Hay-Zama Lakes Waterfowl Staging and Bald Eagle Nesting Monitoring Program, 2004

Alberta Conservation Association

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EXECUTIVE SUMMARY

The Hay-Zama lakes complex (HZLC), located in the mid-boreal mixed-wood ecoregion of the province of Alberta, Canada, is an internationally recognized critical staging and nesting area for waterfowl and shorebirds. However, numerous active oil and gas wells are located within the HZLC. To assess the impacts of these industrial activities on aquatic ecosystems in the complex, the Hay-Zama Lakes Monitoring Program (HZLMP), focusing on waterfowl monitoring, was initiated in 1978. The HZLMP, directed by the Hay-Zama Committee (HZC), is a cooperative venture among a variety of stakeholders including, representatives of the oil and gas industry, government agencies, First nations, and conservation groups. As a member of the HZC, the Alberta Conservation Association (ACA) contributes advice on conservation issues and delivers the waterfowl monitoring program. In addition to monitoring waterfowl populations, the HZLMP monitors bald eagle nesting sites to quantify i) breeding success and ii) changes in population size through time.

Canada geese (*Branta canadensis*) and northern pintails *(Anas acuta)* were the most abundant waterfowl species during the spring of 2004. Other common geese include the greater white-fronts (*Anser albifrons)* and lesser snow geese (*Chen caerulescens*) while ducks include mallards *(A. platyrhynchos),* blue-wing teals (*A. discors),* and American widgeons (*A. americana*). The 2004 spring migration of both geese and ducks peaked during the first week of May, consistent with long-term trends (1978 – 2003 for geese and 1994 – 2003 for ducks).

Canada geese and to a lesser extent, swans, were the most common goose species during the fall of 2004. Other goose species observed were greater white-fronts and lesser snow geese. Gadwall *(Anas strepera)* and to a lesser extent, mallards, were the predominant duck species during the fall. Other common duck species include green-wing teal (*A. crecca),* canvasback *(Aythya. valisineria),* blue-wing teal, and the American widgeon. Fall goose migration in 2004 peaked on 6 September, roughly one week earlier than the long-term (1978 – 2003) average date while duck migration peaked on 14 September, consistent with the long-term (1994 -2003) average peak date.

Results from the 2004 surveys of bald eagles indicate 5 active nesting pairs. This observation is within the range of 3 to 7 nesting pairs recorded in past surveys. Number of eaglets in the active nests ranged from 2 to 3.

During our 2004 study period, migrating waterfowl populations were observed on only 11 of the 26 well sites in the study area and densities of waterfowl did not exceed the Alberta Sustainable Resource Development threshold limit of 600 birds on any occasion. The highest numbers recorded at a well site were 571 ducks and geese combined during spring migration, and 370 ducks during fall migration. Consequently, no wells were shut down due to waterfowl presence.

Key words: Hay-Zama Lakes, wetlands, waterfowl, bald eagle, nesting, oil and gas, industrial development.

ACKNOWLEDGEMENTS

I am grateful to the following individuals, agencies, and corporations for their contributions and assistance in delivering this project. The Hay-Zama Committee oversaw all activities on the project and fostered a collaborative and cooperative approach to working with all stakeholders. Funding was provided by the committee's industry members: Nav Energy Trust, Crispin Energy Inc., Devlan Energy Inc., and Atlas Energy Inc. Technical support for aerial surveys was provided by Babtiste Metchooyeah (Dena Tha First Nation), Pat Cabezas (Cabezas Resources Inc.) and John Hallett and Mike Rosendal (Alberta Conservation Association). Peter Aku, Garry Scrimgeour, and John Hallett (Alberta Conservation Association) reviewed this report and provided valuable insights and editorial suggestions.

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1.0 INTRODUCTION

1.1 General introduction

The Hay-Zama Lakes complex (HZLC), located in the mid-boreal mixed-wood ecoregion of the province of Alberta, Canada (Strong and Leggat 1992), is an internationally recognized critical staging and nesting area for waterfowl and shorebirds. The complex was designated as a "Wetland of International Importance, especially as Waterfowl Habitat" by the Ramsar Convention in 1981, and in 1990 it was nominated by the World Heritage Convention as a World Heritage Site. In 1999 it was designated as a Wildland Provincial Park by the Province of Alberta. In addition to abundant migrating waterfowl, several other wildlife species occur in the Hay-Zama complex (Saxena et. al 1995).

Numerous active oil and gas wells are located within the HZLC. Oil and gas exploration has occurred on the complex since 1965 and currently, there are 26 active oil and gas wells within the complex boundaries. Stakeholders felt that this activity would have a negative affect on wildlife, particularly waterfowl, in the area through increased risk of exposure to spills of crude oil or diesel used to power pump jacks and harassment from daily helicopter access to wells by maintenance crews. To assess the impacts of these oil and gas exploration activities on aquatic ecosystems in the complex, the Hay-Zama Lakes Monitoring Program (HZLMP), focusing on waterfowl monitoring, was initiated in 1978 by the Hay-Zama Committee (HZC).

The HZC, consisting of representatives from the oil and gas industry, Dene Tha' First Nation, municipal, provincial and federal government agencies, and environmental and conservation organizations, directs industrial activities within the HZLC. Since 1995, the HZC has also directed the HZLMP. Although waterfowl monitoring on the complex began in 1978 methods and efforts have varied among years. To standardize the monitoring efforts, the HZC asked the Government of Alberta - Fish and Wildlife Division (AFWD) in 1995 to supervise the waterfowl monitoring program. When the Alberta Conservation Association (ACA) was formed in 1997, AFWD in turn delegated monitoring responsibilities to the ACA.

1.2 Study rationale

In 1995 the Alberta Energy and Utilities Board (AEUB), in consultation with the HZC, revised guidelines for oil and gas operations within the Hay-Zama Lakes complex during which boundaries were defined around the wetland complex to include the most environmentally sensitive areas to industrial activity (AEUB 1996). Monitoring of selected wildlife species within the new boundaries was developed to comply with the following clause in the AEUB guidelines pertaining to general drilling and production requirements:

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[1] 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[2] and for what period of time.
2. All wells, batteries, compressor stations, satellites, and pipeline routes shall be patrolled within 24 hours.

1.3 Study objectives

The objectives of the present study were to:

i) determine whether congregations of duck and geese exceeded previously determined threshold densities that should necessitate a change in management practices.
ii) quantify number of nesting bald eagles and estimate brood production.

[1]Alberta Environmental Protection, presently Alberta Sustainable Resource Division (ASRD).
[2]Alberta Fish and Wildlife defined the criterion for suspension of production in 1992 as 600 ducks and / or geese within a 30-m radius of an active well site.

2.0 STUDY 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 complex's major fluvial system, Hay River, meanders through the complex, 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 northwest, as well as several unnamed creeks (Figure 1). Major lacustrine cells include Hay, Zama, Duck, and Sand lakes. Numerous unnamed shallow water bodies (commonly known as sloughs) make up the remainder of the complex's wetted 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.

Hay Lake, Amber River, and Zama Lake Indian Reserves all border the wetland complex. 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.

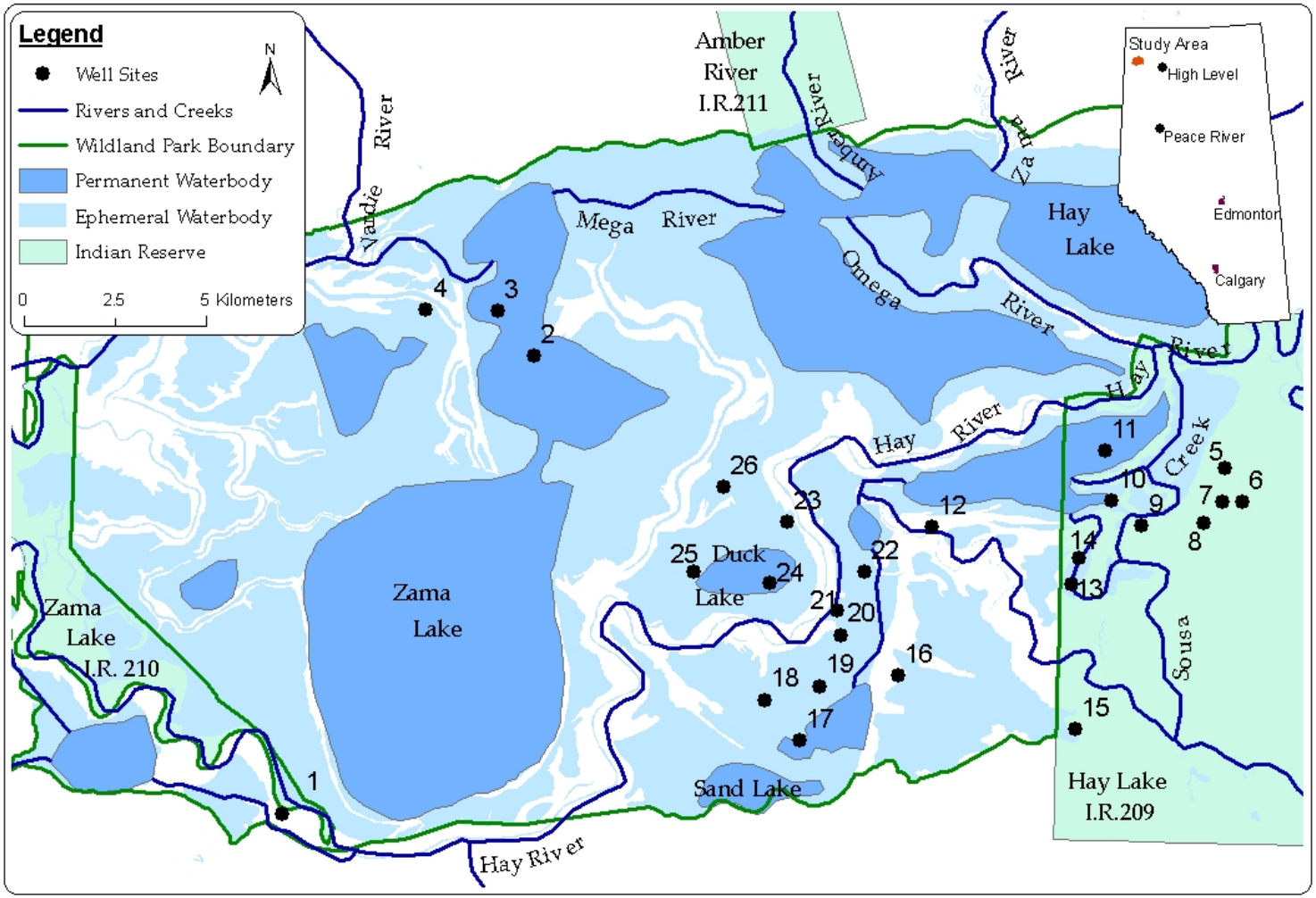

Figure 1. Location of Hay-Zama Lakes study area and oil and gas well sites monitored during spring and fall migration periods in 2004.

2.2 Ecoregion, forest cover, and soils

The HZLC occurs in the mid boreal mixed-wood ecoregion (Strong and Leggat 1992). The climate is characterized by relatively low annual precipitation, cool summers and long, cold winters (Strong and Leggat 1992).

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

Soils in the study 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 level in the HZLC is an important attribute of the region and profoundly influences the structure and functioning of plant communities. 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.

In addition to abundant migrating waterfowl, several other wildlife species occur in the complex (Wright 1998). These include raptors, gulls, terns, and numerous songbirds. Ungulates include wood bison (*Bison bison athabascae*), which are considered to be the only free-ranging disease-free herd in Alberta, moose (*Alces alces*) and white-tailed deer (*Odocoileus virginianus*). 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 (*Stizostedion vitreum*), 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

Waterfowl (ducks and geese) numbers at all active oil and gas well sites within the wetland complex were monitored at weekly intervals during the 2004 spring and fall migration periods for a total of 11 surveys. Four spring surveys were completed from 3 May to 25 May and seven fall surveys from 30 August to 12 October. Aerial surveys were flown in a Bell 206 or R-44 rotary wing aircraft at an altitude of approximately 30 m with ground speeds of 60 to 100 km/h. Our survey routes were similar to those of previous surveys (Saxena et al. 1995, Schaffe and Wright 1997) and included all active wells in addition to general coverage of the complex to monitor migration periods (Figure 1). Flight speed was reduced at well sites to minimize disturbance of waterfowl and to facilitate accurate counts. Waterfowl counts at the well sites encompassed a radius of 30 m around the well. If the threshold level of 600 ducks or geese within the 30-m radius is exceeded in an area, the High Level office of AEUB office will be notified to determine whether well suspension procedures should be initiated. Suspended

wells will be patrolled within 24 h and production resumed as soon as waterfowl numbers fall below threshold levels. For monitoring of migration periods all waterfowl observed within 200 m of the survey route were recorded and where practical, identified to species.

We compared peak counts from our studies with those of historical records. Peak goose migration data from 1978 to 1993 were reported by Calverley et al. (1993) and from 1994 to 2003 by Saxena et al.(1995), Schaffe and Wright (1997) and Wright (2004). The duck surveys have been conducted using similar methods as during our study since 1994. Although goose survey methods varied among years, comparisons of our data with the historical data should provide some insight into general trends in migration patterns.

3.2 Bald eagle nesting survey

Nesting sites of bald eagles (*Haliaeetus leucocephalus)* on the complex were monitored in a single aerial survey on 17 June 2004. The survey date was scheduled approximately three weeks later than the 26 May survey of 2003 to ensure adult eagles were no longer brooding eggs and young in the nests could be counted. The survey route covered areas of the complex with large mature trees suitable for nesting, and included all nesting sites identified in previous surveys (see Saxena et al. 1995, Schaffe and Wright 1997, Wright 2003). Locations of nests were geo-referenced using a Global Positioning (GPS) system. Number of adults, young, or eggs were recorded and nest status was reported using the following categories

1. Brooding, if eggs or brooding adults were observed.
2. Rearing, if young were observed in the nest.
3. Empty, if no evidence of nesting was observed.

4.0 RESULTS

4.1 Waterfowl monitoring

4.1.1 Well site monitoring

During the 2004 migration periods, waterfowl numbers remained below threshold densities at all well sites in the study area. Waterfowl were observed on only 11 of the 26 well sites in the study area. The highest numbers recorded at a well site were 571 ducks and geese combined during spring migration, and 370 ducks during fall migration. Water level in the Hay River was low throughout the spring migration period that resulted in many of the ephemeral sloughs and sheetwater areas remaining dry throughout the entire study period.

Brief summaries of observations of waterfowl and general habitat descriptions for each of the 26 well sites monitored in this study are provided below. Appendix 1 lists the actual number of waterfowl, shorebirds, and other avifauna (e.g., gulls, coots, raptors) observed and recorded at the well sites.

Well location 1. Grid reference = 2-6-112-7-W6. This gas well is operated by Devlan Exploration Inc. and is located near the south bank of the Hay River, in an ephemeral sheetwater area (Figure 1). Waterfowl were not observed at this site.

Well location 2. Grid reference = 15-11-113-7-W6. This oil well is operated by Nav Energy Trust and is situated in the permanent basin of North Zama Lake. Waterfowl were present at this site in relatively low numbers during both spring (range = 32 –132) and fall (range = 10 – 150).

Well location 3. Grid reference = 9-15-113-7-W6. This oil well is operated by Nav Energy Trust and is situated in a marsh area dominated by emergent vegetation to the north of North Zama Lake. Waterfowl were present at this site in low to moderate numbers (range = 66 – 210) during the spring and absent during the fall.

Well location 4. Grid reference = 10-16-113-7-W6. This oil well is operated by Nav Energy Trust and is located in an isolated ephemeral sheetwater area in the northwest part of the wetland complex. Waterfowl were not observed at this site.

Well location 5. Grid reference = 5-2-113-5-W6. This oil well is operated by Nav Energy Trust and is located within the Hay Lake Indian Reserve (I.R. 209) in a willow thicket adjacent to an ephemeral sheetwater area. Waterfowl were not observed at this site.

Well location 6. Grid reference = 15-35-112-5-W6. This gas well operated by Nav Energy Trust, is located within the Hay Lake Indian Reserve (I.R. 209), in an ephemeral sheetwater area. Waterfowl were not observed at this site.

Well location 7. Grid reference = 13-35-112-5-W6. This oil well is operated by Nav Energy Trust and is located within the Hay Lake Indian Reserve (I.R. 209) in an ephemeral sheetwater area. Waterfowl were not observed at this site.

Well location 8. Grid reference = 8-34-112-5-W6. This oil well is operated by Nav Energy Trust and is located within the Hay Lake Indian Reserve (I.R. 209) in an ephemeral sheetwater area. Waterfowl were not observed at this site.

Well location 9. Grid reference = 8-33-112-5-W6 This oil well is operated by Crispin Energy Inc. and is located within the Hay Lake Indian Reserve (I.R. 209) in a willow thicket adjacent to an ephemeral sheetwater area. Waterfowl were not observed at this site.

Well location 10. Grid reference = 15-33-112-5-W6 This oil well is operated by Atlas Energy Ltd. and is located in an ephemeral marsh that typically dries up by the end of the spring monitoring period. A causeway connects the well site to the upland south of the complex providing year-round access. No waterfowl was observed at this site.

Well location 11. Grid reference = 12-4-113-5-W6 This oil well is operated by Crispin Energy Inc. and is located in an ephemeral marsh that typically dries up by the end of the spring monitoring period. Waterfowl were present at this site in low to high numbers (range = 18 - 571) during the spring surveys; the highest number of waterfowl

observed during the spring surveys was 300 ducks and 271 Canada geese (*Branta canadensis*) at this site on 3 May 2004. Waterfowl were absent at this site during the fall monitoring period.

Well location 12. Grid reference = 3-36-112-6-W6 Oil well operated by Crispin Energy Inc. and is located in a willow thicket adjacent to an ephemeral watercourse. Waterfowl were not observed at this site.

Well location 13. Grid reference = 7-29-112-5-W6 This gas well is operated by Nav Energy Trust and is located within the Hay Lake Indian Reserve (I.R. 209) in an ephemeral marsh in the southeast part of the wetland complex. No waterfowl was observed at this site.

Well location 14. Grid reference = 12-28-112-5-W6 This gas well is operated by Nav Energy Trust and is located within the Hay Lake Indian Reserve (I.R. 209) in an ephemeral marsh in the southeast part of the wetland complex. No waterfowl was observed at this site.

Well location 15. Grid reference = 7-8-112-5-W6 This gas well is operated by Nav Energy Trust and is located within the Hay Lake Indian Reserve (I.R. 209) in an ephemeral marsh in the southeast part of the wetland complex. No waterfowl was observed at this site.

Well location 16. Grid reference = 9-14-112-6-W6 This gas well is operated by Nav Energy Trust and is located in an isolated ephemeral sheetwater area in the southeast part of the wetland complex. No waterfowl was observed at this site during the spring; 21 Canada geese were recorded during the fall survey (30 August).

Well location 17. Grid reference = 12-10-112-6-W6 This gas well is operated by Nav Energy Trust and 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 = 45 - 200) during the spring and in low to high numbers during the fall (range = 45 - 370); the highest number of waterfowl (n = 370) observed during the fall surveys occurred at this site on 12 October.

Well location 18. Grid reference = 2-16-112-6-W6 This gas well is operated by Nav Energy Trust and is situated in a permanent marsh north of Sand Lake. Waterfowl were present at this site in low numbers (range = 7 - 82) for the spring monitoring period and in low to moderate numbers for the fall monitoring period (range = 8 – 280).

Well location 19. Grid reference = 6-15-112-6-W6 This oil well is operated by Nav Energy Trust. One observation of 30 ducks was recorded during the spring monitoring period (10 May). No waterfowl was observed at this site during the fall monitoring period.

Well location 20. Grid reference = 8-22-112-6-W6 This oil well is operated by Nav Energy Trust and is located in an ephemeral marsh. No waterfowl was observed at this site.

Well location 21. Grid reference = 16-22-112-6-W6 This gas well is operated by Nav Energy Trust and is located in an ephemeral marsh. There were no waterfowl observed at this site during the spring monitoring period. One observation of 25 ducks was recorded during the fall monitoring period (6 September).

Well location 22. Grid reference = 5-26-112-6-W6 This gas well is operated by Nav Energy Trust and is located in an ephemeral marsh. No waterfowl was observed at this site.

Well location 23. Grid reference = 8-33-112-6-W6 This oil well cluster (3 wells) is operated by Nav Energy Trust and is located in an ephemeral sheetwater area between the Hay River and Duck Lake. No waterfowl was observed at this site.

Well location 24. Grid reference = 2-28-112-6-W6 This oil well cluster (4 wells) is operated by Nav Energy Trust and is situated in the permanent lake basin of Duck Lake. Waterfowl were present at this site in low numbers for both spring and fall monitoring periods. Numbers observed ranged from 12 to 55 ducks.

Well location 25. Grid reference = 7-29-112-6-W6 This oil well cluster (2 wells) is operated by Nav Energy Trust and is situated in the permanent lake basin of Duck Lake. Waterfowl were present at this site in relatively low numbers for both spring and fall monitoring periods. Numbers observed ranged from 3 to 100 ducks.

Well location 26. Grid reference = 16-32-112-6-W6 This gas well is operated by Nav Energy Trust and is located in an ephemeral marsh between Duck Lake and West Hay Lake. Water in this area typically draws down rapidly after peak spring water level. One pair of mallards was observed at this site on 10 May and 25 May. On all other survey days, no waterfowl were observed.

4.1.2 General waterfowl migration

Waterfowl numbers reported in this document represent observations on the survey route. These migration data are presented as a comparison to migration numbers observed in past surveys (see Appendix 2) and are not intended to represent a population estimate.

In 2004, spring goose migration peaked on 3 May with 10,655 Canada geese (CAGO), 730 Greater white-fronts *(Anser albifrons;* GWFG), and 425 Lesser snow geese (*Chen caerulescens;* LSGO) (Table 1). Timing of the 2004 goose migration peak (3 May) was consistent with the long-term (1978 - 2003) average date of 4 May but with considerably higher numbers (Appendix 2). The peak of the spring duck migration (43,111 birds) coincided with peak goose migration on 3 May (Table 1). Similar to geese, the 2004 peak duck migration date of 3 May was close to the long-term (1994 - 2003) average date of 7 May (Appendix 2), but numbers observed in 2004 (i.e., 43,111) were considerably higher than the 10-year average of 28,407.

Table 1. Summary of number of ducks and geese observed in the Hay-Zama study area in spring 2004. Geese: CAGO - Canada goose, GWFG - Greater white-fronted goose, LSGO - Lesser snow goose.

Date	Ducks	CAGO	GWFG	LSGO	Swans
3 May	43,111	10,655	730	425	25
10 May	27,028	8,905	705	478	13
17 May	6,689	80	0	2	9
25 May	12,104	15	0	0	9
Total	88,932	19,655	1435	905	56

Canada geese were the most common goose species observed during spring monitoring (Table 1). Greater white-fronts and LSGO were present for the earlier survey dates, but fewer in number. Swans were present on all spring survey dates, however, it was unknown whether they were trumpeters (*Cygnus buccinator*) or tundras (*C. columbianus*); similarities of these two species make accurate identification from the air difficult without undue harassment of the birds.

During the spring surveys, on average 47% of ducks were unidentifiable. Of the 45,240 identified ducks, northern pintails *(Anas acuta)* were the most abundant species, accounting for 32% of the total (Figure 2, Appendix 3). Mallards *(A. platyrhynchos),* blue-wing teals (*A. discors),* and American widgeons (*A. americana*) were abundant as well, accounting for 14%, 11%, and 9%, of the total, respectively while northern shovelers *(A. clypeata)* and canvasbacks *(Aythya valisineria)* each accounted for 8% of the total. The remaining 18% of duck species, in order of abundance, were, green-wing teals (*Anas crecca),* ruddy ducks *(Oxyura jamaicensis)*, scaups *(Aythya marila or A. affinis),* gadwalls *(Anas strepera),* common goldeneyes *(Bucephala clangula),* redheads (*Aythya americana)*, buffleheads *(Bucephala albeola),* cinnamon teals (*Anas cyanoptera),* ring-necked ducks *(Aytheya collaris*), and white-winged scoters (*Melanitta fusca*) (Figure 2). Other waterfowl species of note include common merganser *(Mergus merganser)* and grebes *(Aechmophorus occidentalis, Podiceps grisegena).*

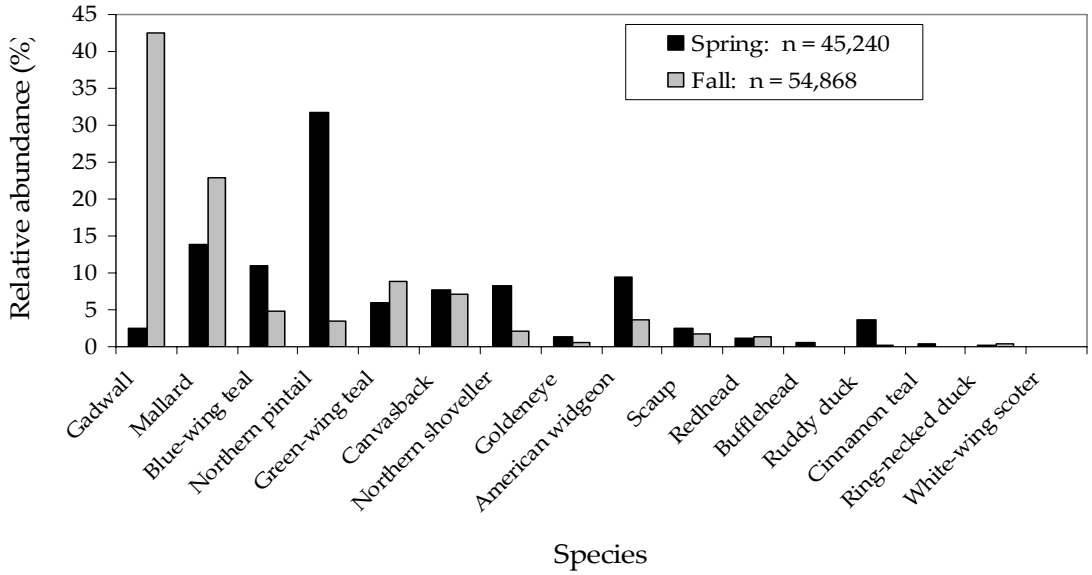

Figure 2. Relative abundance of duck species observed during the 2004 spring and fall migrations in the Hay-Zama study area in Alberta.

Fall goose migration in 2004 peaked on 6 September with 2,552 CAGO and 6 GWFG (Table 2), roughly one week earlier than the long-term average date of 17 September and with considerably fewer birds than the long-term mean of 7,463 (Appendix 2). Fall duck migration peaked on 14 September with 32,016 birds. This date was consistent with the long-term average peak date of 17 September, but numbers observed were considerably lower in 2004 than the 10-year average of 48,028 (Appendix 2).

Canada geese were the most common goose species observed during the fall (Table 2). Very few GWFG and LSGO were observed; GWFG were present for the two earliest survey dates and LSGO were present mid-way through the fall monitoring period. Swans were present throughout fall monitoring, with greatest numbers observed in the latter survey dates, typical of past observations.

Table 2. Summary of number of ducks and geese observed in the Hay-Zama study area in fall 2004. Geese: CAGO - Canada goose, GWFG - Greater white-fronted goose, LSGO - Lesser snow goose.

Date	DUCKS	CAGO	GWFG	LSGO	Swans
30 Aug	13,183	448	15	0	7
6 Sep	17,581	2,552	6	0	19
14 Sep	32,016	193	0	0	34
20 Sep	13,745	40	0	50	10
27 Sep	15,162	106	0	36	73
4 Oct	15,476	1	0	0	192
12 Oct	11,316	0	0	0	182
Total	118,479	3,340	21	86	517

During the fall survey, on average, 53% of ducks were unidentifiable. Of the 54,868 identified ducks, gadwall *(Anas strepera)* was the predominant species, accounting for 42% of the total, followed by mallard *(A. platyrhynchos)* at 22% (Figure 2). Green-wing teal (*A. crecca),* canvasback *(Aythya. valisineria),* blue-wing teal (*Anas discors),* American widgeon (*A. americana*), and northern pintails *(A. acuta)* were observed in moderate numbers, accounting for 9%, 7%, 5%, 4% and 3% of the total, respectively. The remaining 8% of duck species observed in order of abundance were northern shoveler *(A. clypeata),* scaup *(Aythya marila or A. affinis),* redhead (*A. americana),* common goldeneye *(Bucephala clangula),* ring-necked duck *(Aythya collaris*), ruddy duck *(Oxyura jamaicensis),* and bufflehead *(Bucephala albeola)* (Figure 2).

4.2 Bald eagle nesting

Bald eagle nesting success has been monitored annually on the Hay-Zama lakes complex since 1994 (Appendix 4). Saxena et al. (1995) reported 6 active nesting pairs in a June 1994 survey of the treed areas along the Hay River. The survey area was expanded in 1996 to include other suitable nesting habitats within the wetland complex boundaries, specifically, the small aspen upland east of Sand Lake and the aspen

uplands on the west end of the complex (Figure 3). From 1995 to 2003 active nesting pairs observed on the complex ranged from 3 to 7 with the lowest count of 3 being attributed to a wildfire in late May 2001 that burned through several nesting sites along the Hay River (Shaffe and Wright 1997, Wright 2004).

During the 17 June 2004 survey, 5 active nests were observed that were classified as rearing and containing young eagles (eaglets) (Table 3). Brood size ranged from 2 to 3 eaglets and at least one adult eagle was present at each of the five nests.

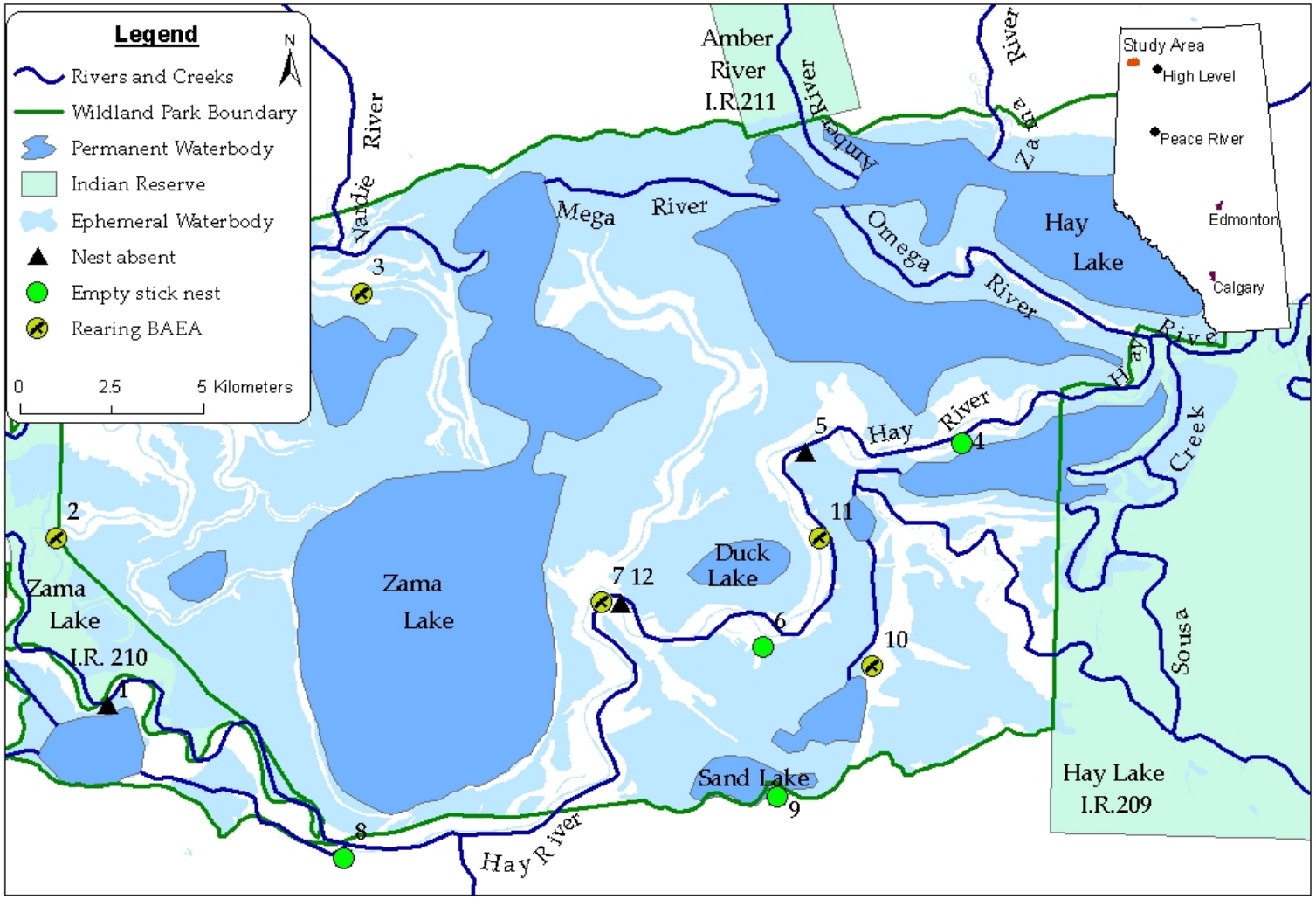

Figure 3. Locations of bald eagle (BAEA) nest sites observed in an aerial survey in the Hay-Zama study area 17 June 2004.

Table 3. Summary of observations recorded during a survey of bald eagle nest sites in the Hay-Zama study area on 17 June 2004.

Site	Location (UTM)		Status	Number observed			Comments
	Easting	Northing		Adults	Young	Eggs	
1	369918	6510319	absent	0	0	0	Not found
2	358525	6514823	rearing	1	3	0	
3	376796	6521484	rearing	1	2	0	
4	393105	6517409	empty	0	0	0	Nest in good condition
5	388872	6517157	absent	0	0	0	
6	387706	6511868	empty	0	0	0	Nest in disrepair
7	383334	6513080	rearing	2	2	0	
8	376306	6506117	empty	0	0	0	Nest in good condition
9	388104	6507802	empty	0	0	0	Nest in good condition
10	390669	6511350	rearing	1	3	0	
11	389233	6514829	rearing	1	2	0	
12	383838	6513051	absent	0	0	0	Not found
Total				6	12	0	

4.3 Summary

Monitoring of waterfowl populations during critical migration periods is a stakeholder strategy designed to identify possible negative environmental impacts on selected species. These monitoring efforts allow for continued oil and gas production unless a large congregation of waterfowl is present at a well site, at which point well production must be suspended. Alberta Sustainable Resource Development (ASRD) defined a threshold of 600 ducks and/or geese within a 30-m radius of the well site as the criteria for suspension of well production. The alternative, as defined by AEUB, is a general suspension of production on the complex during the migration periods (approximately 15 April to 31 May and 15 September to 15 October).

The maximum number of waterfowls observed at a well site during the 11 aerial surveys in 2004 was 571 birds at the oil well located on 12-4-113-5W6, below the threshold number of 600 birds defined by ASRD. Consequently, AEUB did not require any of the oil and gas companies operating within the study area to suspend production at any of the well sites. As in past surveys, northern pintail was the most common duck species observed during spring surveys and gadwall was the predominate duck species observed during fall surveys.

Five active bald eagle nesting pairs were observed during the 17 June 2004 survey. This observation is within the range of 3 to 7 nesting pairs recorded in past surveys. Three of the active nests contained two eaglets and the other two contained three eaglets each.

Based on the results presented in this report I recommend that monitoring of waterfowl at well sites continue during migration periods to ensure that AEUB is notified expeditiously in the event of the presence of a threshold concentration of waterfowl. I also recommend that the timing of the bald eagle nest surveys be delayed to obtain accurate counts of young. The Hay-Zama complex is well recognized as an important waterfowl staging area and management practices to date have focused on industrial activity during migration periods. I further suggest that additional monitoring be conducted during waterfowl breeding and molting seasons to determine the significance of the complex to breeding and molting waterfowl.

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6.0 APPENDIX

Appendix 1. Summary of number of waterfowls observed during the 2004 spring and fall migrations at oil and gas well sites in the Hay-Zama study area in Alberta. wf = waterfowl, sb = shorebirds, ot = other (raptors, coots, gulls).

Spring 2004

Well location		3 May			10 May			17 May			25 May		
No.	Legal description	wf	sb	ot	wf	sb	ot	wf	sb	ot	wf	sb	ot
1	2-6-112-7-W6	0	0	0	0	0	0	0	0	0	0	0	0
2	15-11-113-7-W6	0	0	1	0	25	3	32	30	0	132	0	0
3	9-15-113-7-W6	210	0	1	0	0	2	0	0	0	66	0	1
4	10-16-113-7-W6	0	0	0	0	0	0	0	0	0	0	0	0
5	5-2-113-5-W6	0	0	0	0	0	0	0	0	0	0	0	0
6	15-35-112-5-W6	0	0	0	0	0	0	0	0	0	0	0	0
7	13-35-112-5-W6	0	0	0	0	0	0	0	0	0	0	0	0
8	8-34-112-5-W6	0	0	0	0	0	0	0	0	0	0	0	0
9	8-33-112-5-W6	0	0	0	0	0	30	0	0	7	0	0	0
10	15-33-112-5-W6	0	0	0	0	0	0	0	0	0	0	0	0
11	12-4-113-5-W6	571	0	0	0	0	20	55	0	0	18	0	1
12	3-36-112-6-W6	0	0	0	0	0	0	0	0	0	0	0	0
13	7-29-112-5-W6	0	0	0	0	0	0	0	0	0	0	0	0
14	12-28-112-5-W6	0	0	0	0	0	0	0	0	0	0	0	0
15	7-8-112-5-W6	0	0	0	0	0	0	0	0	0	0	0	0
16	9-14-112-6-W6	0	0	0	0	0	0	0	0	0	0	0	0
17	12-10-112-6-W6	200	0	0	80	0	0	91	0	0	45	0	0
18	2-16-112-6-W6	80	0	0	82	0	0	0	0	0	7	0	0
19	6-15-112-6-W6	0	0	0	30	0	0	0	0	0	0	0	0
20	8-22-112-6-W6	0	0	0	0	0	0	0	0	0	0	0	0
21	16-22-112-6-W6	0	0	0	0	0	0	0	0	0	0	0	0
22	5-26-112-6-W6	0	0	0	0	0	0	0	0	0	0	0	0
23	8-33-112-6-W6	0	0	0	0	0	0	0	0	0	0	0	0
24	2-28-112-6-W6	0	0	0	0	0	0	19	0	0	12	0	100
25	7-29-112-6-W6	0	0	60	3	0	0	14	0	0	18	0	60
26	16-32-112-6-W6	0	0	1	2	0	0	0	0	0	2	0	0

Fall 2004 (first 4 of 7 monitoring events)

Well location		30 Aug			6 Sep			14 Sep			20 Sep		
No.	Legal description	wf	sb	ot	wf	sb	ot	wf	sb	ot	wf	sb	ot
1	2-6-112-7-W6	0	0	0	0	0	0	0	0	0	0	0	0
2	15-11-113-7-W6	135	0	0	150	0	0	52	40	0	0	0	0
3	9-15-113-7-W6	0	0	0	0	0	0	0	0	0	0	0	0
4	10-16-113-7-W6	0	0	0	0	0	0	0	0	0	0	0	0
5	5-2-113-5-W6	0	0	0	0	0	0	0	0	0	0	0	0
6	15-35-112-5-W6	0	0	0	0	0	0	0	0	0	0	0	0
7	13-35-112-5-W6	0	0	0	0	0	0	0	0	0	0	0	0
8	8-34-112-5-W6	0	0	0	0	0	0	0	0	0	0	0	0
9	8-33-112-5-W6	0	0	0	0	0	0	0	0	0	0	0	0
10	15-33-112-5-W6	0	0	0	0	0	0	0	0	0	0	0	0
11	12-4-113-5-W6	0	0	0	0	0	0	0	0	0	0	0	0
12	3-36-112-6-W6	0	0	0	0	0	0	0	0	0	0	0	0
13	7-29-112-5-W6	0	0	0	0	0	0	0	0	0	0	0	0
14	12-28-112-5-W6	0	0	0	0	0	0	0	0	0	0	0	0
15	7-8-112-5-W6	0	0	0	0	0	0	0	0	0	0	0	0
16	9-14-112-6-W6	21	0	0	0	0	0	0	0	0	0	0	0
17	12-10-112-6-W6	90	0	0	0	0	0	250	0	52	0	0	0
18	2-16-112-6-W6	20	0	0	280	0	0	0	0	0	0	0	0
19	6-15-112-6-W6	0	0	0	0	0	0	0	0	0	0	0	0
20	8-22-112-6-W6	0	0	0	0	0	0	0	0	0	0	0	0
21	16-22-112-6-W6	0	0	0	25	0	0	0	0	0	0	0	0
22	5-26-112-6-W6	0	0	0	0	0	0	0	0	0	0	0	0
23	8-33-112-6-W6	0	0	0	0	0	0	0	0	0	0	0	0
24	2-28-112-6-W6	20	0	0	55	0	0	40	0	0	0	0	0
25	7-29-112-6-W6	50	0	200	50	0	0	100	0	100	0	0	0
26	16-32-112-6-W6	0	0	0	0	0	0	0	0	0	0	0	0

Fall (final 3 of 7 monitoring events)

Well location		27 Sep			4 Oct			12 Oct		
No.	Legal description	wf	sb	ot	wf	sb	ot	wf	sb	ot
1	2-6-112-7-W6	0	0	0	0	0	0	0	0	0
2	15-11-113-7-W6	10	0	0	0	0	0	0	0	1
3	9-15-113-7-W6	0	0	0	0	0	0	0	0	0
4	10-16-113-7-W6	0	0	0	0	0	0	0	0	0
5	5-2-113-5-W6	0	0	0	0	0	0	0	0	0
6	15-35-112-5-W6	0	0	0	0	0	0	0	0	0
7	13-35-112-5-W6	0	0	0	0	0	0	0	0	0
8	8-34-112-5-W6	0	0	0	0	0	0	0	0	0
9	8-33-112-5-W6	0	0	0	0	0	0	0	0	0
10	15-33-112-5-W6	0	0	0	0	0	0	0	0	0
11	12-4-113-5-W6	0	0	0	0	0	1	0	0	0
12	3-36-112-6-W6	0	0	0	0	0	0	0	0	0
13	7-29-112-5-W6	0	0	0	0	0	0	0	0	0
14	12-28-112-5-W6	0	0	0	0	0	0	0	0	0
15	7-8-112-5-W6	0	0	0	0	0	0	0	0	0
16	9-14-112-6-W6	0	0	0	0	0	0	0	0	0
17	12-10-112-6-W6	45	0	0	0	0	0	370	0	0
18	2-16-112-6-W6	0	2	0	8	0	0	0	0	0
19	6-15-112-6-W6	0	0	0	0	0	0	0	0	0
20	8-22-112-6-W6	0	0	0	0	0	0	0	0	0
21	16-22-112-6-W6	0	0	0	0	0	0	0	0	0
22	5-26-112-6-W6	0	0	0	0	0	0	0	0	0
23	8-33-112-6-W6	0	0	0	0	0	0	0	0	0
24	2-28-112-6-W6	24	0	0	28	0	0	44	0	22
25	7-29-112-6-W6	60	0	0	64	0	0	75	0	50
26	16-32-112-6-W6	0	0	0	0	0	0	0	0	0

Appendix 2. Summary of peak number of geese observed from 1978 to 2004 and peak number of ducks observed from 1994 to 2004 during spring and fall migration in the Hay-Zama study area in Alberta.

Geese (1978 to 2004)

Year	Spring migration		Fall migration	
	Date of peak	Total #geese	Date of peak	Total #geese
1978	28 Apr	5,588	27 Sep	13,688
1980	4 May	2,396	24 Sep	39,876
1981	6 May	6,278	20 Sep	8,417
1982	12 May	20,486	30 Aug	6,278
1983	5 May	22,064	10 Aug	7,604
1984	4 May	4,599	6 Sep	3,556
1985	8 May	3,529	20 Sep	5,445
1986	4 May	5,081	18 Sep	7,173
1987	5 May	8,588	31 Aug	3,692
1988	7 May	15,668	15 Sep	1,693
1989	29 Apr	6,398	2 Sep	1,317
1990	4 May	1,022	17 Sep	2,368
1991	2 May	817	10 Sep	4,062
1992	10 May	650	29 Sep	21,513
1993	7 May	1,068	24 Sep	4,724
1994	26 Apr	535	5 Oct	4,780
1995	3 May	9,082	8 Sep	7,122
1996	6 May	3,949	10 Sep	8,666
1997	7 May	3,973	2 Sep	222
1998	4 May	206	17 Sep	10,988
1999	29 Apr	6,975	9 Sep	7,570
2000	1 May	5,483	18 Sep	4,559
2001	30 Apr	4,252	13 Sep	4,332
2002	6 May	5,056	4 Sep	1,905
2003	28 Apr	7,879	15 Sep	5,035
1978 – 2003 Average	4 May	6,065	13 Sep	7,463
2004	3 May	11,810	6 Sep	2,558

Ducks (1994 to 2004)

Year	Spring migration		Fall migration	
	Date of peak	Total #ducks	Date of peak	Total #ducks
1994	24 May	18,417	8 Sep	35,525
1995	3 May	11,706	14 Sep	53,859
1996	6 May	19,810	16 Sep	28,255
1997	1 May	13,884	24 Sep	29,165
1998	8 May	32,676	10 Sep	62,941
1999	6 May	49,556	16 Sep	63,617
2000	1 May	29,307	2 Oct	32,902
2001	30 Apr	39,427	18 Sep	43,095
2002	13 May	52,725	18 Sep	43,095
2003	5 May	16,564	15 Sep	87,830
1994 – 2003 Average	7 May	28,407	17 Sep	48,028
2004	3 May	43,111	15 Sep	32,016

Appendix 3. Summary of abundance of waterfowl species observed on the aerial survey route during the 2004 spring and fall migrations in the Hay-Zama study area in Alberta.

Spring

	3 May	10 May	17 May	25 May
Geese and Swans				
Canada Goose (*Branta canadensis*)	10,655	8,905	80	15
Greater White-fronted Goose *(Anser albifrons)*	730	705	0	0
Snow Goose (*Chen caerulescens*)	425	478	2	0
Swans (*Cygnus columbianus, C. buccinator*)	25	13	9	9
Ducks, Grebes and Mergansers				
Mallard (*Anas platyrhynchos*)	1314	2043	1132	1788
Gadwall (*Anas strepera*)	650	143	8	291
Blue-winged Teal *(Anas discors)*	3021	1055	390	474
Northern Pintail *(Anas acuta)*	10339	3598	107	323
Green-winged Teal (*Anas crecca)*	1634	720	25	296
Canvasback (*Aythya valisineria*)	1666	1067	322	409
Northern Shoveler *(Anas clypeata)*	1151	1082	347	1192
American Widgeon (*Anas americana*)	2347	1853	10	71
Scaup (*Aythya marila or A. affinis*)	417	150	187	340
Common Goldeneye (*Bucephala clangula*)	145	120	42	269
Bufflehead (*Bucephala albeola*)	65	53	74	109
Redhead (*Aythya americana*)	387	45	50	26
Ring-necked Duck *(Aythya collaris)*	6	0	20	26
Ruddy Duck (*Oxyura jamaicensis*)	120	574	483	443
Cinnamon Teal (*Anas cyanoptera*)	0	0	3	173
White-winged Scoter (*Melanitta fusca*)	0	0	4	13
Grebes (*Aechmophorus occidentalis, Ppodiceps grisegena*)	0	2	0	93
Common merganser (*Mergus merganser*)	0	0	0	2
Unidentified Ducks	20424	14523	3485	5738
Total	43686	27028	6689	12076

Fall (first 4 of 7 monitoring events)

	30 Aug	6 Sep	14 Sep	20 Sep
Geese and Swans				
Canada Goose (*Branta canadensis*)	448	2552	193	40
Greater White-fronted Goose *(Anser albifrons)*	15	6	0	0
Snow Goose (*Chen caerulescens*)	0	0	0	50
Swans (*Cygnus columbianus, C. buccinator*)	7	19	34	10
Ducks, Grebes and Mergansers				
Mallard (*Anas platyrhynchos*)	0	1032	4289	1600
Gadwall (*Anas strepera*)	1170	5431	5775	3610
Blue-winged Teal *(Anas discors)*	0	953	1010	0
Northern Pintail *(Anas acuta)*	0	369	440	50
Green-winged Teal (*Anas crecca)*	0	779	2165	0
Canvasback (*Aythya valisineria*)	5	1640	920	0
Northern Shoveler *(Anas clypeata)*	0	134	355	0
American Widgeon (*Anas americana*)	495	589	220	0
Scaup (*Aythya marila or A. affinis*)	0	150	440	30
Common Goldeneye (*Bucephala clangula*)	0	25	40	0
Bufflehead (*Bucephala albeola*)	0	2	0	0
Redhead *Aythya americana*)	0	0	0	0
Ring-necked Duck *(Aythya collaris)*	0	227	0	0
Ruddy Duck (*Oxyura jamaicensis*)	0	38	20	0
Cinnamon Teal (*Anas cyanoptera*)	0	0	0	0
White-winged Scoter (*Melanitta fusca*)	0	0	0	0
Grebes (*Aechmophorus occidentalis, Ppodiceps grisegena*)	0	0	0	0
Common merganser (*Mergus merganser*)	0	0	0	0
Unidentified Ducks	11513	6212	16342	8455
Total	13183	17581	32016	13745

Fall (final 3 of 7 monitoring events)

	27 Sep	4 Oct	12 Oct	
Geese and Swans				
Canada Goose (*Branta canadensis)*	106	1	0	
Greater White-fronted Goose *(Anser albifrons)*	0	0	0	
Snow Goose (*Chen caerulescens*)	36	0	0	
Swans (*Cygnus columbianus, C. buccinator*)	73	192	182	
Ducks, Grebes and Mergansers				
Mallard (*Anas platyrhynchos*)	1976	1843	1859	
Gadwall (*Anas strepera*)	3622	2285	1471	
Blue-winged Teal *(Anas discors)*	430	216	62	
Northern Pintail *(Anas acuta)*	792	142	55	
Green-winged Teal (*Anas crecca)*	707	830	405	
Canvasback (*Aythya valisineria*)	610	660	120	
Northern Shoveler *(Anas clypeata)*	300	323	55	
American Widgeon (*Anas americana*)	2	40	688	
Scaup (*Aythya marila or A. affinis*)	72	229	40	
Common Goldeneye (*Bucephala clangula*)	88	144	10	
Bufflehead (*Bucephala albeola*).	6	0	0	
Redhead *Aythya americana*)	751	1	30	
Ring-necked Duck *(Aythya collaris)*	0	0	0	
Ruddy Duck (*Oxyura jamaicensis*)	0	1	0	
Cinnamon Teal (*Anas cyanoptera*)	0	0	0	
White-winged Scoter (*Melanitta fusca*)	0	0	0	
Grebes (*Aechmophorus occidentalis, Ppodiceps grisegena*)	0	0	0	
Common merganser (*Mergus merganser*)	195	0	0	
Unidentified Ducks	5611	8762	6521	
Total	15162	15476	11316	

Appendix 4. Summary of the results of bald eagle nesting surveys in the Hay-Zama study area in Alberta from 1994 to 2004.

Year	Number of active nests	Comments
1994	6	Source: Saxena et al (1995)
1995	4	Source: Schaffe and Wright (1997)
1996	4	Survey area expanded
1997	5	none
1998	7	none
1999	5	none
2000	7	none
2001	3	Wildfire burned through east portion of study area 2 days prior to survey
2002	6	none
2003	7	none
2004	5	none
Mean	5.4	

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