Enhancement and monitoring of nesting habitat for
Common Loons (*Gavia immer*) on Whatshan Lake Reservoir

Mandy Kellner and Harry van Oort
Kingbird Biological Consultants Ltd.
Revelstoke BC
250-837-0820
mandy.kellner@gmail.com
Dec 2011

Prepared for BC Hydro Fish and Wildlife Compensation Program
Executive summary

Common Loons (*Gavia immer*) are large, piscivorous birds that nest on the shoreline of lakes, immediately adjacent to the water. At Whatshan Reservoir in southeastern British Columbia, construction of a dam and flooding of original wetland and riparian habitats has likely led to the reduction of suitable nesting habitat. Further affecting the productivity of loons at Whatshan, are disturbance from human development and recreation on the reservoir, and the flooding of nests through reservoir operations. Floating nest platforms have been used successfully to increase loon reproductive success in other lakes and reservoirs, and could help mitigate negative impacts of reservoir operations and encourage the loons to nest away from areas prone to human disturbance. In response to a low rate of reproductive success documented during previous work, we installed five floating artificial nest platforms in spring 2011. The platforms were received and installed late in the breeding season. They were planted with local plants and anchored in protected coves, in areas known to be used by nesting loons. There was vigorous growth of herbs on the platforms, and survival of alder and willow seedlings and stakes. By mid-summer, platforms were vegetated enough to appear as riparian habitat, adding diversity to the reservoir and potentially offering resting, foraging, or cover habitats to wildlife.

Loons did not nest on the floating platforms in 2011, likely due to of the late deployment of the platforms. We monitored 5 pairs of territorial loons, 4 of which attempted to nest and 2 of which were successful in hatching 1 chick each (2/5 pairs, 40% success). We located 5 nests in total. Of the 2 successful nests, 1 was on a natural floating platform made by a root ball mass, which has been used both successfully and unsuccessfully in the past. The second was a late re-nest at shoreline on an island. This nest hatched over 1 month after the first successful nest. Of the 3 unsuccessful nests, 1 was on an old dock and likely failed due to human disturbance, 1 shoreline nest was flooded, and 1 failed to develop, probably due to immersion of the eggs in water at full pool.

The failures of nests as a result of flooding in 2011 reinforce the potential of floating platforms to increase reproductive success. Platforms may also help prevent late incubation and hatch dates, such as observed in 2011. However, platforms could lead to an increase in human disturbance. To try and lower this possibility, most platforms were placed in areas of little or no human activity, and information signs regarding the project and loon behaviour were installed around Whatshan Lake. Small, unobtrusive signs were also attached to platforms to identify them as nesting habitat and ask boaters to avoid the area.

Platforms were left anchored in place for the winter in order to assess durability of the platforms and anchoring systems. To assess the utility of these platforms as permanent habitat enhancement structures, their post-winter condition will need to be determined. Some spring maintenance will be required to ensure that anchor cables are snag-free and functioning correctly, and that platforms are floating at the correct level. We also recommend low-intensity monitoring of nesting loons to determine if loons do use the platforms in the 2012 season and how this affects reproductive success.
Keywords
Common loon, *Gavia immer*, reservoir, nesting success, nesting habitat, artificial nesting platform, Whatshan Lake
Table of Contents

Executive summary ........................................................................................................................................ i
Keywords ....................................................................................................................................................... ii
List of Figures ............................................................................................................................................... iv
List of Tables ................................................................................................................................................ iv
Introduction .................................................................................................................................................. 1
Study area ..................................................................................................................................................... 2
Methods ........................................................................................................................................................ 3
    Platform Installation ............................................................................................................................. 3
    Loon nest surveys .................................................................................................................................. 7
    Data analysis and management ............................................................................................................ 7
Results ........................................................................................................................................................... 7
    Timing of nest initiation and incubation ............................................................................................... 7
    Nesting success ..................................................................................................................................... 7
    Platform condition ................................................................................................................................ 8
    Public education .................................................................................................................................. 10
    Other wildlife ...................................................................................................................................... 10
Discussion .................................................................................................................................................... 10
    Use of platforms .................................................................................................................................. 10
    Nesting success of loons ..................................................................................................................... 10
    Platforms ............................................................................................................................................. 11
Enhancement implications .......................................................................................................................... 12
Acknowledgements ..................................................................................................................................... 13
References .................................................................................................................................................. 13
Appendix 1. Loon nest information ........................................................................................................... 15
Appendix 2. Photo log of plant development on platforms ....................................................................... 17
Appendix 3. Issues and solutions for platforms and anchoring systems ................................................... 20
Appendix 4. Public education signage installed in 2011 .......................................................................... 21
Appendix 5. Incidental observations of wildlife at Whatshan Lake, 2011 .................................................. 22
List of Figures

Figure 1. Map showing the location of Whatshan Lake in south-central British Columbia. ........................ 2
Figure 2. New platform ready for being planted with vegetation................................................................. 4
Figure 3. Planting a new platform during installation. ................................................................................. 4
Figure 4. Location of artificial nest platforms and natural loon nests on Whatshan Lake, summer 2011...5
Figure 5. Attaching anchor block to cable, showing hose for protection, quick link, and cable swage...... 6
Figure 6. The ½ block pulley system ............................................................................................................. 6
Figure 7. Reservoir elevation, minimum water elevation allowed under the current WUP, and initiation
dates for successful and unsuccessful loon nests at Whatshan Reservoir, 2011................................. 8
Figure 8. The South End platform in July, showing herbaceous growth and new leaves on willow stakes. 9
Figure 9. Damaged area on the North End platform, Oct 13. Fibres were excavated from a hole and
strewn around.............................................................................................................................................. 9
Figure 10. Successful nests: nest WG2 (left), which hatched a single young, with the fate of the 2nd egg or
young unknown, and nest LG1 (right) which hatched 1 young from the single egg and was constructed
on a natural floating platform on the base of a small floating log. ............................................................ 16
Figure 11. Failed nests: nest SE1, which failed likely due to human disturbance (left), nest WG1 about to
be flooded (centre), and nest FL1 (right), which later contained 2 eggs that did not develop, perhaps due
to immersion. .............................................................................................................................................. 16
Figure 12. Flicker Lagoon (FL) platform when first planted May 28 (left) and on Oct 13 (right). ............... 17
Figure 13. Lagoon (LG) platform on May 28 (left) and Oct 13 (right). ....................................................... 17
Figure 14. North End (NE) platform on June 6 (left) and Jul 24 (right)..................................................... 17
Figure 15. South end (SE) platform on Jul 24 (left), with sprouting willow stakes, and on Oct 13 (right). 18
Figure 16. White Grouse (WG) platform on Jun 20 (left), showing the ramp that was later removed, and
on Oct 13 (right), with sprouting willow stakes and info sign. ................................................................. 18
Figure 17. Leaf-out on apparently dead willow stakes (left), lush herbaceous growth (centre), and a
growing alder seedling (right). .................................................................................................................... 19
Figure 18. Long roots growing down through a platform are visible in the water below..................... 19

List of Tables

Table 1. Pros and cons of nest platforms, and particularly Floating Islands, as a habitat enhancement
measure to benefit Common Loons. .......................................................................................................... 11
Introduction

Common loons (*Gavia immer*) nest immediately next to the water’s edge, often amongst emergent vegetation (Campbell et al. 2008), and select diverse microsites such as muskrat mounds, floating or emergent logs, bare ground, or floating bog mats, with floating mats offering the best chance of nesting success (McIntyre and Barr 1997). On Whatshan Lake Reservoir (and elsewhere in the Columbia Basin) much of the higher-quality nesting habitat along the lakeshore was likely lost with reservoir creation, and was replaced largely by the steep dry banks that surround much of the reservoir at present (Utzig and Schmidt 2011). Areas within Whatshan Lake Reservoir that appear to offer suitable nesting habitat become flooded by rising reservoir levels each spring.

Potentially(compounding the impacts from reservoir creation and operations are other factors known to be detrimental to loon nesting success, such as the waves created by motorized recreation on the reservoir and the shoreline development along the southern lake. Four years of data on loon reproductive success and timing of reproduction on Whatshan Lake between 2006 and 2010 have shown that most pairs of loons do not successfully reproduce and that reproductive rates are low (0 – 50% of nests are successful per year) (van Oort and Kellner 2007, van Oort and Kellner 2008, Kellner and van Oort 2009, Kellner and van Oort 2011), compared to the Canadian average of 50% or better (Timmermans and Jones 2002). Over the 4 years of monitoring 4 or 5 loon pairs each year, 4 nests were confirmed (and others suspected) to have failed due to rising water levels flooding nests built on shore or on unstable floating substrates (Kellner and van Oort 2011). Other causes of nest failure were suspected human disturbance and suspected predation.

An indirect negative impact to the productivity of loons nesting on Whatshan Lake Reservoir is that successful nests are most commonly initiated near or after the reservoir has reached full pool, late in the nesting season (Kellner and van Oort 2011). This results in later dates for nest initiation, compared with other records from the West Kootenay which document nesting in early- to mid-May (Campbell et al. 2008), and also results in late hatching of young, with potential consequences for juvenile recruitment.

Research in other regions has shown that loons readily use artificial floating nest platforms (Piper et al. 2002, McIntyre and Barr 1997), and that reproductive success can increase when nesting platforms are used (Piper et al. 2002). In British Columbia, the use of floating nest platforms has been suggested as a “management tool” for loon populations on reservoirs (Campbell et al. 2008).

At Whatshan Lake Reservoir, the configuration of the shoreline, with secluded bays and lagoons, plus the relatively small drawdown height of the reservoir, are conducive to enhancement with nesting platforms. Additionally, data is available on reproductive success, timing of nesting, and causes of nest failure prior to enhancement, to which the post-enhancement data could be compared. For this project, we therefore proposed to enhance loon nesting habitat on Whatshan Lake by providing artificial, floating nest platforms. The aim was to reduce nest failures due to flooding while avoiding any negative impacts from increased predation or human disturbance to nests. We installed 5 floating nest platforms and monitored their use and the reproductive success of all Common Loons nesting on Whatshan Lake.
in 2011. The artificial platforms were developed by Floating Islands International. We also monitored the state of the platforms throughout the summer, to document plant growth and assess suitability of this technology for enhancement work in Whatshan and other BC reservoirs.

**Study area**
Enhancement work and monitoring was done at 5 locations on Whatshan Lake Reservoir. Whatshan Lake Reservoir west of Lower Arrow Lake, immediately north of Hwy 6 at the Needles ferry, and approximately 55 km southwest of Nakusp, BC (Fig. 1).

![Figure 1. Map showing the location of Whatshan Lake in south-central British Columbia.](image)

The reservoir is approximately 17 km long with a convoluted shoreline and a number of lagoons and islands. The reservoir supports considerable fish stocks and is valued for its recreational fishery. The southern end of the reservoir is characterized by high levels of shoreline cottage development and is used heavily during the summer months for motorized water sports. Water level fluctuations at the Whatshan Lake Reservoir are controlled throughout the year by the operations of the hydroelectric
power generating plant. These operations are detailed by the Whatshan Lake Reservoir Water Use Plan (BC Hydro 2005). In this document, it was prescribed that the water levels should be maintained at or above: 636.5 m during the winter; 639.1 m elevation from May 15th to June 14th; and, 640.35 m from June 15th to October 1st. These target water levels were developed to benefit recreational quality and fish populations of the reservoir.

Methods

Platform Installation
Loon nesting platforms were pre-fabricated by Floating Islands West, California (http://www.floatingislandswest.com). They are approximately 2m X 1.5m in size, and constructed with durable non-toxic plastic mesh product that can act as a rooting substrate for vegetation (Figure 2). They were planted on-site with a combination of locally-sourced grass, sedge, herbaceous plants, and shrub seedlings or stakes. Rock wool, a growing medium that supplies water and air to roots and allows for easy root growth, was first inserted into pre-formed holes to wick water up to plants, then plants with small root balls or bare roots were placed in the holes (Figure 3). Mats of moss and duff were used to provide potential nesting material, and a combination of earthworm castings, moss, and soil was used to cover any bare matrix material and provide a growing medium for plants or seeds. The entire platform was over-seeded with a mix of herbaceous seeds commonly used to revegetate drawdown zones in the region, and rocks and wood were added, as necessary, to achieve the desired floatation level. Branched stakes of alder or willow, 1 – 2 m tall, were added to provide some cover from aerial predators.

Platform installation locations were selected based on the following criteria for a site, adopted from DeSorbo et al (2008):

1. lack of nesting success in previous years, due to water level fluctuations,
2. within the boundaries of established territories, and near old nest sites – to prevent behavioural changes such as increases in aggression, increased intrusions into territories, or new territories being squeezed in, as observed by Mager et al (2008),
3. protected from wind and wave action, with waves being generated by wind or power boats,
4. without extensive shoreline development, and
5. acceptable to BC Hydro and the public.
Platforms were installed between May 28 – 31, 2011 and monitored until October 13 to assess condition, and provide maintenance if necessary. Two platforms were moved late in the summer: wave action was greater than anticipated at one site; and we waited for a pair of nesting loons to finish nesting at a second site, prior to making the final installation in order to minimize disturbance. Final platform locations are shown in Figure 4.
Two anchoring systems were used, both involving 2 anchors per platform, attached to opposite sides. In all cases, the anchors consisted of 1 or 2 submerged concrete cinder blocks attached by plastic-coated aluminum aircraft cable and stainless steel quick-links (Figure 5). A length of plastic garden hose was used to protect the cable from rubbing and fraying against the anchor blocks (Figure 5). In the static – anchor system (used on 2 platforms), both sides of the platform were connected directly to the anchor cables, with enough slack to be gently taught at full pool elevations. On the other 3 platforms, a pulley-system was used on the one side, in an attempt to better accommodate water level fluctuations. The pulley-system involved running the cable from the anchor blocks up through a pulley at the platform and down to ½ of a concrete block suspended in the water column (Figure 6). For both systems, all cables were adjusted to allow platforms to be fully buoyant at full pool.
Figure 5. Attaching anchor block to cable, showing hose for protection, quick link, and cable swage.

Figure 6. The ½ block pulley system
Loon nest surveys
We monitored the nesting behaviour and reproductive success of Common Loons on Whatshan Lake Reservoir from late May to late July, 2011, using the protocol of Kellner and van Oort (2011). Monitoring was conducted, weather-permitting, using a canoe and two observers. If the weather was not conducive to boating, monitoring occurred from shore where possible. For each of the 5 territories previously identified on the lake (Kellner and van Oort 2011), we attempted to locate loon pairs, and their nest sites if possible, and determine the number of eggs and fate of these nests. If loon pairs were accompanied by young, the number, size, colour, and behaviour of young were recorded (McIntyre and Barr 1997). When a loon or nest was located, a handheld global positioning system (Garmin Map76CSX) was used to record its location on the reservoir.

Data analysis and management
Data from field notebooks were entered in an Excel spreadsheet after each survey. All waypoints were downloaded and saved on computer, and projected in ArcView to check accuracy of the waypoints and associated field notes. Data on nest locations and success and the final report are to be submitted to the Province of BC through the Wildlife Species Inventory submission site. Data on nesting success will also be submitted to the Canadian Lakes Loon Survey.

We examined observations to estimate dates for nest initiation, start of incubation, and hatching. To determine the impacts of reservoir operations on loon nests, we documented the fate of all known nests as the breeding season progressed and as the reservoir filled. To determine at what date nests would no longer be affected by reservoir operations, we obtained data on daily maximum water levels at Whatshan from BC Hydro and determined the date of maximum water elevation. We calculated nesting success per year as the number of loon pairs observed with young divided by the number of territorial loon pairs observed in spring.

Results

Timing of nest initiation and incubation
Nesting by loons was underway when the platforms were first installed in late May. Two loons were incubating on May 28, on nests containing 1 and 2 eggs (Lagoon and South End territories, respectively, Figure 6). Other incubation start dates were June 6 (White Grouse) and June 20 (Flicker Lagoon and White Grouse). The June 20 nest at White Grouse was a re-nest, following the flooding of the pair’s initial nest from June 6. Information on nest locations, dates of initiation, and fates is detailed in Appendix 1, and nest locations are mapped in Figure 4.

Nesting success
Loons did not nest on the platforms in 2011. Using natural nests, 2 of the 5 pairs on Whatshan Lake Reservoir successfully hatched 1 young each (40% of pairs were successful). One very small, black chick was observed on each of June 20 (Lagoon territory) and July 24 (White Grouse territory re-nest). In total, 5 nests were located for 4 pairs, with the 5th pair never showing obvious nesting behaviour (e.g.,
localizing around an area or nest-building). Of the 3 failed nests, 1 failure was likely due to the high level of human disturbance at the nest site and area, and we suspect that two nests failed as a consequence of flooding by the reservoir operation. For one of these latter nests, our confidence that the reservoir flooded it was low; evidence to support this cause of failure was that the eggs had failed to develop, and that the reservoir increased in elevation following nest initiation (Figure 7).

**Platform condition**

All 5 platforms supported excellent plant survival and growth throughout the summer (Appendix 2). Vigorous herbaceous growth occurred from transplanted herbs and from seeds (Figure 8). Alder seedlings survived and grew new leaves. Willow and alder stakes also sprouted new leaves throughout the summer.

![Reservoir elevation graph](image)

**Figure 7.** Reservoir elevation, minimum water elevation allowed under the current WUP, and initiation dates for successful and unsuccessful loon nests at Whatshan Reservoir, 2011.
Wave action on the newly-planted platforms was clearly detrimental on small portions of two platforms (North End and White Grouse). These affected sides were washed of soil, duff, and seeds, although plants remained in pre-made holes in the matrix. All affected areas were re-covered and re-seeded, and burlap was used in 1 case to provide extra cover and retain soil. Platforms affected by wave action were relocated.

Physical damage was found on one platform (North End) in October (Figure 9). This platform was partially torn apart, with a hole dug in the matrix and the debris scattered around. No evidence was found to identify the culprit species but potential suspects included muskrats and otters.

Anchoring systems appeared intact after the summer, with the exception of wear on one of the cables on the North End platform, where the cable was attached to the quick-link on the platform. This platform was moved to a more sheltered area and should be closely inspected in spring. The concrete
blocks used as anchors appeared to be sufficient to keep platforms from drifting or being moved by wave action during summer months. The ½ block pulley system was working well to absorb slack in anchor lines when viewed in October, when reservoir levels were 640.5 m, well above winter minimums of 636.5 m. Appendix 3 details some issues that arose with the platforms in. Platforms were left in place for winter 2011/2012.

Public education
A sign describing the project was developed and installed at the south end of the lake (Appendix 4). This is where the majority of development, fishing activity, and power boat mooring occurs. Small signs were affixed to each platform to identify them as loon nesting platforms. Generic loon information signs (Loon Alert, supplied by the Canadian Lakes Loon Survey) were posted at the 2 public boat launches at forest service campsites at the north end of the lake. Informal discussions with lake users, regarding loons, loon behaviour, nesting habitat, and human impacts, occurred opportunistically throughout the summer.

Other wildlife
In July, spotted sandpipers (Actitis macularius) were seen foraging on the South platform. A list of other incidental wildlife observations is included as Appendix 5.

Discussion

Use of platforms
The lack of use by nesting loons was not surprising. Platforms were installed when 2 out of the 5 pairs were already incubating, due to delays in procuring the Floating Islands. Platforms should be installed before nesting begins, and ideally soon after the lake becomes ice free (NALF 2005, DeSorbo et al 2008). Upon installation in late May 2011, the platforms did not resemble natural nesting habitat and were clearly new structures introduced into the loon territories. We expect that chances of loons using the platforms will be much greater in 2012; the loons will be familiar with the platforms, now well-covered by vegetation. It is normal for the use of platforms to increase in the years after installation (Piper et al 2002, DeSorbo et al 2007).

Nesting success of loons
Loons had relatively high nesting success at Whatshan Lake in 2011, with 40% of the loon pairs raising 1 young. Success rates in previous years have ranged from 0 % in 2006 (van Oort and Kellner 2006) to 50 % in 2008, or an average of 30% from 2008 to 2010 (Kellner and van Oort 2011). Flooding of nests continues to lead to late initiation dates for re-nesting attempts. For example, the flooding of an early nest at White Grouse led to the successful re-nest around Jun 20, and the sighting of a single very small young in late July. This chick was hatched over 1 month later than the other successful nest this season. As discussed in Kellner and van Oort (2011), delayed nesting could have implications for size at fall migration, juvenile survival, and future reproduction (Newton and Marquiss 1984, Hochachka 1990, Naef-Daenzer et al. 2001).
Platforms
One platform (South End) was installed in an area with considerable shoreline development and human activity, and where there was a history of nest failure due to high levels of human disturbance. Although platforms are not generally recommended for this type of site (DeSorbo et al 2008), loons continue to nest in the high use area without success, and so we installed a platform in this territory in hopes of luring the pair away from the old dock that has been used as a nest platform in previous years. This dock provides a relatively quiet site in May when the loons select it for nesting, but receives high use by humans in June and July. For example, we have observed people fishing off the dock when the loons were nesting and mooring powerboats adjacent to the nest site. The new nest platform is approximately 200m from the old dock, but is behind the protective log boom that guards the Whatshan Dam, and will hopefully provide a nest site with fewer disturbances, if selected by the loons. Floating buoys or signs may be useful to further reduce human activity in the area if the platform is used by loons in the future.

Growth of the plants on the platforms, and their appearance at the end of the summer in 2011, was very promising. The durability of the platforms throughout the winter is unknown, and may certainly detract from the potential of this technology as a habitat enhancement tool at Whatshan Lake Reservoir. Ideally, the platforms will withstand winter conditions on the lake and thus require little maintenance. Standard protocol for cedar log rafts is to remove them from the water each fall and re-install each spring, so the logs do not become waterlogged (NALF 2005, DeSorbo et al 2008). Water logging is not an issue for the synthetic Floating Islands, and remaining in the water should contribute to the development of plant communities on the rafts. However, removal of rafts protects them and the anchoring systems from the potentially destructive action of ice. These, and other, pros and cons are detailed in Table 1.

Table 1. Pros and cons of nest platforms, and particularly Floating Islands, as a habitat enhancement measure to benefit Common Loons.

<table>
<thead>
<tr>
<th>Pro/con</th>
<th>Issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔️</td>
<td>Floating nest platforms provide nesting habitat that should be safe from flooding and are known to appeal to loons in other areas.</td>
</tr>
<tr>
<td>✔️</td>
<td>Islands are naturally buoyant and will not become waterlogged, so they do not need to be removed from the water to dry, possibly resulting in lower maintenance than cedar platforms.</td>
</tr>
<tr>
<td>✔️</td>
<td>Pre-formed islands are light and easy to work with, for installation, planting, and anchoring by 2 people. Installation can be done by zodiac or canoe.</td>
</tr>
<tr>
<td>✔️</td>
<td>The matrix seems excellent at supporting plant growth and the platforms quickly develop a natural appearance with lush growth. The presence of vegetated islands adds complexity to the reservoir habitat even if not used by loons.</td>
</tr>
</tbody>
</table>
Platforms could negatively impact reproductive success if their use results in greater human disturbance or predation.

Platforms could negatively impact reproductive success if anchors become tangled and platforms cannot float properly.

Some research has indicated negative impacts on loons after platforms were installed, due to increased aggressive behaviours between loons (Mager et al 2008).

Uncertainty about winter-hardiness or long-term durability at this point in time.

Relative to cedar platforms, the Floating Island platforms pose larger potential to become garbage if they break from moorings or are destroyed by ice, because they are synthetic.

Enhancement implications

The vegetated islands clearly add to the diversity of habitats available at Whatshan Lake, and potentially benefit many wildlife species through providing foraging habitat, resting spots, or cover. However, the appeal of nest platforms to loons remains uncertain, due to the late deployment of the platforms in 2011. If the platforms begin to be used by loons, platforms may offer a solution to impacts from both habitat loss and reservoir operations. However, concerns and potential negative impacts remain.

Specifically, anchoring systems and floatation of the platforms must be checked in the spring to ensure that the platforms do not initially appeal to loons as nesting habitat and then lead to nest failure due to flooding from poor floatation or snagged anchor lines. Other concerns regarding platforms include increased aggression between loons, and resulting reductions in survival and productivity (Mager et al 2008). These potential negative impacts of platforms should be considered; however, while ensuring that the platforms function properly should be within the scope of most monitoring programs, monitoring intrusions or aggression towards chicks or adults is likely not. Fortunately, it is thought that these negative impacts may be short term (Mager et al 2008), and that platforms should increase productivity of loons in the long term (McIntyre and Matheson 1977, Piper et al 2002).

As a result, we recommend follow-up work to include:

1. a site visit early spring to ensure that anchoring systems have not been destroyed by winter conditions and are still anchored and functioning properly,
2. monitoring of use of platforms or natural nests by loons in early May and June, and
3. monitoring hatching success of loons in July.

Targets would include ensuring that platforms function correctly, and determining if platforms led to an increase in nesting success, and if possible, determining causes of nest failures.
Acknowledgements

Financial, logistical, and technical support, as well as GIS work, was contributed by the Fish and Wildlife Compensation Program- Columbia. We are especially grateful to Irene Manley who contributed greatly to the project through initiating the use of Floating Islands and providing enthusiasm, support, and hours of work planting and installing platforms. We thank Laddie Flock and his team at Floating Islands West http://www.floatingislandswest.com/ for providing the Loon islands used in this project.

References


Appendix 1. Loon nest information

Table A-1. Locations, descriptions, and fates of loon nests on Whatshan Lake, 2011.

<table>
<thead>
<tr>
<th>Date</th>
<th>Territory</th>
<th>Nest ID</th>
<th>UTM_X</th>
<th>UTM_Y</th>
<th>Description</th>
<th># eggs</th>
<th>Fate</th>
</tr>
</thead>
<tbody>
<tr>
<td>28-May-11</td>
<td>Lagoon</td>
<td>LG-1</td>
<td>421748</td>
<td>5535048</td>
<td>On natural floating platform of log / root ball with sod. Same site as previous 2 years (2009, 2010). Mud and grass nest.</td>
<td>1</td>
<td>Hatched 1 young 20-Jun</td>
</tr>
<tr>
<td>20-Jun-11</td>
<td>White Grouse</td>
<td>WG-2</td>
<td>421263</td>
<td>5539464</td>
<td>East side of island, nest of mud and vegetation on shore. 20 m from platform.</td>
<td>2</td>
<td>Hatched 1 young 24-Jul.</td>
</tr>
<tr>
<td>20-Jun-11</td>
<td>Flicker</td>
<td>FL-1</td>
<td>421909</td>
<td>5536252</td>
<td>Flattened grass/sedge at waterline on peninsula. 20m from platform.</td>
<td>2</td>
<td>Failed, observed 13-Oct. Suspect flooded.</td>
</tr>
</tbody>
</table>
Figure 10. Successful nests: nest WG2 (left), which hatched a single young, with the fate of the 2nd egg or young unknown, and nest LG1 (right) which hatched 1 young from the single egg and was constructed on a natural floating platform on the base of a small floating log.

Figure 11. Failed nests: nest SE1, which failed likely due to human disturbance (left), nest WG1 about to be flooded (centre), and nest FL1 (right), which later contained 2 eggs that did not develop, perhaps due to immersion.
Appendix 2. Photo log of plant development on platforms

Figure 12. Flicker Lagoon (FL) platform when first planted May 28 (left) and on Oct 13 (right).

Figure 13. Lagoon (LG) platform on May 28 (left) and Oct 13 (right).

Figure 14. North End (NE) platform on June 6 (left) and Jul 24 (right).
Figure 15. South end (SE) platform on Jul 24 (left), with sprouting willow stakes, and on Oct 13 (right).

Figure 16. White Grouse (WG) platform on Jun 20 (left), showing the ramp that was later removed, and on Oct 13 (right), with sprouting willow stakes and info sign.
Figure 17. Leaf-out on apparently dead willow stakes (left), lush herbaceous growth (centre), and a growing alder seedling (right).

Figure 18. Long roots growing down through a platform are visible in the water below.
Appendix 3. Issues and solutions for platforms and anchoring systems.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anchor cable showed wear in one instance.</td>
<td>Galvanized chain may be preferable to attach a stationary anchor; however, the pulley system requires cable. Protecting platforms from wave action will help reduce wear on cables.</td>
</tr>
<tr>
<td>The anchoring systems used have a risk of snagging on the stumps on the reservoir bottom, leading to platforms not floating correctly and loon nests getting inundated as the reservoir fills.</td>
<td>Pulley systems reduce slack in the system and are recommended. Platforms and cables should be checked in the spring to ensure they are floating correctly. Attempt to locate platforms in stump-free areas.</td>
</tr>
<tr>
<td>The design of the Floating Islands needs refining.</td>
<td>Specifically:</td>
</tr>
<tr>
<td></td>
<td>1) the square, high edge on the initial platforms may be difficult for loons to access unless weighted down with rocks and logs, as done in 2011, and</td>
</tr>
<tr>
<td></td>
<td>2) the ‘ramps’ for chicks to access the platform were poorly designed – the painted plywood was bubbling and peeling, and the attachment method with the supplied yellow polypropylene rope was poor quality and visually disturbing when trying to be unobtrusive. The platforms should simply have gently sloping edges all around.</td>
</tr>
<tr>
<td>Excavation in to a platform by some unknown animal occurred in the late summer or fall.</td>
<td>Identification and deterring of the culprit is necessary.</td>
</tr>
<tr>
<td>Wave action interfered with plant establishment.</td>
<td>Platforms should be monitored soon after installation to ensure plants are growing and not being overly disturbed, and to determine if platforms need to be relocated.</td>
</tr>
</tbody>
</table>
Appendix 4. Public education signage installed in 2011
## Appendix 5. Incidental observations of wildlife at Whatshan Lake, 2011

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>Species</th>
<th>Total</th>
<th>Male</th>
<th>Female</th>
<th>Young</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>28-May-11</td>
<td>Loongoon</td>
<td>Osprey</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-May-11</td>
<td>S end</td>
<td>Osprey</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>overhead.</td>
</tr>
<tr>
<td>30-May-11</td>
<td>powerline on whatshanrd</td>
<td>Osprey</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>on nest on transmission pole</td>
</tr>
<tr>
<td>30-May-11</td>
<td>s end</td>
<td>Spotted Sandpiper</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>nesting around dam?</td>
</tr>
<tr>
<td>30-May-11</td>
<td>Flicker</td>
<td>Spotted Sandpiper</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>06-Jun-11</td>
<td>N lake</td>
<td>Mallard</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td>on nest</td>
</tr>
<tr>
<td>06-Jun-11</td>
<td>N lake</td>
<td>Gull sp.</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>06-Jun-11</td>
<td>powerline on whatshanrd</td>
<td>Osprey</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>on nest</td>
</tr>
<tr>
<td>11-Jun-11</td>
<td>Arrow park ferry</td>
<td>Canada Goose</td>
<td>10</td>
<td>6</td>
<td></td>
<td></td>
<td>pretty big kids!</td>
</tr>
<tr>
<td>11-Jun-11</td>
<td>White Grouse</td>
<td>Spotted Sandpiper</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>on island</td>
</tr>
<tr>
<td>11-Jun-11</td>
<td>Loongoon</td>
<td>Osprey</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24-Jul-11</td>
<td>Ritchie campsite</td>
<td>Common Merganser</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td></td>
<td>female and 2 young</td>
</tr>
<tr>
<td>24-Jul-11</td>
<td>Ritchie campsite</td>
<td>Osprey</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>on nest 5 of campsite</td>
</tr>
<tr>
<td>24-Jul-11</td>
<td>Ritchie campsite</td>
<td>cedar waxwings</td>
<td>many</td>
<td></td>
<td></td>
<td></td>
<td>mule or white tails, seen from a distance on muddy shore</td>
</tr>
<tr>
<td>24-Jul-11</td>
<td>N shore</td>
<td>Deer</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24-Jul-11</td>
<td>N shore</td>
<td>Great Blue Heron</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>on nest on powerline tower on platform and boom</td>
</tr>
<tr>
<td>24-Jul-11</td>
<td>N shore</td>
<td>Kingfisher</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>resting on boom</td>
</tr>
<tr>
<td>24-Jul-11</td>
<td>N shore</td>
<td>cedar waxwings</td>
<td>many</td>
<td></td>
<td></td>
<td></td>
<td>drinking/foraging at seepage area on dam</td>
</tr>
<tr>
<td>25-Jul-11</td>
<td>powerline on whatshanrd</td>
<td>Osprey</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>on nest on powerline tower on platform and boom</td>
</tr>
<tr>
<td>25-Jul-11</td>
<td>Whatshan Dam</td>
<td>Spotted Sandpiper</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>resting on boom</td>
</tr>
<tr>
<td>25-Jul-11</td>
<td>Whatshan Dam</td>
<td>Solitary Sandpiper</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>drinking/foraging at seepage area on dam</td>
</tr>
<tr>
<td>25-Jul-11</td>
<td>Whatshan Dam</td>
<td>Barn Swallows</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25-Jul-11</td>
<td>Narrows</td>
<td>Common Merganser</td>
<td>12</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>Location</td>
<td>Species</td>
<td>Count</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>-----------</td>
<td>----------------------</td>
<td>-------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13-Oct-11</td>
<td>N end</td>
<td>Mallard</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13-Oct-11</td>
<td>N end</td>
<td>Hooded merganser</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13-Oct-11</td>
<td>Narrows</td>
<td>Kingfisher</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>