B.C. Invasive Mussel Defence Program: 2016 Final Report

BRITISH COLUMBIA | Ministry of Environment and Climate Change Strategy

Prepared by: Ecosystems Branch
B.C. Ministry of Environment and Climate Change Strategy

October 2017

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 (formerly Department of Fisheries and Oceans)
EKISS	Eastern Kootenay Invasive Species Society
ENV	Ministry of Environment and Climate Change Strategy
FLNRO	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 *Wildlife Act*.
RCMP	Royal Canadian Mounted Police
ZQM	Zebra and Quagga mussels

Term	Definition
High-risk watercraft	Any watercraft or piece of equipment that was in any province or U.S. state known or suspected of having ZQM in the past 30 days.

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 recent review of economic impacts related 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 for infrastructure maintenance if ZQM are introduced to the Province. 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 (FLNRO), Ministry of Agriculture (AGR), B.C. Hydro, and the Columbia Basin Trust (CBT). The pilot season consisted of six mobile decontamination units, 12 trained watercraft inspectors, lake monitoring for ZQM, and "Clean, Drain, Dry" education and outreach activities.

In March 2016, the Province announced an enhanced Program, consisting of 32 trained auxiliary Conservation Officers staffed at eight watercraft inspection stations strategically situated along eastern and southern border locations to target boaters entering B.C. This document reports on the logistics, activities, and findings of the enhanced 2016 season of the Program for the operational period of April 1st to October 15th 2016.

1.2 REGULATORY AND JURISDICTIONAL FRAMEWORK

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

The Program consists of three main components:

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

Provincial legislation gives the Province authority to take action on ZQM. The Controlled Alien Species (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.

Inspectors are trained to deliver the watercraft inspection program and have been designated as Auxiliary Conservation Officers under the *Wildlife Act.* This designation provides powers to intercept/stop, inspect, search, 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 CAS Regulation as it pertains to ZQM (available at www.gov.BC.ca/invasive-species).

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 infested boats at the border.

B.C. Invasive Mussel Defence Program Expansion

On March 30th 2017 the Province announced $3 million in funding to go towards two new inspection stations, expanding inspection hours and the inspection operating season, more than doubling the number of inspectors, increasing public education, expanding scientific lake monitoring, and providing Canada's first multi-purpose mussel-sniffing dog.

To see the full news release please visit: https://news.gov.B.C.ca/releases/2017ENV0029-000946

1.3 CONSERVATION OFFICER SERVICE

The partnership with the COS has been critical to the successful delivery of the Program. The COS has been a foundation partner, helping with many of the major program delivery pieces including hiring, training, and working alongside full-time Conservation Officers.

Through the two years of Program operations, procedures have quickly evolved to streamline delivery of decontamination and quarantine orders, as well as violation and warning tickets, all of which are now being entered into the Conservation Officer enforcement database.

1.4 JURISDICTIONAL COORDINATION

Ongoing coordination with other jurisdictions in Canada and the U.S. was critical for the overall success of the Program. The Province is a signatory on the *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 Regional Defence Strategy for invasive species, as part of the Pacific Northwest Economic Region.

The B.C. Ministry of Environment and Climate Change Strategy (formerly Ministry of Environment) worked very closely with the Alberta invasive mussel program regarding high-risk watercraft notifications during the 2016 season. On-going and effective communication enabled both provinces to address high-risk watercraft in a timely manner.

2. PROGRAM LOGISTICS

2.1 OPERATIONS

In 2016, Program operations were administered by the B.C. Ministry of Environment and Climate Change Strategy (ENV). The Program supervisor, Program coordinator, and 32 inspectors were staffed through the Ecosystems Branch of ENV. A sergeant with the COS served as COS Coordinator for the program and assisted with hiring, training, communications, and program implementation.

A total of eight inspection crews comprising 32 auxiliary Conservation Officers were operational on April 1st 2016. Each inspection crew consisted of four trained auxiliary Conservation Officers (CO) equipped with mobile mussel decontamination units. The inspection crews had base locations in the Lower Mainland, Penticton, Nelson, Invermere, Cranbrook, Valemount, and Dawson Creek; however, they conducted watercraft inspection stations at 14 different locations at key entry points into the province along the eastern and southern borders (see Figure 1 and Appendix A for station details). As in other jurisdictions, the watercraft inspection stations were operational only during daylight hours for safety reasons. The inspection stations in Dawson Creek and Valemount were operational until September 4th 2016, to coincide with winter conditions, and in all other locations until October 31st 2016.

Data from the 2015 boating season and inspection locations were used to identify optimal locations for inspection stations for the 2016 season. The locations were assessed for suitability as permanent inspection stations 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 infested watercraft intercepted.

Many of the watercraft inspection stations were located at Commercial Vehicle Safety and Enforcement weigh scales since they provided safe and suitable locations for inspecting and decontaminating watercraft. The Program also worked directly with CBSA staff on the delivery of Standard Operating Procedures for receiving notifications of any high-risk boats intercepted at the southern border crossings. This allowed for additional coverage along the B.C/U.S. border crossings.

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 Report All Poachers and Polluters (RAPP) Hotline operated by COS 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, the COS Program liaison, the Program coordinator and the Program supervisor. A response was then coordinated based on the availability of inspectors.

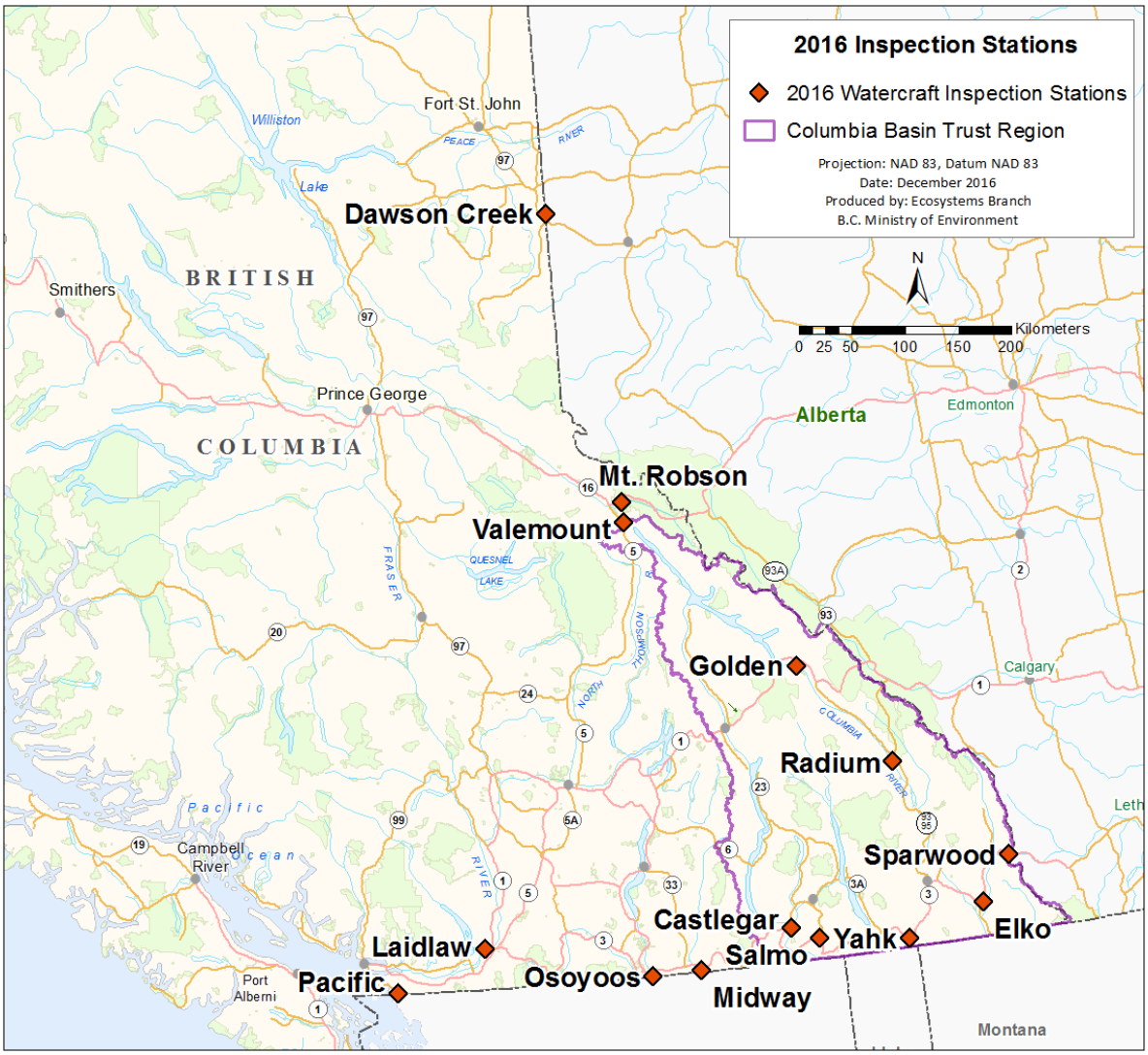


Figure 1. Watercraft inspection station locations for the 2016 season.

2.2 INSPECTION CREW TRAINING (AUXILIARY COS)

Inspector positions require an education/background from a recognised compliance and enforcement or natural resource management program (degree or diploma). 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

To improve compliance by those carrying non-motorized watercraft, signs at each watercraft inspection station were redesigned for the 2016 season to include pictograms of various watercraft types (Figure 2). Signs were designed and approved by the Ministry of Transportation and Infrastructure (MOTI).

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

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

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

In accordance with ENV's watercraft risk assessment, any watercraft or piece of equipment that was in any province or U.S. state known or suspected of having ZQM in the past 30 days 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 extent determined as practical by inspectors, and had not been drained and dried was also considered high-risk even if it has been out of the water for over 30 days. Low risk watercraft are those that have been used solely within British Columbia or other non-contaminated provinces or states within the last 30 days.

The inspectors used investigative skills to verify information provided by watercraft owners. This was done through detailed watercraft inspections, and in some situations if required, through follow-up with third parties to confirm information obtained during interviews.

Figure 2. New inspection station signs for the 2016 season with the addition of new graphics showing different watercraft types to help improve compliance of non-motorized watercraft. Signs were designed and approved by the Ministry of Transportation and Infrastructure.

2.4 PROGRAM FUNDING AND BUDGET

The 2016 season of Provincial Invasive Mussel Defence Program was funded by B.C. Hydro, Columbia Basin Trust, Columbia Power Cooperation, Fortis B.C., and AGR, with in-kind contributions from ENV, and FLNRO. Fisheries and Oceans Canada (DFO) provided financial support to the lake monitoring program for sample analysis.

A summary of total expenditures for the 2016 season is provided in (Table 1). The total operational cost was $3,119,753. This included salary, travel, vehicle, outreach/education, non-capital equipment and maintenance, research, lake monitoring and capital equipment costs.

Salary costs included inspectors staffed from April to September (8) and October (24), one full time program coordinator, and a project assistant from July to March 2017 to assist with program start-up. The salary cost did not include any salary contributions from the Province for the program manager or supervisor. The funding delivered to the COS provided support for a dedicated sergeant as program liaison, and helped with the hiring, training and coordination of crews implementing the program.

Travel costs primarily consisted of meals and accommodation for inspectors travel to inspection stations, as well as partial relocation costs for crew members, and travel required for training. Travel also included training costs for the program start up in March 2017.

Vehicle costs included gas, repairs and monthly lease fees for eight trucks and two cars from April to September/October.

Table 1. Total expenditures for the 2016 season of the Invasive Mussel Defence Program.

2016 / 2017	Original 2016/17 Budget	Additional March 2017 Funding	Revised 2016/17 Budget	Actuals March 31 2017	Variance	CBT [1] 2016 Budget	CBT [1] 2016 Actuals	Variance
Salary	$1,289,812		$1,289,812	$1,273,361	$16,451	$152,550	$152,550	$0
Travel & Training	$206,800		$206,800	$130,056	$76,744	$26,675	$26,675	$0
Vehicle	$162,000		$162,000	$127,438	$34,562	$20,250	$20,250	$0
Education / Awareness / Research	$314,545		$314,545	$411,086	-$96,541	$18,750	$18,750	$0
COS support	$100,000		$100,000	$100,000	$0	$12,500	$12,500	$0
Non-capital equipment / maintenance	$168,562		$168,562	$189,175	-$20,613	$17,527	$17,527	$0
Lake monitoring[2]	$58,800	$450,000	$508,800	$514,643	-$5,843	$1,625	$1,625	$0
Total Operations	**$2,300,519**		**$2,750,519**	**$2,745,759**	**$4,760**	**$249,877**	**$249,877**	
Capital Equipment[2]	$231,750	$170,000	$401,750	$373,994	**$27,756**		$0	
Total	**$2,532,269**	**$620,000**	**$3,152,269**	**$3,119,753**	**$32,516**		**$249,877**	

Notes:
[1] Columbia Basin Trust
[2] Includes Provincial Government funding provided in March 2017 for the lake monitoring program and for capital equipment.

Outreach costs included the development and production of outreach materials (i.e., rack cards, wallet cards, stickers, and resin blocks containing adult ZQM) that were distributed by the crews at the watercraft inspection stations. The program partnered with the Invasive Species Council of B.C. to develop specific education materials to target the boating industry in B.C. as well as youth outreach materials for distribution at watercraft inspection stations. Also included were costs for the development of the mobile-friendly invasive mussel website, development of a provincial Clean, Drain, Dry logo, and social media and web-based advertising. A province-wide mail-out to more than 200 marinas and businesses in the boating industry was carried out in the winter of 2016/2017 using data collected during the 2016 season. The mail-out provided information about the Program; Clean, Drain, Dry; and how to report high-risk boats being transported into the province of B.C.

Outreach/education also included costs for exhibitor booths at sportsman and boating shows, and the outreach events listed in Table 2 (see Section 4.4). In addition, a 26 ft. mobile outreach trailer was purchased during the 2016 season in partnership with the COS. This trailer tours around the province to key outreach/education events such as boating and fishing shows to promote the message of Clean, Drain, Dry and raise awareness about invasive mussels and other high-risk aquatic invasive species.

Outreach/education costs also included the purchase and training of a multipurpose mussel detection dog. The primary handler of the dog is the COS program liaison. The dog is being trained to sniff out mussels, as well as firearms and bear parts, and will be used in evidence recovery cases.

Research costs included the lake monitoring program to test for the presence of invasive ZQM larvae in lakes throughout B.C. (as part of early detection) and funding to support several regional committees to collect samples. Also included were costs for analysis of all samples collected during the 2016 lake monitoring program for early detection. In addition, research costs supported a study to quantify the potential impacts of ZQM introduction on salmonids in large lakes in B.C., as part of the collaboration with the University of British Columbia Fisheries Centre. In March 2017, the Province announced $450,000 in funding to the Habitat Conservation Trust Foundation to provide three years of support to expand government's ongoing invasive mussel lake monitoring to detect potential invasive mussel larvae.

Non-capital equipment and maintenance costs included uniforms, electronic devices (iPhones, iPads, satellite messengers, and software licenses), highway signs, and safety equipment. Also included were costs for the necessary maintenance, repairs, and storage of the pressure washers.

Capital equipment costs included the purchase of six mobile decontamination units at the start of the 2016 season. Additional capital funding allowed for the purchase of six portable message boards and three additional pressure washers in March 2017. An equipment loan agreement was established with the Eastern Kootenay Invasive Species Society (EKISS) for the use of their pressure washer in the watercraft inspection program.

3. WATERCRAFT INSPECTION SUMMARY FOR 2016

3.1 ALL WATERCRAFT ENCOUNTERS

During the 2016 expanded season, just over 24,500 watercraft were inspected, and the crews interacted with approximately 50,000 people to promote Clean, Drain, Dry. Of the total watercraft inspected, 685 were identified as coming from a high-risk province or state, 90 were issued Decontamination Orders, and 68 were issued quarantine periods to meet the required 30-day drying time. Of the total watercraft inspected, 17 were confirmed to have adult invasive mussels (see Section 3.2 for further detail on high-risk watercraft).

The remainder of this section presents and discusses the watercraft inspection data collected by the crews at each station across the entire season. Data were 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 measure of 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. Simple statistical analyses (Mann-Whitney U Test) were used to detect significant differences in encounter frequency, where possible (see figure notes for details).

3.1.1 Watercraft Inspection Summary by Station

Watercraft encounters (Figure 3) were highest at the Golden station (6,378 boats), followed by the Radium station (4,625 boats), the Elko station (2,417 boats), and the Castlegar station (1,699 boats).

The encounter frequency (watercraft encounters/effort) across each inspection station showed that the busiest inspection stations were Elko, Sparwood, Yahk, Golden, and Mt. Robson (Figure 4). The stations with the lowest frequency of boater traffic were Pacific Border, Osoyoos, and Dawson Creek. Interestingly, the three stations with the lowest frequency of boater traffic had the highest percentage of high-risk boats (Figure 4). This 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. It is important to note that the encounter frequency only represents boater traffic during the operational hours and does not capture any nighttime boater traffic. To date, no other jurisdiction in the Pacific Northwest has regularly operated inspection stations during nighttime hours. In August 2016, a night inspection trial was conducted at the Golden inspection station to identify appropriate lighting and safety procedures for operating at night.

Watercraft inspection data were also used to determine the number of different jurisdictions boats were traveling from (Figure 5). The Dawson Creek station inspected boats coming from 44 different provinces and states, which is more than any other inspection station, while the Midway station inspected boats from seven different provinces and states. These data provide important information on the different routes that boaters are traveling.

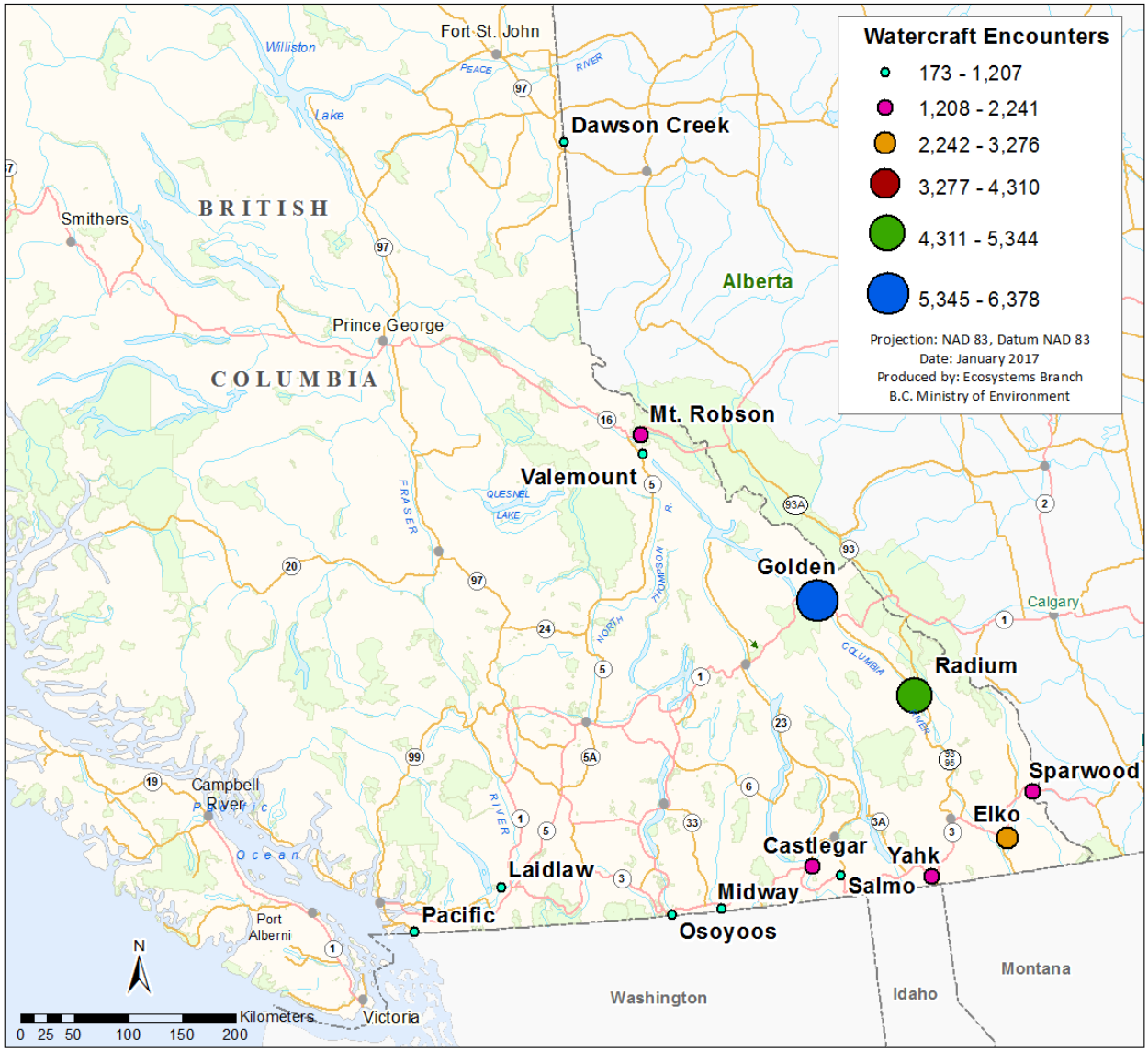


Figure 3. Total watercraft encounters for inspection stations during the 2016 season.

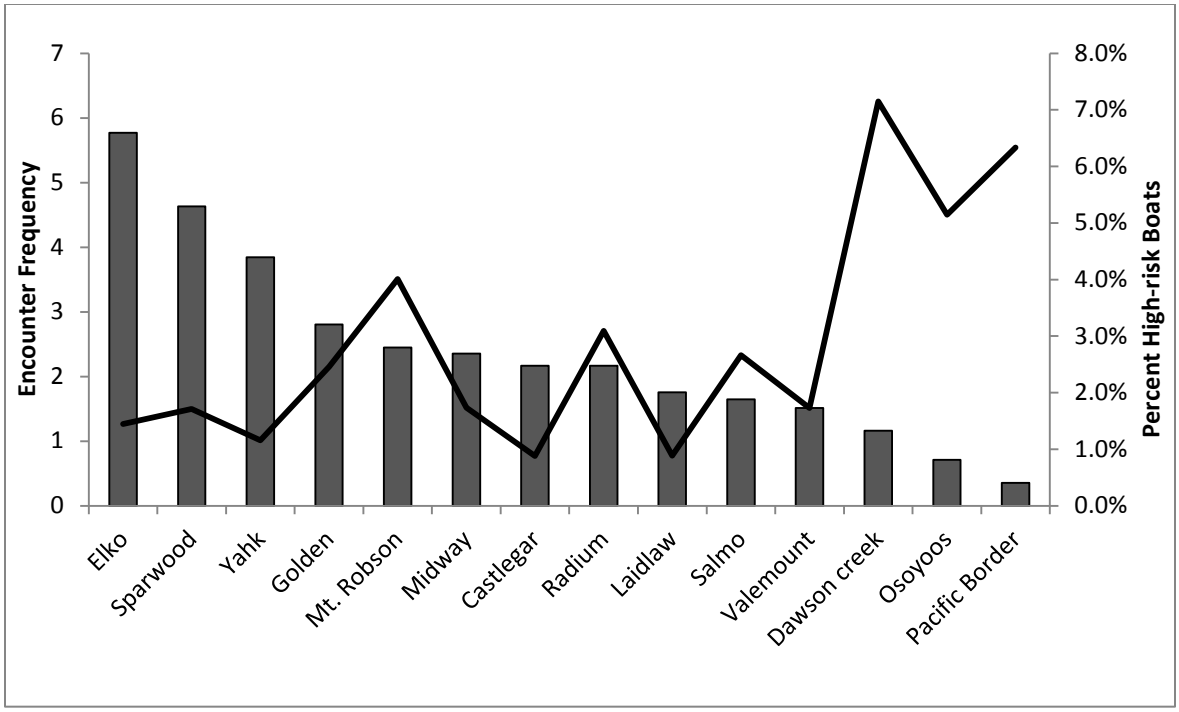


Figure 4. Encounter frequency by inspection station in comparison to percent of high-risk boats per inspection station, from April to October 2016.

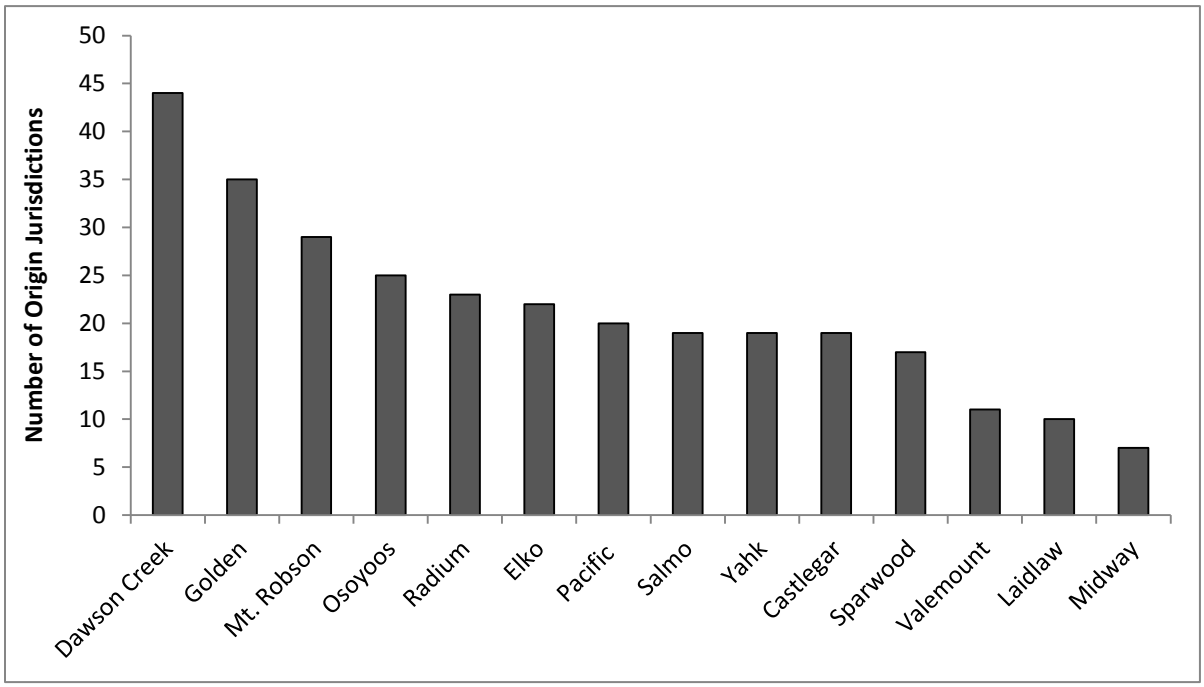


Figure 5. The total number of origin jurisdictions from which boats were traveling that were intercepted between April and October 2016, by inspection station.

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

Highway inspection stations were operational from April 01 to October 15. The total effort (operational hours) of the inspection stations 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 beginning of September, and the southern inspection stations were only operational until October 15. Watercraft encounters showed a similar trend, increasing over the spring months (April to June) and peaking in July and August.

Encounter frequency (watercraft encounters/effort) was compared across all months of the 2016 season. Figure 7 shows that encounter frequency was significantly different among months, with the exceptions of April vs October, May vs September, and August vs July. The non-significant difference between April vs October and May vs September indicate that the spring and fall periods were similar in terms of encounter frequency (Figure 7).

Figure 8 shows the total watercraft encounters and total effort by days of the week across the 2016 season. Watercraft encounters appeared to peak on Fridays and Saturdays, and was the lowest on Tuesdays and Wednesdays. Total effort was similar across all days of the week since the inspection stations were operational seven days a week (Figure 8).

The encounter frequency (watercraft encounters/effort) did not significantly differ between Thursday, Friday, Saturday, Sunday, and Monday, based on Mann-Whitney U-test results (Figure 9). This illustrates that watercraft encounters yielded similar results on the weekends and days around the weekend, and could be related to travellers taking extended weekend holidays. Tuesdays and Wednesdays had significantly lower encounter frequencies as compared with Thursdays through Sundays.

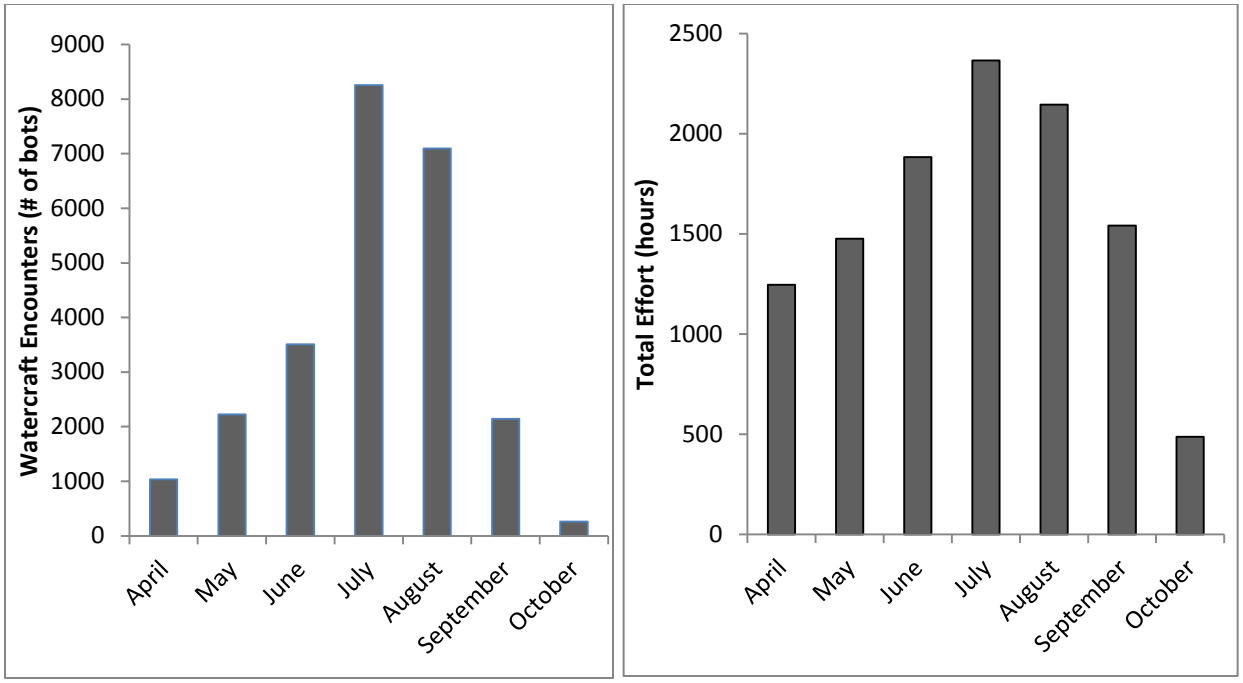


Figure 6. Watercraft encounters (left) and total effort (right) by month across inspection stations.

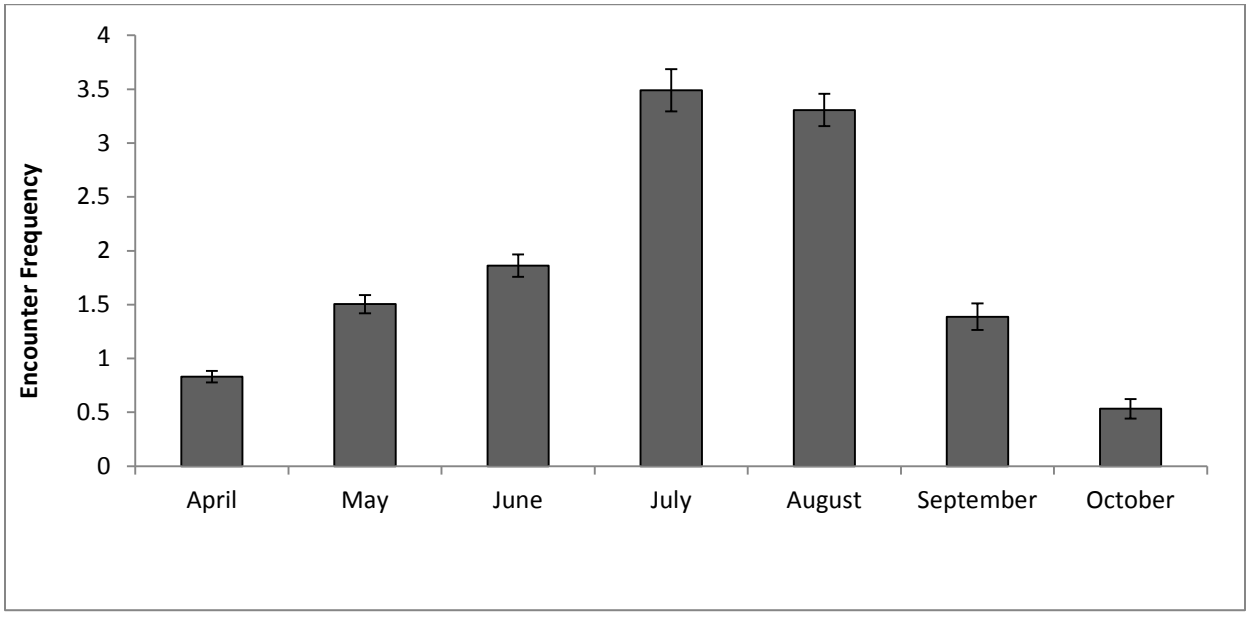


Figure 7. Encounter frequency by month across all inspection stations (error bars illustrate the standard error). Mann-Whitney U Test results showed that all months were significantly different, with the exception of April vs October, May vs September, and July vs August.

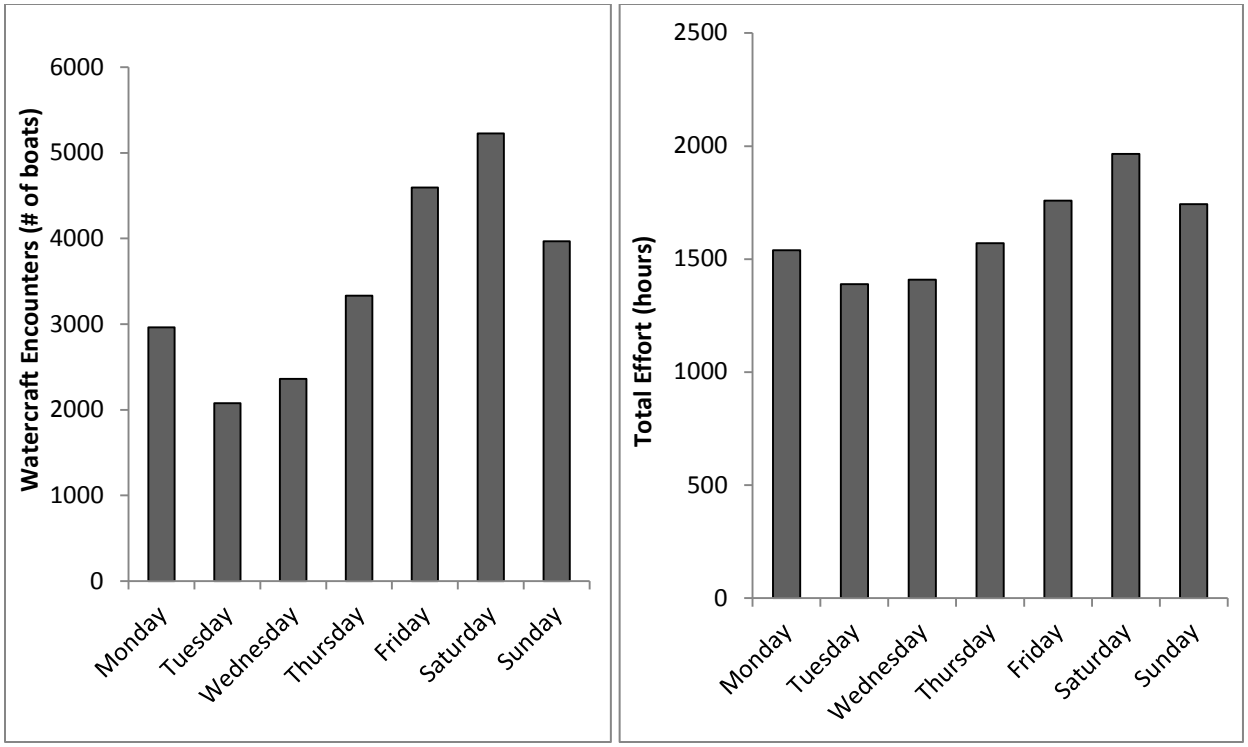


Figure 8. Watercraft encounters (left) and total effort (right) by day of the week across inspection stations. Statutory holidays were included in the data analyses.

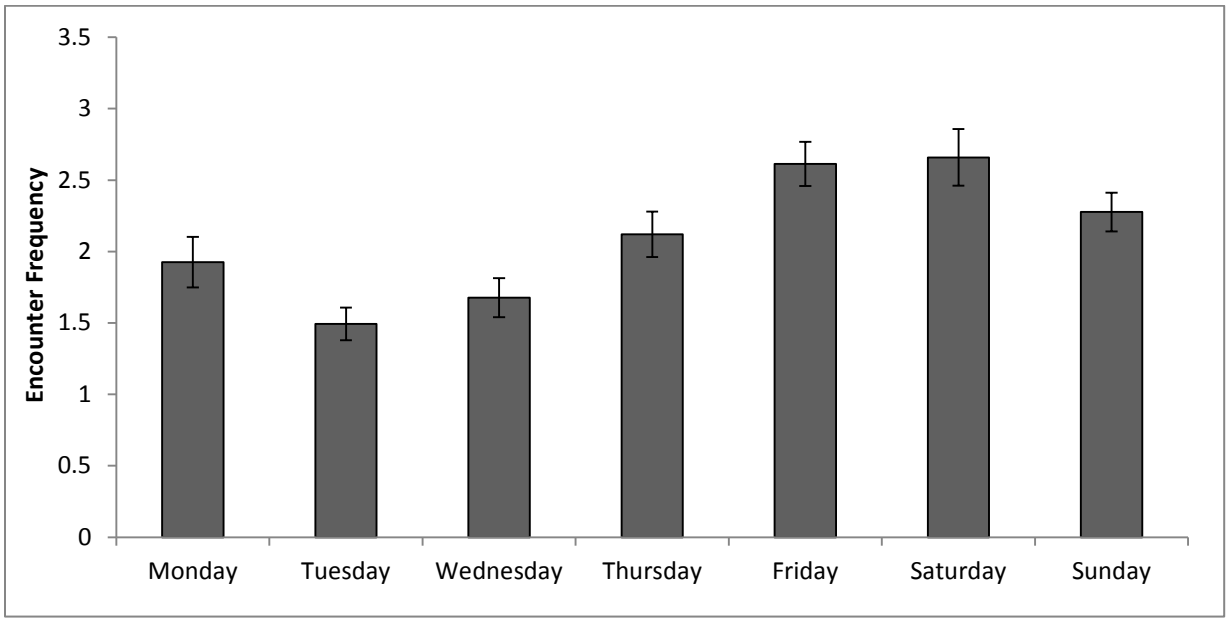


Figure 9. Encounter frequency by day of the week from April to October 2016 across inspection stations (Error bars illustrate the standard error). Statutory holidays were included in the data analyses.

3.1.3 Watercraft Inspection Summary by Hour of the Day

Times of day when boats stopped at inspection stations were recorded as a measure of boater traffic. The encounter frequency was measured as the ratio of watercraft encounters by the number of shifts across each hour of the day. Figure 10 shows that the encounter frequency was normally distributed, peaked in the middle of the day, and was lowest at the start and the end of the daily operational period.

The first night inspection trial was conducted on Wednesday, August 24th at the Golden inspection station; the station was operational from 22:00 to 05:30. Three boats that came through the inspection station at 22:00, 23:00, and 04:00, respectively. All three boats were coming from Alberta and were considered of low risk. Additional data are needed to better understand boater traffic at night.

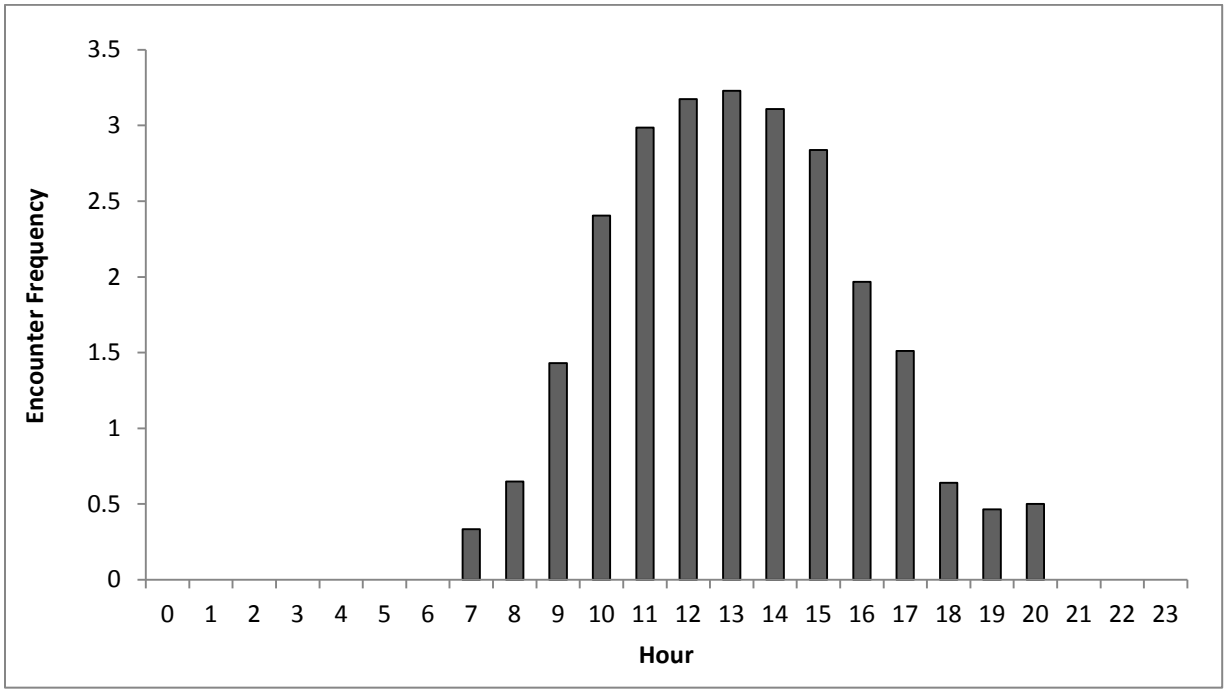


Figure 10. Encounter frequency by time of day across all inspection stations for the 2016 season. Data from the night inspection trial that took place on August 24th were not included.

3.1.4 Source and Destination Locations

Inspected watercraft traveled into B.C. from 57 different provinces, territories, and states (Figure 11 and Figure 12). Exactly half of the watercraft inspected was traveling from a waterbody within B.C. during the 2016 season. This is a decrease from the 2015 season which saw 60% of inspected watercraft traveling within the province. This shows that a higher proportion of the watercraft inspected during 2016 were coming from out of province. The inspected watercraft coming from out of province traveled primarily from neighbouring jurisdictions: Alberta (37.5%), Washington (3.5%), Saskatchewan (1.9%), and Montana (1.8%). The remaining 3.0% came from 50 different provinces, states, and territories (Figure 11).

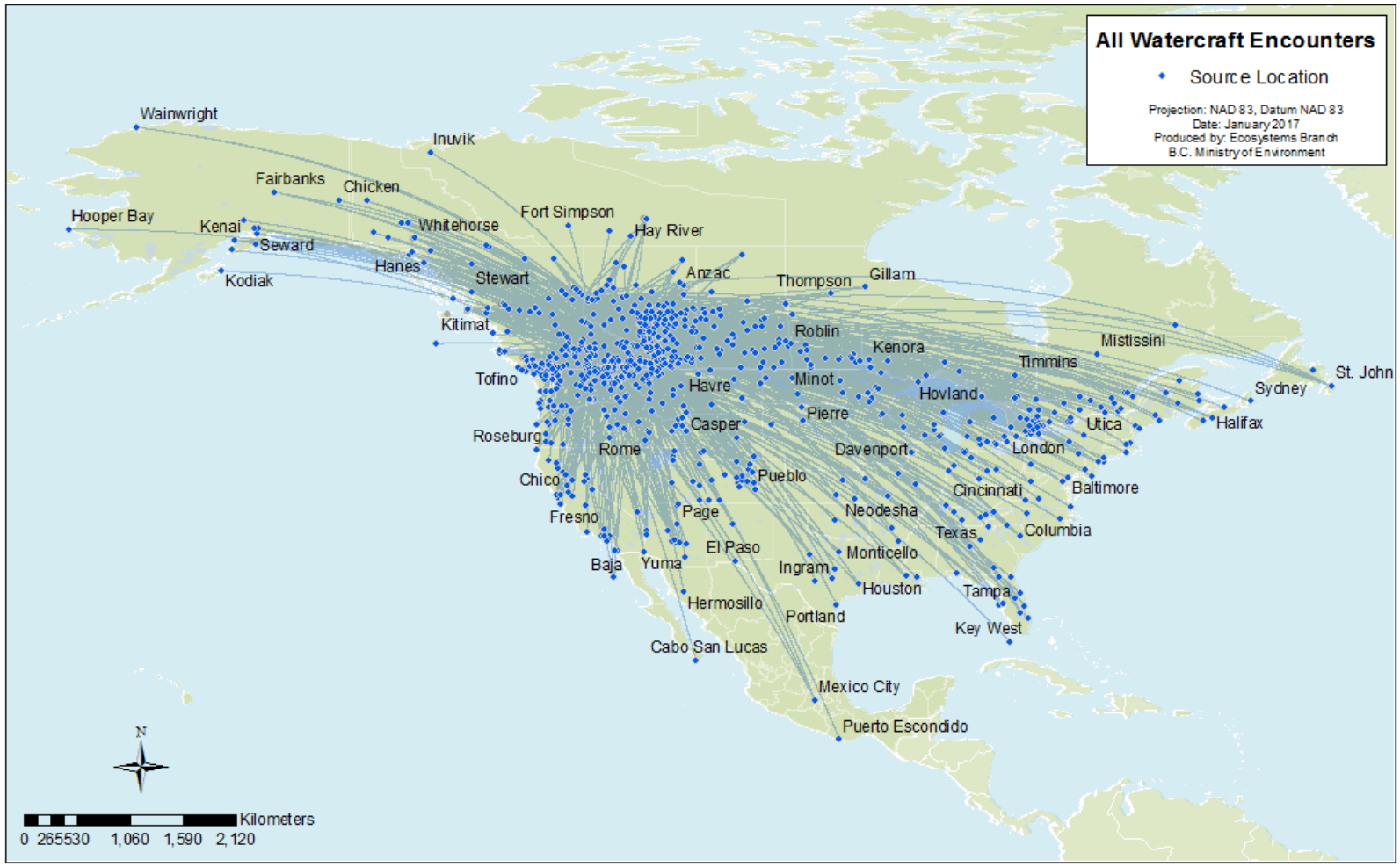


Figure 11. Previous location for all watercraft inspected in B.C. from April to October 2016.

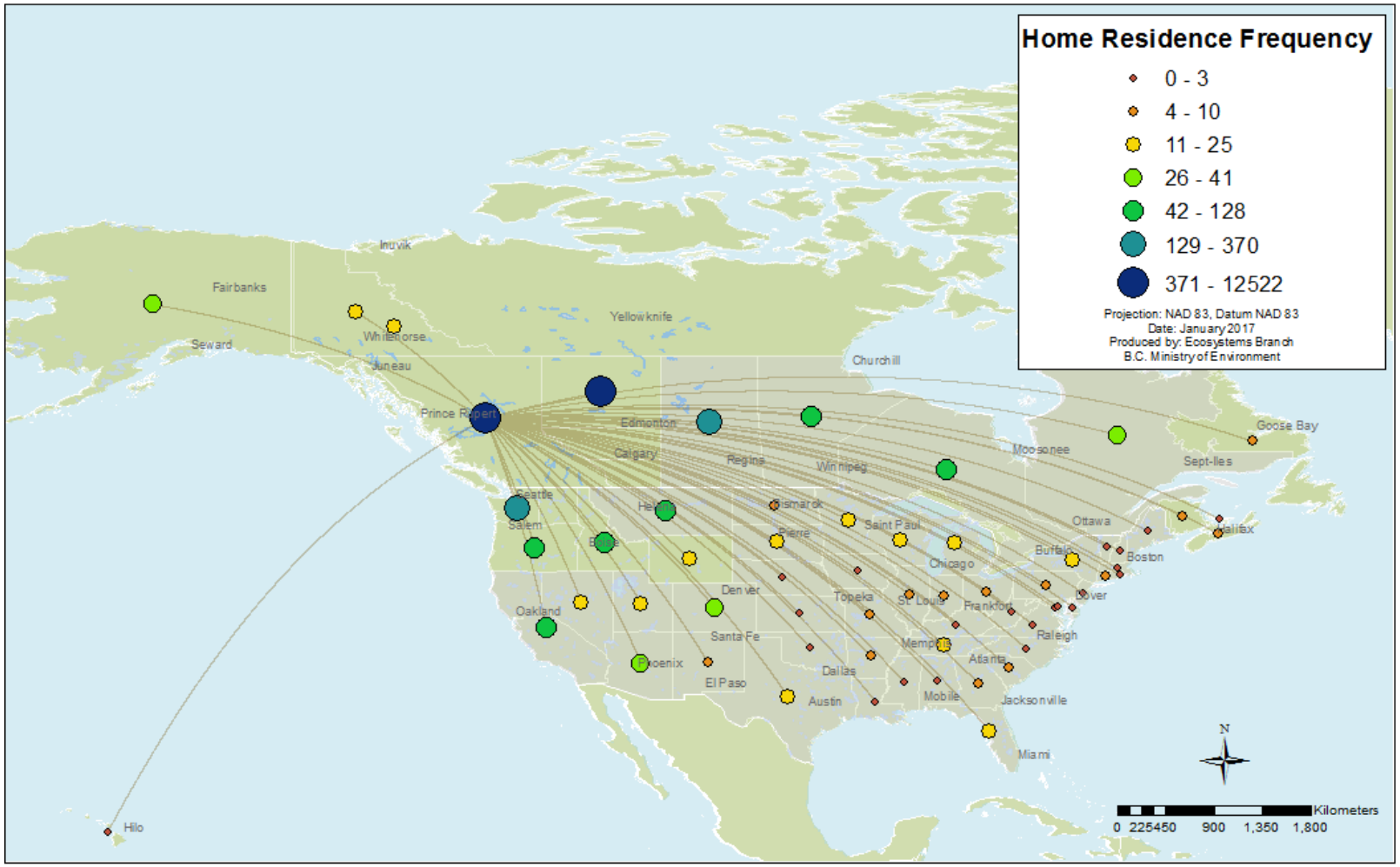


Figure 12. Home residence by province/state of all watercraft inspected during the 2016 season.

The majority of watercraft were destined for waterbodies within B.C. (85.9%), followed by waterbodies in neighbouring jurisdictions: Alberta (8.5%), Montana (1.6%), Idaho (1.3%), and Alaska (0.8%) (Figure 13). The remaining 2% of the watercraft were destined for waterbodies in 31 different jurisdictions (Figure 14).

The most common destination waterbodies within B.C. were Shuswap Lake (8.4%), Okanagan Lake (6.9%), Windermere Lake (6.0%), Lake Koocanusa (4.1%), Pacific Ocean (3.6%), Kootenay Lake (3.0%), and Kinbasket Lake (2.5%) (Figure 15).

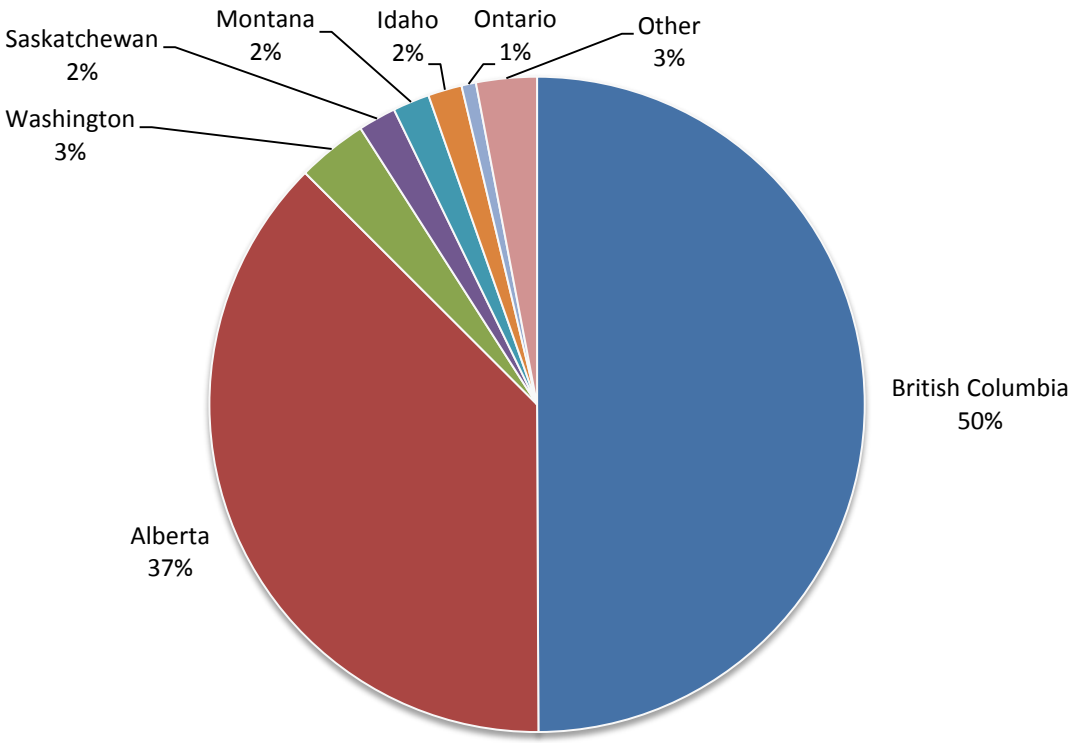


Figure 13. Destination jurisdictions of all watercraft inspected during the 2016 season. Other jurisdictions included 50 different provinces, territories, and states.

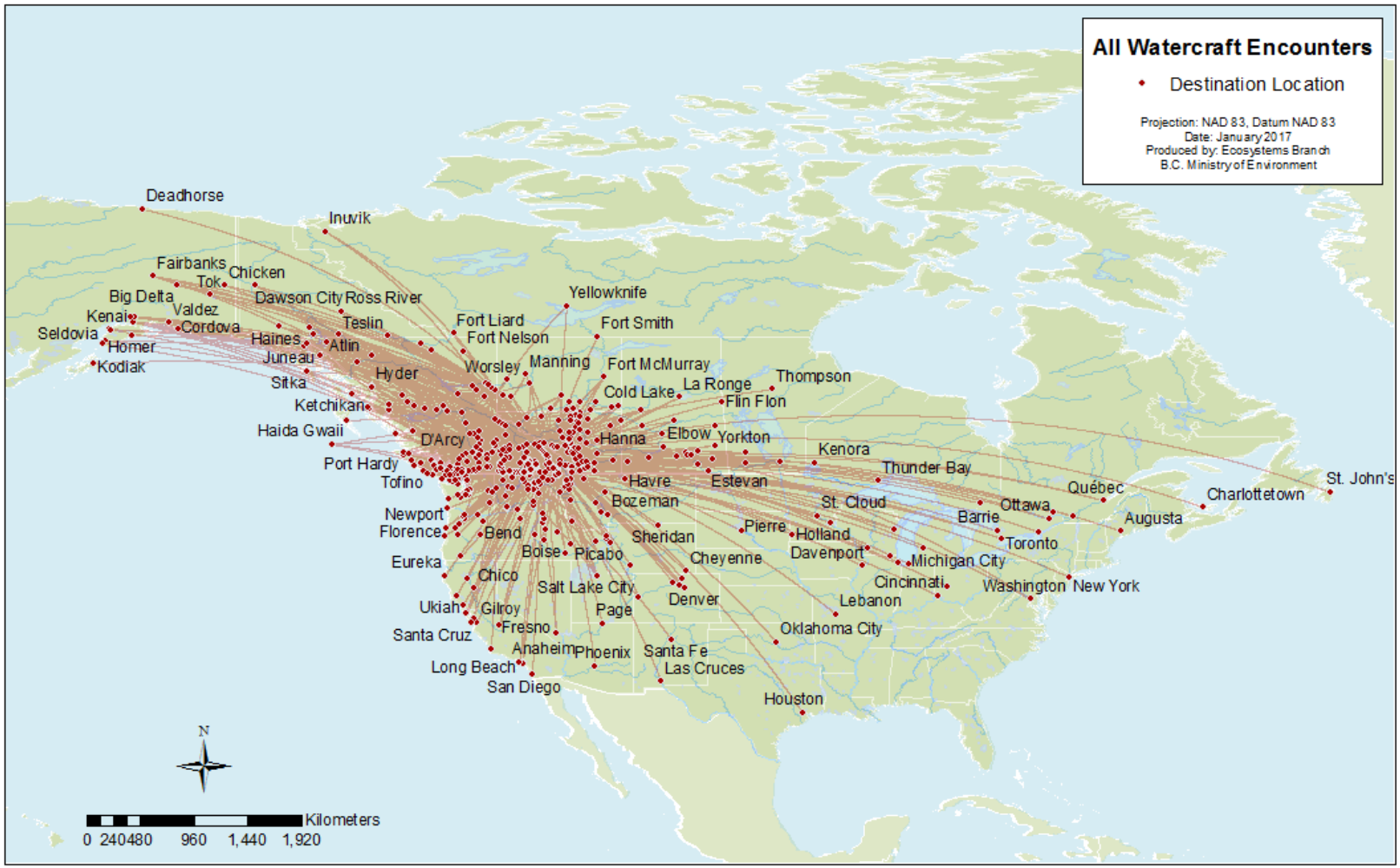


Figure 14. Destination location for all watercraft inspected from April to October 2016.

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. Figure 15 illustrates that compliance at inspection stations was very similar across all the months, and on average 81% of watercraft stopped at the inspection stations. This represents an increase of 9% from the 2015 compliance rate of 72%.

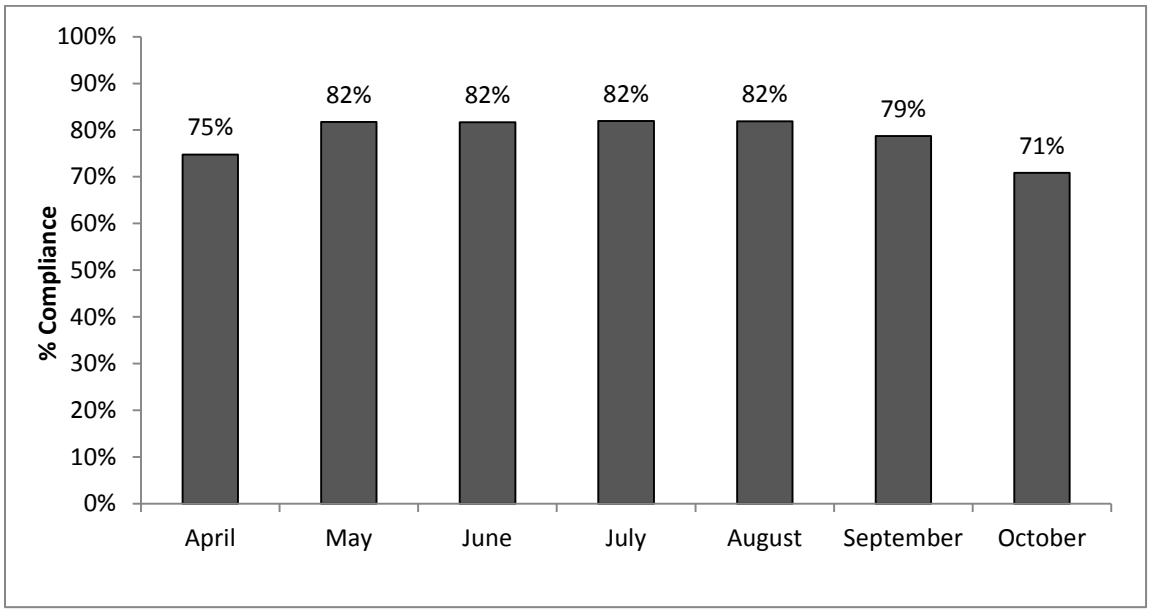


Figure 15. Percent compliance by month across inspection stations for 2016.

During the 2016 season the inspectors also recorded whether the vehicles that failed to stop were motorized or non-motorized. Figure 16 shows that, on average across all the months, 77% of the watercraft that failed to stop were non-motorized. For the 2016 season, new signs were placed at the inspection stations that showed images of non-motorized watercraft to help improve compliance (see Figure 2). The data from Figure 16 show that further education to the boating community is needed to improve compliance of non-motorized watercraft.

Figure 17 shows the compliance rates for each inspection station across the 2016 season. Compliance rates ranged from 95% at the Osoyoos border crossing to 56% at the Laidlaw weigh scale situated on Highway 1 in the Lower Mainland.

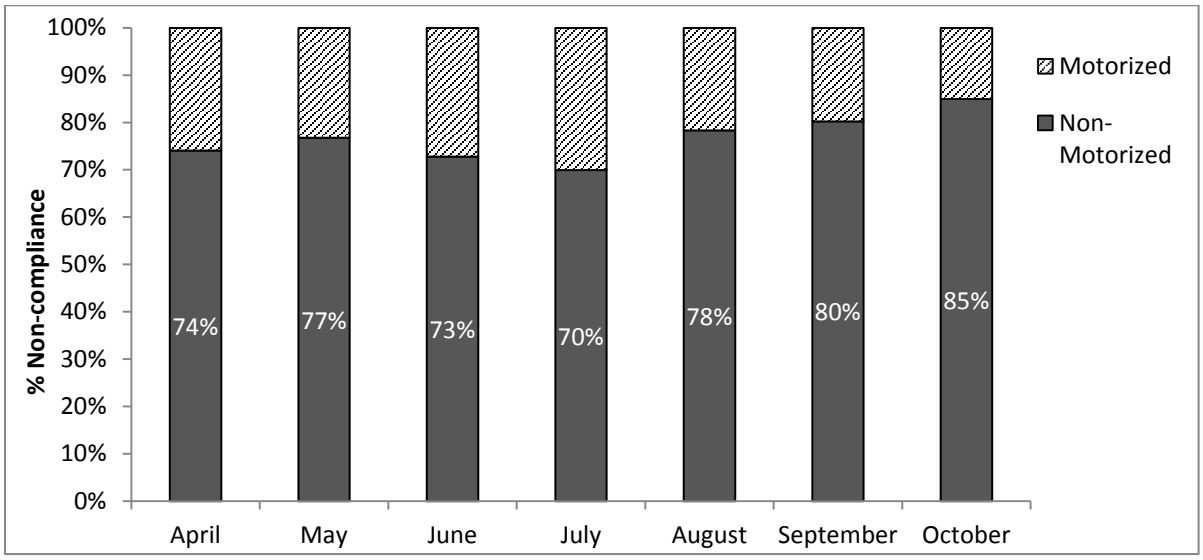


Figure 16. Percent of non-compliant watercraft that were motorized vs. non-motorized.

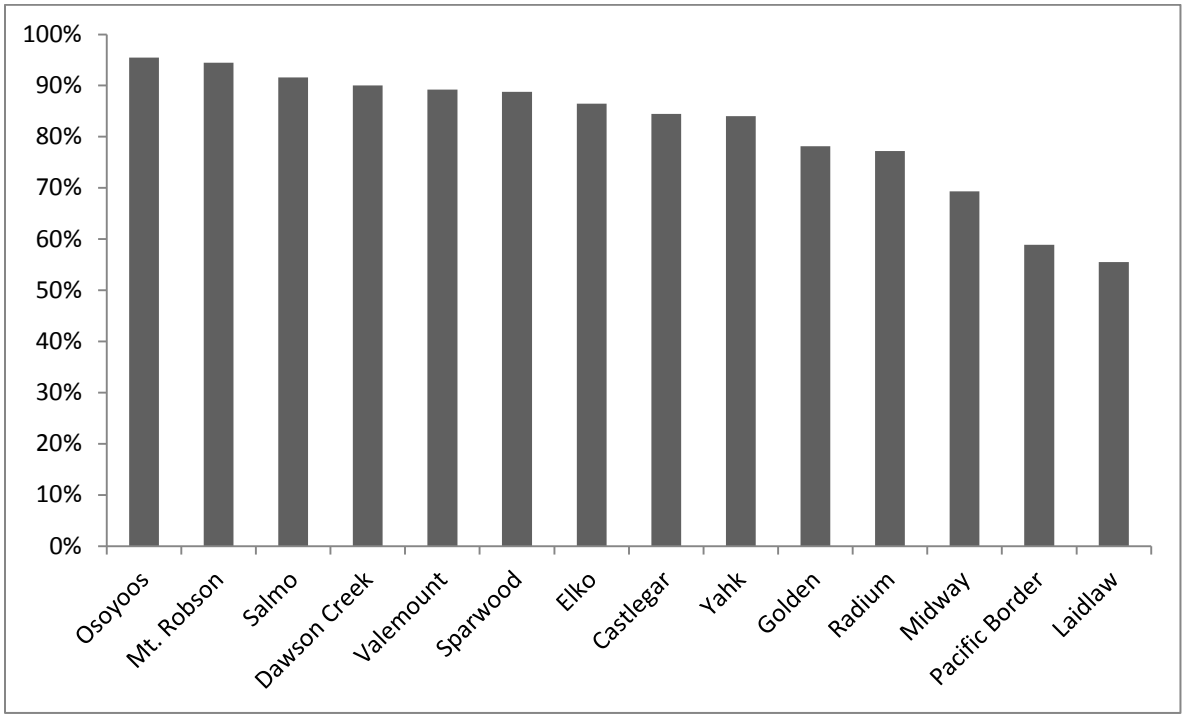


Figure 17. Percent compliance by inspection station for the 2016 season.

The inspectors also recorded whether each watercraft coming through the station had been through a previous inspection. Figure 18 shows the per cent of boats that stopped at an inspection station and which had already been through an inspection station. The highest percentages of previously inspected boats appeared to occur at Yahk, Sparwood, Elko, Salmo, Radium, and Golden. This highlights 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. All of these locations, except for Radium and Salmo, were also ranked highest for encounter frequency (see Figure 4), indicating the effectiveness of these particular stations.

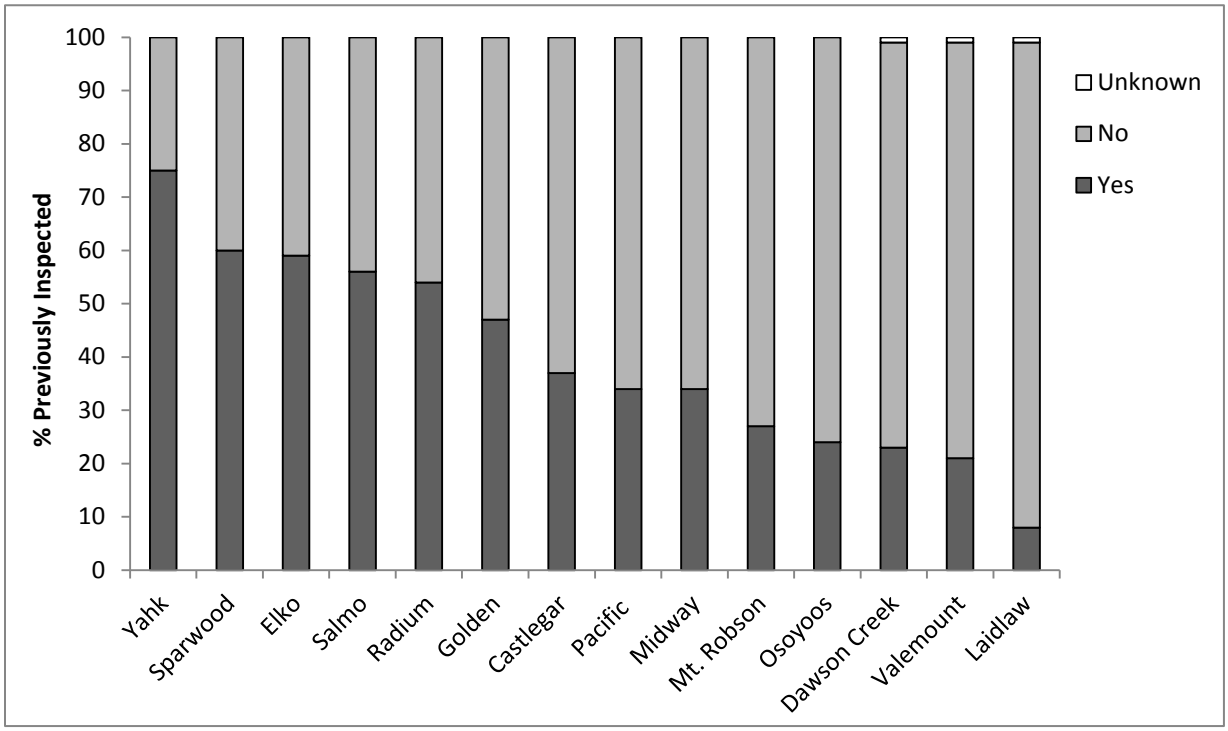


Figure 18. Per cent of watercraft intercepted per inspection station that had been previously inspected.

3.2 HIGH-RISK WATERCRAFT ENCOUNTERS

3.2.1 By Station and Month

A total of 685 high-risk watercraft were encountered during the 2016 season, 126 of which were inspected during April and May, which indicates the importance of opening the inspection stations on April 1st. In both 2015 and 2016, the total number of high-risk boats inspected peaked in July. In 2016, the total numbers of high-risk boats were very close in June and August, and in May and September, which indicates a general increase in watercraft volume in the spring and decrease in the fall.

There was a large decrease in the number of high-risk boats intercepted during September to October: from 65 boats to 9 (Figure 19); however, it is important to note that inspection stations were only operational until October 15 so there was not a full month of data.

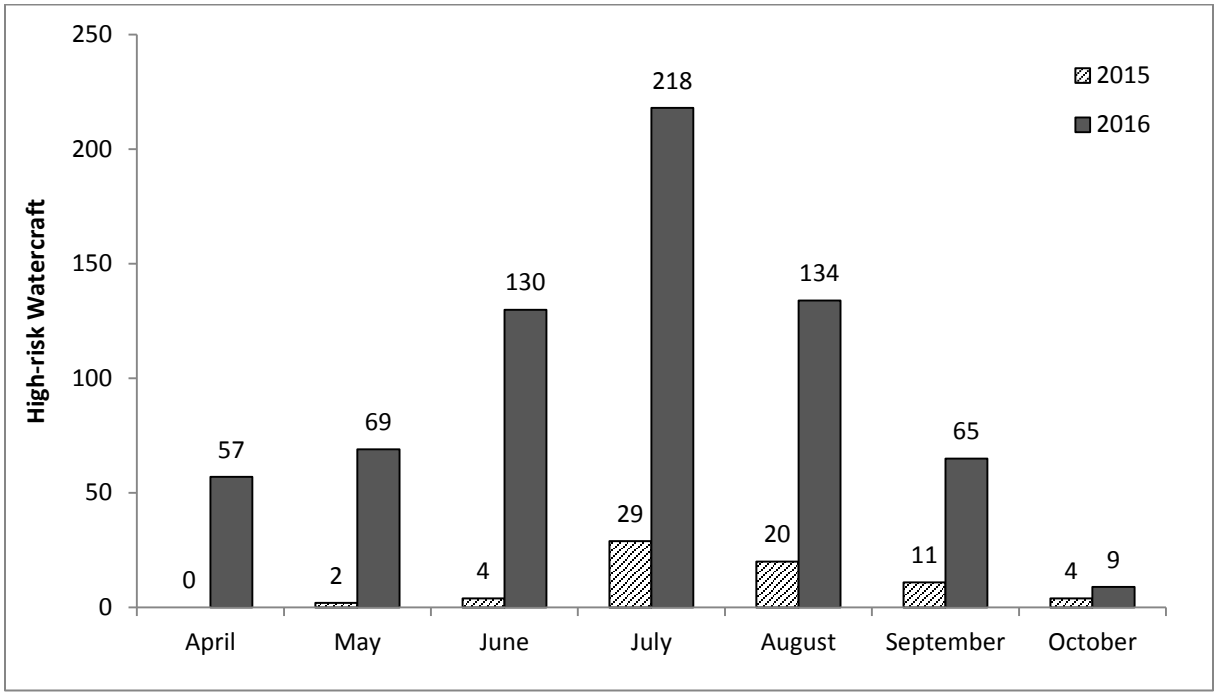


Figure 19. Total high-risk watercraft encounters across the 2016 season. Three high-risk boats were intercepted in March 2016 and are not included in this chart.

Figure 20 illustrates the number of high-risk watercraft encounters across inspection stations. The Golden inspection station intercepted the most high-risk watercraft (157), followed by Radium (143), Dawson Creek (70), Mt. Robson (68), and Osoyoos (38). As previously stated, the Dawson Creek and Osoyoos inspection stations had very low overall encounter frequencies (see Figure 4) but higher numbers of high-risk boats relative to other inspection stations. These data clearly indicate the importance of the April 1st start date. In future years of the Program, earlier start dates may be trialed in February and March.

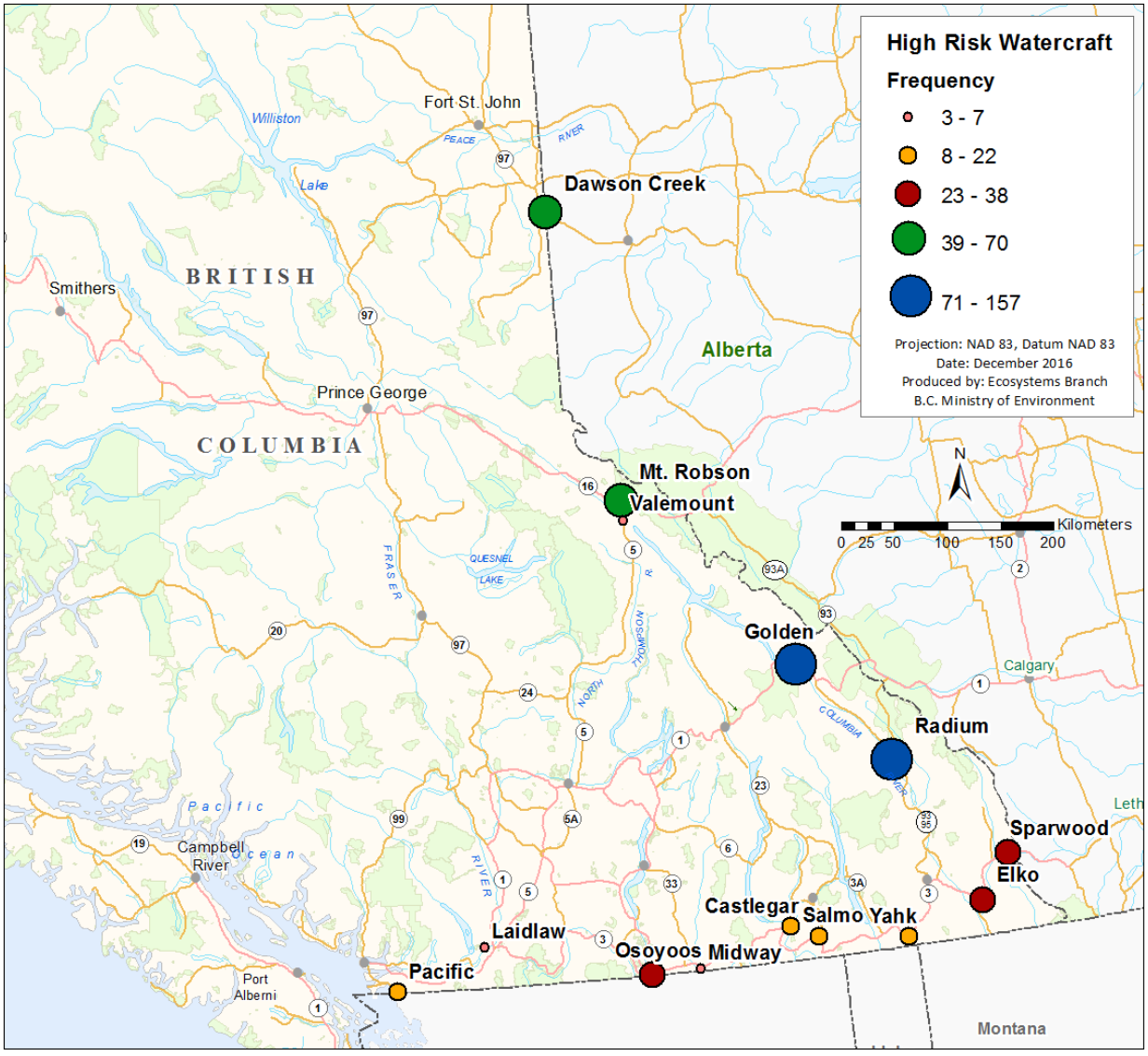


Figure 20. The number of high-risk watercraft by inspection station for the 2016 season.

3.2.2 Source and Destination Locations

Of the 685 high-risk watercraft identified by inspection crews, 160 came from Ontario (23%), 76 from Saskatchewan (11.1%), 75 from Manitoba (11.0%), 73 from California (10.7%), and 52 from Arizona (7.6%). The remaining 36.2% came from 42 different provinces and states (Figure 21 and Figure 23).

Of the high-risk watercraft inspected, 23% were destined for waterbodies in the Kootenay region, 14% were destined for waterbodies in the Okanagan region, 12% for the Lower Mainland, 8% for the Thompson-Nicola, and 6% for Vancouver Island (Figure 22 and Figure 24). The remaining 29% of the high-risk watercraft were destined for waterbodies outside of B.C. If a watercraft was still considered high-risk following inspection/decontamination, the destination jurisdiction was notified.

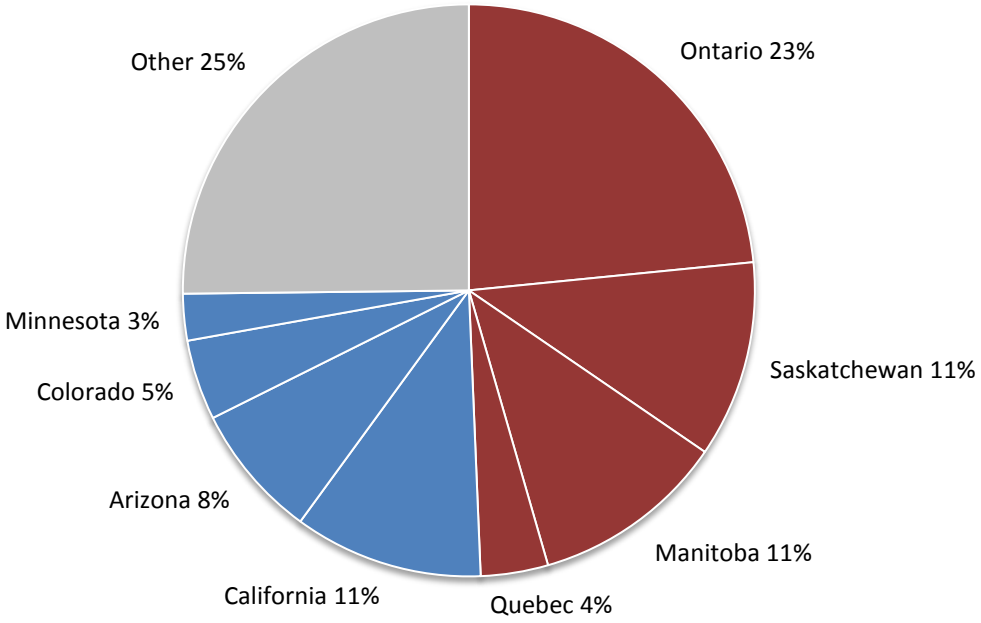


Figure 21. Source locations of all 685 high-risk watercraft identified during the 2016 season. Other jurisdictions consisted of different provinces and states.

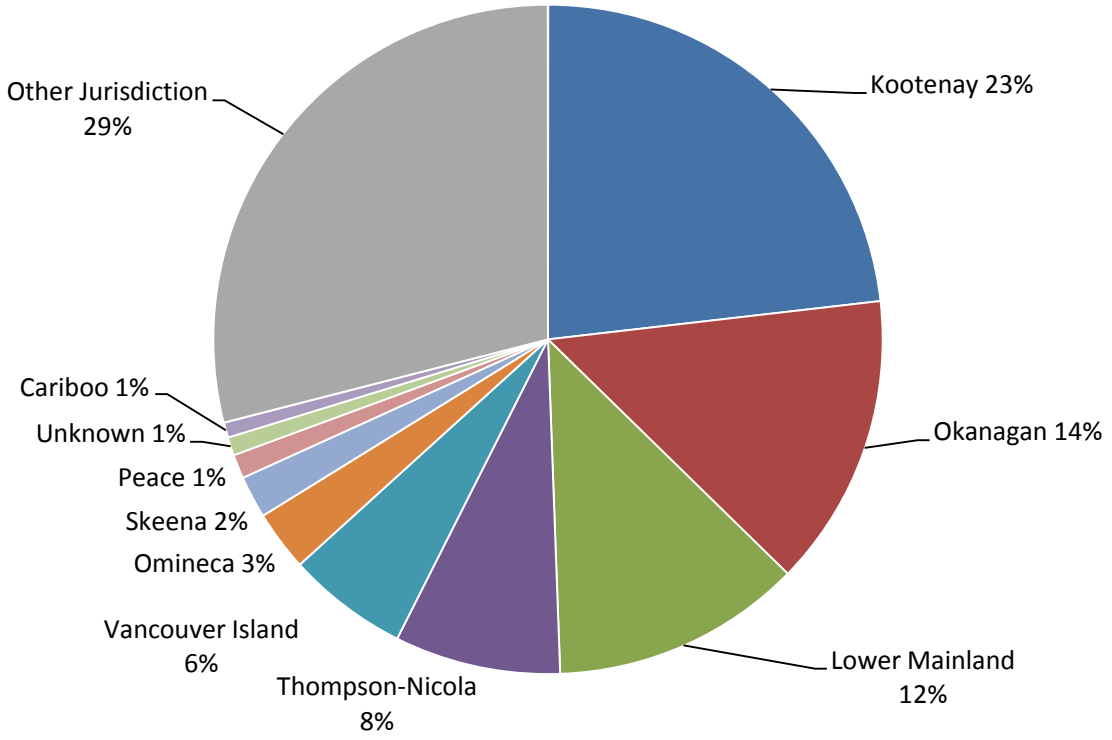


Figure 22. Destination regions of all 685 high-risk watercraft identified during the 2016 season. Other jurisdictions consisted of Alberta, Alaska, Colorado, Idaho, Montana, Utah, Washington, and Yukon Territory.

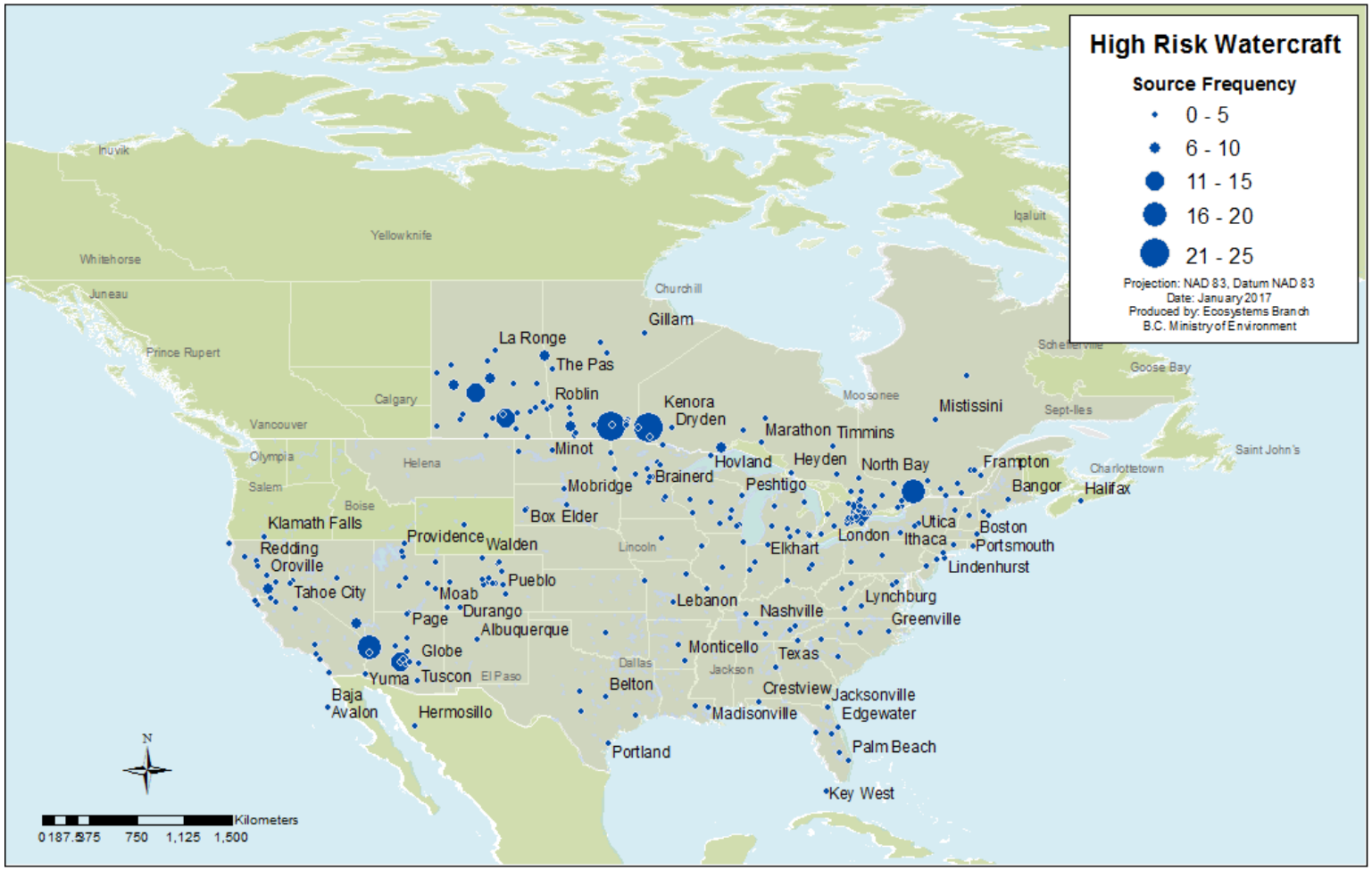


Figure 23. Source locations of the 685 high-risk watercraft inspected during the 2016 season.

Figure 24. Destination locations of the 685 high-risk watercraft identified during the 2016 season.

3.2.3 Watercraft Types

Despite the fact that canoes and kayaks comprised the highest percentage of the total number of watercraft inspected (34.5%), they represented very little risk with only 3.9% registering as high-risk. Conversely, small and large sailboats represented the smallest percentage of the total watercraft inspected (1%), but posed disproportionately higher risk at 8.3% and 14.7%, respectively. Other watercraft types that posed high risk included cabin cruisers (8.8%), dories/drift boats (6%), pontoon boats (5.9%), and jet boats (3.1%) (Figure 25).

These results are consistent with larger boats such as sailboats, cabin cruisers, and pontoon boats posing higher risk of infestation than smaller boats because they typically sit in infested waterbodies for long periods of time. However, canoes, kayaks, and small sailboats can still pose a risk of transporting standing water as they are more commonly moved between waterbodies from multiple jurisdictions in short periods of time. For this reason, all non-motorized watercraft types are required to stop at inspection stations and are treated the same as motorized watercraft during inspections.

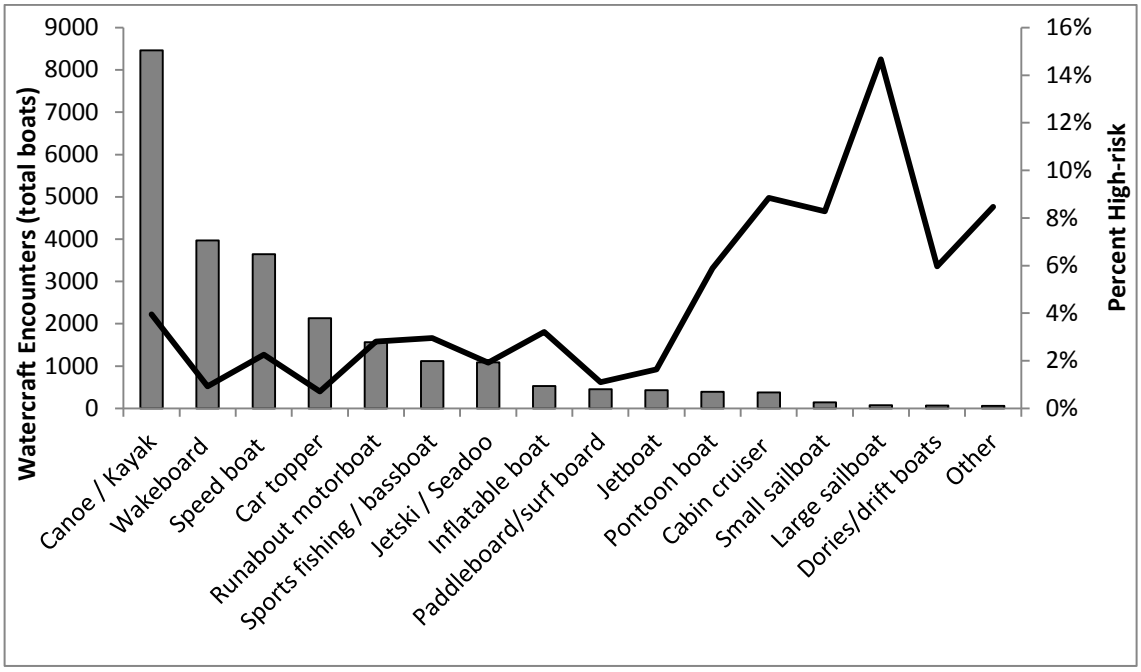
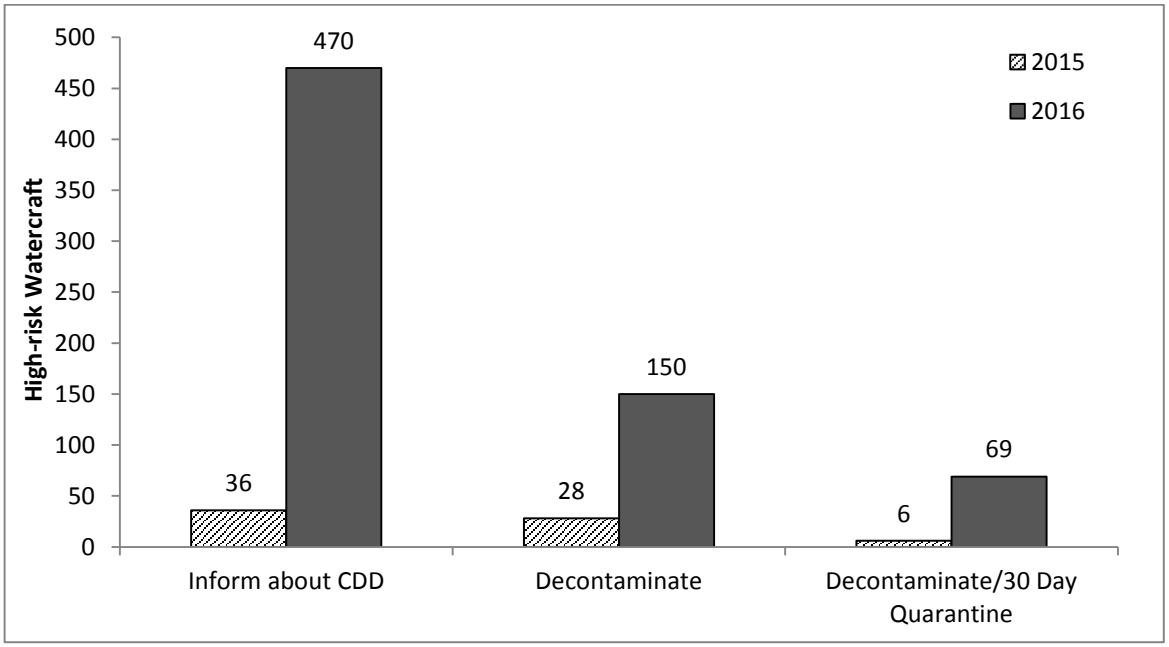


Figure 25. Total watercraft encounters by watercraft type (primary axis) and the per cent that registered as high-risk (secondary axis).

3.2.1 Inspection Findings

Of the 685 high-risk watercraft identified as coming from high-risk jurisdictions, 150 were decontaminated. Of those, 69 were issued quarantine orders to allow for sufficient drying time of 30 days out of water (Figure 26). Of the 150 watercraft that were decontaminated, 17 were confirmed to have adult invasive mussels. The remaining 470 high-risk watercraft received full inspections with no signs of standing water or invasive mussels and had been cleaned, drained and dried. These watercraft did not receive decontamination, based on clean inspections and having been out of the water for over 30 days, or having arrived from a previous successful 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 371 of the 685 high-risk watercraft had been through a previous inspection station within either B.C. or another jurisdiction.



CDD = Clean, Drain, Dry

Figure 26. Actions taken by inspection crews following inspection of high-risk watercraft.

3.3 MUSSEL INFESTED WATERCRAFT

A total of 17 mussel infested watercraft were encountered, (either through notifications or at inspection stations), of which 10 had been through a previous inspection station in another jurisdiction and of which B.C. had received advanced notification. This highlights the importance of having several layers of inspection stations to increase the likelihood of detection. Of the total mussel fouled boats, 10 were initially intercepted and inspected at the Golden inspection station on Highway 1.

The highest number of mussel infested watercraft encounters took place in August with five, followed by four in April, and three in June and September. The four mussel fouled boat encounters in April demonstrate the importance of having inspection stations operational at the beginning of boating season in the spring. Figure 27 compares these results to the 2015 field season, by month.

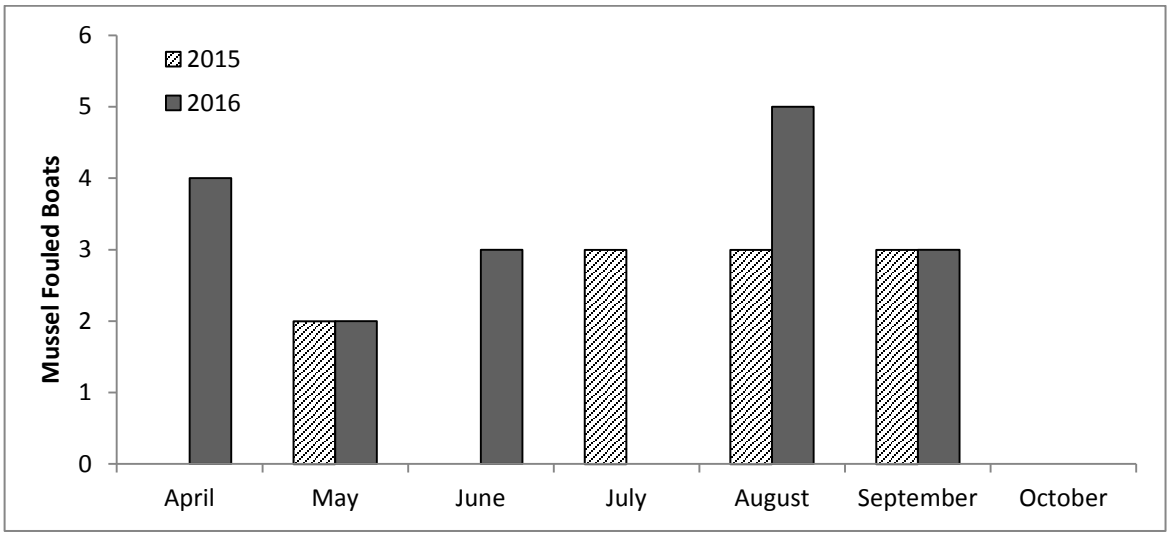


Figure 27. The number of mussel infested watercraft of the 2015 and 2016 seasons, by month.

Of the mussel fouled boats, 14 had come from Ontario, 1 from Lake Winnipeg, 1 from Lake Michigan, and 1 from Lake Mead, Nevada (Figure 28). The proportion of mussel fouled boats that had come from Ontario increased from 64% in the 2015 pilot season to 82% in the 2016 season, representing an 18% increase. With only 1 of the 17 mussel fouled boats coming from a southern U.S. state, this illustrates the continued threat coming from the eastern mussel infested provinces and states.

The destination of the mussel fouled boats by region was highest for the Lower Mainland/South Coast with 11 boats (59%), followed by the Thompson-Nicola, Okanagan, and Vancouver Island regions at two boats each (12%), and the Kootenay region with one mussel fouled boat (6%) (Figure 29 and Figure 30).

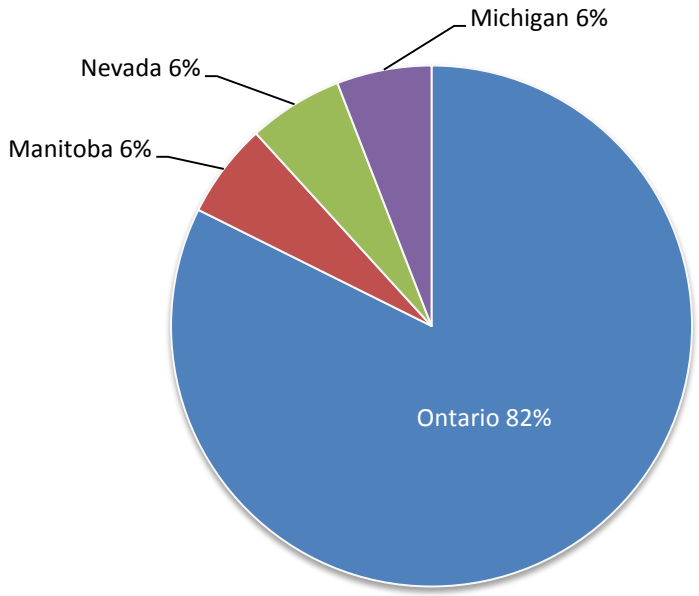


Figure 28. Source provinces and states of the 17 mussel fouled watercraft intercepted during the 2016 season.

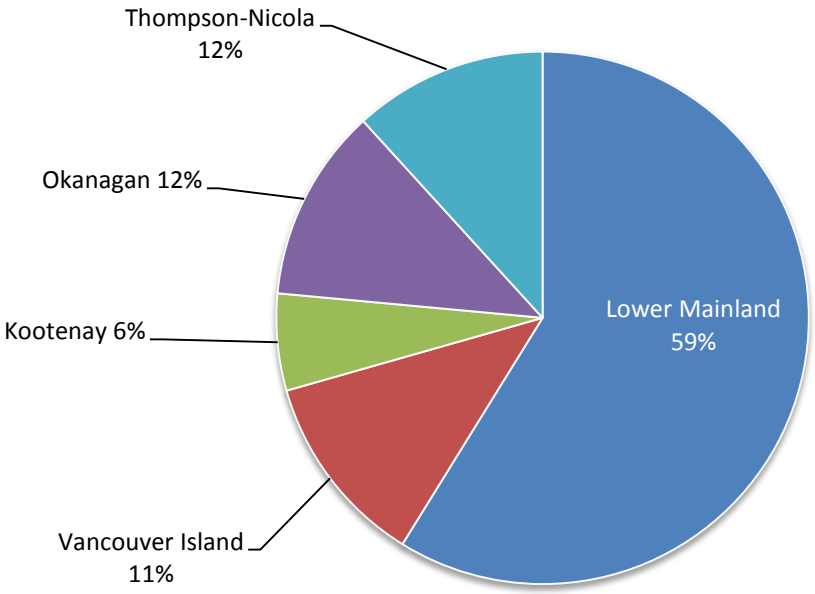


Figure 29. Destination regions of the 17 mussel fouled watercraft intercepted during the 2016 season.

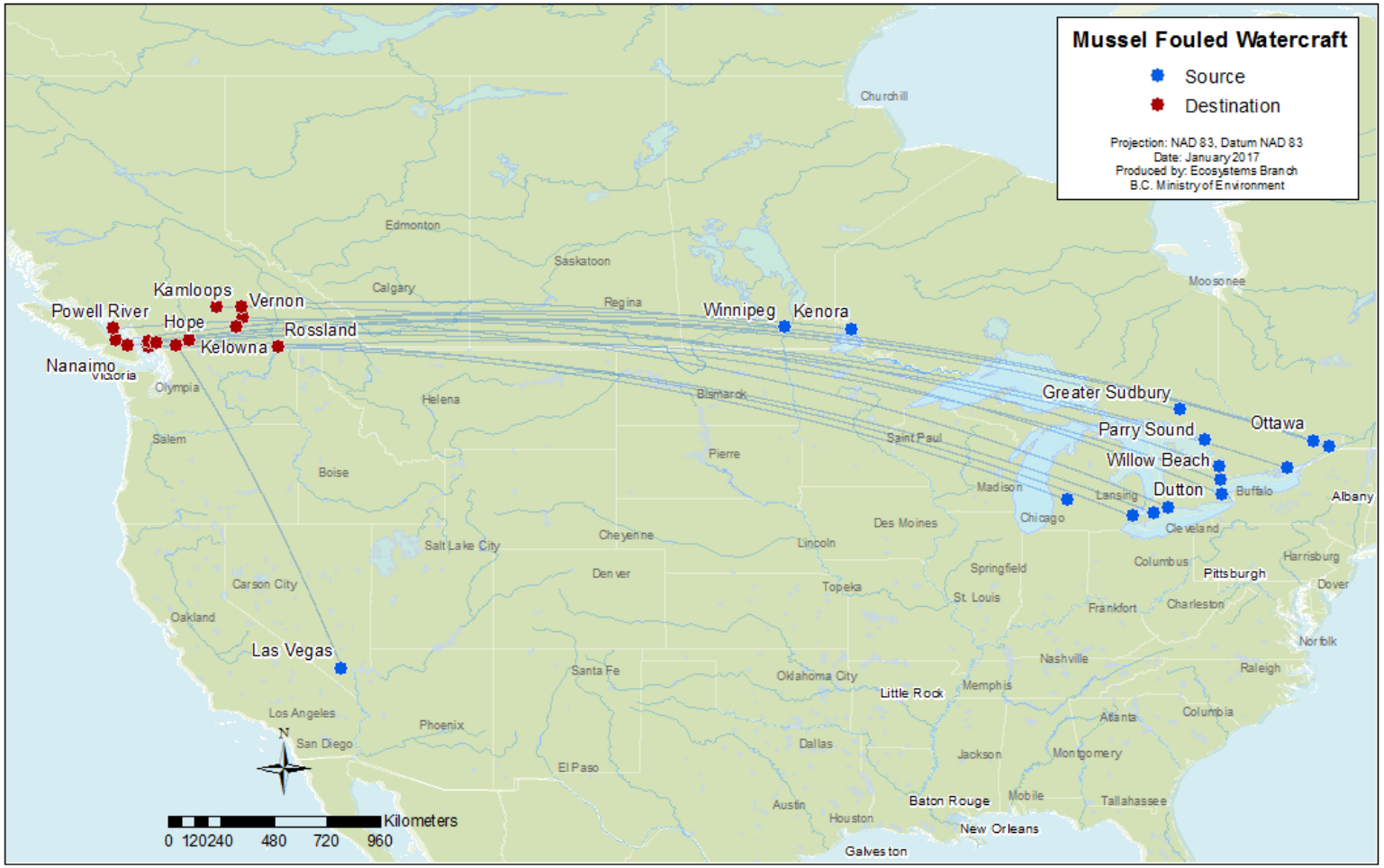


Figure 30. Source and destination locations of mussel infested watercraft decontaminated during the 2016 season.

3.4 COMMERCIALLY HAULED WATERCRAFT

Of the total watercraft inspected (just over 24,500), 192 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 9% of high-risk watercraft were commercially hauled, 53% of mussel infested watercraft (9 of the 17 boats) were commercially hauled (Figure 31).

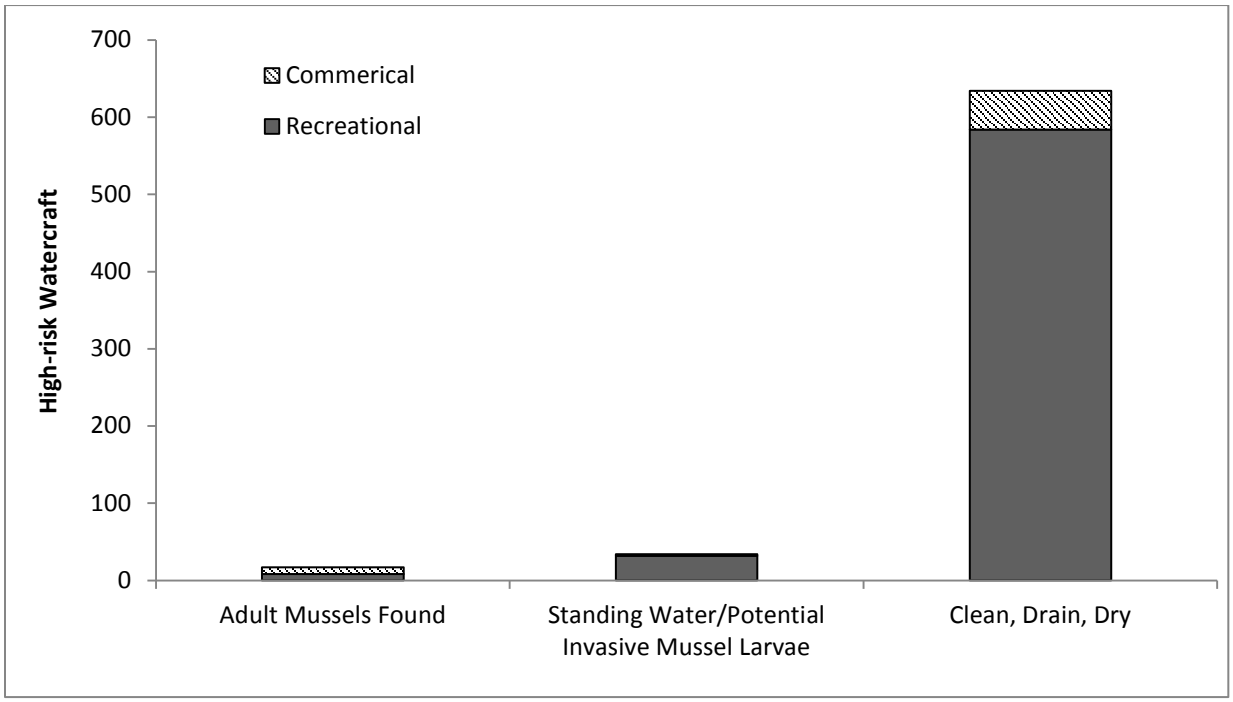


Figure 31. Proportion of high risk watercraft commercially or recreationally hauled across different inspection findings for the 2016 season.
Due to the microscopic size of the mussel larvae, their presence cannot be confirmed at the inspection station, so the risk of standing water is assessed based on where the boat was coming from and how long it has been out of the water.

Figure 32 illustrates the source location for all 192 commercially hauled watercraft inspected. The most common source locations were boats coming from Alberta and several south eastern states such as Pennsylvania, Texas, and Florida. The Golden inspection station intercepted the highest number of commercially hauled watercraft (62), followed by the Pacific border crossing (37), and the Osoyoos border crossing (36). This is expected since the Trans-Canada Highway, where the Golden station is located, is a primary travel route for commercially hauled watercraft. Interestingly, despite the Elko station being the highest for watercraft encounter frequency it only saw three commercially hauled watercraft, indicating Highway 3 is not a major route for commercially hauled watercraft.

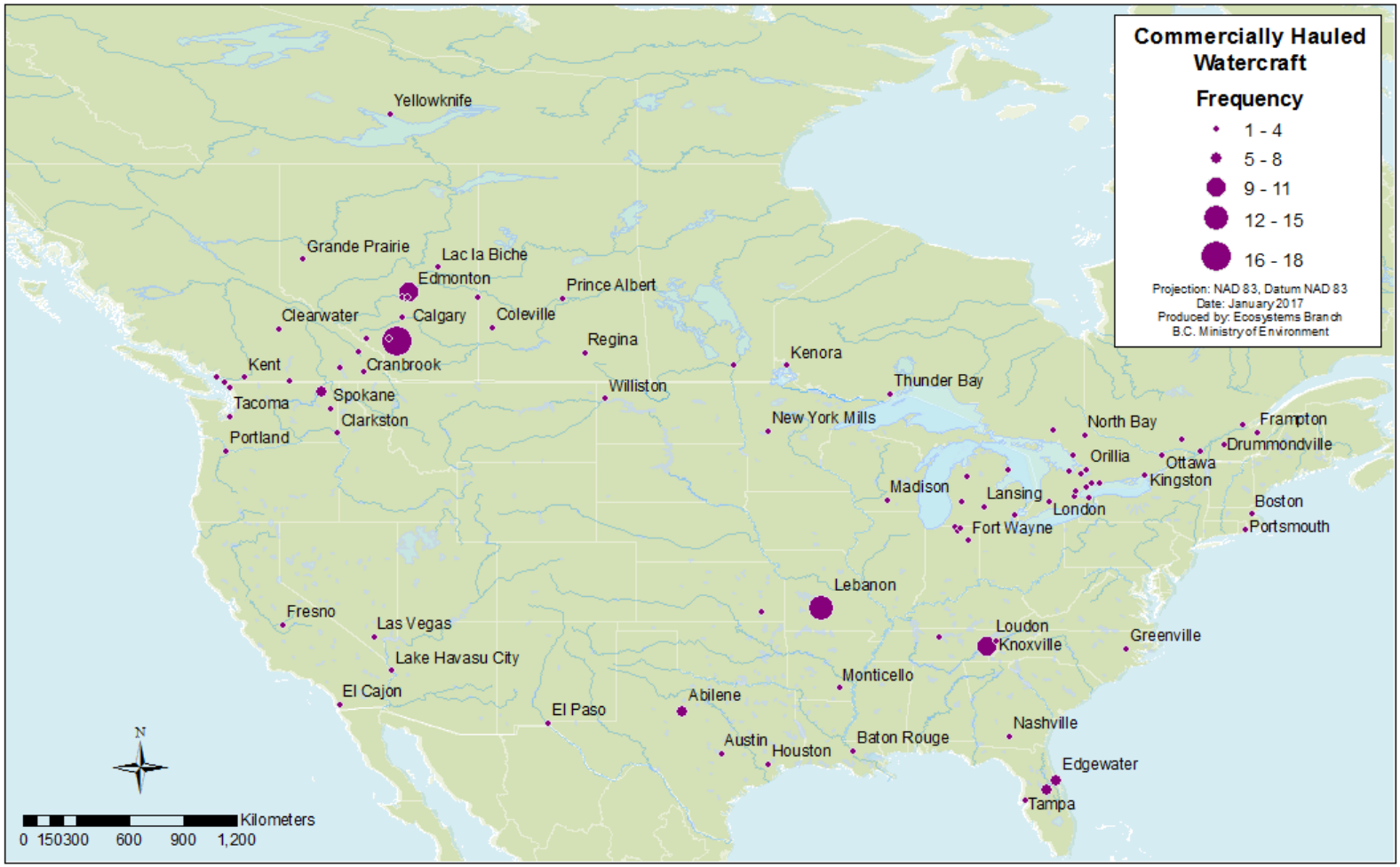


Figure 32. Source location of commercially hauled watercraft.

4. OUTREACH/EDUCATION ON CLEAN, DRAIN, DRY

4.1 INSPECTION STATIONS

It is estimated that inspection crews interacted with approximately 50,000 people across all the inspection stations during the 2016 season to promote the message of Clean, Drain and Dry. 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 /CDD. For the 2016 season, watercraft owners having previous knowledge of AIS/CDD averaged 62%, which is similar to levels from the 2015 pilot season. It appeared that previous knowledge of AIS/ CDD was highest at the end of the 2016 season (Figure 33), indicating that the program and other outreach sources, such as local stewardship groups, had served to increase the public's awareness.

Information on the source of previous knowledge of AIS / CDD was also collected. Figure 34 shows that the top source was the previous inspection station visited (56%), followed by word of mouth (8%), TV advertising/news (5%), brochures (5%). and highway signs (4%). These data provide important information about how to effectively target the boating community to raise awareness about AIS/CDD in future years of the program.

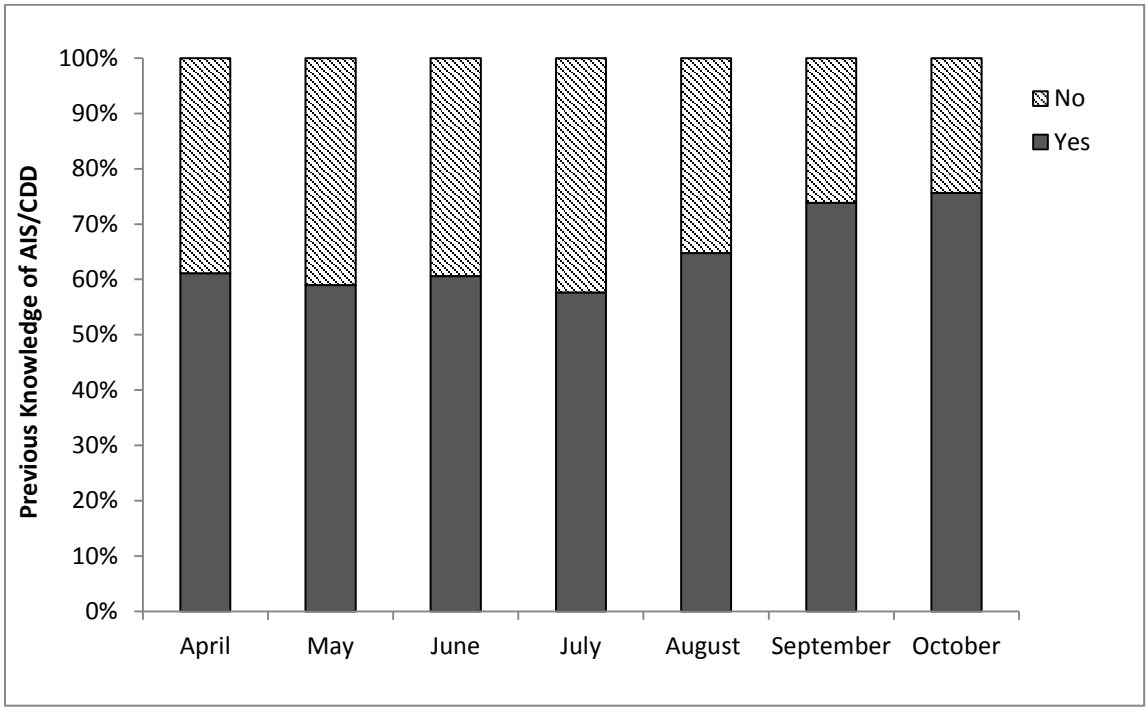


Figure 33. Watercraft owners' previous knowledge of aquatic invasive species and/or Clean, Drain, Dry across each month of program operations in 2016.

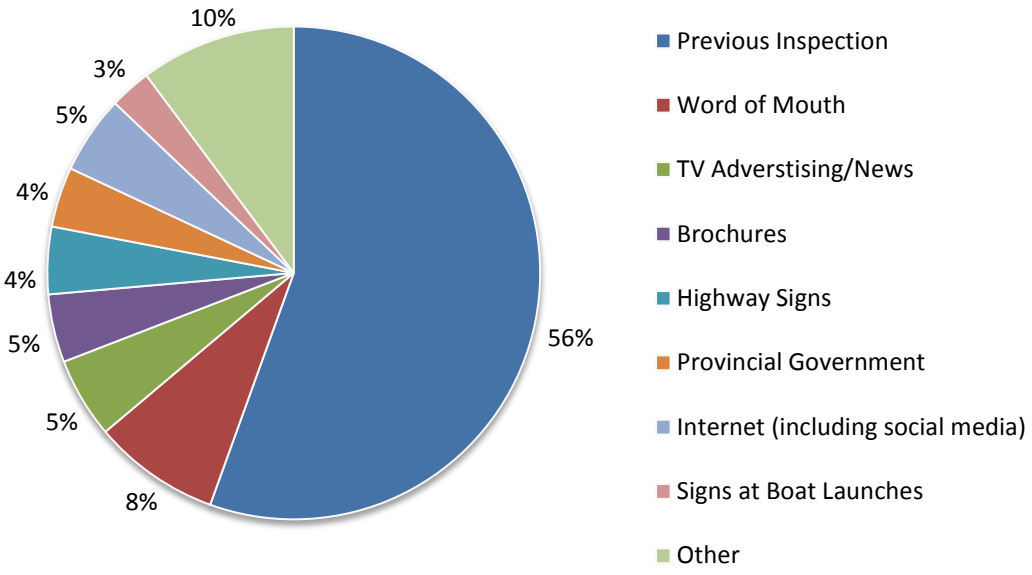


Figure 34. Sources of previous knowledge of aquatic invasive species or Clean, Drain, Dry. Other sources of knowledge include but are not limited to: work-related training, radio, newspaper, local government outreach, regional invasive species councils, magazines, the Invasive Species Council of B.C., and boat licensing courses. Data were collected from boaters attending inspection stations.

Public interest in the program was so high that a new category had to be added to the data forms to account for members of the public without boats who were voluntarily stopping at stations to get more information about AIS. Over the entire season, 419 people voluntarily stopped at an inspection station to get more information. This is a very positive sign of the public support and interest in the Program.

4.2 PARTNER SURVEYS AND QUESTIONNAIRES

Numerous partner groups also participated in outreach during the 2016 season. The Okanagan and Similkameen Invasive Species Society (OASISS) and Columbia Shuswap Invasive Species Society (CSISS) are two groups that attended boat launches to inform boaters about the threat of ZQM to B.C. These two groups performed surveys at local boats launches and asked a series of questions that aligned with information being collected at the Provincial inspection stations. Questions asked included how boaters had previously received knowledge of AIS/CDD. Figure 35 and Figure 36 indicate results from OASSIS's 2016 questionnaire and CSISS's 2016 survey. In addition to receiving AIS/CDD knowledge from inspection stations, these two methods of data collection highlighted the educative powers of television and radio advertising, and signage—particularly highway inspection signs and billboards. The data collected at boat launches showed a much higher percentage of previous knowledge from signage, in particular highway signs and billboards (23% and 38% respectively), relative to the data collected at the Provincial inspection stations (4%).

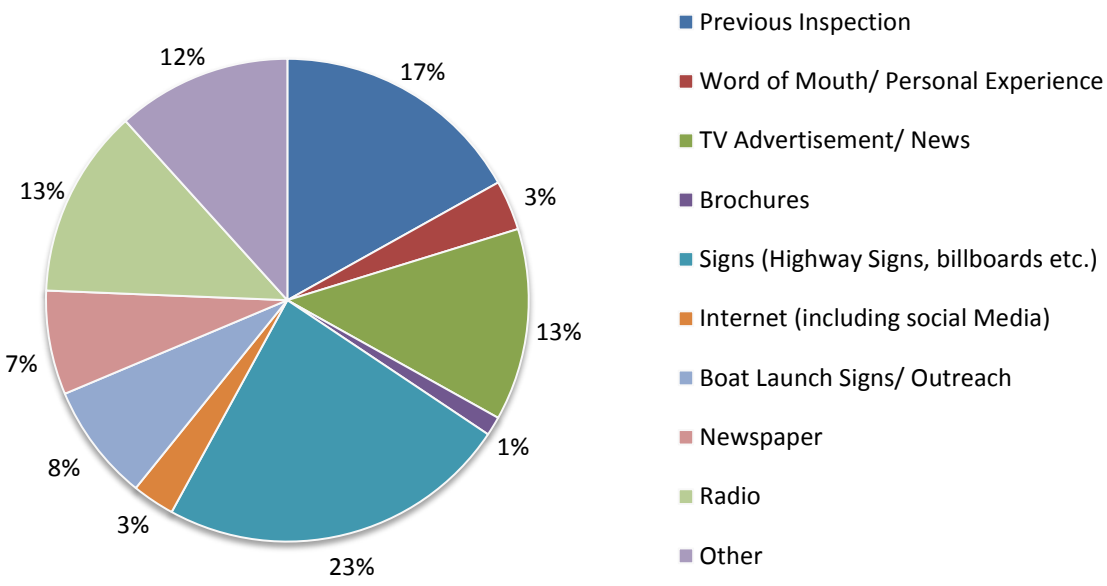


Figure 35. This chart indicates sources of previous knowledge of aquatic invasive species and/or Clean, Drain, Dry. Data obtained from the 2016 OASSIS Boat Launch Questionnaire. Other sources of knowledge include but are not limited to: Canada/US border checks, boat-related courses, boat repair shops, information booths, OASSIS outreach events, personal reading/research, related work, and the provincial government.

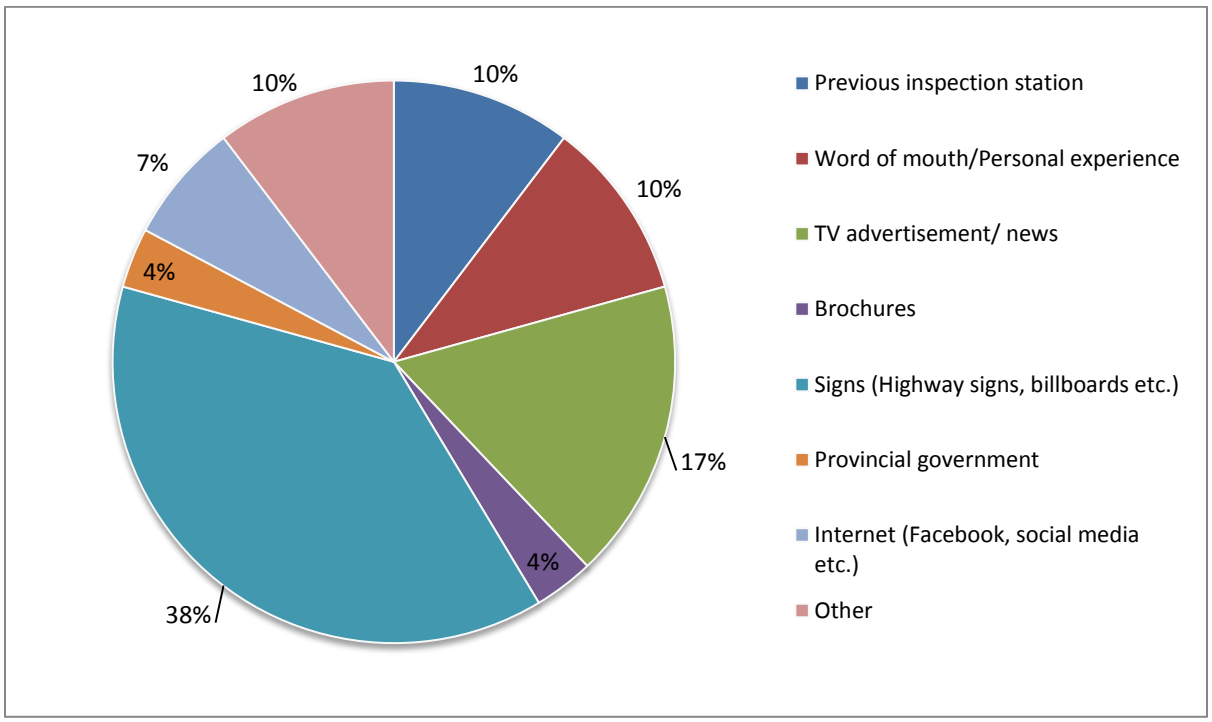


Figure 36. Sources of previous knowledge of aquatic invasive species and/or Clean, Drain, Dry. Data obtained from 2016 CSISS Boat Launch Survey.

4.3 OUTREACH TOOLS

During the 2016 season, a 26 ft. mobile outreach trailer was purchased in partnership with the COS (Figure 37). This trailer will tour around the province to key outreach and education events such as boating fishing shows to promote the message of Clean, Drain, Dry and raise awareness about invasive mussels and other high-risk aquatic invasive species.

Outreach/education costs also included the purchase and training of a multipurpose mussel detection dog (Figure 38). The primary handler of the dog is the COS program liaison. The dog is being trained to sniff out mussels as well as firearms and bear parts, and will also be used in evidence recovery cases.

A province wide mail-out to over 200 marinas and businesses in the boating industry was carried out in winter 2016/2017 using data collected during the 2016 season. The mail-out provided information about the Program, about CDD and how to report high-risk boats being transported into B.C.

Figure 37. Mobile outreach trailer that will tour and attend outreach events in partnership with the COS.

Figure 38. Kilo is the newest addition to the Program team and is being trained as a multipurpose mussel detection dog.

4.4 OUTREACH EVENTS

While the Provincial inspection stations were the first priority of the Program, when time permitted 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 2 provides a detailed list of the events attended during the 2016 season.

Program staff worked closely with event organizers and participants of the Land Rover Kelowna Melges 24 Canadian National Championship which took place in Okanagan Lake June 24th–26th 2016. The Penticton inspection crew decontaminated several sailboats participating in the event that came from high-risk jurisdictions. This was the first international boating event that the Program worked with, and feedback from the event organizers and participants will help to streamline the inspection process for participants bringing their boats into B.C. for future events.

Table 2. Outreach events attended during the 2016 inspection season.

Event	Date(s)	Location	Total people in attendance
2016 B.C. Boat & Sportsman/Hunting Show	March 4th - 6th 2016	Abbotsford	~35,000
2016 B.C. Interior Sportsman Show	April 9/10th 2016	Kelowna	4,000-5,000
2016 Gun & Sportsman Show	April 9/10th 2016	Dawson Creek	6,000-7,000
East Kootenay Trout Hatchery 50th Anniversary	April 23rd 2016	Fort Steele	1,400
Cabellas Grand Opening	June 25/26th 2016	Langley	1,500
Land Rover Kelowna Melges 24 Canadian National Championship	June 24/25th 2016	Kelowna	n/a
Lake Windermere Ambassadors Summer Splash	August 7th 2016	Invermere	40
Huntmania Sportsman Show	August 6 /7th 2016	Fort St. John	150*
Cabellas Fall Events	August 20th & 28th 2016	Langley	n/a
Mosquito Creek Boat Show	September 9th - 11th 2016	North Vancouver	240*
Vancouver International Boat Show	Jan 18th - 22nd 2017	Vancouver	~31,000
2016 B.C. Boat & Sportsman/Hunting Show	March 3rd - 5th 2017	Abbotsford	~35,000

*Number of people that the crew interacted with at the booth.

4.5 MARKETING/MEDIA CAMPAIGNS

At the start of the 2016 season the Program launched a marketing campaign to promote the CDD message. The campaign included a new mobile friendly website: gov.B.C./ca/invasivemussels and advertising via Facebook and other online platforms (Figure 39). The total number of views to the Invasive Mussel website home page from June 28th to September 5th was 7,997. During that same period there were 7 million impressions on Facebook (number of times people saw a Facebook post) and 127,075 Facebook post engagements (likes, comments, shares, and link clicks).

Figure 39. Facebook advertisement promoting the message of Clean, Drain, Dry as part of the online marketing campaign.

MOTI also made numerous social media posts about the Program to promote the CDD message and the importance of stopping at the mandatory inspection stations. MOTI tracked approximately 25,900 reaches/visits across eight Facebook posts, four Tweets and one post on the Tran B.C. blog between April and September 2016.

Through strong support and collaboration with MOTI, invasive species messages were displayed on overhead highway reader board signs throughout the Province (Figure 40). The messages displayed "Stop Aquatic Invasive Species, Clean, Drain, Dry Your Watercraft" and the Program received very positive feedback from the public.

Figure 40. Ministry of Transportation and Infrastructure overhead reader board signs displaying Aquatic Invasive Species / Clean, Drain, Dry messaging.

5. LAKE MONITORING

Ongoing monitoring of B.C. lakes to test for the presence of invasive mussel veliger larvae is an important component of the Program. Monitoring is a critical first step in the early detection and rapid response to prevent invasive mussels from becoming established in the province. Veliger monitoring has been taking place in B.C. lakes since 2011 and the number of lakes sampled has increased substantially over the years.

Further information on the sampling protocols used for ZQM veliger monitoring can be found in the *B.C. Aquatic Invasive Species Survey Methods* [1]. The collected water samples are sent to a lab in B.C. and analyzed using cross-polarized light microscopy, the standard method used by other jurisdictions for ZQM veliger monitoring and detection.

In 2016, 233 samples were collected from 98 lakes throughout B.C. (Figure 41). Samples were collected by ENV and FLNRO regional staff, B.C. Hydro, and the 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), Okanagan and Similkameen Invasive Species Society (OASISS), and Northwest Invasive Plant Council (NWIPC). See Appendix B for results from cross-polarized light microscopy analyses of the 2016 samples.

[1] British Columbia Aquatic Invasive Species Survey Methods. 2015. Inter-Ministry Invasive Species Working Group. 42pp.

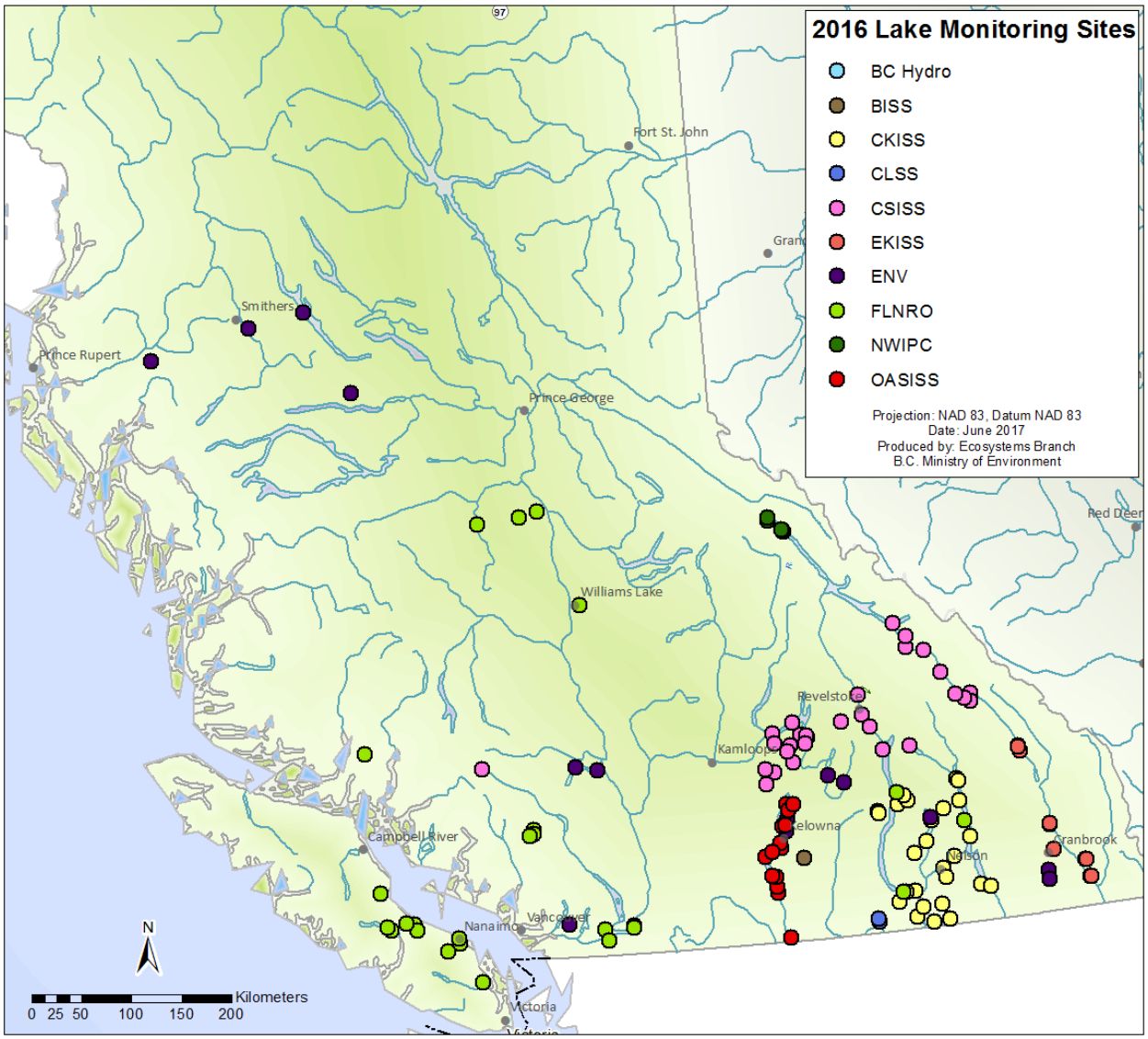


Figure 41. Locations of 2016 invasive mussel veliger samples collected by ENV and FLNRO regional staff, and regional invasive species committees.
Boundary Invasive Species Society (BISS), Central Kootenay Invasive Species Society (CKISS), Columbia-Shuswap Invasive Species Society (CSISS), Christina Lake Stewardship Society (CLSS), East Kootenay Invasive Species Society (EKISS), Ministry of Environment and Climate Change Strategy (ENV), Ministry of Forests, Lands and Natural Resource Operations and Rural Development (FLNRO), Okanagan and Similkameen Invasive Species Society (OASISS), and Northwest Invasive Plant Council (NWIPC). (See Appendix B for full list of samples and results).

6. RESEARCH

The Program has just completed its second year of operations. For a new program of this nature, it is critical that information on efficacy and compliance be collected, and to constantly identify ways to improve operations. Prior to the start of the Program, no data were available on boater movements in B.C. and no agency was tracking them. Hence, a standardised, real-time data collection process was established at the beginning of the Program to capture information on boater movements, compliance, awareness, enforcement actions taken, and level of risk associated with each watercraft. This information is used to determine the most effective positioning of inspection stations, and to monitor Program effectiveness.

The boater movement data collected also form the foundation of collaboration with the University of Alberta, Mathematical Biology Research Chair, which is developing a boater movement model to optimize boat inspection locations based on data collected by the Program. A boater movement model is also critical in case of a ZQM detection in B.C. waters, as it will identify where monitoring efforts should be placed in waterbodies having the highest risk for secondary introduction.

A significant gap that remains is an estimate of economic effects of ZQM in B.C. on aboriginal, commercial, and recreational fisheries. In order to quantify these effects, the Program is working with the University of British Columbia Fisheries Centre. The focus of the study is to quantify the impact that ZQM would have on salmonids in large lakes in B.C. This information will be an important to further understanding both the economic and ecological effects of ZQM if introduced into B.C.

7. PARTNERSHIPS AND COLLABORATION

Partnerships and collaboration are at the foundation of the Program. Establishing a new program of this complexity requires working with various levels of government in B.C., Canada, and the U.S. Within provincial government the Program is administered by staff within ENV Ecosystems Branch, and the COS.

The Program has also benefited from the active support of the provincial Inter-Ministry Invasive Species Working Group (IMISWG). Through the IMISWG, Program communications were amplified from MOTI highway billboards to Facebook and Twitter from multiple ministries, all reaching targeted audiences on the importance of the Clean, Drain, Dry message to reduce the risk associated with invasive mussels.

The Program also works with B.C. Parks, Service B.C., and FLNRO for program delivery, education and outreach, and monitoring. For example, the Program provided B.C. Parks with 68 permanent Clean, Drain, Dry signs for posting at boat launches in parks throughout the province.

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.

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. The first objective under the agreement was to develop an action plan to address shared priorities for ZQM prevention and rapid response.

At the federal level, the CBSA is the key partner in intercepting boats at the Canada/US border and sending them to Provincial inspection stations. It is the federal Aquatic Invasive Species regulation, under the federal *Fisheries Act*, that enables the CBSA to respond to mussel infested boats.

Inter-agency coordination is another critical component of the Program delivery. Coordination with Commercial Vehicle Safety and Enforcement and CBSA staff was critical for procuring commercial weigh scales and border crossing areas as highway inspection stations. In addition, Provincial inspectors delivered on-the-ground training to numerous agencies throughout the course of the season, including Commercial Vehicle Safety and Enforcement, CBSA, marina operators, the South Coast Marine Unit of the RCMP, and Metro Vancouver Water Works staff.

In future years of the Program, on-the-ground training will be expanded as possible to include other agency representatives such as Federal Fisheries Officers, Natural Resource Officers, Provincial Park Rangers, Municipal Police, and National Parks staff.

8. SUMMARY OF LESSONS LEARNED

8.1 REGULATORY CONSIDERATIONS

In response to the recent discovery of Zebra Mussels in Montana, and the high risk of mussel introduction to Saskatchewan, both jurisdictions were added to the CAS Regulation list (Schedule 5), enabling staff to order decontaminations and quarantines of boats originating from these jurisdictions. This change came into effect in March 2017 and is in place for the 2017 inspection season.

Under the current legislation, all watercraft entering B.C. and passing by an open inspection station must report in. Failure to stop at an open inspection station could result in a $345 fine. For the 2017 inspection season, a reader board will be in place at stations that are closed (after hours) that displays a toll-free number that motorists can call and report in if they are transporting watercraft. The information collected will be assessed to determine if the watercraft is a high risk for transporting mussels. If it is, a follow-up inspection will be conducted.

The Province will continue to work with partners to explore all regulatory options to maximize Program operations, including strengthening legislation to support mandatory inspection for all watercraft entering B.C.

8.2 INSPECTION STATION LOCATIONS

Despite having low watercraft encounter frequencies, the Osoyoos and Dawson Creek inspection stations had the highest percentage of high-risk watercraft, and saw boats coming from a large number of different jurisdictions. This highlights the importance of placing inspection stations at strategic locations to target boats coming in from outside of B.C., in addition to locations that target high volumes.

With 82% of the high-risk watercraft intercepted during the 2016 boating season identified as coming from the east, it is clear that the B.C./Alberta border crossings should continue to be a priority in 2017. The B.C./U.S. border crossings represent a challenge as the total number of crossings and volume of watercraft transported are relatively low at some locations. While these cannot be ignored, it is not an effective use of staff time to have a full-time inspection presence at each crossing. With the passing of the Federal AIS legislation in June 2015, the Province will continue to work with the CBSA to increase coverage along southern border crossings. This will allow inspection crews to focus efforts on a smaller number of higher traffic stations, and also to be alerted to high-risk watercraft wanting to enter B.C. from other U.S. border crossings.

8.3 WATERCRAFT INSPECTION SUMMARY

During the month of April, 57 high-risk watercraft were inspected and four mussel-fouled boats were intercepted, demonstrating the importance of opening inspections stations for April 1st. This largely targets 'snowbirds' who are coming up from southern jurisdictions.

The first night inspection trial that took place on August 24th provided the opportunity to identify appropriate lighting and safety procedures for operating at night. Additional data are needed during both weekdays and weekends to further assess the number of boaters traveling at night and to assess the operational requirements.

8.4 COMPLIANCE

The average compliance for the 2016 season (81%) is comparable to other jurisdictions' watercraft inspection program compliance rates after several years of operation. Increasing the size and number of highway signs at watercraft inspection stations should help improve compliance in future years. Other jurisdictions have also reported improved compliance following increased enforcement presence at stations, meriting exploration of this option in future years.

A number of factors affected the overall compliance at inspection stations. For example, the Osoyoos border crossing 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, which is situated on Highway 1 with high speed limits (120 km/h) and large volumes of semi-truck traffic passing the station. This made it more difficult for boaters to see the inspection station, and to safely slow down and pullover. Compliance was also affected by the physical station location of stations situated on roads (e.g., a corner, cloverleaf, or intersection), any nearby road construction (competing signage), and by targeted traffic direction (one versus two).

A total of 46 tickets and 36 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 onsite 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. At the start of the 2016 season, a vehicle transporting a watercraft from Ontario that failed to stop at an inspection station was reported to the local Conservation Officer (via the RAPP line), who then intercepted the vehicle and escorted it to the station for proper inspection. Invasive mussels were found during inspection and a complete decontamination of the watercraft was performed. The owner was issued a ticket for failing to stop at an inspection station.

Data from inspection stations show that a large proportion of non-compliant vehicles were transporting non-motorized watercraft. This indicates a need for improved highway signage to educate boaters on mandatory watercraft inspections at stations for non-motorized watercraft such as canoes, kayaks, and paddleboards. This will be addressed for future years of the program.

8.5 HIGH-RISK WATERCRAFT

For safety, legislative and logistical reasons, it was not always possible for high-risk watercraft to be fully inspected and decontaminated at a highway inspection stations while a watercraft was being transported. During the 2016 season this occurred primarily for commercially hauled watercraft (see below for further detail), and also for complex watercraft experiencing mechanical problems. In these situations follow-up inspections and/or further decontamination was required at the destination location. When the destination was in another jurisdiction, quick and effective communication was critical to ensure that high-risk watercraft were addressed in a timely manner. These high-risk situations emphasize the importance of maintaining on-going communication between jurisdictions throughout the inspection season.

8.6 PREVIOUSLY INSPECTED WATERCRAFT

Compliance by previously inspected boats stopping at inspection stations helps indicate that highway signs and general program messaging are clear. It is also important to have this compliance because there is a chance that previous inspections missed attached invasive mussels. Due to the very small size of ZQM, they can easily go undetected during an inspection, and mussels can become dislodged during transportation, making them visible upon a subsequent inspection. Therefore, receiving a second inspection can increase the likelihood of detecting invasive mussels attached on trailered boats and equipment, and is part of the perimeter defence layered approach.

8.7 COMMERCIALLY HAULED WATERCRAFT

Data showed that large commercially hauled watercraft posed a significant risk relative to recreationally hauled boats. They also pose significant logistical and operational challenges for inspection crews. Large commercially hauled watercraft were typically inaccessible during transport because they were either too high off the ground (required a crane for offloading), were wrapped in plastic, or the engine or interior was locked. This resulted in inspection crews not being able to fully inspect and decontaminate watercraft until it reached its end destination. It also created problems for commercial haulers who were delayed during watercraft transportation without receiving a complete inspection and decontamination. Given that commercial haulers comprise a small community, there is an opportunity to establish an effective working relationship with them that will ultimately reduce risks.

Feedback received from boaters and commercial haulers during the 2016 season indicates some confusion and frustration when procedures do not align between jurisdictions. The Program has amended legislation and developed a commercial hauler notification program to minimize effects on commercial haulers. We also reviewed the decontamination protocols with neighbouring jurisdictions to standardise operational procedures and minimize delays and frustrations for the 2017 season. The Program will continue to work on improving the information available on the website and exploring new tools and avenues for reaching out to the commercial and boating industry both in B.C. and across other jurisdictions.

8.8 RESEARCH AND COLLABORATION

Research and collaboration with neighbouring jurisdictions continue to be priorities for the Program to make the best available information and science available to optimize program delivery. This includes continuous improvements in research, expanded lake monitoring, new detection, and outreach tools to leverage the foundation that the Program was built on.

APPENDIX A 2016 WATERCRAFT INSPECTION STATION DETAILS

Station Name	Hwy #	Region	Type	Traffic Direction/Comments
Castlegar	3	Kootenay	Weigh scale	East and westbound
Dawson Creek	2	Peace	Pullout	Westbound
Elko	93 and 3	Kootenay	Rest area	West, east and northbound
Golden	1	Kootenay	Weigh scale	Westbound
Laidlaw	1	Lower Mainland	Weigh scale	Eastbound
Midway	3	Kootenay	Weigh scale (not active)	East and westbound
Mt. Robson	16	Omineca	Pullout	Westbound
Osoyoos	97	Okanagan	Border crossing	Northbound
Pacific	176 Ave	Lower Mainland	Pullout	Northbound
Radium	95	Kootenay	Pullout	Southbound
Salmo	3	Kootenay	Pullout	Westbound
Sparwood	3	Kootenay	Weigh scale	Westbound
Valemount	5	Omineca	Pullout	Westbound
Yahk	95 and 3	Kootenay	Weigh scale	Westbound

APPENDIX B RESULTS FROM 2016 VELIGER SAMPLE ANALYSIS USING CROSS-POLARIZED LIGHT MICROSCOPY

Analysis completed by the Limno Lab in Vancouver, B.C.

Lake / Waterbody	Sampling Agency [2]	Lat (Decimal degrees)	Long (Decimal degrees)	Date Sampled (YYYY-MM-DD)	ZQM [1] Veligers Detected (Yes/No)	Native Species Detected
Alouette Lake	ENV	49.2935661	-122.488142	2016-07-19	No	-
Alouette Lake	ENV	49.2935661	-122.488142	2016-07-19	No	-
Alouette Lake	ENV	49.2935661	-122.488142	2016-08-16	No	-
Alouette Lake	ENV	49.2935661	-122.488142	2016-09-22	No	-
Alta Lake	FLNRO	50.1088642	-122.981652	2016-07-20	No	Ostracoda
Anderson Lake	ENV	50.7012034	-122.303218	2016-09-13	No	-
Arrow Lake	CSISS	50.6372649	-117.923924	2016-07-21	No	-
Arrow Lake	FLNRO	49.3404159	-117.870746	2016-08-24	No	-
Babine Lake	ENV	54.85067	-126.18437	2016-08-08	No	-
Bittern Lake	CSISS	50.9776426	-116.599534	2016-09-29	No	Ostracoda
Blackwater Lake	CSISS	51.621542	-117.404794	2016-09-28	No	Ostracoda
Bolean Lake	CSISS	50.529872	-119.491873	2016-08-16	No	Ostracoda
Bowron Lake	ENV	53.25105	121.40649	2016-08-31	No	Ostracoda
Box Lake	CKISS	50.2058409	-117.711951	2016-07-06	No	Ostracoda
Box Lake	CKISS	50.2058409	-117.711951	2016-08-31	No	Ostracoda
Brannen Lake	ENV	49.21410	124.05016	2016-08-23	No	-
Burns Lake	ENV	54.131835	-125.453662	2016-08-29	No	Ostracoda
Cameron Lake	FLNRO	49.2892803	-124.588495	2016-07-16	No	-
Cedar Lake	CSISS	51.2629164	-116.982042	2016-09-28	No	Ostracoda
Champion Lake #3	CKISS	49.1864508	-117.611591	2016-07-14	No	Ostracoda
Champion Lake #3	CKISS	49.1864508	-117.611591	2016-09-09	No	Ostracoda
Chimney Lake	ENV	51.91558	121.95348	2016-07-09	No	Ostracoda
Chimney Lake	ENV	51.92528	121.97732	2016-07-09	No	Ostracoda
Christina Lake	CLSS	49.1021697	-118.24067	2016-07-10	No	-
Christina Lake	CLSS	49.1235756	-118.250209	2016-07-10	No	Ostracoda
Christina Lake	CLSS	49.1021697	-118.24067	2016-06-08	No	Ostracoda
Christina Lake	CLSS	49.1235756	-118.250209	2016-06-08	No	-
Christina Lake	CLSS	49.1021697	-118.24067	2016-08-28	No	-
Christina Lake	CLSS	49.1235756	-118.250209	2016-08-28	No	-
Columbia Lake	ENV	50.28905	115.86983	2016-08-24	No	Ostracoda

Lake / Waterbody	Sampling Agency [2]	Lat (Decimal degrees)	Long (Decimal degrees)	Date Sampled (YYYY-MM-DD)	ZQM [1] Veligers Detected (Yes/No)	Native Species Detected
Columbia River	CKISS	49.1020808	-117.707852	2016-07-08	No	-
Columbia River	CKISS	49.3343185	-117.699793	2016-07-08	No	-
Columbia River	CKISS	49.1020808	-117.707852	2016-08-02	No	Ostracoda
Columbia River	CKISS	49.1020808	-117.707852	2016-09-06	No	-
Columbia River	CKISS	49.3343185	-117.699793	2016-09-06	No	-
Columbia River	CSISS	51.0468992	-116.593202	2016-08-02	No	Ostracoda
Columbia River	CSISS	51.485328	-117.181148	2016-09-12	No	Ostracoda
Comox Lake	FLNRO	49.6279477	-125.082529	2016-07-17	No	-
Cottonwood Lake	CKISS	49.4301081	-117.255383	2016-07-14	No	-
Cottonwood Lake	CKISS	49.4301081	-117.255383	2016-09-09	No	-
Cranberry Marsh	NWIPC	52.8197914	-119.242998	2016-08-24	No	Ostracoda
Dragon Lake	ENV	52.57227	122.25184	2016-08-29	No	Ostracoda
Dragon Lake	ENV	52.57206	122.25078	2016-08-29	No	Ostracoda
Dragon Lake	ENV	52.57851	122.24319	2016-08-29	No	Ostracoda
Duncan Lake	CKISS	50.3024334	-116.944156	2016-07-07	No	-
Duncan Lake	CKISS	50.3024334	-116.944156	2016-08-05	No	-
Duncan Lake	CKISS	50.2791646	-116.924142	2016-08-05	No	-
Duncan Lake	CKISS	50.3024334	-116.944156	2016-09-08	No	-
Duncan Lake	CKISS	50.2791646	-116.924142	2016-09-08	No	-
Echo Lake	CSISS	50.9302996	-118.471175	2016-09-27	No	-
Elk Lake	ENV	48.53860	123.40750	2016-08-22	No	Ostracoda
Ellison Lake	ENV	49.998132	-119.402142	2016-09-20	No	Ostracoda
Erie Lake	CKISS	49.1914005	-117.352448	2016-08-12	No	Ostracoda
Erie Lake	CKISS	49.1914005	-117.352448	2016-09-09	No	Ostracoda
Errock Lake	FLNRO	49.228216	-122.008615	2016-07-23	No	Ostracoda
Fish Lake	CKISS	50.0459298	-117.180436	2016-09-07	No	Ostracoda
Gardom Lake	CSISS	50.6063321	-119.204604	2016-07-25	No	Ostracoda
Great Central Lake	FLNRO	49.3221068	-124.997179	2016-07-14	No	-
Green Lake	FLNRO	50.1617707	-122.9257	2016-08-22	No	-
Horne Lake	FLNRO	49.3498049	-124.73819	2016-07-18	No	-
Idabel Lake	BIS	49.7400375	-119.179323	2016-08-28	No	-
Jones Lake	FLNRO	49.2381505	-121.60511	2016-09-05	No	Ostracoda
Joyce Lake	CSISS	50.5681741	-119.613292	2016-09-26	No	Ostracoda
Kal Lake	ENV	50.180369	-119.341378	2016-09-14	No	Ostracoda

Lake / Waterbody	Sampling Agency [2]	Lat (Decimal degrees)	Long (Decimal degrees)	Date Sampled (YYYY-MM-DD)	ZQM [1] Veligers Detected (Yes/No)	Native Species Detected
Kalamalka Lake	OASISS	50.1803796	-119.340823	2016-07-14	No	Ostracoda
Kalamalka Lake	OASISS	50.1803796	-119.340823	2016-08-05	No	Ostracoda
Kalamalka Lake	OASISS	50.1803796	-119.340823	2016-08-18	No	Ostracoda
Kalamalka Lake	OASISS	50.2304953	-119.267316	2016-07-14	No	Ostracoda
Kalamalka Lake	OASISS	50.2304953	-119.267316	2016-08-05	No	Ostracoda
Kalamalka Lake	OASISS	50.2304953	-119.267316	2016-08-20	No	Ostracoda
Kinbasket Lake	NWIPC	52.6794495	-119.02575	2016-06-23	No	-
Kinbasket Lake	NWIPC	52.6807215	-119.030751	2016-07-08	No	-
Kinbasket Lake	NWIPC	52.6874246	-119.039895	2016-07-08	No	-
Kinbasket Lake	NWIPC	52.7026466	-119.055511	2016-07-08	No	-
Kinbasket Lake	CSISS	51.5280161	-117.433473	2016-08-03	No	Ostracoda
Kinbasket Lake	CSISS	51.7566855	-117.57489	2016-09-12	No	-
Kinbasket Lake	B.C. Hydro	52.04991	118.33470	2016-10-12	No	-
Kinbasket Lake	B.C. Hydro	52.05996	118.29227	2016-10-12	No	-
Kinbasket Lake	B.C. Hydro	52.05586	118.32003	2016-10-12	No	-
Kinbasket Lake	ENV			2016-07-30	No	-
Koocanusa Lake	EKISC	49.5474041	-115.73005	2016-08-16	No	Ostracoda
Koocanusa Lake	EKISC	49.2636877	-115.28338	2016-08-16	No	Ostracoda
Koocanusa Lake	EKISC	49.2600618	-115.274297	2016-08-16	No	Ostracoda
Kootenay Lake	CKISS	49.9135056	-116.907919	2016-07-07	No	-
Kootenay Lake	CKISS	49.6098519	-117.114319	2016-07-15	No	Ostracoda
Kootenay Lake	CKISS	49.7696263	-116.857171	2016-07-15	No	Ostracoda
Kootenay Lake	CKISS	49.300055	-116.662898	2016-07-15	No	Ostracoda
Kootenay Lake	CKISS	49.5088694	-117.281651	2016-07-15	No	Ostracoda
Kootenay Lake	CKISS	49.6098519	-117.114319	2016-08-04	No	Ostracoda
Kootenay Lake	CKISS	49.7696263	-116.857171	2016-08-04	No	Ostracoda
Kootenay Lake	CKISS	49.300055	-116.662898	2016-08-04	No	Ostracoda
Kootenay Lake	CKISS	49.9135056	-116.907919	2016-08-05	No	-
Kootenay Lake	CKISS	49.5088694	-117.281651	2016-08-05	No	-
Kootenay Lake	CKISS	50.102435	-116.939015	2016-08-05	No	-
Kootenay Lake	CKISS	49.7696263	-116.857171	2016-09-02	No	Ostracoda
Kootenay Lake	CKISS	49.3292575	-116.790171	2016-09-03	No	-
Kootenay Lake	CKISS	49.6098519	-117.114319	2016-09-02	No	-

Lake / Waterbody	Sampling Agency [2]	Lat (Decimal degrees)	Long (Decimal degrees)	Date Sampled (YYYY-MM-DD)	ZQM [1] Veligers Detected (Yes/No)	Native Species Detected
Kootenay Lake	CKISS	49.300055	-116.662898	2016-09-02	No	Ostracoda
Kootenay Lake	CKISS	49.9135056	-116.907919	2016-09-08	No	-
Kootenay Lake	CKISS	49.5088694	-117.281651	2016-09-08	No	Ostracoda
Kootenay Lake	FLNRO	49.9152484	-116.905325	2016-08-15	No	-
Lady King Lake	CSISS	50.4300457	-119.618885	2016-08-16	No	Ostracoda
Windermere Lake	EKISC	50.515354	-116.019329	2016-09-14	No	Ostracoda
Windermere Lake	EKISC	50.4705868	-115.995398	2016-09-14	No	Ostracoda
Windermere Lake	EKISC	50.5033593	-116.02072	2016-09-14	No	Ostracoda
Lakelse Lake	ENV	54.39089	-128.53397	2016-08-16	No	-
Langford Lake	ENV	48.44434	123.52647	2016-08-22	No	Ostracoda
Little Cranberry Lake	NWIPC	52.7944935	-119.254127	2016-08-26	No	-
Long Lake	FLNRO	49.2100959	-124.021668	2016-07-11	No	Ostracoda
Loon Lake	CSISS	51.0565987	-116.804992	2016-09-29	No	Ostracoda
Lost Lake	FLNRO	50.1276543	-122.936245	2016-07-21	No	-
Lower Arrow Lake	CKISS	49.3409238	-117.871388	2016-07-08	No	-
Lower Arrow Lake	CKISS	49.3409238	-117.871388	2016-08-02	No	Ostracoda
Lower Arrow Lake	CKISS	49.3424486	-117.829192	2016-09-06	No	-
Mabel Lake	ENV	50.453455	-118.736909	2016-09-20	No	-
Mara Lake	CSISS	50.8360719	-118.993576	2016-08-17	No	Ostracoda
Mara Lake	CSISS	50.8107218	-118.974354	2016-08-17	No	-
Mara Lake	CSISS	50.7668947	-119.016841	2016-08-17	No	Ostracoda
Mara Lake	CSISS	50.8362001	-118.993439	2016-09-22	No	Ostracoda
Mara Lake	CSISS	50.7669042	-119.016813	2016-09-22	No	-
Marmot Lake	FLNRO	52.9269639	-123.570011	2016-09-09	No	Ostracoda
Milburn Lake	FLNRO	52.9762758	-122.941695	2016-09-11	No	Ostracoda
Mitten Lake	CSISS	51.0422395	-116.585084	2016-08-02	No	Ostracoda
Moyie Lake Lower	ENV	49.2823371	-115.841002	2016-08-23	No	-
Moyie Lake Upper	ENV	49.3676384	-115.83813	2016-08-23	No	-
Nanaimo Lake	FLNRO	49.0927144	-124.172809	2016-07-11	No	-
Nancy Greene Lake	CKISS	49.2583866	-117.93975	2016-08-02	No	Ostracoda
Nancy Greene Lake	CKISS	49.258273	-117.941275	2016-09-06	No	-
Okanagan Lake	OASISS	49.5053908	-119.585898	2016-07-09	No	Ostracoda
Okanagan Lake	OASISS	49.5053908	-119.585898	2016-08-10	No	Ostracoda
Okanagan Lake	OASISS	49.5053908	-119.585898	2016-08-18	No	Ostracoda

Lake / Waterbody	Sampling Agency [2]	Lat (Decimal degrees)	Long (Decimal degrees)	Date Sampled (YYYY-MM-DD)	ZQM [1] Veligers Detected (Yes/No)	Native Species Detected
Okanagan Lake	OASISS	49.5923988	-119.599258	2016-07-09	No	Ostracoda
Okanagan Lake	OASISS	49.5923988	-119.599258	2016-08-10	No	Ostracoda
Okanagan Lake	OASISS	49.5923988	-119.599258	2016-08-18	No	Ostracoda
Okanagan Lake	OASISS	49.6021689	-119.652211	2016-07-08	No	Ostracoda
Okanagan Lake	OASISS	49.6021689	-119.652211	2016-08-06	No	Ostracoda
Okanagan Lake	OASISS	49.6021689	-119.652211	2016-08-18	No	Ostracoda
Okanagan Lake	OASISS	50.2349333	-119.364825	2016-07-15	No	Ostracoda
Okanagan Lake	OASISS	50.2349333	-119.364825	2016-08-05	No	Ostracoda
Okanagan Lake	OASISS	50.2349333	-119.364825	2016-08-19	No	Ostracoda
Okanagan Lake	OASISS	50.2348956	-119.361822	2016-07-15	No	Ostracoda
Okanagan Lake	OASISS	50.2348956	-119.361822	2016-08-05	No	Ostracoda
Okanagan Lake	OASISS	50.2348956	-119.361822	2016-08-19	No	Ostracoda
Okanagan Lake	OASISS	49.8462638	-119.490294	2016-08-07	No	Ostracoda
Okanagan Lake	OASISS	49.8462638	-119.490294	2016-08-20	No	Ostracoda
Okanagan Lake	OASISS	49.8889429	-119.500135	2016-08-07	No	Ostracoda
Okanagan Lake	OASISS	49.8889429	-119.500135	2016-08-20	No	Ostracoda
Okanagan Lake	OASISS	49.7784314	-119.722868	2016-08-07	No	Ostracoda
Okanagan Lake	OASISS	49.7784314	-119.722868	2016-08-20	No	Ostracoda
Okanagan Lake	OASISS	49.8158473	-119.622115	2016-08-07	No	Ostracoda
Okanagan Lake	OASISS	49.8158473	-119.622115	2016-08-20	No	Ostracoda
Okanagan Lake	OASISS	50.0404098	-119.450549	2016-08-07	No	Ostracoda
Okanagan Lake	OASISS	50.0404098	-119.450549	2016-08-20	No	Ostracoda
Osoyoos Lake	ENV	49.037547	-119.463943	2016-09-19	No	Ostracoda
Osoyoos Lake	OASISS	49.0377334	-119.464518	2016-07-15	No	Ostracoda
Osoyoos Lake	OASISS	49.0377334	-119.464518	2016-07-08	No	Ostracoda
Osoyoos Lake	OASISS	49.0377334	-119.464518	2016-08-21	No	Ostracoda
Pend D'Oreille River	CKISS	49.0393232	-117.492496	2016-08-02	No	Ostracoda
Pend D'Oreille River	CKISS	49.0393232	-117.492496	2016-09-06	No	Ostracoda
Pinaus Lake	CSISS	50.4299805	-119.61898	2016-08-16	No	-
Premier Lake	ENV	49.91825	115.64647	2016-08-31	No	Ostracoda
Puntchesakut lake	FLNRO	53.023034	-122.679208	2016-09-10	No	-
Puntzi Lake	ENV	52.11389	124.02936	2016-09-14	No	-
Quamichan Lake	ENV	48.78844	123.67098	2016-08-23	No	Ostracoda
Quesenel Lake	ENV	52.30534	121.02088	2016-06-09	No	-

Lake / Waterbody	Sampling Agency [2]	Lat (Decimal degrees)	Long (Decimal degrees)	Date Sampled (YYYY-MM-DD)	ZQM [1] Veligers Detected (Yes/No)	Native Species Detected
Revelstoke Lake	CSISS	51.1471903	-118.200035	2016-09-20	No	-
Revelstoke Lake	B.C. Hydro	51.08842	118.11999	2016-08-16	No	-
Revelstoke Lake	B.C. Hydro	51.04464	118.11489	2016-08-16	No	-
Revelstoke Lake	B.C. Hydro	51.29430	118.27257	2016-08-17	No	-
Rosebud Lake	CKISS	49.047202	-117.268059	2016-07-14	No	Ostracoda
Rosebud Lake	CKISS	49.047202	-117.268059	2016-09-09	No	Ostracoda
Sardis Pond	FLNRO	49.1289157	-121.952764	2016-09-04	No	-
Seton Lake	ENV	50.6687945	-121.988287	2016-09-14	No	Ostracoda
Shuswap Lake	CSISS	50.8510337	-119.077683	2016-07-25	No	Ostracoda
Shuswap Lake	CSISS	50.7215654	-123.625065	2016-07-25	No	-
Shuswap Lake	CSISS	50.963877	-119.17301	2016-07-26	No	Ostracoda
Shuswap Lake	CSISS	50.75487	-119.226961	2016-07-26	No	Ostracoda
Shuswap Lake	CSISS	50.7559734	-119.227581	2016-09-22	No	Ostracoda
Shuswap Lake	CSISS	50.8800584	-119.464081	2016-09-22	No	Ostracoda
Shuswap Lake	CSISS	50.7096441	-119.285061	2016-09-22	No	Ostracoda
Skaha Lake	ENV	49.451928	-119.581452	2016-09-09	No	Ostracoda
Skaha Lake	OASISS	49.4511782	-119.581925	2016-07-10	No	Ostracoda
Skaha Lake	OASISS	49.4511782	-119.581925	2016-08-13	No	Ostracoda
Skaha Lake	OASISS	49.4511798	-119.581856	2016-08-19	No	Ostracoda
Skimikin Lake	CSISS	50.7859607	-119.444372	2016-09-26	No	Ostracoda
Slocan Lake	CKISS	49.984206	-117.377665	2016-07-06	No	-
Slocan Lake	CKISS	49.9543758	-117.36253	2016-08-03	No	-
Slocan Lake	CKISS	49.7696404	-117.472734	2016-08-17	No	-
Slocan Lake	CKISS	49.984206	-117.377665	2016-09-07	No	-
Slocan Lake	CKISS	49.9543758	-117.36253	2016-09-07	No	Ostracoda
Slocan Lake	CKISS	49.7696404	-117.472734	2016-09-07	No	-
Slocan Lake	ENV	49.98458	-117.37746	2016-09-27	No	-
Somenos Lake	FLNRO	48.8021668	-123.706972	2016-07-06	No	Ostracoda
Spider Lake	FLNRO	49.3440717	-124.624128	2016-07-19	No	-
Sproat Lake	FLNRO	49.2870588	-124.940244	2016-07-12	No	-
Sugar Lake	ENV	50.376705	-118.529559	2016-08-31	No	Ostracoda
Summit Lake	CKISS	50.1566596	-117.655895	2016-07-06	No	Ostracoda
Summit Lake	CKISS	50.1566596	-117.655895	2016-08-31	No	Ostracoda

Lake / Waterbody	Sampling Agency [2]	Lat (Decimal degrees)	Long (Decimal degrees)	Date Sampled (YYYY-MM-DD)	ZQM [1] Veligers Detected (Yes/No)	Native Species Detected
Three Valley Lake	CSISS	50.8565421	-118.066492	2016-09-27	No	-
Tie Lake	EKISC	49.4187183	-115.320006	2016-08-08	No	Ostracoda
Tie Lake	EKISC	49.4163353	-115.311428	2016-08-08	No	Ostracoda
Tie Lake	EKISC	49.4135067	-115.30379	2016-08-08	No	Ostracoda
Trout Lake	CSISS	50.6451862	-117.53692	2016-07-18	No	Ostracoda
Tyhee Lake	ENV	54.70959	-127.03932	2016-08-15	No	Ostracoda
Upper Arrow Lake	CKISS	50.1319009	-117.810853	2016-07-06	No	-
Upper Arrow Lake	CKISS	50.2361491	-117.797925	2016-07-06	No	-
Upper Arrow Lake	CKISS	50.1319009	-117.810853	2016-08-03	No	-
Upper Arrow Lake	CKISS	50.2361491	-117.797925	2016-08-03	No	Ostracoda
Upper Arrow Lake	CKISS	50.1319009	-117.810853	2016-08-31	No	Ostracoda
Upper Arrow Lake	CKISS	50.2361491	-117.797925	2016-08-31	No	-
Upper Arrow Lake	CSISS	50.6371798	-117.923314	2016-09-20	No	Ostracoda
Upper Arrow Lake	FLNRO	50.2356498	-117.797285	2016-08-23	No	Ostracoda
Upper Little Slocan Lake	CKISS	49.6808614	-117.657623	2016-09-01	No	-
Wahleach Lake	ENV	49.2469068	-121.603915	2016-08-17	No	-
Wahleach Lake	ENV	49.2521924	-121.610307	2016-08-17	No	Ostracoda
Wasa Lake	EKISC	49.7768242	-115.733717	2016-08-05	No	Ostracoda
Wasa Lake	EKISC	49.7834167	-115.736129	2016-08-05	No	Ostracoda
Wasa Lake	EKISC	49.7868022	-115.738916	2016-08-05	No	Ostracoda
Westwood Lake	FLNRO	49.1622753	-124.00015	2016-07-08	No	Ostracoda
Whatshan Lake	CKISS	50.0847344	-118.090001	2016-08-03	No	-
Whatshan Lake	CKISS	50.0684718	-118.085315	2016-08-31	No	-
White Lake	FLNRO	50.8809098	-125.294811	2016-12-09	No	Ostracoda
White Swan Lake	ENV	50.12868	115.51626	2016-08-31	No	Ostracoda
Williams Lake	ENV	52.06479	122.05237	2016-08-17	No	Ostracoda
Williams Lake	ENV	52.06585	122.07073	2016-08-17	No	Ostracoda
Williams Lake	ENV	52.07156	122.06289	2016-08-17	No	Ostracoda
Williams Lake	FLNRO	52.1610536	-122.113317	2016-09-07	No	Ostracoda
Williamson Lake	CSISS	50.9687411	-118.170379	2016-08-25	No	Ostracoda
Willow Lake	CSISS	51.0089585	-116.679472	2016-09-29	No	Ostracoda
Windermere Lake	ENV	50.51464	116.01917	2016-08-24	No	Ostracoda, Unionidae
Wood Lake	ENV	50.104628	-119.367015	2016-09-14	No	Ostracoda

Lake / Waterbody	Sampling Agency [2]	Lat (Decimal degrees)	Long (Decimal degrees)	Date Sampled (YYYY-MM-DD)	ZQM [1] Veligers Detected (Yes/No)	Native Species Detected
Wood Lake	OASISS	50.0527457	-119.408832	2016-07-09	No	Ostracoda
Wood Lake	OASISS	50.0527457	-119.408832	2016-08-14	No	Ostracoda

[1] ZQM = Zebra and Quagga Mussels.

[2] Central Kootenay Invasive Species Society (CKISS), Columbia-Shuswap Invasive Species Society (CSISS), East Kootenay Invasive Species Society (EKISS), Ministry of Environment and Climate Change Strategy (ENV), Forests, Lands and Natural Resource Operations and Rural Development (FLNRO), Okanagan and Similkameen Invasive Species Society (OASISS), and Northwest Invasive Plant Council (NWIPC).