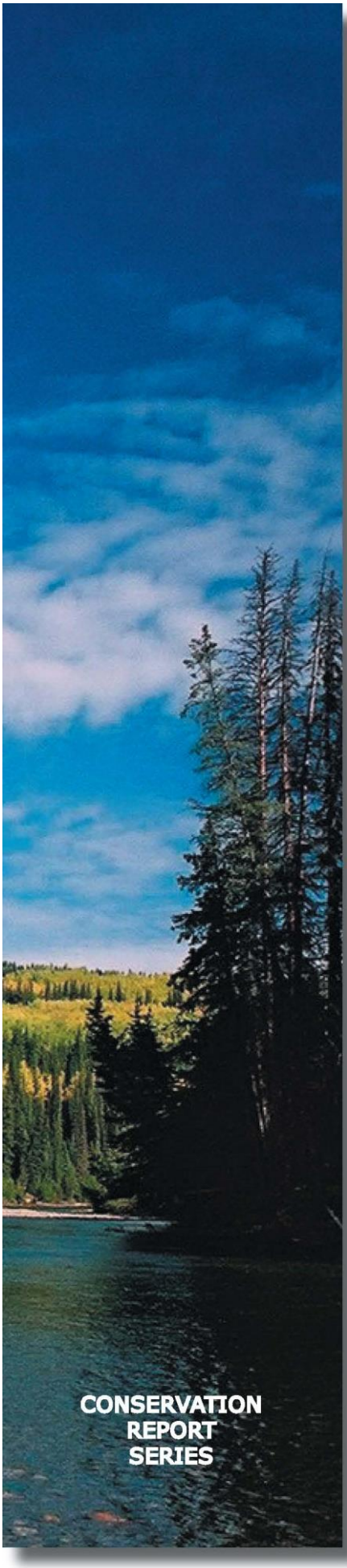

Hay-Zama Lakes Waterfowl Staging and Bald Eagle Nesting Monitoring Program, 2012

Alberta Conservation Association

Conserving Alberta's Wild Side

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Hay-Zama Lakes Waterfowl Staging and Bald Eagle Nesting Monitoring Program, 2012

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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 2012, aerial surveys were flown over the HZLC approximately seven days apart for five weeks in spring, and six weeks in fall. Spring surveys commenced the first week of May 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 5 June 2012.

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 11 surveys, but congregations were below the threshold limit at all sites. The largest congregation of waterfowl within 30 m of an active well was 89 ducks in spring and 310 ducks in fall. Therefore, extraction activities were not suspended in 2012.

Throughout the HZLC, Canada goose (*Branta canadensis*) was the most abundant goose species observed during spring migration in 2012. Mallard *(Anas platyrhynchos)*, and to a lesser extent, northern pintail *(A. acuta)*, were the most abundant of the identified duck species observed (5.4% of ducks were unidentified). The highest aggregate counts for both ducks and geese staging over the entire complex occurred during the first survey week in the spring (1 May), similar to long-term trends (1994 – 2011).

Canada goose was also the most abundant goose species observed during the fall migration in 2012. Mallard, and to a lesser extent, gadwall *(A. strepera)*, were the most abundant of the identified duck species observed (18.5% of ducks were unidentified). The highest aggregate count of geese staging over the entire complex occurred during the third survey week in the fall (20 September), similar to long-term trends. The highest aggregate count for ducks occurred during the fourth survey week (27 September), similar to long-term trends.

Six nesting pairs of bald eagles *(Haliaeetus leucocephalus)* were located during the one-day survey in 2012. This is equal to the six nests observed in 2011, and within the range observed during annual surveys since 1994 (three to eight nesting pairs). The number of eaglets observed in the active nests, ranged from one to three.

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).

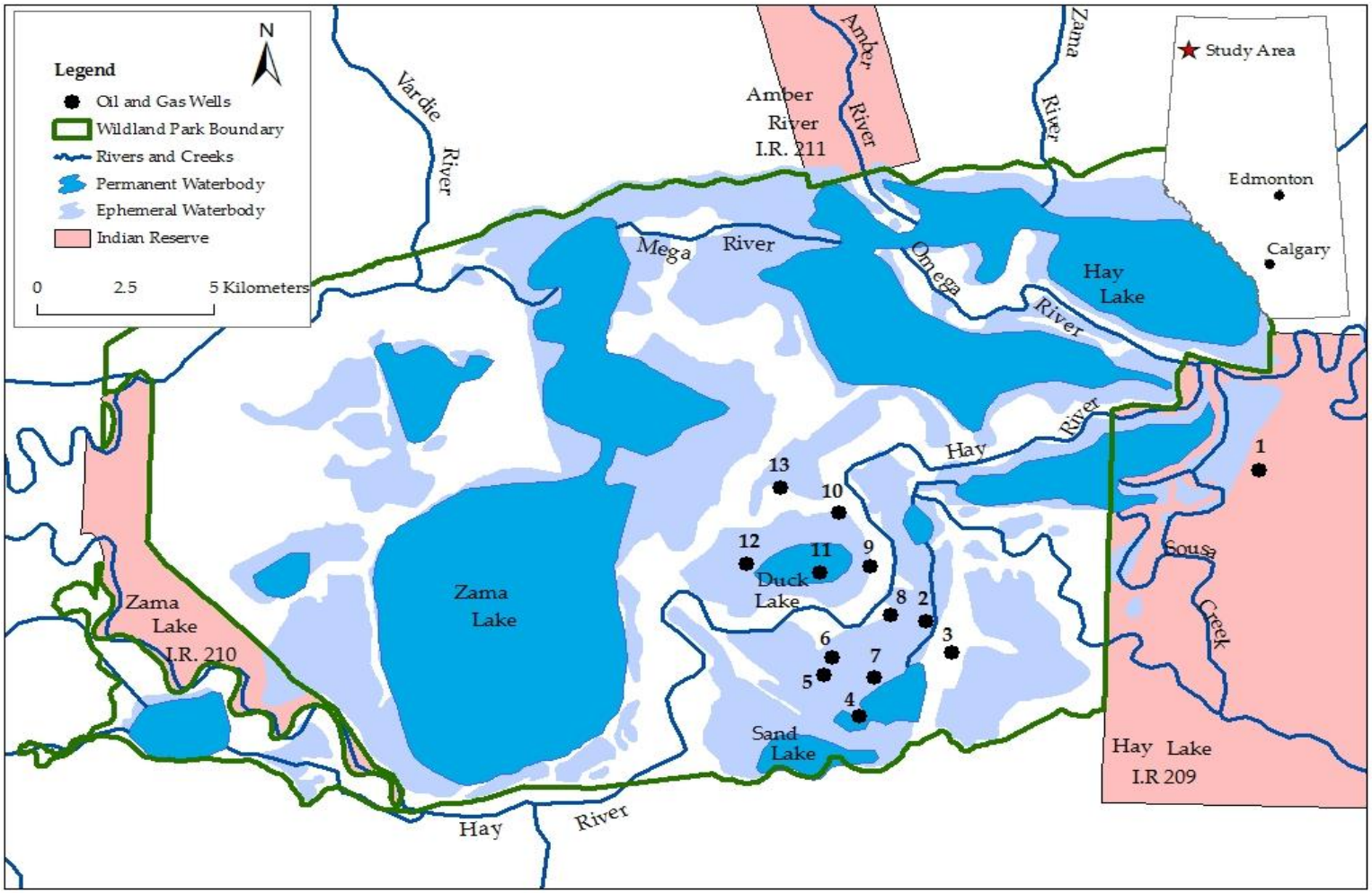

Figure 1. Location of Hay-Zama lakes survey area and oil and gas well sites monitored from 1 to 29 May, and from 6 September to 11 October, 2012.

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 2012. Spring surveys occurred from 1 to 29 May (five one-day surveys). Fall surveys occurred from 6 September to 11 October (six 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 was 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 11 days within a 64 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 of the surveys I was the lone observer in 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 2012).

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 5 June 2012, 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 2012). Flight time for this survey was 2.5 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 2012 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 89 ducks recorded at site #5 on 1 May (Table 1). The highest fall survey count was 310 ducks at site #4 on 13 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 (1 to 29 May 2012).

Site #	1 May	8 May	16 May	22 May	29 May
1	0	0	0	0	0
2	57	0	0	0	0
3	0	0	0	0	0
4	15	0	5	0	0
5	89	0	5	2	0
6	0	0	0	0	0
7	0	0	16	0	5
8	0	0	20	7	1
9	0	0	8	0	0
10	0	6	0	3	0
11	8	0	25	52	0
12	0	25	10	25	80
13	0	0	0	9	4

Table 2. Summary of the total waterfowl observed at each well site during fall migration (6 September to 11 October 2012).

Site #	6 Sep	13 Sep	20 Sep	27 Sep	4 Oct	11 Oct
1	0	0	0	0	0	0
2	31	0	0	0	0	0
3	0	0	0	0	0	0
4	180	310	160	280	130	0
5	0	18	6	10	0	0
6	0	0	0	0	0	0
7	0	11	0	0	0	0
8	0	0	0	0	0	0
9	0	30	30	0	0	0
10	0	0	0	0	0	0
11	215	190	135	35	60	0
12	142	47	42	205	9	0
13	0	0	0	0	0	0

4.2 Waterfowl staging numbers within the HZLC

In spring 2012, I observed the greatest aggregate counts for both geese and ducks (n = 11,832 geese, n = 23,980 ducks) during the 1st survey week (1 May) (Table 3), which is equivalent to the mode (most common) for both species, from 1994 to 2011 (Appendices 3 and 4). For geese, this one day count in 2012 is considerably higher than both the long term mean (n = 5,189 ± 3,070) and the 2011 greatest aggregate count (n = 7,446) (Appendix 3). For ducks, it is similar to the long term mean (n = 26,849 ± 13,338), but considerably higher than the 2011 greatest aggregate count (n = 17,021) (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 observed on 1, 8 and 16 May (Appendix 5). Swans were present on all spring survey dates in low to moderate numbers (range: 41 – 138) (Table 3). I was unable to determine whether they were trumpeter (*Cygnus*

buccinator) or tundra swans (*C. columbianus*), as the 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 2012.

Date	Ducks	Geese	Swans
1 May	23,980	11,832	138
8 May	9,491	5,142	123
16 May	3,792	201	84
22 May	7,933	63	46
29 May	3,671	18	41
Total	**48,867**	**17,256**	**432**

Overall during the spring surveys, 5.4% of ducks were unidentifiable. Of the 46,250 ducks I identified, mallard *(Anas platyrhynchos)* was the most abundant species, accounting for 34.4% of the total, followed by northern pintail *(A. acuta)* at 26.1%. American widgeon (*A. americana*) and green-wing teal (*A. crecca)* were moderately abundant as well, accounting for 11.2% and 6.4% of the total, respectively (Figure 2; Appendix 5).

The remaining 21.9% of duck species, in order of abundance, were canvasback *(Aythya valisineria),* gadwall *(Anas strepera),* lesser scaup *(Aythya affinis)*, blue-wing teal (*Anas discors),* northern shoveler *(A. clypeata),* redhead (*Aythya americana),* common goldeneye *(Bucephala clangula),* ring-necked ducks *(A. collaris*), ruddy duck *(Oxyura jamaicensis)*, bufflehead *(Bucephala albeola),* teal species (*Anas crecca* or *A. discors),* white-winged scoter (*Melanitta fusca*), and surf scoter (*M. perspicillata*) (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 sandhill cranes (*Grus canadensis*) (Appendix 5).

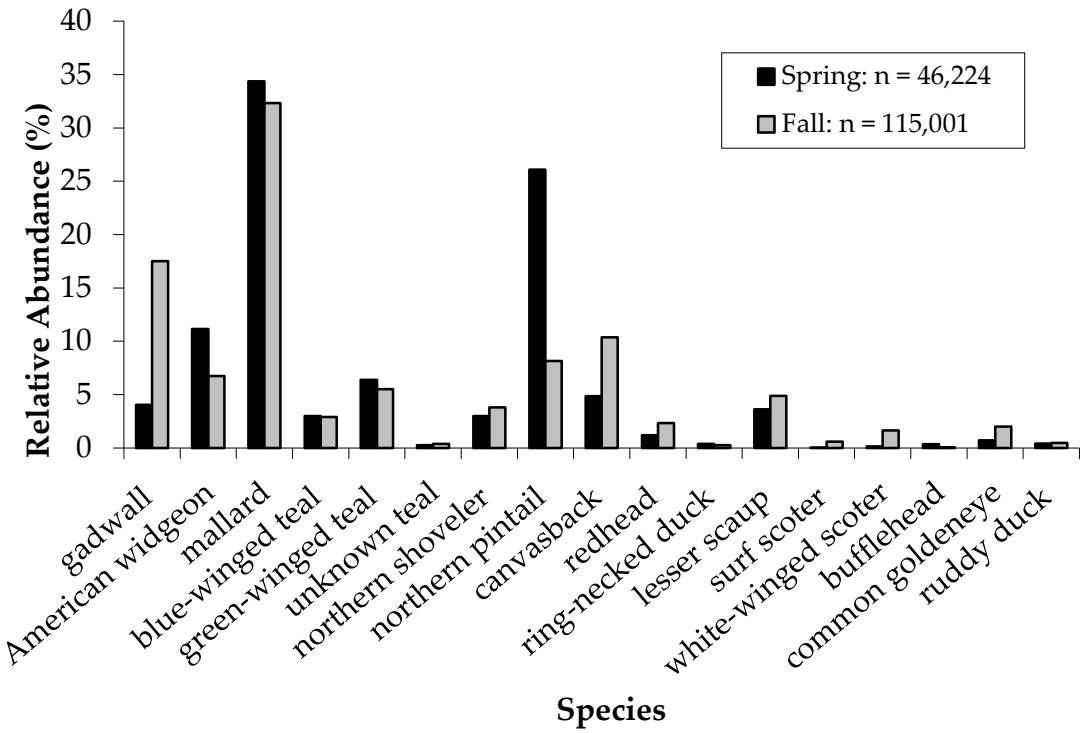

Figure 2. Relative abundance of identified duck species observed during the 2012 spring and fall migrations in the HZLC (5.4% during spring and 18.5% during fall were unidentified).

In fall 2012, Canada geese were the most abundant of the goose species I observed during monitoring. Lesser snow geese were present on the 1st, 3rd and 4th survey week and a small flock of 10 greater white-fronted geese was observed on the 2nd survey week (Appendix 6). The greatest aggregate count for geese (n = 11,429) was on week 3 (20 September) (Table 4), which is equivalent to the mode for 1994 to 2011, and one week earlier than the 2011 greatest aggregate count (Appendix 3). Numbers observed were considerably higher than both the long term mean (n = 3,960 ± 3,187) and the 2011 greatest aggregate count (n = 1,660) (Appendix 3).

For ducks, the greatest aggregate count (n = 44,003) was observed on week 4 (27 September) (Table 4), which is equivalent to the mode for 1994 to 2011, but one week later than the 2011 greatest aggregate count (Appendix 4). Numbers observed were consistent with the long term mean (n = 45,477 ± 15,213), and the previous year's observations (n = 46,037) (Appendix 4).

Table 4. Summary of the total number of waterfowl observed (identified and unidentified) during aerial surveys in HZLC in fall 2012.

Date	Ducks	Geese	Swans
6 Sep	13,035	3,823	8
13 Sep	32,425	3,114	91
20 Sep	39,828	11,429	227
27 Sep	44,003	8,131	999
4 Oct	11,411	6,111	2,483
11 Oct	1,487	4,599	662
Total	**142,189**	**37,207**	**4,470**

Overall during the fall survey, 18.5% of ducks were unidentifiable. Of the 115,840 ducks I identified, mallard was the predominant species recorded, accounting for 32.3% of the total, followed by gadwall at 17.5% (Figure 2, Appendix 6). Canvasback, northern pintail, American widgeon, and green-wing teal were observed in moderate numbers, accounting for 10.4%, 8.2%, 6.7%, and 5.5% of the total, respectively.

The remaining 19.4% of duck species observed, in order of abundance, were lesser scaup, northern shoveler, blue-wing teal, redhead, common goldeneye, white-winged scoter, surf scoter, ruddy duck, teal species, ring-necked duck, and bufflehead (Figure 2). Other waterfowl species of note include American coot, common merganser, eared grebe, western grebes *(Aechmophorus occidentalis)*, and red-necked 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 5 June 2012 survey, I observed twelve of the historical nests and in total counted six active bald eagle nests (Table 5), consistent with the six active nests observed in 2011, and within the long term range of three to eight. The active nests contained broods ranging from one to three eaglets, and had one or two adults present. Additionally, four adult bald eagles were observed which were not associated with a nest site.

Nest site #17 contained a brooding red-tailed hawk (*Strix nebulosa*) with two eggs visible (Table 5 and Figure 3). Seven nest sites present in past surveys were not observed during the 2012 survey; nest site #5 was burned in the 2001 wildfire, nest site #6 was last observed in 2001, nest site #2 was last observed in 2007, nest sites #8 and #12 were last observed in 2010, and nest sites #14 and #18 were last observed in 2011 (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 5 June 2012.

Site	Status	Number observed			Comments
		Adults	Eaglets	Eggs	
1	empty	0	0	0	Nest in good condition.
2	absent	0	0	0	Not found. Last seen in 2007.
3	rearing	1	2	0	Nest empty in 2011.
4	rearing	2	3	0	Mallard carcass in nest.
5	absent	0	0	0	Not found. Last seen in 2000.
6	absent	0	0	0	Not found. Last seen in 2001.
7	rearing	1	2	0	Nest not seen in 2011.
8	absent	0	0	0	Not found. Last seen in 2010.
9	rearing	1	1	0	Rearing in 2011.
10	empty	0	0	0	Adjacent tree fallen on nest.
11	empty	0	0	0	Nest in good condition.
12	absent	0	0	0	Not found. Last seen in 2010.
13	rearing	2	2	0	Shorebird carcass in nest.
14	absent	0	0	0	Not found. Last seen in 2011.
15	empty	0	0	0	Nest in good condition.
16	empty	0	0	0	2 adult BAEA observed 4 weeks prior.
17	other	0	0	0	RTHA with 2 eggs visible.
18	absent	0	0	0	Not found. Last seen in 2011.
19	rearing	2	3	0	Eaglets very small.
Total	**6 active nests**	**9**	**13**	**0**	

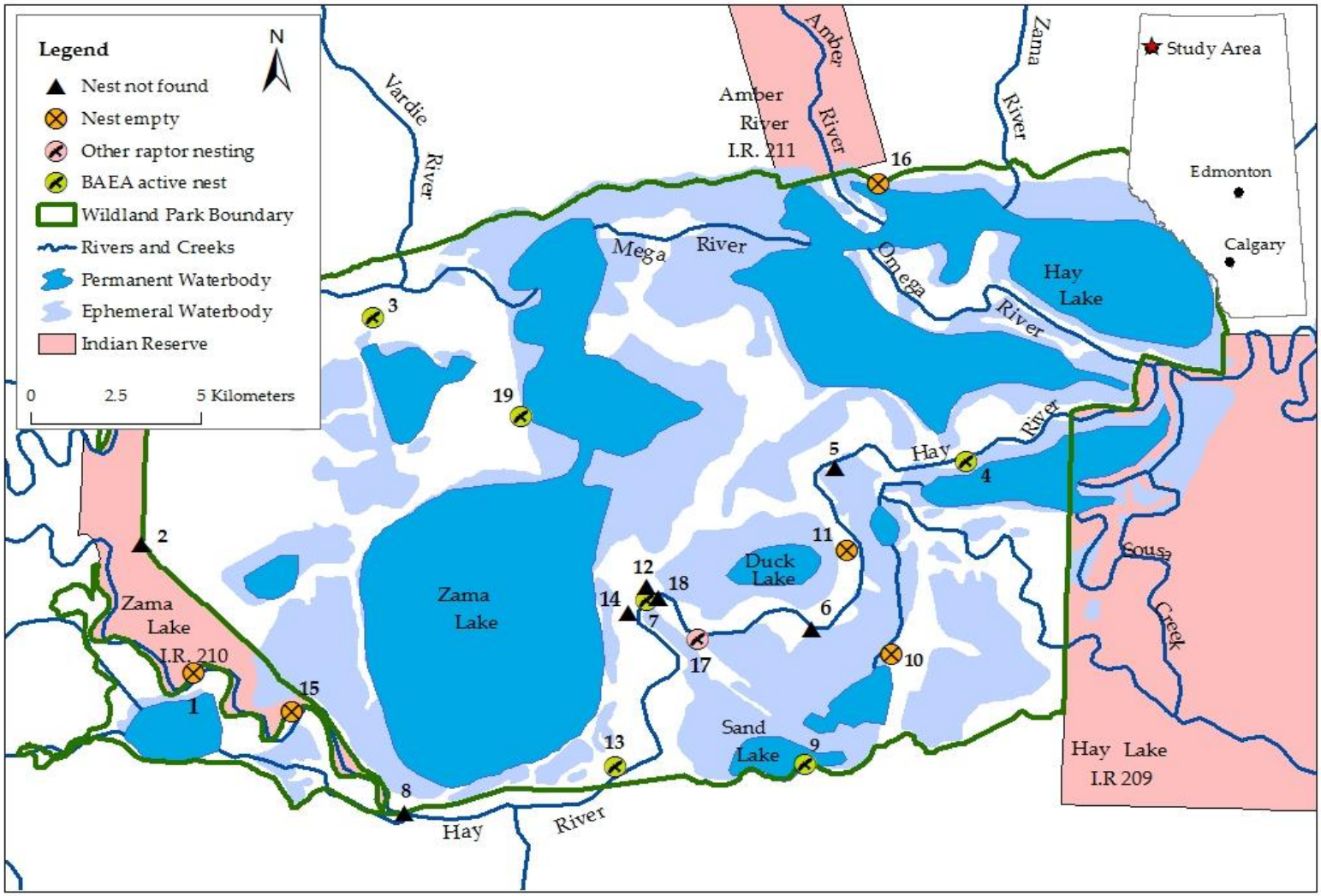

Figure 3. Location and status of bald eagle (BAEA) nest sites observed in an aerial survey in the HZLC, 5 June 2012.

4.4 Summary

The highest count of waterfowl observed at a single well site during the 11 one-day aerial surveys was 310 birds at Site #4, 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 2012.

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 5 June 2012 survey. This is consistent with the six active nests observed in 2011, and within the range of three to eight active nests recorded in 18 years of previous surveys in this area. The number of eaglets observed in the active nests ranged from one to three.

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6.0 APPENDICES

Appendix 1. Flight conditions during aerial surveys of the HZLC for spring and fall migration periods, 2012.

Date	Flight duration (h)	Temp. (°C)	Wind direction; speed (knots)	Cloud cover (%)	General conditions
Spring					
1 May	2.1	15	SE; 20 kts	60	HZLC mostly ice-covered
8 May	2.5	18	W; 20-30 kts	40	Wind gusting; water level rising
16 May	2.1	7	W; 10 kts	100	400m ceiling
22 May	2.4	12	E; 5 kts	100	750m ceiling; Omega R flowing E
29 May	2.3	22	SE; 15 kts	5	Small grass fire; water level receding
BAEA					
5 Jun	2.5	14	W; 7 kts	60-90	Cloud cover reduced during survey
Fall					
6 Sep	2.5	23	S, W; 5 kts	20	Water levels very low; shifting wind
13 Sep	2.3	14	S, W; 10 kts	100	2,000m ceiling
20 Sep	2.3	21	W; 20 kts	0	Hazy, smoke from fire 20km N
27 Sep	2.3	23	SW; 15-20 kts	100	1,500m ceiling; hazy; wind gusting
4 Oct	2.5	10	NW, S; 7 kts	0	Hazy; shifting wind
11 Oct	2.0	-6	NE; 5 kts	100	1,000m ceiling; ice forming

Appendix 2. Summary of observations of waterfowl and general habitat descriptions for each of the 13 well site locations monitored in the HZLC (1 – 29 May; 6 September – 11 October 2012).

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 2012 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 only present at this site in low numbers on the first spring survey (54 mallards, 2 blue-winged teal, 3 Canada geese) and the first fall survey (25 gadwall, 6 mallard).

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 2012 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 in very low numbers in spring (range: 5 to 10). The highest numbers of waterfowl observed at a well site during fall (n = 310) was at this site.

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 present at this site in low numbers (range: 2 to 89). The highest numbers of waterfowl observed at a well site during spring (n = 89) was at this site.

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 2012 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: 5 to 16).

Well location 8. Grid reference: 3-23-112-6-W6. This oil well is located in an ephemeral marsh. Waterfowl were present at this site in very low numbers in spring (range: 1 to 20) and absent in fall.

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 low numbers (range: 8 to 30).

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: 3 to 6) 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 present at this site in low numbers in spring (range: 8 to 52) and present in low to high numbers in fall (range: 35 to 215).

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. Waterfowl were present at this site in low numbers in spring (range: 10 to 80) and present in low to high numbers in fall (range: 9 to 205).

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 present at this site in very low numbers in spring (range: 4 to 9) and absent in fall.

Appendix 3. Summary of the survey week of highest aggregate count of geese observed from 1994 to 2012 during spring and fall migration in the HZLC. Modal (most common) week and mean counts (± standard deviation) for 1994 to 2011 are compared with 2012.

	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
2011	week 2	7,446	week 4	1,660
1994 – 2011	Mode = week 1	Mean = 5,189 ± 3,070	Mode = week 3	Mean = 3,960 ± 3,187
2012	week 1	11,832	week 3	11,429

Appendix 4. Summary of the survey week of highest aggregate count of ducks observed from 1994 to 2012 during spring and fall migration in the HZLC. Modal (most common) week and mean counts (± standard deviation) for 1994 to 2011 are compared with 2012.

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
2010	week 2	17,021	week 3	46,037
1994 – 2011	Mode = week 1	Mean = 26,849 ± 13,338	Mode = week 4	Mean = 45,477 ± 15,213
2012	week 1	23,980	week 4	44,003

Appendix 5. Summary of the counts of waterfowl species during the 2012 spring migration in the HZLC.

	1 May	8 May	16 May	22 May	29 May
Canada goose (*Branta canadensis*)	11,393	4,875	49	63	18
greater white-fronted goose *(Anser albifrons)*	400	80	116	0	0
snow goose (*Chen caerulescens*)	39	187	36	0	0
swans (*Cygnus columbianus, C. buccinator*)	138	123	84	46	41
American coot (*Fulica americana*)	404	61	399	403	157
American widgeon (*Anas americana*)	3,535	855	244	460	63
blue-winged teal *(Anas discors)*	395	297	55	450	182
bufflehead (*Bucephala albeola*)	51	11	34	36	35
canvasback (*Aythya valisineria*)	1,118	469	187	403	69
common goldeneye (*Bucephala clangula*)	85	37	69	74	65
common merganser (*Mergus merganser*)	0	12	2	5	7
unidentified dabbler species	492	930	112	23	2
unidentified diver species	3	29	4	17	1
gadwall (*Anas strepera*)	230	1,025	17	385	214
eared grebes (*Podiceps nigricollis*)	0	0	3	25	10
red-necked grebes (*Podiceps grisegena*)	0	0	0	0	3
western grebes (*Aechmophorus occidentalis*)	0	0	0	0	0
green-winged teal (*Anas crecca)*	1,981	791	10	136	31
lesser scaup (*Aythya affinis*)	492	213	665	196	109
mallard (*Anas platyrhynchos*)	5,479	2,686	1,313	3,841	2,572
northern pintail *(Anas acuta)*	9,061	1,608	278	1,052	56
northern shoveler *(Anas clypeata)*	511	193	173	449	52
redhead (*Aythya americana*)	168	55	103	127	100
ring-necked duck *(Aythya collaris)*	41	8	86	22	23
ruddy duck (*Oxyura jamaicensis*)	0	14	83	85	13
surf scoter (*Melanitta perspicillata*)	0	0	0	1	4
unidentified teal species (*Anas* spp.)	67	3	49	1	1
unidentified duck species	271	246	269	149	69
white-winged scoter (*Melanitta fusca*)	0	9	39	21	3
Total	**36,354**	**14,817**	**4,479**	**8,470**	**3,900**

Appendix 6. Summary of the counts of waterfowl species during the 2012 fall migration in the HZLC.

	6 Sep	13 Sep	20 Sep	27 Sep	4 Oct	11 Oct
Canada goose (*Branta canadensis*)	3,822	3,104	11,423	7,687	6,111	4,599
greater white-fronted goose *(Anser albifrons)*	0	10	0	0	0	0
snow goose (*Chen caerulescens*)	1	0	6	444	0	0
swans (*Cygnus columbianus, C. buccinator*)	8	91	227	999	2,483	662
American coot (*Fulica americana*)	527	3,424	2,176	3,537	203	750
American widgeon (*Anas americana*)	655	1,474	2,797	2,759	60	0
blue-winged teal *(Anas discors)*	794	522	971	707	352	0
bufflehead (*Bucephala albeola*)	8	5	16	46	1	0
canvasback (*Aythya valisineria*)	1,145	4,481	3,260	1,238	1,780	29
common goldeneye (*Bucephala clangula*)	105	1,307	567	262	59	0
common merganser (*Mergus merganser*)	38	80	476	189	55	0
unidentified dabbler species	513	1,518	180	159	270	4
unidentified diver species	27	63	165	110	29	0
gadwall (*Anas strepera*)	2,516	2,624	7,439	5,855	1,700	0
eared grebes (*Podiceps nigricollis*)	57	25	235	35	15	0
red-necked grebes (*Podiceps grisegena*)	0	17	3	0	0	0
western grebes (*Aechmophorus occidentalis*)	6	19	18	0	0	0
green-winged teal (*Anas crecca)*	628	1,897	2,019	1,797	3	8
lesser scaup (*Aythya affinis*)	222	1,085	3,609	3,397	131	61
mallard (*Anas platyrhynchos*)	2,141	6,465	9,347	14,453	3,871	895
northern pintail *(Anas acuta)*	790	3,437	2,304	2,559	292	0
northern shoveler *(Anas clypeata)*	279	399	1,212	2,392	100	0
redhead (*Aythya americana*)	548	822	824	407	91	0
ring-necked duck *(Aythya collaris)*	80	73	40	105	3	0
ruddy duck (*Oxyura jamaicensis*)	97	227	167	25	37	0
surf scoter (*Melanitta perspicillata*)	0	180	409	110	0	0
unidentified teal species (*Anas* spp.)	0	105	5	90	230	0
unidentified duck species	2,345	4,513	6,607	7,065	2,291	490
white-winged scoter (*Melanitta fusca*)	104	1,148	320	277	56	0
Total	**17,456**	**39,115**	**56,822**	**56,704**	**20,223**	**7,498**

Appendix 7. Summary of the counts of bald eagle nesting surveys in the HZLC from 1994 to 2012.

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
2012	6	
Mean	**5.5 ± 1.3**	

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