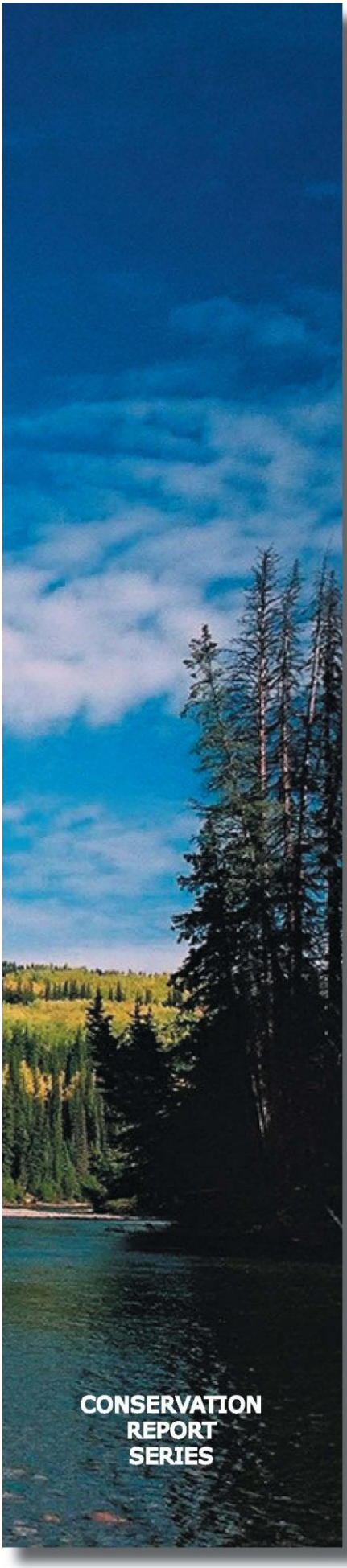

Hay-Zama Lakes Waterfowl Staging and Bald Eagle Nesting Monitoring Program, 2011

Alberta Conservation Association

Conserving Alberta's Wild Side

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Hay-Zama Lakes Waterfowl Staging and Bald Eagle Nesting Monitoring Program, 2011

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EXECUTIVE SUMMARY

The Hay-Zama Lakes Complex (HZLC), located in the Boreal Forest Central Mixedwood Natural Subregion of Alberta, Canada, is an internationally recognized critical staging and nesting area for waterfowl and shorebirds. Numerous oil and gas producing wells located within the HZLC pose a risk to the aquatic ecosystem. The Hay-Zama Lakes Monitoring Program (HZLMP) was initiated in 1978 to moderate the potential impacts of these industrial activities by monitoring waterfowl density and distribution. The HZLMP is directed by the Hay-Zama Committee (HZC), and functions as a cooperative venture supported by a group of stakeholders representing the oil and gas industry, federal, provincial and municipal government agencies, First Nations and conservation groups. The Alberta Conservation Association (ACA) is a member of the HZC and has been monitoring migrating waterfowl and nesting bald eagles within the complex since 1997.

The primary purpose of the monitoring program was to survey waterfowl densities in close proximity to the producing oil and gas wells within the HZLC. If a large congregation of waterfowl is detected near a well site, the Energy Resources Conservation Board (ERCB) has the authority to suspend extraction activity. The density necessary to suspend industrial activity was defined by Alberta Sustainable Resource Development (ASRD) at a threshold of 600 ducks and/or geese within a 30 m radius of a well site. Waterfowl monitoring occurs during spring and fall migration periods (approximately 15 April to 31 May and 15 August to 15 October) in compliance with the ERCB (formerly Alberta Energy and Utilities Board (EUB)) directive for this complex.

Secondary objectives were to estimate the number of staging waterfowl within the HZLC during the two migration periods, and to conduct a one day survey of bald eagle nests, adults, and eaglets along a pre-existing survey route within the HZLC.

In 2011, aerial surveys were flown over the HZLC approximately seven days apart for five weeks in spring, and seven weeks in fall. Spring surveys commenced the final week of April immediately after ice break-up on the complex, while fall surveys commenced the first week of September. The survey route covered all producing wells in the

complex to monitor waterfowl numbers at the well sites, as well as additional transects throughout the complex to estimate staging waterfowl numbers. A single aerial survey for bald eagle nest sites within the HZLC was flown on 7 June 2011.

Waterfowl congregations were surveyed near 20 active wells on 13 sites within the HZLC (four sites contained multiple wells). Waterfowl were observed at 10 of these sites on at least one occasion over the 12 surveys, but congregations were below the threshold limit at all sites. The largest congregation of waterfowl within 30 m of an active well was 26 ducks in spring and 320 ducks in fall. Therefore, extraction activities were not suspended in 2011.

Throughout the HZLC, Canada goose (*Branta canadensis*) was the most abundant goose species observed during spring migration in 2011. Mallard *(Anas platyrhynchos)*, and to a lesser extent, northern pintail *(A. acuta)*, were the most abundant of the identified duck species observed (11% of ducks were unidentified). The highest aggregate counts for both ducks and geese staging over the entire complex occurred during the second survey week in the spring (5 May), one week later than long-term trends (1994 – 2010).

Canada goose was also the most abundant goose species observed during the fall migration in 2011. Mallard, and to a lesser extent, green-winged teal (*Anas crecca*) and gadwall *(A. strepera)*, were the most abundant of the identified duck species observed (7.7% of ducks were unidentified). The highest aggregate count of geese staging over the entire complex occurred during the fourth survey week in the fall (22 September), later than long-term trends. The highest aggregate count for ducks occurred during the third survey week (15 September), earlier than long-term trends.

Six nesting pairs of bald eagles *(Haliaeetus leucocephalus)* were located during the one-day survey in 2011. This is lower than the eight nests observed in 2010, but within the range observed during annual surveys since 1994 (three to eight nesting pairs). The number of eaglets observed in four of the active nests, ranged from one to three. The remaining two active nests each contained two eggs and a brooding adult.

Key words: Hay-Zama lakes, wetlands, well site, waterfowl, bald eagle, staging, aerial survey.

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1.0 INTRODUCTION

1.1 General introduction

The Hay-Zama Lakes Complex (HZLC), located in the Boreal Forest Central Mixedwood Natural Subregion of Alberta, has gained international recognition for its significance for staging waterfowl and shorebirds. Official recognition includes the 1982 Ramsar Convention designation of a "Wetland of International Importance, especially as Waterfowl Habitat", and nomination by the World Heritage Convention as a World Heritage Site in 1990. In 1999 it was designated as a Wildland Provincial Park by the Province of Alberta.

The HZLC has a long history of industrial activity. Oil and gas exploration has occurred on the complex since 1965 and currently there are 20 producing oil and gas wells located on 13 sites within the complex boundaries. Stakeholders felt that the high level of industrial activity within the complex may have a negative effect on wildlife, particularly waterfowl. Risks to local wildlife populations range from harassment due to regular well maintenance activities to exposure to spills of crude oil or diesel used to power pump jacks. To moderate the impacts of oil and gas activities on aquatic ecosystems in the complex, the Hay-Zama Committee (HZC) was formed in 1978, which then initiated the Hay-Zama Lakes Monitoring Program (HZLMP), focusing on monitoring migrating waterfowl and nesting bald eagles.

The HZC consists of representatives from the oil and gas industry (NuVista Energy Ltd.), Dene Tha' First Nation, Energy Resources Conservation Board, municipal, provincial and federal government agencies (M.D. of Mackenzie #23; Alberta Energy; Alberta Environment; Alberta Sustainable Resource Development (ASRD), Fish and Wildlife, and Public Lands and Forests Divisions; Alberta Tourism, Parks and Recreation; Environment Canada, Department of Fisheries and Oceans), and environmental and conservation organizations (Alberta Conservation Association (ACA); Alberta Wilderness Association; Ducks Unlimited Canada), and collaboratively directs industrial activities within the HZLC. Although waterfowl monitoring on the complex began in 1978 and includes all migration seasons except 1979, methods and effort have varied since the inception of the program. To standardize monitoring

efforts, the HZC enlisted the Government of Alberta, Fish and Wildlife Division to carry out wildlife monitoring activities. This task was delegated to the ACA by the government in 1997.

1.2 Survey rationale

Oil and gas operations within the HZLC are regulated by the Energy Resources Conservation Board (ERCB), formerly Alberta Energy and Utilities Board (EUB). In 1995, ERCB in consultation with the HZC, revised regulations for oil and gas operations within the HZLC. Boundaries were defined around the wetland complex to include the areas most environmentally sensitive to industrial activity (Alberta Energy and Utilities Board 1996). Monitoring protocols of select wildlife species (waterfowl and bald eagles) within the new boundaries were developed by the HZC to comply with the following clause in the ERCB guidelines pertaining to general drilling and production activities:

1. During a 5-week spring period (commencing mid-April) and an 8-week fall period (commencing mid-August) each year, the company shall:
    a. Suspend well production and helicopter operations, or
    b. AEP [Alberta Environmental Protection, presently ASRD] and operators within the Complex will monitor fish and wildlife activity in the Complex and, in consultation with the Fish and Wildlife Division of AEP, determine for which wells, if any, suspension of production and helicopter operations is required and for what period of time.
2. Suspension of operation shall include:
    a. Consultation with the EUB to establish appropriate shutdown procedures and sequences,
    b. Shutting in the wells, and
    c. Depressurizing all pipelines and vessels.
3. All wells, batteries, compressor stations, satellites, and pipeline routes shall be patrolled within 24 hours of production being suspended.

These monitoring efforts allow for continued oil and gas production unless a threshold of 600 ducks and/or geese is present within a 30 m radius of the well site, at which point well production must be suspended. A suspended well must be surveyed again within 24 h and ERCB advised of the updated waterfowl count. Guidelines suggest ERCB will allow production to be resumed as soon as waterfowl numbers are below threshold levels.

The alternative, as defined by ERCB, is a general suspension of production on the complex during the migration periods (approximately 15 April to 31 May and 15 August to 15 October). This strategy was developed by the HZC to ensure that a minimum number of waterfowl would be affected in the event of a blowout or oil spill. This was determined by the committee to be an acceptable compromise between economic activity and ecological integrity within the HZLC. ACA is responsible for monitoring and reporting the waterfowl congregations at producing well sites to ERCB, but does not have any regulatory authority in this matter. ERCB has the authority to suspend production of any wells when threshold numbers are detected.

1.3 Survey objectives

There are three objectives for this program. The primary objective is to monitor waterfowl numbers near producing oil and gas wells at regular intervals throughout the spring and fall migration period and report to ERCB any incidents of waterfowl congregations that exceed the defined threshold.

The secondary objectives are to estimate staging waterfowl numbers for the HZLC during spring and fall migration periods for comparison with previous years and to gauge progress of the season's migration; and finally, to estimate the number of bald eagle nests, nesting adults, and eaglets on the complex.

2.0 SURVEY AREA

2.1 Description

The Hay-Zama lakes are part of a unique and diverse wetland complex located in northwestern Alberta at 58°45'N, 119°00'W (Figure 1). Comprised of over 50,000 ha of open water, wet meadows, rivers and floodplain woodlands, this area is characterized by highly variable water levels both on a seasonal and annual basis (Fearon and Larsen 1986).

The major fluvial system, Hay River, meanders through the HZLC, separated from lacustrine cells by high levees. Other fluvial systems entering the complex include Sousa Creek to the southeast, Vardie River, Amber River, and Zama River all to the north, and Mega River to the west, as well as several unnamed creeks (Figure 1). Major lacustrine cells include Hay, Zama, Duck and Sand lakes. Numerous unnamed sloughs make up the remainder of the complex's wetland area. During spring runoff, high water in the Hay River backs up Omega River and Sousa Creek filling the complex. After peak runoff, the complex slowly discharges into the Hay River via these same drainages. By mid-summer some of the large ephemeral lacustrine cells recede into vast grasslands.

Three Indian Reserves (Hay Lake, Amber River, and Zama Lake) border the HZLC. People of the Dene Tha' First Nation have used and continue to use the complex and surrounding areas for traditional purposes such as hunting, fishing, trapping, gathering and traditional ceremonies.

Oil and gas wells within the wetlands are situated on man-made islands with caissons around the well head and accompanying infrastructure to protect them from high water. Construction of the islands and caissons, including their height, are regulated by ERCB (Alberta Energy and Utilities Board 1996).

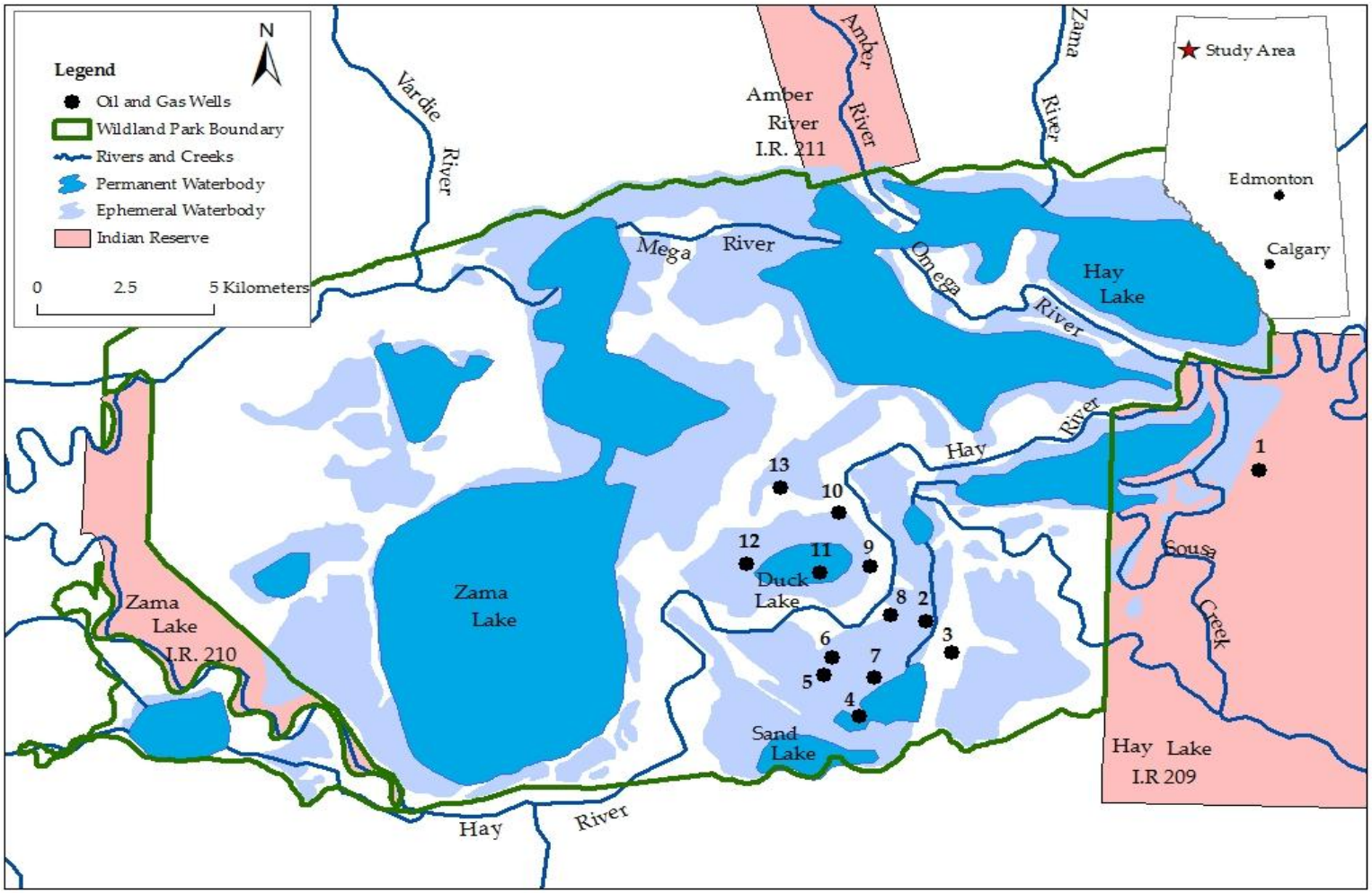

Figure 1. Location of Hay-Zama lakes survey area and oil and gas well sites monitored from 28 April to 26 May and from 2 September to 13 October 2011.

2.2 Natural region, forest cover and soils

The HZLC occurs in the Boreal Forest Central Mixedwood Natural Subregion (Natural Regions Committee 2006). The climate is characterized by relatively low annual precipitation (Strong and Leggat 1992), short, warm summers and long, cold winters (Natural Regions Committee 2006).

Forest cover in the ecoregion is dominated by trembling aspen (*Populus tremuloides*) and balsam poplar (*Populus balsamifera*), with understories commonly containing blue joint (*Calamagrostis canadensis*), prickly rose (*Rosa acicularis*), bunchberry (*Cornus canadensis*), wild sarsaparilla (*Aralia nudicaulis*), dewberry (*Rubus pubescens*), and common fireweed (*Epilobium angustifolium*) (Strong and Leggat 1992).

Soils in the survey area include luvisols, regosols, gleysols, and organic types (Bentz et al. 1994). Luvisolic soils dominate the well-drained upland sites where glaciolacustrine deposits form the dominant parent material. Regosolic soils are prominent on recently deposited sediments of fluvial origin like the floodplains of the Hay River and its tributaries. Gleysolic soils are very common in poorly drained areas, often overlain by organic layers or peat (Bentz et al. 1994).

2.3 Plant and animal communities

Fluctuating water levels in the HZLC are an important attribute of the region and profoundly influence the structure and functioning of plant communities. Annual and seasonal fluctuations of up to 2 m have been recorded by Environment Canada (2007). Aspen and balsam poplar dominate the limited upland sites with sporadic occurrence of white spruce (*Picea glauca*), and paper birch (*Betula papyrifera*). Fluvial deposits adjacent to watercourses are dominated by balsam poplar, with a dense understory of willow (*Salix* spp.), red-osier dogwood (*Cornus stolonifera*), and chokecherry (*Prunus virginiana*). Dense willow thickets, often associated with thick grass and sedge meadows (*Carex spp*.), cover the poorly drained transitional areas between the river levees and the ephemeral lacustrine basins. Sedges, slough grass (*Beckmannia syzigachne*), water smartweed (*Polygonum* spp.), yellow cress (*Rorippa palustris*), and small bedstraw (*Galium trifidum*) cover the ephemeral lacustrine basins once water levels have receded (Bentz et al. 1994).

In addition to abundant migrating waterfowl, several other wildlife species occur in the complex (Wright 1998). These include raptors, gulls, terns and numerous songbirds. Bald eagles (*Haliaeetus leucocephalus)* nest in the treed areas along the Hay River or in aspen uplands bordering the complex. Northern harriers (*Circus cyaneus*) are commonly observed and short-eared owls (*Asio flammeus*) are occasionally observed during surveys. Wright (1999) reported 34 species of neotropical migrants in a 1998 mist-netting survey on riparian habitats in the complex.

Ungulates include moose (*Alces alces*), white-tailed deer (*Odocoileus virginianus*), as well as a wood bison herd (*Bison bison athabascae*) considered to be the only free-ranging, disease-free herd in Alberta. Larger carnivores include black bear (*Ursus americanus*), wolf (*Canis lupus*), and red fox (*Vulpes vulpes*). Beaver (*Castor canadensis*) and muskrat (*Ondatra zibethicus*) have been observed in past monitoring surveys and their dams, lodges and push-ups are evident throughout the complex (Saxena et. al 1995; Wright 1998).

Fish species in the Hay River and tributaries include northern pike (*Esox lucius),* walleye (*Sander vitreus*), burbot (*Lota lota*), white sucker (*Catostomus commersoni*), and longnose sucker (*C. catostomus*) (Shaffe and Wright 1997). Additionally, flooded grasslands in spring provide critical spawning and rearing habitat for northern pike (Moller and Rosin 1994; Shaffe and Wright 1997; Wright 1998).

3.0 MATERIALS AND METHODS

3.1 Waterfowl monitoring near well sites

Aerial surveys were flown at approximately weekly intervals during the two migration periods of 2011. Spring surveys occurred from 28 April to 26 May (five one-day surveys). Fall surveys occurred from 2 September to 13 October (seven one-day surveys). My survey route was similar to previous surveys (Saxena et al. 1995; Schaffe and Wright 1997) and survey time for this portion of the flight ranged from 0.7 to 1.0 h (Appendix 1). Overall, I monitored 13 sites, containing 20 producing wells (Figure 1). The four sites containing multiple wells were regarded as single sites.

Aerial surveys were flown in an R-44 rotary wing aircraft equipped with pop-out floats, at an altitude of approximately 30 m, with ground speeds of 60 to 100 km/h. Flight speed was reduced at well sites to minimize disturbance and to facilitate accurate waterfowl (ducks and geese) counts. The aircraft was oriented to allow me an unobstructed view from the front left side, and if required, would circle the well site for an accurate count. Waterfowl counts at the well sites encompassed a radius of 30 m around the well caisson.

The aerial survey approach for monitoring waterfowl around producing wells has a number of assumptions, as well as limitations, for assessing harm to waterfowl from industrial activities. First, I assume waterfowl near well sites are detected before they attempt to move and avoid disturbance from the aircraft. Second, I assume all individuals can be counted within 30 m of the caisson, and that counts are not biased as densities increase. Third, the detection of waterfowl aggregations does not account for issues that occur if chronic contamination were to occur near wells, either affecting waterfowl directly or by degrading their habitat and food web. Fourth, this survey intensity was limited to 12 days within a 71 day migration period over spring and fall, which limits the ability to detect high congregations of waterfowl should they occur. Fifth, I am not able to conduct surveys in periods of adverse weather conditions (wind speed >50 km/h), which may preclude the detection of waterfowl seeking refuge from heavy weather on the sheltered side of the well structures.

3.2 Waterfowl staging numbers within the HZLC

Following each well site survey, I flew around the perimeter (approximately 200 m from the shoreline) of all the major wetlands in the HZLC to count the number of waterfowl over the migration periods. Flight time for this portion of the survey ranged from 1.0 to 1.5 h (Appendix 1). All waterfowl observed within 200 m of either side of the survey route were recorded and identified to species, where possible. For all but one of the surveys, I was the lone observer in the aircraft. On the 22 September survey, I was accompanied by Mike Ranger (ACA), an experienced observer, who counted the waterfowl on the right side of the aircraft, while I counted the waterfowl on the left side and in front of the aircraft. These observations are compiled and used as a comparison to counts from previous years and to gauge progress of the season's migration. I compared my weekly counts with mean (± standard deviation) counts

recorded for this area since 1994 (Saxena et al. 1995; Schaffe and Wright 1997; Wright 2011).

The survey approach for monitoring staging waterfowl within the HZLC has some assumptions and limitations for assessing staging population numbers. First, I assumed most waterfowl present on the complex are congregated, or are visible from the perimeter of the major wetlands. This is sufficient for the smaller wetlands, but has some limitations for the larger water bodies. Second, I assumed minimal movement of waterfowl between wetlands during the survey, preventing multiple counts of individuals. Additionally, the assumptions regarding survey intensity and weather conditions listed previously, also apply to monitoring of staging waterfowl.

3.3 Bald eagle nesting survey

I monitored nesting sites of bald eagles on the HZLC in a single aerial survey on 7 June 2011, a time of year when adults will flush from the nest more readily, allowing an accurate count of eggs or eaglets in the nest (Wright 2004). My survey route covers all areas within the Wildland Park boundaries that have large mature trees, and includes all nest sites identified in previous surveys (Saxena et al. 1995; Schaffe and Wright 1997; Wright 2011). Flight time for this survey was 3.0 h (Appendix 1). I geo-referenced locations of nests with a Global Positioning System (GPS) unit and recorded numbers of adults, eaglets, or eggs, and nest status using the following categories:

1. Brooding - if eggs or brooding adults were observed in the nest.
2. Rearing - if eaglets were observed in the nest.
3. Empty - if no evidence of nesting was observed.
4. Absent - if the nest was not found in this year's survey but historically existed at the location.

Assumptions and limitations for the bald eagle nesting survey include that the date of the survey was late enough to ensure that all breeding eagles have nested and that any new nests, not observed in previous surveys, were visible from the aircraft and detected in the current survey.

4.0 RESULTS

4.1 Waterfowl monitoring near well sites

During the 2011 spring and fall migration period surveys, waterfowl counts remained below threshold densities at all well sites in the HZLC. I observed waterfowl at 10 of the 13 well site locations in the survey area (Tables 1 and 2). There were very few waterfowl present at any of the well sites during spring migration, with the highest count of 26 ducks recorded at site #12 on 5 May (Table 1). The highest fall survey count was 320 ducks at site #12 on 2 September (Table 2). Brief summaries of waterfowl observations and general habitat descriptions for each of the 13 well site locations monitored in this survey, are provided in Appendix 2.

Table 1. Summary of the total waterfowl observed at each well site during spring migration (28 April to 26 May 2011).

Site #	28 April	5 May	12 May	19 May	26 May
1	0	0	0	0	0
2	2	4	0	0	2
3	0	0	0	0	0
4	4	12	0	0	0
5	0	5	0	0	0
6	0	0	0	0	0
7	0	7	0	0	0
8	0	0	6	0	0
9	0	10	0	4	0
10	0	2	0	0	9
11	0	0	0	0	0
12	0	26	0	0	0
13	0	0	0	0	3

Table 2. Summary of the total waterfowl observed at each well site during fall migration (2 September to 13 October 2011).

Site #	2 Sep	8 Sep	15 Sep	22 Sep	29 Sep	6 Oct	13 Oct
1	0	0	0	0	0	0	0
2	0	0	4	0	0	0	0
3	0	0	0	0	0	0	0
4	0	3	33	0	170	0	16
5	15	0	10	0	0	26	0
6	0	0	0	0	0	0	0
7	0	0	2	2	0	0	0
8	0	2	0	0	0	0	0
9	0	0	8	1	0	0	0
10	0	0	0	0	0	0	0
11	0	140	92	0	20	9	34
12	320	0	17	0	16	11	22
13	2	0	0	1	6	0	0

4.2 Waterfowl staging numbers within the HZLC

In spring 2011, I observed the greatest aggregate counts of both geese and ducks (n = 7,446 geese, n = 17,021 ducks) during the 2nd survey week (5 May) (Table 3), one week later than the mode (most common) of week 1 for both species, from 1994 to 2010 (Appendices 3 and 4). For geese, this one day count in 2011 is considerably higher than both the long term mean (n = 5,065 ± 3,110) and the 2010 greatest aggregate count (n = 4,852) (Appendix 3). For ducks, it is considerably lower than both the long term mean (n = 27,427 ± 13,514), and the 2010 greatest aggregate count (n = 24,708) (Appendix 4).

Canada geese (*Branta canadensis*) were the most abundant of the goose species I observed during spring monitoring. Greater white-fronted geese *(Anser albifrons)* and lesser snow geese (*Chen caerulescens*) were only observed on 5 and 12 May (Appendix 5). Swans were present on all spring survey dates in very low numbers (range: 3 – 34) (Table 3). I was unable to determine whether they were trumpeter (*Cygnus buccinator*)

or tundra swans (*C. columbianus*), as similarities of these two species make accurate identification from the air difficult without undue harassment of the birds.

Table 3. Summary of the total number of waterfowl observed (identified and unidentified) during aerial surveys in the HZLC in spring 2011.

Date	Ducks	Geese	Swans
28 April	16,844	1,981	34
5 May	17,021	7,446	17
12 May	9,513	1,604	23
19 May	7,026	38	12
26 May	3,603	24	3
Total	**54,007**	**11,093**	**89**

Overall during the spring surveys, 11.0% of ducks were unidentifiable. Of the 48,047 ducks I identified, mallard *(Anas platyrhynchos)* was the most abundant species, accounting for 36.3% of the total, followed by northern pintail *(A. acuta)* at 18.5%. American widgeon (*A. americana*) and green-wing teal (*A. crecca)* were moderately abundant as well, accounting for 12.7% and 11.1% of the total, respectively (Figure 2; Appendix 5).

The remaining 21.4% of duck species, in order of abundance, were blue-wing teal (*A. discors),* gadwall *(A. strepera),* northern shoveler *(A. clypeata),* canvasback *(Aythya valisineria),* lesser scaup *(A. affinis)*, teal species (*Anas crecca* or *A. discors),* common goldeneye *(Bucephala clangula),* redhead (*Aythya americana),* ring-necked ducks *(A. collaris*), surf scoter (*Melanitta perspicillata*), white-winged scoter (*M. fusca*), ruddy duck *(Oxyura jamaicensis)*, and bufflehead *(Bucephala albeola)* (Figure 2). Other waterfowl species of note include American coot *(Fulica americana),* common mergansers (*Mergus merganser),* eared grebes *(Podiceps nigricollis),* red-necked grebes *(Podiceps grisegena),* and western grebes *(Aechmophorus occidentalis)* (Appendix 5).

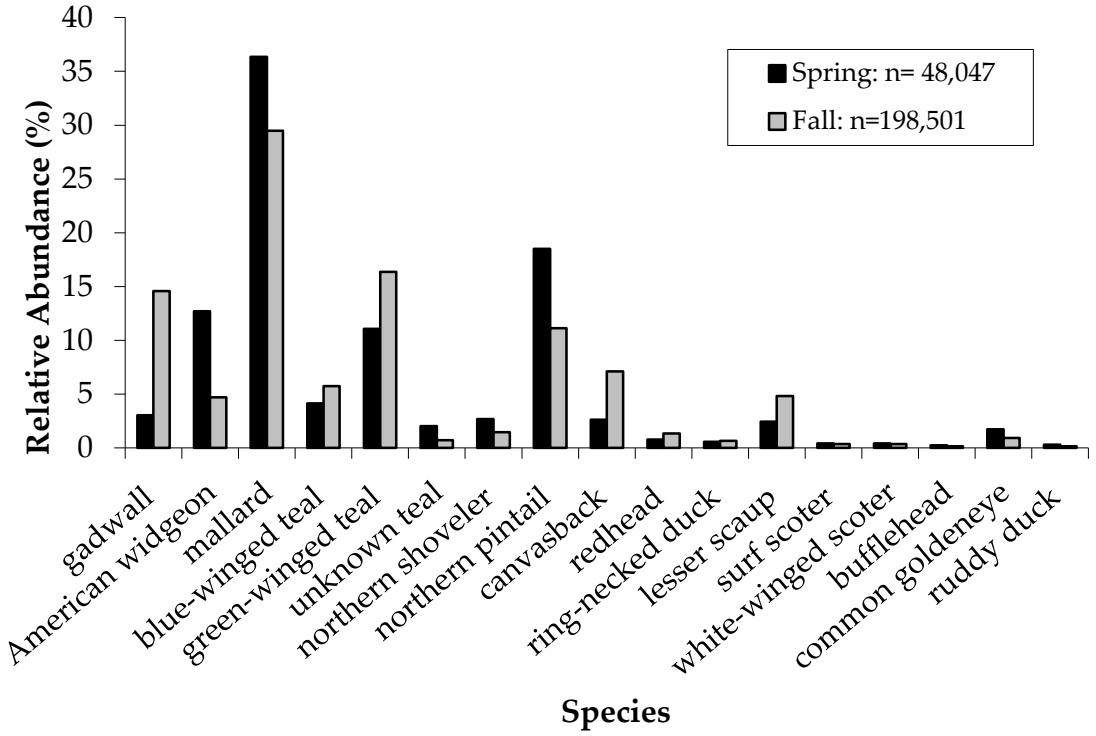

Figure 2. Relative abundance of identified duck species observed during the 2011 spring and fall migrations in the HZLC (11.0% during spring and 7.7% during fall were unidentified).

In fall 2011, Canada geese were the most abundant of the goose species I observed during monitoring. Greater white-fronted geese were present only on the 2nd and 4th survey week and a small flock of 10 lesser snow geese was observed on the 1st survey week (Appendix 6). The greatest aggregate count for geese was 1,660 (1,425 Canada geese and 235 greater white-fronts) (Table 4) on week 4 (22 September), one week later than the mode of week 3 for 1994 to 2010, and one week earlier than the 2010 greatest aggregate count (Appendix 3). Numbers observed were considerably lower than both the long term mean (n = 4,095 ± 3,231) and the 2010 greatest aggregate count (n = 6,241) (Appendix 3).

For ducks, the greatest aggregate count (n = 46,037) was observed on week 3 (15 September) (Table 4), one week earlier than both the mode for 1994 to 2010 and the 2010 greatest aggregate count (Appendix 4). Numbers observed were consistent with

the long term mean (n = 45,444 ± 15,680), and the previous year's observations (n = 40,481) (Appendix 4).

Table 4. Summary of the total number of waterfowl observed (identified and unidentified) during aerial surveys in HZLC in fall 2011.

Date	Ducks	Geese	Swans
2 Sep	16,163	287	0
8 Sep	35,071	1,346	4
15 Sep	46,037	1,379	39
22 Sep	37,549	1,660	40
29 Sep	39,553	310	80
6 Oct	23,998	1,234	297
13 Oct	16,470	929	2,203
Total	**214,841**	**7,145**	**2,663**

Overall during the fall survey, 7.7% of ducks were unidentifiable. Of the 198,501 ducks I identified, mallard was the predominant species recorded, accounting for 29.5% of the total, followed by green-wing teal and gadwall at 16.4% and 14.6%, respectively (Figure 2, Appendix 6). Northern pintail, canvasback, blue-wing teal, lesser scaup and American widgeon, were observed in moderate numbers, accounting for 11.1%, 7.1%, 5.7%, 4.8% and 4.7% of the total, respectively.

The remaining 6.1% of duck species observed, in order of abundance, were northern shoveler, redhead, common goldeneye, teal species, ring-necked duck, white-winged scoter, surf scoter, ruddy duck, and bufflehead (Figure 2). Other waterfowl species of note include American coot, common merganser, and eared grebe (Appendix 6).

4.3 Bald eagle nesting survey

Bald eagle nesting sites have been monitored annually on the HZLC since 1994 (Appendix 7). By 2011, nineteen nesting sites had been identified (Table 5 and Figure 3) and active nesting pairs observed on the complex have ranged from three to eight annually. The lowest count of three was coincident with a wildfire in late May 2001 that burned through several nesting sites along the Hay River (Wright 2002).

During the 7 June 2011 survey, I observed two nests which had not been seen in past surveys, and in total counted six active bald eagle nests (Table 5); this is less than the eight active nests observed in 2010, but within the long term range of three to eight. Four of the active nests contained broods ranging from one to three eaglets, and the two remaining active nests each contained a brooding adult and two eggs. Additionally, three juvenile and three adult bald eagles were observed which were not associated with nest sites.

Nest site #14 contained a brooding great grey owl (*Strix nebulosa*) and two owlets (Table 5 and Figure 3). Six nest sites present in past surveys were not observed during the 2011 survey; nest site #2 was last observed in 2007 in good condition, nest site #5 was burned in the 2001 wildfire, and nest sites #7, #8, #12 and #17 were last observed in 2010 (Table 5).

Table 5. Summary of bald eagle (BAEA) nests classed as brooding, rearing, empty, or absent (not found) along with the presence of adults, eaglets and eggs in the HZLC during an aerial survey on 7 June 2011.

Site	Status	Number observed			Comments
		Adults	Eaglets	Eggs	
1	empty	0	0	0	Nest in poor condition.
2	absent	0	0	0	Not found. Last seen in 2007.
3	empty	0	0	0	Nest in good condition.
4	empty	0	0	0	Nest in good condition.
5	absent	0	0	0	Not found. Last seen in 2000.
6	empty	0	0	0	Nest much smaller, but in good condition.
7	absent	0	0	0	Not found. Last seen in 2010.
8	absent	0	0	0	Not found. Last seen in 2010.
9	rearing	2	2	0	One adult on nest, one roosting nearby.
10	empty	0	0	0	Adjacent tree fallen on nest.
11	rearing	1	3	0	Coot carcass on edge of nest.
12	absent	0	0	0	Not found. Last seen in 2010.
13	brooding	2	0	2	One adult on nest, one roosting nearby.
14	other	0	0	0	Great grey owl and 2 owlets.
15	rearing	1	3	0	One eaglet much smaller than the others.
16	rearing	1	1	0	Eaglet very large.
17	absent	0	0	0	Not found. Last seen in 2010.
18	brooding	2	0	2	One adult on nest, one roosting nearby.
19	empty	0	0	0	Two adult BAEA observed 5 May, 2011.
Total	**6 active nests**	**9**	**9**	**4**	

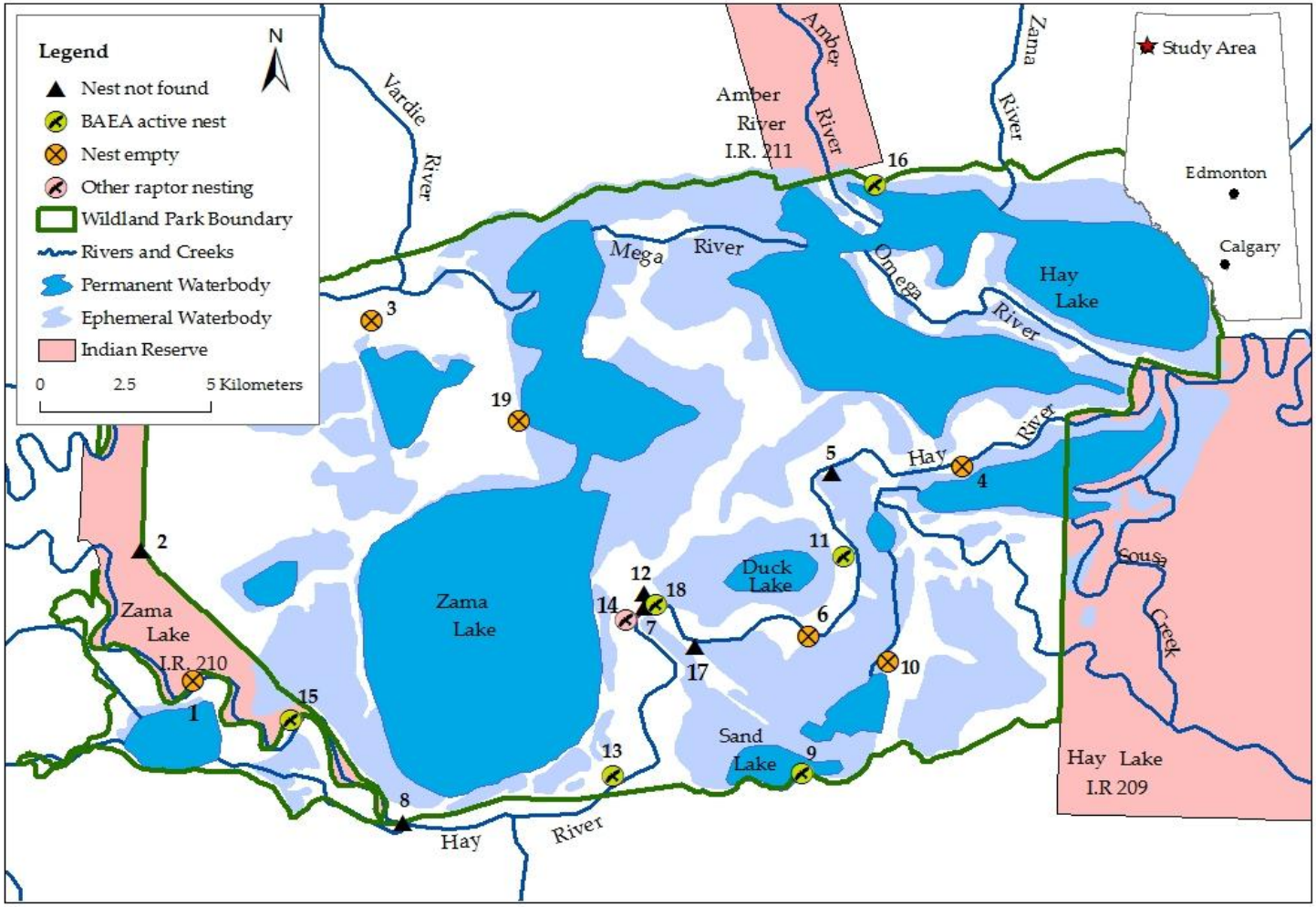

Figure 3. Location and status of bald eagle (BAEA) nest sites observed in an aerial survey in the HZLC, 7 June 2011.

4.4 Summary

The highest count of waterfowl observed at a single well site during the 12 one-day aerial surveys was 320 birds at Site #12, which is below the threshold limit of 600 birds within 30 m of a well caisson. Consequently, ERCB did not require suspension of production for any well sites in the HZLC in 2011.

Throughout the HZLC, Canada geese were the most common goose species observed during both the spring and fall surveys. Mallard was the most common duck species observed during both the spring and fall surveys.

Six active bald eagle nests were observed during the 7 June 2011 survey. This is a decrease from the eight active nests observed in 2010, but within the range of three to eight active nests, recorded in 17 years of previous surveys in this area. The number of eaglets observed in four of the active nests, ranged from one to three. The remaining two active nests each contained two eggs and a brooding adult bald eagle.

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6.0 APPENDICES

Appendix 1. Flight conditions during aerial surveys of the HZLC for spring and fall migration periods, 2011.

Date	Flight duration (h)	Temp. (°C)	Wind direction; speed (knots)	Cloud cover (%)	General conditions
Spring					
28 Apr	2.1	9	E; 15 kts	30	HZLC mostly ice-covered
5 May	2.1	9	WNW; 5 kts	80	Omega River flowing into the complex
12 May	2.4	17	NNW; 15-20 kts	60	Wind gusting; water level rising
19 May	2.4	16	NW; 3 kts	0	Hazy; water level rising
26 May	2.2	18	SE; 10 kts	0	Hazy; 5km visibility; water level rising
BAEA					
7 Jun	3.0	12	N; 10 kts	80	Omega River flowing out of the complex
Fall					
2 Sep	2.3	8	E; 5 kts	100	350m ceiling
8 Sep	2.1	25	NE, W; 5 kts	60	Wind shifting
15 Sep	2.1	17	nil; nil	10	Hazy; good visibility
22 Sep	2.1	15	SW; 15-20 kts	10	Wind gusting
29 Sep	2.3	10	W, SE; 10-15 kts	90	Wind shifting and gusting
6 Oct	2.1	8	SSW; 5 kts	90	500m ceiling
13 Oct	2.0	6	NNW; 5 kts	75	Good

Appendix 2. Summary of observations of waterfowl and general habitat descriptions for each of the 13 well site locations monitored in the HZLC (28 April – 26 May; 2 September – 13 October 2011).

Well location 1. Grid reference: 5-2-113-5-W6. This oil well is located within the Hay Lake Indian Reserve (I.R. 209) in a willow thicket adjacent to an ephemeral sheetwater area. There were no waterfowl observed at this site during the 2011 survey period.

Well location 2. Grid reference: 6-23-112-6-W6. This gas well is located in an ephemeral sheetwater area north of Sand Lake. Waterfowl were present at this site in very low numbers in spring (range: 2 to 4) and absent in fall, except for the 15 September survey, when 4 mallards were observed.

Well location 3. Grid reference: 9-14-112-6-W6. This gas well is located in an isolated ephemeral sheetwater area in the southeast portion of the wetland complex. There were no waterfowl observed at this site during the survey period.

Well location 4. Grid reference: 12-10-112-6-W6. This gas well is located on the west end of an unnamed permanent lake, north of Sand Lake. Waterfowl were present at this site in low to moderate numbers (range: 3 to 170).

Well location 5. Grid reference: 2-16-112-6-W6. This gas well is located in a permanent marsh north of Sand Lake. Waterfowl were absent at this site in spring, except for the 5 May survey, when 5 mallards were observed. Waterfowl were present in low numbers in fall (range: 10 to 26).

Well location 6. Grid reference: 10-16-112-6-W6. This oil well is located in a permanent marsh north of Sand Lake. There were no waterfowl observed at this site during the survey period.

Well location 7. Grid reference: 7-15-112-6-W6. This site contains 2 oil wells (7-15 and 8-15-112-6-W6) and is situated in an ephemeral sheetwater area north of Sand Lake. Waterfowl were present at this site in very low numbers (range: 2 to 7).

Well location 8. Grid reference: 3-23-112-6-W6. This oil well is located in an ephemeral marsh. Waterfowl were absent at this site except for the 12 May survey, when 2 mallards and 4 blue-winged teal were observed; and on 8 September when 2 mallards were observed.

Well location 9. Grid reference: 6-27-112-6-W6. This gas well is located on the east shore of Duck Lake. Waterfowl were present at this site in very low numbers (range: 1 to 10).

Well location 10. Grid reference: 8-33-112-6-W6. This site contains 4 oil wells (8-33, 4-34, 4-34(2) and 6-34-112-6-W6) and is located in an ephemeral sheetwater area between Hay River and Duck Lake. Waterfowl were present at this site in very low numbers in spring (range: 2 to 9) and absent in fall.

Well location 11. Grid reference: 2-28-112-6-W6. This site contains 3 oil wells (2-28, 3-28(2) and 15-21-112-6-W6) and is situated in the permanent lake basin of Duck Lake. Waterfowl were absent in spring and present in low to moderate numbers in fall (range: 9 to 140).

Well location 12. Grid reference: 7-29-112-6-W6. This site contains 2 oil wells (2-29 and 7-29-112-6-W6) and is situated in the permanent lake basin of Duck Lake. The highest numbers of waterfowl observed at a well site during both spring (n = 26) and fall (n = 320) was at this site.

Well location 13. Grid reference: 16-32-112-6-W6. This gas well is located in an ephemeral marsh north of Duck Lake. Waterfowl were absent in spring, except for 26 April, when 3 mallards were observed, and present in very low numbers in fall (range: 1 to 6).

Appendix 3. Summary of the survey week of highest aggregate count of geese observed from 1994 to 2011 during spring and fall migration in the HZLC. Modal (most common) week and mean counts (± standard deviation) for 1994 to 2010 are compared with 2011.

	Spring migration		Fall migration	
Year	Date of survey	Total # geese	Date of survey	Total # geese
1994	week 1	535	week 6	4,780
1995	week 1	9,082	week 3	7,122
1996	week 1	3,949	week 3	8,666
1997	week 2	3,973	week 2	222
1998	week 1	206	week 5	10,988
1999	week 1	6,975	week 3	7,570
2000	week 1	5,483	week 4	4,559
2001	week 1	4,252	week 3	4,332
2002	week 2	5,056	week 2	1,905
2003	week 1	7,879	week 4	5,035
2004	week 1	11,810	week 2	2,558
2005	week 2	7,113	week 6	2,904
2006	week 1	1,311	week 2	1,323
2007	week 1	1,363	week 3	1,036
2008	week 1	5,756	week 3	27
2009	week 2	6,354	week 2	350
2010	week 2	4,852	week 5	6,241
1994 – 2010	Mode = week 1	Mean = 5,065 ± 3,110	Mode = week 3	Mean = 4,095 ± 3,231
2011	week 2	7,446	week 4	1,660

Appendix 4. Summary of the survey week of highest aggregate count of ducks observed from 1994 to 2011 during spring and fall migration in the HZLC. Modal (most common) week and mean counts (± standard deviation) for 1994 to 2010 are compared with 2011.

Year	Spring migration		Fall migration	
	Date of survey	Total # ducks	Date of survey	Total # ducks
1994	week 5	18,417	week 2	35,525
1995	week 1	11,706	week 1	53,859
1996	week 1	19,810	week 4	28,255
1997	week 1	13,884	week 5	29,165
1998	week 2	32,676	week 2	62,941
1999	week 2	49,556	week 4	63,617
2000	week 1	29,307	week 5	32,902
2001	week 1	39,427	week 4	43,095
2002	week 3	52,725	week 4	43,095
2003	week 2	16,564	week 4	87,830
2004	week 1	43,111	week 3	32,016
2005	week 1	29,014	week 3	53,021
2006	week 1	15,951	week 4	42,295
2007	week 2	15,675	week 3	47,176
2008	week 1	12,666	week 4	27,796
2009	week 2	41,064	week 4	49,478
2010	week 1	24,708	week 4	40,481
1994 – 2010	Mode = week 1	Mean = 27,427 ± 13,514	Mode = week 4	Mean = 45,444 ± 15,680
2011	week 2	17,021	week 3	46,037

Appendix 5. Summary of the counts of waterfowl species during the 2011 spring migration in the HZLC.

	28 Apr	5 May	12 May	19 May	26 May
Canada goose (*Branta canadensis*)	1,981	6,540	1,581	38	24
greater white-fronted goose *(Anser albifrons)*	0	900	5	0	0
snow goose (*Chen caerulescens*)	0	6	18	0	0
swans (*Cygnus columbianus, C. buccinator*)	34	17	23	12	3
American coot (*Fulica americana*)	660	299	202	48	120
American widgeon (*Anas americana*)	162	3,045	1,782	784	325
blue-winged teal *(Anas discors)*	146	986	202	317	339
bufflehead (*Bucephala albeola*)	61	10	20	3	17
canvasback (*Aythya valisineria*)	550	375	181	113	40
common goldeneye (*Bucephala clangula*)	703	49	5	37	38
common merganser (*Mergus merganser*)	40	0	0	0	0
unidentified dabbler species	464	601	0	118	110
unidentified diver species	14	7	35	6	9
gadwall (*Anas strepera*)	16	55	1,222	44	123
eared grebes (*Podiceps nigricollis*)	4	6	0	3	3
red-necked grebes (*Podiceps grisegena*)	0	1	0	1	1
western grebes (*Aechmophorus occidentalis*)	0	2	0	1	2
green-winged teal (*Anas crecca)*	2,109	1,955	190	973	85
lesser scaup (*Aythya affinis*)	474	213	247	127	111
mallard (*Anas platyrhynchos*)	8,753	3,243	2,007	2,253	1,208
northern pintail *(Anas acuta)*	2,156	3,913	1,643	951	233
northern shoveler *(Anas clypeata)*	5	469	439	145	223
redhead (*Aythya americana*)	95	116	102	24	32
ring-necked duck *(Aythya collaris)*	59	83	43	53	42
ruddy duck (*Oxyura jamaicensis*)	6	2	81	19	33
surf scoter (*Melanitta perspicillata*)	0	4	100	59	41
unidentified teal species (*Anas* spp.)	161	111	222	364	122
unidentified duck species	870	1,700	925	606	455
white-winged scoter (*Melanitta fusca*)	0	84	67	30	17
Total	**17,508**	**17,326**	**9,715**	**7,077**	**3,726**

Appendix 6. Summary of the counts of waterfowl species during the 2011 fall migration in the HZLC.

	2 Sep	8 Sep	15 Sep	22 Sep	29 Sep	6 Oct	13 Oct
Canada goose (*Branta canadensis*)	277	495	1,379	1,425	310	1,234	929
greater white-fronted goose *(Anser albifrons)*	0	851	0	235	0	0	0
snow goose (*Chen caerulescens*)	10	0	0	0	0	0	0
swans (*Cygnus columbianus, C. buccinator*)	0	4	39	40	80	297	2,203
American coot (*Fulica americana*)	1,452	459	1,256	2,519	1,156	1,296	227
American widgeon (*Anas americana*)	1,825	1,032	1,217	1,465	1,540	1,745	514
blue-winged teal *(Anas discors)*	551	1,885	2,974	2,435	2,890	534	106
bufflehead (*Bucephala albeola*)	23	2	12	239	7	5	10
canvasback (*Aythya valisineria*)	2,496	1,782	2,608	1,857	1,496	2,185	1,710
common goldeneye (*Bucephala clangula*)	36	218	618	256	310	293	106
common merganser (*Mergus merganser*)	38	25	0	935	0	42	40
unidentified dabbler species	1,090	889	652	331	2,075	24	177
unidentified diver species	364	358	1,780	45	115	2	13
gadwall (*Anas strepera*)	959	3,202	7,565	3,150	4,001	6,050	3,997
eared grebes (*Podiceps nigricollis*)	44	125	50	19	1	1	1
red-necked grebes (*Podiceps grisegena*)	0	6	0	0	0	3	0
western grebes (*Aechmophorus occidentalis*)	0	2	4	1	0	0	0
green-winged teal (*Anas crecca)*	823	5,770	6,403	6,534	8,490	3,400	1,040
lesser scaup (*Aythya affinis*)	962	1,102	952	3,609	1,367	1,279	285
mallard (*Anas platyrhynchos*)	2,872	9,972	12,515	11,664	10,193	5,257	6,019
northern pintail *(Anas acuta)*	1,490	4,669	5,602	2,374	4,703	1,985	1,244
northern shoveler *(Anas clypeata)*	99	637	1,036	599	314	25	187
redhead (*Aythya americana*)	359	478	1,130	360	134	2	186
ring-necked duck *(Aythya collaris)*	165	168	223	517	167	22	63
ruddy duck (*Oxyura jamaicensis*)	45	9	123	25	48	22	33
surf scoter (*Melanitta perspicillata*)	0	370	85	145	69	20	8
unidentified teal species (*Anas* spp.)	350	72	242	70	159	431	82
unidentified duck species	1,576	2,188	1,780	788	1,450	674	646
white-winged scoter (*Melanitta fusca*)	40	243	279	150	25	0	4
Total	**17,659**	**35,655**	**49,102**	**40,086**	**40,710**	**25,294**	**16,698**

Appendix 7. Summary of the counts of bald eagle nesting surveys in the HZLC from 1994 to 2011.

Year	Active nests	Comments
1994	6	Source: Saxena et al (1995)
1995	4	Source: Schaffe and Wright (1997)
1996	4	Survey area expanded
1997	5	
1998	7	
1999	5	
2000	7	
2001	3	Wildfire burned through east portion of survey area 2 days prior to survey
2002	6	
2003	7	
2004	5	
2005	4	Wildfire burned through much of survey area 3 weeks prior to survey
2006	4	
2007	7	
2008	5	
2009	6	
2010	8	One new nest found on survey route
2011	6	Two new nests found on survey route
Mean	**5.5 ± 1.4**	

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