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April 29, 2011

Honorable Kimberly D. Bose, Secretary, and
Nathaniel J. Davis, Sr., Deputy Secretary
FEDERAL ENERGY REGULATORY COMMISSION
888 First Street, NE
Washington, DC 20426

VIA ELECTRONIC FILING

Re: **Lake Chelan Hydroelectric Project No. 637**
Article 406 – Wildlife Habitat Plan
Annual Winter Wildlife Survey Report for 2010

Dear Secretary Bose and Deputy Secretary Davis:

On April 10, 2008, the Federal Energy Regulatory Commission (Commission) issued the "*Order Modifying and Approving Wildlife Habitat Plan under Article 406*"[1] requiring the Public Utility District No. 1 of Chelan County, Washington (Chelan PUD) to provide an annual report on the results of the winter wildlife surveys by April 30 of each year to the Commission, the U.S. Forest Service (USFS), the U.S. Department of the Interior, National Park Service (NPS), the U.S. Fish and Wildlife Service (USFWS) and the Washington Department of Fish and Wildlife (WDFW).

In accordance with the above Order, Chelan PUD hereby files the Annual Winter Wildlife Survey Report for 2010 to the Commission. Copies of the report are being provided by copy of this letter with the above federal and state agencies.

Please do not hesitate to contact me or Von Pope at (509) 661-4625 regarding any questions or comments regarding this report.

Sincerely,

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Enclosure

c: Robert Kuntz, NPS
Catherine Willard, USFS
Steve Lewis, USFWS
Dave Volsen, WDFW

[1] 123 FERC ¶ 62,039 (2008) at P. 3

LAKE CHELAN ANNUAL WINTER WILDLIFE SURVEY REPORT

WINTER of 2010-2011

Public Utility District No. 1 of Chelan County

P. O. Box 1231

Wenatchee, Washington 98807

April 2011

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INTRODUCTION

Since 1982, the Public Utility District No. 1 of Chelan County (Chelan PUD) has monitored big-game and other wildlife that winter along the Lake Chelan Hydroelectric Project (License No. 637) as a Federal Energy Regulatory Commission (FERC) compliance measure. On 31 March 2004, the existing operating license expired, though monitoring continued during annual licenses. On 6 November 2006, a new operating license was awarded to Chelan PUD (FERC 2006). On 10 April 2008, the FERC approved the Lake Chelan Wildlife Plan, which prescribed the continuation of annual winter wildlife surveys similar to those conducted during the second license for the project (1974-2004). During consultation on the new Lake Chelan Wildlife Habitat Plan, the Lake Chelan Wildlife Forum elected to add water birds to the Lake Chelan winter wildlife survey for the 50-year-license period (2006-2056). The objective for the Lake Chelan winter wildlife survey is to monitor numbers of wintering big game, waterfowl, eagles, and other wildlife observed during the winter boating surveys. Results are documented in the Lake Chelan Winter Wildlife Survey Report, which is provided to FERC, the Washington Department of Fish and Wildlife (WDFW), the U.S. Fish and Wildlife Service (USFWS), the USDA Forest Service, and the National Park Service by 30 April annually as required by Article 406 in the operating license.

Lake Chelan provides a unique opportunity to monitor big game, waterfowl, eagles, and furbearers that tend to concentrate at lower elevations along the lake during the winter months. While surveys provide only minimum species numbers, repeated counts over time provide an index of population status for a number of wildlife species. Spatial and temporal information gathered on wildlife wintering along Lake Chelan provides useful information to state and federal natural resource management agencies for wildlife management along Lake Chelan. In addition, long-term population indices may be useful in observing the response of some wildlife species to wildfires that have occurred in the Lake Chelan basin over the past decade or so. The Rex Creek and Deer Point fires (2001 and 2002, respectively) burned a significant portion of deer winter range along the north shore, destroying extensive bitterbrush stands. More recently, the Flick Creek and Domke Lake Fires on the south shore have further altered the habitat along Lake Chelan. This report summarizes winter wildlife monitoring along Lake Chelan for the winter of 2010-2011.

STUDY AREA

Lake Chelan lies in central Washington on the east slope of the Cascade Mountains in northern Chelan County. The lake is approximately 1 mile wide and 50 miles long. It extends from the Columbia River breaks to the high Cascades. The lake's maximum elevation is 1,100 feet m.s.l., with mountain peaks in excess of 8,000 feet above the lake. Most of the survey area lies within both the Wenatchee National Forest and the North Cascades National Park complex. Six vegetation zones, described by Franklin and Dyrness (1973), lie within the study area: *Pinus ponderosa, Pseudotsuga menziesii, Abies grandis, Pinus contorta, Abies lasiocarpa*, and *Artemisia tridentata/Agropyron spicatum*. The study area (Figure 1) includes a 40 mile stretch of Lake Chelan and the surrounding terrain from First Creek, at Lake Chelan State Park (lake mile 13), to the mouth of the Stehekin River, at Stehekin (lake mile 54) and encompasses both shores.

METHODS

Survey Methods

Each winter season, Chelan PUD schedules 12 boating surveys along Lake Chelan to provide an index of wildlife wintering along the lake. The winter season is defined as late November through late March. Each winter season is divided into four periods with three surveys in each including: early (late November – mid-December), mid (late December – early January), late (mid – late February) and the green-up period (March). During each survey, the boat is driven up one shore of the lake (north or south) and down the opposite shore. Each year, the initial shoreline surveyed is chosen at random and the route alternates thereafter to balance the number of morning and afternoon sighting opportunities along each shore.

A minimum of three people conduct the surveys from an open boat to maximize visibility. The boat is driven at a slow cruising speed (~3,200 rpm) usually within 100-200 yards of the lake shoreline. Wildlife species observed are identified using 10x40mm binoculars from the boat or with spotting scopes (20-60 x 60mm and 6-100 x 100mm) from the shore. The same area (Lake Chelan State Park to Stehekin) is surveyed each survey (Lake mile 13.5 - 54.5, Figure 1) unless inclement weather (high winds or heavy snow) necessitate termination of a survey.

Big Game and Furbearer Observations

All big game and furbearer species observed are recorded to the nearest tenth lake mile and the shore on which they are observed (north or south). Mule deer (*Odocoileus hemionus*), mountain goat (*Oreamnos americanus*), and bighorn sheep (*Ovis canadensis*) may be classified by age and sex. The extent to which these animals are classified varies depending on the species, the winter period being surveyed, and visibility conditions. Other big game or furbearers that may be encountered such as black bear, cougar, and bobcat are recorded but not classified by age or sex.

Deer are classified by age, sex, and species to the extent possible during the first two survey periods (early and mid-winter). For bucks, the maximum number of antler points on one side is recorded. During the remaining two periods (late winter and green-up) deer are only classified by age (adult or fawn) and species since bucks have typically shed their antlers. When visibility is poor or long distances prevent age and sex identification, deer are recorded as unclassified. Mule deer are the dominant species observed, however, black-tailed (*O. h. columbianus*) or white-tailed deer (*O. virginianus*) are observed occasionally and recorded by species, age, and sex where possible. Deer counts through mid-winter provide information on the buck populations and buck/doe ratios while late winter and green-up surveys provide an index of adult/fawn ratios and potential recruitment for portions of the Manson, Entiat, Slide Ridge, and Clark Game Management Units.

Typically, mountain goats are observed from long distances making sex classification more difficult. Therefore, mountain goats are only classified by age (adults and kids). Relative abundance, distribution, and age data provide an index for managing mountain goat in the Lake Chelan Basin. In past years the Stehekin Valley was surveyed once per winter (rarely twice) with binoculars and spotting scopes from observation points along the valley roads. These surveys have usually consisted of two consecutive days of surveying for goats, the afternoon of one day followed by the morning of the second day. The Stehekin Valley surveys supplement the surveys along the lake by adding information on goat abundance, distribution, and age composition in the Stehekin Valley. Results of these surveys have often been

influenced by weather conditions that limit visibility. The number of goats observed during these surveys has varied from zero to 40.

Historically, bighorn sheep were native to Washington and the Lake Chelan area. Unrestricted hunting and parasites and diseases carried by domestic sheep eliminated bighorns from Washington by the early 1900's. In March 1999, WDFW coordinated the release of 13 bighorn sheep onto the north shore of Lake Chelan along with the USDA Forest Service and the Foundation for North American Wild Sheep (FNAWS). Key to this re-introduction was the FNAWS negotiations to remove domestic sheep from the USDA Forest Service grazing allotment in that area of the north shore of Lake Chelan. An additional 34 bighorns were released in February and March 2000. The sheep were released between Grade and Coyote creeks. The transplanted bighorns were captured from expanding populations in Lincoln, Kittitas, and Yakima counties in Washington and from the Okanogan Valley of southern British Columbia. During 2009, 12 bighorn sheep along Lake Chelan were radio-collared by WDFW in 2009 to monitor this population.

Information on bighorn sheep relative abundance and age and sex ratios is important for monitoring and managing this re-introduced herd. Winter surveys are optimum for gathering data on bighorn sheep abundance, age, sex, and distribution because the sheep congregate on winter range at relatively lower elevations (Geist 1971). Bighorn sheep observed are counted and classified by age (adult or lamb) and sex (ram or ewe) when conditions allow during each survey period. Bighorn rams are further classified as class 1, 2, 3, or 4 rams (Geist 1968).

Eagles, Waterfowl and Water Bird Observations

Eagles, waterfowl, and other water birds (grebes, gulls, loons) observed are recoded to the nearest tenth lake mile and to the nearest shore to which they are observed. When visibility permits, eagles, waterfowl, and other birds observed on the lake are classified by species using 10x40mm binoculars or variable power spotting scopes. In addition, eagles may be recorded as adults or sub-adults when conditions allow. When visibility is poor, ducks may be classified as dabblers or divers, or simply as unknown waterfowl. The mouth of the Stehekin River is generally surveyed from the shoreline with spotting scopes as visibility allows. This area generally exhibits the highest concentration and species diversity of waterfowl within the survey area.

Data Summary Methods

Data gathered are summarized for the overall winter season and by each winter period to provide population metrics (age and sex ratios) and/or allow for monitoring of specific trends (annual population indices) for the species observed. In addition, data may be summarized by shore (north or south) to provide similar information for different management areas. To provide a minimum estimate for the number of mountain goats observed in the study area by winter season, we tallied the maximum number of goats recorded within each particular band (or area) among all surveys. The geographic separation between areas where goat bands were observed is assumed to be large enough that goats are not moving between bands during the winter season which could lead to biased counts.

Since deer shed their antlers after the mid-winter period, the early and mid-winter periods are used to monitor buck ratios (bucks/100 does) and age structure (# of antler points). Throughout the winter survey season age data are recorded and summarized to determine fawn ratios (fawns/100 adults). Similar population metrics are calculated for bighorn sheep for all surveys. Unclassified animals are removed from the data set prior to calculating any age or sex ratios. Since visibility may limit the

ability to classify animals and may greatly influence buck/ram and fawn/lamb ratios, only surveys that have a classification rate of 25% or greater are used to calculate these ratios.

The average number of all species observed during each winter period and for the winter season overall is calculated by totaling the number of animals observed during each survey and dividing by the number of surveys conducted in each period (typically 3). The overall average is calculated by totaling the number of animals observed over the entire winter survey season divided by the number of surveys collected (usually 12). Since the number of animals observed on any particular survey may vary drastically (especially for deer), the maximum number of animals observed on any one survey are reported to provide an indication of minimum numbers. However, relatively low numbers for any species observed does not necessarily indicate low population numbers. Winter and weather conditions may combine to limit the number of animals present or visible for one or more surveys conducted.

RESULTS AND DISCUSSION

During the winter season of 2010-2011, 12 surveys were conducted between 1 December 2010 and 1 April 2011 (Table 1). The area surveyed was consistent and complete for all surveys although visibility was reduced during a portion of nine surveys due to low clouds or fog. Reduced visibility likely limited the numbers of animals seen, especially for mountain goats which are frequently observed at higher elevations than deer and bighorn sheep. In addition to poor visibility, vegetative cover and topography undoubtedly further limited the number of animals recorded. Therefore, all numbers are considered to represent the minimum number present during any one survey.

Mountain Goats

Goat Counts

During the winter of 2010-11, an average of 92.0, 93.3, 48.3, and 69.7, mountain goats were observed per boat survey for the early, mid, late and green-up periods, respectively. The number of mountain goats seen per boat survey this past winter ranged from 30 to 124 (Table 1). The maximum number of mountain goats observed on any survey during the 2010-11 winter seasons was 124, on 15 December 2010. The maximum number observed along the north shore (n = 78) occurred on 23 March 2011; whereas the maximum number along the south shore (n = 82) occurred twice, including 15 and 30 December 2010. A single survey for mountain goats was conducted in the Stehekin Valley above Lake Chelan on 10 February 2011 from accessible roads. No goats were observed during this single survey.

Estimated numbers

The minimum number of goats estimated for the Lake Chelan wintering area surveyed during the 2010-11 winter season was 172 (Figure 2). The estimated number of mountain goats observed on the south shore (n = 94) was up considerably from previous seasons, but not as high as last season's counts. However, numbers remained relatively high compared to the 29-year average of 53 due to several high counts obtained over the course of the 2010-11 surveys. The estimated number of mountain goats on the north shore (n = 78) is fewer than estimates obtained over the past few seasons (Table 2). Trend data (1982 to 2010) for estimated mountain goat population numbers (Figure 3) show that typically, the north shore has had more mountain goats, with the exception of surveys in the early – mid-1980's and in recent years (Table 2). While bands of goats were seen in similar places along each shore in previous seasons, the numbers of goats observed during the 2010-11 surveys were higher along the south shore and lower along

the north shore. However, low snowpack during the late winter period this season left a majority of habitat open for goats at higher elevations, especially along the north shore. Therefore, if some north shore individuals were missed entirely during winter surveys, the total population could be much higher than the estimated minimum of 172 mountain goats. Even so, estimated numbers of goats observed for 2010-11 survey are the 5th highest since Chelan PUD began conducting big game winter surveys in 1982 (Table 3).

The ratio of kids/100 adults is a measure of mountain goat kid production and survival. Within the study area, a ratio of 42.0 kids/100 adults was observed (Figure 4) during the 2010-11 winter season. We observed 27.0 kids/100 adults (average = 22.1) along the north shore and 52.7 kids/100 adults (average = 27.1) along the south shore during the 2010-11 winter season. Recently, kid ratios have been higher along the south shore compared to that of the north shore (Table 2).

From the winter for 1990-91 to 1999-00, the ratio of kids/100 adult goats along the north shore was relatively low (16.4) compared to ratios observed during the 1980's (24.3) and during the last decade (24.0). This year's ratio of 27.0 was higher than recent years and higher than the 29 year average of 22.1 kids/100 adults along the north shore. The relatively mild winter may have allowed goats to winter at higher elevations (especially on the north shore, which has a south aspect) making them more difficult to observe during our surveys. The recent series of consecutive mild winters has likely influenced higher kid production and survival along Lake Chelan as seen on the south shore. In the early 1980's, kid ratios were slightly higher along the north shore of the lake, whereas the ratios have fallen and the south shore now demonstrates a higher kid to adult ratio (Figure 5).

During the past 20 years, much of the available mountain goat winter range along Lake Chelan has been underutilized by mountain goats. Until recently, goats were not using portions of their winter ranges that were used in the early to mid-1980's (especially along the south shore) or portions of winter ranges were being used by fewer goats. During 2010-11, goat observations were more distributed along both shores, making it difficult to determine separate "herds" of animals. However, few goat observations have been made in the area uplake of Riddle Creek along the south shore and Canoe Creek along the North Shore, and these portions of historic habitat appears to be underutilized. Surveys conducted within the Stehekin Valley have produced low numbers of goats during the last decade. Washington Department of Game surveys that were conducted within the study area between 1954 and 1970 (Fielder and McKay 1984) also recorded greater mountain goat use uplake of Canoe Creek along the north shore and in the Stehekin Valley compared to what we have seen in the last decade. However, relatively few surveys have been conducted in the Stehekin Valley in recent years.

Historically, the total mountain goat population along Lake Chelan has not shown strong growth in response to management efforts in use since the late 1970's. Mountain goat hunting along the south shore of the lake and in the Stehekin Valley has been closed since the 1978 hunting season. Goat hunting on the north shore of the lake closed in 1980. In 2001, limited mountain goat hunting (1-2 tags) was resumed on the north shore. After the introduction of goats from the Olympic Mountains in 1983 and 1984 (Fielder and Keesee 1988) the overall population and the ratio of kids per 100 adults increased for several years, but then declined again (Figures 4 and 5). Prescribed fires and fertilization on goat winter ranges also have not resulted in a substantial increase in goat populations. Supplementation with mineral blocks containing 90 ppm of selenium to increase production (Fielder 1986) coincided with a local increase in kid production on the downlake portion of the goat winter range along the north shore. Recent wildfires within the Lake Chelan drainage have burned thousands of acres of mountain goat winter range. Johnson (1983) noted that changes in habitat after fires may lead to population increases. Ratios of kids/100 adults for the entire survey area have generally been on the increase since the winter beginning

in 1996. Continued monitoring of this mountain goat population after recent large-scale fires will provide a chance to explore this hypothesis.

During the summer of 2001, the Rex Creek Fire burned most of the area on the north shore from the lake to the ridge-top from approximately Moore Point to Safety Harbor Creek (18 miles). Almost every location along the north shore of the lake where mountain goats were observed during surveys suffered a 30-100% burn of vegetation. The recent fires in the Lake Chelan basin could give biologists an opportunity to test this theory. Chelan County PUD surveys have compiled 29 years of data on mountain goat abundance, distribution, and kid to adult ratios for the north and south shores of Lake Chelan. Continuing to monitor the population trends of mountain goats along Lake Chelan provides an opportunity to examine the effects of fire on goat winter range. Since the Rex Creek fire, goat numbers increased along the north shore of the lake, but we have also seen kid ratios lag slightly behind those of the south shore.

Deer

During the 2010-11 winter season 3,253 deer were observed for all surveys combined (Table 1). Of all deer recorded, 73% (n = 2,362) were observed on the north shore and the remaining 27% (n = 891) along the south shore. The greatest number of deer observed on a single survey was 756 (30 December 2010) during the mid-winter period. This survey day produced the highest numbers observed on the north shore (n = 558) but peak numbers along the south shore (n = 201) were observed during the 21 December survey. Average deer numbers for the early, mid, late, and green-up winter periods were 141, 623, 103, and 218, respectively. The average number of deer observed per survey along the South shore (74.3) was the highest observed in the history of the survey for that shore and well above the 29 year average (Table 3) of 22.1. The average number of deer observations per survey along the north shore (n = 196.8) was also higher than the 29-year average of 102.5.

For all surveys, 2,252 deer (69%) were classified by age (adult or juvenile). During all surveys, greater than 25% of all deer observed were classified. Along the north shore, 72% (n = 1,694) of deer observations were classified compared to 63% (n = 558) along the south shore (Table 4). The north shore fawn ratio (fawns/100 adults) observed for the 2010-11 winter season was 38.5 fawns/100 adults. The south shore exhibited a similar fawn ratio this season, with 37.8 fawns/100 adults. Overall, the ratio observed for the entire survey area was 38.3 fawns/100 adults.

During the early and mid-winter periods a cumulative total of 235 bucks were observed. This was the highest number of bucks observed during the 29-year history. Bucks were only observed and/or classified during 4 surveys: 15, 21, and 30 December and 4 January. The number of bucks/100 does observed for the entire survey area during the early and mid-winter surveys was 22.0 bucks/100 does. Buck ratios on the north shore were 20.8 for the early and mid-winter periods combined. Buck ratios on the south shore were higher overall (26.2 bucks/100 does). The average number of 1, 2, 3, and 4 point bucks for the early and mid-winter period along both shores was 5.8, 16.2, 7.7, and 9.5, respectively. The average number of 1, 2, 3, and 4 point bucks observed along the north shore during the early and mid-winter period was 3.7, 10.3, 6.3, and 7.8, respectively. Along the south shore, the average number of 1, 2, 3, and 4 point bucks observed per survey for the early and mid-winter period was 2.2, 5.8, 1.3, and 1.7.

Along the south shore, 75% of the 891 deer observed were within a 15-mile segment of relatively east-facing shoreline located between First Creek (lake mile 13) and Still Creek (lake mile 28). Forty-nine percent of all mule deer observations on the north shore occurred within a 10-mile segment of shoreline from Antilon Creek (lake mile 18) to Falls Creek (lake mile 29). This area is where the majority of deer observations generally occur during each winter. Much of the bitterbrush forage within this north shore

area was burned during the Deer Point fire in 2002. An additional 40% of north shore deer observations occurred within another 10-mile stretch located from Canoe Creek uplake to Moore Point. This area last burned during the Rex Creek fire in 2001.

Since the 1996-97 winter season, relatively fewer deer have been observed along Lake Chelan during annual winter surveys (Figure 6). The winter of 1996 – 97 was particularly harsh and an estimated 70% of the deer population in Chelan County was lost (WDFW 2003). While a recovery appears to be apparent based on winter survey data, the extent of the recovery is unknown since recent winters have been considered mild. In mild winters, deer may not descend to the lower elevations of winter range where they are easily visible from the lake. However, the 2010-11 survey average of 271 deer observed per survey is above-average (AVG = 127.8) for the 29-year history of this monitoring.

Bighorn Sheep

Bighorn sheep were observed during every boat survey during the 2010-11 winter season. The average number of bighorn sheep observed during early, mid, late, and green-up periods was 34, 16, 34, and 23, respectively. The maximum number of bighorn sheep observed was 54. This maximum is lower than maximum numbers observed in the previous years (Table 3) but above average for all years since sheep were re-introduced in 1999. The minimum number of sheep observed (n = 2) occurred on 21 December. Collared sheep were observed during many surveys. All bighorn sheep observed on the north shore were located within lake miles 17 and 32 during the winter surveys.

During the spring of 2007, we began classifying all bighorn sheep (Geist 1968) observed on the Lake Chelan winter range. We classified 90% of all bighorn sheep recorded during the 2010-11 winter season and observed an average of 26 bighorn sheep per survey. An average of 12 ewes was observed on each survey. The ratio of rams/100 ewes observed was 81.4 rams/100 ewes (excluding surveys where < 25% of sheep were classified). For classified rams, the maximums observed for any one survey by class was 1-Class I, 4-Class II, 7-Class III, and 15-Class IV. The lamb ratio was 8.3, calculated from surveys in which > 25% of sheep were classified. The maximum number of lambs observed (n = 7) occurred on 9 February. Since data on age and sex ratios has only been collected since 2006, future surveys will help establish trends for age and sex ratios for bighorn sheep. Although only a portion of the estimated 120 animals in the herd are observed during winter surveys, monitoring provides regular updates of herd composition and distribution.

Winter big game survey observations of bighorn sheep ranged from Stink Creek (lake mile 17) to the vicinity of Point no Point (lake mile 32). Most observations (95.6%) have occurred between Antilon Creek and the vicinity of Safety Harbor Creek, with the largest concentration of observations (69%) centered between Mitchell and Grade Creek. Expansion of grass vegetation along the north shore following the Rex Creek and Deer Point fires may have a positive influence on this bighorn sheep population. Bighorn sheep prefer open grassland habitats, as they are grazers rather than browsers such as deer.

Eagles, Waterfowl, and Other Wildlife

Eagle numbers observed during winter surveys along Lake Chelan have been monitored since 1982. The average number of bald eagles (*Haliaeetus leucocephalus*) observed (n = 5.0) during the 2010-11 winter season was relatively high compared to the historical average of 3.5 per survey (Table 5). During the 2010-11 winter season we observed an average 1.6 golden eagles (*Aquila chrysaetos*) per survey, near the historical average of 1.8 per survey. The maximum number of golden eagles observed during any one

survey was 5. Eagle species are observed sporadically along either shore of the lake and are often found in large numbers associated with carrion along or near the shoreline.

Numbers of wintering waterfowl (Family Anatidae) and other water birds (grebes, gulls, loons) along Lake Chelan are a relatively new addition to the winter wildlife surveys with 2010-11 being the fourth year of this data collection. Water bird species numbers are recorded (Table 6) by location (tenth of lake mile) during each survey as part of the new Lake Chelan License. Water birds were concentrated primarily at the mouth of the Stehekin River with 71% (n = 5,697) of all observations (n = 8,055) occurring in the upper mile of the lake near Stehekin.

The composition of water birds observed was dominated by waterfowl which averaged 590 observations per survey and accounted for 88% of the total average (671) of all water birds observed for all surveys (Figure 7). Canada geese (*Branta canadensis*) were the most abundant waterfowl species observed and comprised 29% of total waterfowl observations, followed by American wigeon (*Anas americana*) (27%), mallard (*Anas platyrynchos*) (15%), ring-necked duck (*Aythya collaris*) (10%), and bufflehead (*Bucephala albeola*) (5%). Other species such as lesser scaup *(Aythya affinis),* trumpeter swans (*Cygnus buccinator*), Barrow's goldeneye (*Bucephala islandica*), green winged teal (*Anas crecca*), common goldeneye (*Bucephala clangula)*, redhead (*Aythya americana*), hooded merganser (*Lophodytes cucullatus*), and common merganser (*Mergus merganser*) were seen regularly but in smaller numbers and account for the remaining 14% of the total number of Anatidae observed during the 2010-11 winter season (Figure 8). In 2010-11, we observed a maximum of 21 trumpeter swans, including 2 cygnets. Table 6 shows the number and species of water birds observed during the 2010-11 winter season.

Other water birds observed during the 2010-11 winter season included a surprising number of grebes (Podicipedidae), averaging 80 grebes per survey. Grebe species observed included horned (*Podiceps auritus*), western (*Aechmophorus occidientalis*), pied-billed (*Podilymbus podiceps*), and eared (*Podiceps nigricollis*) grebes. Horned grebes were the most common grebe species observed by far, accounting for 94% of all grebe observations and 5% of all waterbird observations. We observed a maximum of 167 horned grebes (9 February 2011) with an average of 75 horned grebes per survey for the winter season. Unlike the waterfowl, horned grebes were distributed throughout the survey area, with observations in all lake miles surveyed. Common loons (*Gavia immer*) were also observed occasionally, with a maximum of 4 observed on 16 February 2011. American coot (*Fulica americana*) and gulls (Laridae) were uncommon and accounted for less than 1% of the total average of water birds observed for the 2010-11 winter season.

During the 2010-11 winter season biologists also observed 8 coyotes (*Canis latrans*), 4 Northern goshawks (*Accipiter gentilis*), 9 red-tailed hawks (*Buteo jamaicensis*), and 6 peregrine falcons (*Falco peregrinus*). Carrion resulting from winter mortality and predation influences the number of predators and scavengers seen along the lake during winter wildlife surveys. Most big game winter mortality generally occurs late in the winter when animals have exhausted their body fat and energy stores. However, coyotes were observed only during the early and mid-winter surveys. The mild winter likely contributed to greater ungulate survival and lower over-winter mortality.

Fire Influence

The north shore has experienced a number of fires within the last decade. The Rex Creek Fire in the summer of 2001 burned 55,913 acres between Moore Point (lake mile 48) and Safety Harbor Creek (lake mile 30). The fire was started by a lightning storm on 12 August 2001 and eventually burned over much of the mountain goat wintering area between the lake and the ridge-tops along the north shore.

The Rex Creek Fire burned goat foraging areas in a patchy, mosaic pattern due to the rocky nature of goat habitat. Goats may actually benefit from re-growth of vegetation on their winter ranges, especially fast growing grasses and forbs (Johnson 1983). Erosion from the steep charred hills in this region has been significant in some drainages due to lost vegetation.

During the summer of 2002, the human-caused Deer Point Fire burned over a large portion of the mule deer and bighorn sheep ranges along the north shore of Lake Chelan. The area burned consisted of approximately 43,000 acres situated between Coyote Creek downlake to near Green's Landing and included elevations ranging from lake level to high-elevation ridge tops. Much of the burn in lower elevations rejuvenated grasses and shrubs, but the extensive stands of bitterbrush that existed in the Camas Creek area were destroyed. Stand-replacing fires occurred within the Little Gold, Poison, and Camas Creek drainages at mid-to-high elevations. The Deer Point Fire burned large areas and removed most winter forage in areas downlake from Coyote Creek where bighorn sheep have been observed to winter. Lack of forage for deer and bighorns was a concern during the winter immediately after the fire. Feeding stations were established but the winter was mild and the stations were underutilized. In the years following the fires, mild winters with little snowfall have occurred, allowing mule deer and bighorn sheep to maximize use of available forage along the north shore. The bighorns seem to have taken advantage of vigorous re-growth of grasses following the Rex Creek and Deer Point fires. Grass forage for bighorn sheep should continue to be good if noxious weeds (especially cheatgrass) do not invade too heavily.

Mule deer may suffer the effects of the Deer Point Fire for decades. Both bitterbrush and sagebrush are important browse plants for mule deer (Young and Clements 2002), especially during harsh winters along the north shore of Lake Chelan. During mild winters, deer feed on grasses and forbs much of the winter and supplement these forages with bitterbrush. However, during winters with deep snow, deer depend on sagebrush and bitterbrush because the erect, woody stems are available above the snow. Intense fires that burn sage and bitterbrush stands may increase the risk of malnutrition or starvation during harsh winters, potentially leading to population declines. Bitterbrush plants live a long time; up to 70 years (Young and Clements 2002). It will be decades before extensive stands of bitterbrush again cover the north shore of Lake Chelan. Bitterbrush is very difficult to grow from seed or seedlings, even under good conditions. Poor access, dry south-facing slopes that face the direct rays of the summer sun, low precipitation, the reduction of an existing seed source on site (in the form of mature plants), and very poor access for planting will all combine to make re-establishment of bitterbrush stands on the north shore of Lake Chelan difficult. The winters of 2002-03 through 2005-06 were very mild with little snow and few deer were seen at the lower elevations along the lake. There was no evidence that an above normal winter kill of mule deer occurred during the winters since 1996-97. However, during future winters with normal or above normal snow levels and duration, mule deer mortality along Lake Chelan may be high due to the lack of mature bitterbrush stands.

The Flick Creek fire started on 26 July 2006 and burned 7,993 acres of mixed low to mid-elevation forest between Purple Point Campground in Stehekin downlake to Fish Creek. The only area that has not recently burned along the north shore of Lake Chelan within the study area is the approximately two mile segment (lake mile 28-30) between Safety Harbor and Coyote creeks.

Until recently, the south shore had not seen a large wildfire in a number of years. The North 25-Mile Fire (8,845 acres) burned over some areas of winter range within the 25-Mile Creek and Box Canyon areas in 1998 (M. Lenz, pers. comm.). The Pot Peak (17,314 acres) and Deep Harbor (29,314 acres) fires burned large areas of the south shore in 2004. Much of the Deep Harbor complex burned through mixed coniferous forest in a mosaic. However, some areas (such as the Big Creek drainage) experienced stand-

replacing fire events. Additionally, some portions of the Pot Peak Fire burned into regenerating forest within the North 25-Mile fire area. In 2007, the Domke Lake fire burned approximately 11,791 acres of thick, coniferous forest from the South Fork of Bear Creek north and west to Railroad Creek.

ACKNOWLEDGEMENTS

Von Pope, Kelly Cordell-Stine, Eric Degman, Keith Truscott, Jon Gallie, and Matt Phillips conducted the winter big game surveys during the winter of 2010-11. Thanks to all who have helped to make these valuable surveys safe and enjoyable.

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Figure 1. Lake Chelan Winter Wildlife Study Area.

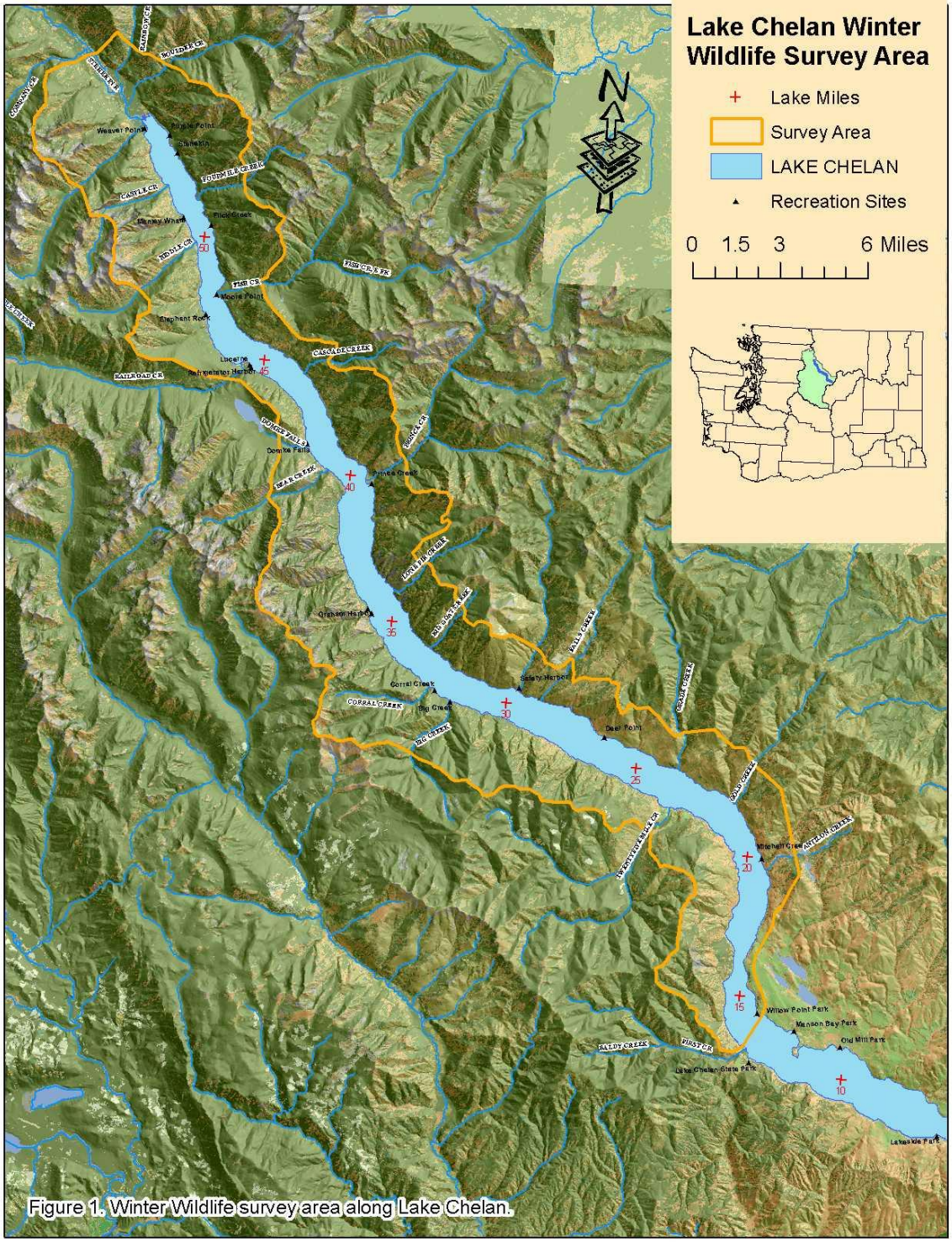
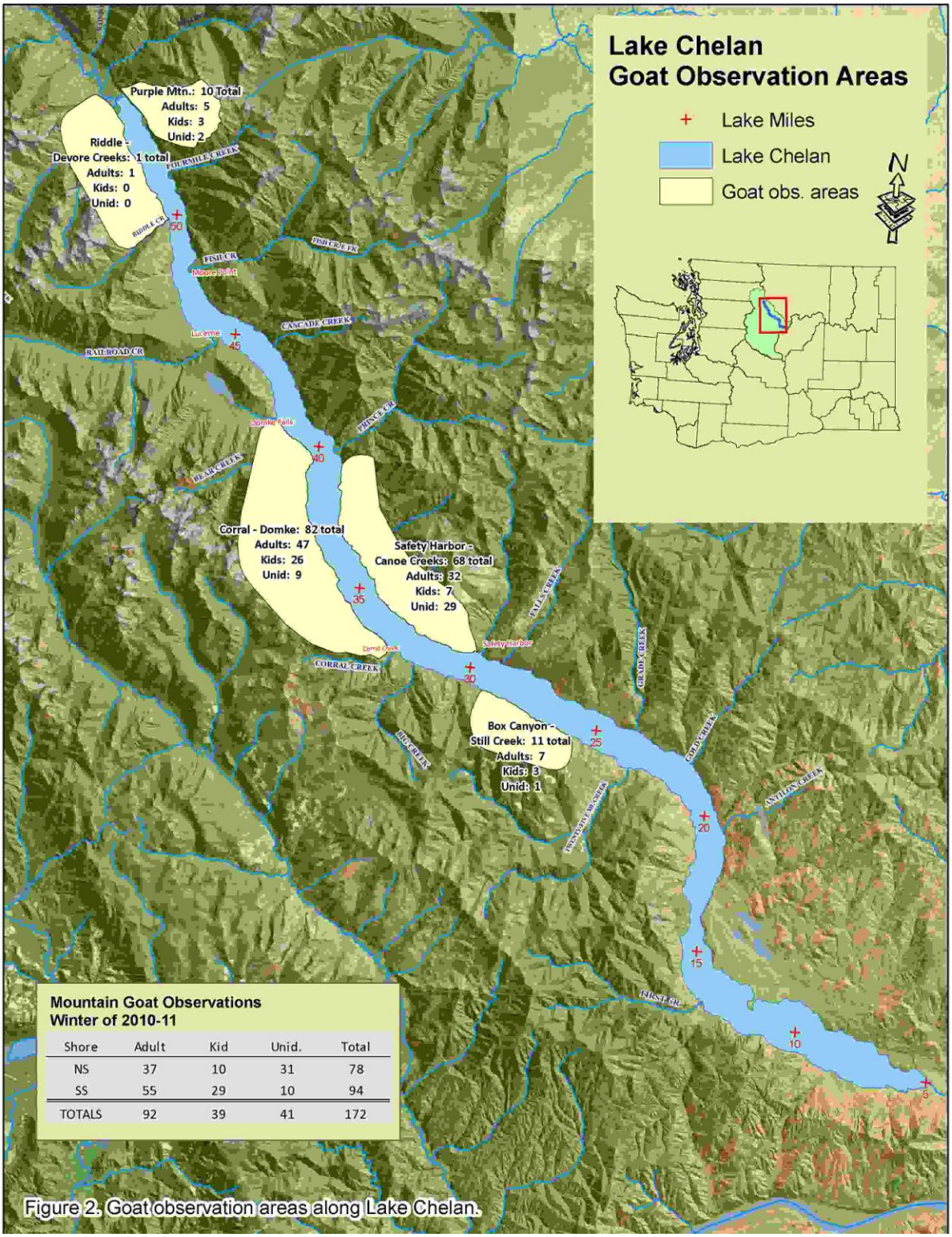


Figure 2. Goat observation areas along Lake Chelan; North shore and South shore groups observed during the winter of 2009 – 2011.



Shore	Adult	Kid	Unid.	Total
NS	37	10	31	78
SS	55	29	10	94
TOTALS	92	39	41	172

Figure 2. Goat observation areas along Lake Chelan.

Figure 3. Number of mountain goats estimated along Lake Chelan by shore including the Stehekin Valley during the winter seasons of 1982 - 2010.

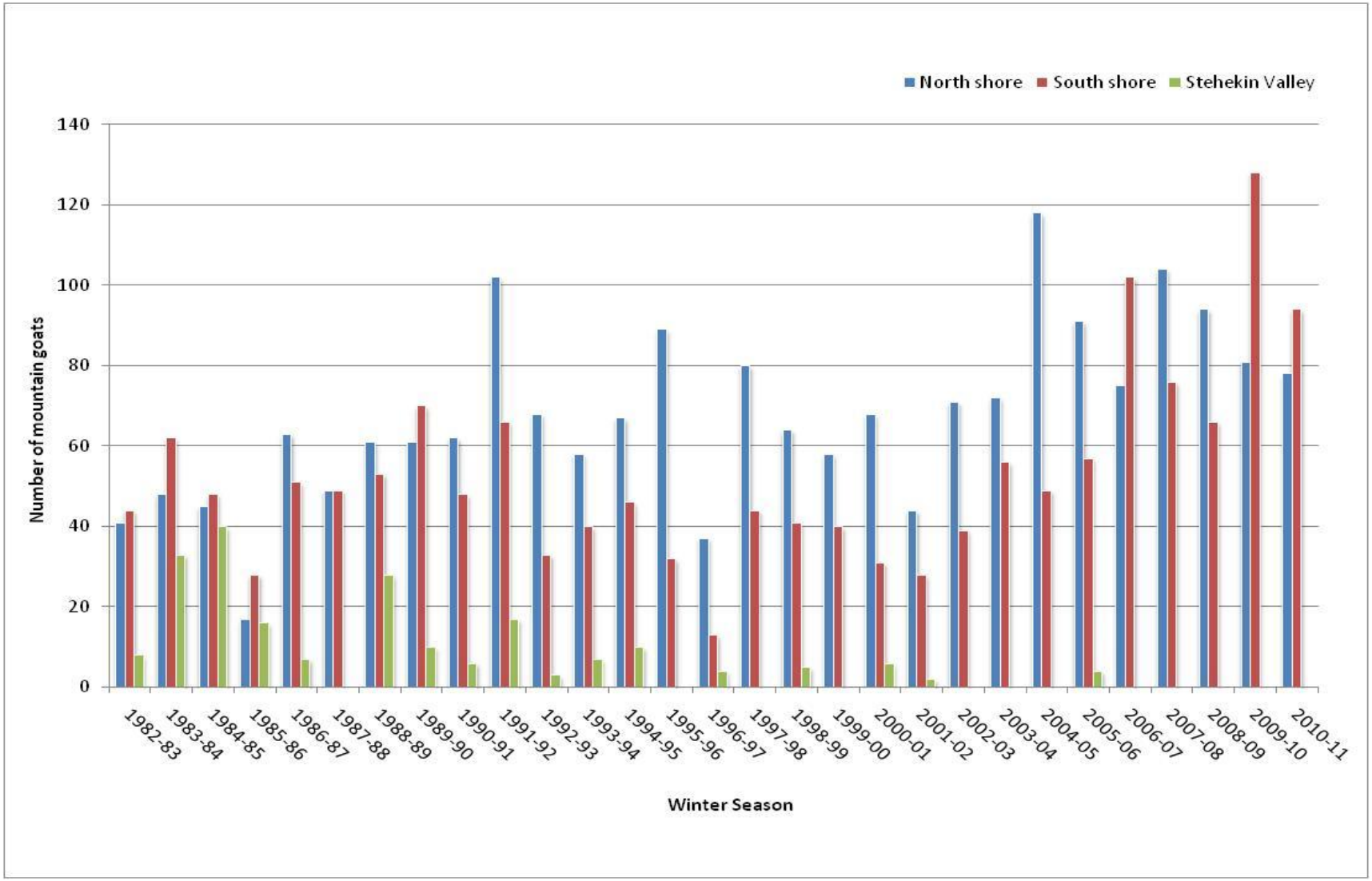


Figure 4. Mountain goat kid to adult ratios (kids/100 adults) for the entire survey area (north and south shores, including Stehekin Valley) during the winter seasons of 1982 - 2010.

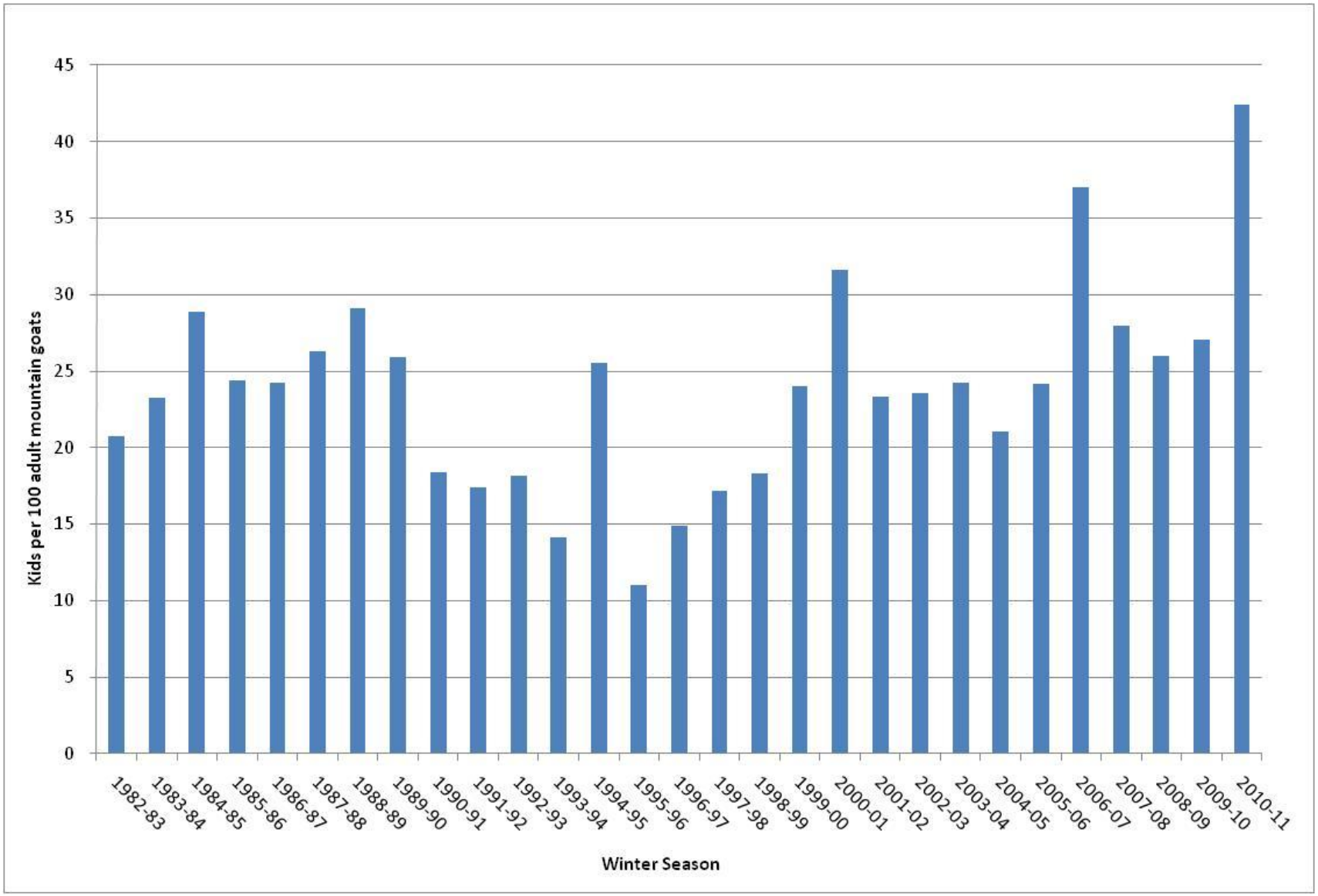


Figure 5. Mountain goat kids per 100 adults (by lakeshore) during the winter seasons of 1982-2010.

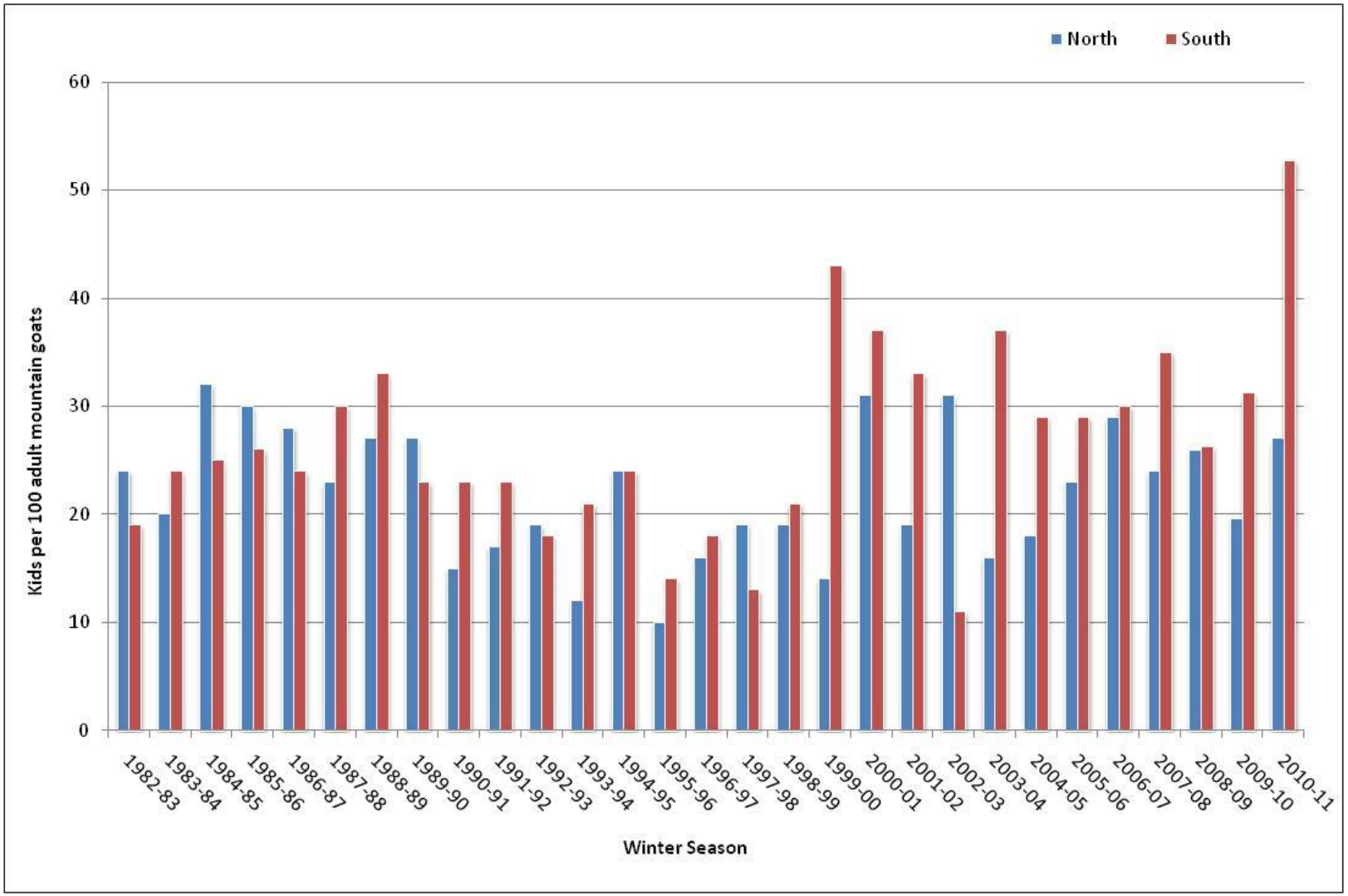


Figure 6. Ungulate maximum counts by year during the winter seasons of 1982-2010.

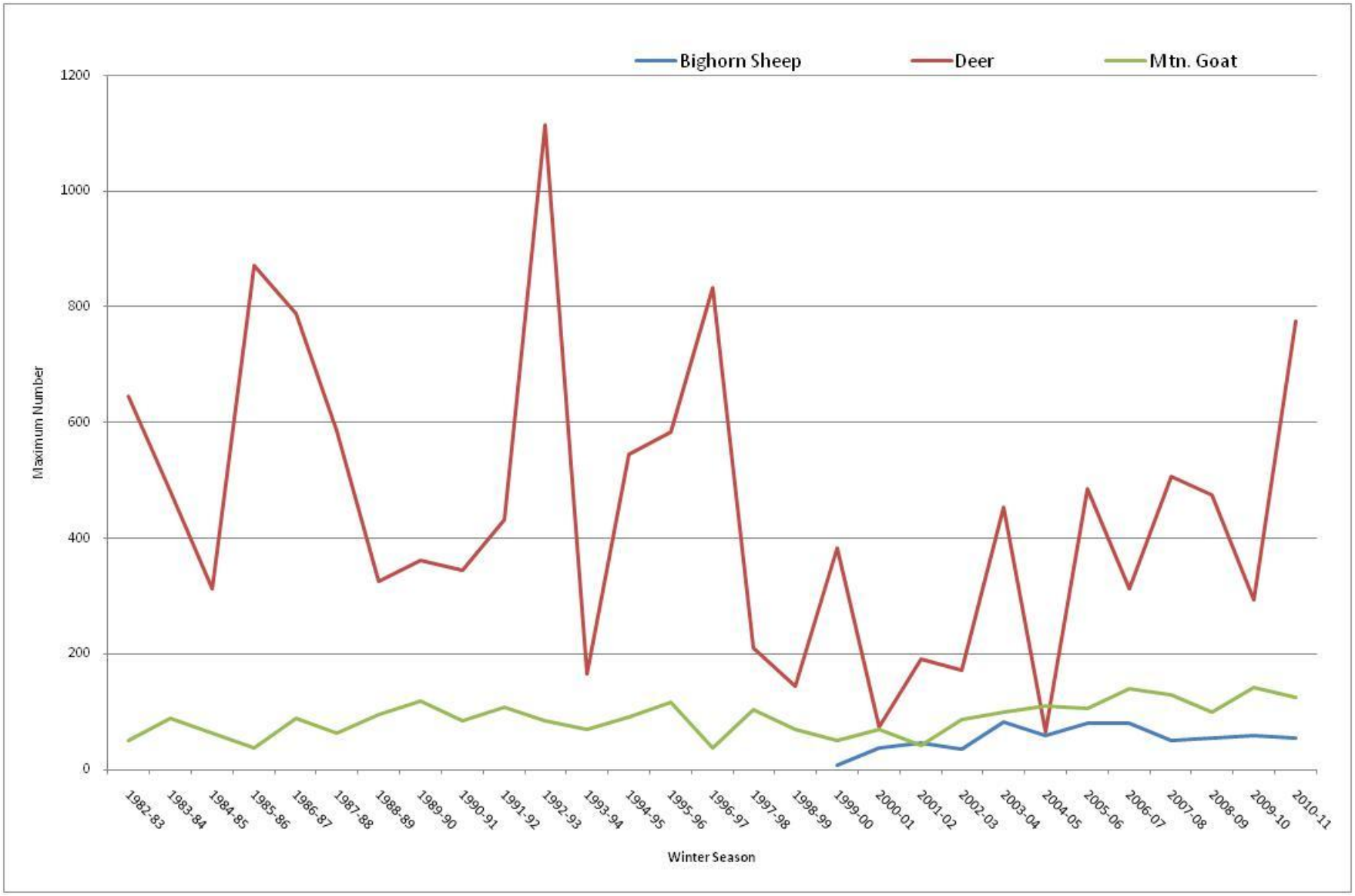


Figure 7. Mean number of deer observed per survey during the winter season on Lake Chelan Study Area 1982-2010.

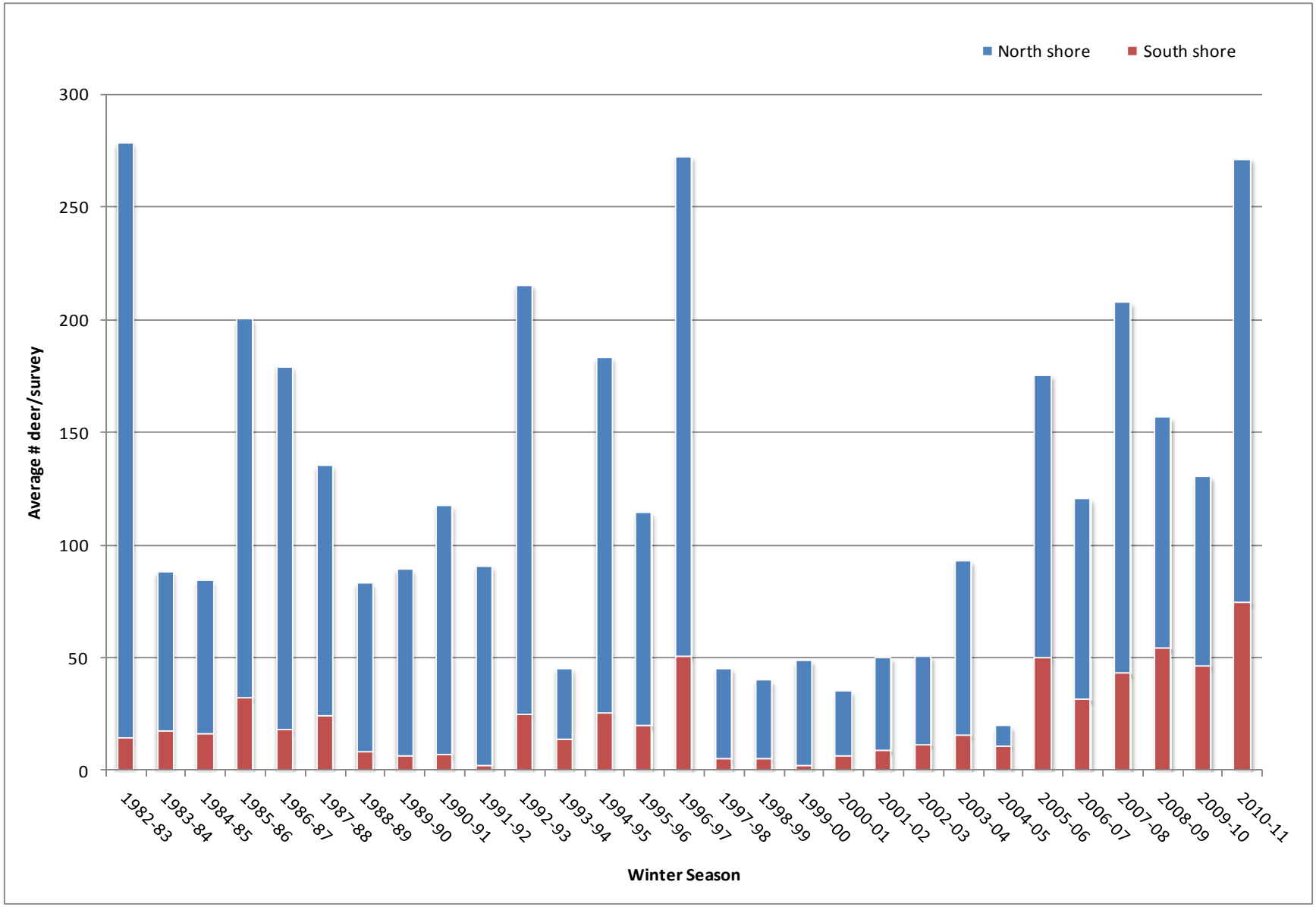


Figure 8. Avian composition by type represented as a percent of the total average of water birds observed for the Lake Chelan Study Area during the 2010-11 winter season.

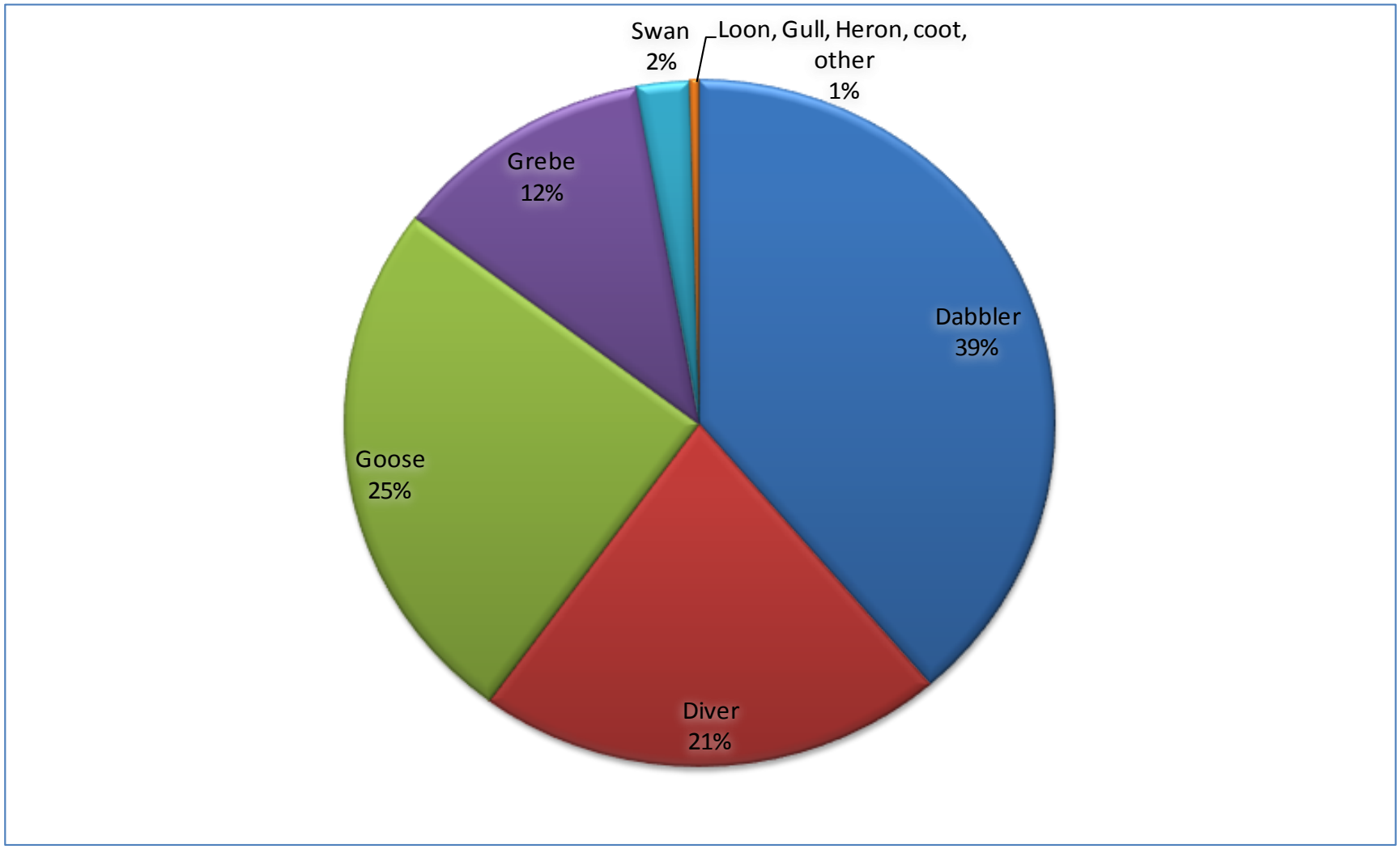


Figure 9. Composition of waterfowl (Family: Anatidae) observed for the Lake Chelan Study Area during the 2010-11 winter season.

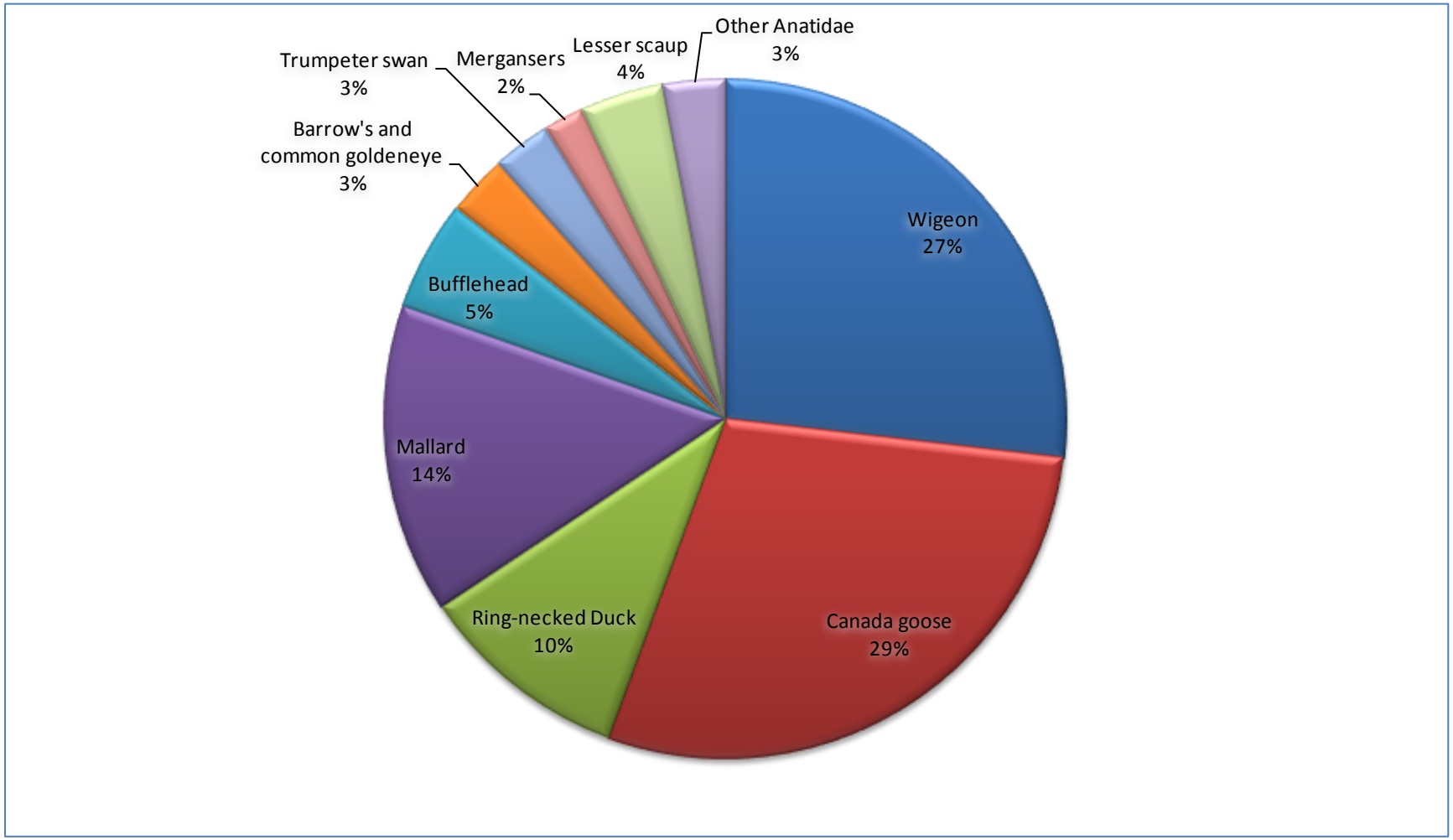


Table 1. Summary of cumulative wildlife observed during each winter period for the 2010-11 Winter season.

	Date	Mountain Goats	Deer	Bighorn Sheep	Bald Eagles	Golden Eagles	Waterfowl, grebes, & loons	Furbearer	Other
Early-Winter	1-Dec	106	19	54	4	0	404	3 coyotes	1 accipiter
	7-Dec	46	8	19	1	0	473	0	1 goshawk
	15-Dec	124	395	28	6	1	495	3 coyotes	1 goshawk
Mid-Winter	21-Dec	98	509	2	4	1	580	2 coyotes	1 goshawk 1 accipiter, 1 red-tailed hawk
	30-Dec	108	756	18	5	2	792	0	1 peregrine falcon
	4-Jan	74	604	28	8	2	994	0	2 gulls
Late-Winter	9-Feb	81	99	37	12	3	1,045	0	1 unid. eagle, 1 gull
	16-Feb	30	107	52	5	5	760	0	1 red-tailed hawk
	3-Mar	34	102	13	5	0	699	0	1 peregrine falcon, 1 gull
Green-up	17-Mar	83	279	46	5	3	702	0	2 red-tailed hawks
	23-Mar	94	217	8	3	1	479	1 black bear	1 peregrine falcon, 1 goshawk, 4 red-tailed hawks
	1-Apr	32	158	14	2	1	611	0	3 peregrine falcons, 1 red-tailed hawk
	Totals	**910**	**3,253**	**319**	**60**	**19**	**8,034**		

Table 2. Mountain goat production within the study area; winters of 1982-83 through 2010-11.

North shore (WDF&W goat unit #6)							South shore (WDF&W goat unit #7)							Stehekin Valley (WDF&W goat unit #21)							TOTAL LAKE CHELAN STUDY AREA						
Winter	Total	Adult	Kid	Unid	% kids	Kids/100 adults	Winter	Total	Adult	Kid	Unid	% kids	Kids/100 adults	Winter	Total	Adult	Kid	Unid	% kids	Kids/100 adults	Winter	Total	Adult	Kid	Unid	% kids	Kids/100 adults
1982-83	41	33	8	0	20	24	1982-83	44	37	7	0	16	19	1982-83	8	7	1	0	13	14	1982-83	93	77	16	0	17	21
1983-84	48	40	8	0	17	20	1983-84	62	50	12	0	19	24	1983-84	33	26	7	0	21	27	1983-84	143	116	27	0	19	23
1984-85	45	31	10	4	24	32	1984-85	48	36	9	3	20	25	1984-85	40	30	9	1	23	30	1984-85	133	97	28	8	22	29
1985-86	17	10	3	4	23	30	1985-86	28	19	5	4	21	26	1985-86	16	12	2	2	14	17	1985-86	61	41	10	10	20	24
1986-87	63	47	13	3	22	28	1986-87	51	41	10	0	20	24	1986-87	7	7	0	0	0	0	1986-87	121	95	23	3	19	24
1987-88	49	39	9	1	19	23	1987-88	49	37	11	1	23	30	1987-88	0	Poor weather conditions - no visibility					1987-88	98	76	20	2	21	26
1988-89	61	48	13	0	21	27	1988-89	53	40	13	0	25	33	1988-89	28	22	6	0	21	27	1988-89	142	110	32	0	23	29
1989-90	61	48	13	0	21	27	1989-90	70	57	13	0	19	23	1989-90	10	7	3	0	30	43	1989-90	141	112	29	0	21	26
1990-91	62	54	8	0	13	15	1990-91	48	39	9	0	19	23	1990-91	6	5	1	0	17	20	1990-91	116	98	18	0	16	18
1991-92	102	87	15	0	15	17	1991-92	66	52	12	2	19	23	1991-92	17	16	0	1	0	0	1991-92	185	155	27	3	15	17
1992-93	68	57	11	0	16	19	1992-93	33	28	5	0	15	18	1992-93	3	3	0	0	0	0	1992-93	104	88	16	0	15	18
1993-94	58	52	6	0	10	12	1993-94	40	33	7	0	18	21	1993-94	7	7	0	0	0	0	1993-94	105	92	13	0	12	14
1994-95	67	54	13	0	19	24	1994-95	46	37	9	0	20	24	1994-95	10	7	3	0	30	43	1994-95	123	98	25	0	20	26
1995-96	89	81	8	0	9	10	1995-96	32	28	4	0	13	14	1995-96	0	Poor weather conditions - no visibility					1995-96	121	109	12	0	10	11
1996-97	37	32	5	0	14	16	1996-97	13	11	2	0	15	18	1996-97	4	4	0	0	0	0	1996-97	54	47	7	0	13	15
1997-98	80	67	13	0	16	19	1997-98	44	38	5	1	12	13	1997-98	0	Poor weather conditions - no visibility					1997-98	124	105	18	1	15	17
1998-99	64	54	10	0	16	19	1998-99	41	34	7	0	17	21	1998-99	5	5	0	0	0	0	1998-99	110	93	17	0	15	18
1999-00	58	51	7	0	12	14	1999-00	40	28	12	0	30	43	1999-00	0	Poor weather conditions - no survey					1999-00	98	79	19	0	19	24
2000-01	68	52	16	0	24	31	2000-01	31	19	7	5	27	37	2000-01	6	5	1	0	17	20	2000-01	105	76	24	5	24	32
2001-02	44	37	7	0	16	19	2001-02	28	21	7	0	25	33	2001-02	2	2	0	0	0	0	2001-02	74	60	14	0	19	23
2002-03	71	54	17	0	24	31	2002-03	39	35	4	0	10	11	2002-03	Poor weather conditions - no survey						2002-03	110	89	21	0	19	24
2003-04	72	62	10	0	14	16	2003-04	56	41	15	0	27	37	2003-04	No survey						2003-04	128	103	25	0	20	24
2004-05	118	100	18	0	15	18	2004-05	49	38	11	0	22	29	2004-05	No survey						2004-05	167	138	29	0	17	21
2005-06	91	74	17	0	19	23	2005-06	57	42	12	3	22	29	2005-06	4	4	0	0	0	0	2005-06	152	120	29	3	19	24
2006-07	75	58	17	0	23	29	2006-07	102	71	31	0	30	44	2006-07	No survey						2006-07	177	129	48	0	27	37
2007-08	104	75	18	11	19	24	2007-08	76	49	17	10	26	35	2007-08	0	0	0	0	0	0	2007-08	180	124	35	21	22	28
2008-09	94	54	14	26	21	26	2008-09	66	38	10	18	21	26	2008-09	No survey						2008-09	160	92	24	44	21	26
2009-10	81	51	10	20	16	20	2009-10	128	93	29	6	24	31	2009-10	Poor weather conditions - no visibility						2009-10	209	144	39	26	21	27
2010-11	78	37	10	31	21	27	2010-11	94	55	29	10	35	53	2010-11	No survey						2010-11	172	92	39	41	30	42

Table 3. Average and maximum numbers of ungulate observations by species per survey during the winter seasons of 1982-83 through 2010-11.

	Average # Observed					Maximum # Observed				
	Mountain goats		Mule deer		Bighorn Sheep	Mountain Goats		Mule Deer		Bighorn Sheep
Winter	North shore	South shore	North shore	South shore	North shore	North shore	South shore	North shore	South Shore	North shore
1982-83	12.4	19.1	264.0	14.0		22	34	625	36	
1983-84	11.6	24.8	71.0	17.0		44	47	410	72	
1984-85	8.8	22.3	68.0	16.0		25	39	282	31	
1985-86	3.6	9.7	168.0	32.0		11	26	768	103	
1986-87	14.2	16.5	161.0	18.0		52	37	758	95	
1987-88	15.4	18.0	110.9	24.0		43	30	534	64	
1988-89	15.4	27.8	74.5	8.3		44	50	315	16	
1989-90	26.3	32.2	83.0	5.9		54	64	357	43	
1990-91	32.9	20.1	110.4	7.1		56	45	337	24	
1991-92	40.1	23.6	88.4	2.2		79	35	427	9	
1992-93	30.0	14.6	190.3	24.9		66	19	1039	75	
1993-94	19.4	14.8	31.8	13.3		52	28	156	32	
1994-95	29.8	14.0	157.5	25.4		59	31	536	69	
1995-96	27.3	10.5	94.3	19.8		86	30	539	81	
1996-97	10.5	3.2	221.5	50.5		35	8	709	123	
1997-98	25.3	11.6	40.3	4.8		70	34	211	34	
1998-99	27.6	11.6	34.8	4.9		56	24	143	32	
1999-00	13.3	7.3	46.3	2.2	1.3	34	20	375	8	2
2000-01	23.9	7.2	28.8	6.1	9.8	49	26	63	16	38
2001-02	14.0	9.8	41.3	8.6	10.2	29	27	192	29	46
2002-03	23.5	8.7	39.3	11.3	12.8	53	33	146	71	35
2003-04	26.0	17.2	77.3	15.3	29.4	77	48	388	65	82
2004-05	44.3	11.7	8.7	10.8	23.5	100	26	24	52	59
2005-06	28.3	18.0	125.4	49.7	37.5	78	41	429	160	79
2006-07	41.2	48.8	89.1	31.2	41.6	62	77	218	94	80
2007-08	48.4	20.8	164.4	42.9	28.8	97	42	388	131	51
2008-09	37.8	19.3	102.6	54.0	34.5	67	55	301	174	55
2009-10	36.3	59.5	83.8	46.3	34.7	56	108	257	111	58
2010-11	31.0	44.8	196.8	74.3	26.6	78	82	558	201	54
Average	**24.8**	**19.6**	**102.5**	**22.1**	**24.2**	**max. 100**	**max. 108**	**max. 1039**	**max. 201**	**max. 82**

Table 4. Lake Chelan study area wintering mule deer herd composition (percent by shore) during winter seasons of 1982-83 through 2010-11.

	North Shore					South Shore				
Winter	% Does	% Fawns	% Bucks	% Classified	% UnClassified	% Does	% Fawns	% Bucks	% Classified	% UnClassified
1982-83	57	37	6	68	32	68	30	1	87	13
1983-84	63	31	5	50	50	66	26	8	48	52
1984-85	52	37	11	23	77	71	24	5	39	61
1985-86	68	27	5	13	87	66	31	3	20	80
1986-87	75	23	3	25	75	54	29	17	16	84
1987-88	64	32	4	52	48	70	28	1	44	56
1988-89	68	30	3	25	75	74	19	7	27	73
1989-90	73	20	7	12	88	0	0	0	0	100
1990-91	76	13	11	22	78	57	6	37	55	45
1991-92	75	22	3	26	74	90	10	0	38	62
1992-93	66	29	4	20	80	60	23	18	27	73
1993-94	90	8	2	23	77	74	18	8	58	42
1994-95	67	25	7	33	67	68	27	4	51	49
1995-96	75	19	6	26	74	75	20	4	29	71
1996-97	81	16	3	58	42	80	16	5	53	47
1997-98	89	8	3	8	92	0	0	0	0	100
1998-99	77	21	2	9	91	50	30	0	3	97
1999-00	53	29	18	3	97	67	33	0	46	54
2000-01	66	32	3	47	53	68	26	6	51	49
2001-02	68	26	6	30	70	72	19	9	29	71
2002-03	66	33	0	2	98	56	21	13	12	88
2003-04	61	27	12	19	81	64	29	7	25	75
2004-05	64	36	2	42	58	64	32	4	22	78
2005-06	66	34	0	4	96	61	30	9	21	79
2006-07	55	37	8	86	14	51	29	20	86	14
2007-08	77	19	4	46	54	79	17	3	52	48
2008-09	82	17	2	63	37	74	21	5	51	49
2009-10	55	11	1	67	33	39	10	2	51	49
2010-11	65	25	10	61	39	43	18	11	72	28
AVG	**69**	**25**	**5**	**33**	**67**	**61**	**21**	**7**	**37**	**63**

Table 5. Average and maximum numbers of avian observations by species and type per survey during winters of 1982-83 through 2010-11.

	Average # observed per survey											Max. # observed per survey										
	Eagles											Eagles										
Winter	Bald	Golden	Coot	Dabbler	Diver	Goose	Grebe	Gull	Loon	Swan	Other/unid	Bald	Golden	Coot	Dabbler	Diver	Goose	Grebe	Gull	Loon	Swan	Other/unid
1982-83	1.3	1.8										5	8									
1983-84	3.7	2.8										12	4									
1984-85	2.1	1.6										8	3									
1985-86	1.9	0.9										7	2									
1986-87	1.3	0.5										6	2									
1987-88	2.8	1.6										10	3									
1988-89	1.9	1.4										5	7									
1989-90	0.8	0.6										3	2									
1990-91	1.9	1.8										6	5									
1991-92	1.0	0.2										6	1									
1992-93	2.4	1.2										9	6									
1993-94	2.1	0.5										6	3									
1994-95	2.0	1.6										9	8									
1995-96	3.5	1.7										7	5									
1996-97	9.7	3.4										27	6									
1997-98	3.5	0.8										7	4									
1998-99	4.0	2.1										7	4									
1999-00	2.7	1.3										7	5									
2000-01	2.3	1.8										6	4									
2001-02	3.0	1.8										9	8									
2002-03	5.0	1.1										14	4									
2003-04	5.3	2.9										13	9									
2004-05	3.2	1.5										6	4									
2005-06	4.9	2.5										12	6									
2006-07	5.8	2.7										13	6									
2007-08	5.3	2.7	2.8	190.8	128.0	119.1	36.8	0.7	1.0	20.5	60.6	10	7	7	603	202	218	71	2	4	37	347
2008-09	5.5	4.6	3.0	216.8	193.0	109.8	59.3	0.9	1.0	23.4	7.8	15	14	7	279	262	221	92	4	3	38	46
2009-10	7.6	2.7	0.3	116.7	147.1	61.0	73.6	0.1	0.7	13.5	0.5	15	5	2	249	313	284	113	1	3	17	4
2010-11	5.0	1.6	0.6	260.0	143.2	169.2	80.0	0.4	1.0	16.2	0.8	12	5	1	561	219	416	171	2	4	21	6
Average	**3.5**	**1.8**										**27**	**14**									

No water bird data available for 1982-83 through 2006-07.

No water bird data available for 1982-83 through 2006-07.

Table 6. Water bird species numbers observed and average by survey for the 2010-11 Winter Wildlife Survey, Lake Chelan.

	Survey												
Species	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Avg**
American Coot	1	1	1				1	1	1			1	0.6
American wigeon	166	136	176	159	203	165	162	152	147	143	102	184	157.9
Barrows goldeneye	5	8	3	7	8	39	11	14	19	11	8	12	12.1
Bufflehead	23	14	23	28	16	23	27	44	38	31	38	63	30.7
Canada goose	89	120	92	245	304	416	134	190	136	136	55	113	169.2
Common goldeneye	5	10	6		1	5	5	6	4	3	6	7	4.8
Common loon							3	4	3	1		1	1.0
Common merganser		12	2		2	8	3	4	8	3	2	6	4.2
Eared grebe										1			0.1
Gadwall			13	10	2	3	21	17	10	4	2		6.8
Great blue heron										1			0.1
Green-winged teal							10	12	17	22	20	12	7.8
Gull						2	1		1		1		0.4
Hooded merganser	11	13	20		18	5	5	4	6		2		7.0
Horned grebe	49	35	50	12	35	52	167	159	74	103	92	76	75.3
Lesser scaup	4	7	60	9	62	4	7	14	78	21	10	3	23.3
Mallard	23	43	28	22	138	190	367	33	67	58	35	35	86.6
Northern pintail							1	2	1	3	2	2	0.9
Pied-billed grebe		1	2					1	1				0.4
Redhead	3	1	3	3		4		2	3	1	1	1	1.8
Ring-necked duck	4	50		73		56	101	77	63	136	81	71	59.3
Trumpeter swan	14	11	15	6	16	17	16	20	19	21	19	20	16.2
Unidentified (any)	2	6	1	2	1								1.0
Western grebe	6	5		4		7	4	4	4	4	4	4	3.8
	405	473	495	580	806	996	1046	760	700	703	480	611	671.3