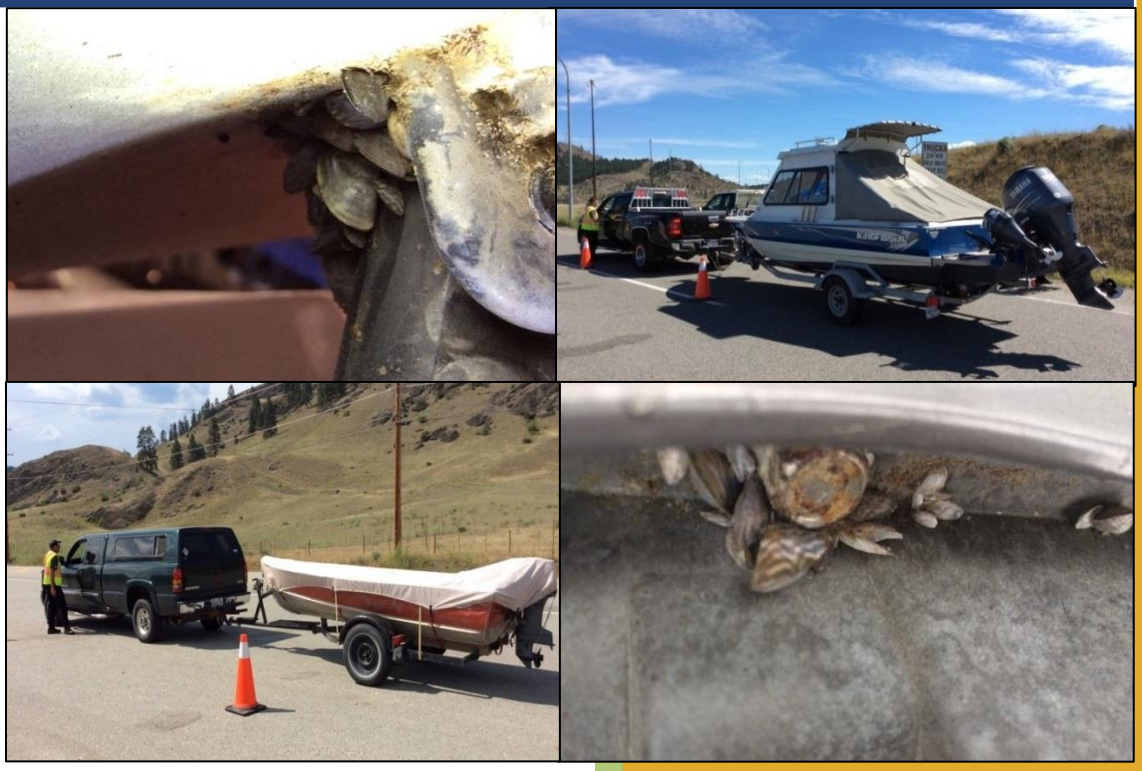
# BC Invasive Mussel Defence Program 2015 Watercraft Inspection Final Report



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BC Ministry of Environment

March 2016

BRITISH COLUMBIA

## ACKNOWLEDGEMENTS

This Watercraft Inspection Program was funded by the BC Ministry of Forests, Lands and Natural Resources (FLNR), Ministry of Agriculture (AGR), Ministry of Environment (MOE), BC Hydro, Columbia Basin Trust (CBT), Columbia Power Cooperation and Fortis BC. The Central Kootenay Invasive Species Society (CKISS), the East Kootenay Invasive Species Society (EKISS) and the Columbia Basin Trust (CBT) generously loaned pressure washers that were used by the Program to decontaminate watercraft. Fisheries and Oceans Canada (DFO) provided financial support to the lake monitoring program for veligers. The report was completed by the Ecosystems Branch, BC Ministry of Environment (March 2016).

*Front cover photo credits: Natasha Audy (top left), Brandon Beck (top right), Graham Wheating (bottom left), and Elyse Matthews (bottom right).*

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## 1. INTRODUCTION

Zebra and Quagga mussels impose substantial economic, environmental and social impacts including increased infrastructure maintenance costs (hydropower, water-works, irrigation) and degradation of native ecosystems (affecting fisheries, recreation and tourism). Unlike British Columbia's (B.C.'s) native mussels, Zebra and Quagga mussels attach to hard surfaces, allowing them to be moved between water bodies by boats and equipment. While not currently present in B.C. or in adjacent waters, Zebra and Quagga mussels could survive in B.C. freshwater systems if introduced.

This could lead to serious impacts on our native salmon populations and could affect the viability of important commercial, recreational and First Nation fisheries. A recent review of economic impacts related to Zebra mussels in the eastern U.S. between 1989 to 2004 estimated spending of $268 million toward affected drinking water and power plant facilities. A B.C. specific economic risk assessment estimates annual costs of $43 million for infrastructure maintenance if Zebra and Quagga mussel are introduced. This assessment does not include impacts to fisheries or property values.

In 2014/15 the Min of FLNR/ENV committed to taking preventative measures against the threat of Zebra and Quagga mussels through the establishment of a Provincial Invasive Mussel Defence Program (the Program). This document reports on the logistics, activities and findings of the Program from May 1st to October 31st 2015. The Provincial Invasive Mussel Defence Program is designed to prevent the spread of Zebra and Quagga mussels through the interception and inspection of watercraft travelling into or through B.C. In 2015 mandatory watercraft inspection stations were strategically placed along eastern and southern border locations to target boaters entering BC.

The Program consists of three main components:

- **Watercraft inspection** to detect and respond to high risk watercraft potentially transporting Zebra and/or Quagga mussels in B.C.
- **Lake monitoring** to assess for the continued absence of Zebra and Quagga mussels in B.C. waters.
- **Outreach and education**, to promote the message of CLEAN, DRAIN, DRY to the boating community in collaboration with the Invasive Species Council of BC and regional invasive species committees.

Program success depends on:

- Multi-agency collaboration (within BC) 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.
- Stakeholder engagement to work collaboratively with the boating industry to prevent the introduction of Zebra and Quagga mussels into the Province of B.C..

Legislative foundation

Legal authority for the Province to take action on Zebra and Quagga mussels is empowered through provincial legislation. The Controlled Alien Species Regulation (CAS) under the *BC Wildlife Act* is the principle legislation that defines, lists and affords provisions to regulate invasive mussels in B.C.

Under the CAS Regulation, the following prohibitions apply in relation to any mussel listed in Schedule 4 (Zebra, Quagga and Conrad's false mussel). It is illegal for a person to:

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

Inspectors who delivered the watercraft inspection program were 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 as it pertains to ZQM (available at www.gov.bc.ca/invasive-species).

## 2. PROGRAM LOGISTICS

Operations

The Invasive Mussel Defence Program operation was administered by the B.C. Ministry of Environment. The Program manager, supervisor and 12 inspectors were staffed through the Ecosystems Branch of the Ministry of Environment. A sergeant with the Conservation Officer Services (COS) served as the COS coordinator for the program and assisted with hiring, training, communications and program implementation.

A total of three inspection crews (six auxiliary conservation officers) were operational starting in late May 2015, with three additional crews becoming operational in mid-July. The six crews ran inspection stations until October 31st 2015. Each crew consisted of two trained auxiliary conservation officers (COs) and were equipped with mobile decontamination units. The inspection crews had base locations in Penticton, Invermere, Cranbrook, Valemount and Nelson (two crews). They conducted roving watercraft inspection stations at approximately 30 different locations at key entry points into the province along the eastern and southern borders (see Figure 1).

The watercraft inspection stations were selected through detailed discussions with Commercial Vehicle Safety and Enforcement (CVSE), Ministry of Transportation and COS staff. Many of the watercraft inspection stations were located at CVSE weigh scales as they provided safe and suitable locations for inspecting and decontaminating watercraft. Canadian Border Services Agency (CBSA) allowed inspection crews to set-up at several southern border crossings. See Appendix 1 for further information on inspection stations.

As in other jurisdictions, the watercraft inspection stations were operational only during daylight hours for safety reasons. The inspection stations were set up on a roving schedule to cover numerous locations on both weekends and weekdays. This roving schedule maximized data collection across both spatial and temporal scales, allowing for the assessment of optimal times and locations for permanent stations in future program years.

In addition to conducting watercraft inspections at established stations, the inspection crews responded to high risk watercraft notifications both from within the province and from other jurisdictions. The Report All Poachers and Polluters (RAPP) Hotline was used for reporting suspicious watercraft that may be transporting invasive mussels. These notifications were sent to the regional COs and then passed

onto inspectors. High risk watercraft notifications from other jurisdictions were sent through an email distribution list to all inspectors, the COS program coordinator and the program supervisor. A response was then coordinated based on the availability of inspectors.

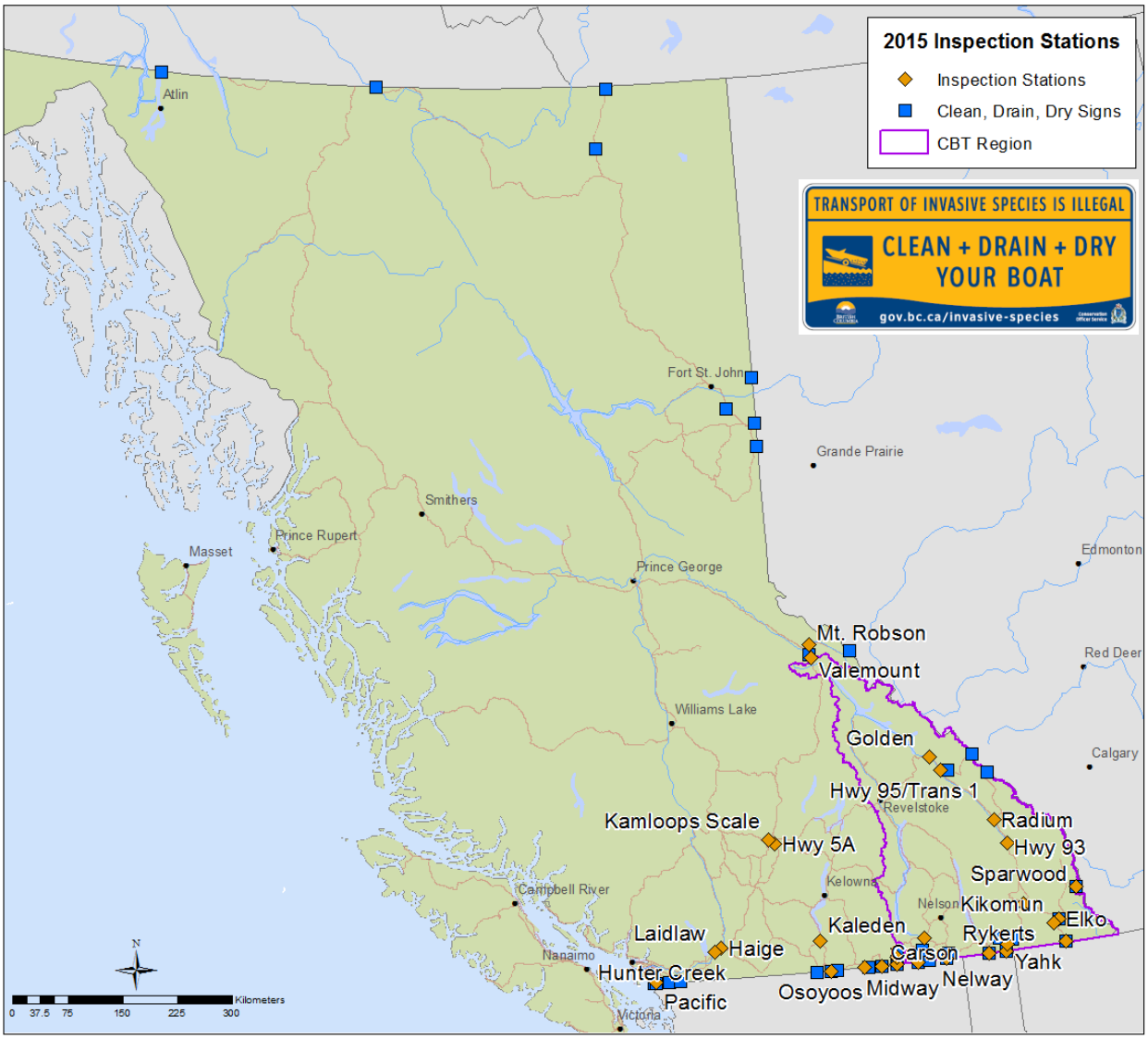


**Figure 1. Watercraft inspection station locations for the 2015 season and locations of the Provincial Clean, Drain, Dry highway signs, as shown in the inset of the map.**

## Inspection crew training (Auxiliary CO)

Inspector positions required an education/background from a recognized compliance and enforcement or natural resource management program (degree or diploma). These positions provided 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 (January 2012 Version). This is the standard protocol used across the Pacific Northwest.

Watercraft risk assessment

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

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

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

According to MOE's watercraft risk assessment any watercraft or piece of equipment that was in any province/state known or suspected of having Zebra or Quagga mussels in the past 30 days was considered high risk. Any watercraft or equipment coming from a state province that has Quagga or Zebra mussel infestations and is not clean to the extent determined as practical by inspectors, and has not been drained and dried, is also considered high risk even if it has been out of the water for over30 days. Low risk watercraft are only those that have been solely used within British Columbia or other non-contaminated provinces/states within the last 30 days.

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

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 Province worked very closely with the Alberta invasive mussel program regarding high risk watercraft notifications during the 2015 spring/summer season. On-going and effective communication enabled the provinces to address high risk watercraft in a timely manner.

### 2.1 PROGRAM FUNDING AND BUDGET

The two year Provincial Invasive Mussel Defence Program was launched in March 2015 with funding contributions from the Ministry of Forests, Lands and Natural Resources (FLNR), Ministry of Agriculture (AGR), Ministry of Environment (MOE), BC Hydro and Fisheries and Oceans Canada (DFO) (Table 1). In July 2015 additional funding from the Columbia Basin Trust (CBT), Columbia Power Cooperation and Fortis BC allowed for inspection crews to double from three to six (Table 2).

Table 1. Funding sources and allocation for two-year pilot Invasive Mussel Defence Program as announced in 2015.

| Funding Source | Start-up (2014/2015) | Year 1 (2015/2016) | Year 2[A] (2016/2017) |
|---|---|---|---|
| **Ministry of Forests, Lands and Natural Resources** | $100,000 | $150,000 | $200,000 |
| **Ministry of Agriculture** | | $200,000 | $200,000 |
| **Ministry of Environment** | $35,000[B] | $100K (in kind) | $100K (in kind) |
| **BC Hydro** | $14,000[B] | $193,000 | $193,000 |
| **Columbia Basin Trust** | | $275,000 | |
| **Columbia Power Corporation (CPC)** | | $70,000 | |
| **Fortis BC** | | $15,000 | |
| **Fisheries and Oceans Canada (DFO)** | $7,500[C] | $7,500[C] | $7,500[C] |
| **Total** | **$156,500** | **$910,500** | **$600,500** |

A - Only includes funds committed as of April 2015.
B - Capital costs
C - Veliger monitoring support

The total operational cost for the 2015 pilot season was $628,620 (Table 2). This included salary, travel, vehicle, educational and miscellaneous equipment and maintenance costs.

Salary costs included inspectors staffed from May to November (five), from July to November (five) and two crew leads staffed from May to December, and July to December respectively. The salary cost did not include in-kind salary contributions from the Province for the program manager, supervisor and coordinator. COS provided 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 auxiliary COs travel to inspection stations (Table 2) as well as partial relocation costs for crew members, and travel required for training.

Vehicle costs included maintenance and repairs for Ministry fleet vehicles used for three inspection crews. Three additional trucks were leased for the period of July to November due to the later start of the three latter inspection crews, as fleet vehicles could not be obtained.

Educational costs included the development and production of educational outreach materials (rack cards, wallet cards, stickers and resin blocks) that were distributed by the crews at watercraft inspection stations. This also included costs for stakeholder engagement and research costs, such as the analysis of plankton tow samples collected for invasive mussel veliger monitoring.

Non-capital equipment and maintenance costs included uniforms, electronic devices (iPhones, iPads, satellite messengers and software licenses), highway signs and safety equipment. This also included any necessary maintenance and repairs to the pressure washers. Capital equipment costs included two mobile decontamination units purchased by the province. Equipment loan agreements were established with the Central Kootenay Invasive Species Society (CKISS), the Kootenay Invasive Species Society (EKISS) and the Columbia Basin Trust (CBT) for the use of their pressure washers in the watercraft inspection program.

Table 2. Total expenditures for the 2015 pilot season of the Watercraft Inspection component of the Invasive Mussel Defence Program. This does not include in-kind salary contributions from the Province or lake monitoring costs.

| 2015 Program Costs | Provincial/Hydro | CBT | Total Program Costs |
|---|---|---|---|
| **Salary** | $202,518 | $141,923 | $344,441 |
| **Travel** | $38,922 | $11,992 | $50,914 |
| **Vehicle** | $9,820 | $20,000 | $29,820 |
| **Educational** | $63,292 | $18,000 | $81,292 |
| **COS support** | $50,000 | $0 | $50,000 |
| **Non-capital equipment/ maintenance** | $47,871 | $28,773 | $72,152 |
| **Actual 2015** | **$412,424** | **$220,688** | **$628,620** |
| **Capital equipment*** | $49,302 | $0 | $49,302 |

*- Acquired in Fiscal 2014-15 for the 2015 season.

# 3. 2015 WATERCRAFT INSPECTION SUMMARY

## 3.1 ALL WATERCRAFT ENCOUNTERS

For the 2015 pilot season a total of 4,351 watercraft were inspected and the crews interacted with approximately 10,000 people to promote Clean, Drain, Dry. Of the watercraft inspected, 70 were identified as coming from a Zebra/Quagga mussel infested province or state. 34 watercraft required decontamination, of which, 15 were confirmed to have invasive mussels or larvae (see Section 3.2 for further detail on high risk watercraft).

The watercraft inspection data collected by the crews at each station across the entire pilot season is presented in the following sections. 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). In order to quantify the frequency in 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) and is illustrated in the figures below. Simple statistical analyses (T-tests) were used to detect significant differences in encounter frequency where possible (see figure legends for details).

Watercraft inspection summary by station

Watercraft encounters were highest at the Elko station (670 boats), followed by the Christina Lake station (416 boats), the Valemount station (354 boats) and the Castlegar station (313 boats) (Figure 2). It is important to note that due to communication challenges (limited satellite coverage) at the Mt. Robson station, the inspection crew was only able to operate for one shift during the 2015 season. Inspection crews were only able to operate for one shift at the Pacific border crossing in the Lower Mainland due to limited space for proper set-up. In addition, ongoing road construction near the Golden station limited how often the inspection crew could operate. Please see Appendix 1 for more information on each station including comments regarding suitability as a permanent station.

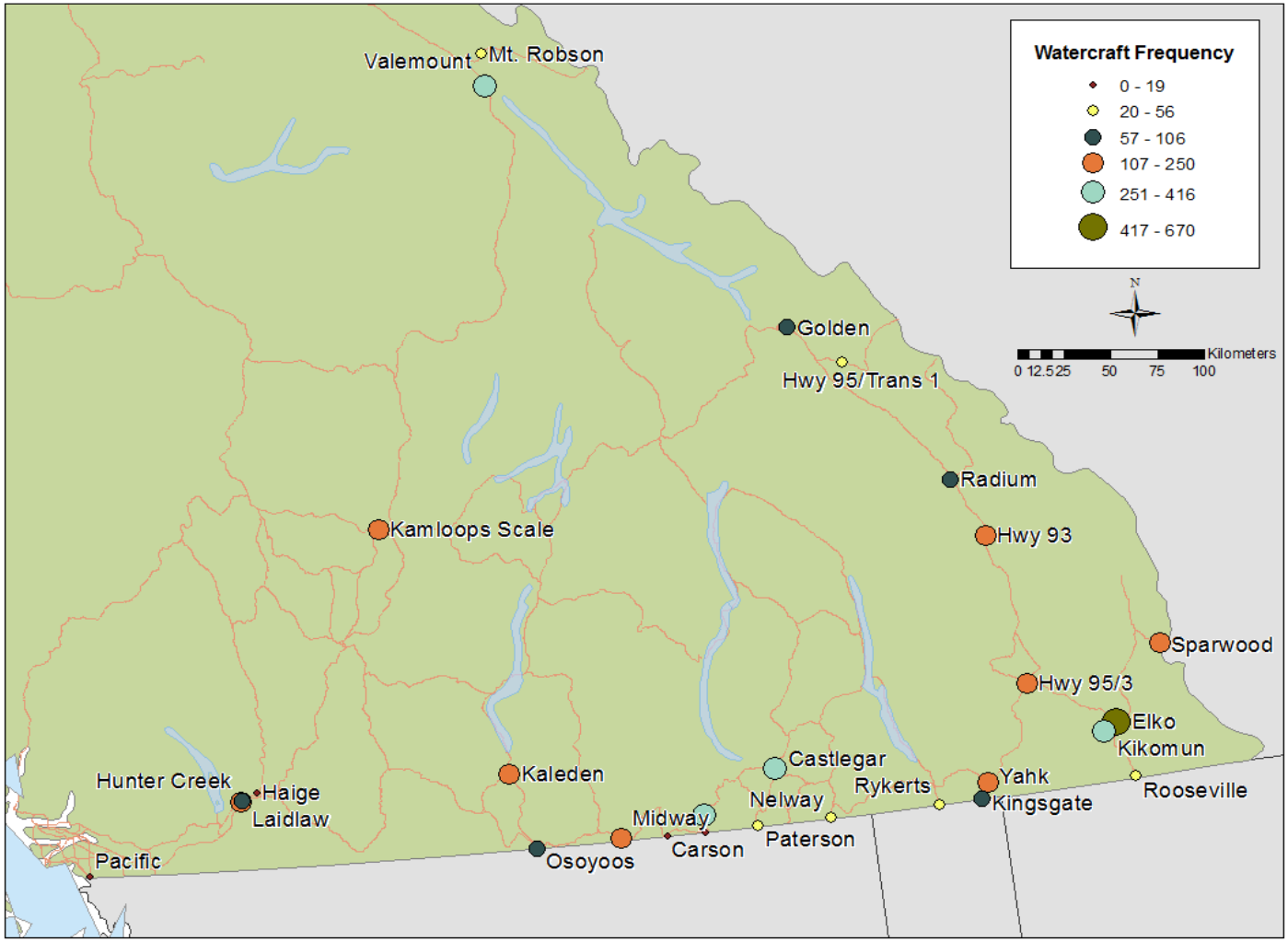


**Figure 2. Total watercraft encounters for inspection stations during the 2015 season.**

The encounter frequency (watercraft encounters/effort) across each inspection station showed that the busiest inspection stations were Elko, Christina Lake, Kikomun, Laidlaw and Hunter Creek (Figure 3). The stations with the lowest frequency of boater traffic were all southern border crossing stations; Rykerts, Cascade, Paterson, Nelway and Carson. For example, at the Rykerts station across 107 hours of operation only 49 boats were inspected and only two boats that failed to stop were recorded. This indicates very low boater traffic at this location between June and October. 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.

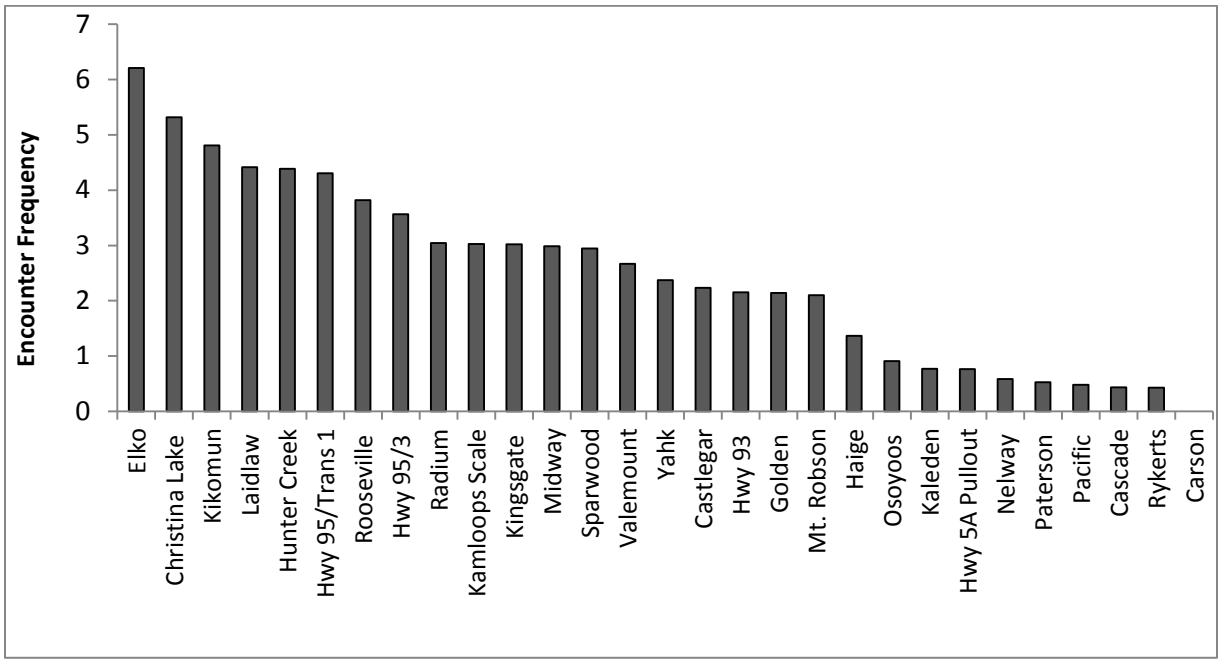


**Figure 3. Encounter frequency by inspection station from June to October 2015.**

Watercraft inspection summary by month

Highway inspection stations were not fully operational until mid-June, therefore measure of total effort and watercraft encounters was lower in June relative to other operational months. Watercraft encounters and total effort was highest during August when all six crews were operational for the entire month (Figure 4). The encounter frequency was significantly higher in July and August relative to September and October when boater traffic decreased (Figure 5).

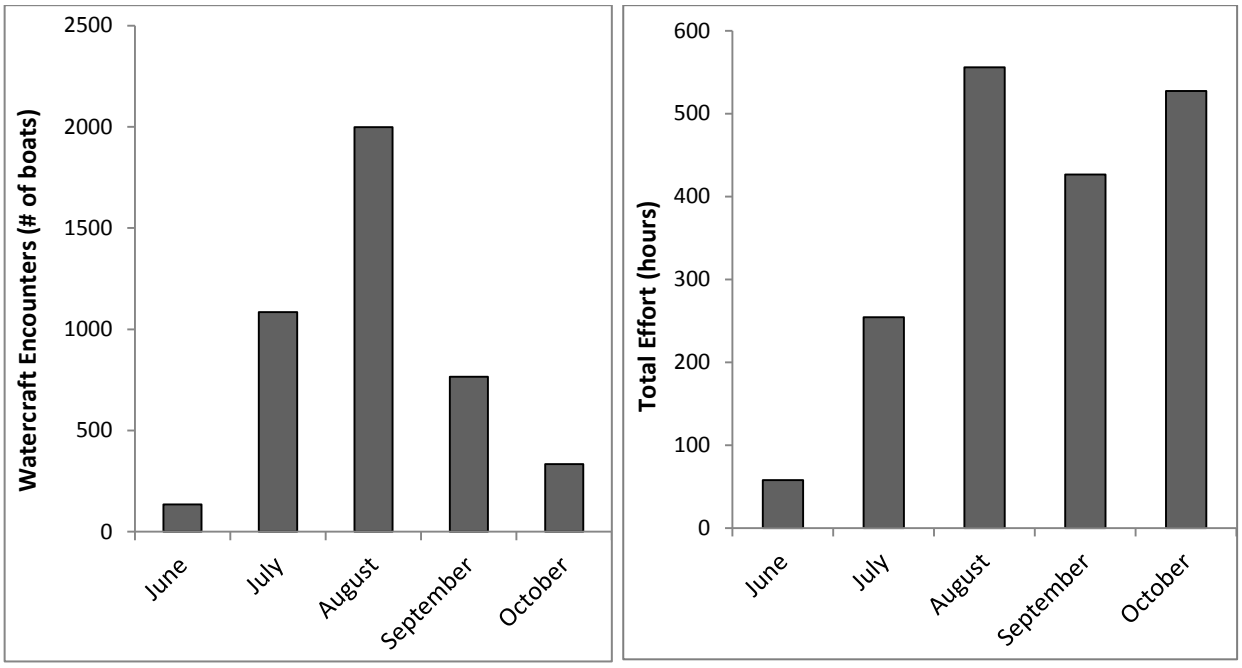


Figure 4. Watercraft encounters (left) and total effort (right) by month across inspection stations.

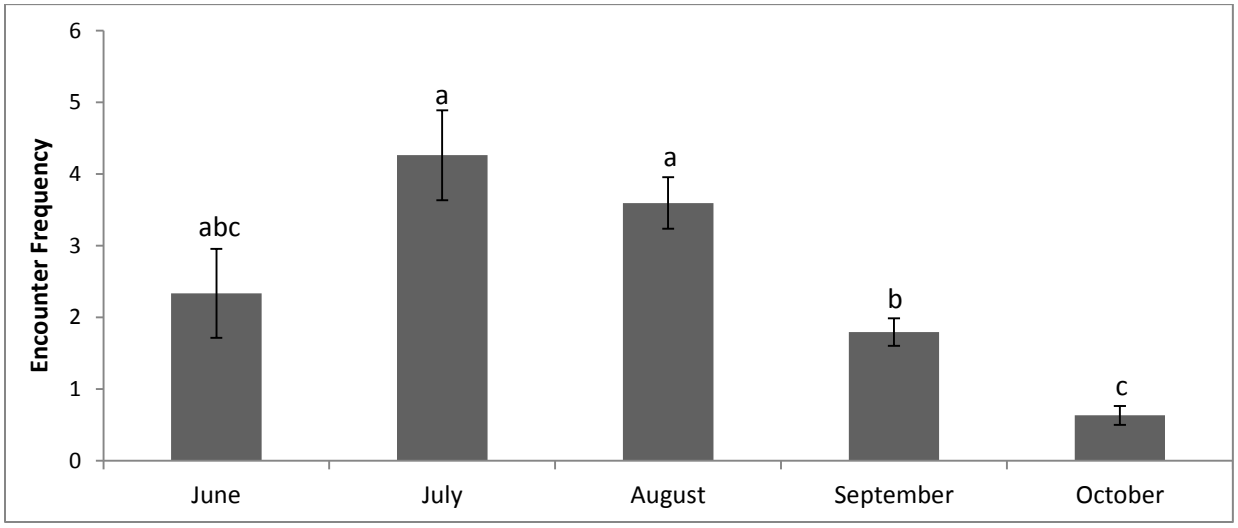


Figure 5. Encounter frequency by month across all inspection stations (Error bars illustrate the standard error). Bars with different letters indicate which months were significantly different from one another based on t-tests (Bonferroni correction $\alpha$=0.005; July-September P<0.001; July-October P<0.0001; August-September P<0.0001; August-October P<0.0001; October-September P<0.001).

Watercraft inspection summary by day of the week

Figure 6 shows the encounter frequency by day of the week across the 2015 pilot season. The data was analysed with and without the inclusion of statutory holidays. As the inclusion of statutory holidays did not change the results, they are included in the figure below. There were no substantive trends in encounter frequency based on the day of the week. Boater traffic on weekends was not significantly different to weekdays. This can be explained by the fact that much of the 2015 season occurred during summer months when many people are on holidays and travel may not be as concentrated around weekends.

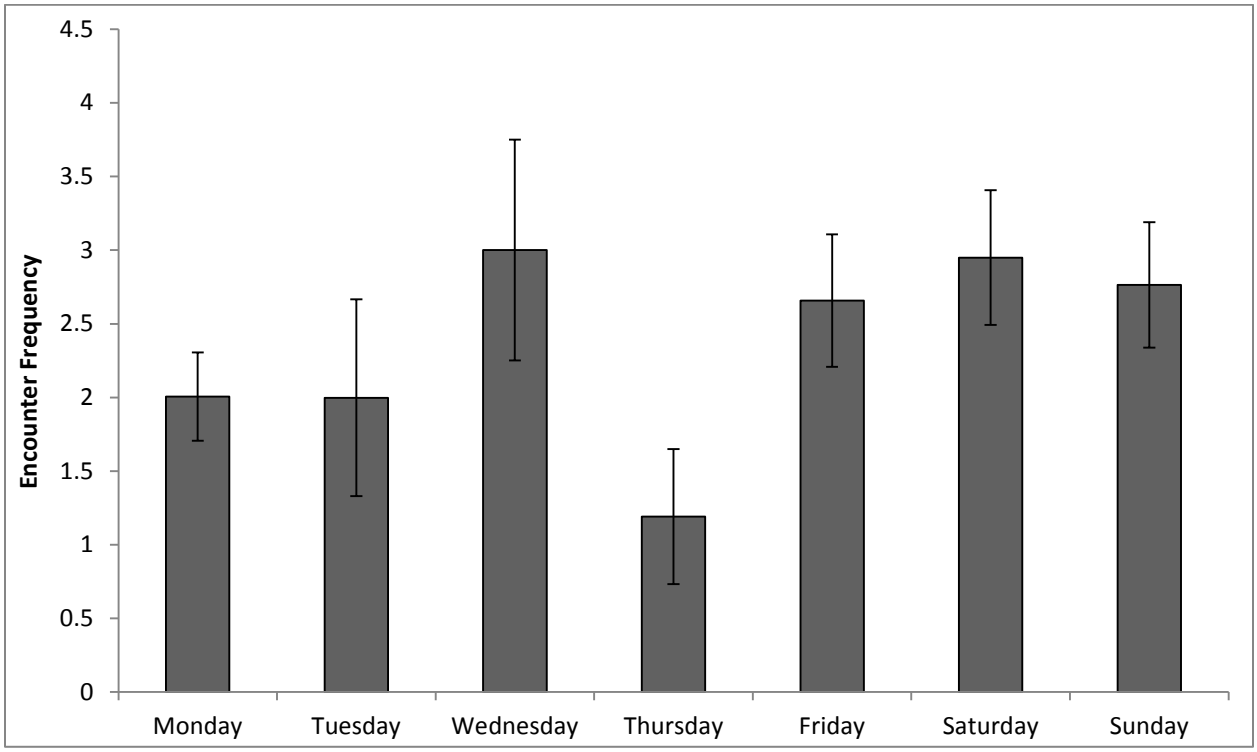


**Figure 6. Encounter frequency by day of the week from June to October 2015 across inspection stations (Error bars illustrate the standard error).**

Watercraft inspection summary by hour of the day

The time of day when boats stopped at inspection stations was recorded as a measure of boater traffic for the months of September and October. The encounter frequency was measured as the ratio of watercraft encounters by the number of shifts across each hour of the day. The encounter frequency did not vary substantially but there were apparent peaks in the late afternoon and encounter rates were lowest at the start and the end of the daily operational period. This could be further assessed in future years by extending the operational hours of inspection stations to assess lower encounter frequency at the start and end of an operational period.

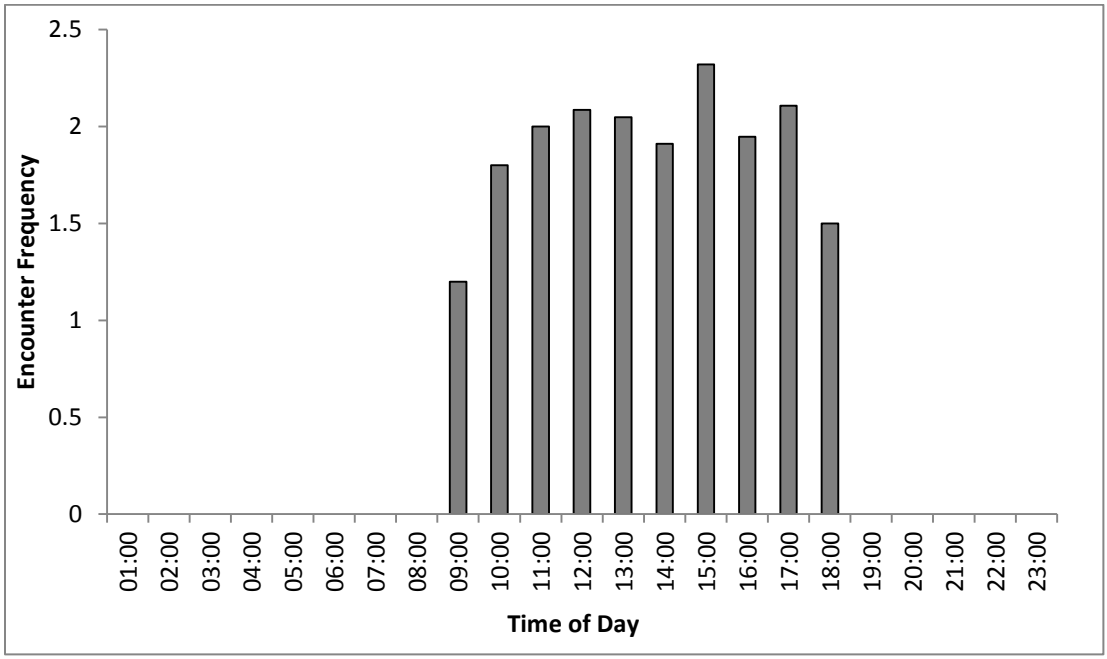


**Figure 7. Encounter frequency across the 24 hour clock for September and October 2015.**

Source and destination locations

Recorded Watercraft traveled into B.C. from 30 different jurisdictions including seven provinces (Alberta, Saskatchewan, Manitoba, Ontario, Quebec, Nova Scotia and Newfoundland) and 23 states (Figure 8). However, the majority of inspected watercraft traveled from a waterbody within B.C. (68%). The remaining primarily traveled from neighbouring jurisdictions: Alberta (21%), Idaho (3.6%) and Washington (2.7%). The remaining 4.5% of the watercraft came from 27 different jurisdictions (Figure 8).

The majority of watercraft were destined for waterbodies within B.C. (79%), followed by waterbodies in neighbouring jurisdictions: Alberta (13%), Idaho (2.7%), Montana (2.2%) and Washington (1.2%). The remaining 1% of the watercraft were destined for waterbodies in 13 different jurisdictions (Figure 9).

The most common destination waterbodies within B.C. were Lake Koocanusa (12.2%), Christina Lake (6.8%), Shuswap Lake (4.3%), Okanagan Lake (4.1%), Kootenay Lake (3.3%), Osoyoos Lake (1.6%), Skaha Lake (1.6%) and Kamloops Lake (1.5%). It is important to note that there were no inspection stations located in the Northeastern part of B.C. at the Dawson Creek border crossings along highways 2 and 49. Therefore the Omineca, Skeena and Peace regions are likely under-represented.

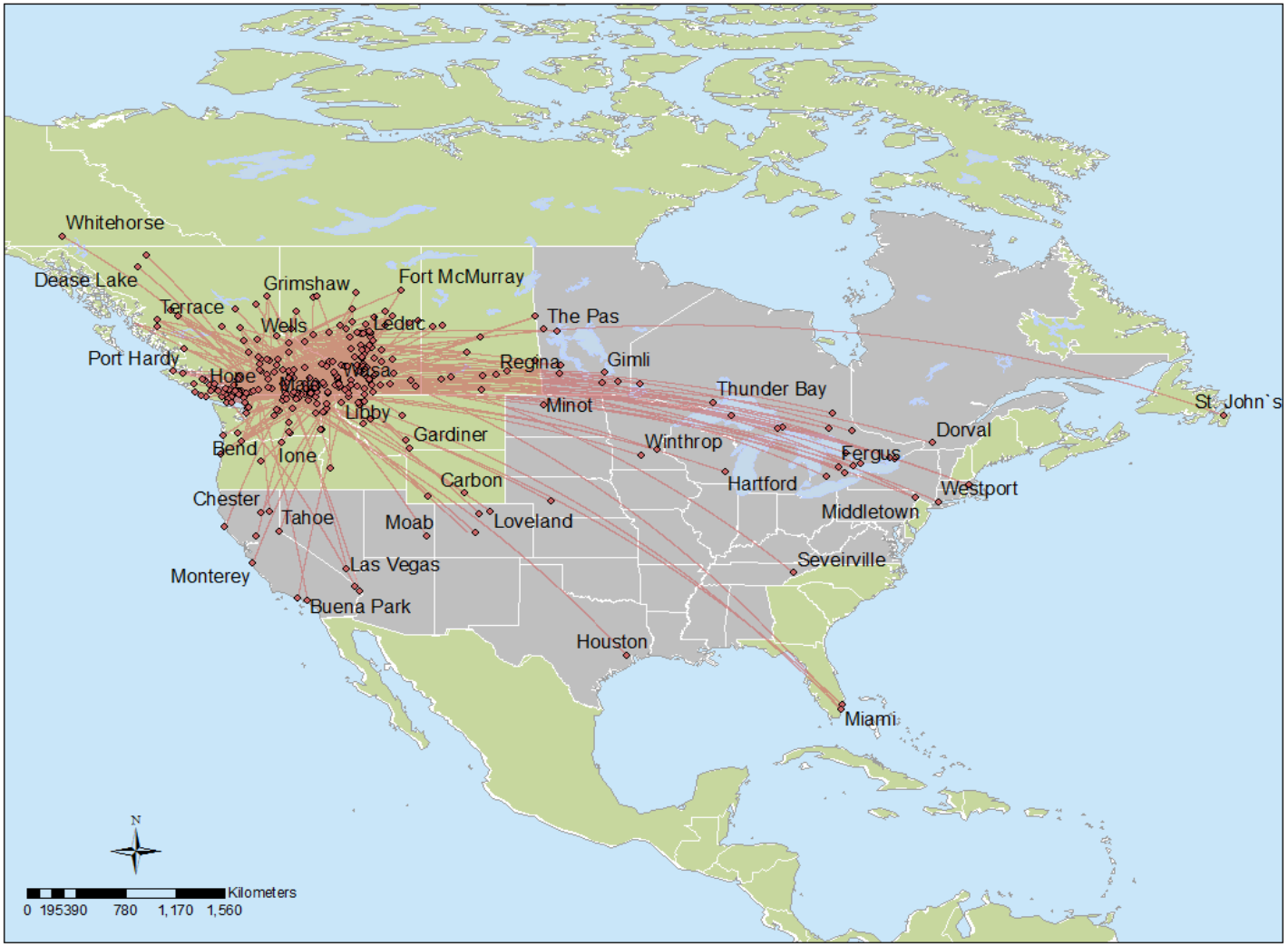


Figure 8. Source location for all watercraft inspected from June to October 2015.

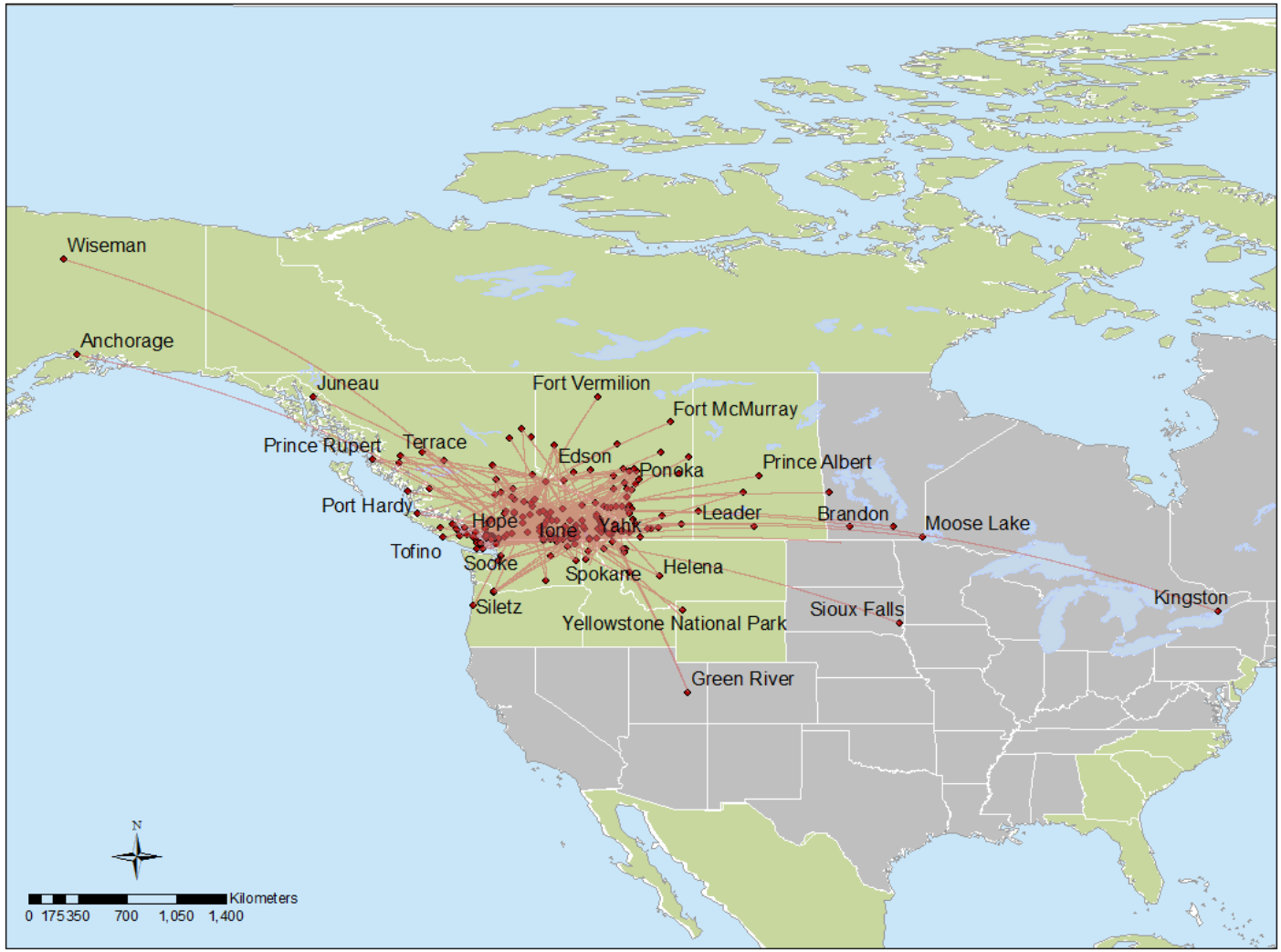


**Figure 9. Destination location for all watercraft inspected from June to October 2015**

Compliance

During each shift at an inspection station, inspectors recorded watercraft failing to stop at the station 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 10 shows the compliance rates for each inspection station across the 2015 season. Compliance rates ranged from 92% at the Osoyoos border crossing to 42% at the Hunter Creek weigh scale.

A number of factors affected the overall compliance at inspection stations. For example, the Osoyoos crossing had very high compliance. Here, watercraft were directed by Canadian Border Services Agency (CBSA) staff to inspectors. This provided little opportunity for watercraft owners to bypass the inspection station. Conversely, several inspection stations such as Hunter Creek, Laidlaw and Kamloops scale, were situated on large highways with high speed limits (120km/h). This decreased the visibility of inspection stations and made it difficult for traffic to safely slow down and pullover. Compliance was also affected by physical station location on roads (e.g. corner, cloverleaf, intersection), nearby road construction, and by targeted traffic direction (one versus two).

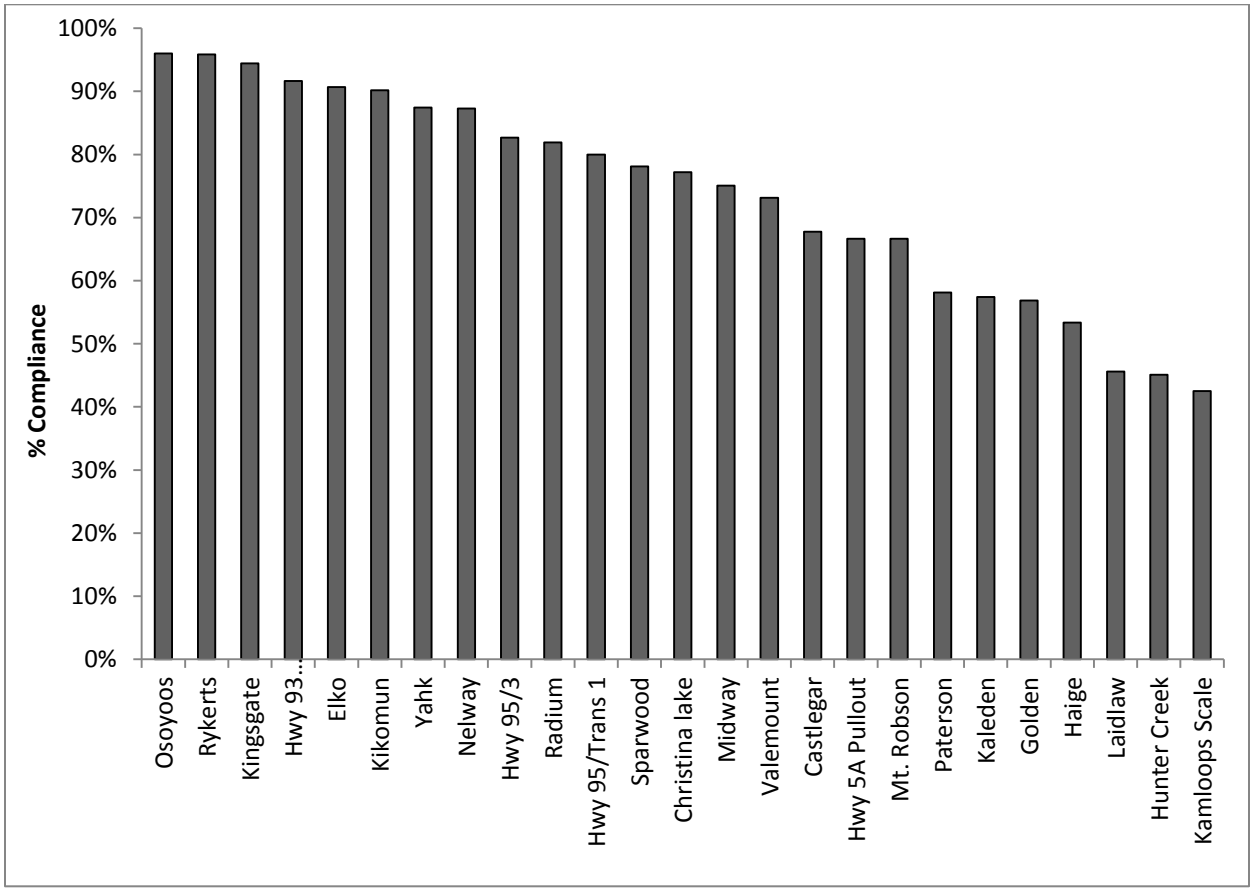


**Figure 10. Percent compliance by inspection station.**

Figure 11 shows that compliance improved from 45% to 79% between the months of June and July and then remained consistent at around 80% for the rest of the season. The average compliance rate for the 2015 season across inspection stations and months was 72%.

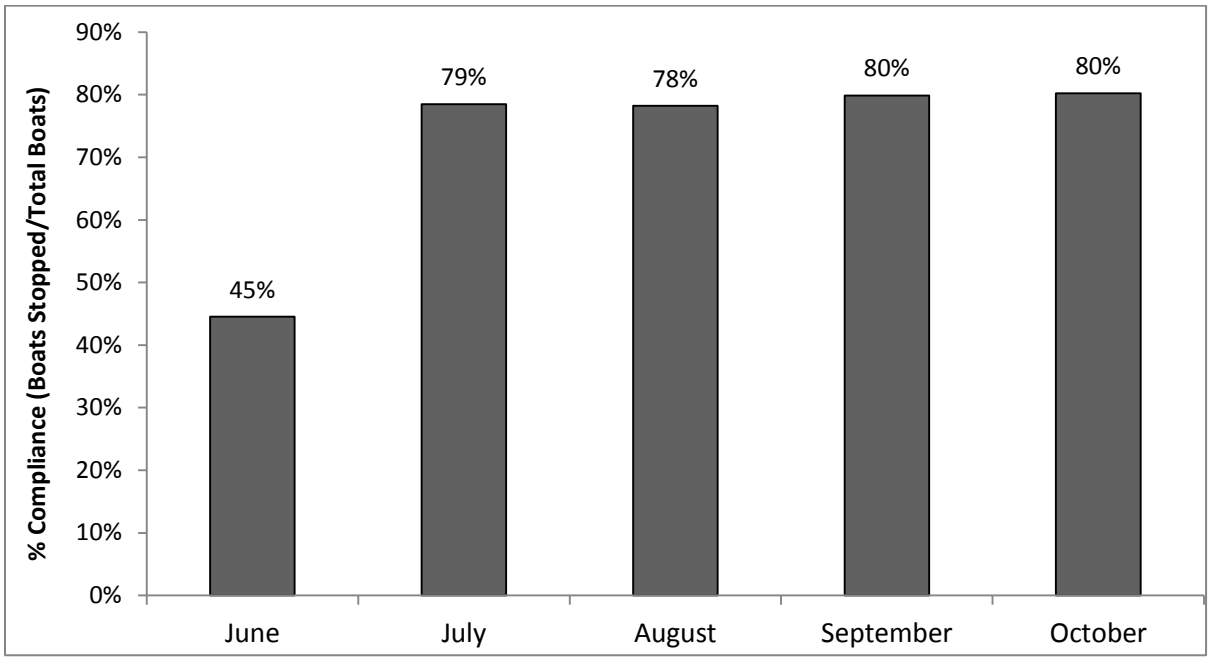


Figure 11. Per cent compliance by month across inspection stations for 2015.

Inspectors also recorded if watercraft owners had previous knowledge of aquatic invasive species (AIS) or Clean, Drain, Dry (CDD) to measure program efficacy and increase education. Watercraft owner's previous knowledge of AIS or CDD increased from 48% in June to 65% in July, and stayed consistently around 62% for the rest of the season. The goal is to continue increasing this number in future years of the program.

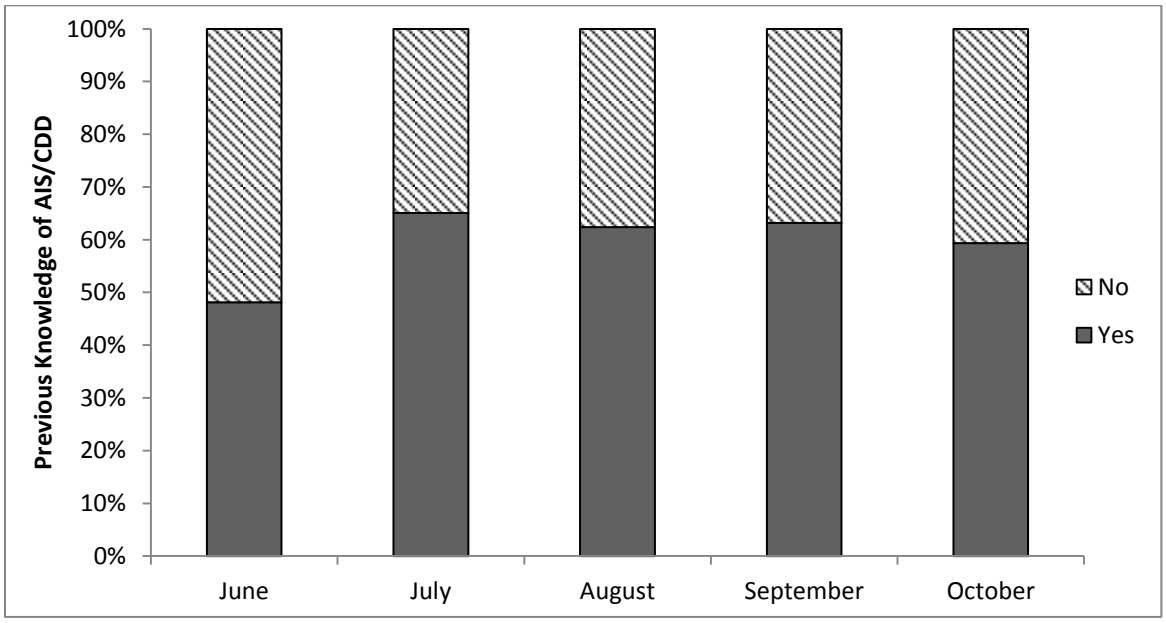


Figure 12. Watercraft owner's previous knowledge of aquatic invasive species (AIS) and/or Clean Drain Dry (CDD) across each month of program operations in 2015.

## 3.2 HIGH RISK WATERCRAFT ENCOUNTERS

### *3.2.1 High Risk Watercraft by Station and Month*

A total of 70 high risk watercraft were encountered over the course of the 2015 season. Of these, 40% (28) were notifications from other jurisdictions. For these notifications, inspections/decontaminations were arranged for a specified date and location. The remaining 60% (42) high risk watercraft were intercepted at highway inspection stations. As such, an encounter frequency for inspection stations was not calculated as it would not be meaningful. However, the absolute number of encounters (notifications plus inspection station encounters) was highest in July and decreased across the rest of the operational months (Figure 13).

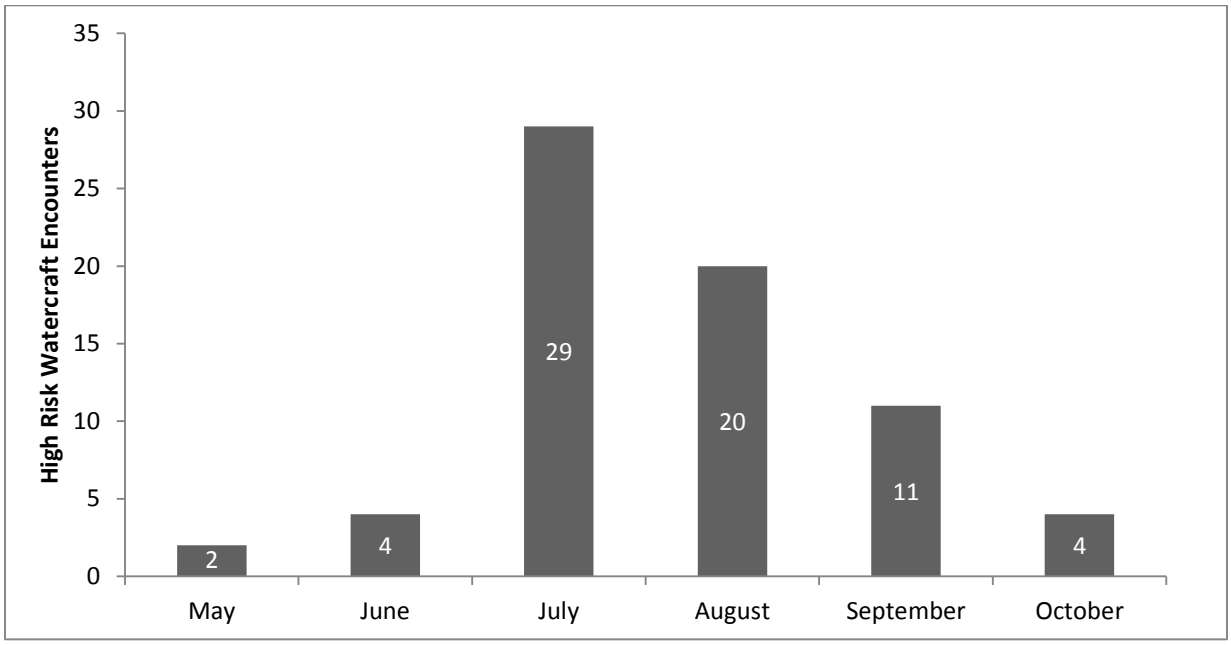


**Figure 13. Total high risk watercraft encounters (including notifications from other jurisdictions) across the 2015 season.**

Figure 14 illustrates the number of high risk watercraft encounters (not including notifications from other jurisdictions) across inspection stations. The Elko inspection station intercepted the largest number of high risk watercraft (six), followed by Osoyoos (five) and Laidlaw (four).

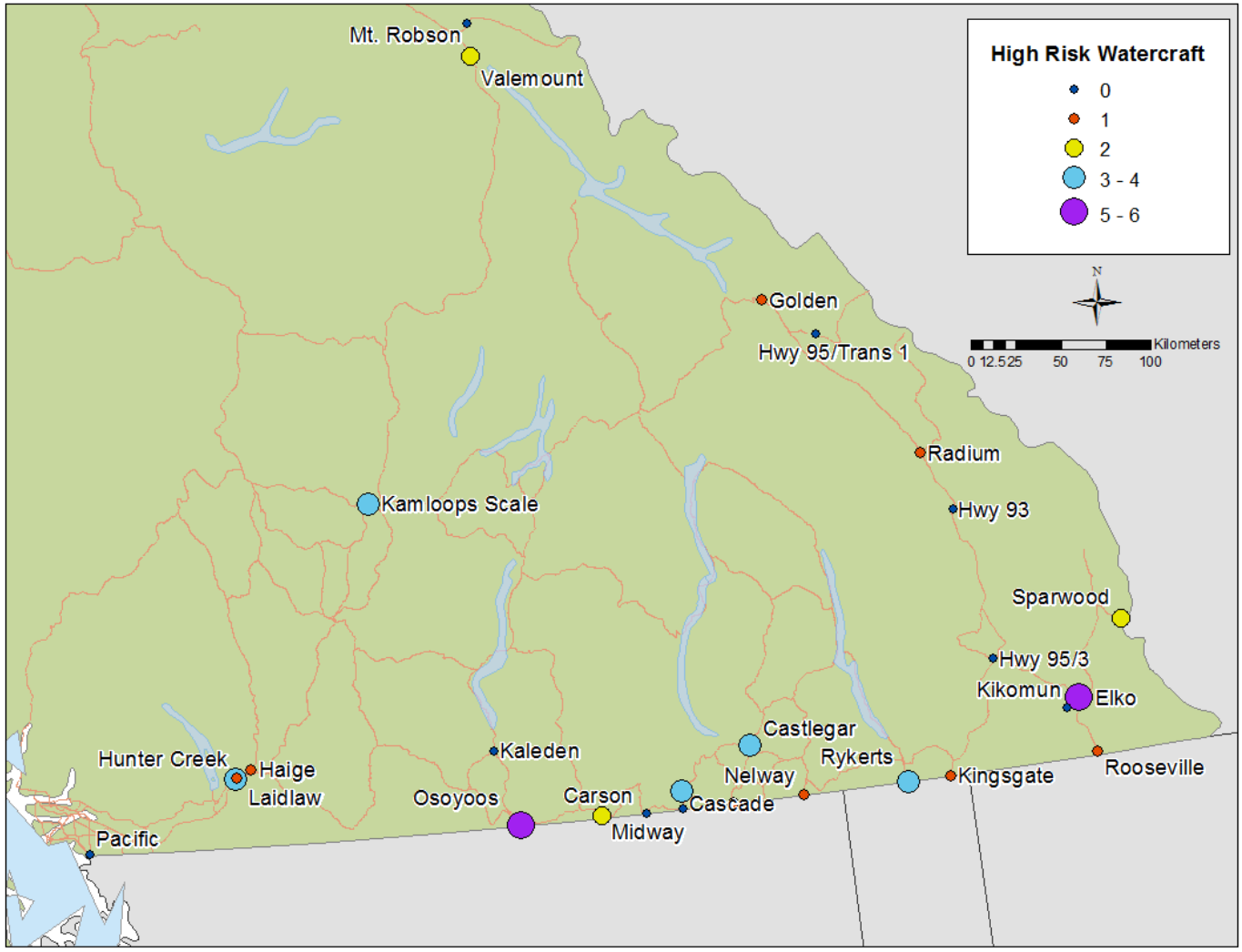


**Figure 14. The number of high risk watercraft (not including notifications from other jurisdictions) by inspection station for the 2015 season.**

### *3.2.2 Source and Destination Locations*

Of the 70 high risk watercraft identified by inspection crews, 43 (62%) came from infested provinces (Ontario, Manitoba or Quebec). The remaining 38% came from 16 different U.S. states (Figure 15 and Figure 17). While this is the first year of the inspection program, notifications of high risk watercraft in previous years primarily came from southern U.S. jurisdictions. The 2015 data indicates a shift in source locations of high-risk watercraft entering British Columbia from southern to eastern jurisdictions. This could be a reflection of increased effort in watercraft inspections along the eastern border in Alberta.

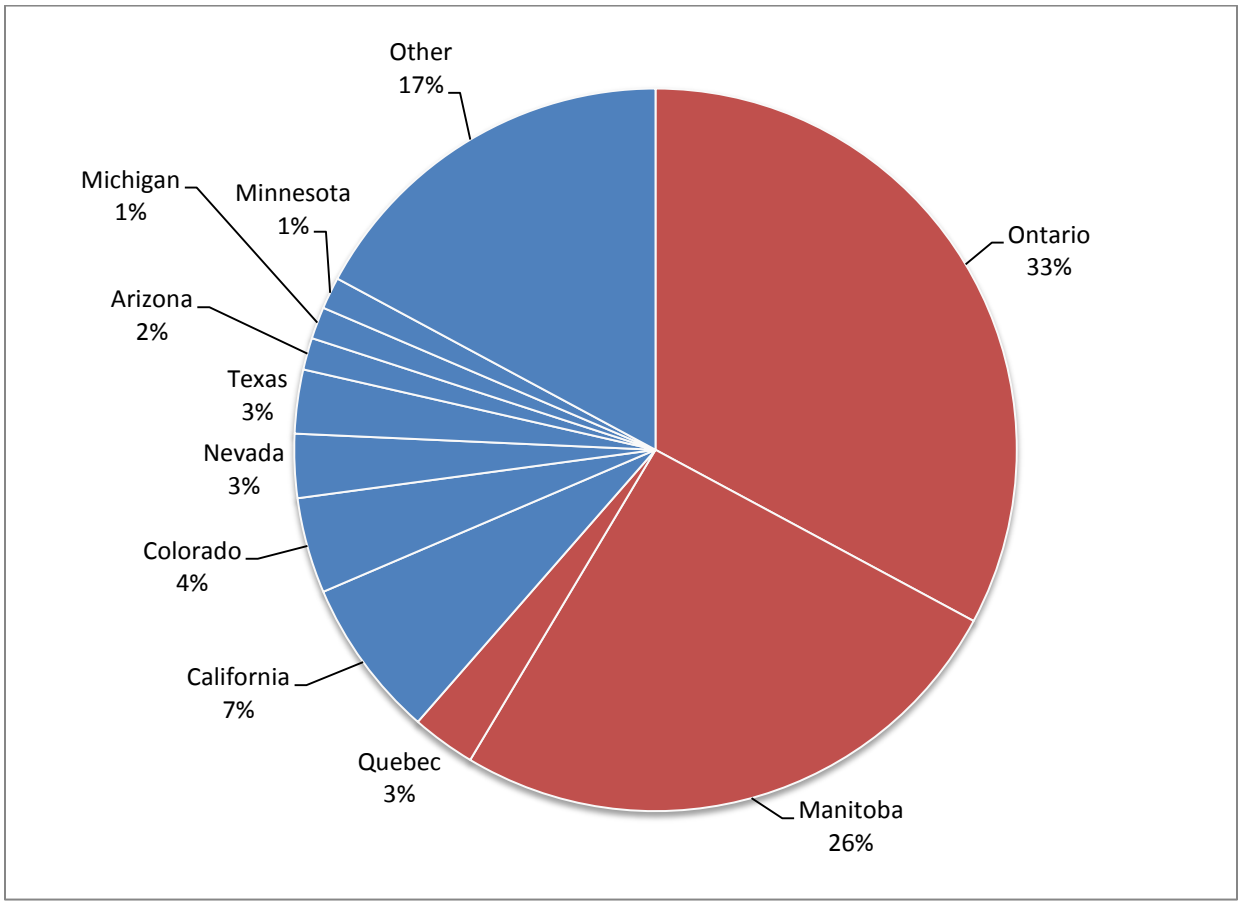


**Figure 15. Source location of all 70 high risk watercraft identified during the 2015 season. The other jurisdictions consists of: Nebraska, New York, North Carolina, North Dakota, South Dakota, Tennessee, Utah, West Virginia and Wyoming.**

Of the high-risk watercraft inspected, 36% were destined for waterbodies in the Okanagan region (Figure 16 and Figure 17), followed by 24% destined for the Pacific Ocean either via the Lower Mainland (12%) or Vancouver Island (12%). High-risk watercraft destined for the Pacific Ocean consisted primarily of large commercially hauled boats coming from the Great Lakes. A total of 15 (21%) high risk watercraft were destined for waterbodies outside of B.C.. If the watercraft was still considered high risk following inspection/decontamination, destination jurisdictions were notified.

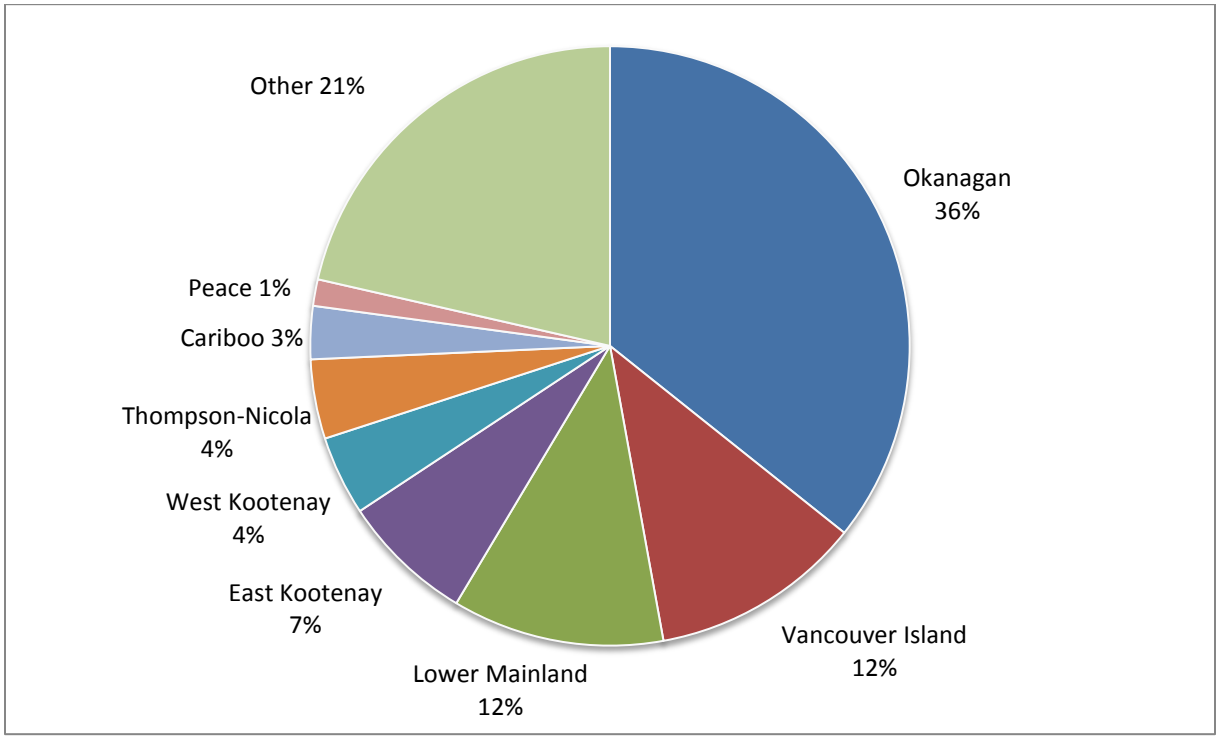


**Figure 16. Destination of all 70 high risk watercraft identified during the 2015 season. The other jurisdictions included: Washington, Alberta, Alaska, Wyoming, Montana and South Dakota.**

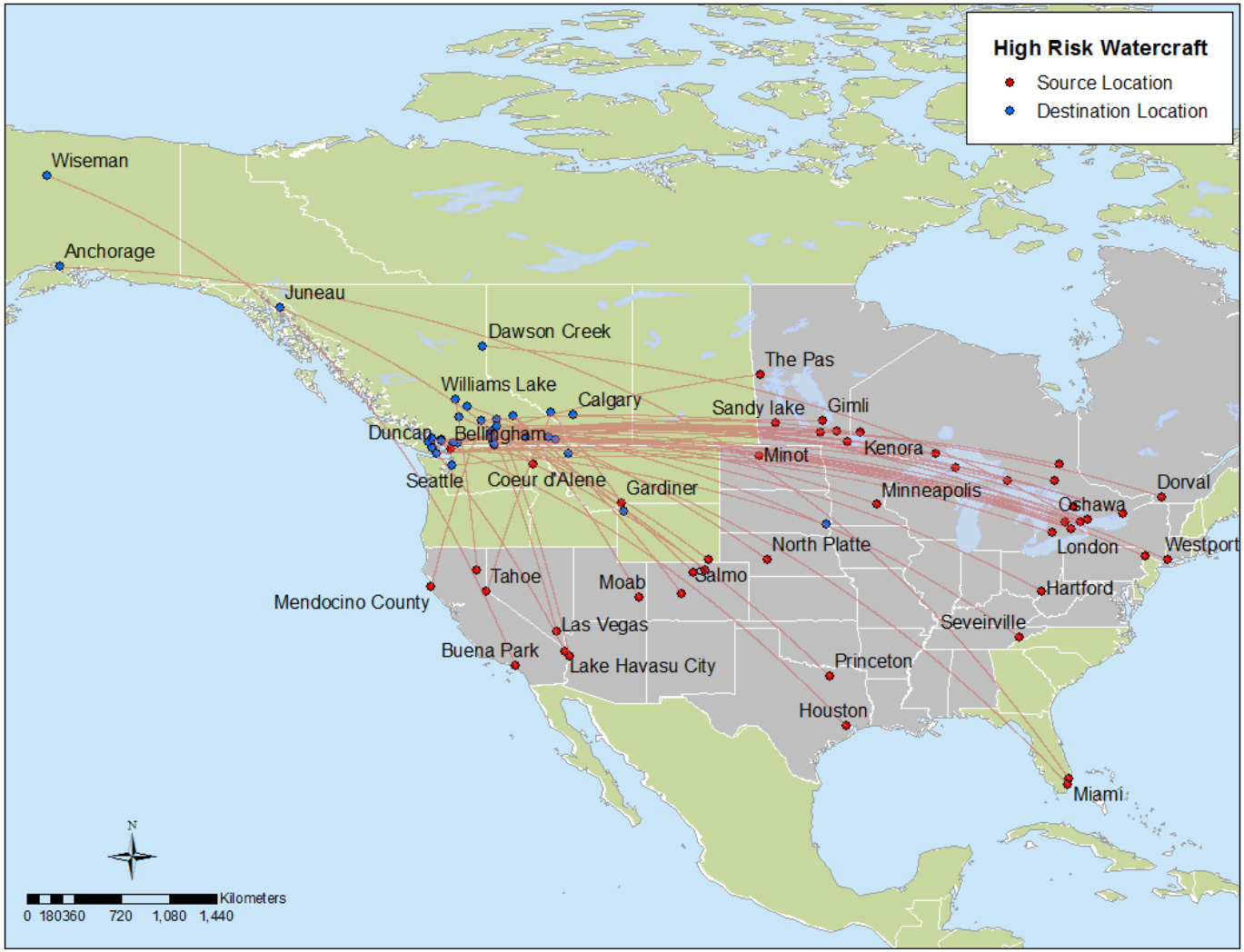


**Figure 17. Source and destination locations of the 70 high risk watercraft identified during the 2015 season.**

### *3.2.3 Watercraft Types*

Despite the fact that canoes and kayaks were the highest total number of watercraft type inspected (23.9%), they represented very little risk with only 2.1% registering as high risk. Conversely, small and large sailboats represented a small per cent of the total watercraft inspected (1.4%), but had disproportionately higher risk at 27% and 23%. Other watercraft types that posed high risk included cabin cruisers (10.2%), jet boats (3.1%) inflatable boats (3%), pontoon boats (2.4%) and sport fishing/bass boats (1.7%) (Figure 18).

These results are consistent with larger boats such as sailboats, cabin cruisers and pontoon boats posing a greater risk than smaller boats because they typically sit in infested waterbodies for long periods of time. Smaller canoes, kayaks and sailboats can still have 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.

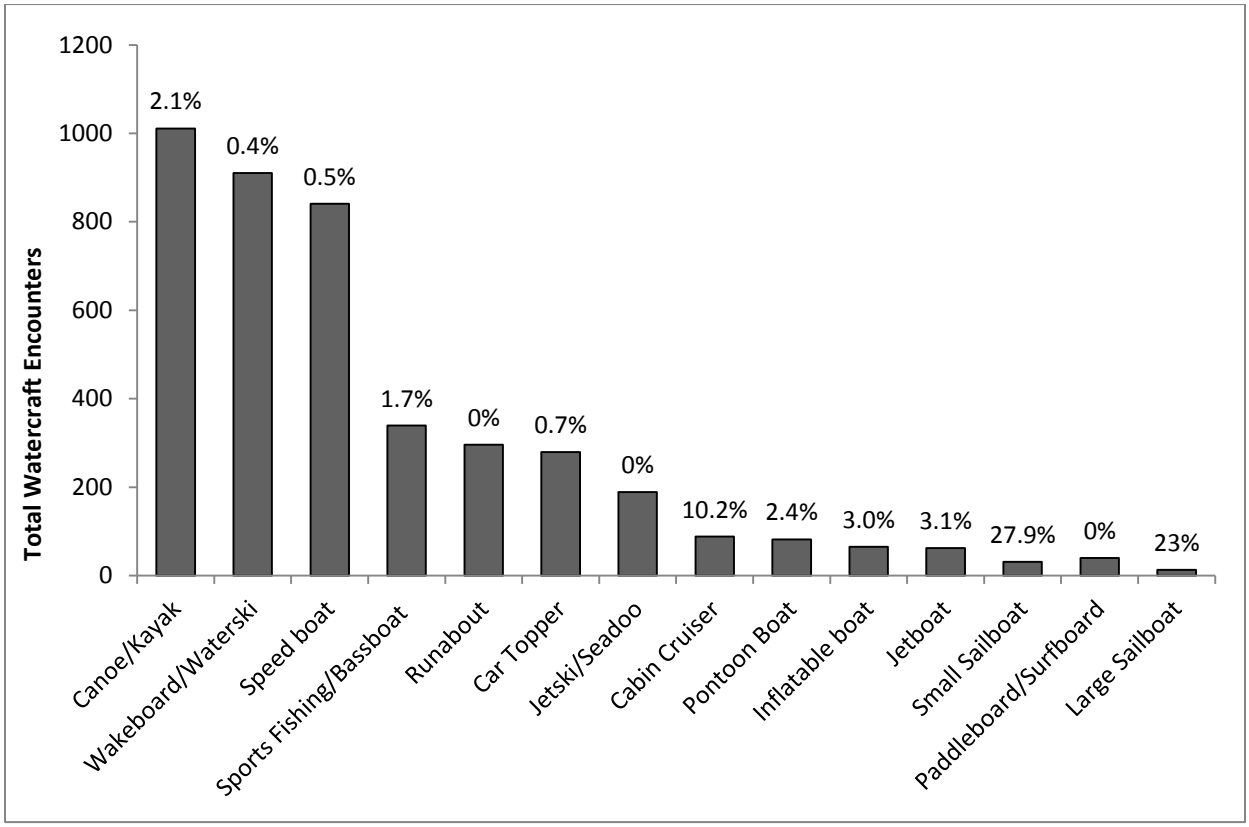


**Figure 18. Total watercraft encounters by watercraft type. Data labels indicate the per cent that registered as high risk.**

### *3.2.1 Inspection Findings*

Of the 70 high risk watercraft identified as coming from infested jurisdictions, 34 were decontaminated. Of those, six were issued quarantine orders to allow for sufficient drying time of 30 days out of water (Figure 19). Of the 34 watercraft that were decontaminated, 11 were confirmed to have adult invasive mussels and four contained standing water and subsequently, risk of containing invasive mussel larvae (Figure 21). The remaining 36 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, having been out of the water for over 30 days, or for arriving from a previous successful inspection.

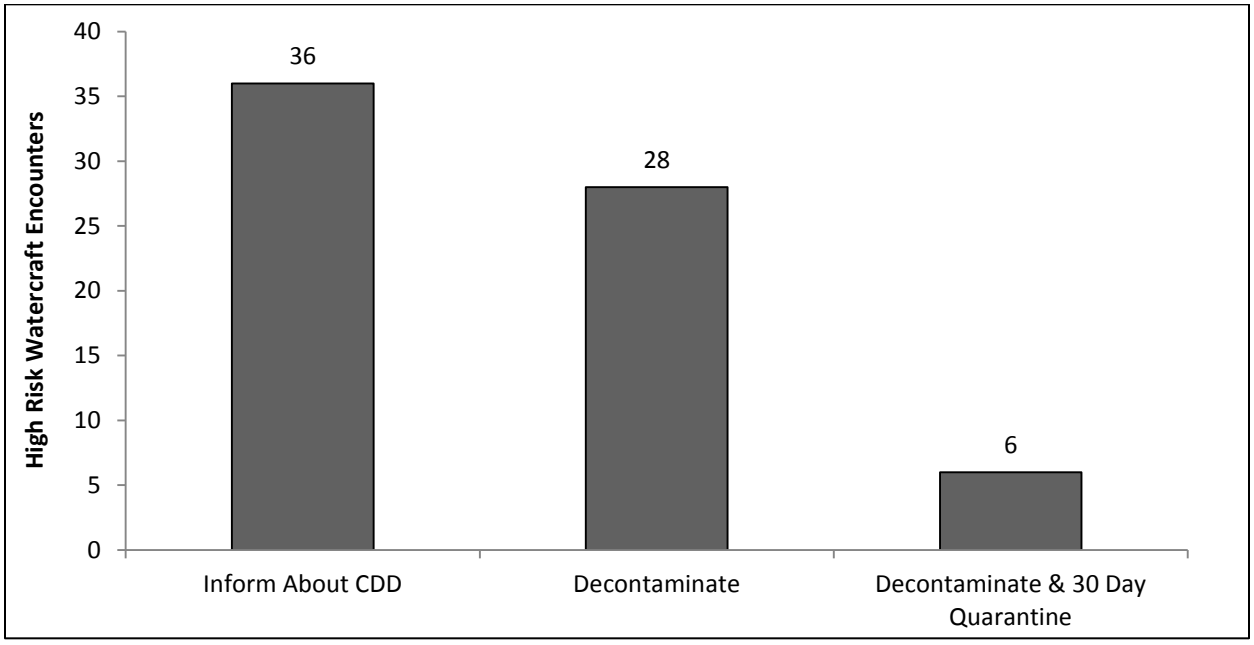


**Figure 19. Actions taken by inspection crews following inspection of high risk watercraft.**

### 3.3 MUSSEL INFESTED WATERCRAFT

A total of 15 mussel infested watercraft were encountered (through notifications or at inspection stations). The highest number of encounters took place in July with six mussel infested watercraft (Figure 20), followed by four infested watercraft in August and three infested watercraft in September. While the inspection stations were not fully operational until June, notifications of high risk watercraft from other jurisdictions occurred in May. This demonstrates the importance of having inspection stations operational at the beginning of boating season in the spring.

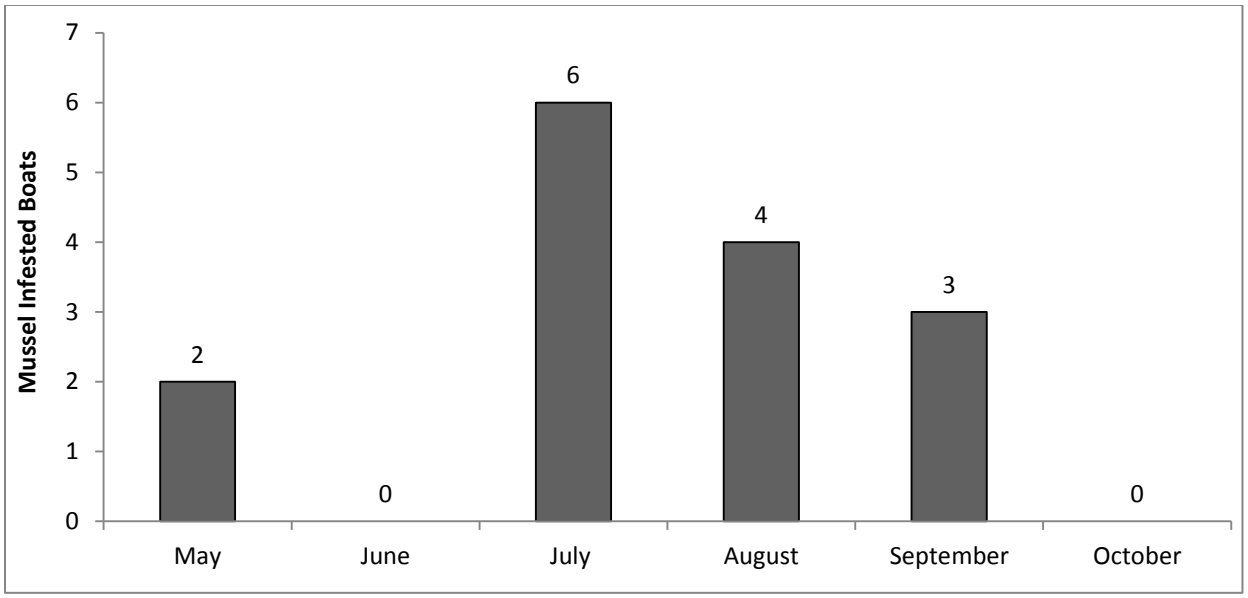


Figure 20. The number of mussel infested watercraft by month of the 2015 season.

A total of 47 of the 70 high risk watercraft had been through a previous inspection station either within B.C. or from within another jurisdiction (Figure 21). Of the 15 mussel infested watercraft, seven had been through a previous inspection station. This highlights the importance of having several layers of inspection stations to increase the likelihood of detection. Of the seven watercraft that had been previously inspected, four were commercially hauled watercraft that could not be fully decontaminated at the previous inspection station and had to be dealt with at the destination in B.C. (see below for further detail on commercially hauled watercraft). Of the remaining three previously inspected watercraft, two could not be fully decontaminated due to mechanical problems. For the remaining one B.C. was notified by the source jurisdiction for follow-up.

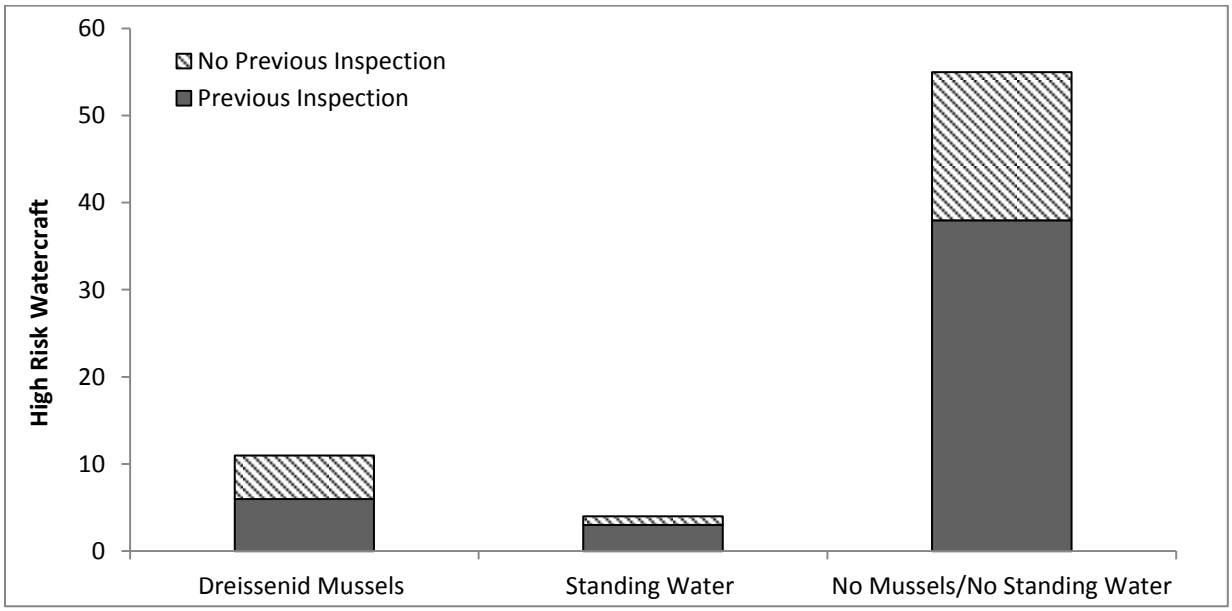


**Figure 21. Inspection findings for high risk watercraft and the proportion that have been through a previous inspection station.**

Nearly all mussel infested watercraft travelled from an infested jurisdiction in the eastern provinces and states, and more specifically, from around the Great Lakes. The Watercraft travelling from Coeur D'Alene, Idaho was identified as high risk because it was registered to an infested State, and large amounts of standing water was found during the inspection (Figure 22).

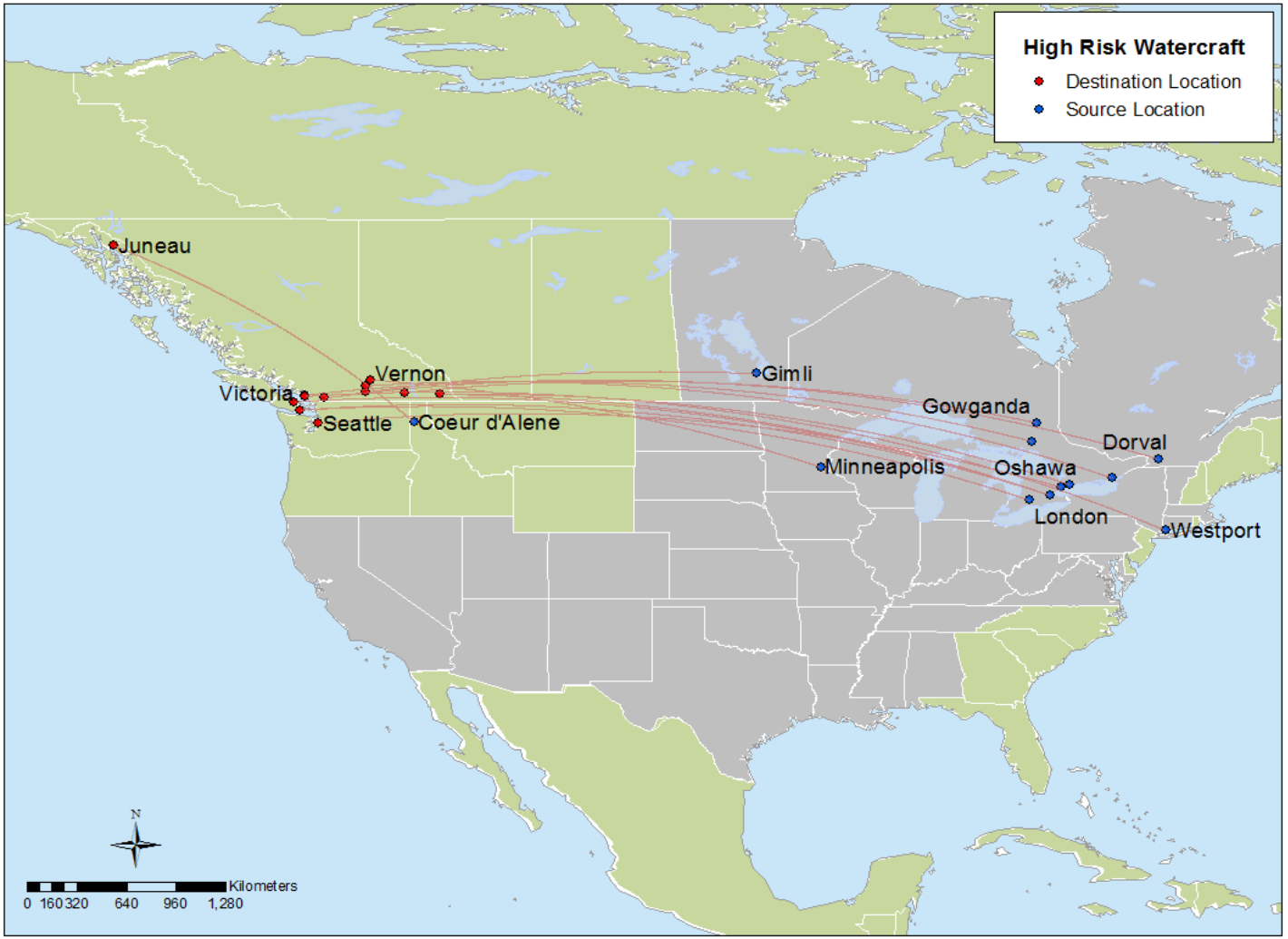


Figure 22. The source and destination locations of mussel infested watercraft decontaminated during the 2015 season.

### 3.4 COMMERCIALLY HAULED WATERCRAFT

Commercially hauled watercraft represent a very low percent of total watercraft, however, they demonstrate a disproportionately higher risk of carrying invasive mussels. While only 17% of high risk watercraft were commercially hauled, 53% of mussel infested watercraft were commercially hauled (Figure 23).

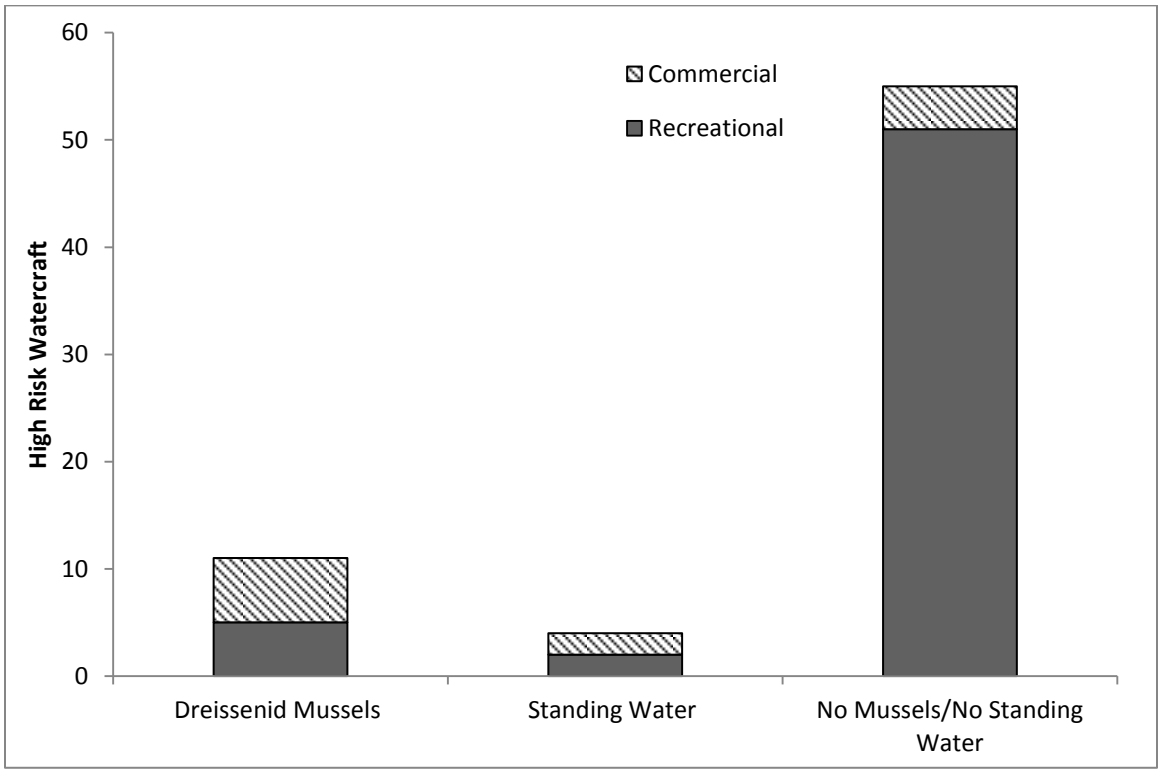


**Figure 23. Proportion of high risk watercraft commercially or recreationally hauled across different inspection findings.**

## 4. 2015 LAKE MONITORING

Another important component of the BC Invasive Mussel Defence Program is on-going monitoring of B.C. lakes to test for the presence of invasive mussel veliger larvae. This monitoring is a critical first step in the early detection and rapid response (EDRR) 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 Zebra and Quagga mussel veliger monitoring can be found in the *BC 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* which is the standard method used by other jurisdictions for Zebra and Quagga mussel veliger monitoring and detection.

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

In 2015, a total of 161 samples were collected from 58 lakes throughout B.C. (Figure 24). Samples were collected by Ministry of Environment and Ministry of Forests, Lands and Natural Resources regional staff and several regional invasive species committees: the Boundary Invasive Species Society (BIS), the Central Kootenay Invasive Species Society (CKISS), the Columbia-Shuswap Invasive Species Society (CSISS), the Christina Lake Invasive Species Society (Christina Lake), the East Kootenay Invasive Species Society (EKISS) and the Okanagan and Similkameen Invasive Species Society (OASISS). See Appendix 2 for results from *Cross Polarized Light Microscopy* analysis of 2015 samples.

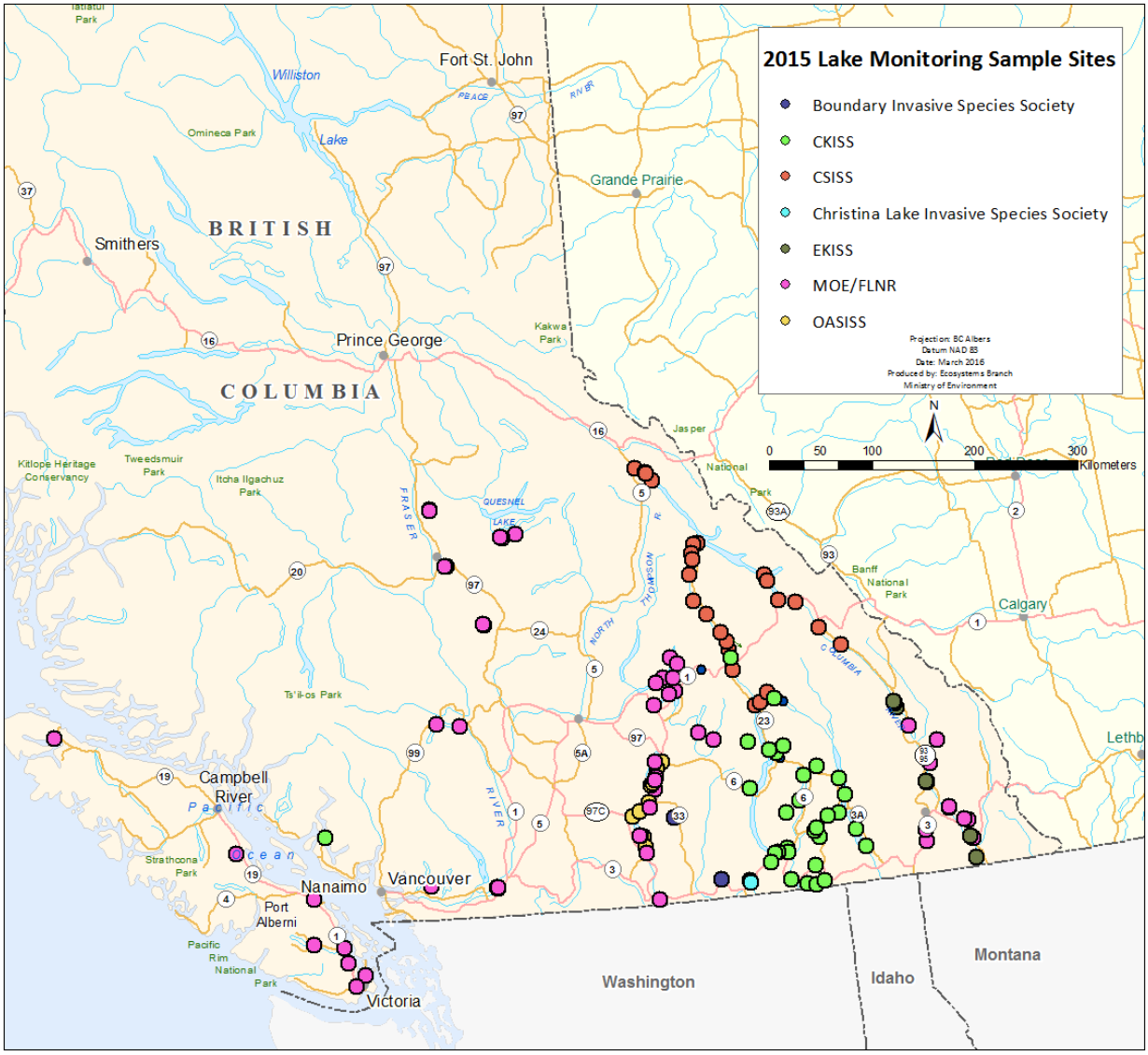


**Figure 24. 2015 invasive mussel veliger samples collected from sites throughout B.C. by Ministry of Environment, Ministry of Forests, Lands and Natural Resources regional staff and regional invasive species committees (see Appendix 2 for full list of samples and results).**

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

During the highway inspection stations inspectors interacted with approximately 10,000 people to educate the boating community on 'Clean, Drain, Dry' practices. Each crew was supplied with various outreach materials including wallet cards, rack cards and stickers to hand out to the public. The crews also had hands on education materials such as Zebra and Quagga mussel shells encased in blocks of resin and photos of mussel encrusted boats and water equipment that they used for public demonstrations.

While the highway inspection stations were the first priority of the program, when time permitted inspection crews also attended local events to provide education and demonstrations on watercraft inspection and decontamination. Inspection crews worked with several regional invasive species committees to identify suitable events to attend.

## 6. LESSONS LEARNED

Legislation

The existing legislation in place (CAS) was found to be fully adequate to manage the risk of invasive mussels being transported into B.C.. It provides the necessary powers to inspectors to stop, inspect and address any mussel related issues associated with transported watercraft. Procedures quickly evolved through the first year of operation such that there are no significant gaps that need to be addressed going forward.

Inter-agency coordination

Inter-agency coordination was a critical component of the Program. Inter-agency coordination with CVSE 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 CVSE, 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 additional agencies such as Federal Fisheries Officers, Natural Resource Officers, Provincial Park Rangers, Municipal Police Departments and National Parks Staff.

Inter-agency co-ordination with other jurisdictions regarding high risk watercraft notifications was also a critical component of the program. The Province of B.C. worked closely with the Alberta mussel program to respond to numerous high risk watercraft notifications coming from the east. The Province worked with other jurisdictions including Manitoba, Montana, Washington, Idaho, Nevada and California regarding high risk watercraft either destined or travelling through for B.C..

Inspection station locations

Data from the 2015 boating season will be used to identify the optimal locations for inspection stations in the 2016 season. The 2015 inspection locations will be assessed for suitability as permanent inspection stations based on encounter frequency (watercraft encounters/effort), safety/communication, direction(s) of traffic targeted, the source location of boaters (per cent coming from outside B.C.) and the number of high risk and mussel infested watercraft intercepted.

With over 50% of the high-risk watercraft intercepted during the 2015 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 2016. The southern border crossings represent a challenge as the total number of crossings and volume of watercraft transportation are relatively low at some locations. While these cannot be ignored, it is not an effective use of staff time to have full-time inspections at each crossing. With the passing of the Federal AIS legislation in June 2015 the Province hopes to continue to work with the Canadian Border Services Agency 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 be alerted to high risk watercraft wanting to enter B.C. from any U.S. border crossings.

Watercraft inspection summary

Watercraft inspection data showed that encounter frequency was not significantly higher on weekends relative to weekdays, illustrating the importance of having highway inspection stations operational seven days a week. While highway inspection stations were not operational until June, several high risk watercraft notifications from other jurisdictions were received in May. This demonstrates the importance of having highway inspection stations open earlier in the year to target the start of the boating season.

Currently, there are no inspection programs in the Pacific Northwest that operate at night, therefore very little is known about watercraft movement at night. In future years, the program aims to work with Ministry of Transportation staff to determine ways to track boater movement outside of operational hours including at night.

Compliance

A number of factors affected overall compliance at inspection stations such as station location on roads (e.g. corner, cloverleaf, intersection), speed limit (80km/h vs. 120km/h), nearby road construction and targeted traffic direction. The average compliance for the 2015 season (72%) is comparable to other jurisdictions' watercraft inspection program compliance rates during their first year 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 in future years.

Data from inspection stations shows 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.

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 2015 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 destination were 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.

Commercially hauled watercraft

Data showed that large commercially hauled watercraft posed a significant risk relative to recreationally hauled boats. They also posed significant logistical and operational challenges for inspection crews. Large commercially hauled watercraft were typically inaccessible during transportation because they were either too high off the ground (required a crane for offloading), they were plastic wrapped, or the engine/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 are a small "community" there is an opportunity to establish an effective working relationship with them that will ultimately reduce risks. Moving forward, it will be important to establish procedures that commercial haulers and owners can use to enable them to move quicker through inspection stations during transportation, with arranged full inspections/decontaminations at the end destination.

## APPENDIX 1

**Table 3. 2015 Watercraft inspection station details.**

| Station Name | Hwy # | Region | Type | Traffic Direction/Comments |
|---|---|---|---|---|
| **Carson** | 41 | West Kootenay | Border crossing | Northbound |
| **Cascade** | 395 | West Kootenay | Border crossing | North and southbound |
| **Castlegar** | 3 | Kootenay | Weigh scale | East and westbound |
| **Christina lake** | 3 | Kootenay | Pullout | East and westbound |
| **Elko** | 93 and 3 | East Kootenay | Pullout | Westbound and northbound |
| **Golden** | 1 | Kootenay | Weigh scale | East and westbound. Road construction prevented crews from setting up at certain times during the 2015 season but very suitable for 2015 season. |
| **Haige** | 7 | Fraser Valley | Weigh scale | West and eastbound |
| **Hunter Creek** | 1 | Fraser Valley | Weigh scale | Westbound |
| **Hwy 5A** | 5A | Okanagan | Pullout | Eastbound. Not suitable for permanent station. |
| **Hwy 93 Columbia Lake** | 93 | East Kootenay | Rest stop | East and westbound |
| **Hwy 95/3** | 95/3 split | East Kootenay | Pullout | East and westbound (primarily) |
| **Hwy 95/Trans 1** | 1 | East Kootenay | Pullout | Westbound. Not safe/suitable for a permanent station. |
| **Kaleden** | 97 | South Okanagan | Weigh scale | East and northbound |
| **Kamloops Scale** | 1 | Thompson | Weigh scale | East and west (at separate times-divided highway) |
| **Kikomun** | Off 93 | East Kootenay | Pullout | North, east, south and west |
| **Kingsgate** | 95 | East Kootenay | Border crossing | Northbound |
| **Laidlaw** | 1 | Fraser Valley | Weigh scale | Eastbound |
| **Midway** | 3 | Kootenay | Weigh scale (not active) | East and westbound |
| **Mt. Robson** | 16 | Kootenay | Pullout | Westbound. Communication challenges (very limited satellite coverage) in 2015 prevented full set-up at this location. |
| **Nelway** | 6 | West Kootenay | Pullout | North and southbound |
| **Osoyoos** | 97 | Okanagan-Shushwap | Border crossing | Northbound |
| **Pacific** | 15 | Lower Mainland | Weigh scale | Northbound. Too many highway signs and not suitable for a permeant station. |
| **Paterson** | 22 | West Kootenay | Weigh scale (not active) | Northbound |
| **Radium** | 95 | East Kootenay | Pullout | Southbound |

| Station Name | Hwy # | Region | Type | Traffic Direction/Comments |
|---|---|---|---|---|
| **Rooseville** | 93 | East Kootenay | Border crossing | Northbound |
| **Rykerts** | 21 | Central Kootenay | Border crossing | North and southbound |
| **Sparwood** | 3 | East Kootenay | Weigh scale | Westbound |
| **Valemount** | 5 | Peace | Pullout | Westbound |
| **Yahk** | 95 and 3 | East Kootenay | Weigh scale | East and northbound |

## APPENDIX 2

**Table 4. Results from 2015 veliger sample analysis using *Cross Polarized Light Microscopy*. Analysis completed by the Limno Lab in Vancouver, B.C..**

| Lake | Sampling Agency | Lat (Decimal degrees) | Long (decimal degrees) | Date sampled (mm/dd/yyyy) | ZQM Veliger Detected? (YES/NO) | Native Species Detected |
|---|---|---|---|---|---|---|
| **Alouette Lake** | MOE | 49.2935661 | -122.4881418 | 07/21/2015 | No | - |
| **Alouette Lake** | MOE | 49.2935661 | -122.4881418 | 08/25/2015 | No | - |
| **Alouette Lake** | MOE | 49.2935661 | -122.4881418 | 09/15/2015 | No | - |
| **Anderson Lake** | MOE | 50.7012034 | -122.3032185 | 07/14/2015 | No | - |
| **Anderson Lake** | MOE | 50.7012034 | -122.3032185 | 08/11/2015 | No | - |
| **Arrow Lake** | CSISS | | | 09/29/2015 | No | - |
| **Arrow Lake** | CSISS | | | 09/29/2015 | No | - |
| **Arrow Lake** | CSISS | | | 09/29/2015 | No | - |
| **Baynes Lake** | MOE | 49.233809 | -115.221889 | 10/05/2015 | No | Ostracoda |
| **Box Lake** | CKISS | 50.2058409 | -117.7119506 | 09/16/2005 | No | Ostracoda |
| **Brannen Lake** | MOE | 49.2141 | -124.05018 | 08/31/2015 | No | - |
| **Chimney Lake** | MOE | 51.54358 | -121.57084 | 08/14/2015 | No | - |
| **Chimney Lake** | MOE | 51.55351 | -121.58481 | 08/14/2015 | No | Ostracoda |
| **Christina Lake** | MOE | 49.123533 | -118.250642 | 09/29/2015 | No | - |
| **Christina Lake** | Christina Lake Invasive Species Society | 49.1236807 | -118.2504725 | 09/05/2015 | No | - |
| **Christina Lake** | Christina Lake Invasive Species Society | 49.1021044 | -118.2408879 | 09/05/2015 | No | - |
| **Columbia Lake** | MOE | 50.28878 | -115.8696 | 08/26/2015 | No | Ostracoda |
| **Columbia River** | CKISS | 49.0914712 | -117.6981404 | 07/16/2015 | No | Ostracoda |
| **Columbia River** | CKISS | 49.0914712 | -117.6981404 | 08/12/2015 | No | - |
| **Columbia River** | CKISS | 49.0914712 | -117.6981404 | 09/18/2015 | No | - |
| **Columbia River** | CSISS | 51.243443 | -116.9110194 | 09/21/2015 | No | - |
| **Columbia River** | CSISS | 51.0696151 | -116.6430572 | 09/21/2015 | No | - |
| **Columbia River** | CSISS | | | 09/23/2015 | No | - |
| **Columbia River** | CKISS | 49.3343185 | -117.6997932 | 08/07/2015 | No | Ostracoda |
| **Columbia River** | CKISS | 49.3666983 | -117.7002527 | 08/20/2015 | No | Ostracoda |
| **Columbia River** | CKISS | 49.3343185 | -117.6997932 | 09/23/2015 | No | - |
| **Columbia River** | CSISS | 51.4838553 | -117.1856209 | 09/23/2015 | No | Ostracoda |
| **Comox Lake** | MOE | 49.62745 | -125.08411 | 08/12/2015 | No | - |
| **Cottonwood Lake** | CKISS | 49.4299117 | -117.2547341 | 09/09/2015 | No | - |
| **Cowichan lake** | MOE | 48.81875 | -124.06781 | 08/18/2015 | No | - |

| Lake | Sampling Agency | Lat (Decimal degrees) | Long (decimal degrees) | Date sampled (mm/dd/yyyy) | ZQM Veliger Detected? (YES/NO) | Native Species Detected |
|---|---|---|---|---|---|---|
| **Dragon Lake** | MOE | 52.57234 | -122.24366 | 08/27/2015 | No | Ostracoda |
| **Dragon Lake** | MOE | 52.56476 | -122.25346 | 08/27/2015 | No | Ostracoda |
| **Elk Lake** | MOE | 48.5389 | -123.40743 | 08/17/2015 | No | Ostracoda |
| **Ellison Lake** | MOE | 49.998132 | -119.402142 | 09/09/2015 | No | Ostracoda |
| **Erie Lake** | CKISS | 49.1901072 | -117.3517802 | 09/10/2015 | No | Ostracoda |
| **Fish Lake** | CKISS | 50.0449377 | -117.1822201 | 09/15/2015 | No | Ostracoda |
| **Garbutts Lake** | MOE | | | 10/22/2015 | No | - |
| **Garbutts Lake** | MOE | | | 10/22/2015 | No | - |
| **Idabel Lake** | Boundary Invasive Species Society | 49.7400943 | -119.1791728 | 08/24/2015 | No | - |
| **Jewel Lake** | Boundary Invasive Species Society | 49.1634069 | -118.6224348 | 08/25/2015 | No | Ostracoda |
| **Kalamalka Lake** | MOE | 50.180473 | -119.34057 | 09/16/2015 | No | Ostracoda |
| **Kalamalka Lake** | OASISS | 50.2263645 | -119.2637408 | 08/20/2015 | No | Ostracoda |
| **Kalamalka Lake** | OASISS | 50.1803796 | -119.3408227 | 08/20/2015 | No | Ostracoda |
| **Kinbasket Lake** | CSISS | | | 09/22/2015 | No | Ostracoda |
| **Kinbasket Lake** | CSISS | | | 09/22/2015 | No | - |
| **Kinbasket Lake** | CSISS | | | 09/23/2015 | No | Ostracoda |
| **Kinbasket Lake** | CSISS | | | 09/26/2015 | No | - |
| **Kinbasket Lake** | CSISS | | | 09/26/2015 | No | - |
| **Kinbasket Reservoir** | CSISS | 52.7944132 | -119.2540929 | 08/30/2015 | No | Ostracoda |
| **Kinbasket Reservoir** | CSISS | 52.6794873 | -119.0251159 | 08/31/2015 | No | - |
| **Kinbasket Reservoir** | CSISS | 52.6794649 | -119.025899 | 08/31/2015 | No | - |
| **Kinbasket Reservoir** | CSISS | 52.7577229 | -119.1170157 | 08/31/2015 | No | - |
| **Kinbasket Reservoir** | CSISS | 52.7470405 | -119.1034291 | 08/31/2015 | No | - |
| **Lake Koocanusa** | EKISS | | | 09/20/2015 | No | - |
| **Lake Koocanusa** | EKISS | | | 09/20/2015 | No | - |
| **Lake Koocanusa** | EKISS | | | 09/20/2015 | No | Ostracoda |
| **Kooteany Lake** | CKISS | 49.6218481 | -116.9653595 | 09/01/2015 | No | - |
| **Kooteany Lake** | CKISS | 49.6218481 | -116.9653595 | 09/29/2015 | No | - |
| **Kooteany Lake** | CKISS | 49.4614485 | -116.7668787 | 07/31/2015 | No | - |
| **Kooteany Lake** | CKISS | 49.4614485 | -116.7668787 | 08/20/2015 | No | - |
| **Kooteany Lake** | CKISS | 49.4614574 | -116.766851 | 09/30/2015 | No | - |

| Lake | Sampling Agency | Lat (Decimal degrees) | Long (decimal degrees) | Date sampled (mm/dd/yyyy) | ZQM Veliger Detected? (YES/NO) | Native Species Detected |
|---|---|---|---|---|---|---|
| **Kooteany Lake** | CKISS | 49.487447 | -117.318518 | 07/13/2015 | No | - |
| **Kooteany Lake** | CKISS | 49.9151851 | -116.9048794 | 08/10/2015 | No | Ostracoda |
| **Kooteany Lake** | CKISS | 49.6088657 | -117.1110084 | 09/01/2015 | No | - |
| **Kooteany Lake** | CKISS | 49.6088657 | -117.1110084 | 09/29/2015 | No | - |
| **Kooteany Lake** | CKISS | 49.300055 | -116.6628983 | 07/31/2015 | No | Ostracoda |
| **Kooteany Lake** | CKISS | 49.300055 | -116.6628983 | 08/28/2015 | No | Ostracoda |
| **Kooteany Lake** | CKISS | 49.300055 | -116.6628983 | 10/02/2015 | No | Ostracoda |
| **Kooteany Lake** | CKISS | 49.5100797 | -117.2832884 | 09/29/2015 | No | Ostracoda |
| **Kooteany Lake** | CKISS | 49.5100797 | -117.2832884 | 09/01/2015 | No | Ostracoda |
| **Kooteany Lake** | CKISS | 49.5100797 | -117.2832884 | 07/27/2015 | No | Ostracoda |
| **Kooteany Lake** | CKISS | 49.7696263 | -116.8571705 | 08/27/2015 | No | - |
| **Kooteany Lake** | CKISS | 49.7696263 | -116.8571705 | 10/02/2015 | No | - |
| **Langford Lake** | MOE | 48.44773 | -123.52531 | 08/17/2015 | No | Ostracoda |
| **Little Slocan Lake** | CKISS | 49.6797882 | -117.6581215 | 09/17/2015 | No | Ostracoda |
| **Lower Arrow Lake** | CKISS | 50.2361584 | -117.7978828 | 09/25/2015 | No | - |
| **Lower Arrow Lake** | CKISS | 49.3425058 | -117.8300052 | 09/23/2015 | No | - |
| **Lower Arrow Lake** | CKISS | 49.3399469 | -117.8721002 | 07/21/2015 | No | - |
| **Mabel Lake** | MOE | 50.453455 | -118.736909 | 09/09/2015 | No | - |
| **Mara Lake** | MOE | | | 06/24/2015 | No | - |
| **Mara Lake** | MOE | | | 09/28/2015 | No | - |
| **Mara Lake** | MOE | 50.83573 | -118.993514 | 09/10/2015 | No | Ostracoda |
| **Mosquito Lake** | CKISS | 50.3316748 | -118.0647155 | 07/23/2015 | No | - |
| **Moyie Lower** | MOE | 49.26934 | -115.8451 | 08/24/2015 | No | - |
| **Moyie Upper** | MOE | 49.36835 | -115.8364 | 08/24/2015 | No | Ostracoda |
| **Nancy Green Lake** | CKISS | 49.2573287 | -117.9415169 | 09/11/2015 | No | - |
| **Okanagan Lake** | OASISS | 49.8462638 | -119.4902941 | 08/16/2015 | No | Ostracoda |
| **Okanagan Lake** | OASISS | 49.8889429 | -119.5001347 | 08/16/2015 | No | Ostracoda |
| **Okanagan Lake** | OASISS | 50.1803796 | -119.3408227 | 06/11/2015 | No | Ostracoda |
| **Okanagan Lake** | OASISS | 49.591877 | -119.5988566 | 08/14/2015 | No | Ostracoda |
| **Okanagan Lake** | OASISS | 50.2348956 | -119.3618217 | 08/19/2015 | No | - |
| **Okanagan Lake** | OASISS | 49.7784314 | -119.7228685 | 08/19/2015 | No | - |
| **Okanagan Lake** | OASISS | 49.5053593 | -119.5873053 | 08/13/2015 | No | Ostracoda |
| **Okanagan Lake** | OASISS | 50.0404098 | -119.450549 | 08/16/2015 | No | - |

| Lake | Sampling Agency | Lat (Decimal degrees) | Long (decimal degrees) | Date sampled (mm/dd/yyyy) | ZQM Veliger Detected? (YES/NO) | Native Species Detected |
|---|---|---|---|---|---|---|
| **Okanagan Lake** | OASISS | 49.6019807 | -119.6502212 | 08/14/2015 | No | Ostracoda |
| **Okanagan Lake** | OASISS | 49.8158473 | -119.6221147 | | No | - |
| **Okanagan Lake** | MOE | 49.845572 | -119.490187 | 09/14/2015 | No | Ostracoda |
| **Okanagan Lake** | MOE | 50.235229 | -119.36192 | 09/17/2015 | No | Ostracoda |
| **Okanagan Lake** | MOE | 49.610181 | -119.651791 | 09/14/2015 | No | Ostracoda |
| **Osoyoos Lake** | OASISS | 49.0371922 | -119.4641629 | 08/12/2015 | No | Ostracoda |
| **Osoyoos Lake** | MOE | 49.037527 | -119.464112 | 06/24/2015 | No | Ostracoda, Unionidae |
| **Osoyoos Lake** | MOE | 49.037527 | -119.464112 | 07/22/2015 | No | Ostracoda |
| **Osoyoos Lake** | MOE | 49.037527 | -119.464112 | 08/19/2015 | No | Ostracoda |
| **Osoyoos Lake** | MOE | 49.037527 | -119.464112 | 09/15/2015 | No | Ostracoda |
| **Peckham's Lake** | MOE | | | 10/23/2015 | No | - |
| **Peckham's Lake** | MOE | | | 10/23/2015 | No | - |
| **Pend D'Oreille River** | CKISS | 49.0393232 | -117.4924964 | 08/07/2015 | No | Ostracoda |
| **Pend D'Oreille River** | CKISS | 49.0393232 | -117.4924964 | 08/20/2015 | No | Ostracoda |
| **Pend D'Oreille River** | CKISS | 49.0393232 | -117.4924964 | 09/13/2015 | No | Ostracoda |
| **Pend D'Oreille River** | CKISS | 49.0197451 | -117.3736244 | 09/12/2015 | No | Ostracoda |
| **Premier** | MOE | 49.94028 | -115.6549 | 08/25/2015 | No | Ostracoda |
| **Quamichan Lake** | MOE | 48.78885 | -123.67111 | 08/17/2015 | No | Ostracoda |
| **Quatse Lake** | MOE | 50.62894 | -127.56045 | 08/20/2015 | No | - |
| **Quesnel Lake** | MOE | 52.31132 | -121.04083 | 08/18/2015 | No | Ostracoda |
| **Quesnel Lake** | MOE | 52.28358 | -121.22953 | 08/18/2015 | No | - |
| **Quesnel Lake** | MOE | 52.29285 | -121.25981 | 08/18/2015 | No | - |
| **Revelstoke Lake** | CSISS | | | 09/28/2015 | No | Ostracoda |
| **Revelstoke Lake** | CSISS | | | 09/24/2015 | No | - |
| **Revelstoke Lake** | CSISS | | | 09/27/2015 | No | - |
| **Revelstoke Lake** | CSISS | | | 09/25/2015 | No | - |
| **Revelstoke Lake** | CSISS | | | 09/28/2015 | No | - |
| **Revelstoke Lake** | CKISS | | | 09/27/2015 | No | - |
| **Revelstoke Lake** | CSISS | | | 09/24/2015 | No | - |
| **Revelstoke Lake** | CSISS | | | 09/27/2015 | No | - |
| **Revelstoke Lake** | CSISS | | | 09/27/2015 | No | - |
| **Revelstoke Lake** | CSISS | | | 09/25/2015 | No | - |

| Lake | Sampling Agency | Lat (Decimal degrees) | Long (decimal degrees) | Date sampled (mm/dd/yyyy) | ZQM Veliger Detected? (YES/NO) | Native Species Detected |
|---|---|---|---|---|---|---|
| **Rosebud Lake** | CKISS | | | 09/09/2015 | No | Ostracoda |
| **Rosen Lake** | MOE | 49.406079 | -115.262032 | 10/05/2015 | No | Ostracoda |
| **Rosen Lake** | MOE | 49.406079 | -115.262032 | 10/05/2015 | No | Ostracoda |
| **Seaton Lake** | MOE | 50.6687945 | -121.9882868 | 07/15/2015 | No | Ostracoda |
| **Seaton Lake** | MOE | 50.6687945 | -121.9882868 | 08/13/2015 | No | - |
| **Shawnigan Lake** | MOE | 48.653403 | -123.629023 | 10/01/2015 | No | Ostracoda |
| **Shuswap Lake** | MOE | | | 06/23/2015 | No | - |
| **Shuswap Lake** | MOE | | | 06/24/2015 | No | - |
| **Shuswap Lake** | MOE | | | 07/04/2015 | No | - |
| **Shuswap Lake** | MOE | | | 07/04/2015 | No | - |
| **Shuswap Lake** | MOE | | | 06/23/2015 | No | - |
| **Shuswap Lake** | MOE | | | 06/24/2015 | No | - |
| **Shuswap Lake** | MOE | | | 06/23/2015 | No | - |
| **Shuswap Lake** | MOE | | | 09/28/2015 | No | - |
| **Skaha Lake** | OASISS | 49.4520296 | -119.5808661 | 09/08/2015 | No | - |
| **Skaha Lake** | MOE | 49.451635 | -119.582476 | 09/03/2015 | No | Ostracoda |
| **Slocan Lake** | MOE | 49.98435 | 117.37772 | 09/14/2015 | No | - |
| **Slocan Lake** | CKISS | 49.9845933 | -117.3775009 | 07/16/2015 | No | - |
| **Slocan Lake** | CKISS | 49.984206 | -117.3776653 | 08/19/2015 | No | - |
| **Slocan Lake** | CKISS | 49.7490187 | -123.8779685 | 07/19/2015 | No | - |
| **Slocan Lake** | CKISS | 49.7490008 | -123.877966 | 08/19/2015 | No | - |
| **Slocan Lake** | CKISS | 49.7696404 | -117.4727339 | 07/16/2015 | No | - |
| **Slocan Lake** | CKISS | 49.7696404 | -117.4727339 | 08/21/2015 | No | - |
| **Stanbert Lake** | CKISS | 50.6796781 | -117.6395914 | 09/30/2015 | No | - |
| **Sugar Lake** | MOE | 50.3769 | -118.528739 | 09/01/2015 | No | Ostracoda |
| **Summit Lake** | MOE | 50.15685 | 117.65596 | 09/14/2015 | No | - |
| **Tie Lake** | EKISS | 49.418007 | 115.312304 | 09/25/2015 | No | Ostracoda |
| **Tie Lake** | MOE | 49.418554 | -115.312294 | 10/05/2015 | No | Ostracoda |
| **Tie Lake** | EKISS | 49.416833 | 115.315707 | 09/25/2015 | No | Ostracoda |
| **Tie Lake** | EKISS | 49.418007 | 115.312304 | 09/25/2015 | No | Ostracoda |
| **Trout Lake** | MOE | 50.64098 | 117.53108 | 09/15/2015 | No | - |
| **Upper Arrow Lake** | CKISS | | | 07/20/2015 | No | - |
| **Upper Arrow Lake** | CKISS | | | 08/18/2015 | No | Ostracoda |
| **Wahleach Lake** | MOE | 49.2449449 | -121.6045887 | 08/26/2015 | No | - |

| Lake | Sampling Agency | Lat (Decimal degrees) | Long (decimal degrees) | Date sampled (mm/dd/yyyy) | ZQM Veliger Detected? (YES/NO) | Native Species Detected |
|---|---|---|---|---|---|---|
| **Wahleach Lake** | MOE | 49.2521924 | -121.6103072 | 07/22/2015 | No | - |
| **Wahleach Lake** | MOE | 49.2521924 | -121.6103072 | 08/26/2015 | No | - |
| **Wahleach Lake** | MOE | 49.2469068 | -121.603915 | 07/22/2015 | No | - |
| **Wasa Lake** | EKISS | | | 09/16/2015 | No | Ostracoda |
| **Wasa Lake** | EKISS | | | 09/16/2015 | No | Ostracoda |
| **Wasa Lake** | EKISS | | | 09/16/2015 | No | Ostracoda |
| **Whatshan Lake** | CKISS | 49.9192496 | -118.1171914 | 07/22/2015 | No | Ostracoda |
| **White Swan Lake** | MOE | 50.12879 | -115.5166 | 08/25/2015 | No | Ostracoda |
| **Williams Lake** | MOE | 52.07024 | -122.04249 | 08/17/2015 | No | Ostracoda |
| **Williams Lake** | MOE | 52.07286 | -122.06935 | 08/17/2015 | No | Ostracoda |
| **Wilson Lake** | CKISS | 50.257462 | -117.6045869 | 10/02/2015 | No | - |
| **Windermere Lake** | EKISS | | | 09/17/2015 | No | Ostracoda |
| **Windermere Lake** | EKISS | | | 09/17/2015 | No | Ostracoda |
| **Windermere Lake** | MOE | 50.5121 | -116.0178 | 08/26/2015 | No | Ostracoda |
| **Windermere Lake** | EKISS | | | 09/17/2015 | No | Ostracoda, Unionidae |
| **Wood Lake** | OASISS | 50.0527457 | -119.4088316 | 08/16/2015 | No | Ostracoda |
| **Wood Lake** | MOE | 50.103422 | -119.36884 | 07/15/2015 | No | Ostracoda |
| **Wood Lake** | MOE | 50.103422 | -119.36884 | 08/12/2015 | No | Ostracoda |
| **Wood Lake** | MOE | 50.103422 | -119.36884 | 10/14/2015 | No | Ostracoda |
| **Wood Lake** | MOE | 50.0749 | -119.3917 | 06/17/2016 | No | - |