and the actuals as of March 31st 2020.

2019-2020	2019-2020 Complete Budget	Actuals as of March 31 2020	COS 2019-20 Budget	COS 2019-20 Actuals	EB 2019-20 Budget	EB 2019-20 Actuals	Variance
Salary	\$2,503,500	\$2,725,954	\$2,403,500	\$2,639,278	\$100,000	\$86,676	-\$222,454
Travel & Training	\$158,000	\$123,861	\$143,000	\$110,998	\$15,000	\$12,863	\$34,139
Corporate Overhead	\$80,000	\$80,000	\$65,000	\$65,000	\$15,000	\$15,000	\$0
Vehicle	\$243,700	\$247,999	\$243,700	\$247,999	\$0	\$0	-\$4,299
Education/ Awareness/ Research	\$171,600	\$129,015	\$89,600	\$95,906	\$82,000	\$33,109	\$42,585
Non-capital equipment/ maintenance	\$220,700	\$188,044	\$202,700	\$183,396	\$18,000	\$4,648	\$32,656
Lake Monitoring	\$75,000	\$63,218	\$55,000	\$55,000	\$20,000	\$8,218	\$11,782
Equipment Amortization	\$15,000	\$15,043	\$15,000	\$15,043	\$0	\$0	-\$43
Total Operations	\$3,467,500	\$3,573,134	\$3,217,500	\$3,412,620	\$250,000	\$160,514	-\$105,591
Capital Equipment	\$17,000	\$17,502	\$17,000	\$17,502	\$0	\$0	-\$502
Total	\$3,484,500	\$3,590,636	\$3,234,500	\$3,430,122	\$250,000	\$160,514	-\$106,093

3. WATERCRAFT INSPECTION SUMMARY FOR 2019

3.1 ALL WATERCRAFT ENCOUNTERS

During the 2019 season, just over 52,000 watercraft were inspected, and the crews interacted with approximately 95,000 people to promote Clean, Drain, Dry. Of the total watercraft inspected, 1,290 were identified as coming from a high-risk province or state, 86 were issued Decontamination Orders, and 79 were issued quarantine periods to meet the required 30-day drying time. Of the total watercraft inspected, 22 were confirmed to have adult invasive mussels (see Section 3.2 for further detail on high-risk watercraft).

The remainder of this section discusses the watercraft inspection data collected by the crews at each station across the entire season. Data was summarized in several ways, including an assessment of total watercraft encounters (total number of watercraft inspected), and total effort (total operational hours). To quantify the frequency at which watercraft came through the inspection stations, the ratio of watercraft encounters to effort was calculated as the encounter frequency. 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 encounters (Figure 2) were highest at the Laidlaw station (14,457 boats), followed by the Golden station (7,636 boats), the Yahk station (7,420 boats), and the Olsen station (6,973 boats).

The encounter frequency (watercraft encounters/effort) across each inspection station showed that the busiest inspection stations were Laidlaw, Yahk, Mt. Robson, Radium, Olsen and Dawson Creek (Figure 3). The stations with the lowest frequency of boater traffic were Cascade, Pacific and Osoyoos. Interestingly, some of the stations with a low frequency of boater traffic had the highest percentage of high-risk boats (Pacific Border and Mt. Robson) (Figure 3). It is important to note that the encounter frequency only represents boater traffic during operational hours.

Watercraft inspection data was also used to determine the number from which different jurisdictions boats were traveling (Figure 4). The Dawson Creek station inspected boats coming from 41 different provinces and states, more than any other inspection station despite having lower overall number of inspections. In contrast, the Cascade and Salmo stations inspected boats from 9 and 22 different provinces and states.

The data illustrates the importance of looking at both the total number of boats inspected as well as the proportion of high-risk boats going through each inspection station. The data also provides important information on the different routes boaters are traveling.

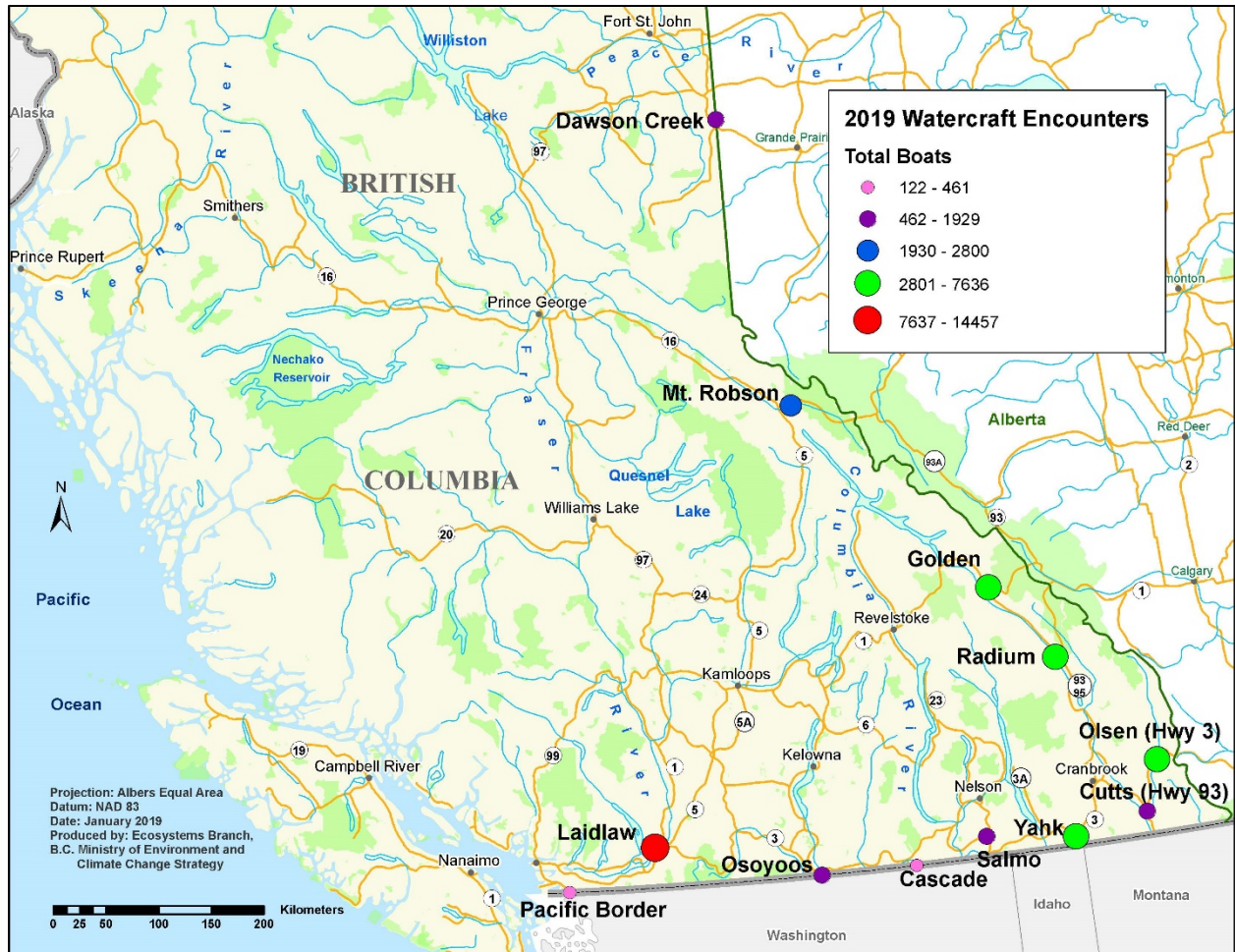


Figure 2. Total watercraft encounters for inspection stations during the 2019 season.

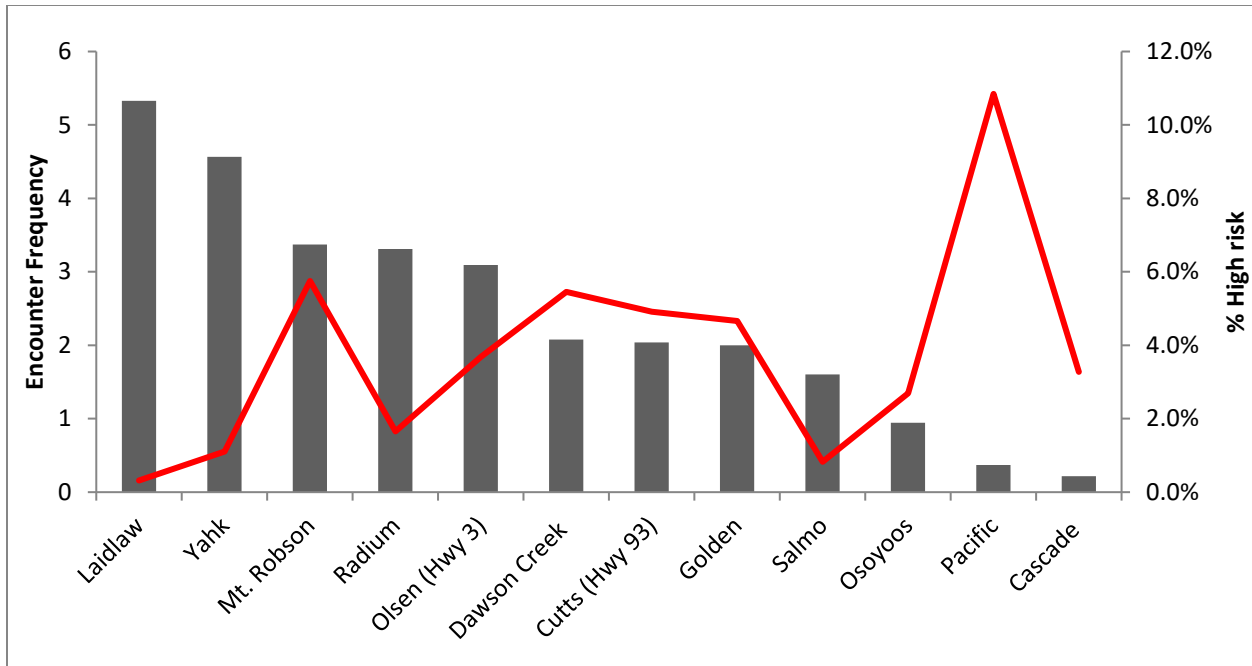


Figure 3. Encounter frequency (bars) by inspection station in comparison to percent of high-risk boats (line) per inspection station, from April to October 2019.

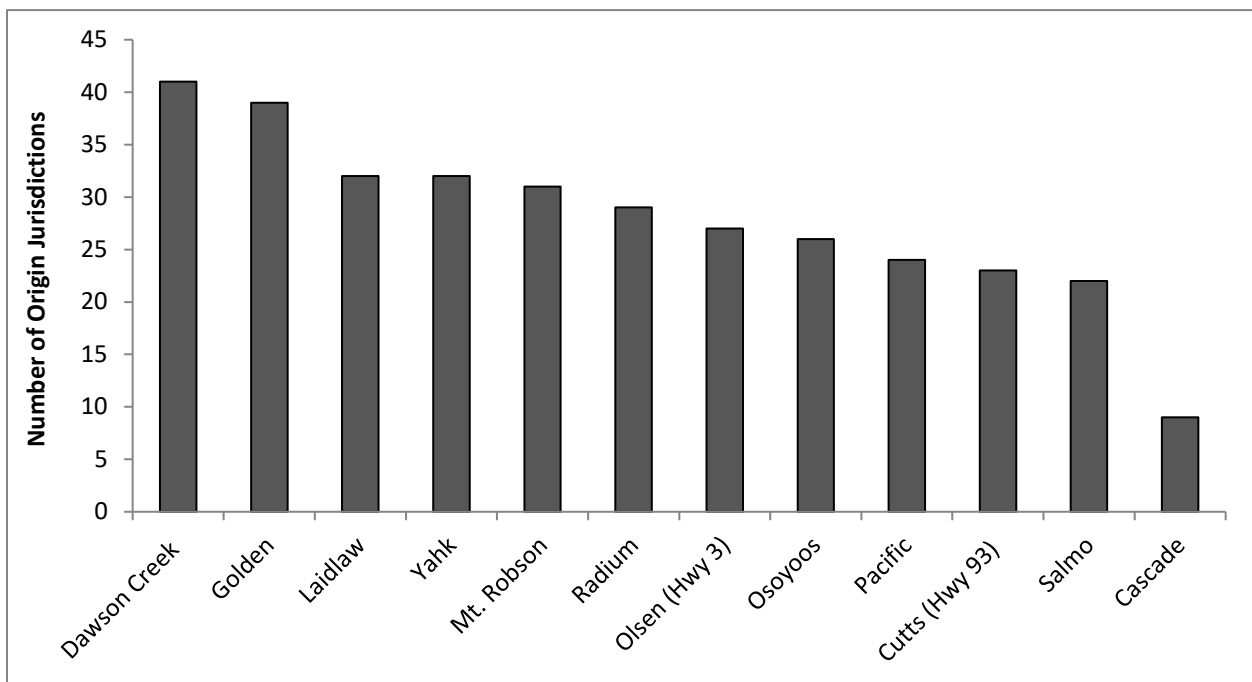


Figure 4. Total number of origin jurisdictions from which boats were traveling that were intercepted between April and October 2019, by inspection station.

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

Highway inspection stations were operational from April 1 to October 26, 2019. The inspection station total effort (operational hours) increased over the spring months (April and May), peaking from June to August (Figure 5). Total effort was lowest in October since the two northern inspection stations (Dawson Creek and Mt. Robson) closed at the end of August. Watercraft encounters and encounter frequency (Figure 6) showed a similar trend, increasing over the spring months (April to June) and peaking in July and August.

Figure 7 shows the total watercraft encounters and total effort by days of the week across the 2019 season. Watercraft encounters and encounter frequency peaked on Fridays and Saturdays and were lowest on Tuesdays and Wednesdays. This is consistent with the data from the 2018 season. Total effort was similar across all days of the week, with the exception of Tuesdays and Wednesdays which were slightly reduced due to occasional operational circumstances requiring 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 traveling into B.C. for holiday long weekends. Conversely some of the stations along the southern border (Osoyoos and Cascade) did have peaks in the volume of boats on the Mondays of the long weekend with boaters returning from the U.S.

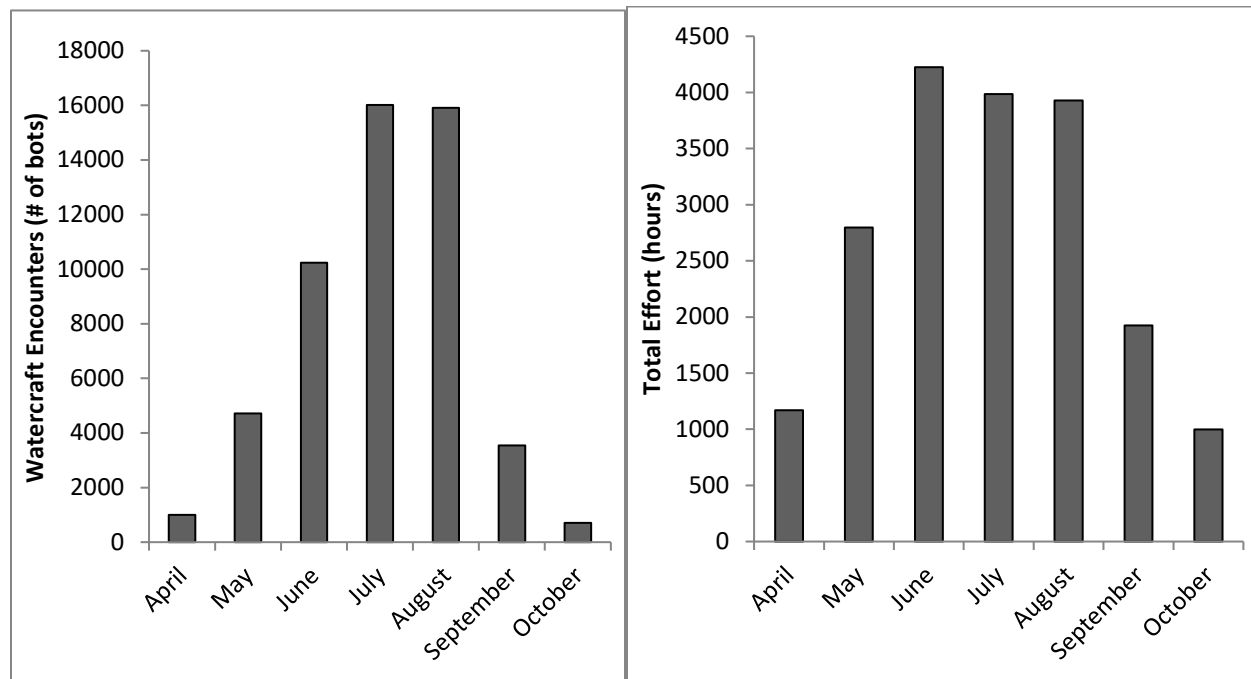


Figure 5. Watercraft encounters (left) and total effort (right) by month across inspection stations.

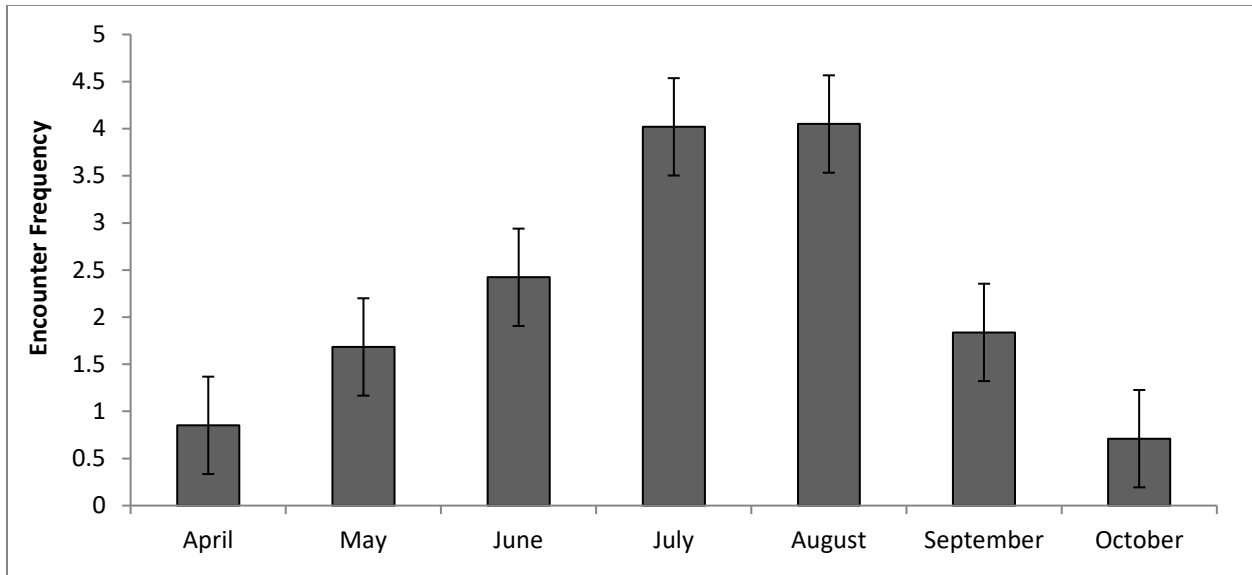


Figure 6. Encounter frequency by month across all inspection stations (error bars illustrate the standard error).

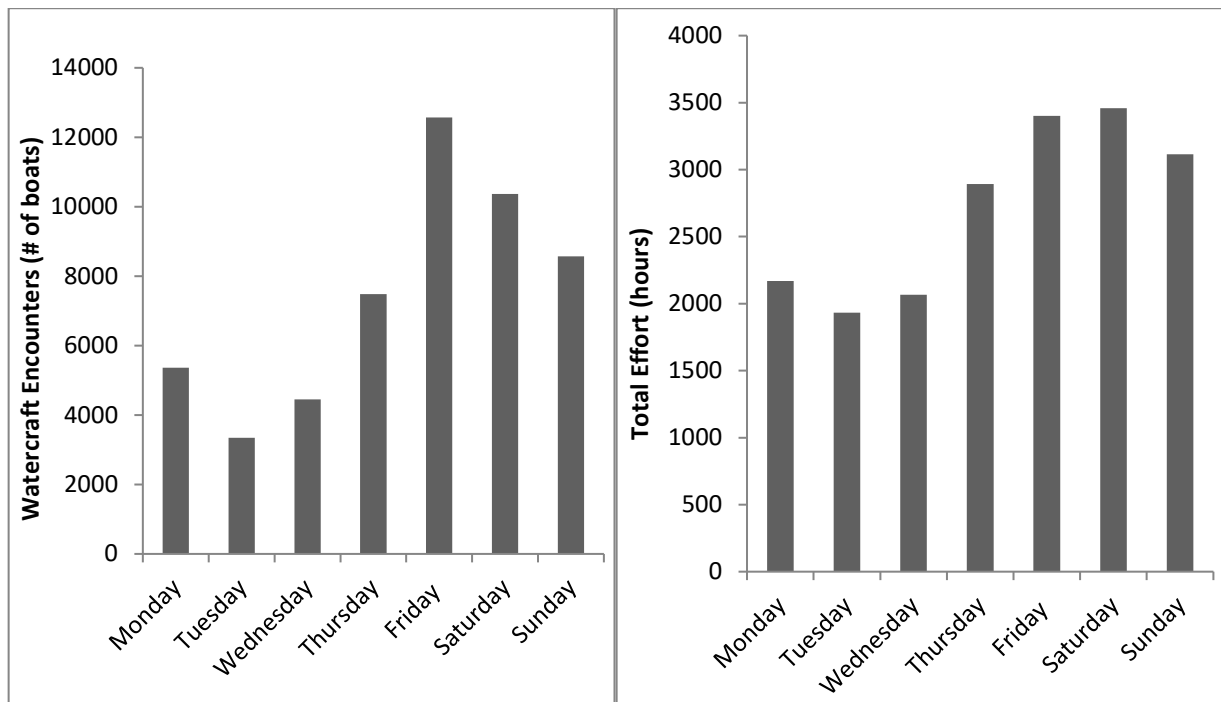


Figure 7. Watercraft encounters (left) and total effort (right) by day of the week across inspection stations. Statutory holidays were included in the data analyses.

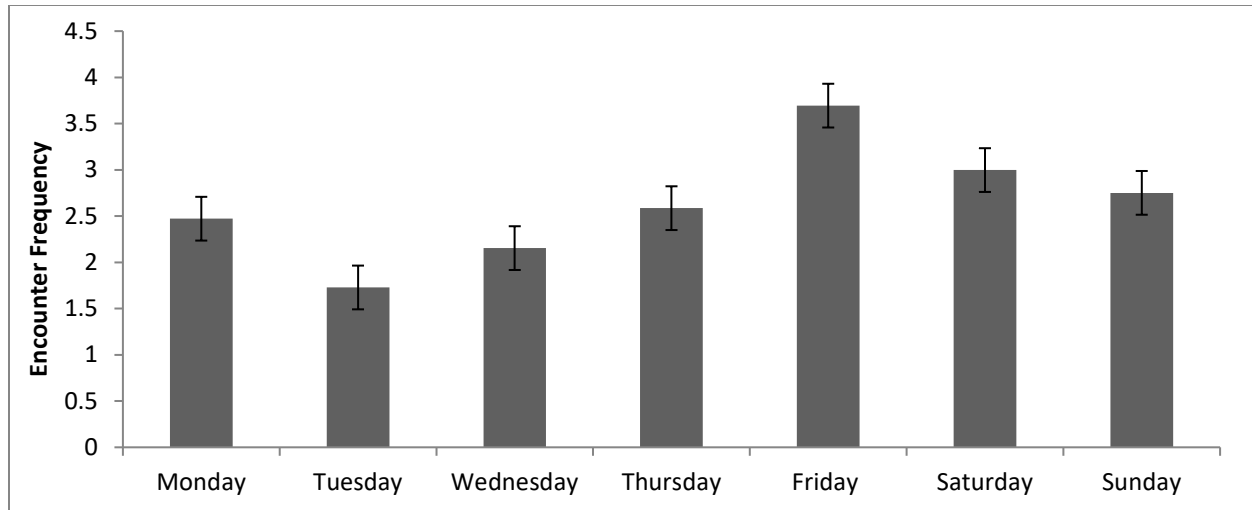


Figure 8. Encounter frequency by day of the week from April to October 2019 across inspection stations. Error bars illustrate the standard error. Statutory holidays were included in the data analyses.

3.1.3 Watercraft Inspection Summary by Hour of the Day

The time of the inspection was recorded by inspectors for every watercraft and Figure 9 illustrates that the volume of boater traffic was normally distributed across all inspection stations, peaked in the middle of the day, and was lowest at the start and the end of the daily operational period. The inspections during nighttime hours reflect those from the Golden inspection station and the Olsen station where nighttime inspections were piloted over long weekends in July and August. At the Golden station from late May to end of August between 10 PM and 5 AM there was a total of 307 inspections. The data shows boater traffic more than tripled between 6 AM and 7 AM and continued to increase until 11-12 PM and then started to decrease again. The data also show that boaters were traveling in the early evening (between 7 PM and 9 PM) but at lower numbers. During the Olsen pilot a total of 102 boats were intercepted between 10 PM and 5 AM, however only 31 of those inspections took place after midnight. This illustrates that most inspections took place between 10 PM and 12 AM during the Olsen pilot.

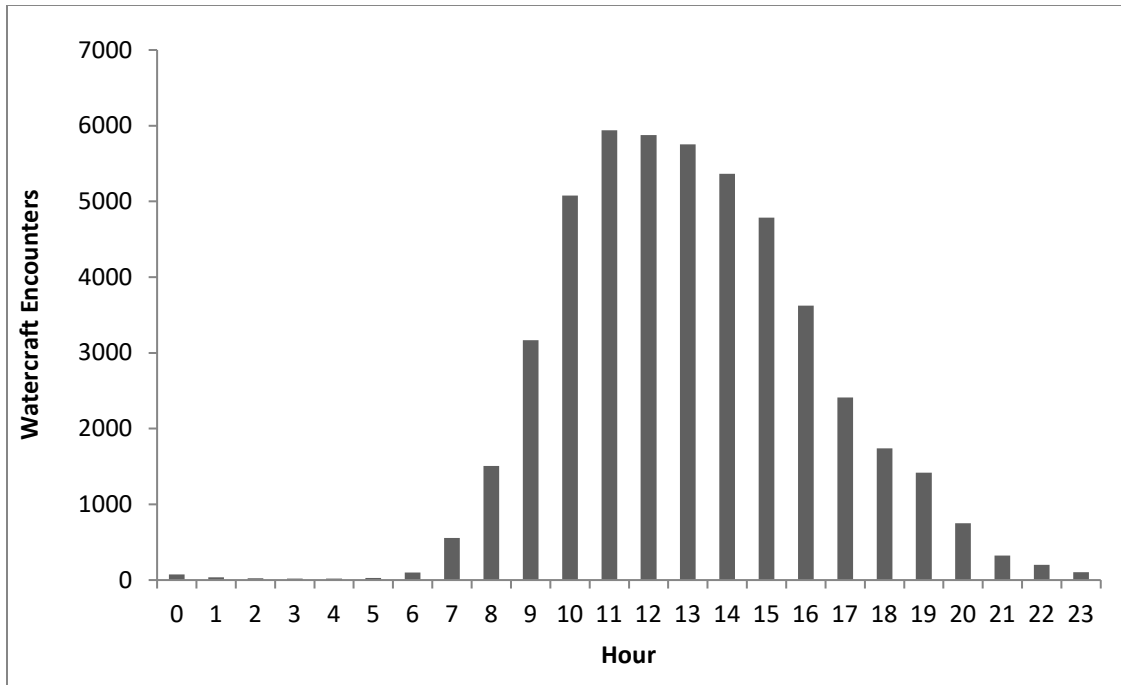


Figure 9. Watercraft encounters by time of day across all inspection stations for the 2019 season.

3.1.4 Source and Destination Locations

Inspected watercraft traveled into B.C. from 61 different provinces, territories, and states (**Error! Reference source not found.** and Figure 10). Of the watercraft inspected, 57% were traveling from a waterbody within B.C. This represents a slight increase from the 2018 season (51%). The inspected watercraft coming from out-of-province traveled primarily from neighbouring jurisdictions: Alberta (29.5%), Washington (3.6%), Montana (2.5%), Idaho (2.3%), and Saskatchewan (1.5%). The remaining 3.8% came from 55 different provinces, states, and territories (**Error! Reference source not found.**).

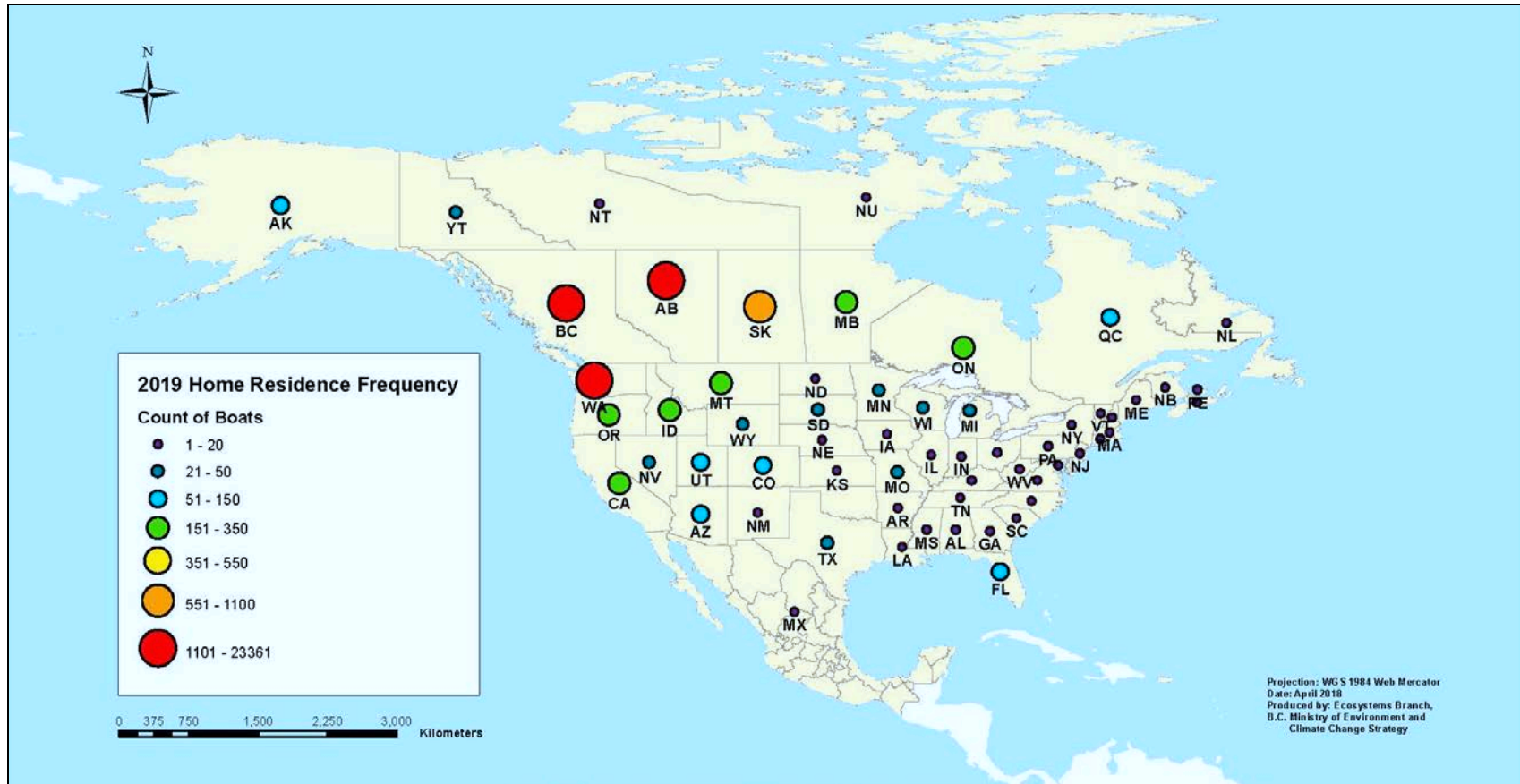


Figure 10. Home residence by province/state of all watercraft inspected during the 2019 season.

The majority of watercraft were destined for waterbodies within B.C. (85%), followed by waterbodies in neighbouring jurisdictions: Alberta (7.3%), Idaho (2.4%), Montana (2.3%), Washington (1.0%) and Montana (0.8) (Figure 11). The remaining 1.5% of watercraft were destined for waterbodies in 35 different jurisdictions (**Error! Reference source not found.**). The most common destination waterbodies within B.C. were Shuswap Lake (6.4%), Okanagan Lake (5.8%), Kootenay Lake (4.0%), Kootcanusa Lake (3.5%), Windermere Lake (3.3%), Osoyoos Lake (3.2%), Pacific Ocean (2.2%), Christina Lake (1.7%), Columbia River (1.5%), Kootcanusa Lake (1.3%), Lake Pend Oreille (1.2%), Kawkawa lake (1.1%), Skaha Lake (1.1%), Elk River (1.0%), and Moyie Lake (1.0%) (Figure 11).

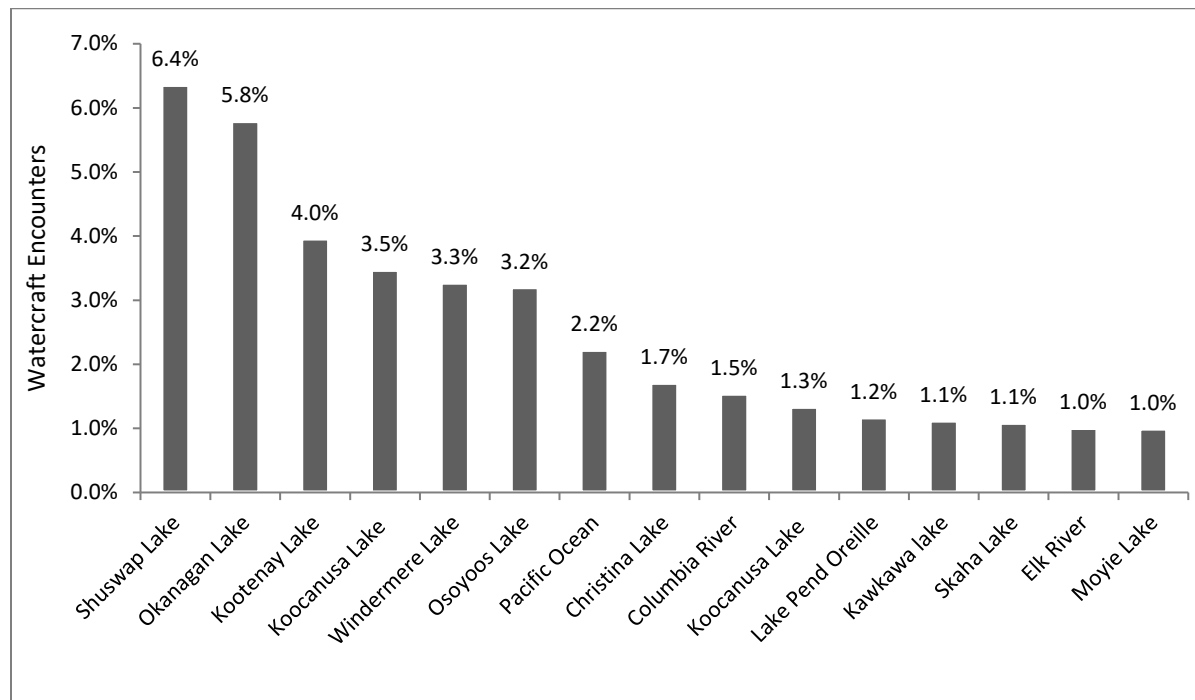


Figure 11. Destination waterbodies by percent of all watercraft encounters during the 2019 season.

3.1.5 Compliance

During each shift, inspectors recorded watercraft that failed to stop at the inspection station and used this number as a measure of compliance. The compliance rate for a shift was calculated as the number of watercraft that stopped over the total number of boats that went by an inspection station. On average, 83% of watercraft stopped at the inspection stations. This represents a 2% increase from the 2018 compliance rate of 81%.

Figure 12 shows the compliance rates for each inspection station across the 2019 season. Compliance rates ranged from 100% at the Osoyoos border crossing to 60% at the Pacific station situated on Highway 15 in the Lower Mainland. It is important to note that the accuracy of recording compliance was affected by the inspectors' ability to see traffic from the inspection area. The low compliance rate at

the Pacific station is likely caused by the large amounts of signs directly after the border, causing confusion for motorists.

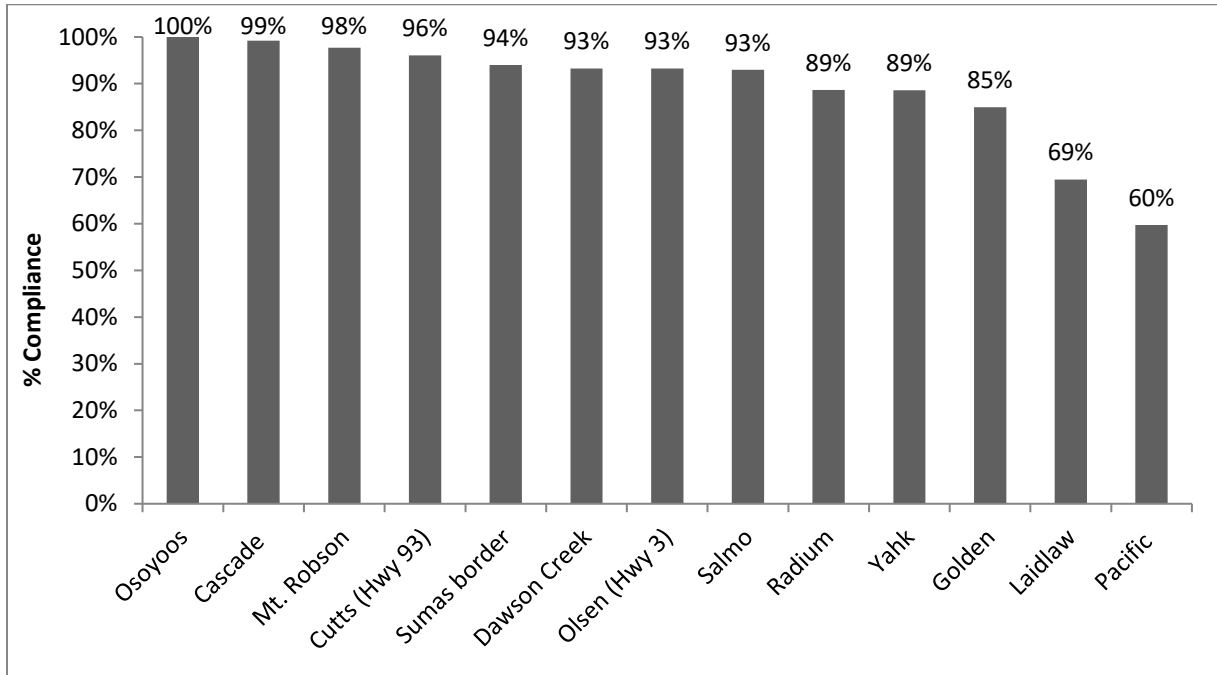


Figure 12. Percent compliance by inspection station for the 2019 season.

During the 2019 season, inspectors also recorded whether the watercraft that failed to stop were motorized or non-motorized. Figure 13 shows that, on average across all the months, 84% of the watercraft that failed to stop were non-motorized. This is an increase from the 2018 season of 79% non-motorized watercraft that failed to stop. This shows continued outreach and education to the non-motorized boating community is needed to help raise awareness that inspection stations are mandatory for all types of watercraft.

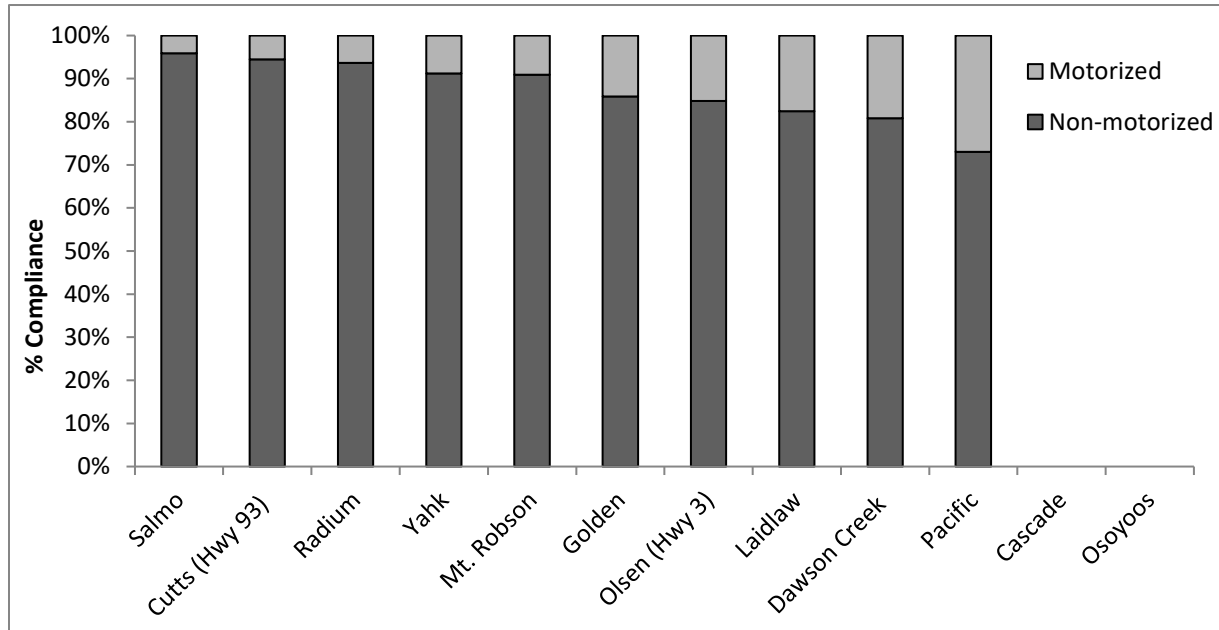


Figure 13. Percent of non-compliant watercraft that were motorized vs. non-motorized.

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 14 shows the percentage of boats that stopped at an inspection station which had already been through an inspection station.

The highest percentages of previously inspected watercraft by station occurred at Salmo (72%), Yahk (60%), Cascade (55%), Osoyoos (46%) and Laidlaw (39%). The Golden and Mt. Robson stations likely had lower percentages of previously inspected (14% and 5%) watercraft since a large percentage of the boats inspected are coming from Alberta and are not intercepted in Alberta inspection stations before arriving at these stations.

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, 13% had been through over one year prior, 29% had been through within the last year, 44% had been through within 30 days and 13% on the same day (Figure 15). This data is very similar to the 2018 season.

A total of 571 of the 1,290 high-risk watercraft (44%) had been through a previous inspection station within either B.C. or another jurisdiction. Collectively, these results highlight the efficacy of the perimeter defence approach of having multiple inspection stations across jurisdictions, for intercepting high-risk boats coming from the east and for educating the boating public.

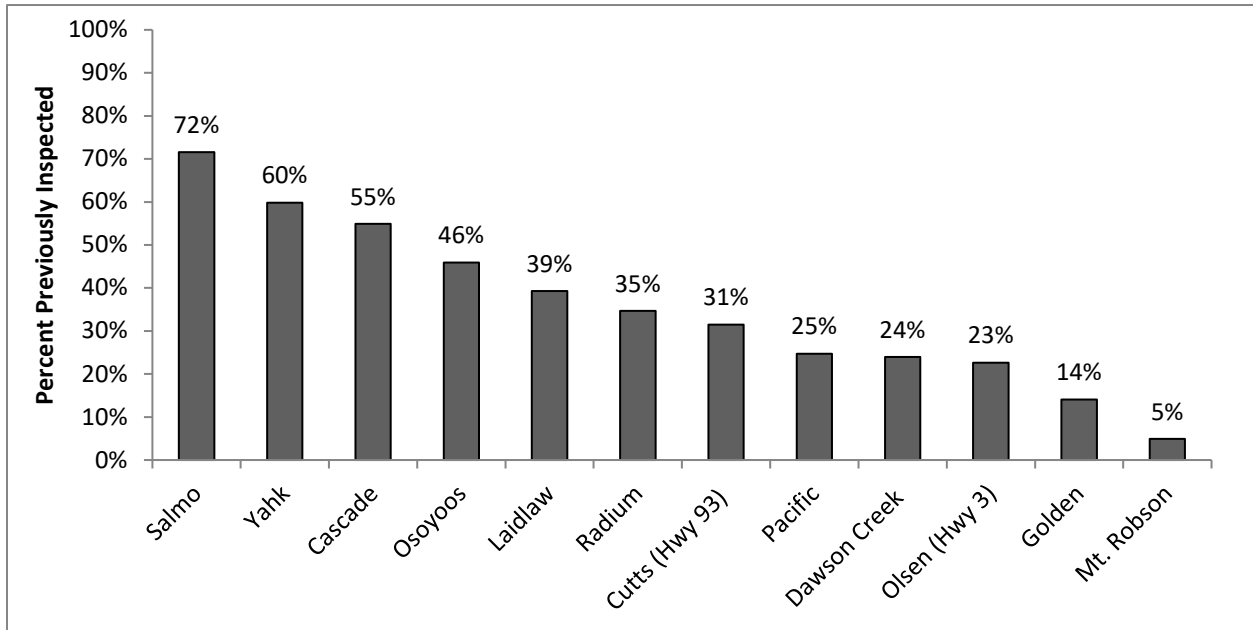


Figure 14. Percent of watercraft intercepted per inspection station that had been previously inspected.

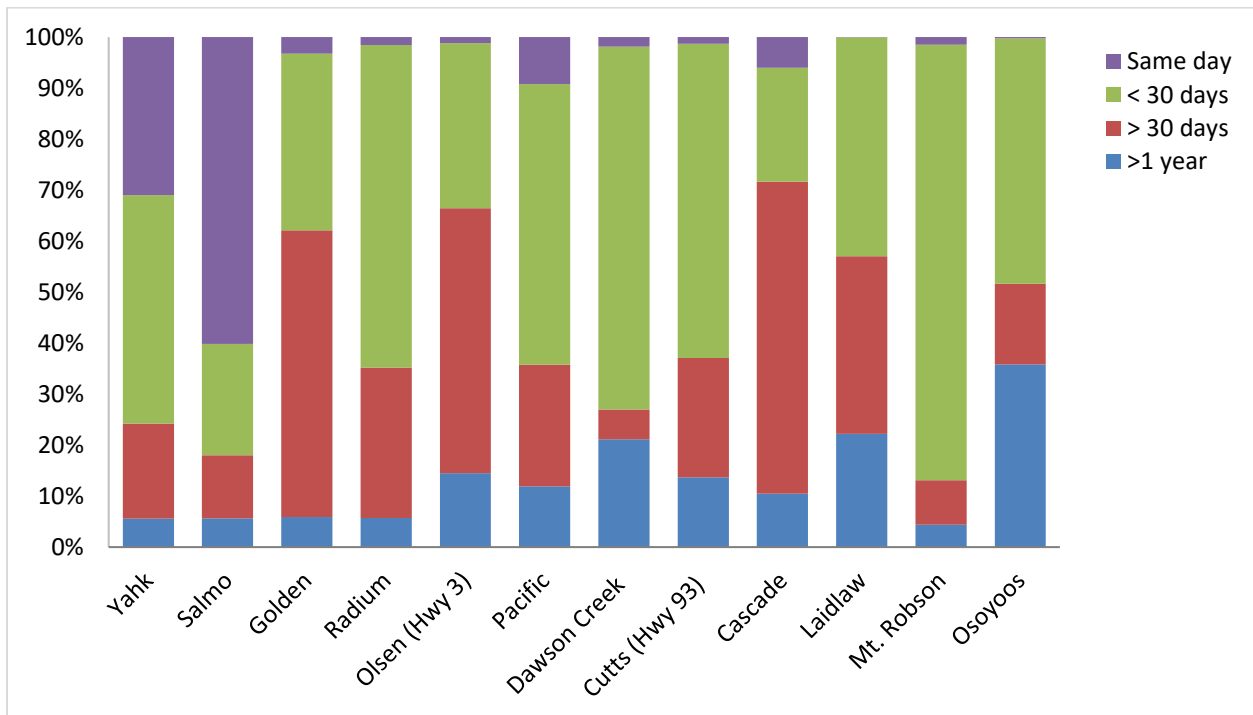


Figure 15. Frequency of watercraft previously inspected at another watercraft inspection station (either in BC or another jurisdiction).

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/interview process. High-risk watercraft 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.
- Coming from or is registered to a state / 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

A total of 1,290 high-risk watercraft were encountered during the 2019 season with 97 inspected during April and May, representing a decrease from 2018 at 211 high-risk inspections. Since the program has been operational, the total number of high-risk boats inspected has peaked in July and was consistent for the 2019 season (Figure 16).

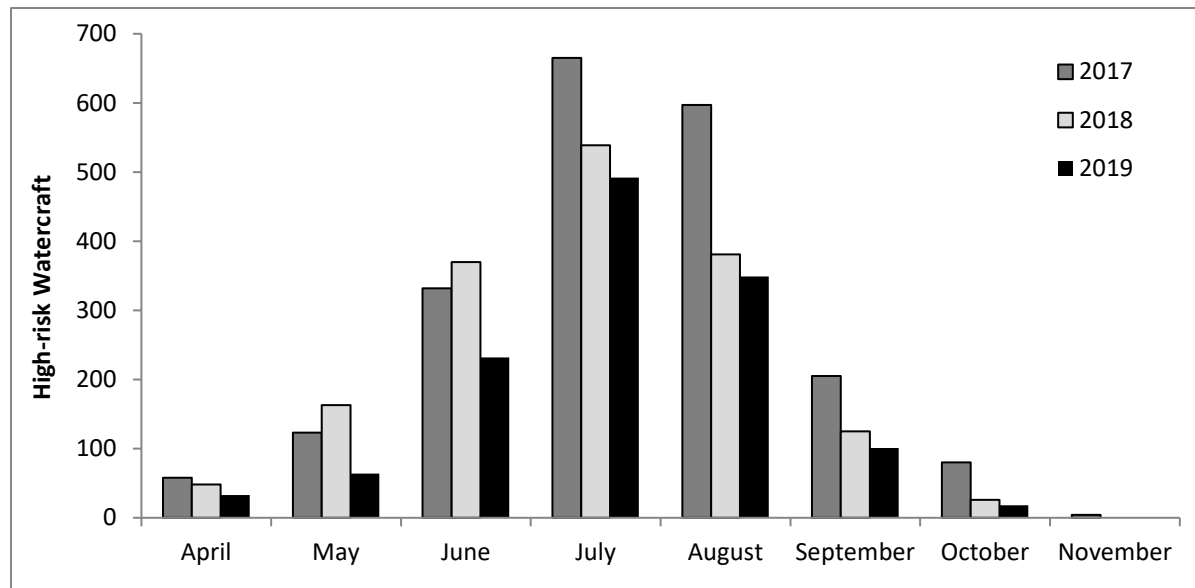


Figure 16. Total high-risk watercraft encounters by month across the 2017-2019 seasons.

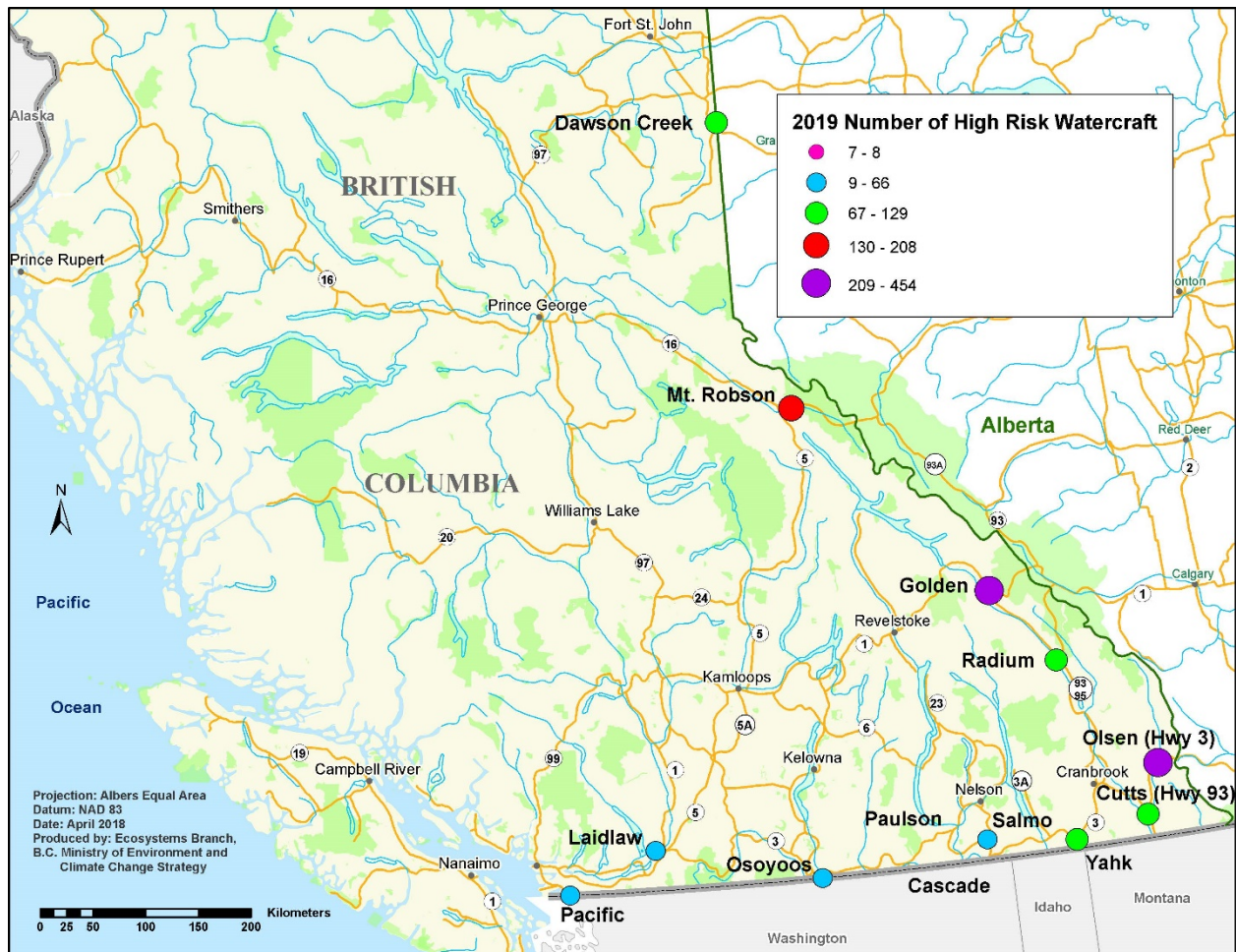


Figure 17 illustrates the number of high-risk watercraft encounters across inspection stations. The Golden inspection station intercepted the most high-risk watercraft (356), followed by Olsen (Hwy 3) (257), Mt. Robson (161), Radium (100), and Yahk (82). The Dawson Creek and Pacific inspection stations had very low overall encounter frequencies (see Figure 3) but higher numbers of high-risk boats relative to other inspection stations. Conversely, the Laidlaw station had the highest total number of inspections (14,457) but only 46 (0.3%) watercraft were high-risk.

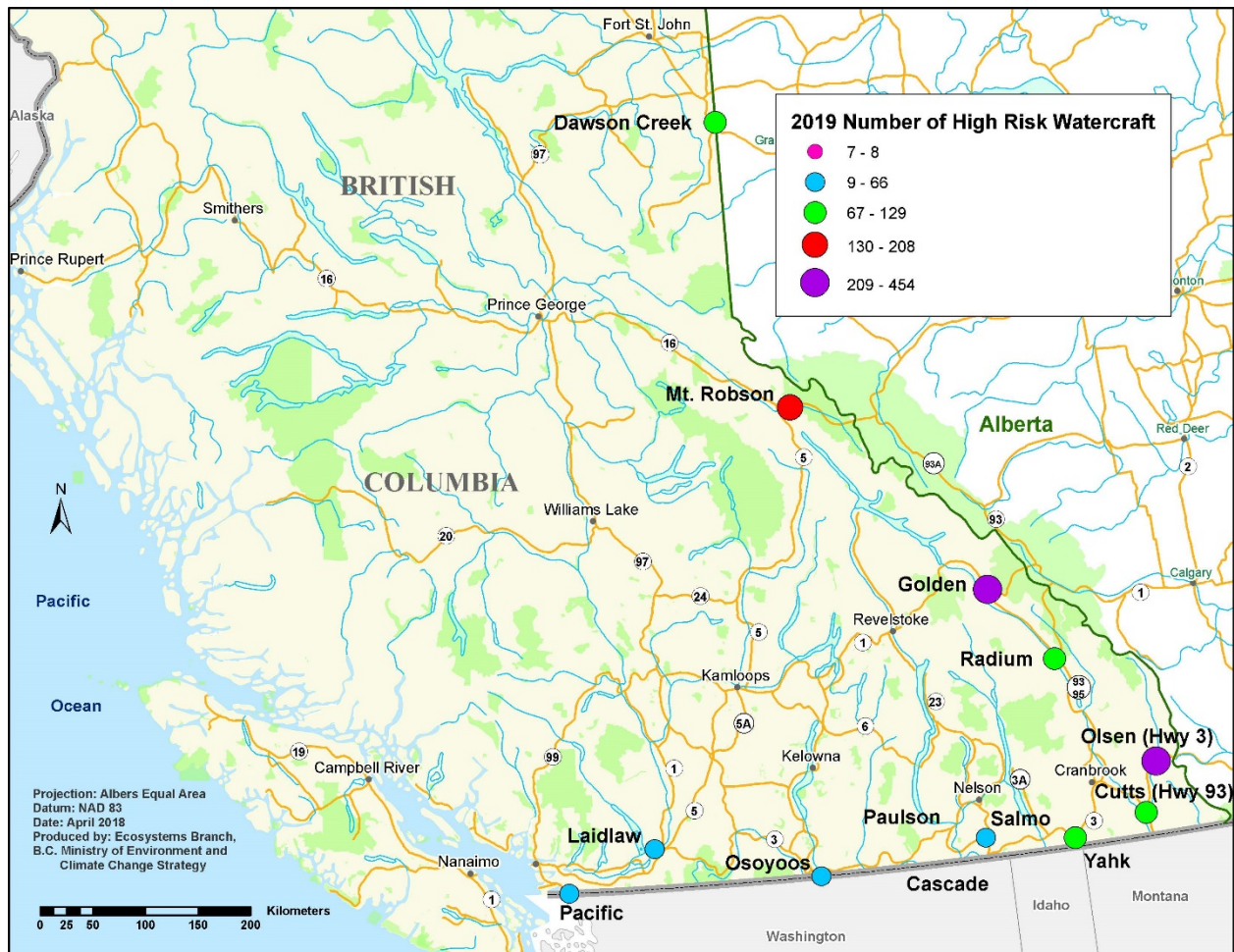


Figure 17. The number of high-risk watercraft by inspection station for the 2019 season.

3.2.1 High Risk Inspection Findings

Of the 1,290 high-risk watercraft, 348 were decontaminated, 86 were issued a decontamination order and 79 had associated quarantine periods to allow for sufficient drying time of 30 days out of water. Not all high-risk watercraft require a decontamination. A watercraft may initially be considered high risk for either dreissenid mussels or other AIS when they enter an inspection station. However following a thorough inspection, it may be deemed low risk without further action required (i.e. decontamination) if it is found to be Clean, Drain, Dry. Of the 1,290 high-risk watercraft 1,050 were deemed Clean, Drain, Dry either after thorough inspection and/or completion of a decontamination.

In addition, not all watercraft that are decontaminated will require 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 orders 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.

A total of 18 watercraft were identified during the 2019 season as transporting either aquatic plants (7), marine mussels or barnacles (7), or other unidentified species/organic matter (4). 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 1,290 watercraft identified as high-risk for either dreissenid mussels or other AIS, 855 watercraft 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.

3.2.2 By Time of Day

Figure 18 shows the number of high-risk watercraft encounters by time of day across all inspection stations and illustrates that the volume of high-risk boats was normally distributed, peaked in the middle of the day, and was lowest at the start and the end of the daily operational period. Between 10 PM and 5 AM, a total of 20 high-risk watercraft were intercepted at the Golden inspection station during the nighttime operations over the entire season. This represents a slight decrease from 24 high-risk inspections during the 2018 season. During the Olsen nighttime pilot in July and August a total of 6 high risk watercraft were intercepted between 10 PM and 5 AM.

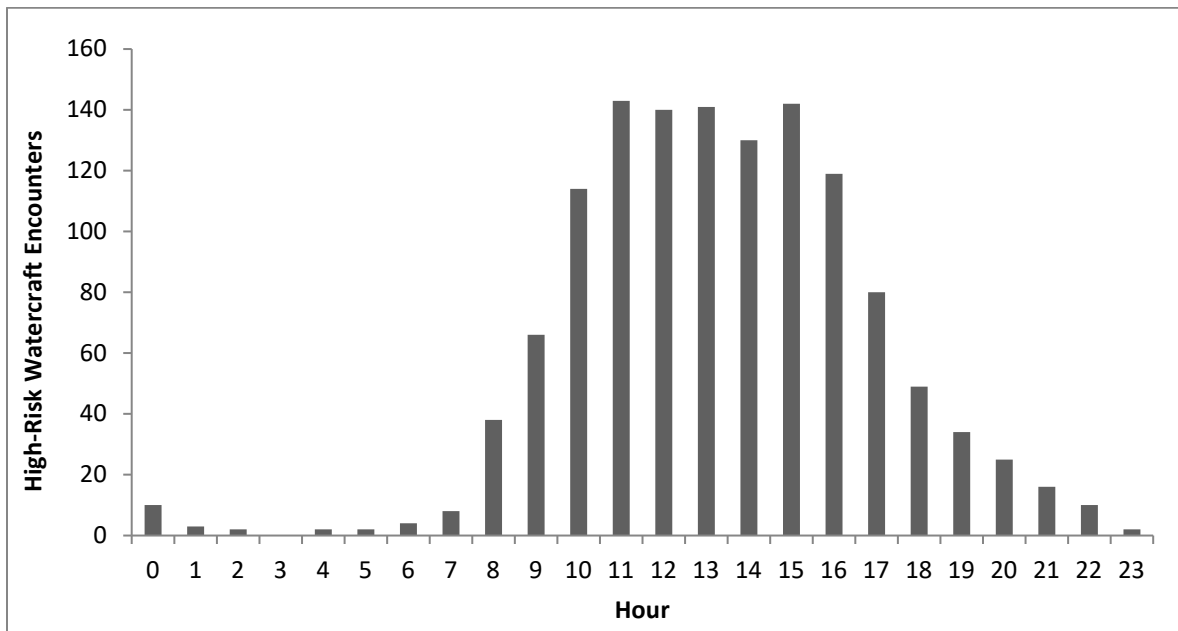


Figure 18. Total high-risk watercraft encounters by time of day across all inspection stations during the 2019 inspection season.

3.2.3 Source and Destination Locations

Of the 1,290 high-risk watercraft identified by inspection crews, 341 came from Saskatchewan (27.7%), 212 from Ontario (17.2%), 114 from Manitoba (9.3%), 78 from Montana (6.3%), 47 from California (3.8%), 44 from Arizona (3.6%) and 28 from both Colorado and Utah (2.3% each)(Figure 19). The remaining 25.3% came from 38 different provinces and states. As expected, due to the change in protocol for watercraft coming from Montana, the number of high-risk watercraft from Montana decreased from 211 boats in 2018 to 78 boats in 2019. The number of high-risk boats from Saskatchewan and Ontario was very similar in 2019 relative to 2018. Figure 21 shows the source location for high-risk watercraft for dreissenid mussels but does not capture watercraft that were identified as high risk for other AIS or not clean, drain, dry.

Of the high-risk watercraft inspected, 23.8% were destined for waterbodies in the Kootenay region, 14.7% for waterbodies in the Okanagan region, 12.8% for the Thompson-Nicola, 10.9% for the Lower Mainland, 6.9% for Vancouver Island, 3.3% for the Omineca, 2.5% for the Skeena and 1.6% for the Cariboo (Figure 20 and Figure 22). The remaining 20.9% of the high-risk watercraft were destined for waterbodies outside of B.C. If a watercraft was still considered high-risk following inspection/decontamination, the destination jurisdiction was notified.

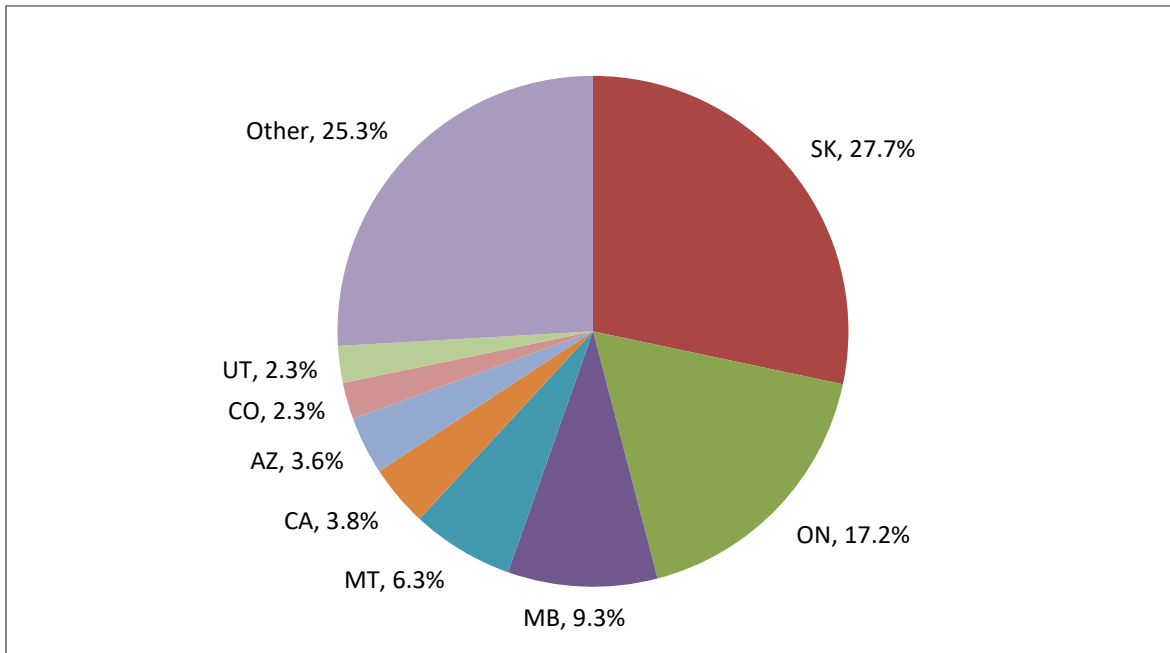


Figure 19. Source locations of the high-risk watercraft identified during the 2019 season. Other jurisdictions consisted of 38 different provinces and states.

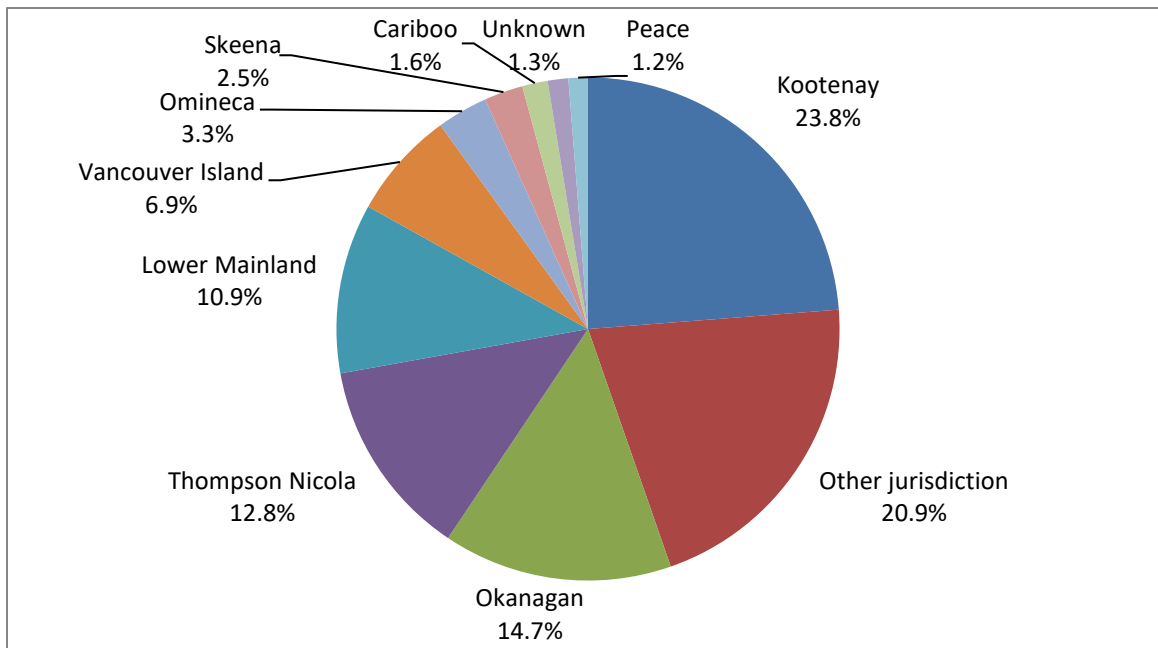


Figure 20. Destination regions of all high-risk watercraft identified during the 2019 season. Other jurisdictions consist of but not limited to: AB, AK, AZ, CA, CO, DC, ID, MB, MI, MT, NT, OR, UT, WA, and YK.

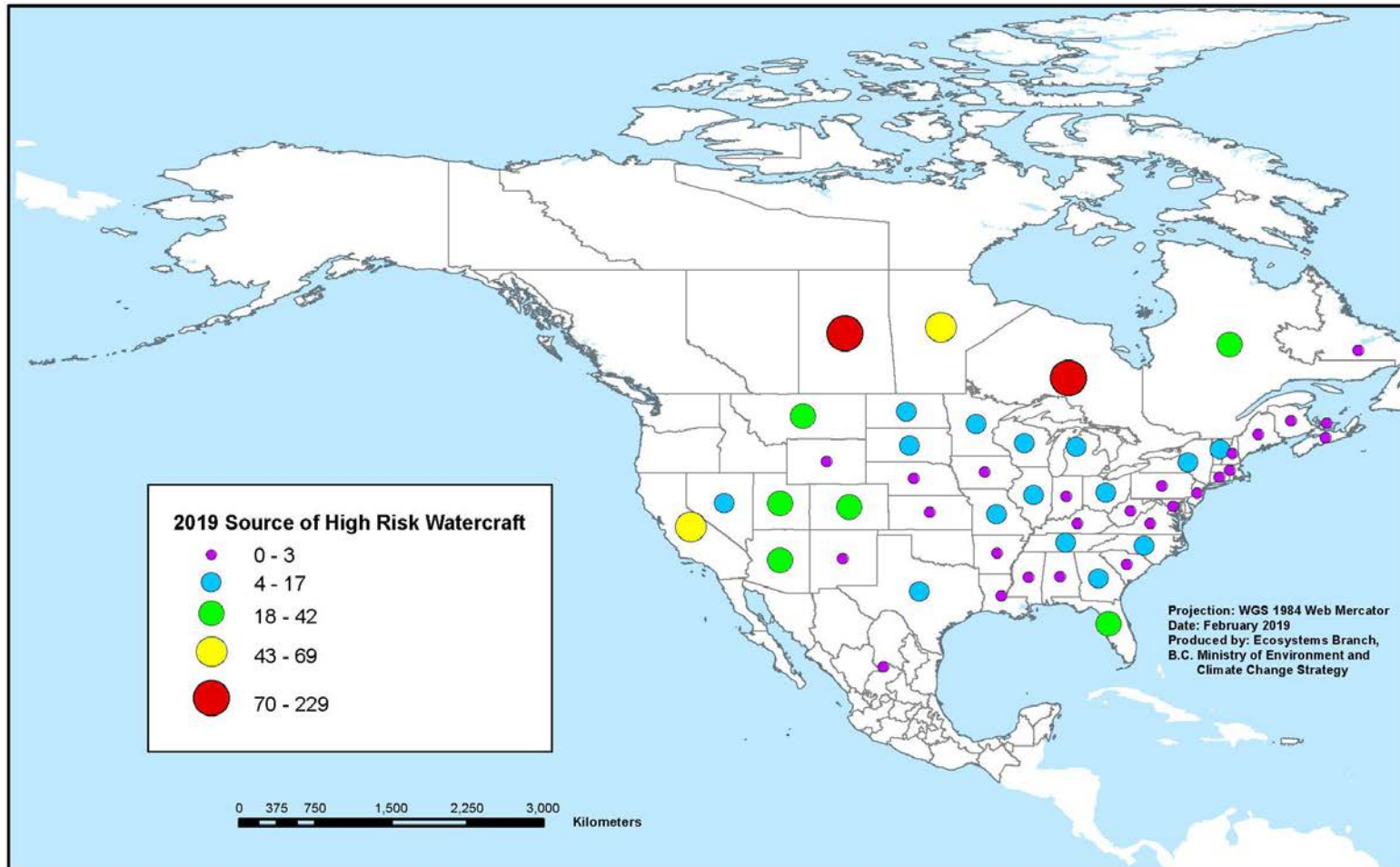


Figure 21. Source locations of the high-risk watercraft inspected during the 2019 season. This only includes watercraft coming from source locations that are high risk for dreissenid mussels and not other AIS.

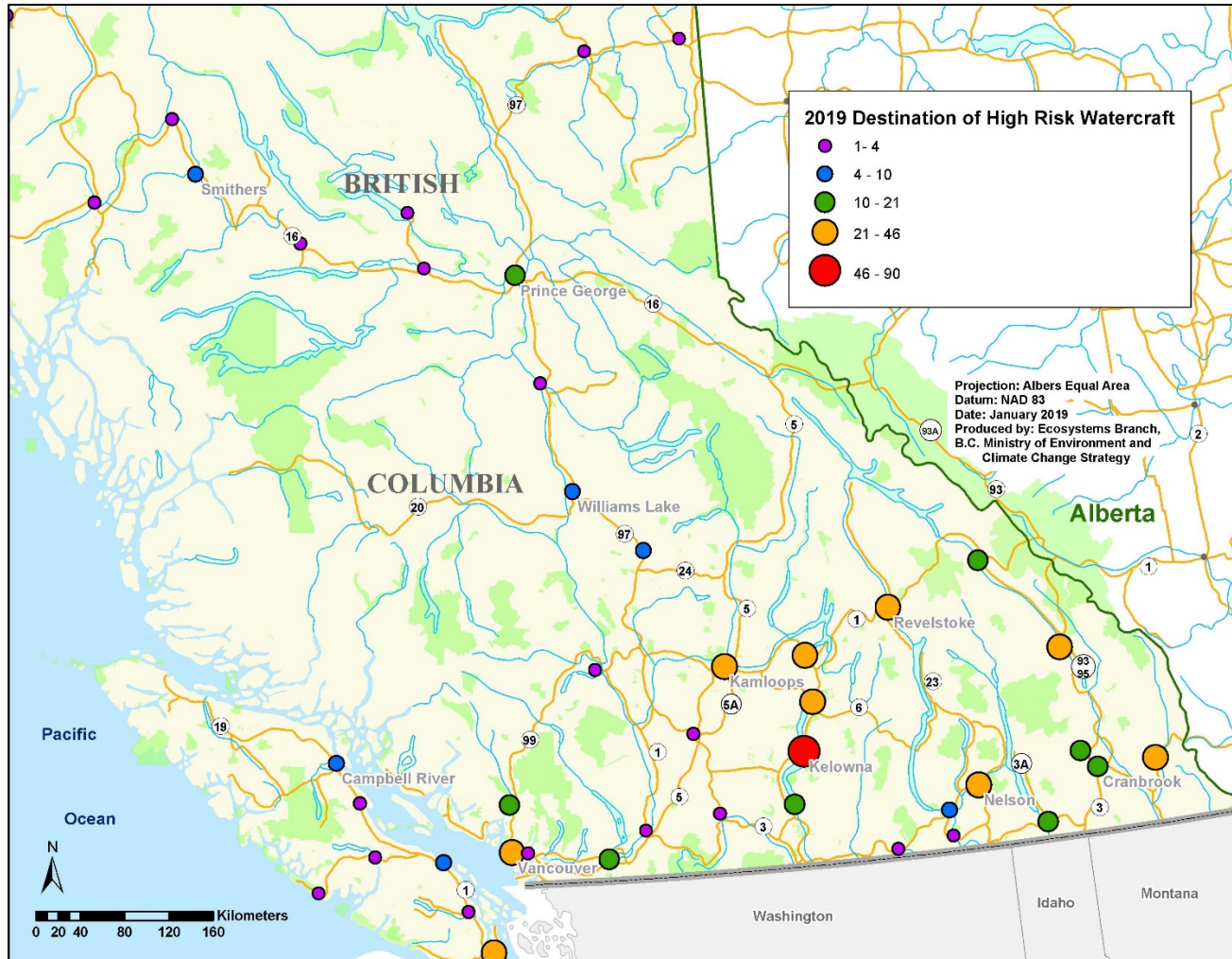


Figure 22. Destination locations of the high-risk watercraft identified during the 2019 season.

3.2.4 Watercraft Types

For the 2019 season in order to streamline the data collection and analysis a change was made to how the watercraft type was recorded. The type of watercraft was recorded into four categories which were defined as:

- **Non-motorized/hand launched:** boats that are not launched from 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/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, jet boats.
- **Very complex watercraft:** A complex watercraft with more than one internal water system (e.g. generator, air conditioners, sea strainers, swamp coolers etc.) or other sources of unverifiable water (e.g. ballast tanks). Examples include cabin cruisers, wakeboard boats, houseboats, larger sailboats.

The type of watercraft was recorded for every inspection. In 2019 non-motorized watercraft (e.g. canoes, kayaks, paddleboards) comprised the highest percentage of the total watercraft inspected (45.7%), they represented a much lower risk with only 3.3% registering as high-risk (Figure 23). Very complex boats represented 14.7% of total inspections while 2.1% were high risk. Due to the change in how the data was recorded in 2019 it is difficult to compare to compare it to previous years. This data will be compared with future years.

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.

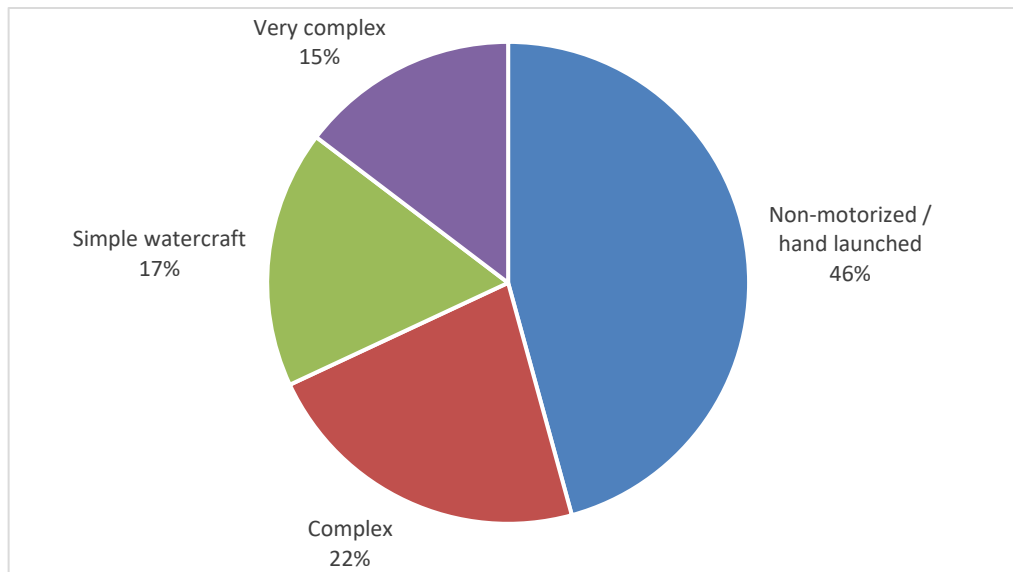


Figure 23. Total watercraft encounters by watercraft type (see above for explanation of each category) for the 2019 season.

3.3 MUSSEL FOULED WATERCRAFT

A total of 22 mussel fouled watercraft were encountered, of which B.C. received advanced notification for 17 either from previous inspection in another jurisdiction or notification from CBSA. This highlights the importance of working with neighbouring jurisdictions' watercraft inspection programs as it increases the likelihood of detection and inspection.

Of the total mussel fouled boats, nine were initially intercepted and inspected at the Golden inspection station on Highway 1 which was operating 24hrs /day during the main boating season. One of the nine mussel fouled boats was intercepted after dark at the Golden inspection station at 2 AM on May 20th and the program had received advanced notification from Alberta. The highest number of mussel fouled watercraft encounters took place in July and September with six and five. In previous years the program saw the highest numbers of mussel fouled boats in May and June (Figure 24). The single record from November was a notification through the program's email inbox from someone transporting the leg of an inboard engine from Ontario to BC. Invasive mussels were found in the internal systems of the engine leg.

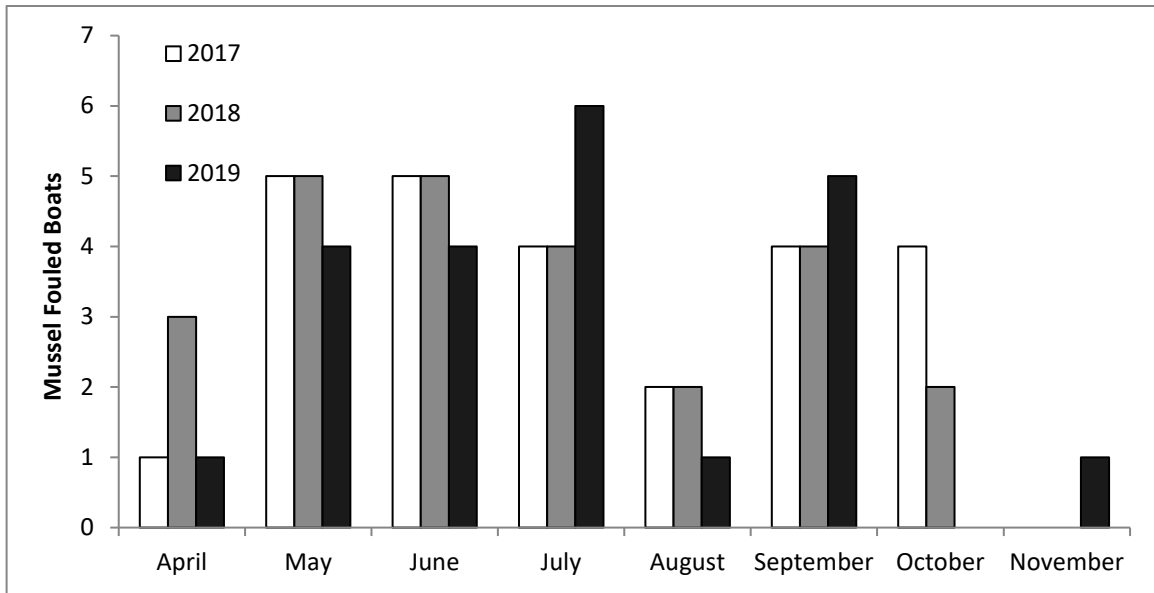


Figure 24. The number of mussel fouled watercraft for the 2017 to 2019 seasons, by month.

Of the total number of mussel fouled boats, 16 had come from Ontario, 3 from Michigan, 2 from Utah, and 1 from North Carolina (Figure 25 and Figure 27). The proportion of mussel fouled boats that came from eastern/Great Lakes jurisdictions in the 2019 season was 86% which is an increase from 72% in 2018. There was a slight decrease in the number of mussel fouled boats coming from a southern U.S. state (Utah and North Carolina), from 5 in 2018 to 3 in 2019. This illustrates the continued threat from waters in the eastern mussel infested provinces and states.

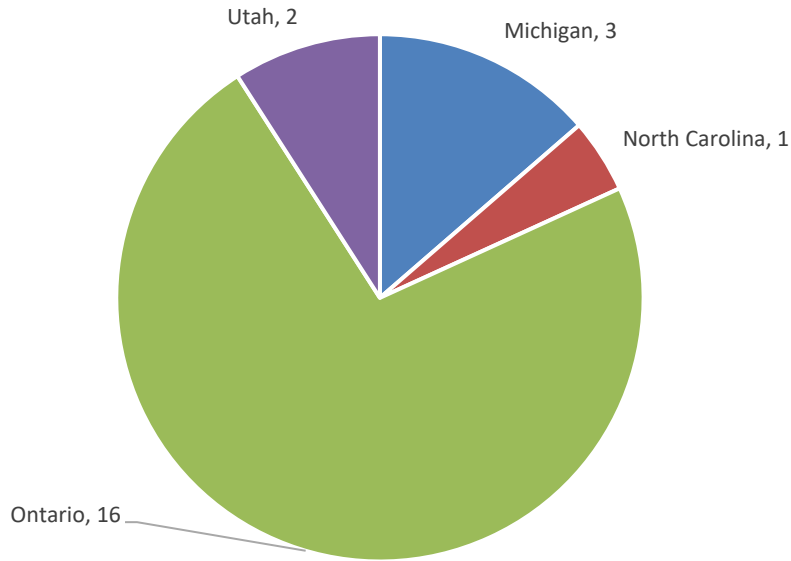


Figure 25. Source provinces and states of the 22 mussel-fouled watercraft intercepted during the 2019 season.

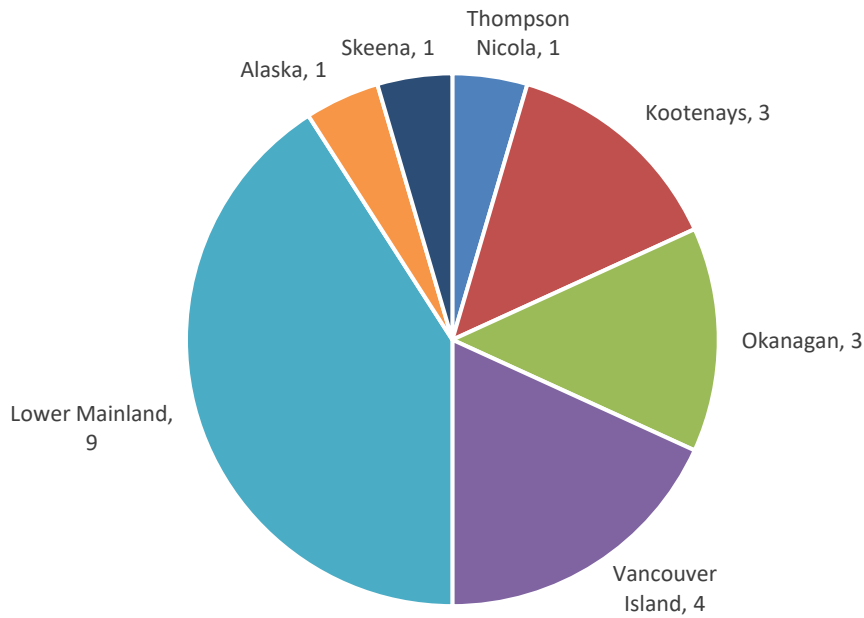


Figure 26. Destination regions in B.C. of the 22 mussel-fouled watercraft intercepted during the 2019 season.

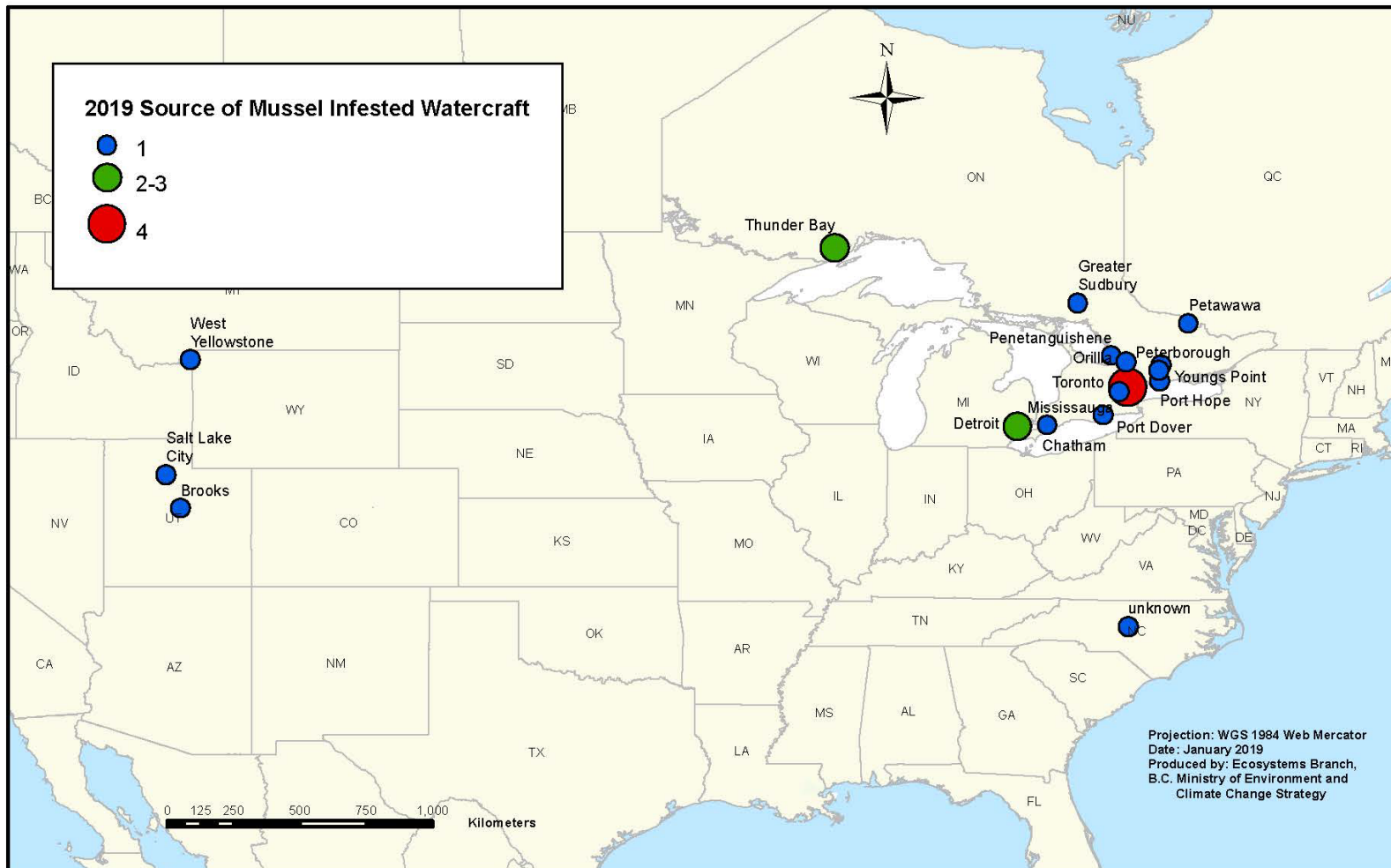


Figure 27. Source location of mussel fouled boats.

The most common destination of the mussel fouled boats by region was the Lower Mainland/South Coast with 9 (41%), followed by Vancouver Island with 4 (18.2%), Okanagan and Kootenays at 3 each (13.6% each), the Thompson-Nicola and Skeena with 1 each (4.5% each), and 1 was destined for Alaska (4.5%) (Figure 26). Of the 22 mussel fouled watercraft 10 (45.5%) were very complex watercraft, 9 (41%) were complex watercraft, 1 each of simple and hand launched watercraft (Figure 28). The other category was for an inboard engine only that was transported from Ontario to the Kootenays for installation on a boat.

The hand launched boat was a kayak that was intercepted at the Olsen station and invasive mussels were found in one of the storage compartments. The kayak was previously launched in Utah waters including Lake Powell. This represents the first mussel fouled hand launched (canoe, kayak) watercraft intercepted by the Program since the start of the program in 2015.

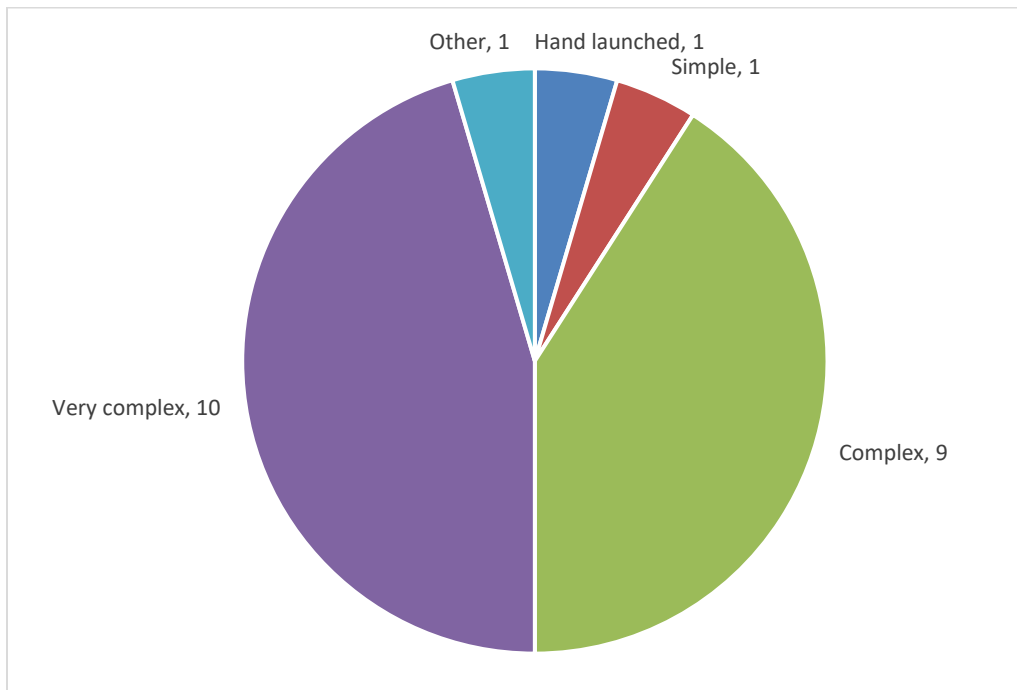


Figure 28. Watercraft type of the 22 mussel-fouled watercraft intercepted during the 2019 season.

3.4 COMMERCIALY HAULED WATERCRAFT

Of the total watercraft inspected (52,000), 284 were commercially hauled, representing less than 1% of the total boats inspected. Commercially hauled watercraft represent a very low percentage of total watercraft inspected; however, they demonstrate a disproportionately higher risk of carrying invasive

mussels. While only 4% of high-risk watercraft were commercially hauled, 31.8% of mussel fouled watercraft (7 of the 22 boats) were commercially hauled.

The Pacific station intercepted the highest number of commercially hauled watercraft (70), followed by Golden (66), Laidlaw (49) and the Osoyoos border crossing (36) (Figure 29). This is similar to the data from the 2018 season and is expected as the Pacific border crossing is one of main crossings in the lower mainland that permits commercial traffic. since the Trans-Canada Highway, where the Golden station is located, is a primary travel route for commercially hauled watercraft. Despite the east Kootenay inspection stations (Cutts, Olsen, Yahk) having high watercraft encounter frequency, they only saw 14 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 BC was Ontario, Washington and Alberta (Figure 30). Commercially hauled boats include a combination of new boats being shipped from manufacturers to marinas/dealers and used boats purchased privately but are too large to be transported privately. New boats are frequently transported to Alberta and then shipped to B.C. (typically the Okanagan). Common locations of boat manufacturers include Texas, Tennessee, Missouri, and Washington. Used boats being commercially hauled from mussel infested jurisdictions pose the highest risk for transporting invasive mussels and common source locations are Ontario and Michigan (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 while they are being transported.

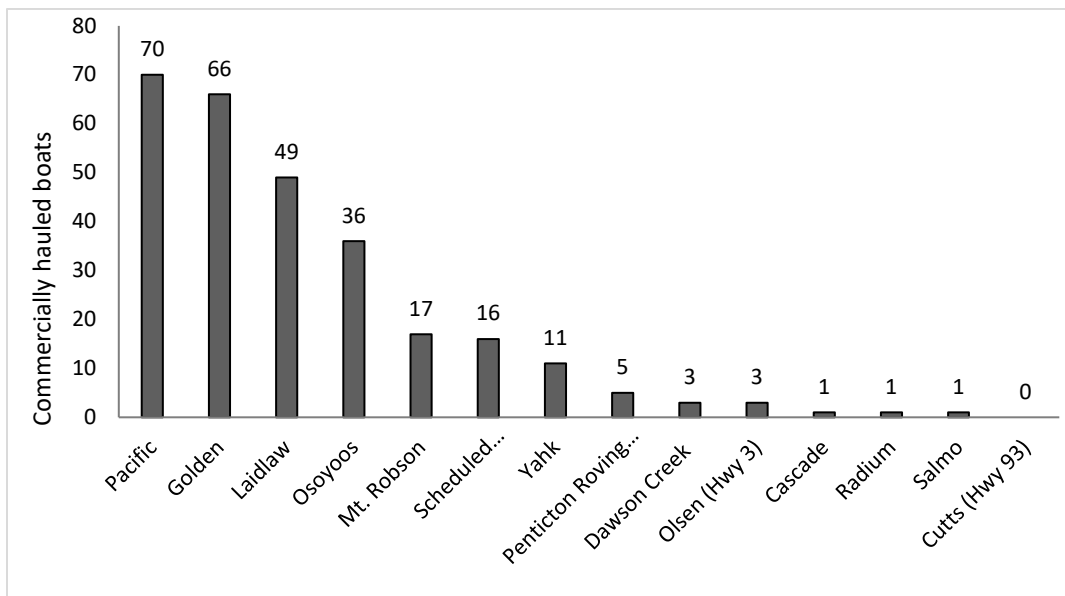


Figure 29. Number of commercially hauled boats intercepted at the watercraft inspection stations during the 2019 season.

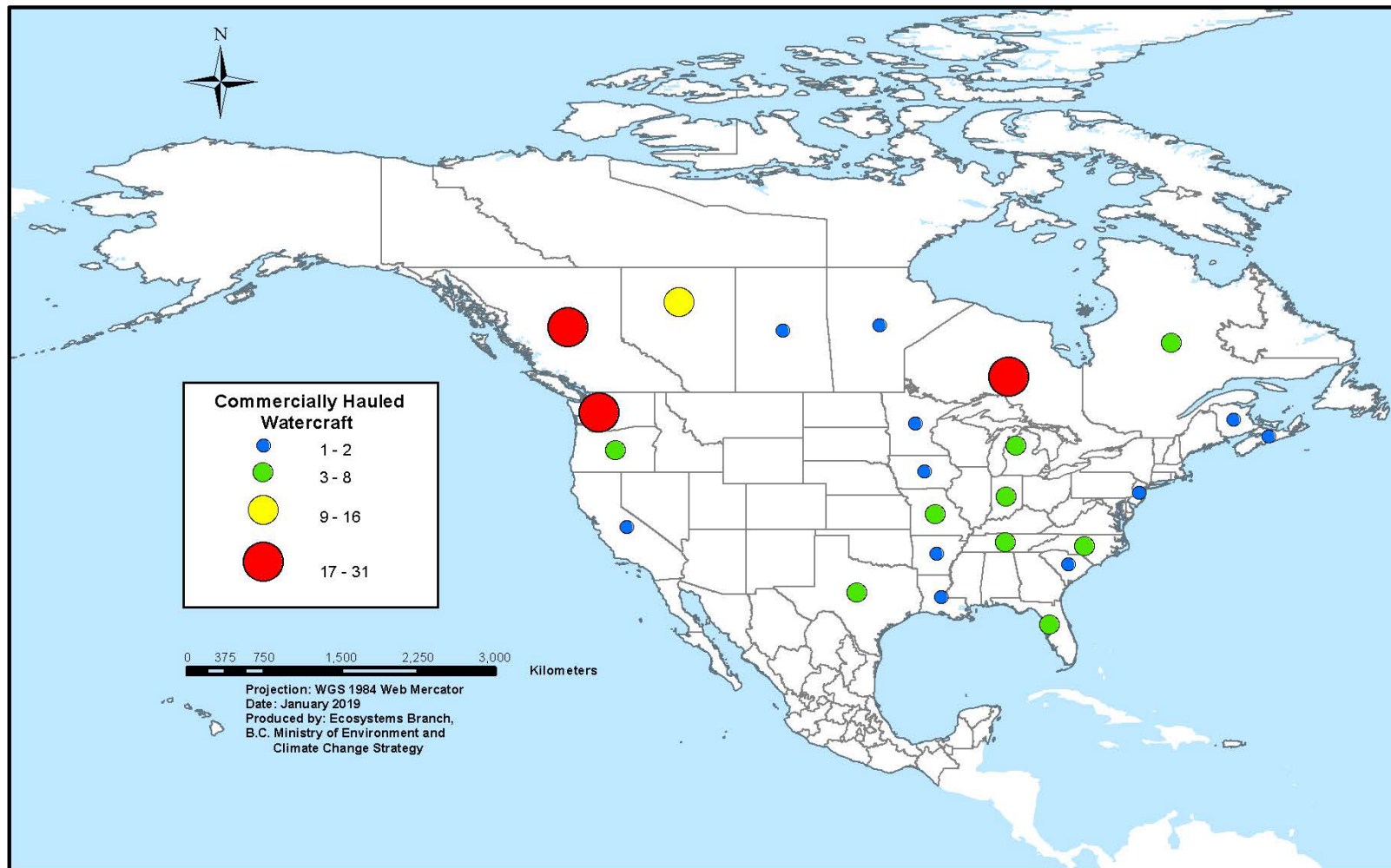


Figure 30. Source location of commercially hauled watercraft.

3.5 PASSPORT PROGRAM

In 2017, B.C. and Alberta launched a joint watercraft passport pilot program. The passport is intended for watercraft traveling frequently through B.C. and Alberta. When 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 passport is stamped each time a boater goes through an inspection station. The passport serves as a record of past watercraft inspections.

Over the course of the 2019 season, 366 passports were issued across the B.C. inspection stations (Figure 31). Of the 52,000 total inspections just over 3,000 were passport inspections. When passport holders stopped at an inspection station they are asked a reduced number of questions initially, 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 passport is stamped and the watercraft is released. Since the program launched in 2017, around 2,470 passports have been issued at B.C. inspection stations.

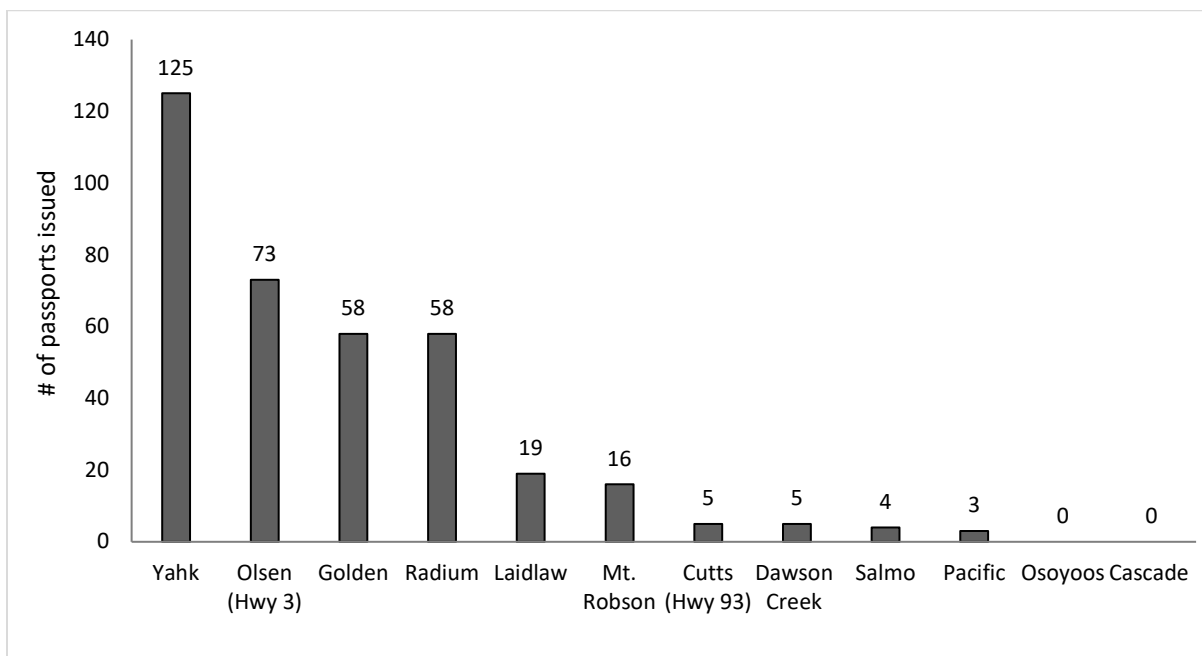


Figure 31. Number of passports issued during the 2019 season, by inspection station.

3.6 CANADA BORDER SERVICES AGENCY NOTIFICATIONS

During the 2019 season, the program worked 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 program received notification for all types of watercraft including canoes, kayaks, and river rafts.

For the 2019, season, the program received 95 notifications from CBSA at several different border crossings that inspectors responded to (Figure 32). These numbers reflect the notifications that were received through the program’s email. In some instances, CBSA officers also notified individual provincial inspectors by phone. It is also important to note that program inspectors were set up at the Osoyoos and Cascade border crossings, during which time boats were directed to the inspectors, so a formal notification was not required. The program also receives notifications from CBSA during the winter months when the inspection stations are closed. These notifications are followed up by the two AIS sergeants in the COS.

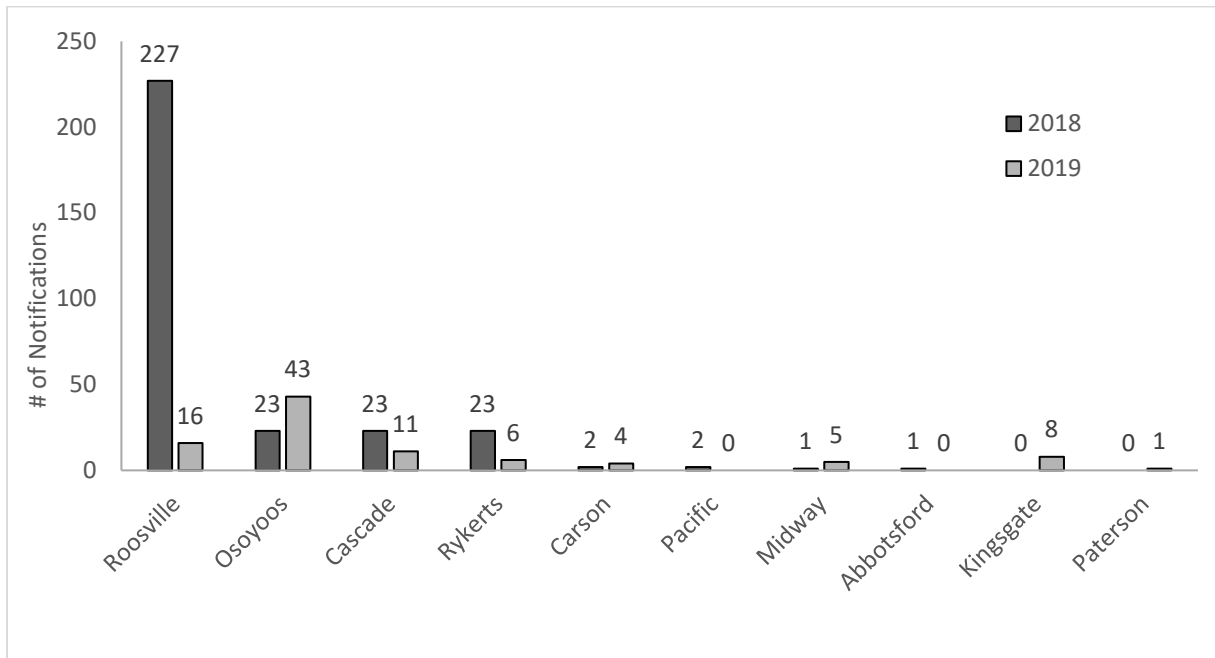


Figure 32. CBSA notifications received across several border crossings for the 2018 and 2019 seasons.

3.7 K9 INSPECTIONS

In 2017, the program launched the AIS K9 Unit with the training of B.C.’s first multipurpose detection dog, Kilo and in 2019 K9 Major joined the program. Kilo and his handler Staff Sergeant Major Josh Lockwood are based in Kelowna while Major and his handler Sergeant Cynthia Mann are based in Nelson.

Both teams were deployed at inspection stations during the 2019 season and they spent at least 90 hrs across 52 separate shifts at various inspection stations. This does not include scheduled inspections that were performed away from inspection stations, K9 training, and participating at numerous outreach events over the course of the season.

Table 2 in section 4.3 below provides a summary of outreach events, meetings and conferences attended by the program and indicates if a K9 was in attendance. This does not represent a complete list of events attended by the K9's during the season.

4. OUTREACH/EDUCATION ON CLEAN, DRAIN, DRY

4.1 INSPECTION STATIONS

Inspection crews had an estimated 95,000 interactions across all the inspection stations during the 2019 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 2019 season, watercraft owners having previous knowledge of AIS and CDD averaged 62% which is only a very slight increase from 2018 at 61%. Figure 33 shows the breakdown of previous knowledge by watercraft inspection station with Salmo being the highest at 81%. As expected, this data aligns closely with the percent of watercraft previously inspected at each station (Figure 14). Figure 34 shows that the top source of previous knowledge was the previous inspection station visited (in B.C.) (80.4%), followed by previous inspection (other jurisdiction) (6.3%), personal experience (6.2%), highway inspection signs (1.7%), brochures (1.4%), word of mouth (1%), Internet (0.6%) and other (2.4%). Of the previous other inspection stations visited, 2.8% were from Alberta and the remaining 3.4% were from other jurisdictions.

Other sources of knowledge include but are not limited to provincial government TV advertising/ news, provincial government, related work, signs at boat launches, US/Canada border inspection, highway billboard signs, regional invasive species groups, local government, and social media. Data was collected from boaters attending inspection stations. This data provides important information about how to effectively target the boating community to raise awareness about AIS/CDD in future years of the program.

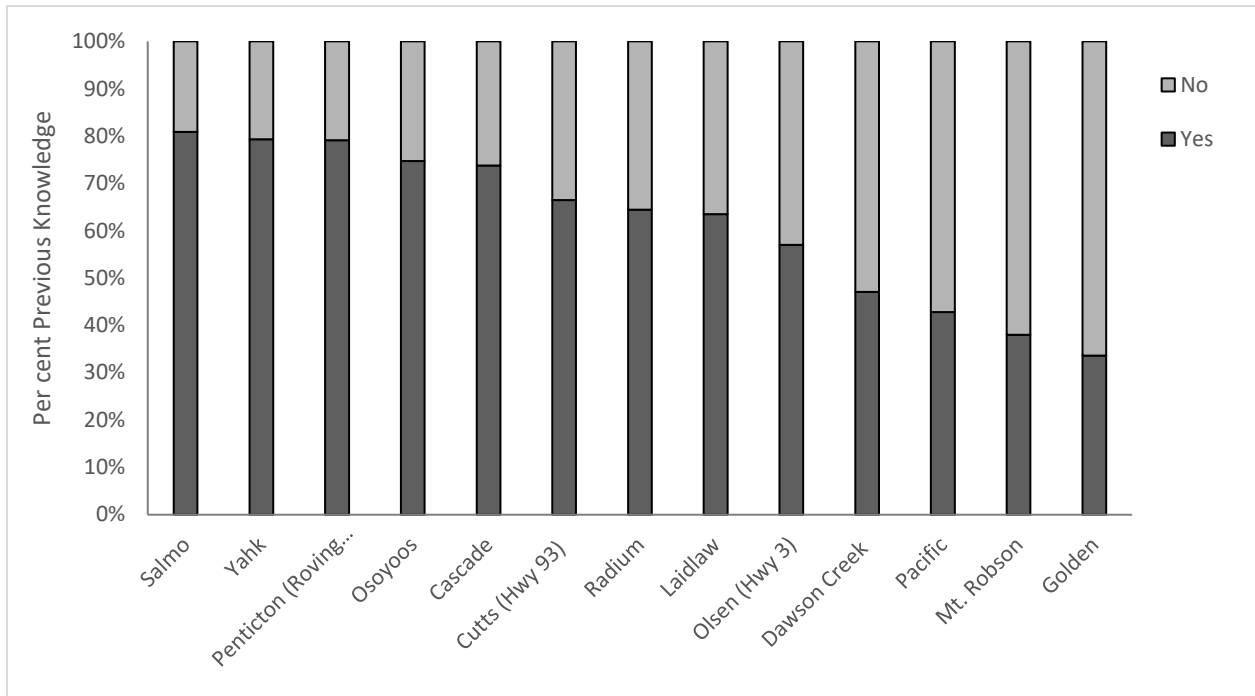


Figure 33. Watercraft owners' previous knowledge of aquatic invasive species and/or Clean, Drain, Dry by watercraft inspection station for 2019.

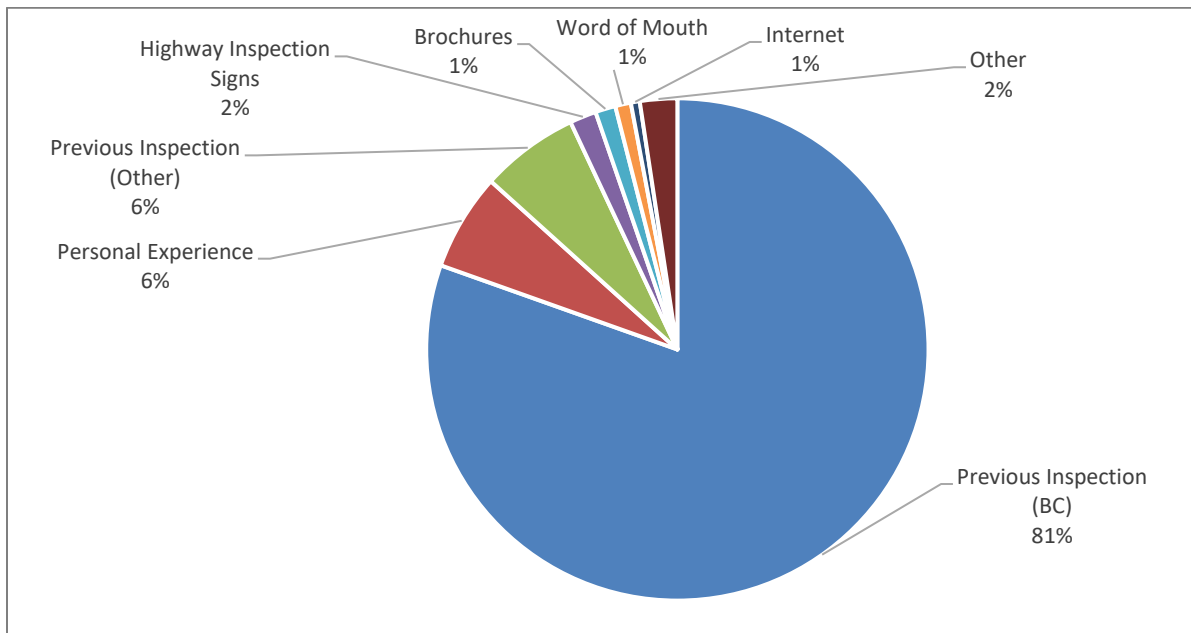


Figure 34. Primary sources of previous knowledge of aquatic invasive species or Clean, Drain, Dry.

Over the entire 2019 season, 166 people voluntarily stopped at an inspection station to get more information, a decrease from the 193 who stopped during the 2018 season. The decrease could be linked to the new signs installed in 2018 at the stations helping to inform boaters what the inspection stations are checking for. In the past, the public may have been stopping without a watercraft to find out what the inspection stations were checking for or to get directions or other visitor/travel information.

The program also received 85 public inquiries over the 2019 season through the program's email (COS.Aquatic.Invasive.Species@gov.bc.ca) which is monitored by all the inspectors and senior program staff. These emails included reports of suspected invasive mussels which were immediately followed up on and verified to be native freshwater mussels or other native species. 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. This is a positive sign of increased awareness about the program amongst boaters bringing their boats into B.C. and wanting to comply.

4.2 OUTREACH EVENTS

While provincial inspection stations were the priority of the program, inspection crews also attended local events to provide education about CDD, invasive mussels, and other high-risk AIS. Inspection crews worked with several regional invasive species committees to identify suitable events to attend.

Table 3 provides a detailed list of the events attended during the 2019 season. This includes provincial events and meetings attended by senior program staff and not out-of-province cross-border meetings. Kilo and his handler attended several events such as the B.C. Boat & Sportsman/Hunting Show and the Vancouver International Boat Show.

In addition to inspectors participating in outreach events through the season, senior program staff also attend numerous regional, national and international conference throughout the year. In 2019, senior program staff participated in the Columbia River Transboundary Conference in Kimberly, B.C. The invasive species session was co-chaired by program staff (Martina Beck) and included a demonstration provided by K9 Major and handler Sergeant Cynthia Mann. In addition, Ministry staff presented on the program's unique model of blending enforcement and science at the International Conference on Aquatic Invasive Species (ICAIS) in Montreal in October 2019. The presentation was very well received and resulted in follow up from other jurisdictions.

Table 2. Outreach events, meetings and conferences attended by inspectors, program staff and the K9 Unit during the 2019 season.

Event Name	Location of Outreach event (City)	Dates	K9 in Attendance
BC Interior Sportsman Show 2019	Kelowna	April 7th 2019	Kilo
Paddle Expo 2019	Chilliwack	April 28th 2019	
Sail Nelson Safe Boating Event	Nelson	May 25th 2019	Major
Swan Lake Society BBQ	Dawson Creek	May 26th 2019	
IMDP Ministerial Announcement	West Kelowna	May 31st 2019	Kilo and Major
100th Meridian Columbia River Basin Team Meeting	Spokane, WA	June 3-5th 2019	n/a
Cabella's Outreach Event	Abbotsford	June 6th 2019	
Christina Lake Pike Challenge	Christina Lake	June 22nd 2019	Major
Christina Lake Homecoming	Christina Lake	July 13th 2019	Major
World Jet Boat Race Championship	Taylor	July 20-21th 2019	
Outreach at boat launches (Okanagan and Kalamalka Lakes)	Kelowna, Vernon & Summerland	Aug 4th, 9-11th 2019	
Ducks Unlimited Canada "Ducks in Trucks"	Cranbrook	Aug 18th 2019	
Compliance Training Event with RCMP & DFO	Osoyoos	Aug 24th 2019	Kilo
Wooden Boat Festival	Vancouver	Aug 24-25th 2019	
Columbia River Transboundary Conference	Kimberley	Sep 12-14th 2019	Major
Columbia-Kootenay Salmon Festival	Invermere	Sep 14th 2019	
Western Regional Panel	Missoula, MT	Oct 9-10th 2019	n/a
International Conference on Aquatic Invasive Species (ICAIS)	Montreal	Oct 27-31 2020	n/a
2020 Vancouver International Boat Show	Vancouver	Feb 5-9th 2020	Kilo and Major
2020 BC Boat & Sportsman/Hunting Show	Abbotsford	March 5-7th 2020	Kilo

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](#). The Province has been conducting early detection lake monitoring for ZQM since 2011. B.C. is one of many jurisdictions across North America conducting early detection monitoring and active prevention efforts for invasive mussels.

The [British Columbia Dreissenid Mussel Lake Monitoring Field Protocol](#) was updated and published in December 2019. It details the provincial protocols used for early detection 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.

In 2018, HCTF announced a new granting program in partnership with ENV designed to fund community efforts to monitor lakes in B.C. for the presence of invasive freshwater mussels. For more information about the program please visit <https://hctf.ca/grants/invasive-mussel-monitoring-grants/>

In 2019 a total of 12 grants were administered by HCTF for the collection of water samples and deployment of substrate samplers. The grant recipients were: Boundary Invasive Species Society (BISS), Central Kootenay Invasive Species Society (CKISS), Coastal Invasive Species Committee, Columbia-Shuswap Invasive Species Society (CSISS), Christina Lake Stewardship Society (CLSS), East Kootenay Invasive Species Society (EKISS), Fraser Valley Invasive Species Society (FVISS), Okanagan and Similkameen Invasive Species Society and Osoyoos Lake Water Quality Society (OASISS), Sea to Sky Invasive Species Council (SSISC), Invasive Species Council of British Columbia (ISCBC), Okanagan Nation Alliance (ONA) and the Lillooet Regional Invasive Species Society (LRISS). Samples were also collected by ENV and FLNRORD regional staff, and BC Hydro.

In 2019 the Province was successful in receiving four years of federal funding under the Canada Nature Fund for Aquatic Species at Risk to support invasive mussel lake monitoring activities within the Fraser and Columbia River Watersheds. The province would like to acknowledge Fisheries and Oceans Canada for their financial support of the 2019 lake monitoring activities. For more information about the Canada Nature Fund please visit <https://www.dfo-mpo.gc.ca/species-especies/sara-lep/cnfasar-fnceap/index-eng.html>

A total of 892 plankton tow samples were collected and approximately 83 substrate samples were collected in 79 lakes throughout BC (Figure 13) during the 2019 season. All samples tested negative for the presence of invasive mussels. A complete list of waterbodies sampled for plankton tow and substrate samplers can be found in Appendix B.

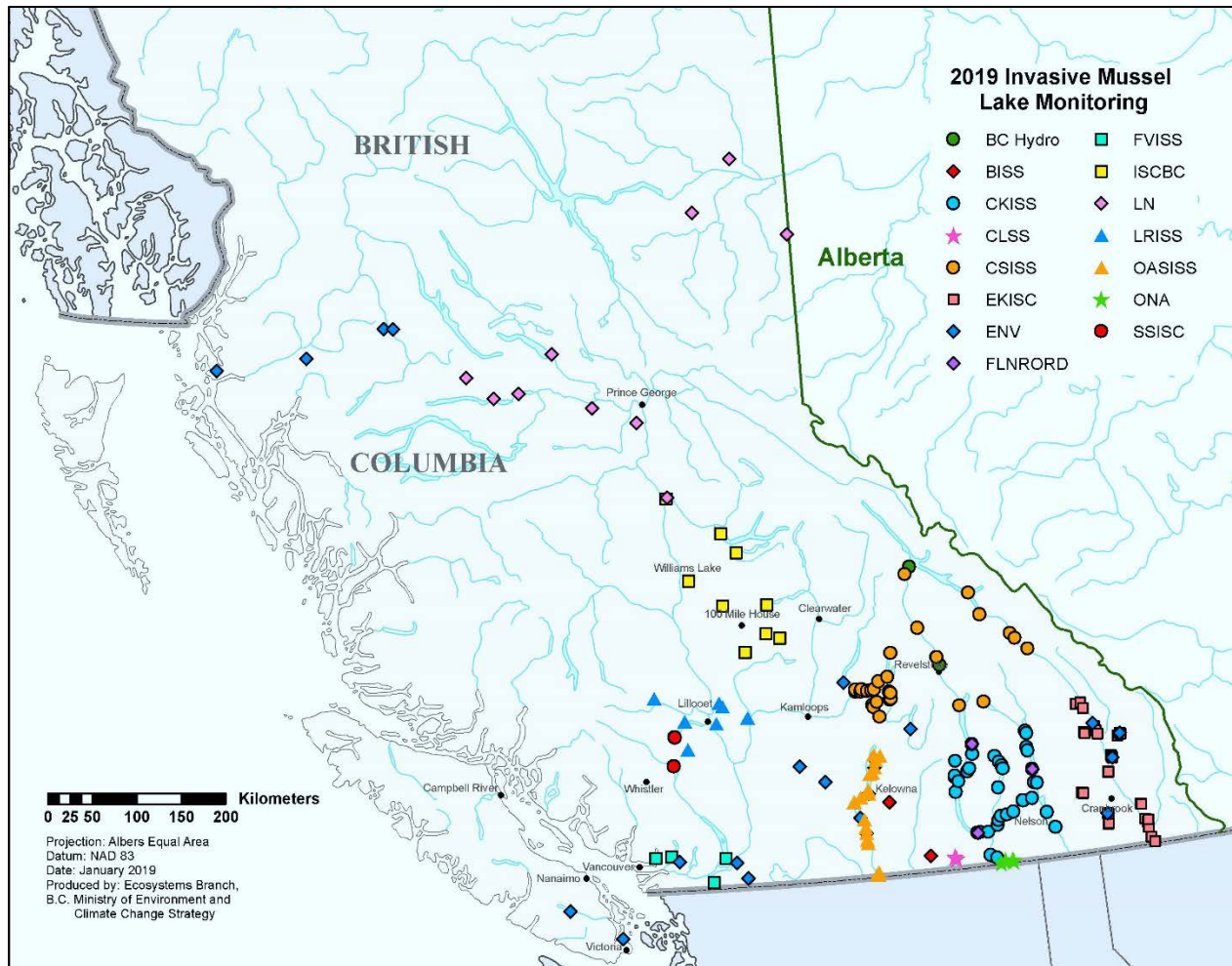


Figure 35. 2019 Lake monitoring plankton tow sampling locations, please see above for the full names of the sampling agencies.

6. PARTNERSHIPS AND COLLABORATIONS

Partnerships are the foundation of the program, and below is a summary of several key partnerships.

CROSS-AGENCY:

In May, 2019 the COS worked together with CBSA in the Lower Mainland to train CBSA Inspectors on Invasive Mussels and reporting protocols. This was an excellent opportunity to work together with CBSA building relationships. Similar to past seasons, throughout the year, local AIS staff worked together with CBSA staff at various ports of entry throughout Southern B.C. to stop the spread of invasive mussels. In addition, during May, 2019 the COS provided training to local RCMP volunteers in the Okanagan on

invasive mussels, and reporting as they assist the program in promoting clean, drain, dry of watercraft while conducting boating safety compliance initiatives.

In September 2019, for a second year the program participated in a two-day multi-agency compliance and enforcement initiative sponsored by the Commercial Vehicle Safety Branch of the Ministry of Transportation and Infrastructure (TRAN) in Kamloops, B.C. This initiative focused on compliance pertaining to provincial regulations that relate to commercial vehicles. This was an excellent opportunity for the program to engage and educate various government compliance and enforcement programs as well as the public about Aquatic Invasive Species (AIS) and the program overall in attempt to reduce and mitigate the spread of AIS.

CROSS-BORDER:

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). As an example, BC actively participates in several sub-committees under NAISC to address priorities for AIS in BC including:

1. working with DFO and CBSA on the international border watercraft notification process;
2. developing national guidelines/standards for use of eDNA in aquatic invasive species monitoring; and
3. working with Western Provinces, DFO and the Pesticide Management Regulatory Agency (PMRA) to develop processes to enable rapid access to registered control products for AIS (with invasive mussels being the priority).

In late 2015, the *Inter-Provincial-Territorial Agreement for Coordinated Regional Defense Against Invasive Species* was signed by B.C., Yukon, Alberta, Saskatchewan, and Manitoba. The agreement broadly focuses on the identification of new or emerging invasive species, preventing and/or monitoring the spread of known invasive species, and control or management options to reduce or eliminate invasive species in western Canada. The initial focus of the agreement is on invasive mussels including coordination of watercraft inspection stations. As an example, in January 2019 program staff participated in joint training session with Alberta, Saskatchewan and Manitoba on incident command training for early detection rapid response for invasive mussels.

Ongoing coordination with other jurisdictions in Canada and the U.S. has been critical 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 [Western Regional AIS Panel](#) and an active participant in the Pacific Northwest Economic Region (PNWER) invasive species working group.

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. Program staff attended the 2020 Invasives Forum hosted by the Invasive Species Council of BC in Richmond, BC.

The Program partnered with the Okanagan Similkameen Invasive Species Society (OASISS) to conduct a training session with marinas and boat retailers in the Okanagan in October. Staff Sergeant Major Lockwood, Kilo and the Penticton inspection crew provided education and a decontamination demonstration to the participants.

7. SUMMARY OF LESSONS LEARNED AND IMPROVEMENTS

At the end of each season, the program undergoes annual reviews considering ongoing feedback from staff, partners, and the public, as well as lessons learned from other jurisdictions across western Canada and the United States. Below is a summary of the lessons learned from the 2019 season that were considered for the planning and implementation of the 2020 season.

7.1 STAFFING/GENERAL OPERATIONS

In 2019 the program welcomed a new administrative coordinator (Kelsey Currie) who is based out of Kamloops. This position oversees many critical administrative functions of the program operations such as staff hiring and onboarding, uniform and equipment procurement and inventory, and records/file management.

Over the winter of 2019-2020 the program leadership team carefully reviewed the decontamination order forms and made several changes to improve accuracy and efficiency of data entry in the field. Changes included making the form more compact in size to be consistent with ticket/warning booklets used by field officers. The updated form will be ready for use in the 2020 season.

A significant change that was made over the winter was the development of a new mobile application for recording watercraft inspection data. The new application known as “INSPECT” is an internal mobile App that will provide enhanced security and efficiency when entering data remotely in the field. The App was developed as part of the broader Species and Ecosystem Inventory System Modernization (SEISM) government initiative and the App will be launched for the 2020 season.

Two additional instructors from the existing Conservation Officer Service marine unit completed the Watercraft Inspection and Decontamination Training (WIT II) through the Pacific States Marine Fisheries Commission in the US. The COS marine instructors were trained in the UMPS III protocols used by the Program and across western states and provinces.

In addition, the COS made some refinements to the Report All Poachers and Polluters Hotline to expand the notification process to include public inquiries about bringing a boat into the Province and to contact the program to determine if an inspection would be required prior to launching into BC waters. As

previously noted, the program received 85 public inquiries of this nature during the 2019 season. These notifications are followed up by inspectors.

The program continues to find incremental improvements to the program to increase efficiencies in program delivery.

7.2 INSPECTION STATION LOCATIONS/HOURS OF OPERATION

For the 2019 season the Golden inspection station moved locations from the Kicking Horse Rest Area to the pullout at the Tourist Information Centre at the entrance into Golden via Hwy 1. This new site was selected through close collaboration with the Town of Golden and TRAN. The new location provided key safety benefits such as cell phone reception, reduced speed limits (60 km/h vs. 100 km/h), and increased visibility of the station by the traveling public. We anticipate that this will contribute to overall increased compliance at the station.

For the 2019 season the program piloted a roving inspection crew in the Okanagan. This was to address high volume of scheduled inspections and decontaminations performed in the Okanagan in previous years. The roving crew was in addition to staff stationed at the Osoyoos border crossing.

The roving crew was very successful in providing increased capacity to respond to watercraft notifications coming from another inspection stations in BC (such as Golden), other jurisdictions (AB, ID, MT, WA) and from CBSA. Watercraft cannot always be decontaminated during transportation at a roadside inspection station and 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 the crew was not responding to notifications, they were able to conduct outreach at local boat launches in the Okanagan. The roving crew will be implemented again for the 2020 season and may be considered for other parts of the province.

Data from the 2019 season at the Salmo inspection station showed very low volumes of high-risk boats were intercepted at 0.8% of total inspections (16 high risk total). In addition, 72% of total inspections had been previously inspected either in BC or by another jurisdiction and 43% of all inspections had been previously inspected the same day. This data was consistent with previous years and shows that the inspection station is not effective in intercepting boaters coming from outside BC. Rather, the station was primarily intercepting local boaters or out of province boaters that had already been inspected.

For the 2020 season the four positions from the Salmo station will be reallocated to establish a formal roving crew based out of Creston. This will be a similar model to the roving crew that operated in Penticton for the 2019 season and was found to be very effective for responding to watercraft notifications from CBSA and other jurisdictions. A roving crew based out of Creston will provide coverage to respond to CBSA notifications spanning from Grand Forks to Creston and into the East Kootenay where applicable.

Data from the Laidlaw inspection station in 2019 revealed a very low percentage of high-risk boats (0.3%) despite the very high number of overall inspections (14,457). This is consistent with data from previous years and confirms that this station is not intercepting boaters from out of province and rather is targeting local traffic. The Laidlaw station also presents safety concerns due to high volumes of traffic and high traveling speeds (120km/h). As part of the annual review following the 2019 season it was decided that the Laidlaw station will not be operational for the 2020 season. The inspection crew will be based out of a new ENV office in Mission and will be roving between the ports of entry and working next to CBSA to target boaters coming from southern high-risk jurisdictions (e.g. California, Arizona and Nevada).

For the 2020 season, adjustments to program operations have been made due to COVID 19 restrictions. The program was able to hire and safely onboard 37 returning inspectors from the 2019 season and they will be operational at 9 stations across the province in advance of the May long weekend. The directions by the Public Health Officer (PHO) for COVID 19 have prevented the program from being able to safely hire and train new staff for the 2020 season. The program will continue to closely monitor the directions provided by the PHO but future impacts to program operations due to COVID-19 are difficult to predict (i.e. staff illness, PHO restrictions, border closures, etc.). The health and safety of staff and the public is our top priority. We expect the program will run until the end of October, 2020.

7.3 COMPLIANCE

The average compliance for the 2019 season was 83% which represents a 2% increase from the 2018 season (81%). This could be linked to ongoing improvements to inspection stations locations such as the change to the location of the Golden inspection station. A total of 116 tickets and 114 warnings were issued by full time Conservation Officers to motorists for failing to stop at a watercraft inspection station. This marks an increase from 2018 season (84 tickets and 50 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.

Several factors affected the overall compliance at B.C. inspection stations. For example, the Cascade and Osoyoos border crossings had very high compliance, where watercraft were directed by CBSA staff to the program inspectors. This provided little opportunity for watercraft owners to bypass the inspection station. Conversely, the Laidlaw weigh scale is situated where highway speed limits are higher at 100-120 km/h and large volumes of semi-truck traffic passing the stations. This makes it more difficult for boaters to see the inspection station, and to safely slow down and pull over. The new inspection station for Golden at the tourist information centre in town provided a site with reduced speed limits (60 km/h vs. 100 km/h) and increased visibility of the station. This will likely help with improving compliance at this station. The increased enforcement presence at the inspection stations during the 2019 season likely also helped with increasing compliance.

APPENDIX A 2019 WATERCRAFT INSPECTION STATION DETAILS

Station Name	Hwy #	Region	Type	Traffic Direction
Cascade	3	Kootenay/ Boundary	Border crossing	Northbound
Cutts (Hwy 93)	93	Kootenay	Pullout	Northbound
Dawson Creek	2	Peace	Pullout	Westbound
Golden	1	Kootenay	Pullout	Westbound
Laidlaw	1	Lower Mainland	Weigh scale	Eastbound
Mt. Robson	16	Omineca	Pullout	Westbound
Olsen (Hwy 3)	3	Kootenay	Rest area	Westbound
Osoyoos	97	Okanagan	Border crossing	Northbound
Pacific	176 Ave	Lower Mainland	Weigh scale	Northbound
Radium	95	Kootenay	Pullout	Southbound
Salmo	3	Kootenay	Pullout	Westbound
Yahk	95 and 3	Kootenay	Pullout	Westbound

APPENDIX B 2019 LAKE MONITORING SAMPLING DETAILS

Waterbody	Region	Sampling Group/Agency*	Sampling Method(s)	Adult or veliger ZQM detected? (Y/N)
Adams Lake	Thompson-Nicola	CSISS	substrate sampler	No
Adams Lake	Thompson-Nicola	ENV	plankton tow	No
Alouette Lake	Lower Mainland	ENV	plankton tow	No
Alta Lake	Lower Mainland	SSISC	substrate sampler	No
Anderson Lake	Lower Mainland	LRISS	plankton tow & substrate sampler	No
Anderson Lake	Lower Mainland	SSISC	plankton tow	No
Arrow Lake, Lower	Kootenay	FLNRORD	plankton tow	No
Arrow Lake, Lower	Kootenay	CKISS	plankton tow & substrate sampler	No
Arrow Lake, Upper	Kootenay	CKISS	plankton tow	No
Arrow Lake, Upper	Kootenay	CSISS	plankton tow & substrate sampler	No
Birkenhead Lake	Lower Mainland	SSISC	substrate sampler	No
Bridge Lake	Cariboo	ISCBC	plankton tow & substrate sampler	No
Buntzen Lake	Lower Mainland	FVISS	plankton tow	No
Burnaby Lake	Lower Mainland	FVISS	substrate sampler	No
Burns Lake	Skeena	ENV	plankton tow	No
Canim Lake	Cariboo	ISCBC	plankton tow & substrate sampler	No
Charlie Lake	Peace	ENV	plankton tow	No
Chilliwack Lake	Lower Mainland	ENV	plankton tow	No
Christina Lake	Okanagan	CLSS	plankton tow & substrate sampler	No
Clucilz Lake	Omineca	ENV	plankton tow	No
Columbia Lake	Kootenay	EKISC	plankton tow	No
Columbia Lake	Kootenay	ENV	plankton tow	No
Columbia River (lower)	Kootenay	CKISS	plankton tow	No
Columbia River (upper)	Kootenay	CSISS	plankton tow	No
Cowichan Lake	Vancouver Island	ENV	plankton tow	No
Crown Lake	Thompson-Nicola	LRISS	plankton tow	No
Cultus Lake	Lower Mainland	FVISS	plankton tow & substrate sampler	No
Diana Lake	Skeena	ENV	plankton tow	No
Dragon Lake	Cariboo	ISCBC	plankton tow & substrate sampler	No
Dragon Lake	Cariboo	ENV	plankton tow	No
Duffy Lake	Thompson-Nicola	LRISS	plankton tow	No

Waterbody	Region	Sampling Group/Agency*	Sampling Method(s)	Adult or veliger ZQM detected? (Y/N)
Duncan Lake	Kootenay	CKISS	plankton tow	No
Elk Lake	Vancouver Island	ENV	plankton tow	No
Emerald Lake	Kootenay	CSISS	substrate sampler	No
Fountain Lake	Omineca	LRISS	plankton tow & substrate sampler	No
Francois Lake East	Skeena	ENV	plankton tow	No
Fraser Lake	Omineca	ENV	plankton tow	No
Gardom Lake	Thompson-Nicola	CSISS	plankton tow	No
Green Lake	Cariboo	ISCBC	plankton tow & substrate sampler	No
Green Lake	Lower Mainland	SSISC	substrate sampler	No
Gun Lake	Thompson-Nicola	LRISS	substrate sampler	No
Harrison Lake	Lower Mainland	FVISS	plankton tow & substrate sampler	No
Horsefly Lake	Cariboo	ISCBC	plankton tow & substrate sampler	No
Idabel Lake	Okanagan	BISS	plankton tow & substrate sampler	No
Jewel Lake	Okanagan	BISS	plankton tow & substrate sampler	No
Kalamalka Lake	Okanagan	ENV	plankton tow	No
Kalamalka Lake	Okanagan	OASISS	plankton tow & substrate sampler	No
Kathlyn Lake	Skeena	ENV	plankton tow	No
Kinbasket Reservoir	Kootenay	BC Hydro	plankton tow	No
Kinbasket Reservoir	Kootenay	CSISS	plankton tow & substrate sampler	No
Koocanusa	Kootenay	EKISC	plankton tow	No
Kootenay Lake	Kootenay	CKISS	plankton tow & substrate sampler	No
Kootenay Lake	Kootenay	FLNRORD	plankton tow	No
Kootenay River (Nelson)	Kootenay	CKISS	plankton tow	No
Lac la Hache	Cariboo	ISCBC	plankton tow & substrate sampler	No
Lake Revelstoke	Kootenay	CSISS	substrate sampler	No
Lakelse Lake	Skeena	ENV	plankton tow	No
Lillian Lake	Kootenay	EKISC	plankton tow	No
Lillooet Lake	Thompson-Nicola	SSISC	plankton tow & substrate sampler	No
Little Shuswap Lake	Thompson-Nicola	CSISS	substrate sampler	No
Lost Lake	Lower Mainland	SSISC	substrate sampler	No
Mabel Lake	Okanagan	ENV	plankton tow	No
Mahood Lake	Thompson-Nicola	ISCBC	substrate sampler	No
Mara Lake	Thompson-Nicola	CSISS	plankton tow & substrate sampler	No

Waterbody	Region	Sampling Group/Agency*	Sampling Method(s)	Adult or veliger ZQM detected? (Y/N)
Mara Lake	Thompson-Nicola	ENV	plankton tow	No
Marshall Lake	Thompson-Nicola	LRISS	substrate sampler	No
Martha Creek	Thompson-Nicola	CSISS	plankton tow	No
Moberly Lake	Peace	ENV	plankton tow	No
Moyie Lake North	Kootenay	EKISC	plankton tow	No
Moyie Lake North	Kootenay	ENV	plankton tow	No
Moyie Lake South	Kootenay	EKISC	plankton tow	No
Moyie Lake South	Kootenay	ENV	plankton tow	No
Nadsilnich Lake (Wset)	Omineca	ENV	plankton tow	No
Nicola Lake	Thompson-Nicola	ENV	plankton tow	No
Okanagan Lake	Okanagan	OASISS	plankton tow & substrate sampler	No
Okanagan Lake	Okanagan	ENV	plankton tow	No
Osoyoos Lake	Okanagan	ENV	plankton tow	No
Osoyoos Lake	Okanagan	OASISS	plankton tow & substrate sampler	No
Pavilion Lake	Thompson-Nicola	LRISS	plankton tow & substrate sampler	No
Pend d'Oreille	Kootenay	ONA	plankton tow & substrate sampler	No
Pennask Lake	Thompson-Nicola	ENV	plankton tow	No
Pitt Lake	Lower Mainland	FVISS	plankton tow & substrate sampler	No
Premier Lake	Kootenay	EKISC	plankton tow	No
Premier Lake	Kootenay	ENV	plankton tow	No
Quesnel Lake	Cariboo	ISCBC	plankton tow & substrate sampler	No
Revelstoke Reservoir	Kootenay	BC Hydro	plankton tow	No
Revelstoke Reservoir	Kootenay	CSISS	plankton tow	No
Seton Lake	Thompson-Nicola	LRISS	substrate sampler	No
Sheridan Lake	Cariboo	ISCBC	plankton tow & substrate sampler	No
Shuswap Lake	Thompson-Nicola	CSISS	plankton tow & substrate sampler	No
Shuswap Lake	Thompson-Nicola	ENV	plankton tow	No
Skaha Lake	Okanagan	ENV	plankton tow	No
Skaha Lake	Okanagan	OASISS	plankton tow & substrate sampler	No
Slocan Lake	Kootenay	CKISS	plankton tow	No
Slocan Lake	Kootenay	ENV	plankton tow	No
St Mary's Lake	Kootenay	EKISC	plankton tow	No
Stuart Lake	Omineca	ENV	plankton tow	No

Waterbody	Region	Sampling Group/Agency*	Sampling Method(s)	Adult or veliger ZQM detected? (Y/N)
Surveyors	Kootenay	EKISC	plankton tow	No
Swan Lake	Peace	ENV	plankton tow	No
Tie Lake	Kootenay	EKISC	plankton tow	No
Trout Lake	Kootenay	CSISS	plankton tow & substrate sampler	No
Tyughton Lake	Thompson-Nicola	LRISS	plankton tow & substrate sampler	No
Tyhee Lake	Skeena	ENV	plankton tow	No
Wahleach/Jones	Lower Mainland	ENV	plankton tow	No
Wasa Lake	Kootenay	EKISC	plankton tow	No
Whatshan Lake	Kootenay	CKISS	plankton tow	No
White Lake	Thompson-Nicola	CSISS	plankton tow & substrate sampler	No
Whiteswan Lake	Kootenay	EKISC	plankton tow	No
Whiteswan Lake	Kootenay	ENV	plankton tow	No
Whitetail Lake	Kootenay	EKISC	plankton tow	No
Williams Lake	Cariboo	ISCBC	plankton tow & substrate sampler	No
Windermere Lake	Kootenay	EKISC	plankton tow	No
Windermere Lake	Kootenay	ENV	plankton tow	No
Wood Lake	Okanagan	ENV	plankton tow	No
Wood Lake	Okanagan	OASISS	plankton tow & substrate sampler	No

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