



PUBLIC UTILITY DISTRICT NO. 1 of CHELAN COUNTY

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April 30, 2009

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. 637-042**
Article 406 – Wildlife Habitat Plan
Annual Winter Wildlife Survey Report for 2008

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 2008 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 regarding any questions or comments regarding this report.

Sincerely,

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Enclosure

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¹ 123 FERC ¶ 62,039 (2008) at P. 3

LAKE CHELAN WINTER WILDLIFE STATUS REPORT

WINTER of 2008-2009



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Public Utility District No. 1 of Chelan County
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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 (Fielder and McKay 1984). On March 31, 2004, the existing license expired, though monitoring continued during annual licenses. On November 6, 2006, a new operating license was awarded to Chelan PUD (FERC 2006). On April 10, 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) at a cost not to exceed \$10,000. During consultation on new Lake Chelan Wildlife Plan, the Lake Chelan Wildlife Forum elected to add water birds (other species, too? I thought that eagles, passerines [like that word, Von?!] etc. were added for the new license, and only deer, sheep, and goats were counted previously?) 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 annually in the Lake Chelan Winter Wildlife Status Report which is due by April 30 each year and is provided to the Washington Department of Fish and Wildlife (WDFW), U.S. Fish and Wildlife Service (USFWS), USDA Forest Service, and the National Park Service.

Lake Chelan provides a unique opportunity to monitor big game, waterfowl, eagles, and furbearers that tend to concentrate 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 where sampling for browse use occurred. More recently, the Flick Creek and Domke Lake Fires on the south shore have further altered the habitat along Lake Chelan. Browse and pellet transects are not included as an objective for the new Lake Chelan License. This report summarizes winter wildlife monitoring along Lake Chelan for the winter of 2008-2009.

STUDY AREA

Lake Chelan lies on the east slope of the Cascade Mountains in northern Chelan County in central Washington. 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 53).

METHODS

Survey Methods

Each winter season, Chelan PUD conducts 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 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 two people conducted the surveys from an open boat to maximize visibility. The boat is driven at a slow cruising speed (~3,200 rpm) usually within 100 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*) (Feldhamer et al. 2003) 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, occasionally, black-tailed (*O. h. columbianus*) or white-tailed deer (*Odocoileus virginianus*) are observed 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. Historically, the number of goats seen has varied from zero to 40.

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). Winter surveys are optimum for gathering data on bighorn sheep abundance, age, and distribution because the sheep congregate on winter range at relatively lower elevations (Geist 1971). Bighorn sheep were re-introduced on the north shore of Lake Chelan in 1999. In 2009, 12 bighorn sheep were radio-collared by WDFW to further monitor this population. Information on bighorn sheep relative abundance and age and sex ratios is important for monitoring and managing this re-introduced herd.

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 calculate fawn ratios, only surveys that have a classification rate of 30% or greater are used to calculate fawn 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 2008-2009, 12 surveys were conducted between 25 November, 2008 and 26 March, 2009. Three surveys were conducted during each of the four winter periods (Table 1). The area surveyed was consistent and complete for all surveys although visibility was reduced during a portion of four surveys due to low clouds and/or snow. 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 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 2008-09, an average of 67.7, 35.7, 52.7, and 72.0, 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 26 to 99 (Table 1). The maximum number of mountain goats observed on any survey during the 2008-09 winter seasons was 99, on 3 December, 2008. The maximum number observed ($n = 67$) along the north shore occurred during the last survey (26 March, 2009), whereas the maximum number along the south shore ($n = 55$) occurred on 3 December, 2008. The Stehekin Valley was not surveyed during the 2008-2009 study period.

Estimated numbers

The minimum number of goats estimated for the 2008-09 winter survey was 160 (Figure 2), down slightly from 180 in 2007-08. The estimated number of mountain goats observed on the south shore ($n = 66$) was down considerably from the 2006-2007 winter season estimate of 102 (Cordell et. al. 2007). The estimated number of mountain goats on the north shore ($n = 94$) is down slightly this year (Table 2). Trend data (1982 to 2008) for estimated mountain goat population numbers (Figure 3) shows that typically, the north shore has had more mountain goats, with the exception of the 2006-07 winter survey (Table 2). While bands of goats were seen in similar places along each shore in 2006-07 and 2007-08, the numbers of goats observed in each band during the 2008-09 surveys were higher than the previous winter along the south shore and lower along the north shore. Therefore, if some individuals were missed entirely during 2006-07 on the north shore or in 2007-08 along the south shore, the total population could be much

higher than the estimated minimum of 160 mountain goats. Even so, estimated numbers of goats observed for 2008-09 survey are the third highest since Chelan County 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 26 kids/100 adults was observed (Figure 4). We observed 25.9 kids/100 adults (average = 22.0) along the north shore and 26.3 kids/100 adults (average = 26.0) along the south shore during the 2008-09 winter season. Recently, average kid ratios have been higher along the south shore compared to that of the north shore (Table 2).

During the 1990's, the ratio of kids/100 adult goats along the north shore was relatively low compared to ratios observed during the 1980's and during the last seven winters. The recent series of consecutive mild winters has likely influenced higher kid production and survival along Lake Chelan. In the early 1980's, kid ratios seemed 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).

It appears that much of the available mountain goat winter range along Lake Chelan is unutilized by mountain goats. We have seen a trend in which goats are 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 are being used by fewer goats. These areas include: Bear Creek, Graham Harbor Creek, Pyramid Creek, Canoe Creek, the area along the south shore between Wolverine Creek and the NW end of the lake, and within the Stehekin Valley (Fielder and McKay 1984). Washington Department of Game surveys that were conducted between 1954 and 1970 (Fielder and McKay 1984) also recorded greater mountain goat use in areas compared to what we have seen in the last decade.

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 has been closed since the 1980 hunting season, except for 1-2 tags which have been issued since 2001. But the overall goat population has not shown an increasing trend as a result (Figure 3). 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 shown little 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. 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 27 years of data on mountain goat abundance, distribution, and kid to adult ratios for the north and south shores of Lake Chelan. We may learn the effects of fire on goat winter range by continuing to monitor the population trends of goats along the Lake. Since the Rex Creek fire, we have seen goat numbers increase along the north shore of the lake, but we have also seen kid ratios lag behind those of the south shore.

Deer

During the 2008-09 winter season 1,879 deer were observed for all surveys combined (Table 1). Of all deer recorded, 66% (n = 1,231) were observed on the north shore and the remaining 34% (n = 648) on the south shore. The greatest number of deer observed on a single survey was 475 (March 11, 2009) during the spring green-up period. This survey day produced the highest numbers observed on both the north (n = 301) and south shore (n = 174). Average deer numbers for the early, mid, late, and green-up winter periods were 25, 79, 167, and 356, respectively. The average number of deer observed on the South shore (54.0) was the highest observed in the history of the survey and well above the 27 year average (Table 3). North shore deer numbers were slightly above the 27-year average.

For all surveys, 1,108 deer (59%) were classified by age (adult or juvenile). Along the north shore, 63% (n = 778) of deer observations were classified compared to 51% (n = 330) along the south shore (Table 4). The fawn ratio (fawns/100 adults) for the 208-09 winter season was 21.5 fawns/100 adults (excluding surveys in which less than 30% of observed animals were classified). The south shore exhibited a higher fawn ratio this season than the north shore with 25.2 and 20.1 fawns/100 adults respectively.

During the early and mid winter periods 27 bucks were classified. Buck ratios ranged from 0 bucks/100 does (November 25, 2008) to 25.0 bucks/100 does (3 December 2008). The average number of bucks/100 does for all six surveys was 11.3 bucks/100 does. Buck ratios on the north shore ranged from 0.0 to 12.5 (3 December 2008) and averaged 7.5 for the early and mid winter periods combined. Buck ratios on the south shore were much higher overall (17.7 bucks/100 does). However, bucks were observed on 83% of the surveys along the south shore, whereas bucks were observed on 50% of the surveys along the north shore during the early and mid winter periods. The average number of 1, 2, 3, and 4 point bucks for the early and mid-winter period combined was 1.3, 1.5, 0.7, and 0.5, respectively.

Along the south shore, 92% of the 648 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). Sixty-five percent of all mule deer observations on the north shore occurred within a 9-mile segment of shoreline between Antilon Creek (lake mile 19) and Coyote Creek (lake mile 28). 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.

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 access the lower elevations of winter range where they are easily visible from the lake. However, the 2008-09 survey average of 157 deer per survey is above-average (AVG = 119) for the 27-year history of this monitoring; and ranks as the 9th highest average observed (Table 3).

Bighorn Sheep

Bighorn sheep were observed during every boat survey during the 2008-09 winter season. The average number of bighorn sheep observed during early, mid, late, and green-up periods was 39, 35, 33, and 30, respectively. The highest numbers of bighorn sheep observed were 55, 50, and 49 bighorn sheep on 18 March, 30 December, and 3 December, respectively. This maximum is lower than maximum numbers observed in the previous years (Table 3). The minimum number of sheep observed (n=4) occurred on March 11, the day following WDFW's spring radio-collaring capture effort (Table 3). Newly collared sheep were observed during subsequent surveys. All bighorn sheep observed on the north shore were located within lake miles 18 and 35 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 72% of all bighorn sheep recorded during the 2008-09 winter season and observed an average of 35 bighorn sheep, with the maximum of 55 recorded on March 18, 2009. An average of 15 ewes was observed on each survey. The ratio of rams/100 ewes observed was 59.0 rams/100 ewes. For the rams classified we observed a maximum of 4-Class I, 8-Class II, 6-Class III, and 7-Class IV rams for any one survey. The lamb ratio was 8.4, substantially lower than the previous year's estimate of 17.3 lambs/100 ewes. The maximum number of lambs observed was 4 and occurred on 26 March 2009. Since trend data on sex ratios has not been collected in the past, future surveys will help determine if the number of ewes has really decreased or whether some groups of ewes and lambs were missed entirely during this past winter season. This information will be important to assist game managers in the future with regard to the north shore bighorn sheep population.

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, WDF&W 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.

The sheep population has grown well since their reintroduction. Winter big game survey sightings of bighorn sheep ranged from Stink Creek (lake mile 17) to Lone Fir Creek (lake mile 36). Most sightings (94.2%) have occurred between Antilon Creek and the vicinity of Safety Harbor Creek, with the largest concentration of observations (60.6%) 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 (5.5) during the 2008-09 winter season was relatively high compared to the historical average of 3.3 per survey (Table 5). During the 2008-09 winter season, we recorded the highest average (4.6) of golden eagles (*Aquila chrysaetos*) among all years, well above the average of 1.6 per survey. The maximum number of golden eagles

observed during any one survey was 14. Eagle species are observed sporadically along either shore of the lake and are often found in large numbers associated with carrion on or near the shoreline.

Numbers of wintering waterfowl (Family Anatidae) and other water birds (grebes, gulls, loons) along Lake Chelan are a new addition to the winter wildlife surveys with 2008-09 being the second 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. Waterfowl were concentrated primarily at the confluence of the Stehekin River with Lake Chelan with 75% (n = 5,513) of all observations (n = 7,356) occurring in the upper mile of the lake near Stehekin.

The composition of water birds observed was dominated by waterfowl which averaged 548.0 observations per survey and accounted for 90% of the total average (613.0) of all water birds observed for all surveys (Figure 7). American wigeon (*Anas Americana*) were the most abundant waterfowl species observed and comprised 26.9% of total waterfowl observations, followed by Canada geese (*Branta canadensis*) (20.0%), ring-necked duck (*Aythya collaris*) (15.1%), mallard (*Anas platyrhynchos*) (10.7%), bufflehead (*Bucephala albeola*) (9.4%), and Barrow's goldeneye (*Bucephala islandica*) (3.9%). Other species such as trumpeter swans (*Cygnus buccinator*), redhead (*Aythya Americana*), canvasback (*Aythya valisineria*), 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 2008-09 winter season (Figure 8). In 2008-09, we observed a maximum of 38 trumpeter swans, including 6 cygnets. Last season's high count was 37 swans. Table 6 shows the number and species of waterbirds observed during the 2008-09 winter season.

Other water birds observed during the 2008-09 winter season included a surprising number of grebes (Podicipedidae), averaging 59.3 grebes per survey. Grebe species observed included horned (*Podiceps auritus*), pied-billed (*Podilymbus podiceps*), and western (*Aechmophorus occidentalis*). Horned grebes were the most common species observed by far. We observed a maximum of 90 horned grebes (25 November 2008) with an average of 55.8 horned grebes for the winter season. Unlike the waterfowl, horned grebes were distributed throughout the survey area, with observations in 81% of the lake miles surveyed. Common loons (*Gavia immer*) were also observed occasionally, with a maximum of 3 observed on 11 December 2008. 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 2008-09 winter season.

During the 2008-09 winter season biologists also observed one bobcat (*Lynx rufus*), one cougar (*Puma concolor*), nine coyotes (*Canis latrans*), one northern goshawk (*Accipiter gentilis*), two peregrine falcons (*Falco peregrines*) and a dead adult goat. 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. Coyotes were seen during 3 consecutive surveys in mid-late December. A bobcat was observed moving across the rocks near a group of deer in early January, and a cougar was observed in early March as it was overlooking a small herd of deer from a rock outcrop. The dead goat was found on the last survey of the year along the south shore. The peregrine falcons were observed in late March 2009 attempting to catch prey along the south shore. Their first attempt was unsuccessful; however, one of the pair was successful during a second attempt, obtaining a horned grebe within approximately 100m of our boat.

Fire Influence

The north shore has experienced a number of fires within the last few years. 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 August 12, 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 July 26, 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

Eric Degman, Keith Truscott, Jeff Osborn, Jon Gallie, Dave Volsen, and Andrew VanWechel assisted with the winter big game surveys during the winter of 2008-09. Winter surveys along the lake can be taxing—the open boat is cold, weather can be difficult, and driving conditions to and from the lake can be treacherous. Not only is it important to have competent surveyors; good company on these long, cold days is equally imperative. 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.

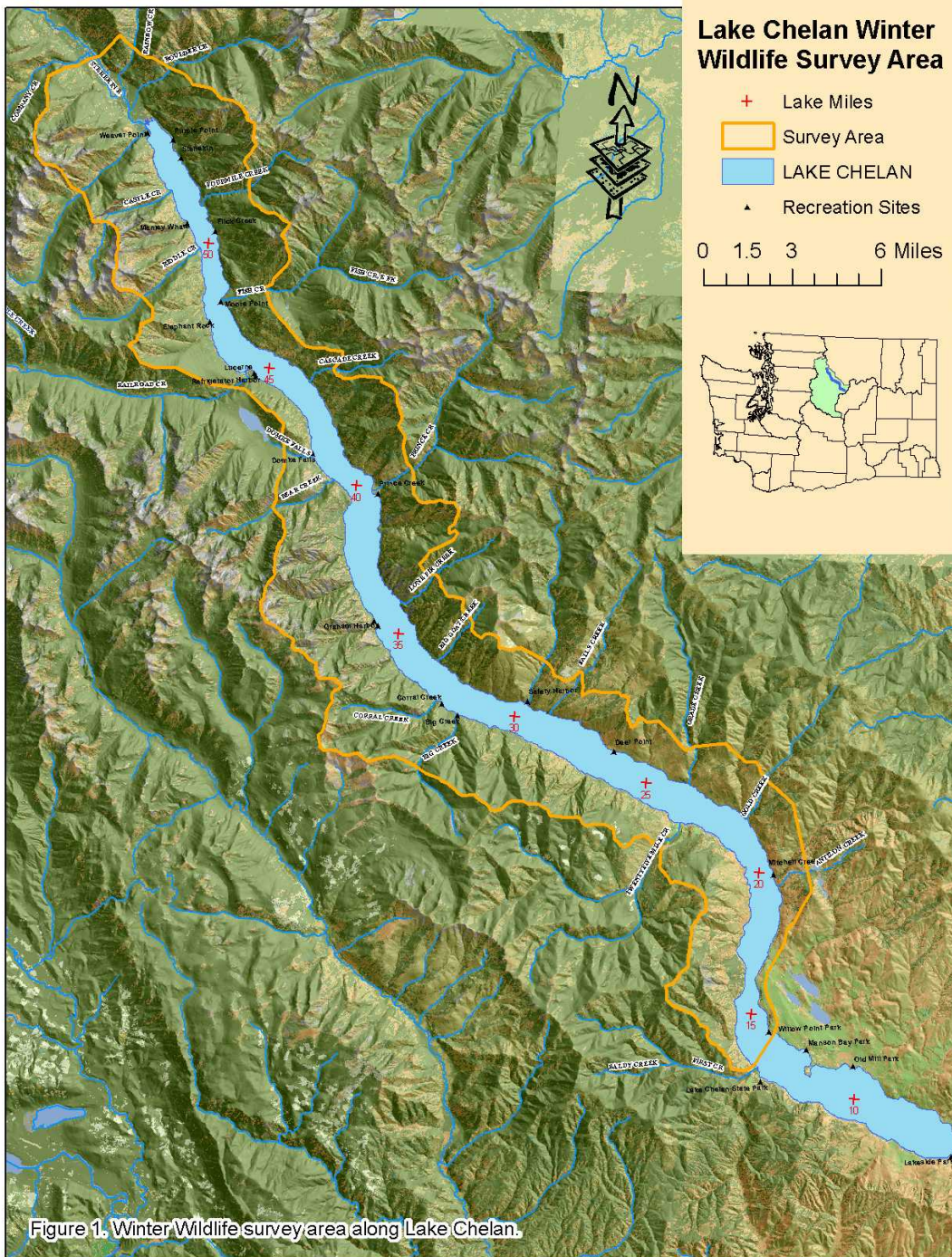


Figure 1. Winter Wildlife survey area along Lake Chelan.

Figure 2. Goat observation areas along Lake Chelan; North shore and South shore groups observed during the winter of 2008 – 2009.

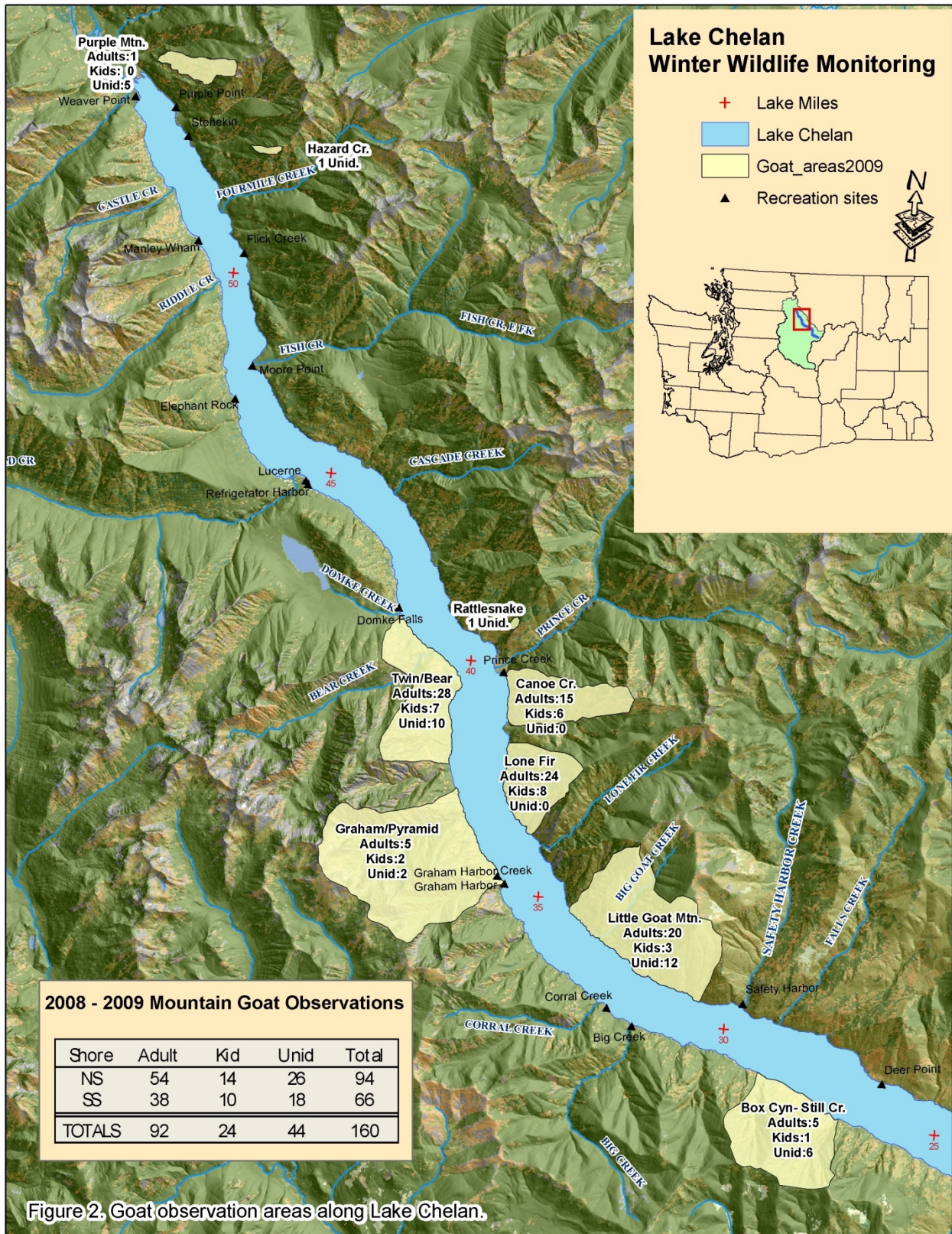


Figure 2. Goat observation areas along Lake Chelan.

Figure 3. Number of mountain goats estimated along Lake Chelan by shore including the Stehekin Valley during the winter seasons of 1982 - 2008.

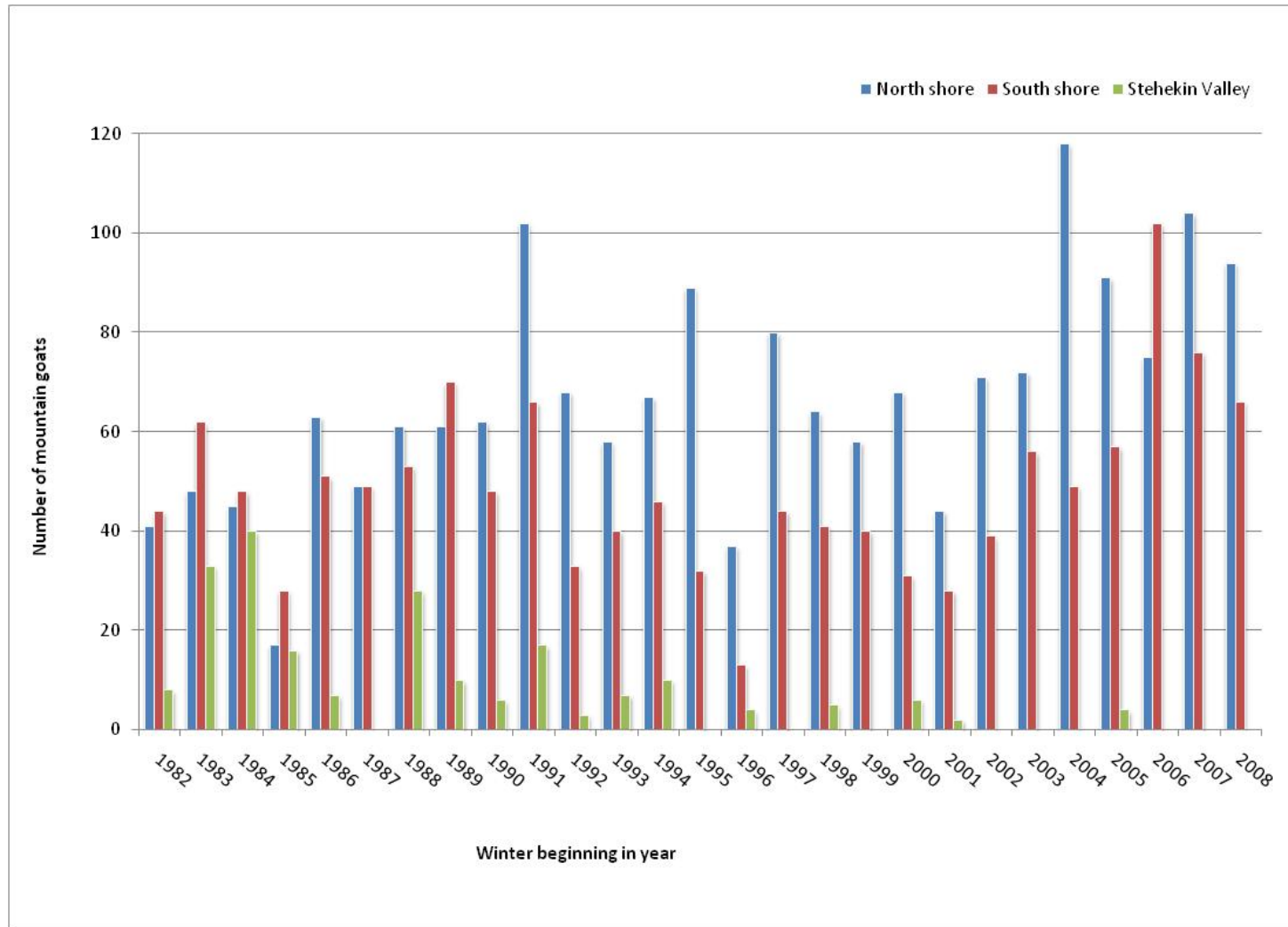


Figure 4. Mountain goat kid to adult ratios (kids/100 adults) for the entire survey area (north and south shores, including Stehekin Valley) during the winter seasons of 1982 - 2008.

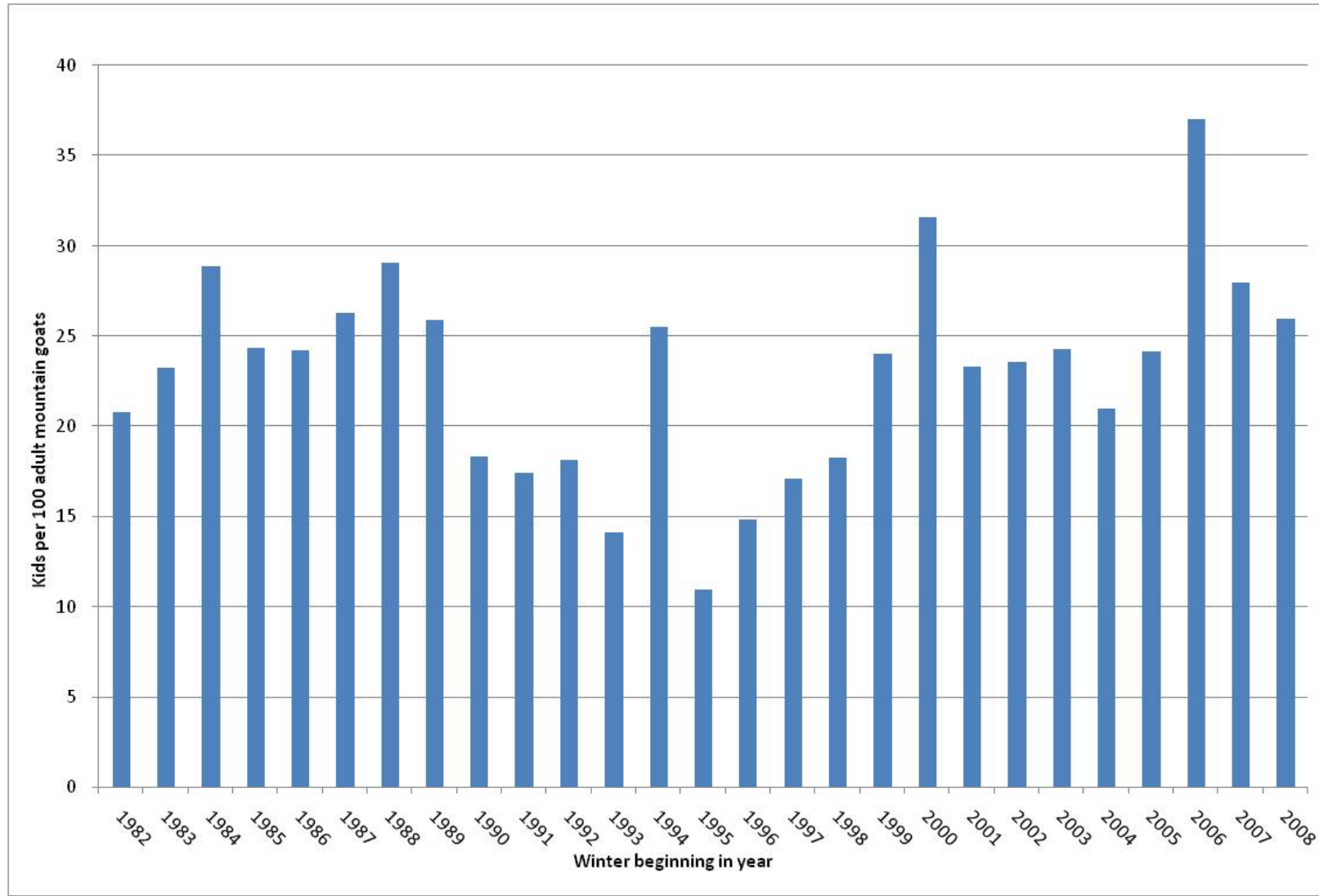


Figure 5. Mountain goat kids per 100 adults (by lakeshore) during the winter seasons of 1982-2008.

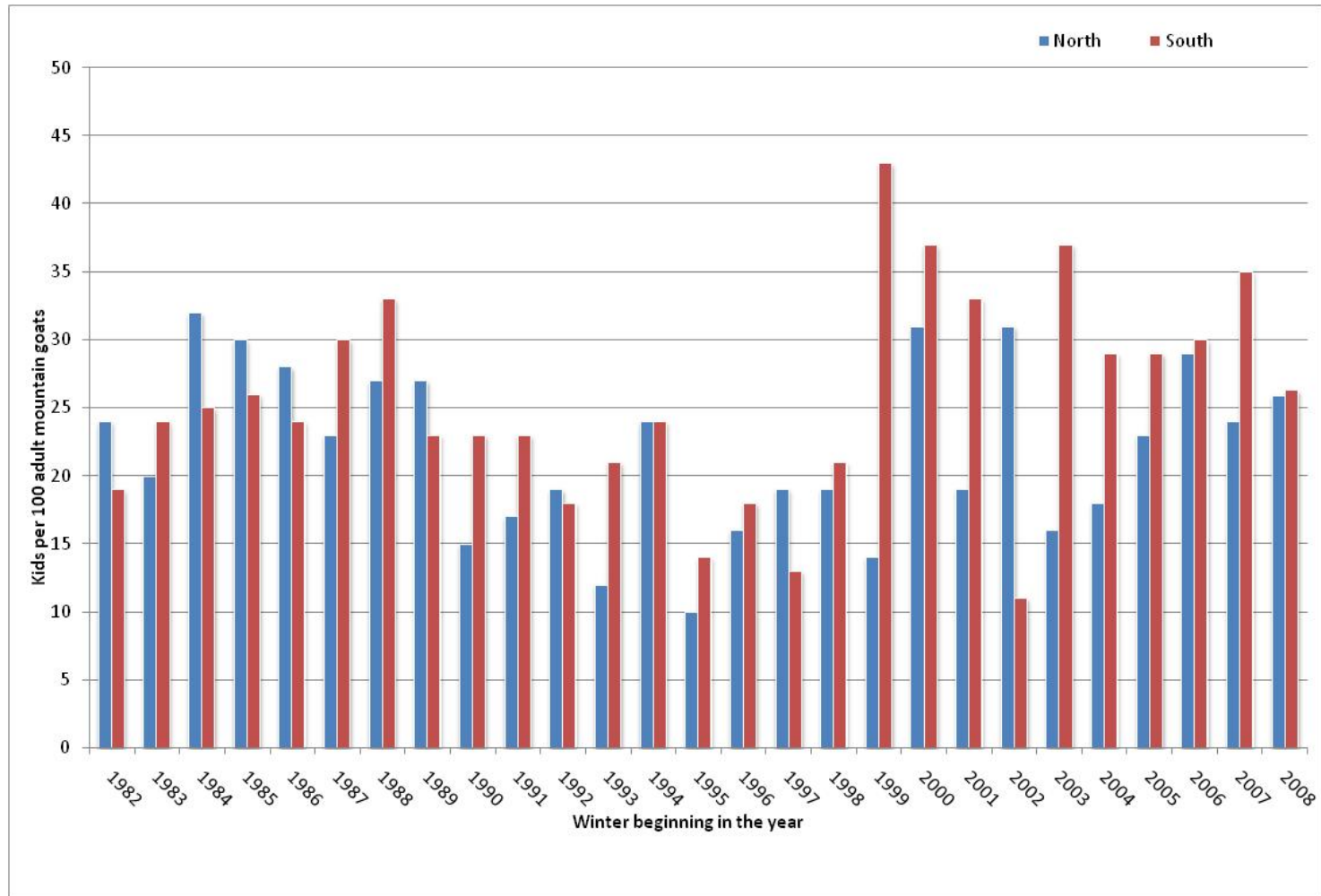


Figure 6. Mean number of deer observed during the winter season on Lake Chelan Study Area 1982-2008.

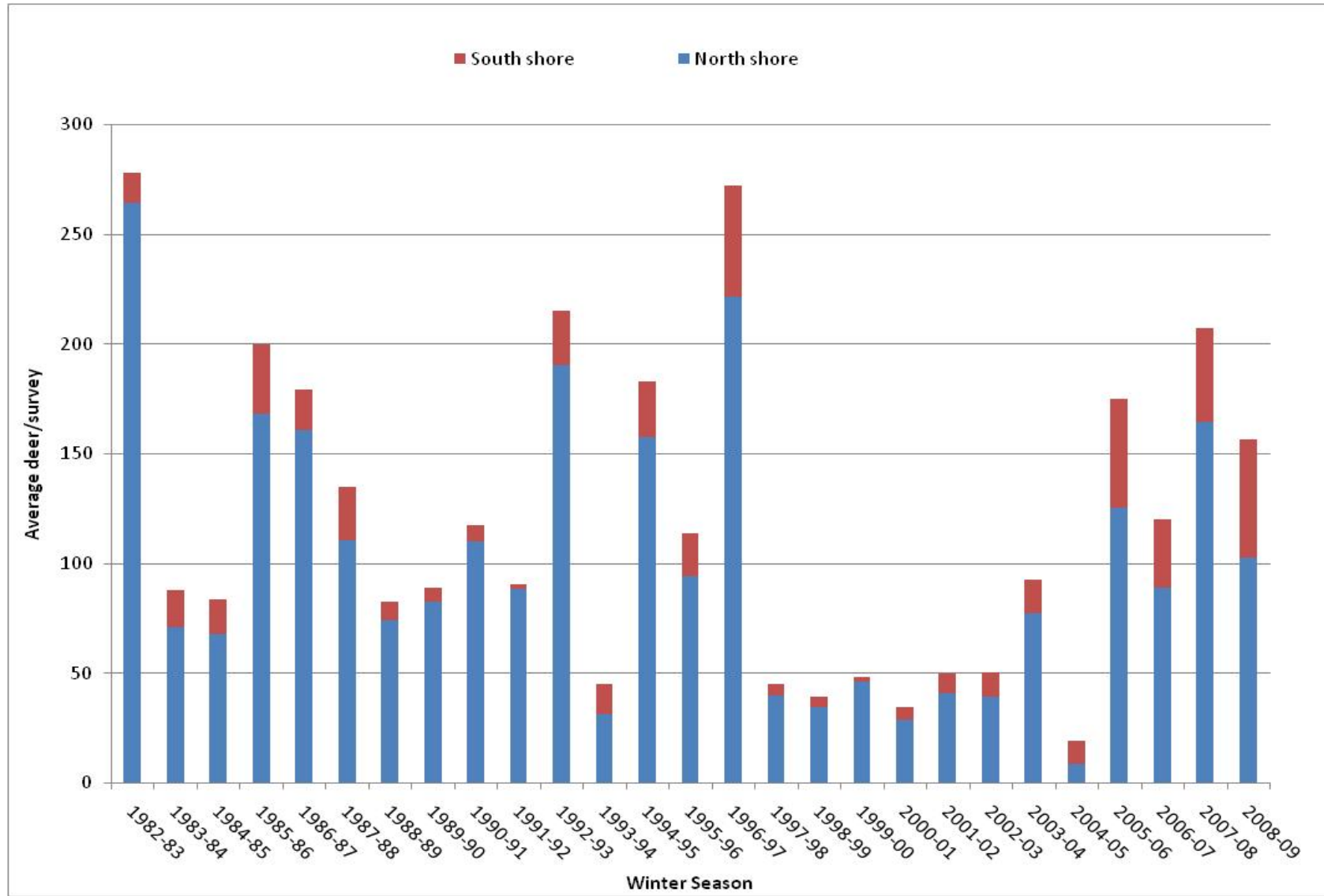


Figure 7. Avian composition by type represented as a percent of the total average of water birds observed for the Lake Chelan Study Area during the 2008-09 winter season.

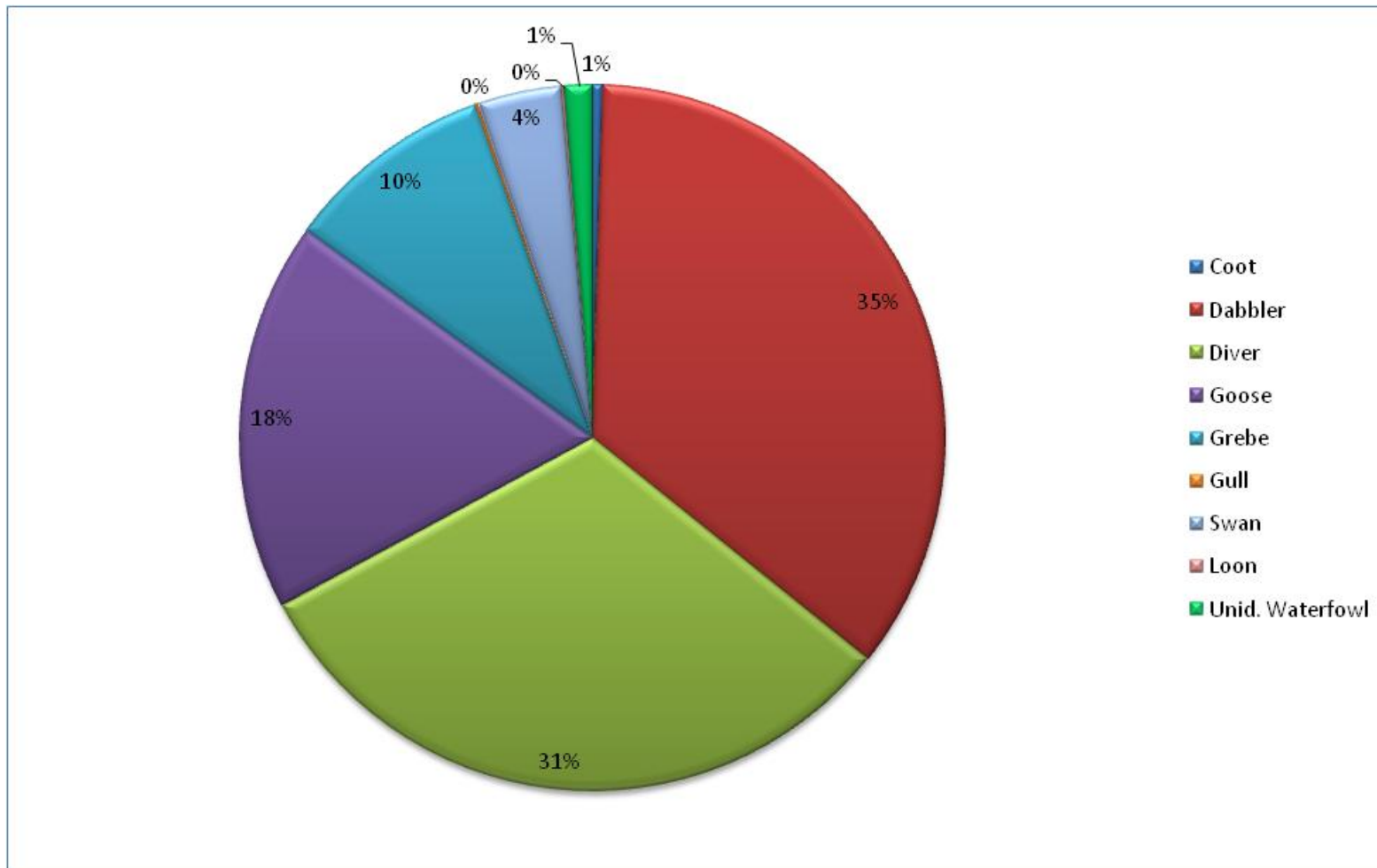


Figure 8. Composition of waterfowl (Family: Anatidae) observed for the Lake Chelan Study Area during the 2008-09 winter season.

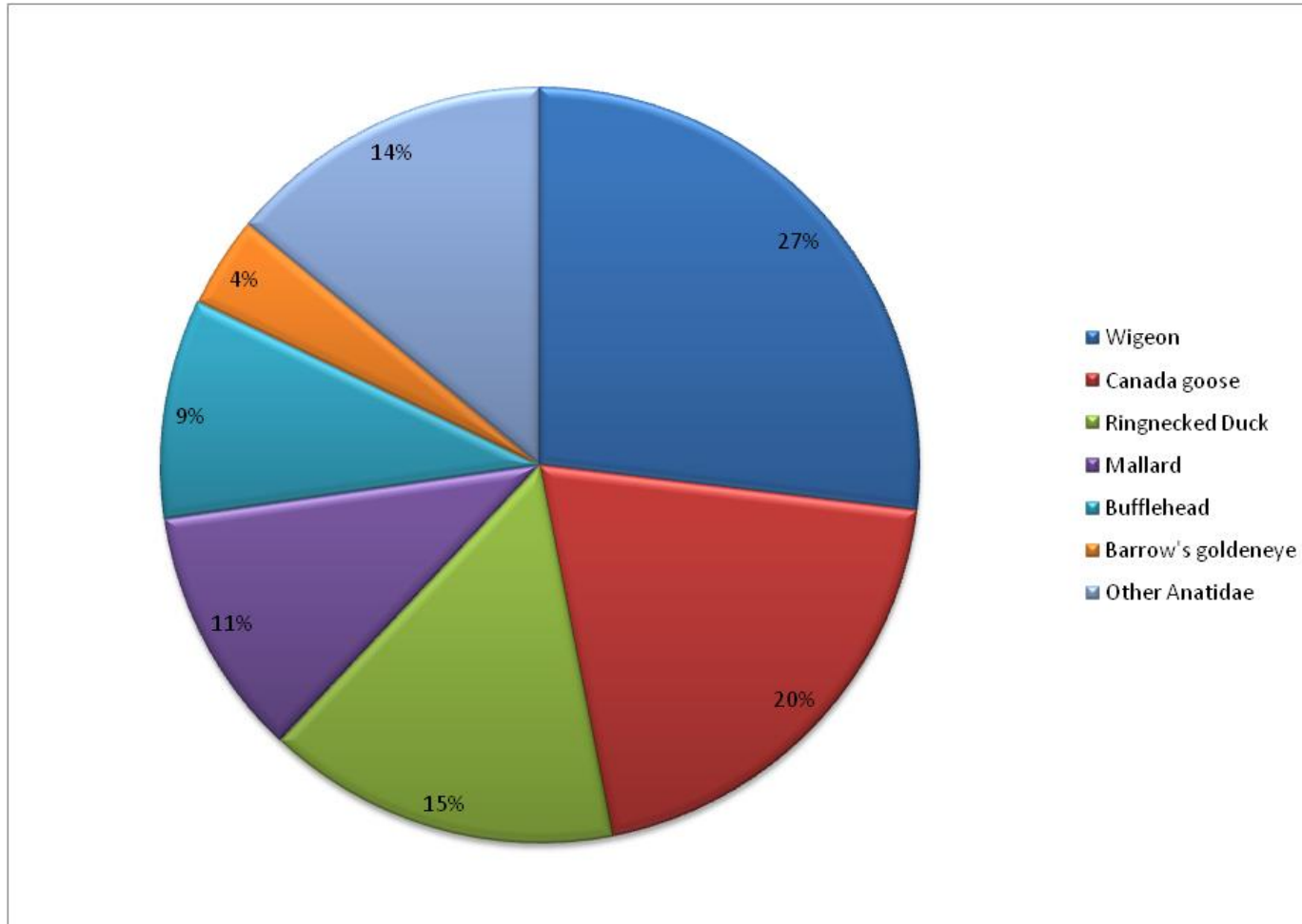


Table 1. Summary of wildlife observed during each winter period for the 2008-09 Winter season.

	Date	Mountain Goats	Deer	Bighorn Sheep	Bald Eagles	Golden Eagles	Waterfowl, grebes, & loons	Predators	Other
Early- Winter	11/25/2008	32	12	34	2	3	479	0	0
	12/3/2008	99	29	49	8	1	532	0	0
	12/11/2008	72	33	35	4	0	487	6 coyotes	0
Mid- Winter	12/23/2008	33	19	44	3	3	699	2 coyotes	0
	12/30/2008	48	41	50	15	14	743	1 coyote	0
	1/9/2009	26	177	12	4	4	673	1 bobcat	0
Late- Winter	2/12/2009	42	236	41	5	7	401	0	0
	2/18/2009	55	194	36	10	8	621	0	0
	2/25/2009	61	71	22	6	4	760	0	0
Green-up	3/11/2009	77	475	4	3	5	716	1 cougar	0
	3/18/2009	70	350	55	5	3	647	0	0
	3/26/2009	69	242	32	1	3	568	0	2 peregrines, 1 goshawk
Totals		684	1879	414	66	55	7326		

Table 2. Mountain goat production within the study area; winters of 1982-83 through 2008-09.

<u>North shore (WDF&W goat unit #6)</u>							<u>South shore (WDF&W goat unit #7)</u>							<u>Stehekin Valley (WDF&W goat unit #21)</u>							<u>TOTAL LAKE CHELAN STUDY AREA</u>						
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	29.3	2006-07	102	71	31	0	30	43.7	2006-07	No survey					2006-07	177	129	48	0	27	37	
2007-08	104	75	18	11	19	24.0	2007-08	76	49	17	10	26	34.7	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	

Table 3. Average and maximum numbers of ungulate observations by species per survey during the winter seasons of 1982-83 through 2008-09.

Winter	Average # Observed					Maximum # Observed				
	Mountain goat:		Mule deer		Bighorn Sheep	Mountain Goats		Mule Deer		Bighorn Sheep
	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
Average	24.1	17.2	99.7	19.3	22.9	max. 100	max. 77	max. 1039	max. 174	max. 82

Table 4. Lake Chelan study area wintering mule deer herd composition (percent by shore) during winter seasons of 1982-83 through 2008-09.

Winter	North Shore					South Shore				
	% 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
AVG	69	25	5	31	69	62	22	7	37	63

Table 5. Average and maximum numbers of avian observations by species and type per survey during winters of 1982-83 through 2008-09.

Winter	Average # observed per survey											Max. # observed per survey											
	Eagles		Coot	Dabbler	Diver	Goose	Grebe	Gull	Loon	Swan	UNID.	Eagles		Coot	Dabbler	Diver	Goose	Grebe	Gull	Loon	Swan	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	No water bird data available for 1982-83 through 2006-07.									6	1	No water bird data available for 1982-83 through 2006-07.									
1992-93	2.4	1.2																					
1993-94	2.1	0.5																					
1994-95	2.0	1.6																					
1995-96	3.5	1.7																					
1996-97	9.7	3.4																					
1997-98	3.5	0.8																					
1998-99	4.0	2.1																					
1999-00	2.7	1.3																					
2000-01	2.3	1.8																					
2001-02	3.0	1.8																					
2002-03	5.0	1.1																					
2003-04	5.3	2.9																					
2004-05	3.2	1.5																					
2005-06	4.9	2.5																					
2006-07	5.8	2.7																					
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	
Average	3.3	1.8										27	14										

Table 6. Water bird species numbers observed and average by survey for the 2008-09 Winter Wildlife Survey, Lake Chelan 2008-09.

Species	Survey												Avg
	1	2	3	4	5	6	7	8	9	10	11	12	
American Wigeon	136	198	194	152	157	174	14	157	137	141	161	152	147.8
Barrows Goldeneye	17	12	17	24	27	47	28	16	16	28	9	19	21.7
Bufflehead	67	43	75	73	52	62	60	25	63	48	30	20	51.5
Canada Goose	18	159	35	221	157	13	56	106	163	104	195	89	109.7
Canvasback	0	0	0	0	0	1	0	1	0	0	0	0	0.2
Common Goldeneye	7	12	11	9	12	2	19	11	5	21	10	13	11
Common merganser	40	0	1	0	16	0	6	2	10	7	3	7	7.7
Gadwall	0	0	0	0	2	1	0	0	1	0	0	0	0.3
Green-winged Teal	0	0	9	0	5	14	4	6	29	0	21	33	10.1
Hooded Merganser	0	5	0	3	2	1	1	3	4	4	0	0	1.9
Lesser Scaup	1	0	0	0	7	2	11	32	60	11	6	13	11.9
Mallard	45	27	31	127	77	85	59	55	39	123	13	23	58.7
Redhead	1	1	0	0	5	18	0	5	8	5	2	7	4.3
Ring-necked duck	54	16	45	7	141	126	82	122	94	98	103	105	82.8
Ruddy Duck	0	0	0	0	0	0	0	1	2	0	0	0	0.3
Trumpeter Swan	0	13	7	8	16	38	33	35	35	35	31	6	21.4
Common Loon	1	0	3	1	0	0	1	1	2	1	1	1	1.0
Gull	3	0	1	1	0	0	0	0	0	1	4	1	0.9
Horned Grebe	90	46	66	28	66	78	23	33	83	57	44	55	55.8
Grebe (other)	2	0	13	0	1	0	4	2	2	1	1	15	3.4
American Coot	0	0	0	0	0	2	0	6	7	7	7	7	3.0