

## Westham Island Canoe Pass Tidal Marsh Project

### Standwatch Surveys: Summer 2014

<b>Report Date</b>	December 16, 2014
<b>Survey Dates &amp; Times</b>	<p>Nine standwatch bird surveys were conducted from July 11<sup>th</sup> 2014 – September 8<sup>th</sup> 2014. The objective of these surveys was to characterize the use of the proposed Westham Island/Canoe Pass Tidal Marsh Project site by waterbirds, with emphasis on shorebirds. The nine surveys conducted during southward shorebird migration period were meant to build upon previous stand watch surveys conducted by Hemmera during the northward shorebird migration period earlier this year (Hemmera 2014).</p> <p>These surveys were focused on peak southward migration periods of Western Sandpiper (<i>Calidris mauri</i>), as this species comprises the vast majority of shorebirds stopping over in the Fraser River Estuary during migration. Survey dates (detailed summary below) were timed to coincide with peak summer adult southward migration and peak juvenile southward migration, resulting in two survey phases during the summer of 2014.</p> <p>1: Southward Adult Migration: Surveys were conducted every three days between July 11 and July 20 (four surveys total)</p> <p><b>Date:</b> July 11, 2014  <b>Sunrise/Sunset:</b> 05:19/21:16 ( <a href="http://www.nrc-cnrc.gc.ca/eng/services/sunrise/">http://www.nrc-cnrc.gc.ca/eng/services/sunrise/</a>)  <b>Survey Time:</b> 09:55 – 13:42  <b>Date:</b> July 14, 2014  <b>Sunrise/Sunset:</b> 05:22/21:14 ( <a href="http://www.nrc-cnrc.gc.ca/eng/services/sunrise/">http://www.nrc-cnrc.gc.ca/eng/services/sunrise/</a>)  <b>Survey Time:</b> 12:00 – 15:30  <b>Date:</b> July 17, 2014  <b>Sunrise/Sunset:</b> 05:26/21:11 ( <a href="http://www.nrc-cnrc.gc.ca/eng/services/sunrise/">http://www.nrc-cnrc.gc.ca/eng/services/sunrise/</a>)  <b>Survey Time:</b> 14:34 – 17:59  <b>Date:</b> July 20, 2014  <b>Sunrise/Sunset:</b> 05:29/21:08 ( <a href="http://www.nrc-cnrc.gc.ca/eng/services/sunrise/">http://www.nrc-cnrc.gc.ca/eng/services/sunrise/</a>)  <b>Survey Time:</b> 06:28 – 09:19</p> <p>2: Southward Juvenile Migration: Surveys were conducted every five days between August 19 and September 8 (5 surveys total).</p> <p><b>Date:</b> August 19, 2014  <b>Sunrise/Sunset:</b> 06:10/20:21 ( <a href="http://www.nrc-cnrc.gc.ca/eng/services/sunrise/">http://www.nrc-cnrc.gc.ca/eng/services/sunrise/</a>)  <b>Survey Time:</b> 06:45 – 09:43  <b>Date:</b> August 24, 2014  <b>Sunrise/Sunset:</b> 06:17/20:11 ( <a href="http://www.nrc-cnrc.gc.ca/eng/services/sunrise/">http://www.nrc-cnrc.gc.ca/eng/services/sunrise/</a>)  <b>Survey Time:</b> 10:25 – 10:55  <b>Date:</b> August 29, 2014  <b>Sunrise/Sunset:</b> 06:24/20:01 ( <a href="http://www.nrc-cnrc.gc.ca/eng/services/sunrise/">http://www.nrc-cnrc.gc.ca/eng/services/sunrise/</a>)</p>

	<p><b>Survey Time:</b> 12:53 – 16:18  <b>Date:</b> September 3, 2014  <b>Sunrise/Sunset:</b> 06:32/19:51 ( <a href="http://www.nrc-cnrc.gc.ca/eng/services/sunrise/">http://www.nrc-cnrc.gc.ca/eng/services/sunrise/</a>)  <b>Survey Time:</b> 07:15 – 10:34  <b>Date:</b> September 8, 2014  <b>Sunrise/Sunset:</b> 06:39/19:40 ( <a href="http://www.nrc-cnrc.gc.ca/eng/services/sunrise/">http://www.nrc-cnrc.gc.ca/eng/services/sunrise/</a>)  <b>Survey Time:</b> 10:06 – 12:55</p>
<p><b>Weather &amp; Tidal Conditions</b></p>	<p>All surveys were conducted in the absence of rain and fog, and during wind speeds less than 19 km/hr. Survey times were centered around peak daytime low tides when possible. The following is a more detailed summary of the weather conditions (general conditions and temperature) and tides on each of the survey dates and for the associated times.</p> <p><b>July 11, 2014</b></p> <p>The survey was conducted under clear skies, with wind speeds ranging from 1 to 2 on the Beaufort Wind Scale (1 – 11 km/hr). Based on climate data from Vancouver International Airport, the average temperature was approximately 23 °C.  <a href="http://climate.weather.gc.ca/climateData/hourlydata_e.html?timeframe=1&amp;Prov=BC&amp;StationID=51442&amp;hlyRange=2013-06-11%7C2014-06-11&amp;cmdB1=Go&amp;Year=2014&amp;Month=7&amp;Day=11">http://climate.weather.gc.ca/climateData/hourlydata_e.html?timeframe=1&amp;Prov=BC&amp;StationID=51442&amp;hlyRange=2013-06-11%7C2014-06-11&amp;cmdB1=Go&amp;Year=2014&amp;Month=7&amp;Day=11</a></p> <p>The survey was conducted during falling, low, and rising tides. Based on the Sand Heads tidal predictions, a high tide of 4.3 m above chart datum occurred at 03:43, falling to a low tide of 0.6 m above chart datum at 11:10, rising again to a high tide of 4.4 m at 18:50.  <a href="http://www.waterlevels.gc.ca/eng/station?type=0&amp;date=2014%2F07%2F11&amp;sid=7594&amp;tz=PDT&amp;pres=1">http://www.waterlevels.gc.ca/eng/station?type=0&amp;date=2014%2F07%2F11&amp;sid=7594&amp;tz=PDT&amp;pres=1</a></p> <p><b>July 14, 2014</b></p> <p>The survey was conducted under clear skies, with wind speeds ranging from 0 to 1 on the Beaufort Wind Scale (0 - 5 km/hr). Based on climate data from Vancouver International Airport, the average temperature was approximately 26 °C.  <a href="http://climate.weather.gc.ca/climateData/hourlydata_e.html?timeframe=1&amp;Prov=BC&amp;StationID=51442&amp;hlyRange=2013-06-11%7C2014-06-11&amp;cmdB1=Go&amp;Year=2014&amp;Month=7&amp;Day=14">http://climate.weather.gc.ca/climateData/hourlydata_e.html?timeframe=1&amp;Prov=BC&amp;StationID=51442&amp;hlyRange=2013-06-11%7C2014-06-11&amp;cmdB1=Go&amp;Year=2014&amp;Month=7&amp;Day=14</a></p> <p>The survey was conducted during falling, low, and rising tides. Based on the Sand Heads tidal predictions, a high tide of 4.2 m above chart datum occurred at 06:34, falling to a low tide of 0.7 m above chart datum at 13:28, rising again to a high tide of 4.7 m at 20:45.  <a href="http://www.waterlevels.gc.ca/eng/station?type=0&amp;date=2014%2F07%2F14&amp;sid=7594&amp;tz=PDT&amp;pres=1">http://www.waterlevels.gc.ca/eng/station?type=0&amp;date=2014%2F07%2F14&amp;sid=7594&amp;tz=PDT&amp;pres=1</a></p> <p><b>July 17, 2014</b></p> <p>The survey was conducted under clear skies, with wind speeds of 1 on the Beaufort Wind Scale (1 – 6 km/hr). Based on climate data from Vancouver International Airport, the average temperature was approximately 16 °C.  <a href="http://climate.weather.gc.ca/climateData/hourlydata_e.html?timeframe=1&amp;Prov=BC&amp;StationID=51442&amp;hlyRange=2013-06-11%7C2014-06-11&amp;cmdB1=Go&amp;Year=2014&amp;Month=7&amp;Day=17">http://climate.weather.gc.ca/climateData/hourlydata_e.html?timeframe=1&amp;Prov=BC&amp;StationID=51442&amp;hlyRange=2013-06-11%7C2014-06-11&amp;cmdB1=Go&amp;Year=2014&amp;Month=7&amp;Day=17</a></p> <p>The survey was conducted during falling, low, and rising tides. Based on the Sand Heads tidal predictions, a high tide of 3.6 m above chart datum occurred at 09:53, falling to a low tide of 1.8 m above chart datum at 15:50, rising again to a high tide of 4.6 m at 22:40.  <a href="http://www.waterlevels.gc.ca/eng/station?type=0&amp;date=2014%2F07%2F17&amp;sid=7594&amp;tz=PDT&amp;pres=1">http://www.waterlevels.gc.ca/eng/station?type=0&amp;date=2014%2F07%2F17&amp;sid=7594&amp;tz=PDT&amp;pres=1</a></p>

**July 20, 2014**

The survey was conducted under cloudy skies, with wind speeds of 1 on the Beaufort Wind Scale (1 – 11 km/hr). Based on climate data from Vancouver International Airport, the average temperature was approximately 22 °C.

[http://climate.weather.gc.ca/climateData/hourlydata\\_e.html?timeframe=1&Prov=BC&StationID=51442&hlyRange=2013-06-11%7C2014-06-11&cmdB1=Go&Year=2014&Month=7&Day=20](http://climate.weather.gc.ca/climateData/hourlydata_e.html?timeframe=1&Prov=BC&StationID=51442&hlyRange=2013-06-11%7C2014-06-11&cmdB1=Go&Year=2014&Month=7&Day=20)

The survey was conducted during falling, low, and rising tides. Based on the Sand Heads tidal predictions, a high tide of 4.4 m above chart datum occurred at 00:04, falling to a low tide of 1.5 m above chart datum at 07:28, rising again to a high tide of 3.6 m at 14:40.

<http://www.waterlevels.gc.ca/eng/station?type=0&date=2014%2F07%2F20&sid=7594&tz=PDT&pres=1>

**August 19, 2014**

The survey was conducted under slightly cloudy skies, with wind speeds of 2 on the Beaufort Wind Scale (7 – 11 km/hr). Based on climate data from Vancouver International Airport, the average temperature was approximately 20 °C.

[http://climate.weather.gc.ca/climateData/hourlydata\\_e.html?timeframe=1&Prov=BC&StationID=51442&hlyRange=2013-06-11%7C2014-06-11&cmdB1=Go&Year=2014&Month=8&Day=19](http://climate.weather.gc.ca/climateData/hourlydata_e.html?timeframe=1&Prov=BC&StationID=51442&hlyRange=2013-06-11%7C2014-06-11&cmdB1=Go&Year=2014&Month=8&Day=19)

The survey was conducted during falling, low, and rising tides. Based on the Sand Heads tidal predictions, a high tide of 4.0 m above chart datum occurred at 00:10, falling to a low tide of 1.5 m above chart datum at 07:45, rising again to a high tide of 3.9 m at 15:32.

<http://www.waterlevels.gc.ca/eng/station?type=0&date=2014%2F08%2F19&sid=7594&tz=PDT&pres=1>

**August 24, 2014**

The survey was conducted under clear skies, with wind speeds ranging from 0 to 2 on the Beaufort Wind Scale (0 – 11 km/hr). Based on climate data from Vancouver International Airport, the average temperature was approximately 21 °C.

[http://climate.weather.gc.ca/climateData/hourlydata\\_e.html?timeframe=1&Prov=BC&StationID=51442&hlyRange=2013-06-11%7C2014-06-11&cmdB1=Go&Year=2014&Month=8&Day=24](http://climate.weather.gc.ca/climateData/hourlydata_e.html?timeframe=1&Prov=BC&StationID=51442&hlyRange=2013-06-11%7C2014-06-11&cmdB1=Go&Year=2014&Month=8&Day=24)

The survey was conducted during falling, low, and rising tides. Based on the Sand Heads tidal predictions, a high tide of 3.9 m above chart datum occurred at 04:51, falling to a low tide of 1.4 m above chart datum at 11:40, rising again to a high tide of 4.1 m at 18:47.

<http://www.waterlevels.gc.ca/eng/station?type=0&date=2014%2F08%2F24&sid=7594&tz=PDT&pres=1>

**August 29, 2014**

The survey was conducted under cloudy skies, with wind speeds ranging from 1 to 3 on the Beaufort Wind Scale (1 – 19 km/hr). Based on climate data from Vancouver International Airport, the average temperature was approximately 18 °C.

[http://climate.weather.gc.ca/climateData/hourlydata\\_e.html?timeframe=1&Prov=BC&StationID=51442&hlyRange=2013-06-11%7C2014-06-11&cmdB1=Go&Year=2014&Month=8&Day=29](http://climate.weather.gc.ca/climateData/hourlydata_e.html?timeframe=1&Prov=BC&StationID=51442&hlyRange=2013-06-11%7C2014-06-11&cmdB1=Go&Year=2014&Month=8&Day=29)

The survey was conducted during falling, low, and rising tides. Based on the Sand Heads tidal predictions, a high tide of 3.8 m above chart datum occurred at 08:27, falling to a low tide of 2.3 m above chart datum at 14:19, rising again to a high tide of 4.2 m at 20:34.

<http://www.waterlevels.gc.ca/eng/station?type=0&date=2014%2F08%2F29&sid=7594&tz=PDT&pres=1>

	<p><b>September 3, 2014</b></p> <p>The survey was conducted under cloudy skies, with wind speeds ranging from 0 to 1 on the Beaufort Wind Scale (0 – 6 km/hr). Based on climate data from Vancouver International Airport, the average temperature was approximately 14 °C.</p> <p><a href="http://climate.weather.gc.ca/climateData/hourlydata_e.html?timeframe=1&amp;Prov=BC&amp;StationID=51442&amp;hlyRange=2013-06-11%7C2014-06-11&amp;cmdB1=Go&amp;Year=2014&amp;Month=9&amp;Day=3">http://climate.weather.gc.ca/climateData/hourlydata_e.html?timeframe=1&amp;Prov=BC&amp;StationID=51442&amp;hlyRange=2013-06-11%7C2014-06-11&amp;cmdB1=Go&amp;Year=2014&amp;Month=9&amp;Day=3</a></p> <p>The survey was conducted during the rising tide. Based on the Sand Heads tidal predictions, a low tide of 1.5 m above chart datum occurred at 06:30, rising to a high tide of 3.9 m at 14:19.</p> <p><a href="http://www.waterlevels.gc.ca/eng/station?type=0&amp;date=2014%2F09%2F03&amp;sid=7594&amp;tz=PDT&amp;pres=1">http://www.waterlevels.gc.ca/eng/station?type=0&amp;date=2014%2F09%2F03&amp;sid=7594&amp;tz=PDT&amp;pres=1</a></p> <p><b>September 8, 2014</b></p> <p>The survey was conducted under partly cloudy skies, with wind speeds ranging from 2 to 3 on the Beaufort Wind Scale (7 – 19 km/hr). Based on climate data from Vancouver International Airport, the average temperature was approximately 19 °C.</p> <p><a href="http://climate.weather.gc.ca/climateData/hourlydata_e.html?timeframe=1&amp;Prov=BC&amp;StationID=51442&amp;hlyRange=2013-06-11%7C2014-06-11&amp;cmdB1=Go&amp;Year=2014&amp;Month=9&amp;Day=8">http://climate.weather.gc.ca/climateData/hourlydata_e.html?timeframe=1&amp;Prov=BC&amp;StationID=51442&amp;hlyRange=2013-06-11%7C2014-06-11&amp;cmdB1=Go&amp;Year=2014&amp;Month=9&amp;Day=8</a></p> <p>The survey was conducted during falling, low, and rising tides. Based on the Sand Heads tidal predictions, a high tide of 4.1 m above chart datum occurred at 04:45, falling to a low tide of 1.2 m above chart datum at 11:18, rising again to a high tide of 4.5 m at 18:06.</p> <p><a href="http://www.waterlevels.gc.ca/eng/station?type=0&amp;date=2014%2F09%2F08&amp;sid=7594&amp;tz=PDT&amp;pres=1">http://www.waterlevels.gc.ca/eng/station?type=0&amp;date=2014%2F09%2F08&amp;sid=7594&amp;tz=PDT&amp;pres=1</a></p>
<p><b>Survey Areas</b></p>	<p>Port Metro Vancouver’s (PMV’s) Habitat Enhancement Program – Westham Tidal Marsh, Delta, BC.</p> <p>The proposed enhancement site is located on the north bank of Canoe Pass, on the south side of Westham Island. The proposed enhancement area is approximately 550 m long (west to east) and has an approximate average width (north to south) of 160 m. Surveys encompassed the proposed enhancement area and three adjacent reference sites of a relatively similar size (one upstream and two downstream of proposed enhancement site) (<b>Figure 1</b>).</p>
<p><b>Survey Team</b></p>	<p>Renae Mackas, Biologist (Hemmera)</p>
<p><b>Scope of Work</b></p>	<p>The proposed project will involve converting an existing non-vegetated intertidal area (predominantly sandflat) into a more productive brackish marsh, thereby improving the overall productivity of the site. This will be accomplished through construction of a containment berm followed by the placement of fill material to the appropriate elevation for the establishment of tidal marsh vegetation. The Project will result in the creation of approximately 40,200 m<sup>2</sup> (4.0 ha) of high-quality intertidal marsh habitat. The surveys focused on use of the survey sites by waterbirds (primary focus on shorebirds use of tidal flats, along with waterfowl and wading birds); however, all avian species interacting with the restoration and reference sites were also documented.</p>

<p><b>Survey Methods</b></p>	<p>Survey protocol followed the same methodology that was used during surveys conducted in spring of 2014 (Hemmera 2014). A single observer conducted 30-minute long standwatches of the proposed restoration site and three reference sites in the Canoe Pass area (<b>Figure 1</b>). Standwatches were conducted from the dike located on the south side of Canoe Pass, which ranges approximately 200 to 300 m from the survey area. On each survey date, the proposed enhancement site was surveyed twice (two 30-minute intervals), and the reference sites were surveyed either once or twice. Over the entire survey period, the proposed enhancement site was surveyed 18 times (total of nine hours), and each reference site was surveyed 11 times (total of 5.5 hours) (<b>Table 1</b>).</p> <p>Binoculars and a spotting scope were used to identify birds near or interacting with the four survey sites. For each bird documented, the species, number of birds, time of observation, and behavior(s) were also recorded. For shorebirds, the duration of time spent on the site was also recorded. Any birds observed flying over but not directly interacting with each survey site was recorded separately as a “flyover”. If the surveyor was unable to identify a bird to species during surveys, the bird was identified to the most specific species group such as unknown duck or unknown gull.</p> <p>Surveys were focused on the non-vegetated portion of the tidal flats and did not encompass marsh habitats to the north alongside Westham Island.</p> <p>There is some potential during standwatch surveys to miss some birds or record some of the same birds more than once. However, most of the waterbirds observed remained still or slow-moving during surveys, and therefore the counts appear to be relatively accurate. Although these surveys may still not provide the absolute total count of birds occupying the sites, it is expected that they provide a relatively accurate indication regarding the level of use by waterbirds.</p>
<p><b>Results</b></p>	<p>A brief summary of results are described below. For detailed survey results, see <b>Tables 2-4</b>.</p> <p>Waterfowl (ducks and geese) made up the large majority of species observed interacting with tidal flats during both the adult and juvenile southward migration periods, followed by Gulls and Terns. (<b>Tables 2 and 3, Figure 2</b>).</p> <p>Three shorebird species were observed on the tidal flats, all in relatively low numbers: Killdeer (n=74), Yellowlegs (not identified to Lesser or Greater (n=4)), Western Sandpiper (n=63). Additionally, another 10 Lesser Yellowlegs and 67 Western Sandpipers were observed as flyovers (<b>Table 4</b>). The largest flock of Western Sandpiper observed interacting directly with the survey sites was 50 birds, observed on July 14 at the <i>Reference Downstream – East</i> survey site. Thirty-seven of the 67 Western Sandpipers observed as flyovers were seen at the <i>Proposed Enhancement Site</i> in two small flocks on August 24 (<b>Table 4</b>), however none were observed directly interacting with the site during any of the observation periods. The numbers of Western Sandpipers observed during these surveys appear to be relatively low compared with numbers reported in other nearby areas of the Fraser River Estuary (e.g., Brunswick Point, based on eBird 2014) or observed in the outer estuary (e.g., high value mudflats in Boundary Bay, Roberts Bank, and Sturgeon Bank).</p> <p>Based on observations from spring of 2014 (Hemmera 2014), the total number of birds observed per hour decreased from west to east across the four sites. In contrast, total bird numbers this summer were highest at the <i>Proposed Enhancement Site</i> during the southward adult shorebird migration period (July 11 to 20) and at the <i>Reference Upstream</i> during the southward juvenile migration period (August 19 to September 8). This pattern is driven by the large numbers of waterfowl (maximum observation of 1150 Canada Geese at <i>Reference Upstream</i> on August 24) and gulls and terns observed at these sites (<b>Figure 2</b>).</p>

<b>Summary &amp; Recommendations</b>	<p>Non-vegetated tidal flats within the proposed enhancement site are predominantly sand, similar to the <i>Reference-Upstream</i> survey area. In contrast, the flats overlapping with <i>Reference Downstream - East</i> and <i>Reference Downstream-West</i> survey areas appear to be characterized by finer silts (mud). Given these general differences, it has been previously anticipated that shorebird habitat values would be higher downstream and even moreso in other areas of the Fraser River Estuary than within the proposed enhancement site (i.e., mudflats of the outer estuary). In addition, all of these tidal flats are located in close proximity to a dyke with an adjacent riparian buffer which might also limit shorebird use given the cover and vantage point for avian predators (i.e., raptors).</p> <p>Western Sandpipers were not observed directly using the <i>Proposed Enhancement Site</i> during the southward migration period for this species, and only individual birds or small flocks (5-50) were observed on the adjacent tidal habitat areas. With consideration to these low numbers, including low numbers of shorebirds observed at this site during northward migration (Hemmera 2014), these standwatch surveys support previous expectations that the proposed enhancement site and adjacent tidal flats is of low habitat value to shorebirds.</p>
<b>References</b>	<p>Hemmera 2014. Spring 2014 Boat and Standwatch Bird Surveys – Proposed Westham Island Canoe Pass Tidal Marsh Project. Available online at &lt;<a href="http://porttalk.ca/HabitatEnhancement/documents">http://porttalk.ca/HabitatEnhancement/documents</a>&gt;</p> <p>Ebird 2014. Range and Point Maps – Western Sandpiper: July – October, 2014. &lt;<a href="http://ebird.org/ebird/map/wessan?neg=true&amp;env.minX=-123.18719136022992&amp;env.minY=49.06906176197862&amp;env.maxX=-123.06994663977093&amp;env.maxY=49.10425044844415&amp;zh=true&amp;gp=false&amp;ev=Z&amp;mr=on&amp;bmo=7&amp;emo=10&amp;yr=cur">http://ebird.org/ebird/map/wessan?neg=true&amp;env.minX=-123.18719136022992&amp;env.minY=49.06906176197862&amp;env.maxX=-123.06994663977093&amp;env.maxY=49.10425044844415&amp;zh=true&amp;gp=false&amp;ev=Z&amp;mr=on&amp;bmo=7&amp;emo=10&amp;yr=cur</a>&gt;</p>

**Table 1 Dates of Standwatch Surveys Conducted at Canoe Pass/ South Westham Island During Adults and Juvenile Shorebird Southward Migration Periods; Delta, BC.**

Site	Migration Period	Date	Observation Period(s)	
<i>Proposed Enhancement Site</i>	<i>Adult</i>	July-11-14	10:33 - 11:03 12:40 - 13:10	
		July-14-14	13:10 - 13:40 14:20 - 14:50	
		July-17-14	15:48 - 16:18 16:55 - 17:25	
		July-20-14	6:28 - 6:58 8:49 - 9:19	
	<i>Juvenile</i>	August-19-14	7:23 - 7:53 9:13 - 9:43	
		August-24-14	11:40 - 12:10 12:44 - 13:14	
		August-29-14	13:30 - 14:00 15:48 - 16:18	
		September-03-14	8:23 - 8:53 9:28 - 9:58	
		September-08-14	10:40 - 11:10 12:25 - 12:55	
	<i>Reference Upstream</i>	<i>Adult</i>	July-11-14	13:12 - 13:42 9:55 - 10:25
			July-14-14	13:45 - 14:15
			July-17-14	16:21 - 16:51
			July-20-14	7:04 - 7:34
<i>Juvenile</i>		August-19-14	6:45 - 7:15	
		August-24-14	12:12 - 12:42	
		August-29-14	12:53 - 13:23	
		September-03-14	7:52 - 8:22 8:55 - 9:25	
		September-08-14	10:06 - 10:36	
<i>Reference Downstream - East</i>	<i>Adult</i>	July-11-14	11:15 - 11:45	
		July-14-14	12:36 - 13:06	
		July-17-14	14:34 - 15:04 17:29 - 17:59	
		July-20-14	8:14 - 8:44	
	<i>Juvenile</i>	August-19-14	8:03 - 8:33	
		August-24-14	10:25 - 10:55 13:15 - 13:45	
		August-29-14	14:05 - 14:35	
		September-03-14	10:04 - 10:34	
		September-08-14	11:14 - 11:44	
<i>Reference - Downstream - West</i>	<i>Adult</i>	July-11-14	12:05 - 12:35	
		July-14-14	12:00 - 12:30 15:00 - 15:30	
		July-17-14	15:10 - 15:40	
		July-20-14	7:41 - 8:11	
	<i>Juvenile</i>	August-19-14	8:39 - 9:09	
		August-24-14	11:04 - 11:34	
		August-29-14	14:41 - 15:11 15:11 - 15:41	
		September-03-14	7:15 - 7:45	
		September-08-14	11:50 - 12:20	

**Table 2 Species Observed Directly Interacting with Tidal Flats During Standwatch Surveys Conducted During Adult Western Sandpiper Southward Migration at South Westham Island; Delta, BC.**

Site	Species Group	Common Name	Latin Name	July 11th			July 14th			July 17th			July 20th			
				Abundance of Species	Abundance of Species Group	Behaviour	Abundance of Species	Abundance of Species Group	Behaviour	Abundance of Species	Abundance of Species Group	Behaviour	Abundance of Species	Abundance of Species Group	Behaviour	
Proposed Enhancement Site	Gulls and Terns	Unidentified Gull	Larus sp.	-	-	-	-	-	-	(3)	(3)	standing, landing	1	1	landing, taking off	
	Hérons	Great Blue Heron	Ardea herodias	1,(2)	1,(2)	standing	1	1	standing	(1)	(1)	standing, taking off	(1)	(1)	flapping	
	Other	Barn Swallow	Hirundo rustica	3	3	flapping	3 (2)	3 (2)	flapping	2 (12)	2 (12)	flapping, loafing/resting	-	-	-	
	Raptors	Bald Eagle	Haliaeetus leucocephalus	-	-	-	(1)	(1)	landing, preening	-	-	-	-	-	-	
	Shorebirds	Killdeer	Charadrius vociferus	1	1	standing, feeding	-	-	-	-	-	-	-	2	2	-
		Yellowlegs	Tringa sp.	-		-	-		-	-	-	-	-			-
	Waterfowl	Canada Goose	Branta canadensis	380 (400)	380 (400)	loafing/resting, standing	-	-	-	-	-	-	-	5	7	standing
Gadwall		Anas strepera	-	-		-	-		-	-	-	-	-	2		standing, preening
Reference Upstream	Gulls and Terns	Unidentified Gull	Larus sp.	-	-	-	-	-	-	6	6	landing, preening	-	-	-	
	Hérons	Great Blue Heron	Ardea herodias	2	2	standing, hunting	-	-	-	1	1	standing, hunting	-	-	-	
	Other	Barn Swallow	Hirundo rustica	3	3	flapping, loafing/resting	-	50	-	-	-	-	-	-	-	-
		European Starling	Sturnus vulgaris	-		-	-		50	landing, standing	-	-	-	-	-	-
	Raptors	Bald Eagle	Haliaeetus leucocephalus	-	-	-	1	1	preening	1	1	landing, standing	-	-	-	
	Shorebirds	Killdeer	Charadrius vociferus	1	1	feeding, loafing/resting	-	-	-	-	-	-	-	-	1	-
		Western Sandpiper	Calidris mauri	-		-	-		-	-	-	-	-	1	standing	
Waterfowl	Canada Goose	Branta canadensis	125 (165)	125 (165)	loafing/resting, walking, standing	-	-	-	-	-	-	-	-	-	-	
Reference Downstream - East	Gulls and Terns	Unidentified Gull	Larus sp.	-	-	-	-	-	-	1	1	preening	1	1	standing	
	Hérons	Great Blue Heron	Ardea herodias	-	-	-	-	-	-	(1)	(1)	hunting	-	-	-	
	Other	Barn Swallow	Hirundo rustica	-	-	-	-	-	-	3	3	flapping	2	2	flapping	
	Shorebirds	Killdeer	Charadrius vociferus	12	12	standing	5	55	feeding	10(3)	10(3)	feeding	4	10	feeding	
		Western Sandpiper	Calidris mauri	-		-	50		landing, standing	-		-	6		feeding	
Waterfowl	Canada Goose	Branta canadensis	90	90	loafing/resting	-	-	-	-	-	-	21	21	landing, standing		
Reference Downstream - West	Hérons	Great Blue Heron	Ardea herodias	1	1	standing	2 (1)	2 (1)	standing, taking off	-	-	-	-	-	-	
	Other	Barn Swallow	Hirundo rustica	-	-	-	-	-	-	7	7	flapping	-	-	-	
	Shorebirds	Western Sandpiper	Calidris mauri	-	-	-	-	-	-	-	-	-	1	1	feeding	

**Note:** On days where two observations were conducted at a site, the number of birds observed at the site during the second "pass" are shown in brackets.



**Table 3 Species Observed Interacting with Tidal Flats During Standwatch Surveys Conducted During Juvenile Western Sandpiper Southward Migration at South Westham Island; Delta, BC.**

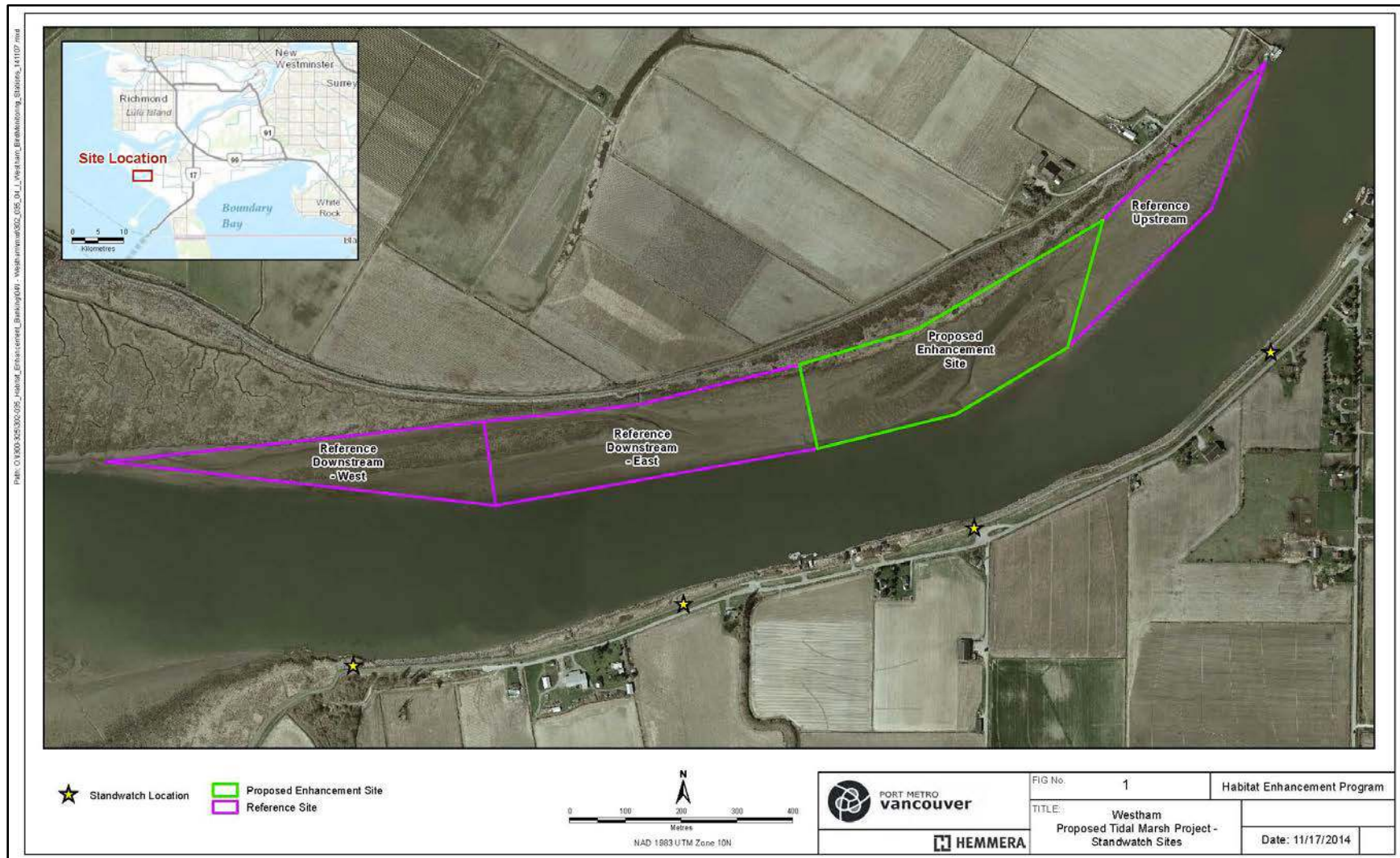
Site	Species Group	Common Name	Latin Name	August 19th			August 24th			August 29th			September 3rd			September 8th			
				Abundance of Species	Abundance of Species Group	Behaviour	Abundance of Species	Abundance of Species Group	Behaviour	Abundance of Species	Abundance of Species Group	Behaviour	Abundance of Species	Abundance of Species Group	Behaviour	Abundance of Species	Abundance of Species Group	Behaviour	
Proposed Enhancement Site	Gulls and Terns	Unidentified Gull	<i>Larus sp.</i>	4 (4)	<b>4 (4)</b>	standing, preening	5 (13)	<b>5 (13)</b>	standing, loafing/resting, walking	145 (450)	-	loafing/resting, landing, standing	125	<b>125</b>	standing, loafing/resting	105 (125)	<b>105 (125)</b>	standing, loafing/resting	
	Hérons	Great Blue Heron	<i>Ardea herodias</i>	1	<b>1</b>	landing, standing	(1)	<b>(1)</b>	landing, standing	2(2)	<b>2(2)</b>	standing, hunting, landing	-	-	-	-	-	-	
	Other	Barn Swallow	<i>Hirundo rustica</i>	(2)	<b>(2)</b>	flapping	-	<b>(39)</b>	-	3	<b>3</b>	flapping	12(7)	<b>12(7)</b>	flapping	(3)	<b>(3)</b>	flapping	
		European Starling	<i>Sturnus vulgaris</i>	-		(25)	standing		-	-		-	-		-	-		-	
		Sandhill Crane	<i>Grus canadensis</i>	-		(14)	loafing/resting		-	-		-	-		-	-		-	
	Raptors	Bald Eagle	<i>Haliaeetus leucocephalus</i>	1	<b>1</b>	standing, preening	1	<b>1</b>	landing	-	-	-	-	-	-	-	-	-	-
	Shorebirds	Killdeer	<i>Charadrius vociferus</i>	4(2)	<b>4(4)</b>	feeding	(5)	<b>(5)</b>	walking, feeding	-	-	-	-	-	-	-	-	-	-
		Yellowlegs	<i>Tringa sp.</i>	(2)		standing, walking	-		-	-	-	-	-	-	-	-	-	-	-
Waterfowl	Canada Goose	<i>Branta canadensis</i>	(2)	<b>(4)</b>	standing, walking	105	<b>106</b>	loafing/resting, standing	3 (110)	<b>6 (119)</b>	standing	-	<b>3(6)</b>	-	1 (1)	<b>9(13)</b>	standing, loafing/resting		
	Mallard	<i>Anas platyrhynchos</i>	(2)		preening	1		loafing/resting	3 (9)		standing, loafing/resting	3(6)		standing	8(12)		loafing/resting		
Reference Upstream	Gulls and Terns	Unidentified Gull	<i>Larus sp.</i>	3	<b>3</b>	landing	26	<b>26</b>	standing	112	<b>112</b>	loafing/resting, standing	3	<b>3</b>	preening, standing	65	<b>65</b>	standing, loafing/resting	
	Hérons	Great Blue Heron	<i>Ardea herodias</i>	-	-	-	1	<b>1</b>	standing	3	<b>3</b>	hunting, standing	1	<b>1</b>	hunting	1	<b>1</b>	standing, hunting	
	Other	Barn Swallow	<i>Hirundo rustica</i>	3	<b>3</b>	flapping	-	<b>-</b>	-	3	<b>5</b>	flapping	2	<b>2</b>	flapping	-	<b>-</b>	-	
		Tree Swallow	<i>Hirundo rustica</i>	-		-	-		2	flapping		-	-		-				
	Raptors	Bald Eagle	<i>Haliaeetus leucocephalus</i>	1	<b>1</b>	flapping, landing	-	<b>-</b>	-	-	<b>-</b>	-	-	<b>-</b>	-	<b>-</b>	-	-	
	Shorebirds	Killdeer	<i>Charadrius vociferus</i>	5	<b>5</b>	standing, feeding	-	<b>-</b>	-	-	<b>-</b>	-	5	<b>5</b>	feeding	13	<b>13</b>	standing, feeding	
	Waterfowl	Canada Goose	<i>Branta canadensis</i>	-	<b>3</b>	-	1150	<b>1151</b>	loafing/resting, standing	16	<b>16</b>	loafing/resting, landing	-	<b>22</b>	-	-	-	-	
Mallard		<i>Anas platyrhynchos</i>	3	standing		1	loafing/resting		-	22		standing, feeding, walking	-		-	-			

Site	Species Group	Common Name	Latin Name	August 19th			August 24th			August 29th			September 3rd			September 8th				
				Abundance of Species	Abundance of Species Group	Behaviour	Abundance of Species	Abundance of Species Group	Behaviour	Abundance of Species	Abundance of Species Group	Behaviour	Abundance of Species	Abundance of Species Group	Behaviour	Abundance of Species	Abundance of Species Group	Behaviour		
Reference Downstream - East	Gulls and Terns	Unidentified Gull	<i>Larus sp.</i>	-	-	-	3	3	standing, walking	23	24	preening, standing	(3)	(3)	standing	-	-	-		
		Caspian Tern	<i>Hydroprogne caspia</i>	-	-	-	-	-	-	1	-	standing	-	-	-	-	-	-		
	Herons	Great Blue Heron	<i>Ardea herodias</i>	1	1	standing	-	-	-	1	1	standing	(1)	-	hunting	1	1	standing, hunting		
	Other	Barn Swallow	<i>Hirundo rustica</i>	2	2	flapping	-	-	-	2	6	flapping	-	-	-	-	-	-		
		Tree Swallow	<i>Tachycineta bicolor</i>	-		-	-		-	4		flapping	-		-	-	-	-	-	-
	Shorebirds	Killdeer	<i>Charadrius vociferus</i>	-	-	-	(4)	(4)	feeding	-	-	-	-	-	-	2	-	feeding		
	Waterfowl	Canada Goose	<i>Branta canadensis</i>	-	-	-	195 (210)	205(223)	loafing/resting, standing	5	5	standing	-	(2)	-	-	-	-		
		Mallard	<i>Anas platyrhynchos</i>	-	-	-	5(8)		loafing/resting	-		-	-		-	-	-	-	-	-
		Red-breasted Merganser	<i>Mergus serrator</i>	-	-	-	5 (5)		swimming	-		-	(2)		preening	-	-	-	-	-
Reference Downstream - West	Gulls and Terns	Unidentified Gull	<i>Larus sp.</i>	-	-	-	3 (8)	3 (8)	loafing/resting, standing, walking	-	-	-	1	1	walking, standing	2	-	standing, walking, preening		
	Herons	Great Blue Heron	<i>Ardea herodias</i>	2	2	standing	2	2	standing, walking	-	-	-	1	1	hunting	-	-	-		
	Shorebirds	Western Sandpiper	<i>Calidris mauri</i>	-	-	-	-	-	-	-	-	-	5	5	feeding	-	-	-		
	Waterfowl	Red-breasted Merganser	<i>Mergus serrator</i>	-	-	-	5	5	swimming	-	-	-	-	-	-	-	-	-		

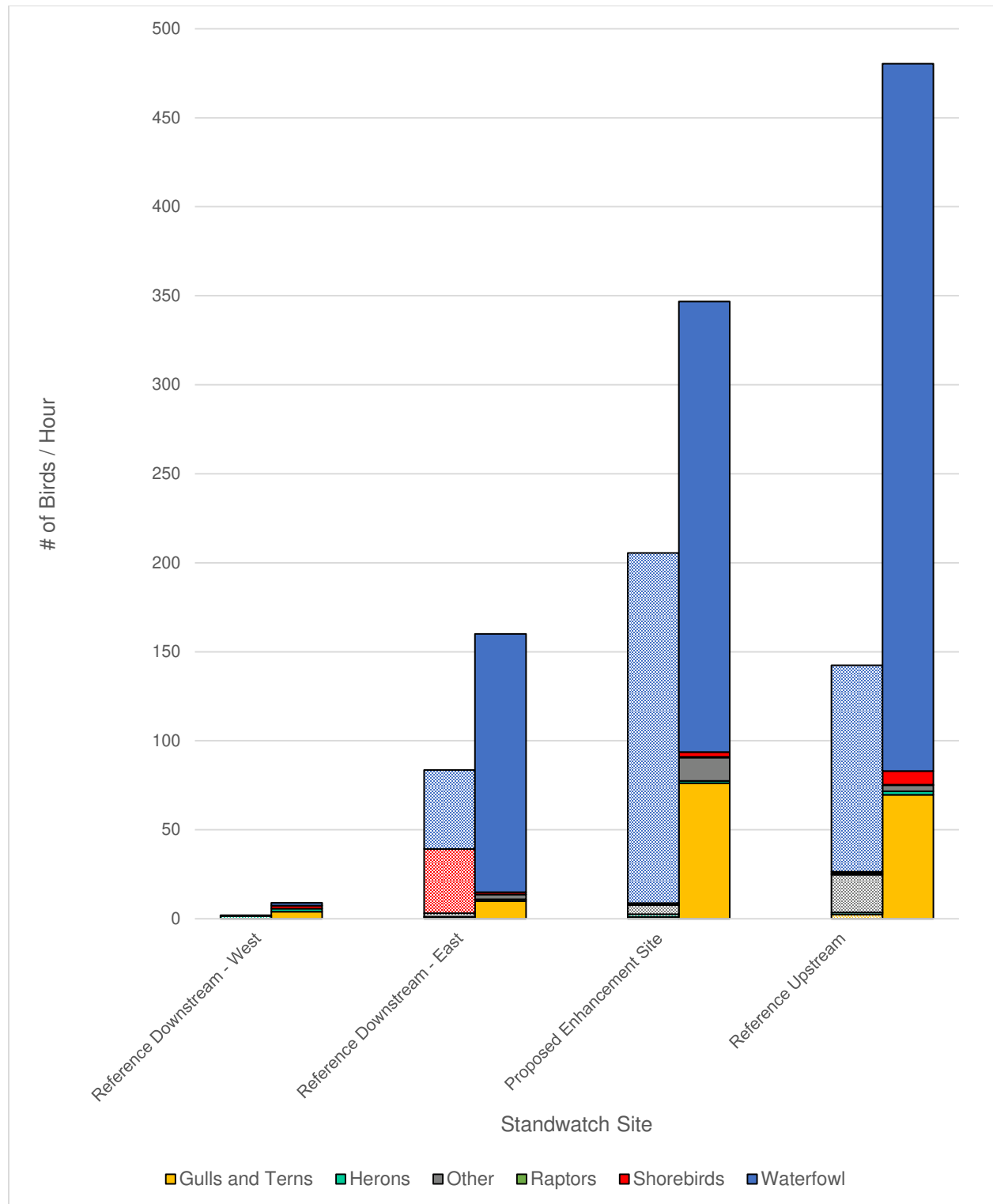
Note: On days where two observations were conducted at a site, the number of birds observed at the site during the second "pass" are shown in brackets.

**Table 4 Cumulative Abundance of Species Observed as Flyovers During Standwatch Surveys Conducted During Juvenile Western Sandpiper Southward Migration at South Westham Island; Delta, BC.**

Site	Gulls and Terns	Herons	Other	Raptors	Shorebirds		Waterfowl		Total
	Unidentified Gull ( <i>Larus sp.</i> )	Great Blue Heron ( <i>Ardea herodias</i> )	Barn Swallow ( <i>Hirundo rustica</i> )	Bald Eagle ( <i>Haliaeetus leucocephalus</i> )	Lesser Yellowlegs ( <i>Tringa flavipes</i> )	Western Sandpiper ( <i>Calidris mauri</i> )	Canada Goose ( <i>Branta canadensis</i> )	Unidentified Duck	
Proposed Enhancement Site	43	2	-	4	10	37	8	-	104
Reference Upstream	150	1	-	3	-	30	4	-	188
Reference Downstream - East	130	1	4	3	-	-	6	1	145
Reference - Downstream - West	131	2	-	2	-	-	33	-	168
<b>Total</b>	<b>454</b>	<b>6</b>	<b>4</b>	<b>12</b>	<b>10</b>	<b>67</b>	<b>51</b>	<b>1</b>	<b>605</b>



**Figure 1 Westham Tidal Marsh Sites Assessed During the July, August, and September 2014 Standwatch Surveys; Delta, BC. Stars Indicate the Approximate Location of Where The Surveyor Conducted Standwatches.**



**Figure 2** Abundance of Species Groups Observed Per Hour During Standwatch Surveys During Adult (Hatched Bars) and Juvenile (Solid Bars) Western Sandpiper Southward Migration of 2014 at South Westham Island; Delta, BC.