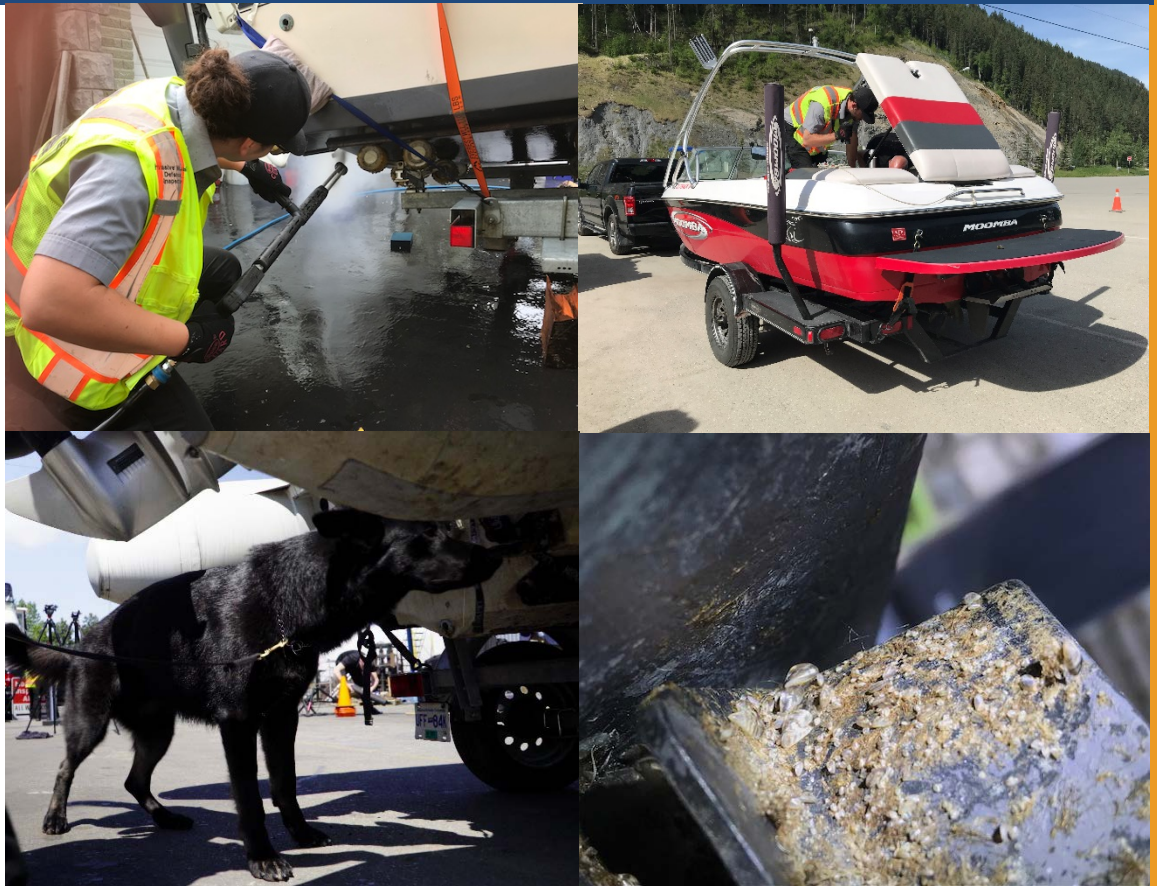


# B.C. Invasive Mussel Defence Program: 2018 Final Report



Ministry of  
Environment and  
Climate Change Strategy

August 2019

## ACKNOWLEDGEMENTS

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## GLOSSARY

Acronym	Definition
AGR	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
FLNR	Ministry of Forests, Lands and Natural Resource Operations and Rural Development
IMISWG	Inter-Ministry Invasive Species Working Group
MOTI	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 British Columbia 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 AB, 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 BC 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 and it is an offence to tamper with or remove a seal.
High-risk watercraft	<p>A high-risk watercraft may be any of the following:</p> <ul style="list-style-type: none"> <li>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</li> <li>Any watercraft or equipment that is 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, or</li> <li>Any watercraft that is dirty, crusty or slimy with the potential risk of transporting other AIS.</li> </ul>



## EXECUTIVE SUMMARY

In 2018, the Invasive Mussel Defence Program had another busy and successful season through both the watercraft inspection stations and lake monitoring activities. A significant change from the 2017 to 2018 season was the transition of the watercraft inspection station operations to the B.C. Conservation Officer Service (COS). The COS oversaw the operations of the 12 watercraft inspection stations that were staffed by 64 auxiliary conservation officers from April to October of 2018.

For the 2018 season, over 40,700 watercraft were inspected and crews had approximately 78,600 interactions with the public to promote Clean, Drain, Dry and raise awareness about aquatic invasive species. Of the total watercraft inspected, 1,652 were identified as high-risk, 288 decontamination orders were issued and 228 watercraft were issued quarantine periods to meet the required 30-day drying time.

Of the more than 40,700 watercraft inspected, 25 were confirmed to have adult invasive mussels. These came from Ontario (16), Arizona (3), Manitoba (2), Michigan (2), Utah (1), and Nevada (1) and were destined for the Lower Mainland (11), Thompson-Nicola (5), Vancouver Island (4), Okanagan (3), and the Kootenays (2). The program received advanced notification on 20 of the 25 mussel fouled boats either from another jurisdiction (e.g., Alberta (AB), Montana (MT), Idaho, Washington (WA)) or by Canada Border Services Agency (CBSA).

New for the 2018 season, through partnership with the Ministry of Transportation and Infrastructure (MOTI), was the launch of new signage at the watercraft inspection stations to help increase visibility and improve compliance at the stations. The program also worked with MOTI to identify and build two new inspection stations in the East Kootenays to provide safe and suitable locations to meet the operational needs of the program. The two new stations are located on Hwy 93 just north of the Roosevelt border crossing and on Hwy 3 just west of Sparwood at the Olsen rest area.

Average compliance at the inspection stations for the 2018 season was 81% and represents a 5% increase from the 2017 season (76%). A total of 82 tickets and 50 warnings were issued by conservation officers to motorists for failing to stop at inspection stations. Watercraft operators who fail to stop at an inspection station are being reported to the Report All Poachers and Polluters (RAPP) hotline and full-time conservation officers are responding and following up.

A lesson learned from the 2018 season was the need for increased supervisory and operational oversight by hiring 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 are touring the inspection stations for the 2019 season.

The program would also like to thank our funding partners; BC Hydro, Columbia Basin Trust, Fortis BC and Columbia Power Corp for their ongoing support.



## 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 if introduced and 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. A review of economic impacts attributed to Zebra mussels in the eastern U.S. between 1989 to 2004 estimated expenditures of US\$268 million for affected drinking water and power plant facilities. 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 fisheries or property values.

In March 2015, the pilot season of the provincial Invasive Mussel Defence Program (the program) was launched through funding provided by the Ministry of Forests, Lands and Natural Resource Operations and Rural Development (FLNRORD), Ministry of Agriculture (AGR), BC Hydro, the Columbia Basin Trust and in-kind funding from Ministry of Environment and Climate Change Strategy (ENV). The pilot season included six mobile decontamination units, 12 trained auxiliary Conservation Officers (inspectors), lake monitoring for ZQM, and "Clean, Drain, Dry" education and outreach activities.

In 2016, the program expanded to 32 inspectors staffed at eight watercraft inspection stations strategically situated along eastern and southern border locations to target boaters entering B.C. This expansion was funded through partnerships with BC Hydro, Columbia Power Corporation, Fortis BC, and Columbia Basin Trust. In 2017, the program operations further expanded to 65 inspectors which included two new inspection stations, bringing the total to ten inspection stations. The hours of operation were extended from dawn to dusk for nine of the stations, and the province's busiest station at Golden was operational 24 hrs per day.

This document reports on the logistics, activities, and findings of the program's 2018 season for the operational period of April 1, 2018 to March 31, 2019.

### 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.;

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- **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 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 the Province of 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](http://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, MT 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 2018 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 British Columbia, 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 2018, program operations were administered by the Ministry of Environment and Climate Change Strategy (ENV) and the B.C. Conservation Officer Service (COS). The officer in charge (OIC), two sergeants and the auxiliary conservation officers were staffed through the COS and oversaw the field operations of the watercraft inspection stations. Ecosystems Branch staff within ENV were leading 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 Ecosystems Branch staff.

#### *Hours of Operation*

All the watercraft inspection stations were staffed with 64 trained auxiliary conservation officers (CO) equipped with mobile decontamination units. Six of the inspection stations (Pacific, Salmo/Paulson, Yahk, Radium, and Olsen Rest Area Hwy 3) had six inspectors for dawn to dusk operations seven days a week. The dawn to dusk stations were operational until late October. Five inspection stations (Laidlaw, Penticton, Cutts Hwy 93, Valemount 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 Valemount and Dawson Creek inspection stations closed in late August. The Golden inspection station had twelve inspectors for 24-hr coverage seven days a week from June to mid-September and operated dawn to dusk with six inspectors during the shoulder seasons in the spring (April/May) and fall (mid-September to late October).

### *Inspection Station Locations*

Data from the 2017 boating season and inspection locations were used to adjust program operations for the 2018 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.

Over the course of the 2018 season, the program worked closely with Ministry of Transportation and Infrastructure (MOTI) to address health and safety concerns at several inspection station locations in the East Kootenays. During the 2017 season, several locations were trialed in the East Kootenays on a temporary basis until suitable long-term locations could be identified by MOTI and senior program staff. As a result, in the early spring of 2018, MOTI built two new inspection stations for the program which provide safe and suitable locations to meet the operational needs of the program. One station (Cutts) is located on Hwy 93 just north of the Roosevelt border crossing and targets high risk boats coming from Montana. The second station (Olsen) is located on Hwy 3 just west of Sparwood and provides a safe location to intercept boaters coming from the east. Inspectors based out of Nelson also rotated between the Salmo and Paulson Summit inspection stations. See Figure 1 and Appendix A for a detailed list of the 2018 inspection station locations.

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 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 2018 season.

### *New Signage at Watercraft Inspection Stations*

Through partnership with the Ministry of Transportation and Infrastructure (MOTI), the program developed new watercraft inspection signs for the 2018 season (Figure 2). The signs have been designed to improve visibility and awareness for motorists transporting watercraft.

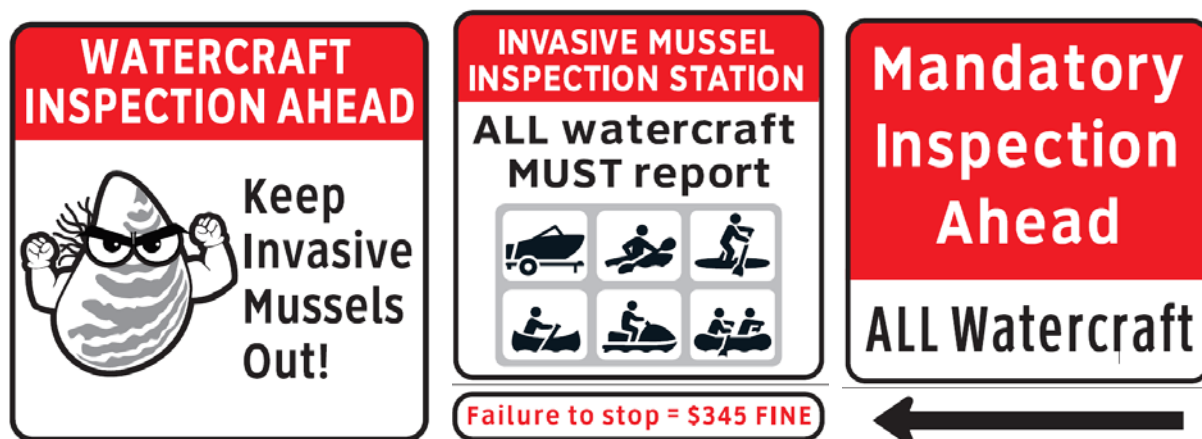


Figure 2. New signage at the watercraft inspection stations for the 2018 season.

## 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 2018 consisted of \$2M from the four program partners (BC Hydro, Columbia Basin Trust, Columbia Power Corp and Fortis BC), \$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 (not shown in Table 1) which brought the total budget to \$3.75M for the 2018 season.

### Ecosystems Branch (EB) Budget

Of the \$1M in dedicated provincial funding, \$250,000 went to the Ecosystems Branch (EB) to cover staff salary time for travel to meetings, program reporting, supporting the COS, outreach materials & partnerships, and lake monitoring sample analysis.

The lake monitoring costs were for the lab analysis of all water samples collected during the 2018 season. The cost of the lab analysis is separate from the grants administered by the Habitat Conservation Trust Foundation (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 one mobile pressure washer, three electronic message boards and 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 under the 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, two 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 2018 season.

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



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**Table 1. Summary of 2018 operating budget broken down by the COS and ecosystems branch (EB) and the actuals as of March 31<sup>st</sup> 2019.**

2018-2019	2018-2019 Complete Budget	Actuals as of March 31 2019	COS 2018-19 Budget	COS 2018-19 Actuals	EB 2018-19 Budget	EB 2018-19 Actuals	Variance
Salary	\$2,373,394	\$2,640,201	\$2,274,550	\$2,540,827	\$98,844	\$99,374	-\$266,807
Travel & Training	\$174,175	\$143,792	\$159,175	\$121,661	\$15,000	\$22,131	\$30,383
Corporate Overhead	\$50,000	\$50,000	\$35,000	\$35,000	\$15,000	\$15,000	\$0
Vehicle	\$257,250	\$242,942	\$257,250	\$242,942	\$0	\$0	\$14,308
Education/ Awareness/ Research	\$149,500	\$146,628	\$68,000	\$105,134	\$81,500	\$41,495	\$2,872
Non-capital equipment/ maintenance	\$244,500	\$236,021	\$244,500	\$217,072	\$0	\$18,949	\$8,479
Lake Monitoring	\$75,375	\$59,950	\$35,375	\$35,000	\$40,000	\$24,950	\$15,425
Equipment Amortization	\$15,000	\$15,043	\$15,000	\$15,043	\$0	\$0	-\$43
<b>Total Operations</b>	<b>\$3,339,194</b>	<b>\$3,534,577</b>	<b>\$3,088,850</b>	<b>\$3,312,678</b>	<b>\$250,344</b>	<b>\$221,899</b>	<b>-\$195,340</b>
Capital Equipment	\$161,000	\$161,569	\$161,000	\$161,569	\$0	\$0	-\$569
<b>Total</b>	<b>\$3,500,194</b>	<b>\$3,696,146</b>	<b>\$3,249,850</b>	<b>\$3,474,247</b>	<b>\$250,344</b>	<b>\$221,899</b>	<b>-\$195,909</b>

## 2018 INVASIVE MUSSEL DEFENCE PROGRAM FINAL REPORT

**Table 2. Anticipated budget for the 2019-2020 season of the Invasive Mussel Defence Program.**

<b>2019-2020</b>	<b>2019-2020 Budget *</b>	<b>COS 2019-20 Budget</b>	<b>EB 2019-20 Budget</b>
<b>Salary</b>	\$2,534,394	\$2,435,550	\$98,844
<b>Travel &amp; Training</b>	\$174,175	\$159,175	\$15,000
<b>Centrally Managed Funds</b>	\$50,000	\$35,000	\$15,000
<b>Vehicle</b>	\$257,250	\$257,250	\$0
<b>Education/ Awareness/ Research</b>	\$149,500	\$68,000	\$81,500
<b>Non-capital equipment/ maintenance</b>	\$244,500	\$244,500	\$0
<b>Lake Monitoring</b>	\$75,375	\$35,375	\$40,000
<b>Equipment Amortization</b>	\$15,000	\$15,000	\$0
<b>Total Operations</b>	<b>\$3,500,194</b>	<b>\$3,249,850</b>	<b>\$250,344</b>
<b>Capital Equipment</b>	\$0	\$0	\$0
<b>Total</b>	<b>\$3,500,194</b>	<b>\$3,249,850</b>	<b>\$250,344</b>

### 3. WATERCRAFT INSPECTION SUMMARY FOR 2018

#### 3.1 ALL WATERCRAFT ENCOUNTERS

During the 2018 season, just over 40,700 watercraft were inspected, and the crews interacted with approximately 78,600 people to promote Clean, Drain, Dry. Of the total watercraft inspected, 1,652 were identified as coming from a high-risk province or state, 288 were issued Decontamination Orders, and 228 were issued quarantine periods to meet the required 30-day drying time. Of the total watercraft inspected, 25 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 a number of 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 the Figures 3 through 10.

##### 3.1.1 Watercraft Inspection Summary by Station

Watercraft encounters (Figure 3) were highest at the Laidlaw station (8,838 boats), followed by the Golden station (8,171 boats), the Olsen station (5,392 boats), and the Yahk station (4,800 boats).

The encounter frequency (watercraft encounters/effort) across each inspection station showed that the busiest inspection stations were Laidlaw, Mt. Robson, Yahk, Radium, Olsen and Golden (Figure 4). The stations with the lowest frequency of boater traffic were Osoyoos, Pacific and Cascade. Interestingly, some of the stations with a low frequency of boater traffic had the highest percentage of high-risk boats (Dawson Creek and Pacific Border) (Figure 4). 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 5). The Golden station inspected boats coming from 44 different provinces and states, more than any other inspection station. In contrast, the Cascade and Paulson stations inspected boats from 12 and 14 different provinces and states. Dawson Creek and Pacific which had low overall numbers of inspections still intercepted boats from some of the highest number of different jurisdictions at 42 and 36, respectively.

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.

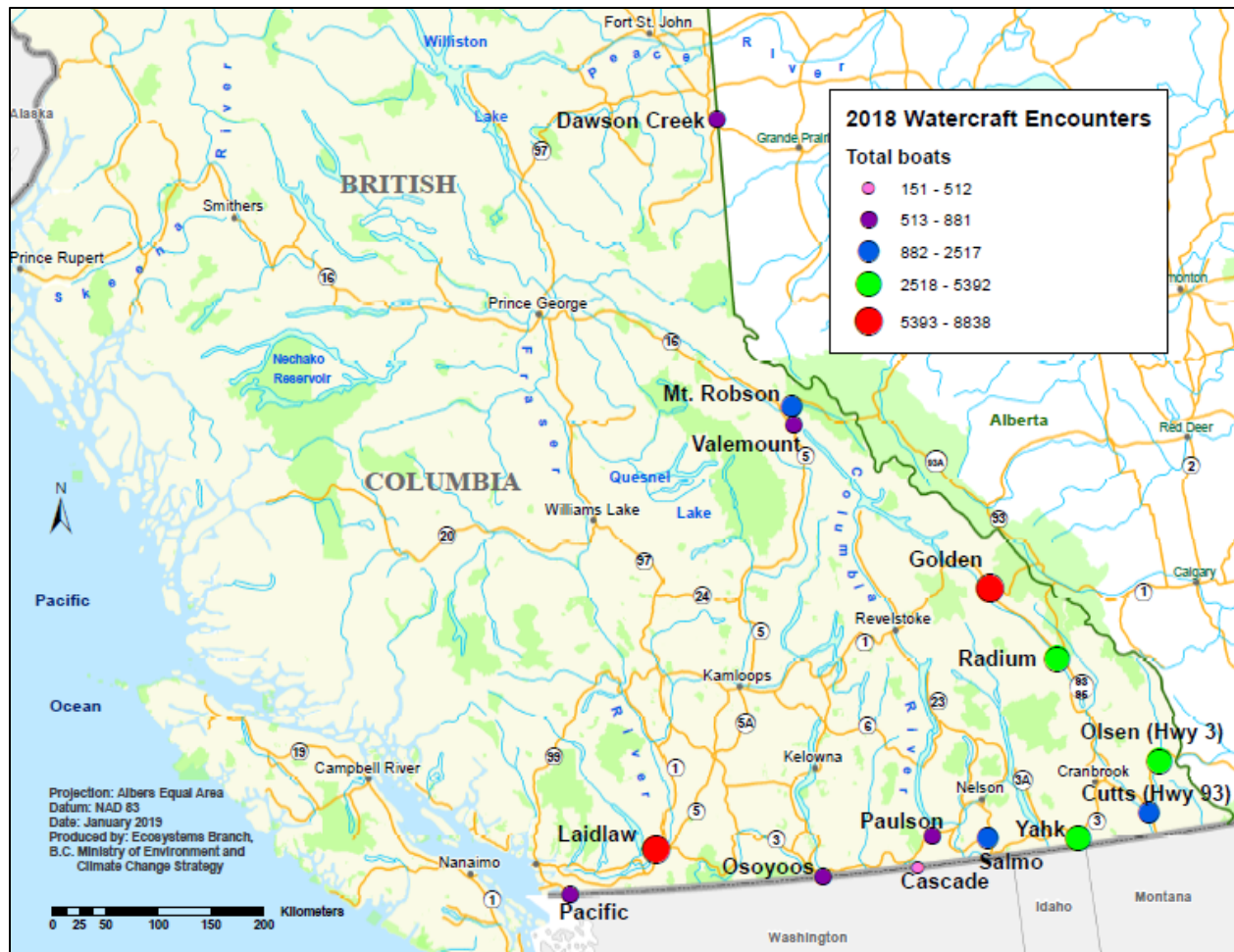


Figure 3. Total watercraft encounters for inspection stations during the 2018 season.

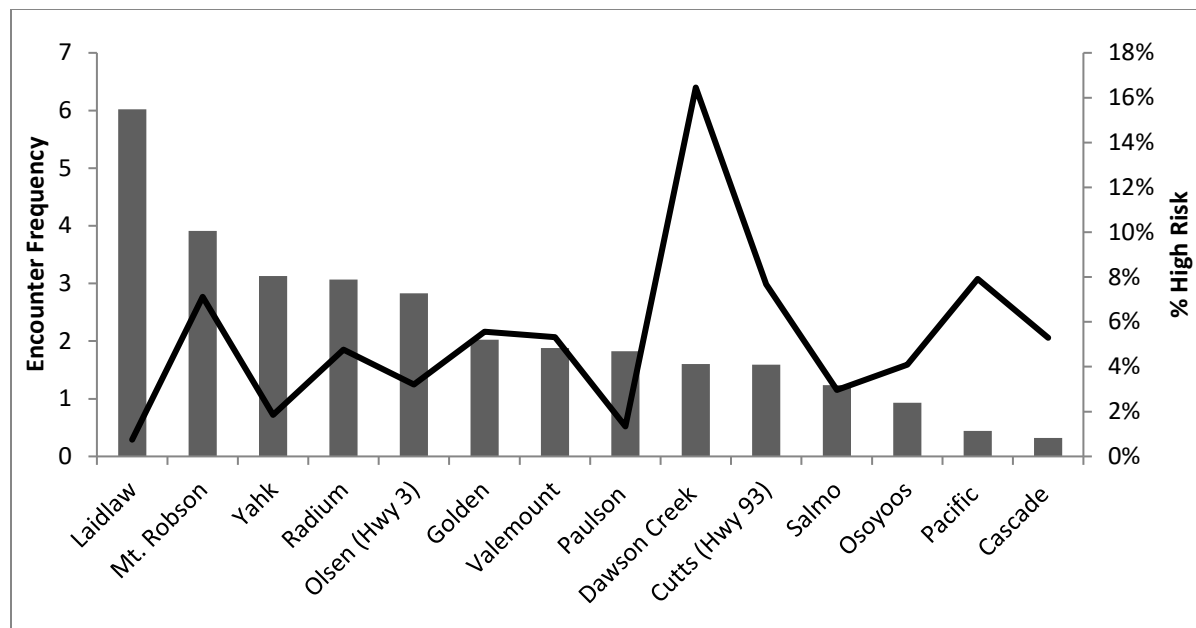


Figure 4. Encounter frequency (bars) by inspection station in comparison to percent of high-risk boats (line) per inspection station, from April to October 2018.

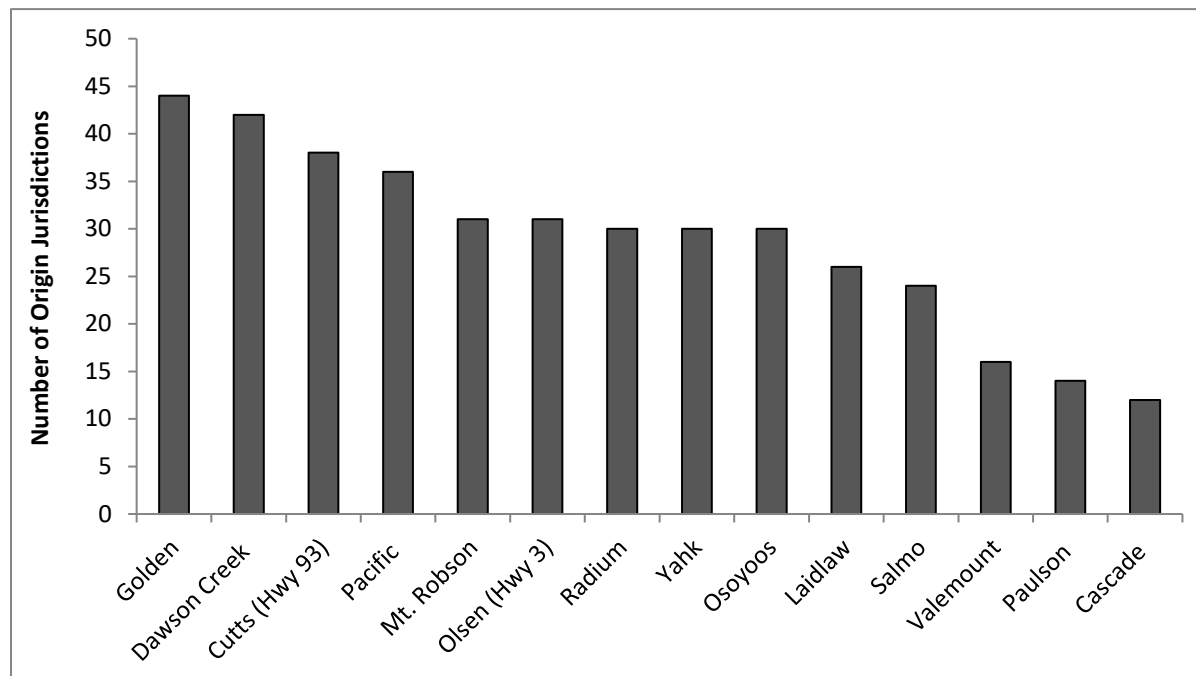


Figure 5. Total number of origin jurisdictions from which boats were traveling that were intercepted between April and October 2018, by inspection station.

### 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, 2018. The inspection station total effort (operational hours) increased over the spring months (April-June), peaking in July and August (Figure 6). Total effort was lowest in October since the two northern inspection stations (Dawson Creek and Valemount) closed at the end of August. Watercraft encounters and encounter frequency (Figure 7) showed a similar trend, increasing over the spring months (April to June) and peaking in July and August.

Figure 8 shows the total watercraft encounters and total effort by days of the week across the 2018 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 2017 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 8). 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 the long weekend. 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.

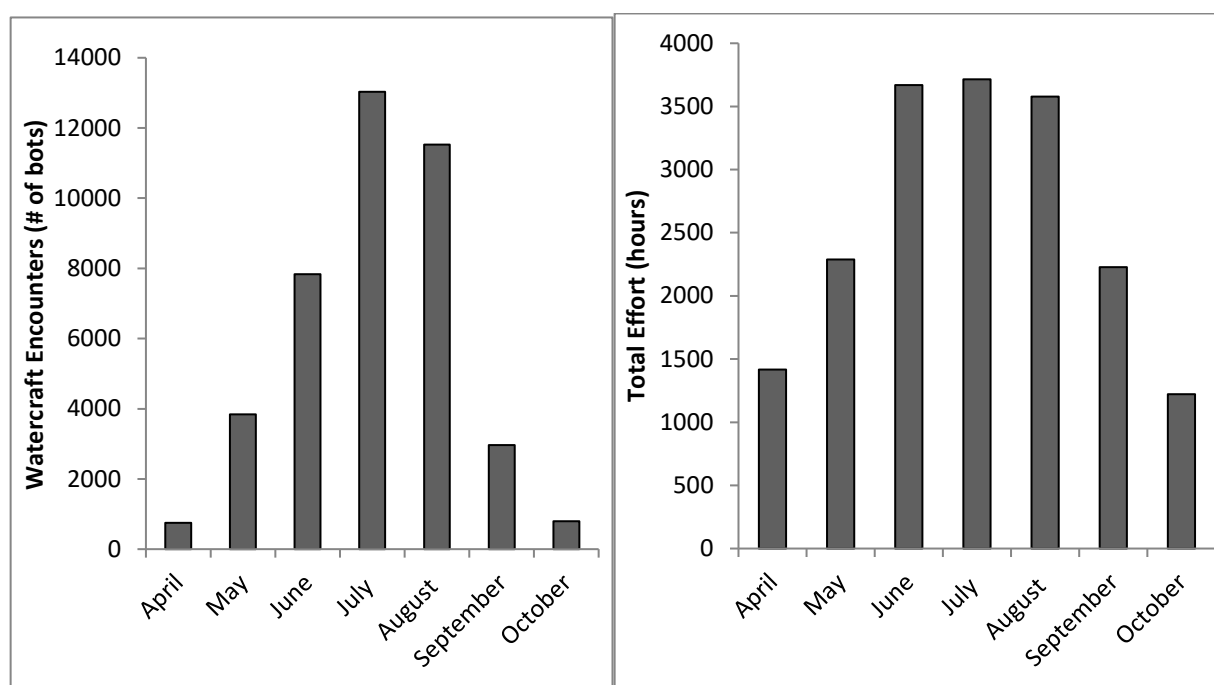


Figure 6. Watercraft encounters (left) and total effort (right) by month across inspection stations.

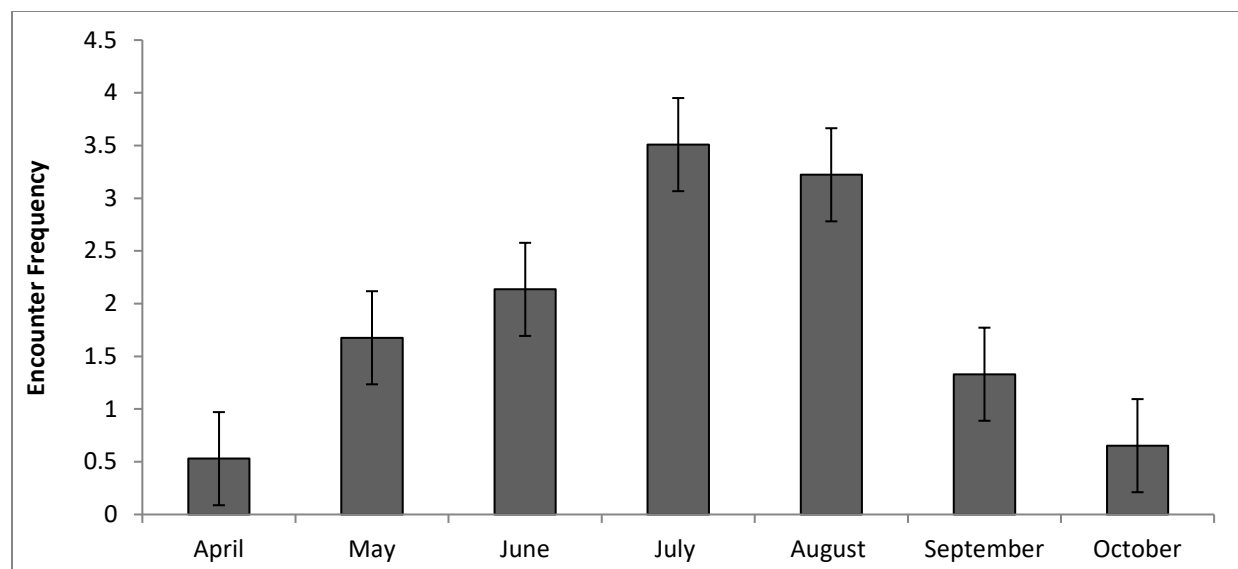


Figure 7. Encounter frequency by month across all inspection stations (error bars illustrate the standard error).

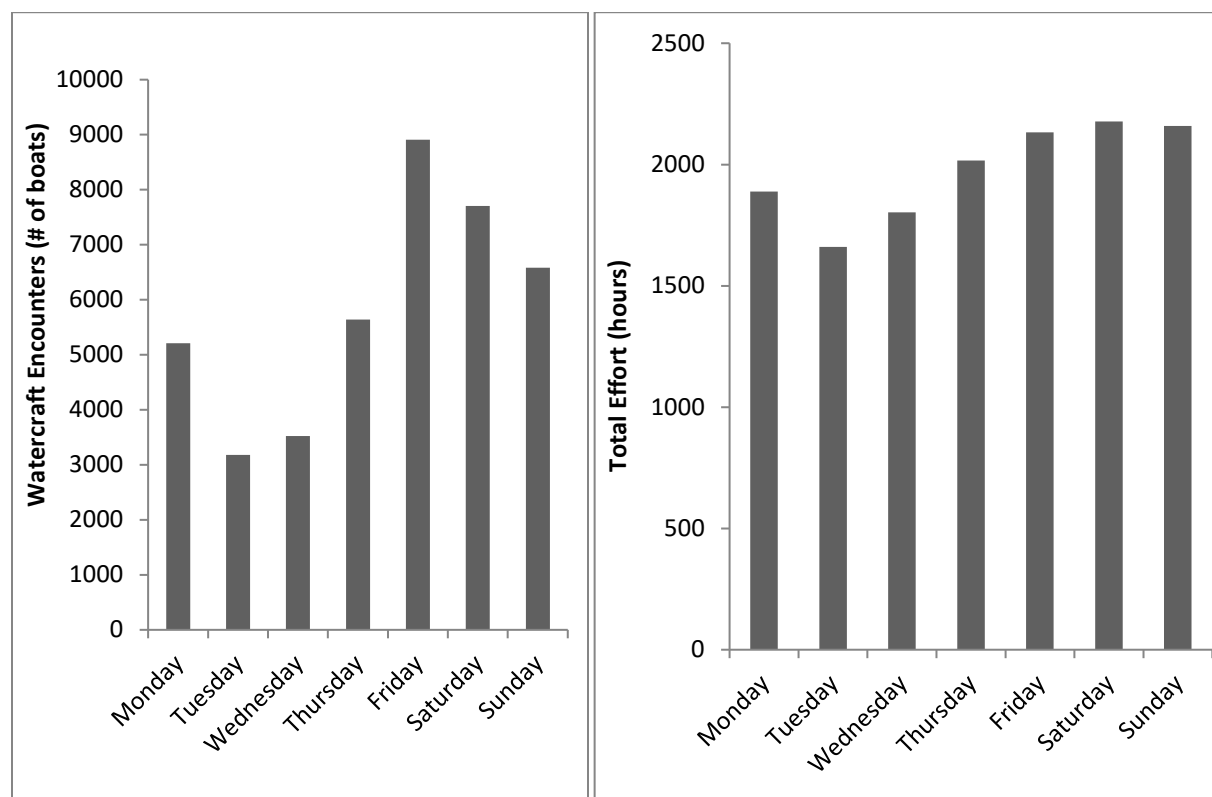


Figure 8. Watercraft encounters (left) and total effort (right) by day of the week across inspection stations. Statutory holidays were included in the data analyses.



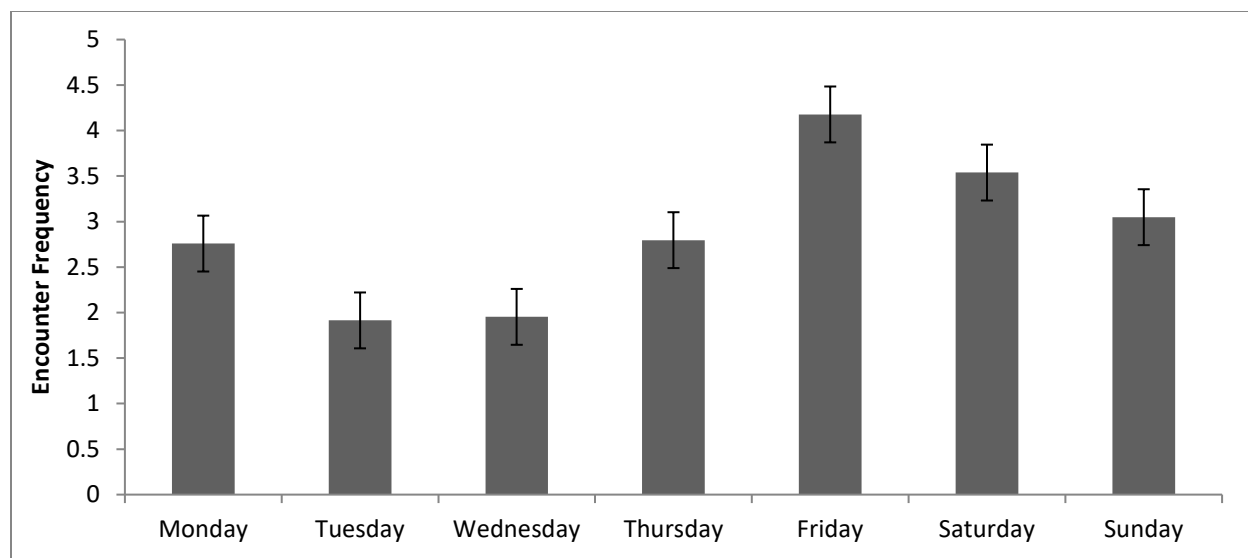


Figure 9. Encounter frequency by day of the week from April to October 2018 across inspection stations. Error bars illustrate the standard error. Statutory holidays were included in the data analyses.

### 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 10 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 - between 10 PM and 7 AM there was a total of 483 inspections. The data shows boater traffic more than tripled between 7 AM and 8 AM, increasing around 8 AM. The data also show that boaters were traveling in the early evening (between 7 PM and 9 PM) but at much lower numbers.

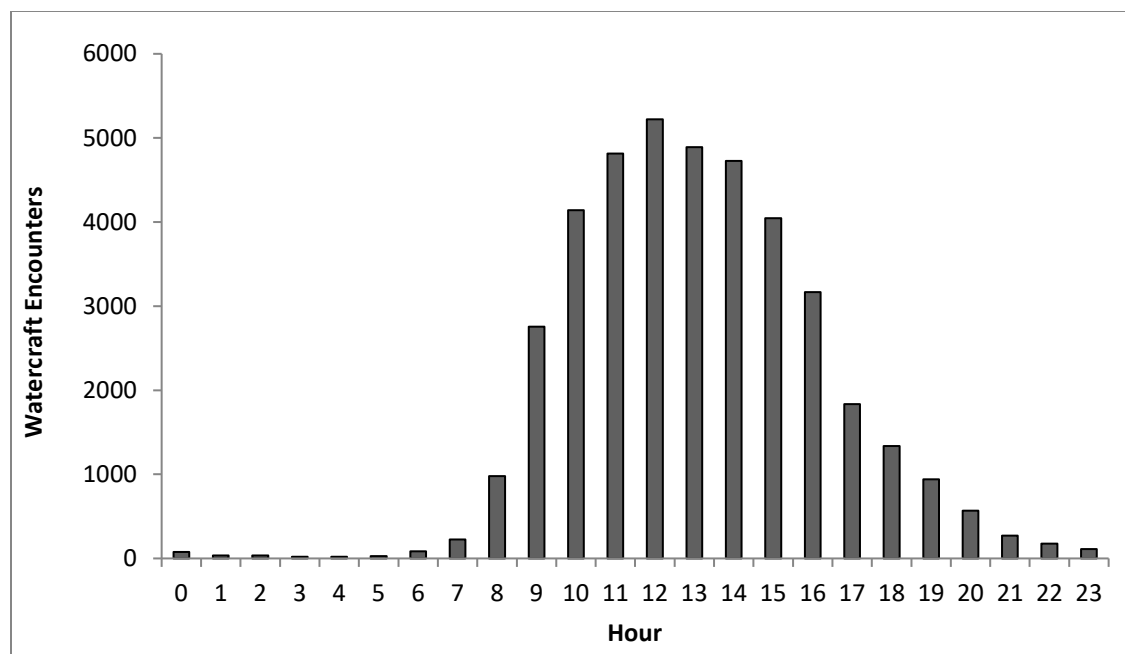


Figure 10. Watercraft encounters by time of day across all inspection stations for the 2018 season.

### 3.1.4 Source and Destination Locations

Inspected watercraft traveled into B.C. from 63 different provinces, territories, and states (Figure 11 and Figure 12). Of the watercraft inspected, 51% were traveling from a waterbody within B.C. This represents no change from the 2017 season. The inspected watercraft coming from out-of-province traveled primarily from neighbouring jurisdictions: Alberta (32.9%), Montana (3.9%), Washington (3.8%), Idaho (2.2%), and Saskatchewan (1.7%). The remaining 4.3% came from 58 different provinces, states, and territories (Figure 11).

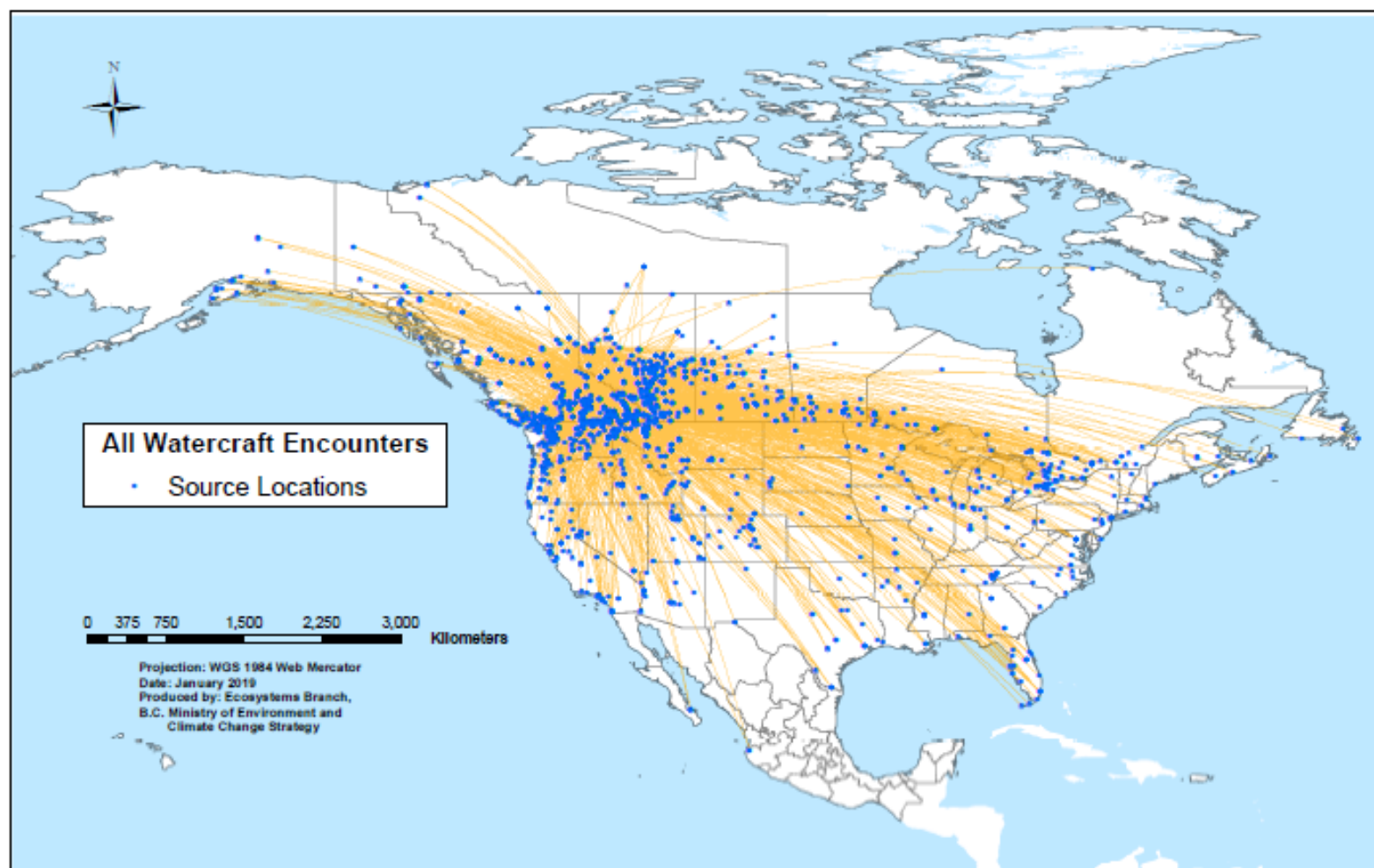


Figure 11. Source location of previous waterbody for all watercraft inspected in B.C. from April to October 2018.

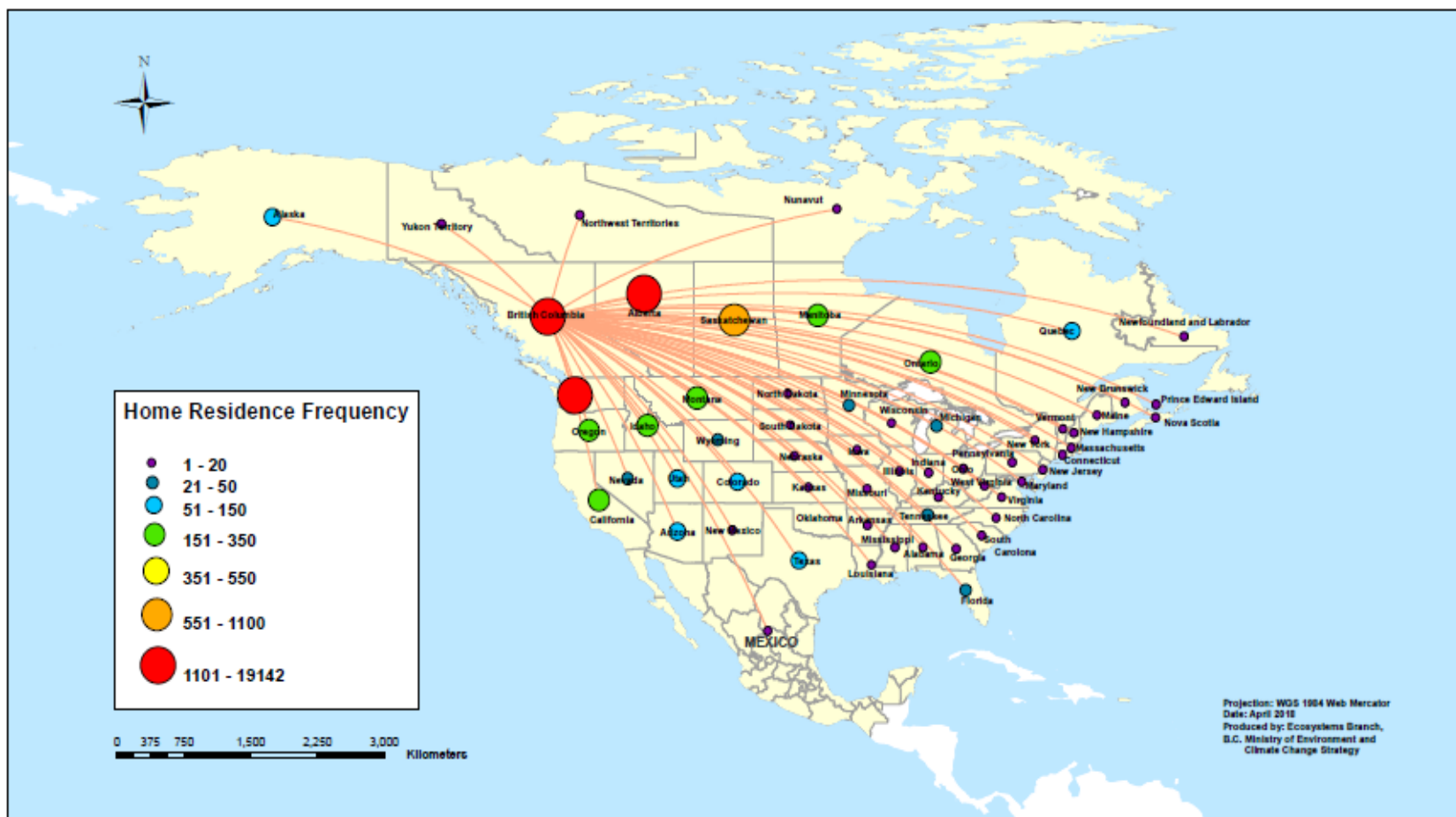


Figure 12. Home residence by province/state of all watercraft inspected during the 2018 season.

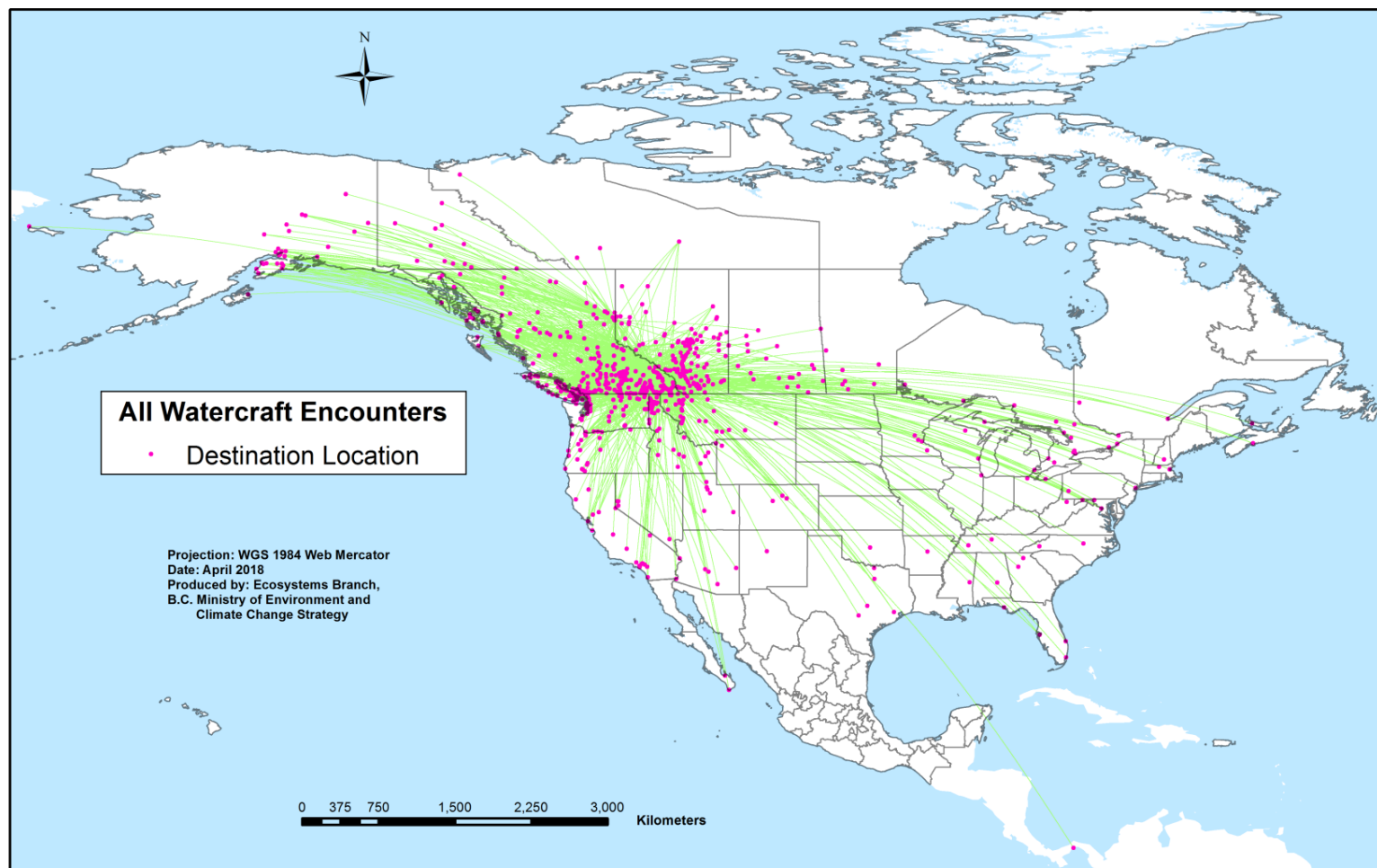
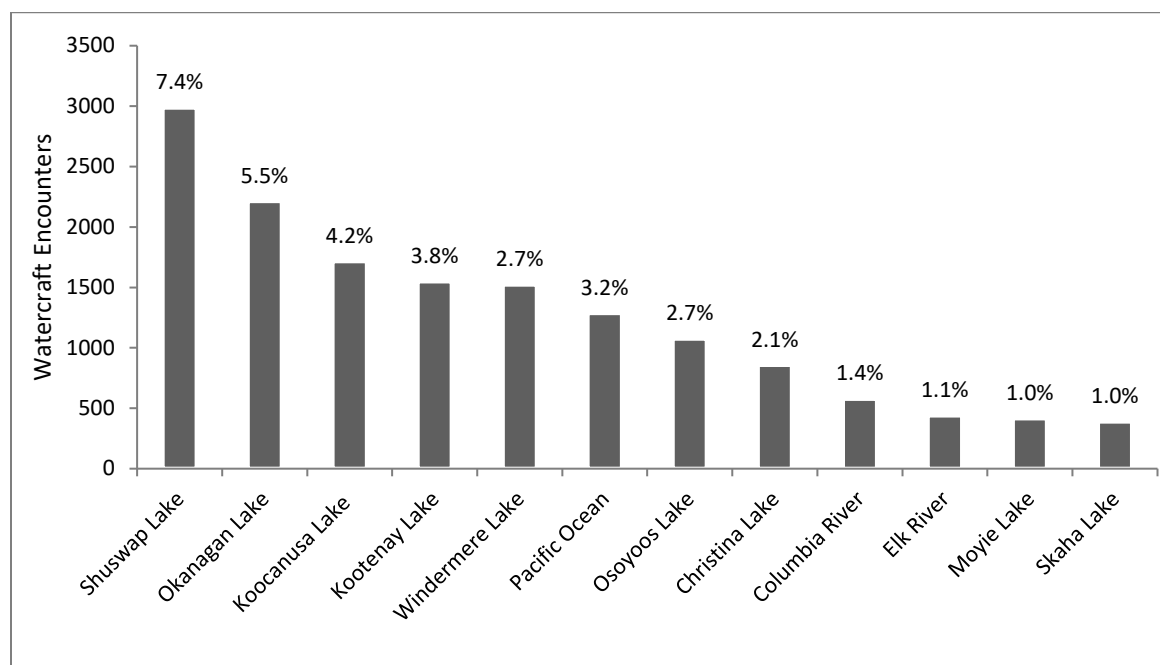


Figure 13. Destination location for all watercraft inspected from April to October 2018.

The majority of watercraft were destined for waterbodies within B.C. (85%), followed by waterbodies in neighbouring jurisdictions: Alberta (7.5%), Idaho (2.3%), Montana (1.9%), Alaska (0.8%) and Washington (0.8%) (Figure 1413). The remaining 1.4% of watercraft were destined for waterbodies in 35 different jurisdictions (Figure 13). The most common destination waterbodies within B.C. were Shuswap Lake (7.4%), Okanagan Lake (5.5%), Koocanusa Lake (4.2%), Kootenay Lake (3.8%), Windermere Lake (4.2%), Pacific Ocean (4.0%), Osoyoos Lake (2.7%) and Christina Lake (3.1%) (Figure 14).



**Figure 14. Destination waterbodies by percent of all watercraft encounters during the 2018 season.**

### 3.1.5 Compliance

During each shift at an inspection station, inspectors recorded watercraft that failed to stop at the 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, 81% of watercraft stopped at the inspection stations. This represents a 5% increase from the 2017 compliance rate of 76%. Figure 15 illustrates that compliance at inspection stations increased from 69% in April to 82% in July.

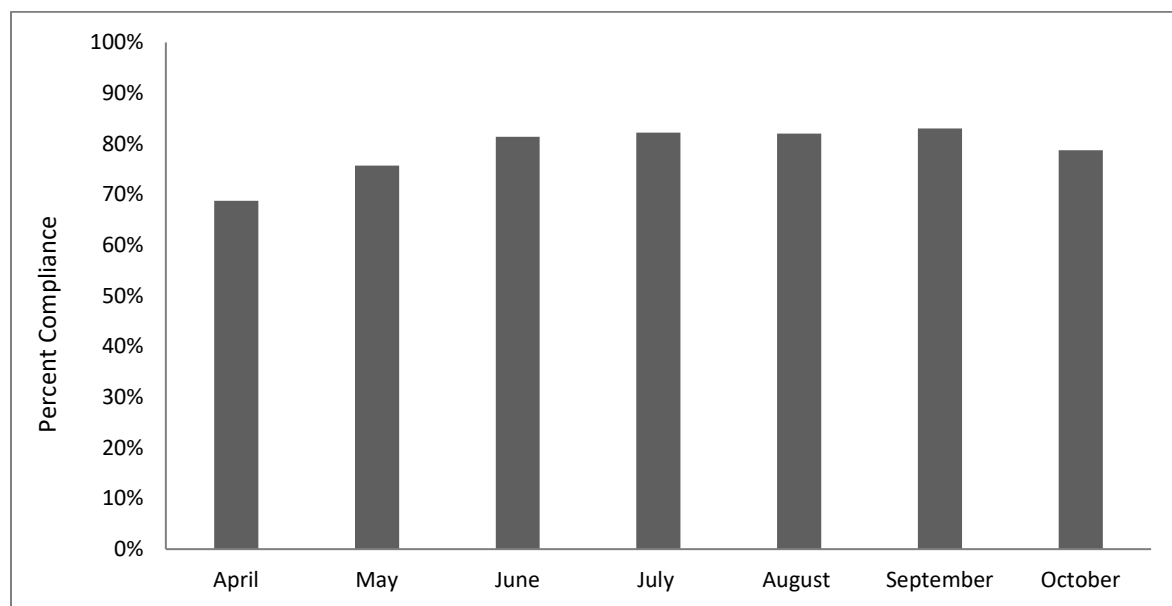


Figure 15. Percent compliance by month across inspection stations for 2018.

Figure 16 shows the compliance rates for each inspection station across the 2018 season. Compliance rates ranged from 100% at the Cascade and Osoyoos border crossings to 57% 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. For example, at the Golden inspection station it was difficult for inspectors to monitor traffic on the road while conducting inspections and performing decontaminations. 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.

During the 2018 season, the inspectors also recorded whether the watercraft that failed to stop were motorized or non-motorized. Figure 17 shows that, on average across all the months, 79% of the watercraft that failed to stop were non-motorized. This is a slight increase from the 2017 season of 76% 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.



## 2018 INVASIVE MUSSEL DEFENCE PROGRAM FINAL REPORT

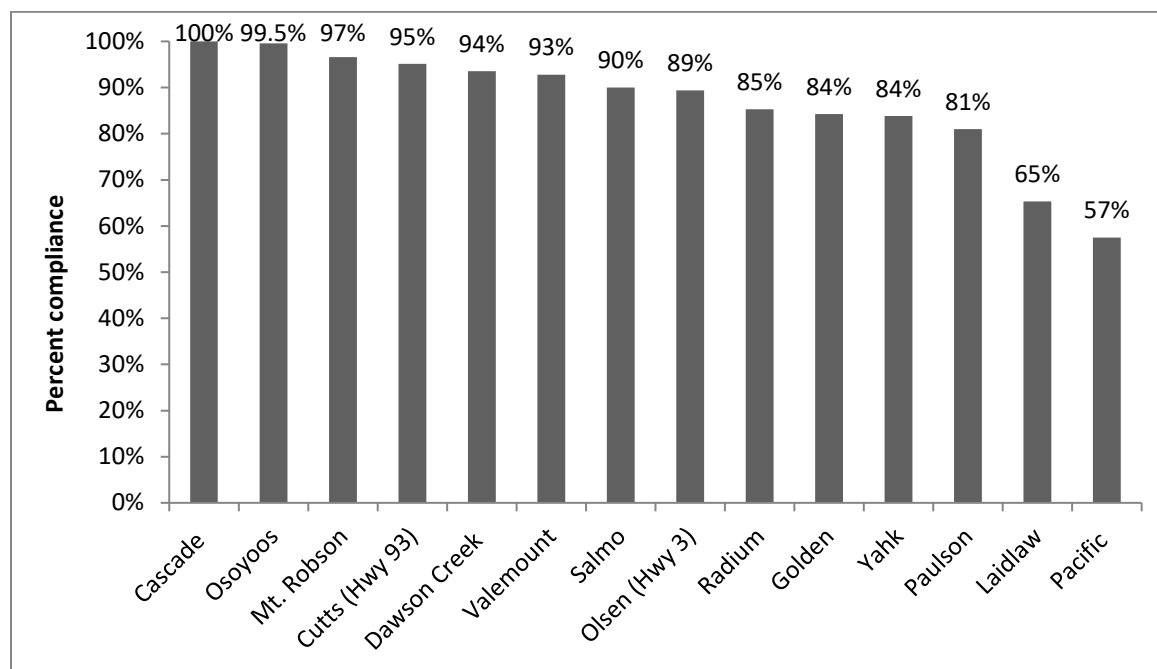


Figure 16. Percent compliance by inspection station for the 2018 season.

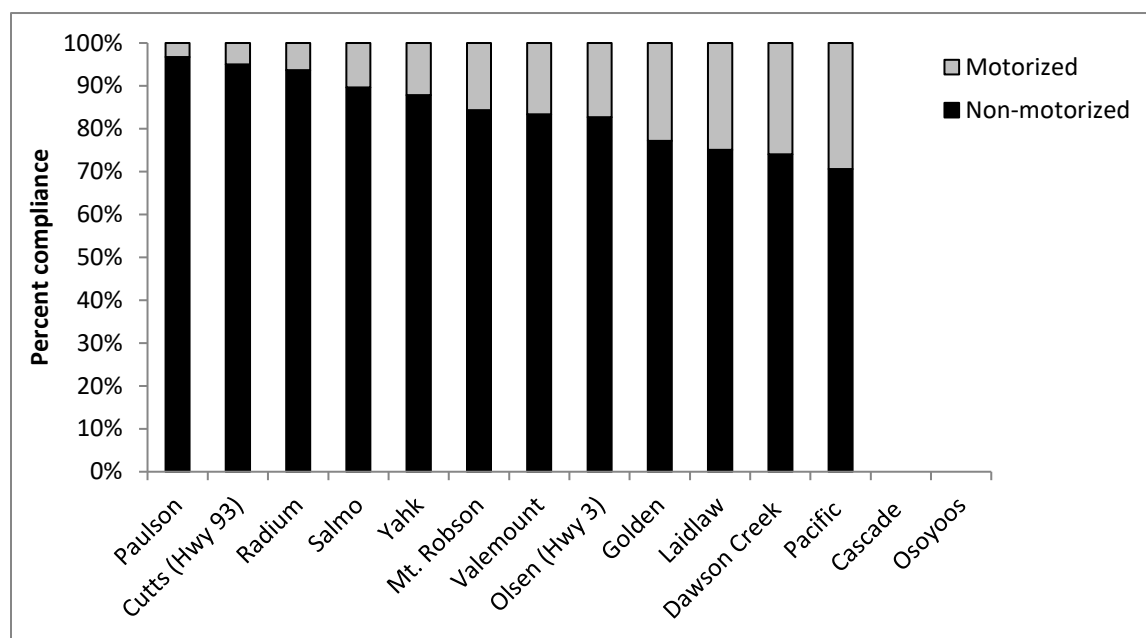


Figure 17. Percent of non-compliant watercraft that were motorized vs. non-motorized.

## 2018 INVASIVE MUSSEL DEFENCE PROGRAM FINAL REPORT

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 18 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 occurred at Salmo, Olsen (Hwy 3), Radium, Cutts (Hwy 93) and Paulson stations. Golden had a lower percentage of previously inspected since a large percentage of the boats inspected are coming from Alberta and are not intercepted before the Golden station.

The timing of when the boater had been through a previous inspection was also recorded at each station. The Salmo inspection station had the highest percent of boats that had been previously inspected the same day. Of the previously inspected watercraft, 16% had been through over one year prior, 29% had been through within the last year, 46% had been through within 30 days and 9% on the same day (Figure 19). This data is very similar to the 2017 season.

Collectively, these results highlight the efficacy of the perimeter defence approach of having multiple inspection stations across jurisdictions, in particular, for addressing high-risk boats coming from the east and for educating the boating public.

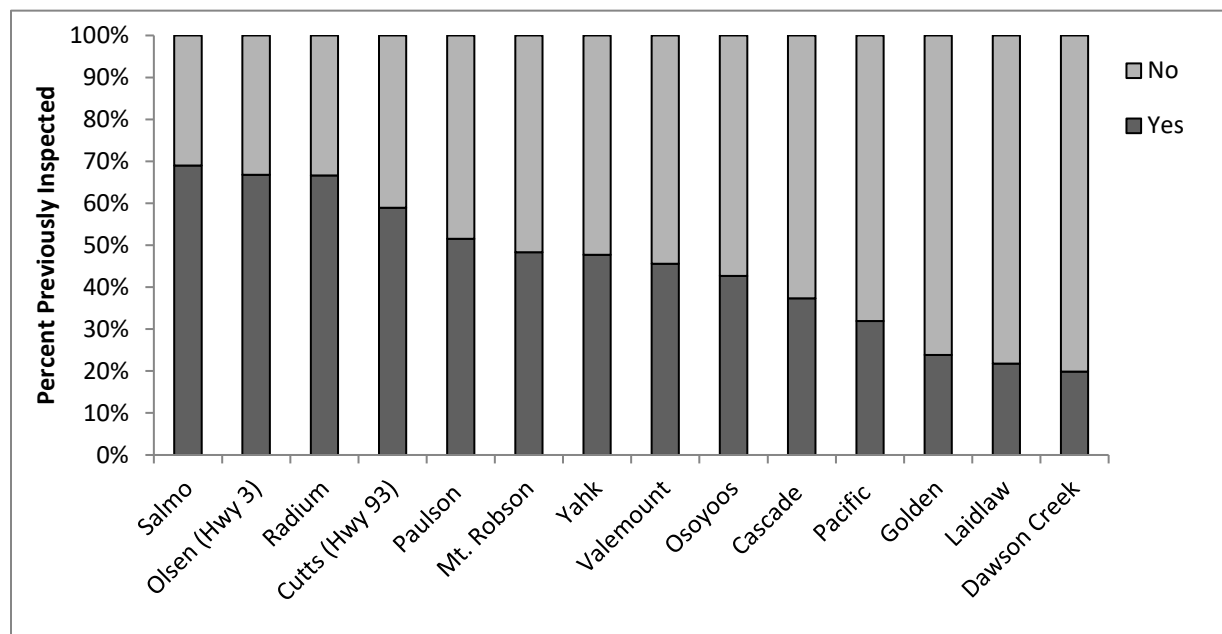
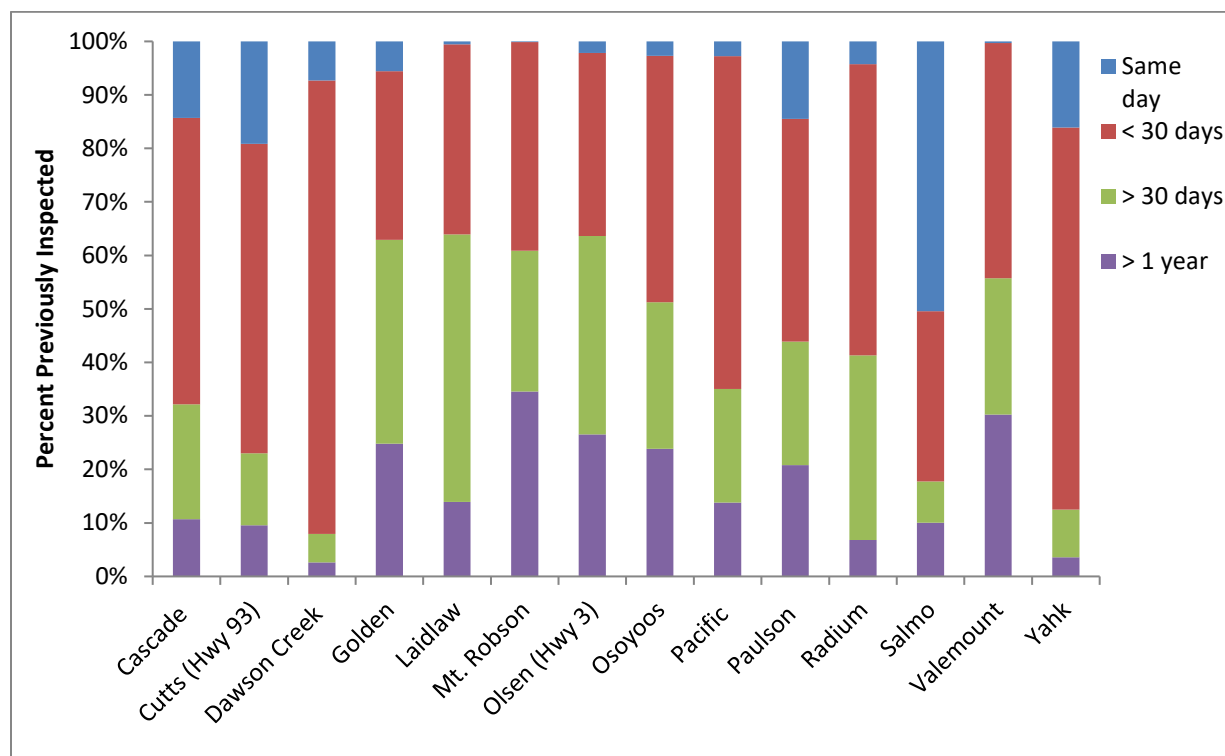


Figure 18. Percent of watercraft intercepted per inspection station that had been previously inspected.



**Figure 19. Frequency of watercraft previously inspected at another watercraft inspection station (either in BC or another jurisdiction).**

## 3.2 HIGH-RISK WATERCRAFT ENCOUNTERS

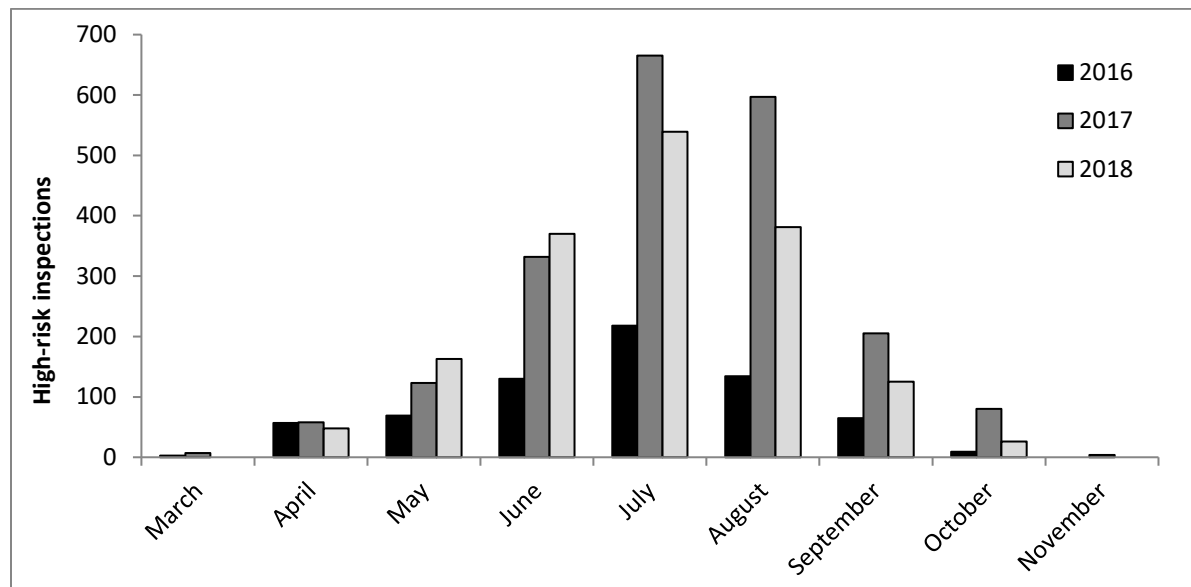
Watercraft can be identified as high risk for several different reasons based on the information obtained by the inspectors during the inspection/interview process. High-risk watercraft are identified as any watercraft or equipment that meet the following criteria:

- 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 1,652 high-risk watercraft were encountered during the 2018 season with 211 inspected during April and May, representing a slight increase from 2017 at 181 high-risk inspections. Since the program has been operational, the total number of high-risk boats inspected has peaked in July. In early July of 2018, the program made an operational change to how watercraft coming from Montana were being assessed for risk. Watercraft that were in waters west of the continental divide in Montana in the previous 30 days were treated as low-risk whereas watercraft in waters east of the continental divide in

the previous 30 days were treated as high-risk. The change was made based on the requirements in Montana that all boats traveling from east of the continental divide must be decontaminated. The one positive and one suspect reservoir in Montana are both east of the continental divide with no direct connectivity west. As illustrated in Figure 20, this resulted in a decrease of high-risk inspections in 2018 compared to 2017 in the months of July to October despite the increase in overall inspections.



**Figure 20. Total high-risk watercraft encounters by month across the 2016-2018 seasons.**

Figure 21 illustrates the number of high-risk watercraft encounters across inspection stations. The Golden inspection station intercepted the most high-risk watercraft (454), followed by Radium (208), Cutts (Hwy 93) (193), Olsen (Hwy 3) (173), Dawson Creek (129) and Mt. Robson (104). The Dawson Creek and Pacific inspection stations had very low overall encounter frequencies (see Figure 4) but higher numbers of high-risk boats relative to other inspection stations. Conversely, the Laidlaw station had the highest total number of inspections (8,838) but only 66 watercraft were high-risk.

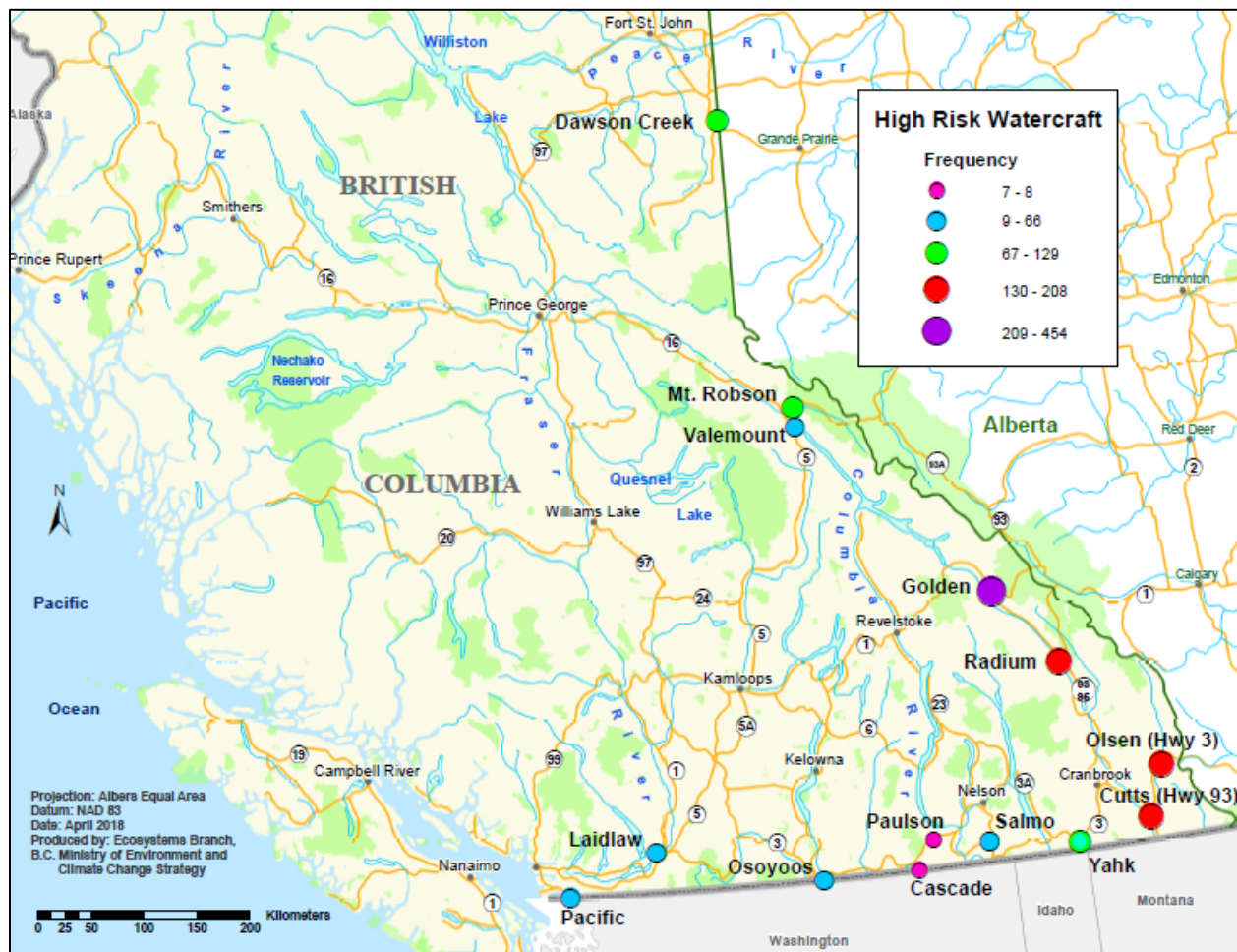


Figure 21. The number of high-risk watercraft by inspection station for the 2018 season.

### 3.2.2 By Time of Day

Figure 22 shows the number of high-risk watercraft encounters by time of day 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 7 AM, a total of 24 high-risk watercraft were intercepted at the Golden inspection station during the nighttime operations over the entire season. This represents a slight decrease from 27 high-risk inspections during the 2017 season.

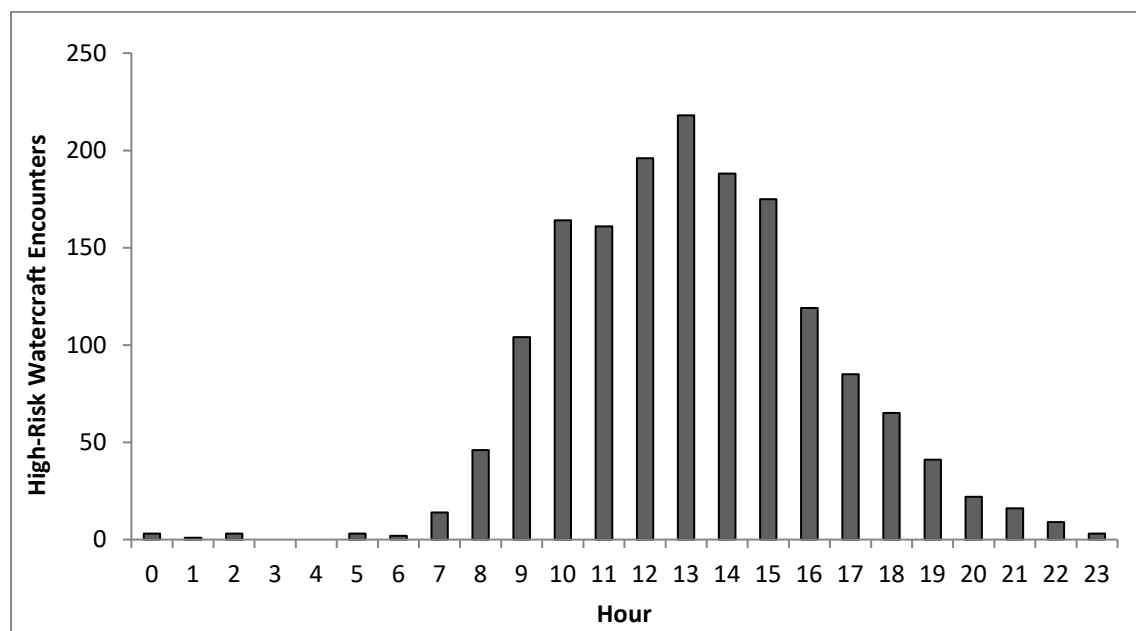


Figure 22. Total high-risk watercraft encounters by time of day across all inspection stations during the 2018 inspection season.

### 3.2.3 Source and Destination Locations

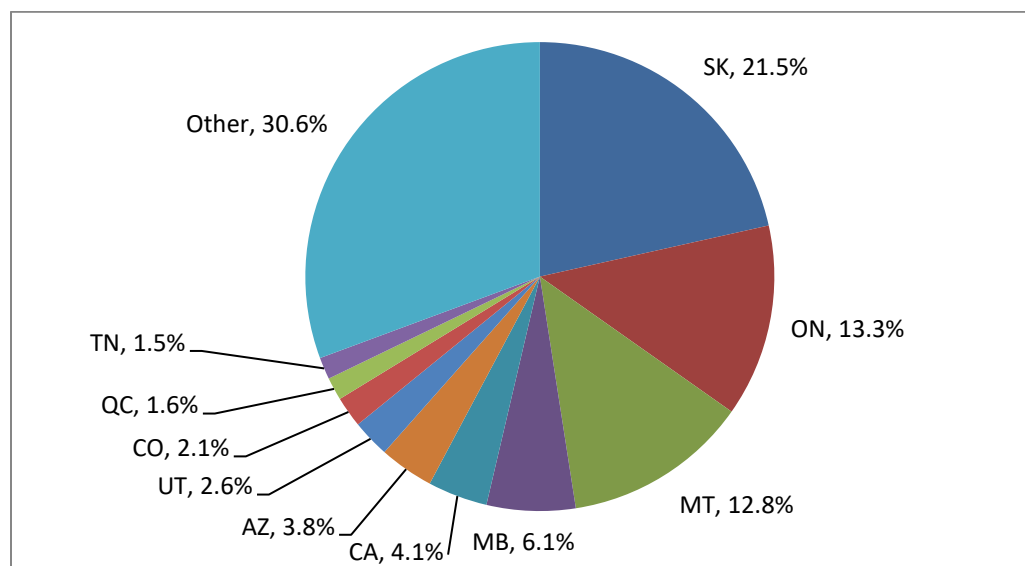
Of the 1,652 high-risk watercraft identified by inspection crews, 355 came from Saskatchewan (21.5%), 211 from Montana (12.8%), 219 from Ontario (13.3%), 101 from Manitoba (6.1%), 68 from California (4.1%), 62 from Arizona (3.8%), and 43 from Utah (2.6%) (Figure 23).

The remaining 30.6% came from 49 different provinces and states (Figure 25). Of note is the number of high-risk boats from California and Arizona increased from 2017 (59 and 51 respectively). As expected, due to the change in protocol for watercraft coming from Montana, the number of high-risk watercraft from Montana decreased from 449 boats in 2017 to 211 in 2018. The number of high-risk boats from Ontario also decreased in 2018 relative to 2017 from 249 to 219, respectively.

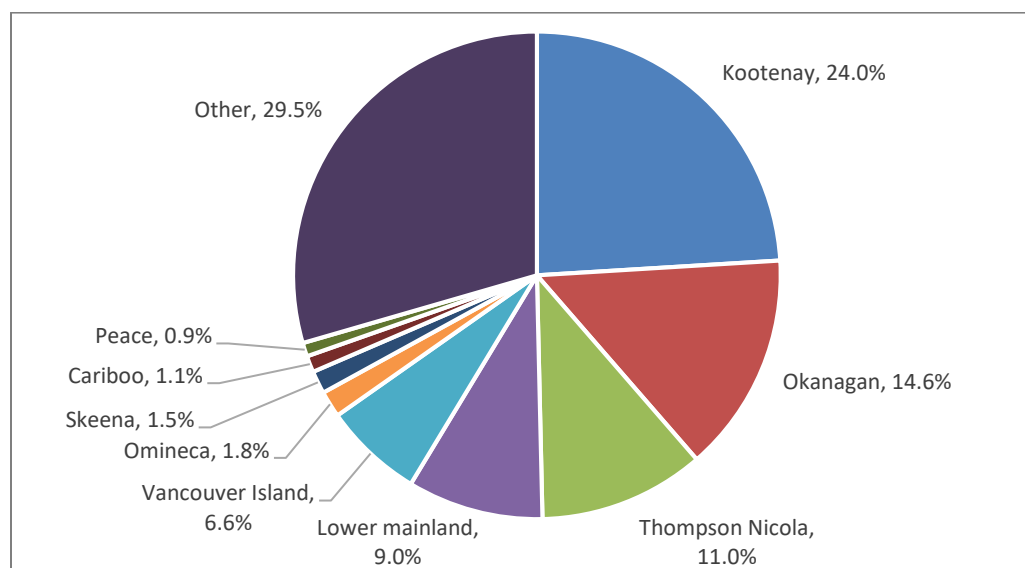
It is important to note that high-risk watercraft with a source location from a non-mussel-infested jurisdiction (i.e. B.C., Washington, Oregon, Idaho, Wyoming, Saskatchewan and Alberta) in Figure 25 may have visited waterbodies from more than one jurisdiction within the previous 30 days or may have been flagged as high-risk for other reasons (whirling disease, not clean, drained, dried, aquatic plants).

Of the high-risk watercraft inspected, 24% were destined for waterbodies in the Kootenay region, 14.6% for waterbodies in the Okanagan region, 10.9% for the Thompson-Nicola, 9% for the Lower Mainland, 6.6% for Vancouver Island, 1.8% for the Omineca, 1.5% for the Skeena and 1.1% for the Cariboo (Figure 24 and Figure 26). The remaining 29.5% 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.

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**Figure 23. Source locations of the high-risk watercraft identified during the 2018 season. Other jurisdictions consisted of 49 different provinces and states.**



**Figure 24. Destination regions of all high-risk watercraft identified during the 2018 season. Other jurisdictions consist of but not limited to: AB, AK, AZ, CA, CO, DC, ID, MB, MI, MN, MT, NT, OR, UT, WA, and YK.**



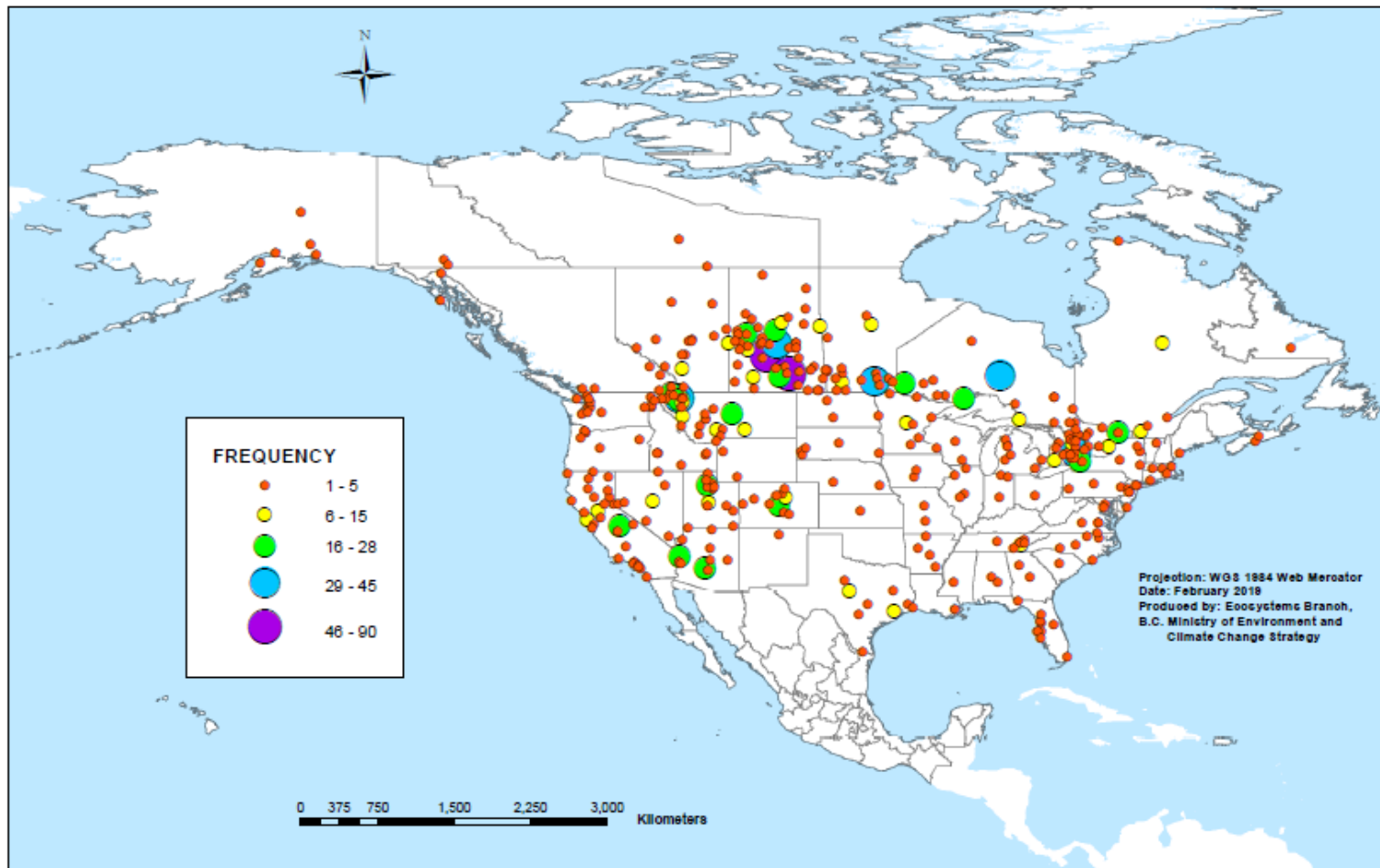


Figure 25. Source locations of the high-risk watercraft inspected during the 2018 season.

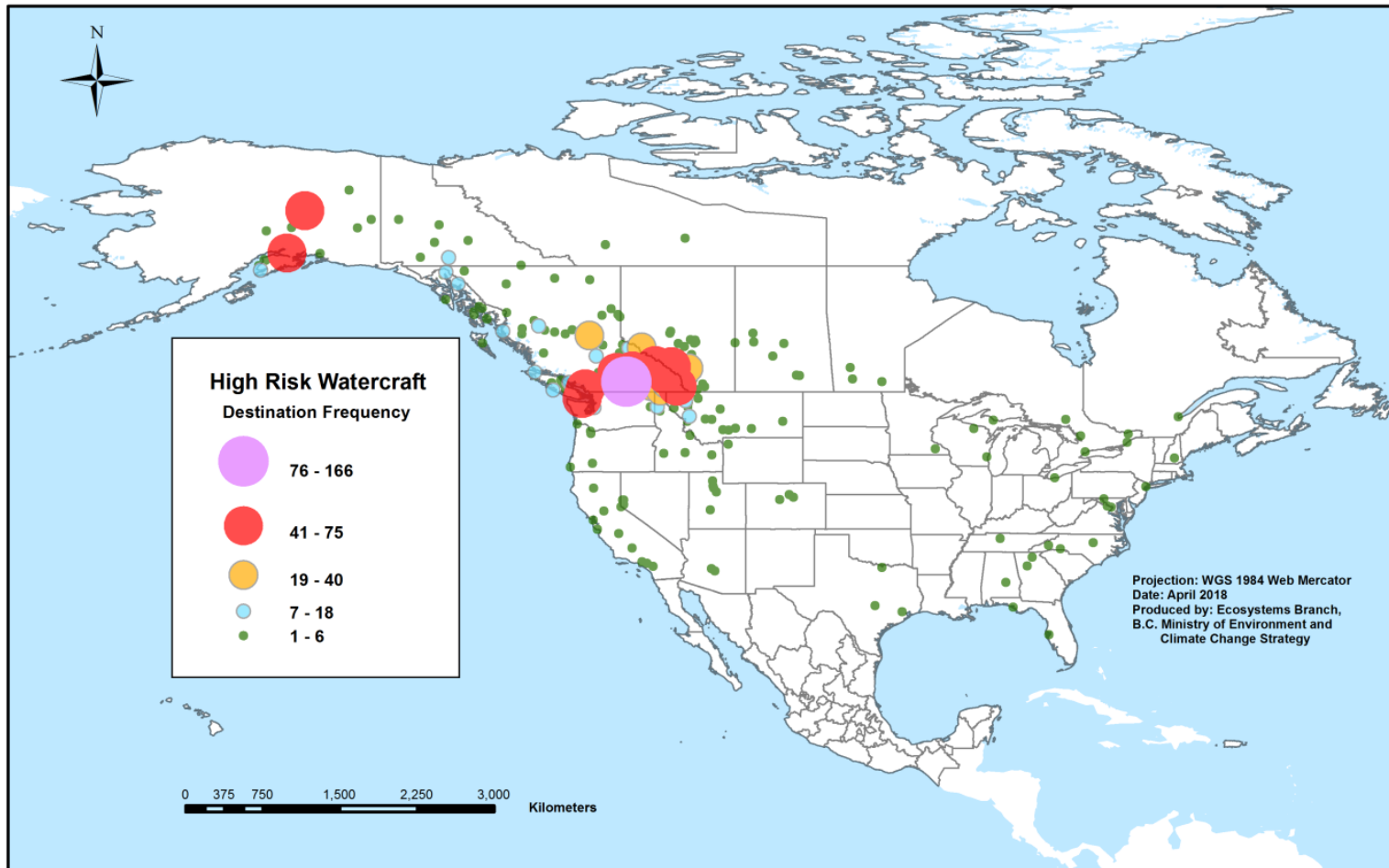
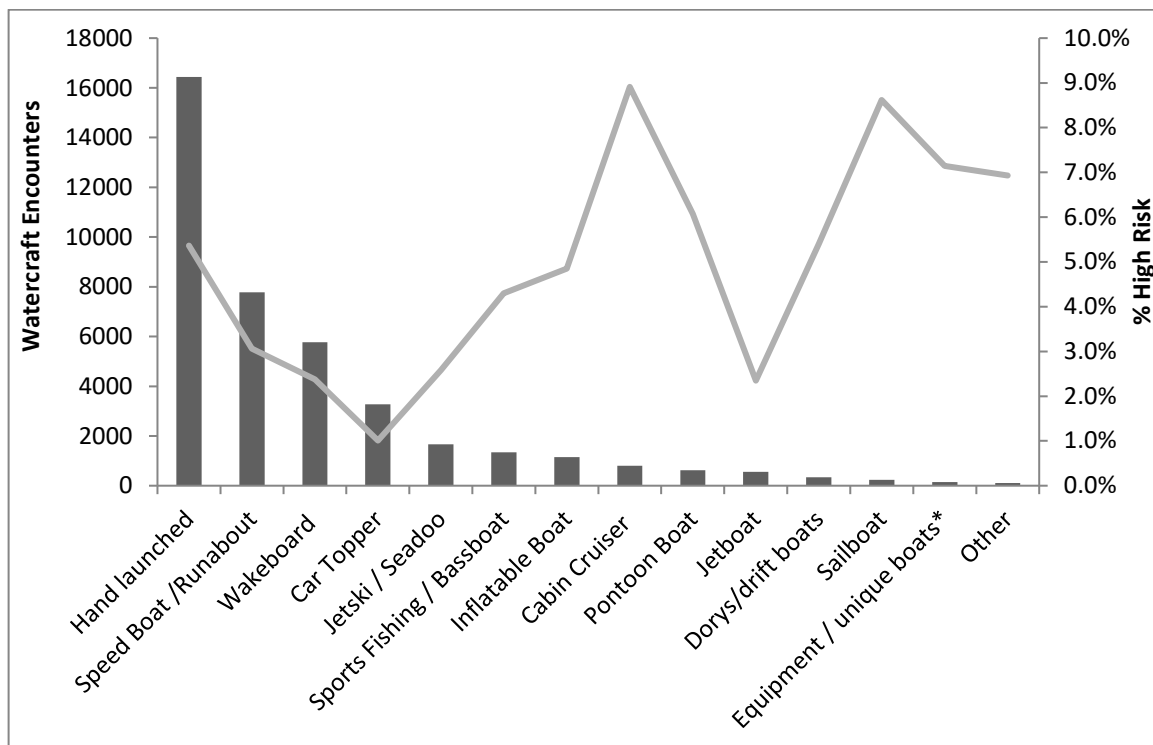


Figure 26. Destination locations of the high-risk watercraft identified during the 2018 season.

### 3.2.4 Watercraft Types

The type of watercraft was recorded for every inspection. Despite the fact that non-motorized watercraft (e.g. canoes, kayaks, paddleboards) comprised the highest percentage of the total watercraft inspected (40.7%), they represented a much lower risk with only 5.4% registering as high-risk (Figure 27). Conversely, sailboats represented the smallest percentage of the total watercraft inspected (0.8%), but posed a disproportionately higher risk, at 8.6%, respectively. Similarly cabin cruisers only represented 2% of the overall inspections but 8.9% were high-risk (Figure 27).

These results are consistent with larger, more complex watercraft such as sailboats, cabin cruisers, and pontoon boats typically being moored in infested waterbodies for longer periods of time than smaller watercraft. Because dories and drift boats frequently traveled from Montana and to the Elk River, a greater percentage of them were deemed high risk. 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.



\* Unique boats include but not limited to equipment/docks, tugboats, submarine, hovercraft, ocean fishing boat, and fanboat.

**Figure 27. Total watercraft encounters by watercraft type (primary axis) and the percent that registered as high-risk (secondary axis).**

### 3.2.1 Inspection Findings

Of the 1,652 high-risk watercraft, 450 were decontaminated. Of those, 288 were issued a decontamination order and 228 had associated quarantine periods to allow for sufficient drying time of 30 days out of water. 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 1,019 of the 1,652 high-risk watercraft (62%) had been through a previous inspection station within either B.C. or another jurisdiction.

### 3.2.2 Other Aquatic Invasive Species

The remaining high-risk watercraft received a full inspection and were found to be cleaned, drained, and dried with no further action required. These watercraft did not undergo decontamination, based on clean inspections and having been out of the water for over 30 days, or having arrived from a previous successful inspection/decontamination.

In addition to assessing watercraft for risk of transporting invasive mussels, inspectors are looking for other aquatic invasive species. A total of 14 watercraft were identified during the 2018 season as transporting either aquatic plants (4), marine mussels or barnacles (5), or other unidentified species/organic matter (5). Inspectors routinely offer to clean the watercraft to ensure they are free of aquatic plants and Clean, Drain, Dry before leaving an inspection station.

A total of 463 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.

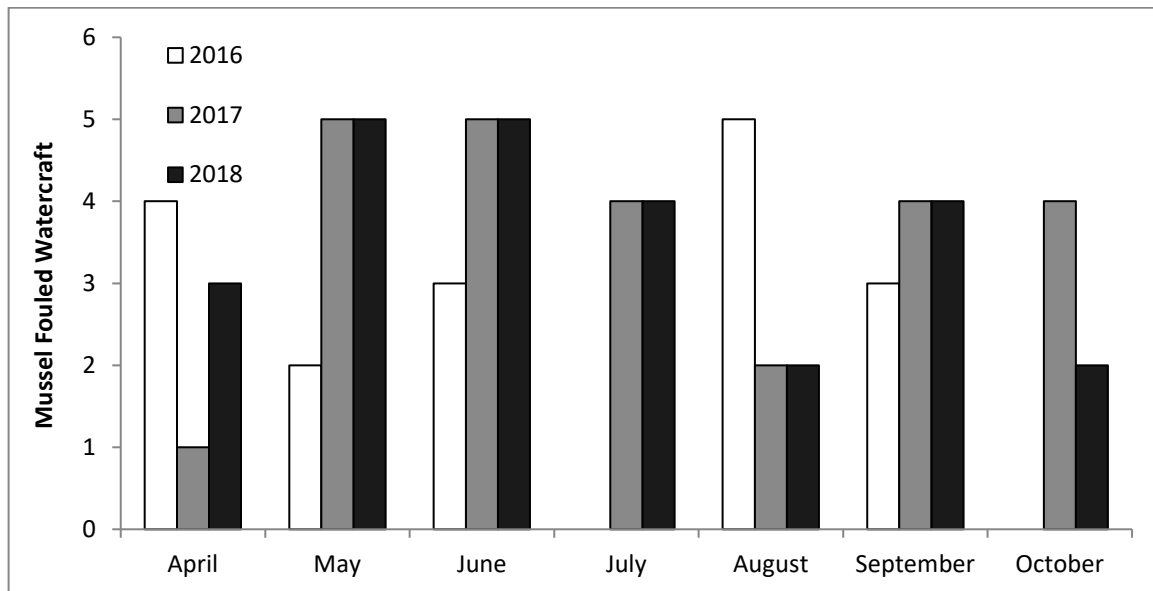
## 3.3 MUSSEL FOULED WATERCRAFT

A total of 25 mussel fouled watercraft were encountered, of which B.C. received advanced notification for 20 either from previous inspection in another jurisdiction or notification from CBSA. This highlights the importance of working with neighbouring jurisdictions' watercraft inspection stations as it increases the likelihood of detection and inspection.

Of the total mussel fouled boats, eight were initially intercepted and inspected at the Golden inspection station on Highway 1 which was operating 24hrs /day during the main boating season. Two of the eight mussel fouled boats were intercepted after dark at the Golden inspection station at 12 AM on June 17th and 5 AM on July 17. The program had received advanced notification for one of the boats from Alberta, and the other boat had been out of the water for over one year so the mussels were not viable.

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The highest number of mussel fouled watercraft encounters took place in May and June with five each, which was the same as 2017. This was followed by four each in July and September. Figure 28 compares these results to the previous two seasons, by month. Differences are the increased number of mussel fouled boats intercepted in April 2018 relative to 2017 and the decrease in October of 2018 relative to 2017.



**Figure 28. The number of mussel fouled watercraft for the 2016 to 2018 seasons, by month.**

Of the total number of mussel fouled boats, 16 had come from Ontario, 3 from Arizona, 2 from Michigan, 2 from Manitoba, and 1 each from Nevada, and Utah (Figure 29 and Figure 31). The proportion of mussel fouled boats that came from eastern/Great Lakes jurisdictions in the 2018 season was 72% which is a decrease from 84% in 2017. There was a slight increase in the number of mussel fouled boats coming from a southern U.S. state (Arizona, Nevada, Utah), from 4 in 2017 to 5 in 2018. This illustrates the continued threat from waters in the eastern mussel infested provinces and states.

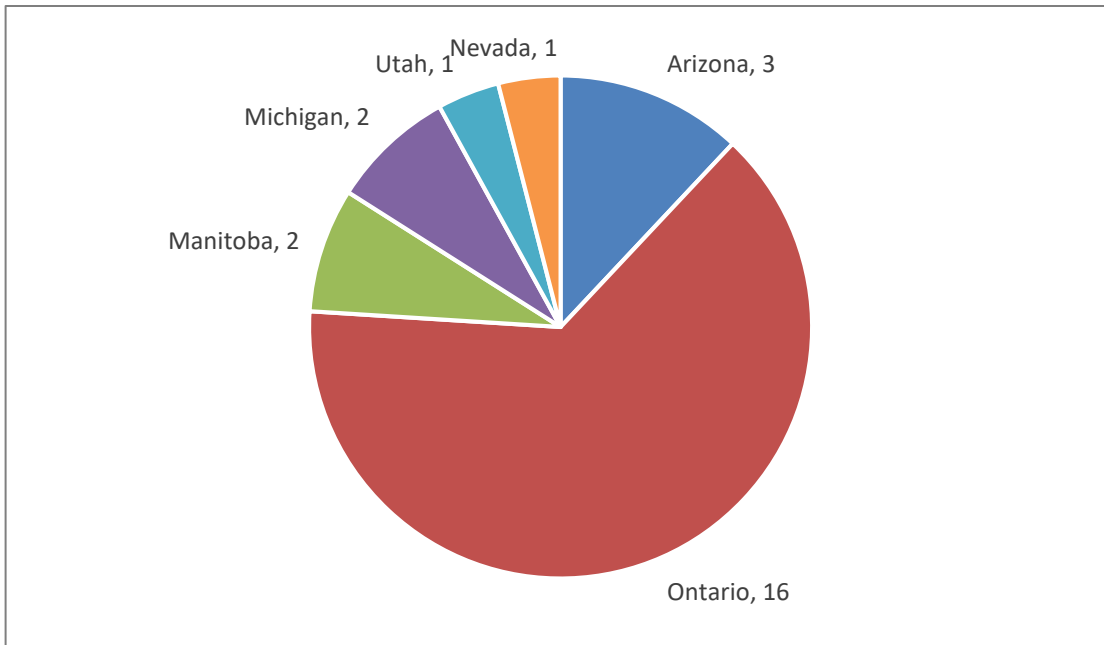


Figure 29. Source provinces and states of the 25 mussel fouled watercraft intercepted during the 2018 season.

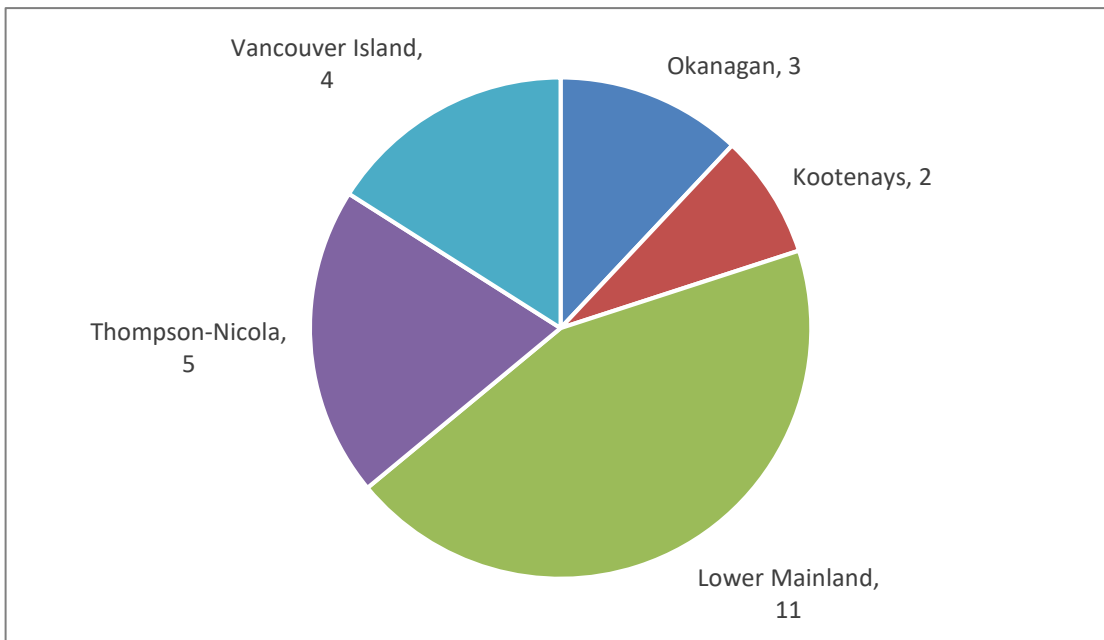


Figure 30. Destination regions in B.C. of the 25 mussel fouled watercraft intercepted during the 2018 season.

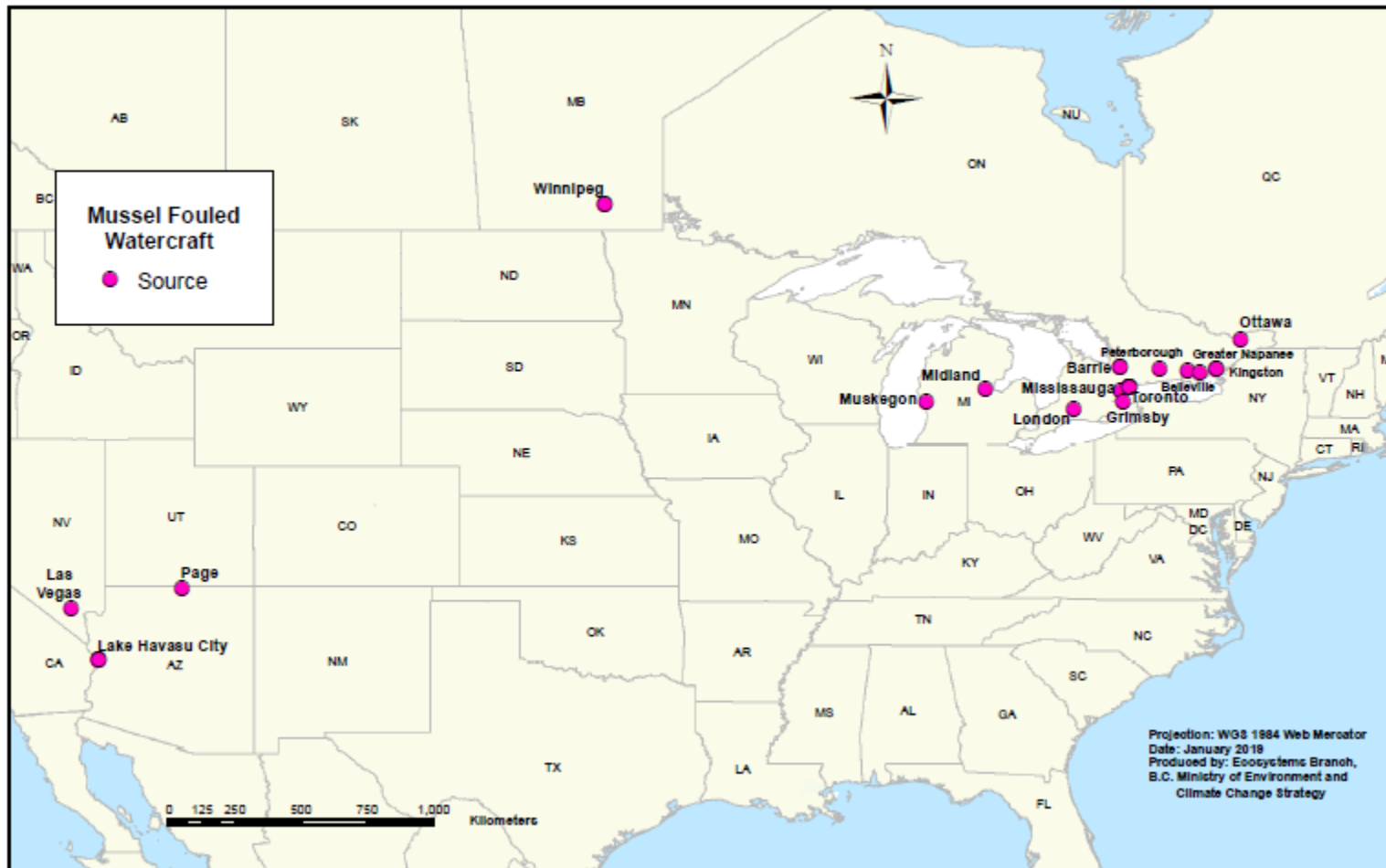


Figure 31. Source location of mussel fouled boats.



The most common destination of the mussel fouled boats by region was the Lower Mainland/South Coast with 11 (44%), followed by the Thompson-Nicola with 5 (20%), Vancouver Island with 4 (16%), Okanagan with 3 (12%), and the Kootenays with 2 (8%) (Figure 30). All 25 of the mussel fouled watercraft intercepted in 2018 were motorized watercraft (Figure 32). The most frequent being cabin cruisers at 60% (15), followed by speed boats at 16% (4), pontoon and sailboats at 8% each (4 total) and sports fishing boats and wakeboard boats at 4% each (2 total).

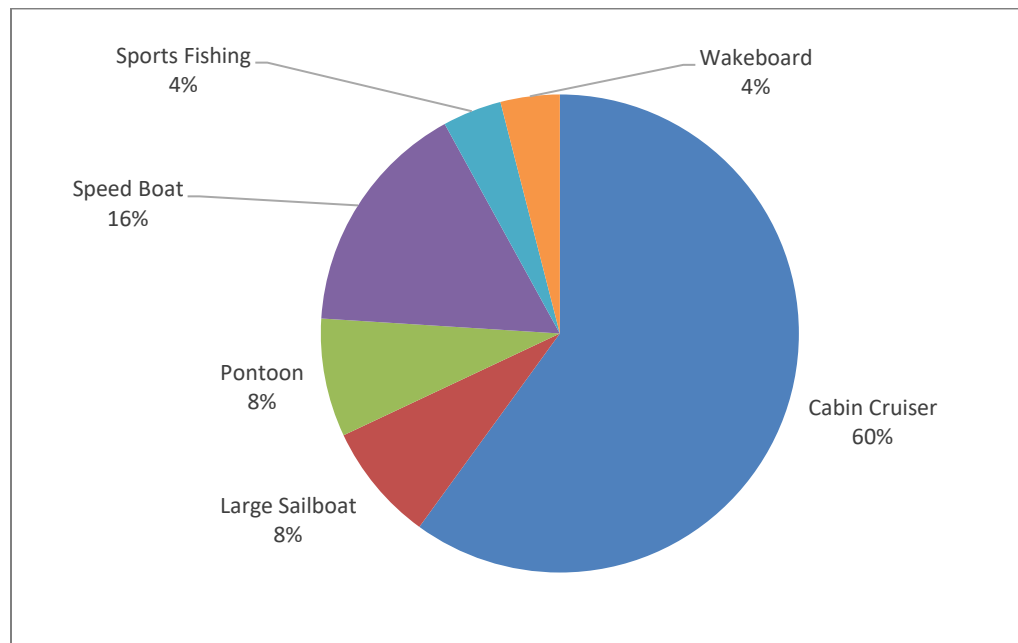


Figure 32. Watercraft type of the 25 mussel fouled watercraft intercepted during the 2018 season.

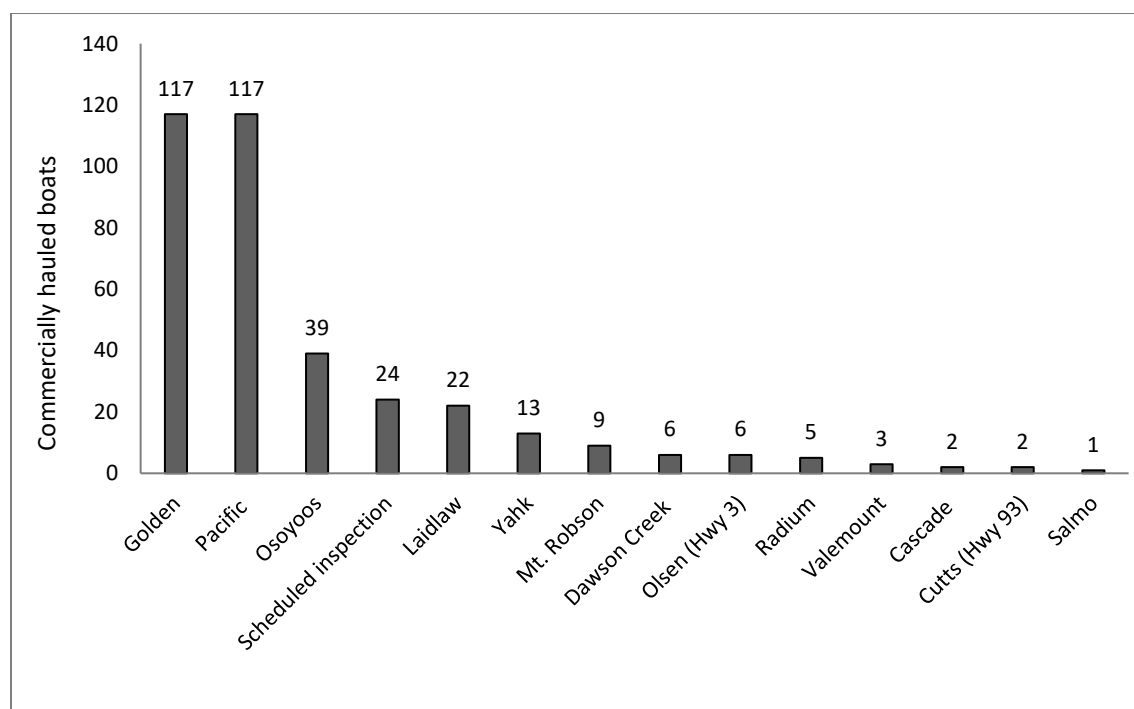
### 3.4 COMMERCIALY HAULED WATERCRAFT

Of the total watercraft inspected (40,700), 366 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 6% of high-risk watercraft were commercially hauled, 36% of mussel fouled watercraft (9 of the 25 boats) were commercially hauled.

The Golden inspection station intercepted the highest number of commercially hauled watercraft (117), followed by the Pacific border crossing (117), and the Osoyoos border crossing (39) (Figure 33). This is consistent with results from the 2017 season and is expected 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, Salmo) having high watercraft encounter frequency,

they only saw 9 commercially hauled watercraft, indicating Highway 3 is not a major route for commercial haulers during the operating hours of the inspection stations.

Figure 34 illustrates the source location for all 366 commercially hauled watercraft inspected. This includes both new and used commercially hauled boats. The most common source location for commercially hauled boats was Alberta as 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 34). 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 33. Number of commercially hauled boats intercepted at the watercraft inspection stations during the 2018 season.**

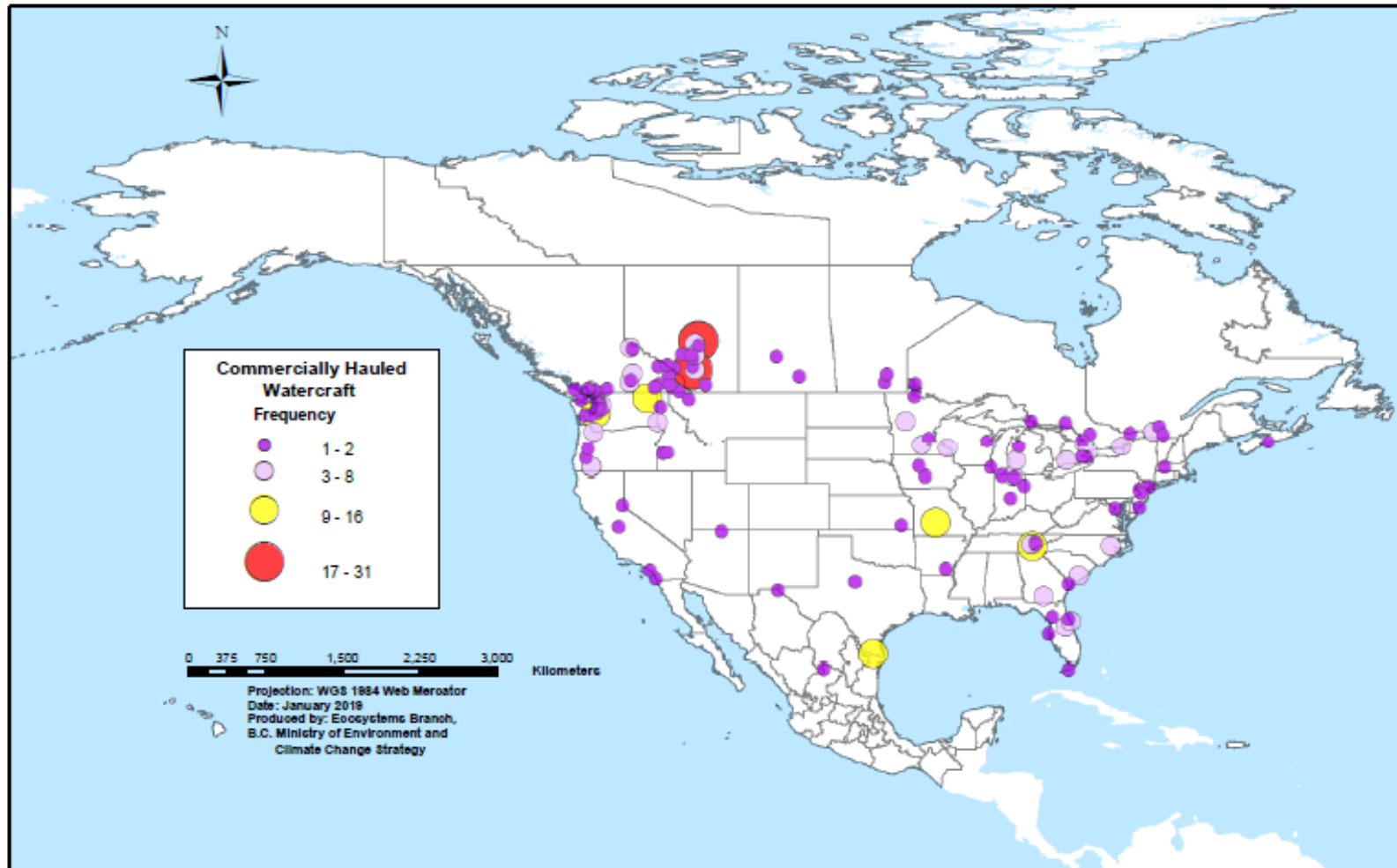


Figure 34. Source location of commercially hauled watercraft.

### 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 2018 season, 691 passports were issued across the B.C. inspection stations (Figure 35). In addition to the 40,700 total inspections there were 2,912 passport holders that stopped for an inspection. When passport holders stopped at an inspection station they were surveyed on their overall experience. Survey results showed that 99% of passport holders found it to be a positive/neutral experience, matching the responses from the 2017 season. Since the program launched in 2017, around 2,300 passports have been issued at B.C. inspection stations.

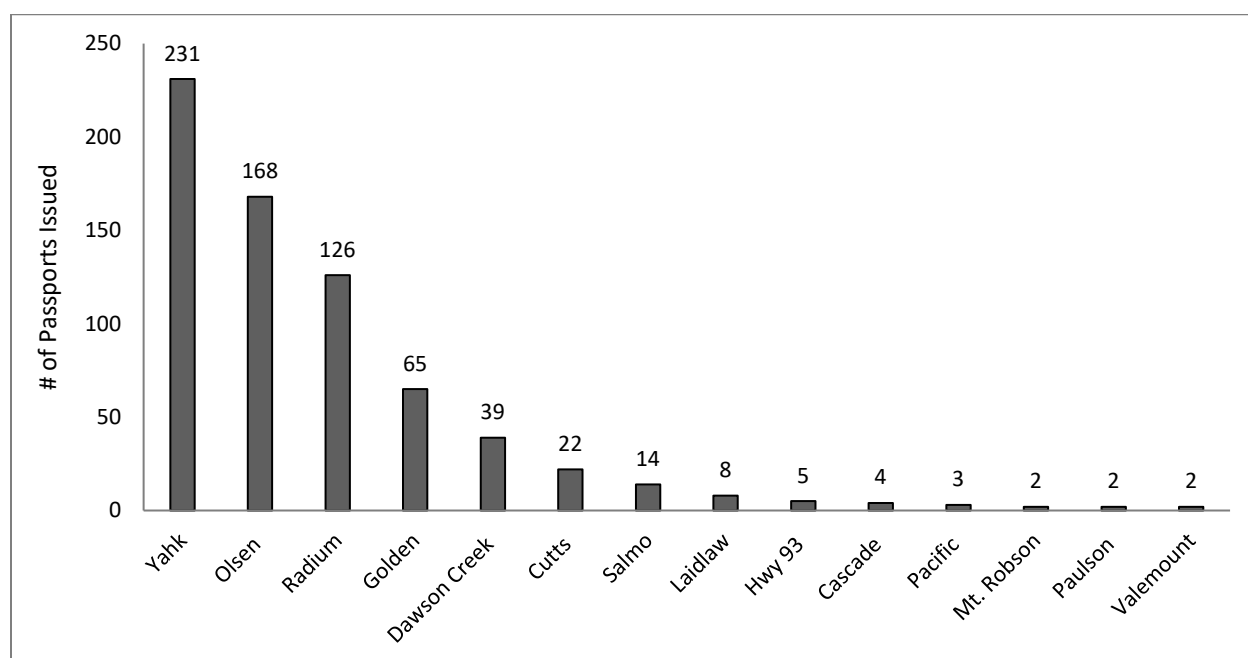
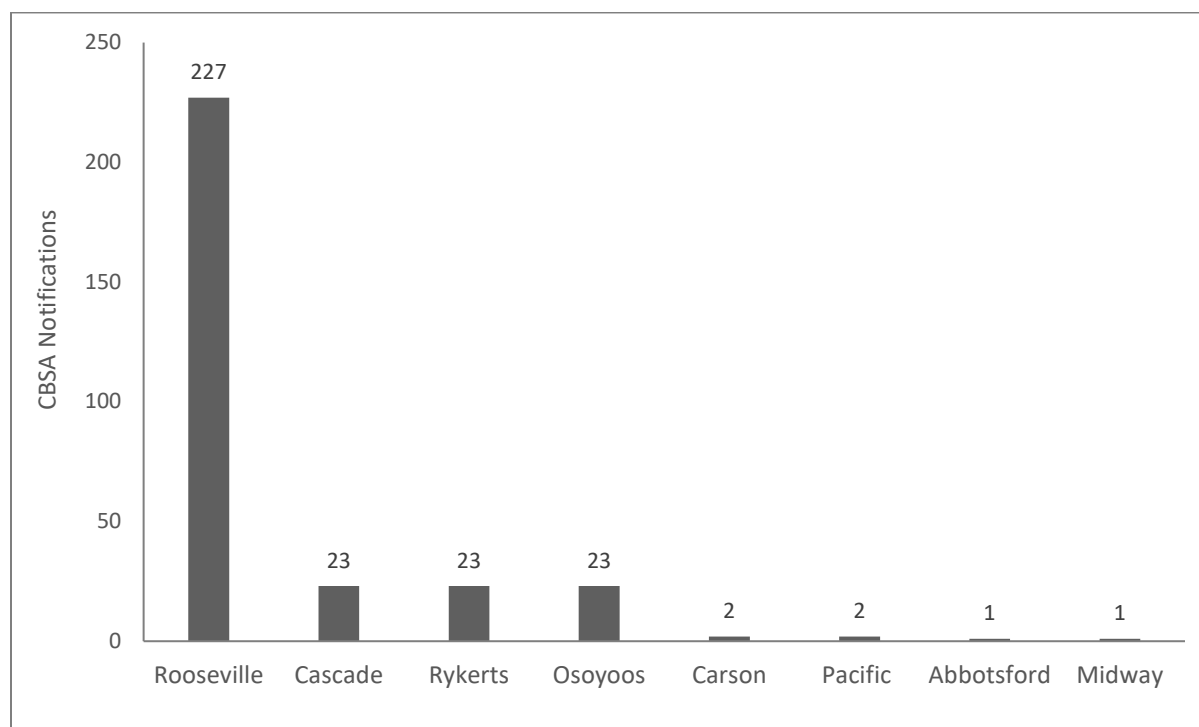


Figure 35. Number of passports issued during the 2018 season, by inspection station.

### 3.6 CANADA BORDER SERVICES AGENCY NOTIFICATIONS

During the 2018 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 2018, season, the program received 300 notifications from CBSA at several different border crossings that inspectors responded to and followed-up on (Figure 36). 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 36. CBSA notifications received across several border crossings during the 2018 season.**

### 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. Kilo's primary handler is Sergeant Josh Lockwood with the COS. Kilo is trained to detect invasive mussels as well as firearms and bear parts and will also be used in evidence recovery cases within the COS. Kilo and his handler toured the watercraft inspection stations during the 2018 season and Kilo was on shift for 655 inspections.

Kilo and Sgt. Lockwood were on shift at the Golden inspection station on Friday June 29<sup>th</sup> when Kilo detected invasive mussels on a watercraft that had been in Lake Winnipeg one week prior. The provincial inspectors at the Golden inspection station were able to visually confirm adult invasive mussels around the engine area and the watercraft was issued a quarantine period and prohibited to launch before the required 30-day drying time had passed.

In addition to serving as an invaluable detection tool for AIS and the other enforcement areas, the K9s play a significant role in outreach and education. Kilo and Sgt. Josh Lockwood attended several outreach events and public presentations throughout the 2018 season including the Vancouver International Boat Show and the B.C. Boat and Sportsman/Hunting Show (see Table 3).

K9 Major and his handler Sergeant Cynthia Mann completed their training in fall 2018 and joins Kilo for the 2019 season touring the watercraft inspection stations. Major is also trained to detect invasive mussels, firearms, bear gall bladders and evidence recovery.



Figure 37. K9 Kilo and his handler Sgt. Josh Lockwood (left) and the newest addition to the team K9 Major and his handler Sgt. Cynthia Mann (right).

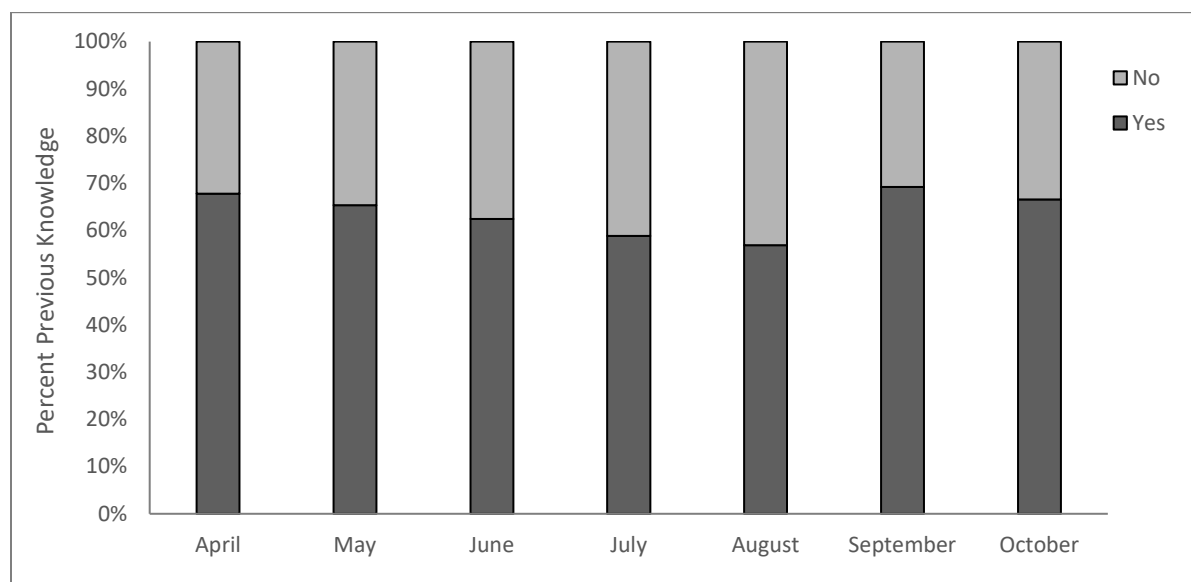
## 4. OUTREACH/EDUCATION ON CLEAN, DRAIN, DRY

### 4.1 INSPECTION STATIONS

It is estimated that inspection crews had approximately 78,600 interactions across all the inspection stations during the 2018 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 2018 season, watercraft owners having previous knowledge of AIS and CDD averaged 61%, similar to the 2017 season results. It appeared that previous knowledge of AIS and CDD was lowest in July and August (Figure 38).

Information on the source of previous knowledge of AIS / CDD was also collected. Figure 39 shows the top source was the previous inspection station visited (in B.C. and other jurisdictions) (81%), followed by personal experience (4%), word of mouth (2.6%), highway inspection signs (2.3%), TV advertising/news (1.6%) and brochures (1.4%). Of the previous inspection stations visited, 67% were in B.C., 9% were in AB, and the remaining 4% were from other jurisdictions. Other sources of knowledge include, but are not limited to: provincial government outreach, internet, related work, highway billboards signs, signs at boat launches, US/Canada border inspections, social media, regional invasive species councils, local government outreach, radio, the Invasive Species Council of BC, magazines and newspaper. 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 38. Watercraft owners' previous knowledge of aquatic invasive species and/or Clean, Drain, Dry across each month of Program operations in 2018.**



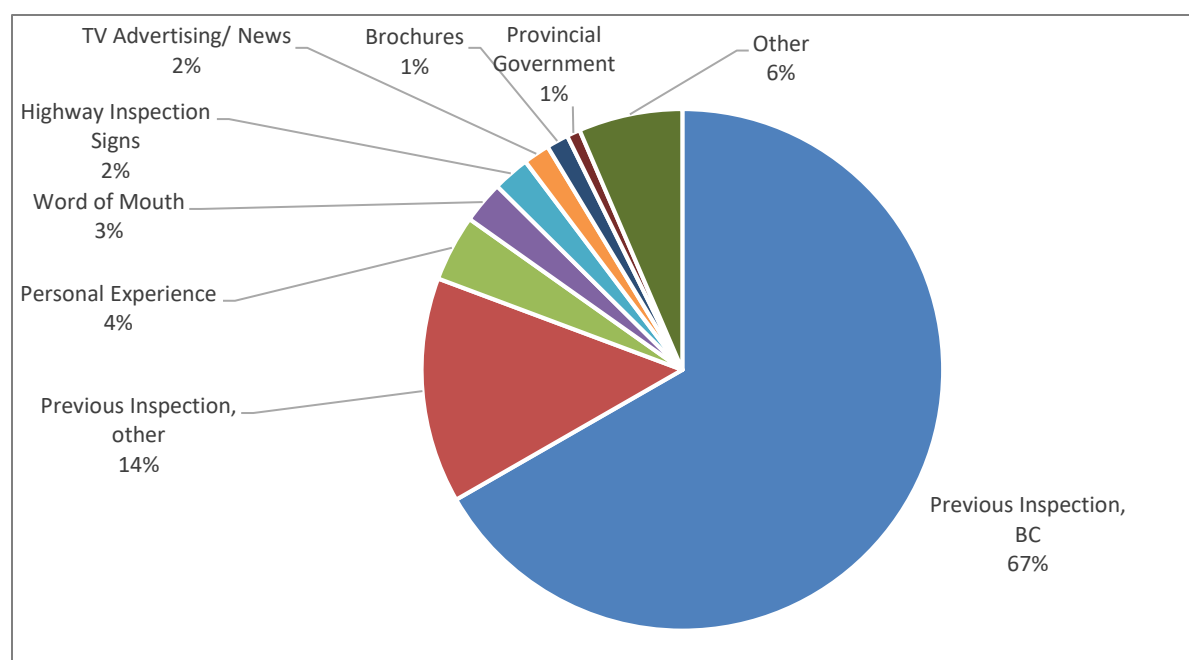


Figure 39. Sources of previous knowledge of aquatic invasive species or Clean, Drain, Dry.

Over the entire 2018 season, 193 people voluntarily stopped at an inspection station to get more information, a decrease from the 480 who stopped during the 2017 season. The decrease could be linked to the new signs 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 87 public inquiries over the 2018 season through the program's email ([COS.Aquatic.Invasive.Species@gov.bc.ca](mailto: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 be in compliance.

## 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 2018 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.

**Table 3. Outreach events and meetings attended during the 2018 season.**

Event Name	Date (s)	Location
B.C. Interior Sportsman Show	April 6, 2018	Kelowna
Kelowna Boat Show	April 28, 2018	Kelowna
Vernon RCMP Volunteer Training	June 6, 2018	Vernon
Charlie Lake Conservation Society	June 7, 2018	Fort St. John
Cultus Lake Days	June 23, 2018	Chilliwack
Sicamous CSISS Public Event	June 26, 2018	Sicamous
Heisting Lake Stewardship Society	July 12, 2018	Christina lake
Swan Lake Centennial	July 21, 2018	Swan Lake Provincial Park
Koocanusa Wakesurf Challenge	July 21, 2018	Newgate
Vancouver Wooden Boat Festival	Aug 24 & 25, 2018	Granville Island
Osoyoos Lake Water Quality Society Presentation	Sept 9, 2018	Osoyoos
Yacht Club Commodores AGM	Sept 29, 2019	Kelowna
Christina Lake Stewardship Society AGM	Nov 22, 2018	Christina Lake
2019 Vancouver International Boat Show	Feb 6 to 10, 2019	Vancouver
2019 B.C. Boat & Sportsman/Hunting Show	Mar 1 to 3, 2019	Abbotsford

## 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 2018. 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, the Habitat Conservation Trust Foundation (HCTF) announced a new granting program in partnership with the B.C. Ministry of Environment and Climate Change Strategy designed to fund community efforts to monitor lakes in B.C. for the presence of invasive freshwater mussels. The program will be continuing for the 2019 season, for more information please visit <https://hctf.ca/grants/invasive-mussel-monitoring-grants/>

A total of 13 grants were administered by the Habitat Conservation Trust Foundation for the collection of water samples and deployment of substrate samplers. Samples were collected by ENV and FLNR regional staff, BC Hydro, Boundary Invasive Species Society (BISS), Central Kootenay Invasive Species Society (CKISS), 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), Northwest Invasive Plant Council (NWIPC), Sea to Sky Invasive Species Council (SSISC), Skeena Fisheries Commission (SFC), Upper Fraser Fisheries Conservation Alliance (UFFCA), Invasive Species Council of British Columbia (ISCBC) and the Lillooet Regional Invasive Species Society (LRISS). Applications were received in spring 2018 and 13 grants were allocated to support lake monitoring efforts for the 2018 season.

A total of 800 plankton tow samples were collected and approximately 60 substrate samples were deployed collected in 90 lakes throughout BC (Figure 13) during the 2018 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.

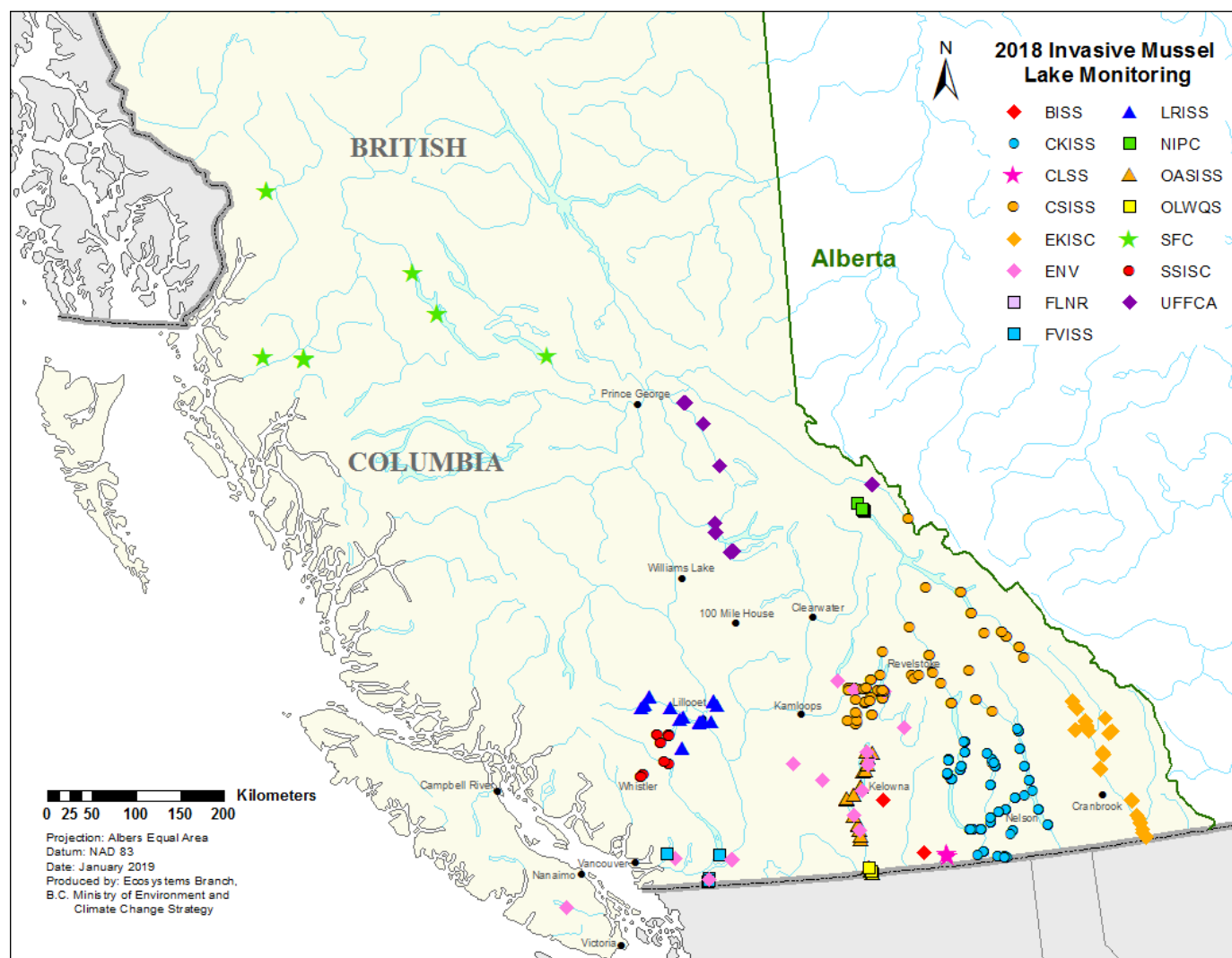


Figure 40. 2018 Lake monitoring plankton tow sampling locations, please see above for the full names of the sampling agencies.

## 6. PARTNERSHIPS AND COLLABORATIONS

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

### CROSS-AGENCY:

During the 2018 season, the program worked directly with the Canada Border Services Agency to receive notifications of watercraft at the southern border crossings, including 24-hr coverage along several southern border crossings. The program received notification for all types of watercraft including

canoes, kayaks, and river rafts. For the 2018 season, the program received 300 notifications from CBSA at several different border crossings that inspectors responded to and followed-up on (Figure 366).

In September 2018, 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 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). In late 2015, the *Inter-Provincial-Territorial Agreement for Coordinated Regional Defense Against Invasive Species* was signed by British Columbia, 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.

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. During the winter of 2018/19, the program worked with the Invasive Species Council of BC on several events which included an Aquatic Invasive Species workshop in conjunction with the 2019 Invasives Forum in February and hosted two webinars in March 2019. Senior program staff are also participating on the Canadian Council of Invasive Species National Clean, Drain, Dry working group to provide input on new clean, drain, dry materials being developed nationally.

## **7. SUMMARY OF LESSONS LEARNED AND IMPROVEMENTS**

At the end of each season, the program undergoes annual reviews taking into account 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 2018 season that were taken into consideration for the planning and implementation of the 2019 season.

### **7.1 STAFFING/GENERAL OPERATIONS**

Lessons learned from the 2018 season included the need for a third sergeant to enhance the level of operational supervisory capacity for the program. For the 2019 season, a third sergeant will be based out of Golden, B.C. to supervise the Golden, Valemount and Dawson Creek inspection crews. In addition, the AIS K9 unit will be expanding for the 2019 season with the addition of K9 "Major" which brings the number of mussel detection dogs to two for the Province. Major's handler will be Sergeant Cynthia Mann located in Nelson, B.C. Having Major on board will enhance K9 presence in the Southeast part of B.C.

Other improvements that will be made for the 2019 season include making ongoing adjustments to the AIS inspector training on watercraft inspection and decontamination. An exciting new partnership with Kingfisher Boats and GA Checkpoint in Port Coquitlam, B.C. will allow the addition of a wakeboard boat and PWC to the decontamination training to help build the inspectors' skills and comfort in decontaminating more complex watercraft.

The program also purchased new capital equipment to support the operational delivery of the program. This included the purchase of one mobile pressure washer, three electronic message boards and five secure storage units to streamline the end of season shut down and equipment inventory.

Continued improvements to the program are evaluated on an on-going basis to find efficiencies in program delivery.

### **7.2 WATERCRAFT INSPECTION SUMMARY**

During the 2018 season, there was a decrease in the number of high-risk watercraft (1,652) relative to 2017 (2,071) despite an increase in the overall number of inspections (40,700 and 35,500 respectively). This decrease was likely a reflection of the operational change made in early July to how watercraft originating in Montana were being assessed for risk. Watercraft that were in waters west of the continental divide in Montana in the previous 30 days and were found to be clean, drain, dry were treated as low risk whereas watercraft that were in waters east of the continental divide in the previous 30 days were treated as high-risk. The change was made based on the requirements in Montana that all boats traveling from east to west of the continental divide must be decontaminated. This was likely also reflected in the decrease in number of decontaminations performed relative to 2017.

Of the 25 mussel fouled boats through the season, eight were intercepted in April and May which is a slight increase from six in 2017. In addition, three of the five boats coming from the south were intercepted during these months, showing the importance of opening the inspection stations at the

beginning of April to target the snow birds traveling north. There was a slight decrease in the percentage of mussel fouled boats coming from the east at 80%, relative to 84% in 2017, but still illustrates that most of the mussel fouled boats are coming from the east.

### 7.3 WATERCRAFT NOTIFICATIONS

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. During the 2018, the program continued to work very closely with CBSA to receive notification of all types of watercraft coming through the border crossings. The program received very similar number of notifications in 2018 relative to 2017 at 300 in total. The majority of the notifications (227) came from the Roosevelt crossing that borders Montana. It is important to note that inspection crews were located directly at the Cascade, Osoyoos and Pacific border crossings so the program was not receiving notifications from these locations when the crews were operational. The program will continue to work closely with CBSA for the 2019 season to further improve the notification system.

Of the 25 mussel fouled watercraft encountered during the 2018 season, 20 had been through a previous inspection station in another jurisdiction, and B.C. had received advanced notification of these watercraft. The program works very closely with other western provinces and states such as AB, SK, MB, WA, ID, MT and OR to receive notification of any high risk or mussel fouled boats destined for B.C. This highlights the importance of having several jurisdictional layers of inspection stations to increase the likelihood of detection and the strength of the perimeter defence approach.

### 7.4 INSPECTION STATION LOCATIONS/HOURS OF OPERATION

The program worked directly with MOTI to identify and build two new inspection stations in the East Kootenays for the start of the 2018 season. One station is located on Hwy 93, just north of the Roosevelt border crossing, and the other is located on Hwy 3 west of Sparwood. These new locations helped to maximize capturing high-risk traffic from both the southern and eastern jurisdictions.

After the first season of operating these two new locations, the inspection data showed that the volume of boats at the Cutts station on Hwy 93 was lower than anticipated. With the ongoing 24hr coverage provided by CBSA at the Roosevelt border, this station will be reduced from dawn to dusk to 10hrs/day operations for the 2019 season. The Olsen station on Hwy 3 will remain at dawn to dusk in 2019 and inspectors working at both the Olsen and Cutts stations will be staffed out of the Fernie COS office to reduce travel time to and from the Cutts station.

Some additional site improvements were identified during the 2018 season at the Yahk inspection station to improve access for motorists and to increase the inspection area and visibility for the traveling public. The program will be working with MOTI to make these changes for the 2019 season. Other adjustments that will be made for the 2019 season include extending the operations of the Radium inspection station to dawn to dusk based on the high volume of boats intercepted in 2018. The operations at the Pacific border crossing station will be reduced to 10hrs/day due to the low volume of boats intercepted in 2018. In addition, the Salmo inspection station will be reduced to 10hrs day due to



the low number of inspections and the high percentage that were repeat inspections on the same day from either the Olsen or Yahk stations situated east on Hwy 3. These adjustments will allow for the addition of a roving crew to be based out of the Okanagan for the 2019 season.

During the 2018 inspection season, the Penticton inspection crew was frequently required to conduct scheduled inspections and decontaminations of high-risk watercraft destined for the Okanagan. The crew received notification of these high-risk boats either by another inspection station (such as Golden) or another jurisdiction. 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. The addition of a roving crew in the Okanagan will increase capacity to address these watercraft destined for the Okanagan while maintaining capacity at the Osoyoos border crossing.

For the 2019 season, the program will continue with having approximately 34 auxiliary inspectors on staff from March to the end of October, and an additional 30 from May to early September. This will allow for the inspection stations to operate 10 hrs per day and seven days per week during the slower shoulder season and run at full scale dawn to dusk and 24 hr (Golden) during the busy boating season (May to early September).

### 7.5 COMPLIANCE

The average compliance for the 2018 season was 81% which represents a 5% increase from the 2017 season (76%). This is likely a result of the new signage that was implemented at the start of the 2018 season in partnership with the Ministry of Transportation and Infrastructure. A total of 82 tickets and 50 warnings were issued by full time Conservation Officers to motorists for failing to stop at a watercraft inspection station. 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 and the Kicking Horse rest area are both situated on highways with high speed limits (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. To help improve compliance and some of these locations, three additional electronic message boards were purchased over the winter and will be available for the start of the 2019 season. In addition, to help address the compliance challenges at the Golden inspection station, the program will be partnering with MOTI and the Town of Golden to pilot the inspection station being setup at the tourist information centre in town.



## APPENDIX A 2018 WATERCRAFT INSPECTION STATION DETAILS

Station Name	Hwy #	Region	Type	Traffic Direction/Comments
Dawson Creek	2	Peace	Pullout	Westbound
Cutts (Hwy 93)	93	Kootenay	Pullout	Northbound
Golden	1	Kootenay	Rest area (Kicking Horse)	Westbound
Laidlaw	1	Lower Mainland	Weigh scale	Eastbound
Mt. Robson	16	Omineca	Pullout	Westbound
Olsen (Hwy 3)	3	Kootenay	Rest area (Olsen)	Westbound
Osoyoos	97	Okanagan	Border crossing	Northbound
Pacific	176 Ave	Lower Mainland	Weigh scale	Northbound
Paulson	3	Kootenay	Pullout	Westbound
Radium	95	Kootenay	Pullout	Southbound
Salmo	3	Kootenay	Pullout	Westbound
Valemount	5	Omineca	Pullout	Westbound
Yahk	95 and 3	Kootenay	Pullout	Westbound

## APPENDIX B RESULTS FROM 2018 VELIGER SAMPLE ANALYSIS

Sampling Agency	Waterbody	Sampling method	Adult or veliger ZQM detected? (Y/N)
BISS	Idabel lake	substrate sampler	No
BISS	Idabel Lake	plankton tow	No
BISS	Jewel Lake	plankton tow	No
CKISS	Arrow Lake lower	plankton tow	No
CKISS	Arrow Lake upper	plankton tow	No
CKISS	Arrow Lake, lower	plankton tow	No
CKISS	Arrow Lake, Lower	substrate sampler	No
CKISS	Arrow Lake, upper	substrate sampler	No
CKISS	Arrow Lake, Upper	plankton tow	No
CKISS	Columbia River	plankton tow	No
CKISS	Duncan Lake	plankton tow	No
CKISS	Kootenay Lake	plankton tow	No
CKISS	Kootenay River (Nelson)	plankton tow	No
CKISS	Kootenay River (Nelson)	substrate sampler	No
CKISS	Pend D'Oreille River	plankton tow	No
CKISS	Pend D'Oreille River	substrate sampler	No
CKISS	Slocan Lake	plankton tow	No
CKISS	Slocan Lake	substrate sampler	No
CKISS	Whatshan Lake	plankton tow	No
CLSS	Christina Lake	plankton tow	No
CSISS	Arrow Lake, Upper	plankton tow	No
CSISS	Arthur Lake	plankton tow	No
CSISS	Bolean Lake	plankton tow	No
CSISS	Columbia River	plankton tow	No
CSISS	Echo Lake	plankton tow	No
CSISS	Gardom Lake	plankton tow	No
CSISS	Griffin Lake	plankton tow	No
CSISS	Joyce Lake	substrate sampler	No
CSISS	Kernaghan Lake	plankton tow	No
CSISS	Kinbasket Reservoir	plankton tow	No
CSISS	Kinbasket Reservoir	plankton tow	No
CSISS	Lake Revelstoke	plankton tow	No
CSISS	Mara Lake	plankton tow	No

Sampling Agency	Waterbody	Sampling method	Adult or veliger ZQM detected? (Y/N)
CSISS	Revelstoke Lake	plankton tow	No
CSISS	Shuswap Lake	plankton tow	No
CSISS	Skimikin Lake	plankton tow	No
CSISS	Spa Lake	plankton tow	No
CSISS	Three Valley Gap Lake	plankton tow	No
CSISS	Trout Lake	plankton tow	No
CSISS	Upper Arrow Lake	plankton tow	No
CSISS	Victor Lake	plankton tow	No
CSISS	Wallenstien Lake	plankton tow	No
CSISS	White Lake	plankton tow	No
CSISS	White Lake	substrate sampler	No
CSISS	Wilbur Lake	plankton tow	No
CSISS	Williamson Lake	plankton tow	No
EKISS	Columbia Lake	plankton tow	No
EKISS	Columbia Lake	substrate sampler	No
EKISS	Koocanusa Lake	plankton tow	No
EKISS	Koocanusa Lake	substrate sampler	No
EKISS	Lake Windermere	plankton tow	No
EKISS	Premier Lake	plankton tow	No
EKISS	Tie Lake	plankton tow	No
EKISS	Tie Lake	substrate sampler	No
EKISS	Wasa Lake	plankton tow	No
EKISS	Wasa Lake	substrate sampler	No
EKISS	Whiteswan Lake	plankton tow	No
EKISS	Whiteswan Lake	substrate sampler	No
EKISS	Whitetail Lake	plankton tow	No
EKISS	Windermere Lake	plankton tow	No
EKISS	Windermere Lake	substrate sampler	No
ENV	Adams Lake	plankton tow	No
ENV	Alouette Lake	plankton tow	No
ENV	Bowron Lake	plankton tow	No
ENV	Chimney Lake	plankton tow	No
ENV	Cowichan Lake	plankton tow	No
ENV	Cultus Lake	plankton tow	No
ENV	Horse Lake	plankton tow	No

Sampling Agency	Waterbody	Sampling method	Adult or veliger ZQM detected? (Y/N)
ENV	Kalamalka Lake	plankton tow	No
ENV	Lakelse Lake	plankton tow	No
ENV	Mabel Lake	plankton tow	No
ENV	Mara Lake	plankton tow	No
ENV	Moyie Lake North	plankton tow	No
ENV	Moyie Lake South	plankton tow	No
ENV	Nicola Lake	plankton tow	No
ENV	Okanagan Lake	plankton tow	No
ENV	Okanagan Lake	substrate sampler	No
ENV	Osoyoos Lake	plankton tow	No
ENV	Pennask Lake	plankton tow	No
ENV	Puntzi Lake	plankton tow	No
ENV	Rainbow Lake	plankton tow	No
ENV	Shuswap Lake	plankton tow	No
ENV	Skaha Lake	plankton tow	No
ENV	Tyee Lake	plankton tow	No
ENV	Wahleach/Jones	plankton tow	No
ENV	Whiteswan Lake	plankton tow	No
ENV	Williams Lake	plankton tow	No
ENV	Windermere Lake	plankton tow	No
ENV	Wood Lake	plankton tow	No
FLNRORD	Arrow Lake, Upper	plankton tow	No
FLNRORD	Kootenay Lake	plankton tow	No
FVISS	Cultus Lake	plankton tow	No
FVISS	Cultus Lake	substrate sampler	No
FVISS	Harrison Lake	plankton tow	No
FVISS	Pitt Lake	plankton tow	No
ISCBC	Bridge Lake	plankton tow	No
ISCBC	Chimney Lake	plankton tow	No
ISCBC	Dragon Lake	plankton tow	No
ISCBC	Green Lake	plankton tow	No
ISCBC	Lac la Hache	plankton tow	No
ISCBC	Sheridan Lake	plankton tow	No
ISCBC	Williams Lake	plankton tow	No
LRISS	Anderson Lake	plankton tow	No

Sampling Agency	Waterbody	Sampling method	Adult or veliger ZQM detected? (Y/N)
LRISS	Carpenter Lake	plankton tow	No
LRISS	Crown Lake	plankton tow	No
LRISS	Duffy Lake	plankton tow	No
LRISS	Fountain Lake	plankton tow	No
LRISS	Fountain Lake	plankton tow	No
LRISS	Fraser River	plankton tow	No
LRISS	Gun Lake	plankton tow	No
LRISS	Gun Lake	plankton tow	No
LRISS	Pavilion Lake	plankton tow	No
LRISS	Pavilion Lake	substrate sampler	No
LRISS	Pavilion Lake	plankton tow	No
LRISS	Pavilion Lake	plankton tow	No
LRISS	Pavilion Lake	substrate sampler	No
LRISS	Seton Lake	plankton tow	No
LRISS	Seton Lake	substrate sampler	No
LRISS	Seton Lake	plankton tow	No
LRISS	Tyaughton Lake	plankton tow	No
LRISS	Tyaughton Lake	plankton tow	No
NWIPC	Kinbasket Reservoir	plankton tow	No
OASISS	Kalamalka Lake	plankton tow	No
OASISS	Kalamalka Lake	substrate sampler	No
OASISS	Okanagan Lake	plankton tow	No
OASISS	Okanagan Lake	substrate sampler	No
OASISS	Okanagan Lake	plankton tow	No
OASISS	Okanagan Lake	substrate sampler	No
OASISS	Osoyoos Lake	plankton tow	No
OASISS	Osoyoos Lake	substrate sampler	No
OASISS	Skaha Lake	plankton tow	No
OASISS	Skaha Lake	substrate sampler	No
OASISS	Wood Lake	plankton tow	No
OASISS	Wood Lake	substrate sampler	No
OLWQS	Osoyoos Lake	plankton tow	No
OLWQS	Osoyoos Lake	substrate sampler	No
SFC	Babine Lake	plankton tow	No
SFC	Lakelse Lake	plankton tow	No

Sampling Agency	Waterbody	Sampling method	Adult or veliger ZQM detected? (Y/N)
SFC	Lakelse Lake	substrate sampler	No
SFC	Meziadin Lake	plankton tow	No
SFC	Stuart Lake	plankton tow	No
SSISC	Alpha Lake	plankton tow	No
SSISC	Alta Lake	plankton tow	No
SSISC	Anderson Lake	plankton tow	No
SSISC	Anderson Lake	substrate sampler	No
SSISC	Birkenhead Lake	plankton tow	No
SSISC	Gates Lake	plankton tow	No
SSISC	Gates Lake	substrate sampler	No
SSISC	Green Lake	plankton tow	No
SSISC	Green Lake	substrate sampler	No
SSISC	Lillooet Lake	plankton tow	No
SSISC	Lillooet Lake	substrate sampler	No
SSISC	Lost Lake	plankton tow	No
UFFCA	Bowron Lake	plankton tow	No
UFFCA	Horsefly Lake	plankton tow	No
UFFCA	Moose Lake	plankton tow	No
UFFCA	Purden Lake	plankton tow	No
UFFCA	Quesnel Lake	plankton tow	No