RECEIVED

JUL 0 2 1991

TAHOE REGIONAL
PLANNING AGENCY

AN EVALUATION OF THE TAHOE BASIN FOR THE SUPPORT OF NESTING AND WINTERING BALD EAGLES

Submitted by:

Richard T. Golightly, Ph.D.
Department of Wildlife
Humboldt State University
and
Humboldt State University Foundation

Contract #CTA-8014.3
with the California Tahoe Conservancy

Prepared by:

David K. Garcelon[1]
Paula M. Golightly[1]
Jeffrey R. Dunk[1]
Sean P. Finn[2]
Larry Fox, Ph.D.[3]

May 1991

[1] Institute for Wildlife Studies, P.O. Box 127, Arcata, California 95521
[2] Wildlife Department, Humboldt State University, Arcata, California 95521
[3] Forestry Department, Humboldt State University, Arcata, California 95521

INSTITUTE FOR WILDLIFE STUDIES

P.O. Box 127, Arcata, California 95521 • A Non-Profit Organization
(707) 822-4258

RECEIVED

JUL 0 2 1991

TAHOE REGIONAL
PLANNING AGENCY

26 June 1991

Jean Shaffer
Tahoe Regional Planning Agency
P.O. Box 1038
Zephyr Cove, NV 89448

Dear Ms. Shaffer,

Enclosed please find a copy of our final report titled "An Evaluation of the Tahoe Basin for the Support of Nesting and Wintering Bald Eagles". We hope you find the document helpful and informative. If you have any questions regarding the content of the report, please feel free to give us a call. Have a pleasant summer.

Sincerely,

Paula Golightly

Paula Golightly
Administrative Assistant/Biologist

Enclosure

ACKNOWLEDGMENTS

We would like to thank the many individuals who provided valuable assistance to us during the project. This project would not have been possible without their knowledge and help. We are indebted to the staff of the U. S. Forest Service, Lake Tahoe Basin Management Unit especially Kathy Erwin, Lisa O'Daly, Helen Soderburg, Julie Perrochet, and Jeff Reiner. We thank California Department of Parks and Recreation including Gene Erba, Jeff Jones, Tom Taylor and Gary Walters. We also thank Russ Wickwire of California Department of Fish and Game for many discussions regarding fisheries and fish habitat. Ted Frantz with Nevada Department of Wildlife and Bob Richards with the Tahoe Research Group also provided additional valuable fisheries information. Ken Legg and Sherry Reed for information regarding the bald eagle nest at Eagle Point in Emerald Bay. Information regarding environmental contamination was supplied by Del Rasmussen of the California Water Resources Control Board and Jim Harrington of California Department of Fish and Game. Rich Callas of California Department of Fish and Game provided information regarding deer herds within the basin. We thank employees of the Tahoe Regional Planning Agency including Jean Schaffer, Kevin Hill, and Roxanne Duer. Shery Lanier provided Audubon Christmas Bird Count information. Warren D'Azevedo and Amy Dansie provided valuable historical information on the Washoe Indians. Gary Roemer, of the Institute's staff, provided helpful comments on drafts of the document.

TABLE OF CONTENTS

Acknowledgments....i

Introduction....1

Study Area....2

Methods....8
- Historical....8
- Availability of Nesting Habitat....8
- Availability of Wintering Habitat....10
- Availability of Roosting Habitat....10
- Availability of Prey....11
- Site Visits....11

Results and Discussion....12
- Historical use of the Basin by Bald Eagles....12
- Closest Nesting Territories to the Basin....18
- Availability of Prey....18
- Environmental Contamination....24
- Nest Site Availability....25
- Description and Analysis of Specific Streams....28

Conclusions....50
- Nesting Potential in the Basin....50
- Wintering Eagle Habitat in the Basin....51
- General Recommendations....51
- Costs Associated with Enhancements....52

Personal Communications....53

Literature Cited....55

Appendix 1....63

INTRODUCTION

The bald eagle (*Haliaeetus leucocephalus*) has been listed by the U.S. Fish and Wildlife Service and the California Department of Fish and Game as an endangered species (USFWS 1986, Jurek 1988). The number of occupied bald eagle territories in California has increased from 32 in 1977 to 93 in 1990; since 1989 the distribution of nest sites has expanded considerably across the state (Jurek 1990). New sites in Humboldt, Mono, Santa Barbara, and San Bernardino Counties have greatly expanded the nesting range of the bald eagle beyond the core area in the northeastern portion of the state.

The plan written for the recovery of bald eagles in the Pacific states (USFWS 1986) outlined several objectives to implement the recovery of the species. According to the plan, secure habitat should be provided for the bald eagle, and suitable habitats that are currently unused but that appear capable of supporting nesting pairs should be identified and protected. Steenhof (1988) stated that identifying potential, but unused, habitat is critical for land managers faced with pressures from development and the need to protect areas for recovering populations of endangered species. Further, wintering habitat must be managed to support both the existing eagle populations and to allow for the needs of an expanding eagle population (USFWS 1986). Numbers of eagles wintering in California have been variable, but counts of eagles each year have ranged from 514 to 1344 (Detrich 1990).

The bald eagle recovery plan designated 47 zones within the Pacific states for which recovery goals were established (USFWS 1986). The California portion of the Lake Tahoe Basin is located in the zone 28 management area of the bald eagle recovery plan (USFWS 1986). The goal for this zone is 15 breeding pairs of bald eagles, with 3 of those pairs on the California side of the Lake Tahoe Basin. There are currently four occupied territories in the management zone (Jurek 1990), but none are within the Lake Tahoe area.

The goals of this investigation were to determine the suitability of the California portion of the Lake Tahoe Basin for the support of both nesting and wintering bald eagles, and to make recommendations pertaining to land management practices which might facilitate attracting bald eagles to the area. Resource enhancement which could allow the Lake Tahoe Basin to support nesting bald eagles or increase the number of wintering eagles supported are suggested.

STUDY AREA

The Lake Tahoe Basin encompasses approximately 1295 km^2 of the watershed or drainage area that contributes to the water supply of Lake Tahoe (Strong 1984, USDA 1988). The study area was defined by the California Tahoe Conservancy, as the portion of the Lake Tahoe Basin within California, hereafter referred to as the Basin (Figure 1 and 2). The Basin is within Placer, El Dorado, and Alpine counties and lies between the Sierra Nevada range to the west and the Carson range to the east (Jorgensen et al. 1978). Elevation at the shore of Lake Tahoe is approximately 1900 m and the surrounding steep and rugged terrain ranges in elevation from 1900 m to approximately 3317 m (Jorgensen et al. 1978). The Basin was formed by faults that caused the area to drop creating a trough, while volcanic activity and uplifting continued to alter the landscape (Strong 1984). Extensive glaciation further changed the topography of the Basin (Strong 1984).

The Basin contains approximately 98 lakes which range in size up to 49,616 ha (Lake Tahoe). The Lake Tahoe shoreline within California is approximately 66.5 km (USDA 1988). The ownership of the California portion of the Lake Tahoe shoreline includes private (39.4 km), California State Parks (16.7 km), U. S. Forest Service (5.6 km), and El Dorado County (3.9 km) (USDA 1988). The U. S. Forest Service acquired additional land since 1988, however these figures were not available at the time of this project. Forty-one perennial streams totaling approximately 264 km in length feed into Lake Tahoe (USDA 1988). The Upper Truckee River flows into Lake Tahoe from the south, through the Truckee marsh at South Lake Tahoe, while the Truckee River flows out the north west corner of the lake near Tahoe City (Figure 1, 2 & 3). Lake Tahoe is characterized as an oligotrophic lake, (USDA 1988) with exceptionally clear water which reaches a depth of approximately 500 m (Jorgensen et al. 1978, Strong 1984)

The climate of the Basin is characterized by warm summers and cold winters with low relative humidity (Elford 1970). Temperatures (means of daily means) for Tahoe City (elevation 1900 m) ranged from -3.2 to 6.6^{o}C (mean 2.4^{o}C) during October through March, and from 9.6 to 17.6^{o}C (mean 13.0^{o}C) during April through September (USDC 1989). At Echo Summit (elevation 2240 m) temperatures ranged from -3.3 to 6.4^{o}C (mean 1.7^{o}C) during October through March, and from 5.2 to 16.6^{o}C (mean 11.2^{o}C) during April through September (USDC 1989). Mean annual precipitation is 77 cm with 50% occurring in winter, 47% in spring and fall, and 3% in summer with an average winter snowdepth of 574 cm (South Lake Tahoe Chamber of Commerce 1991).

Orr and Moffitt (1971) and the USDA (1988) described plant associations in the Basin. While not defined, it appears that their definition of plant associations was probably an aggregation of plants characterized by dominant species within the

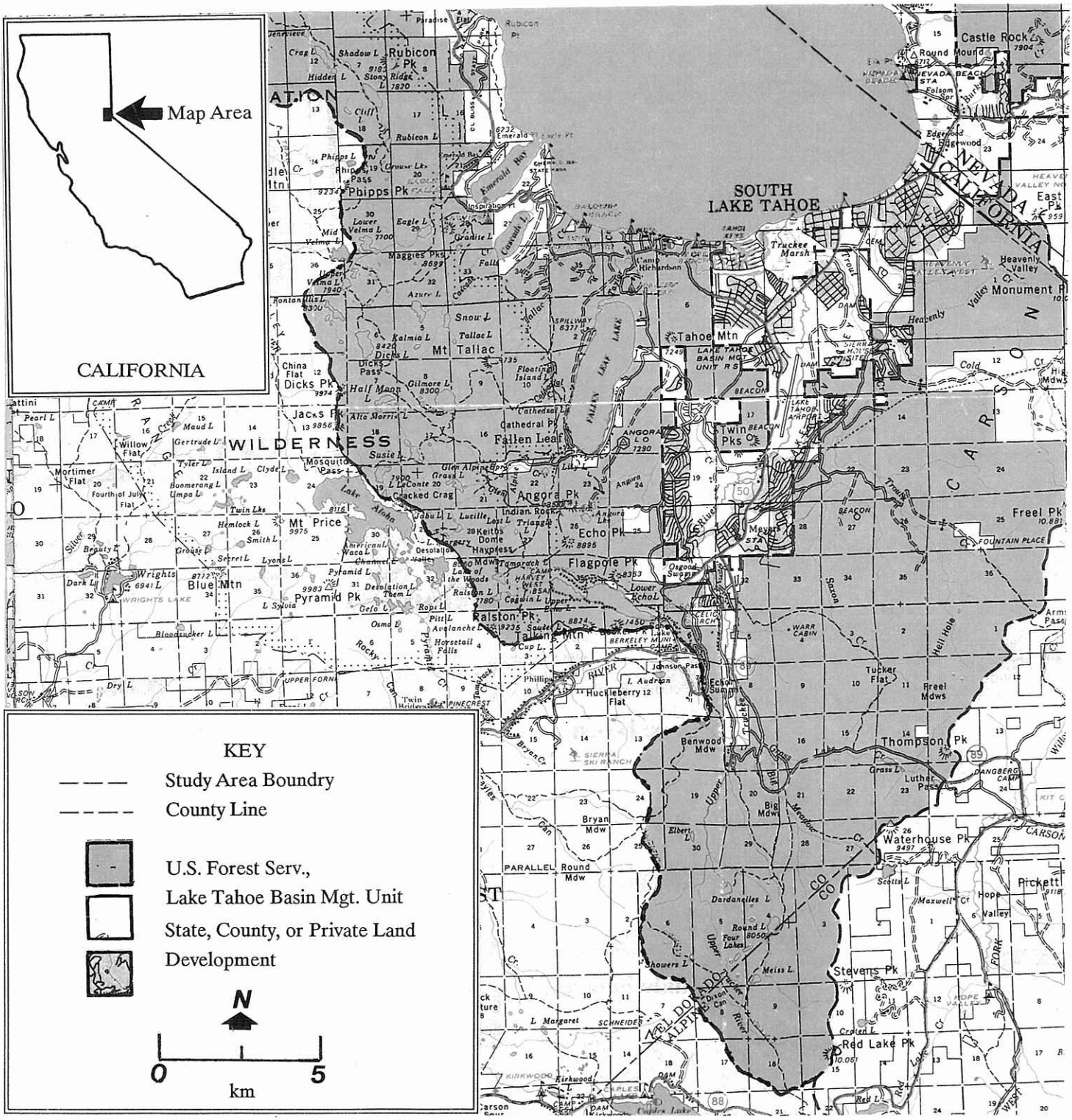

Figure 1. Location of the Lake Tahoe Basin study area (southern portion).

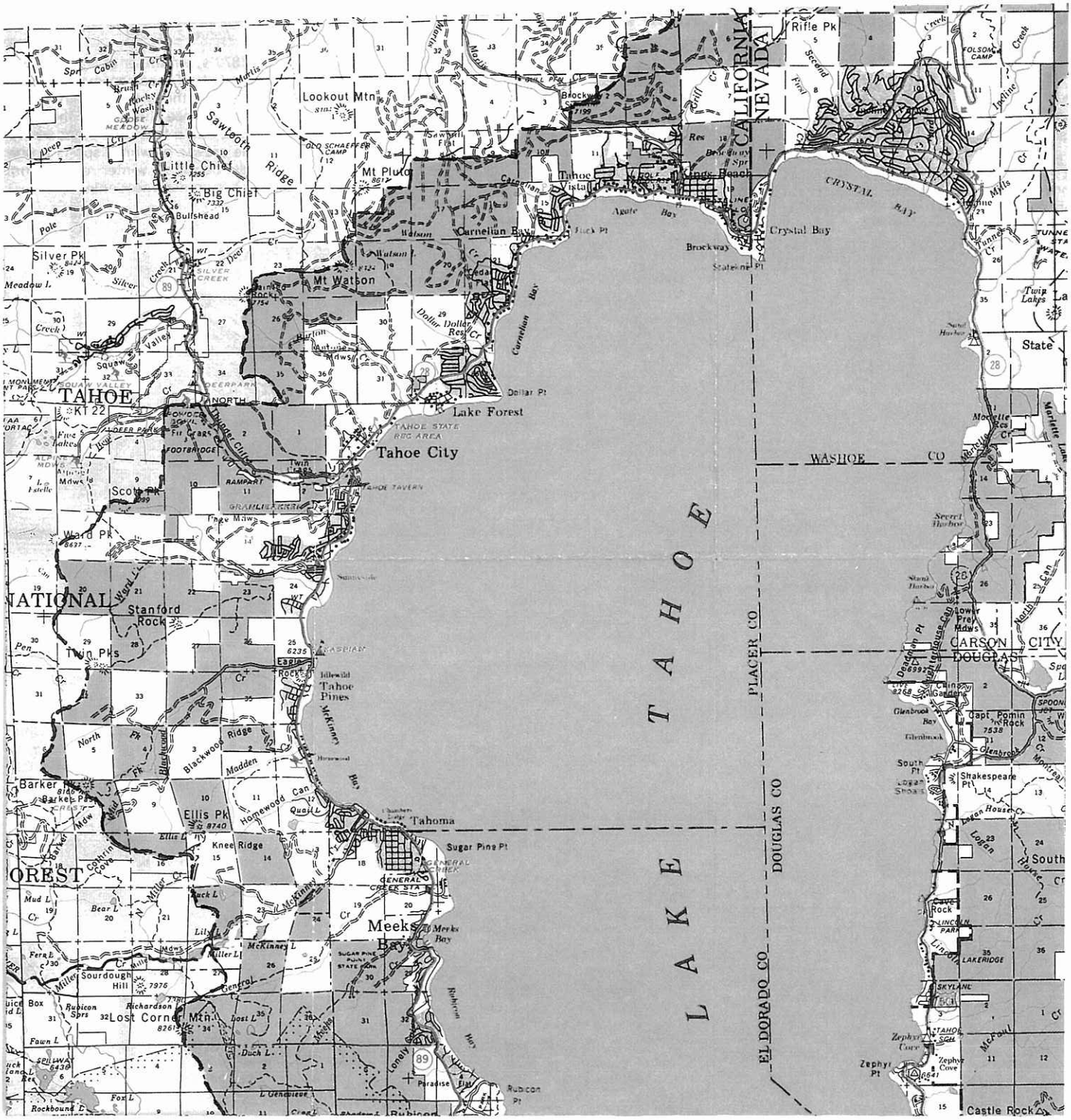

Figure 2. Location of the Lake Tahoe Basin study area (northern portion).

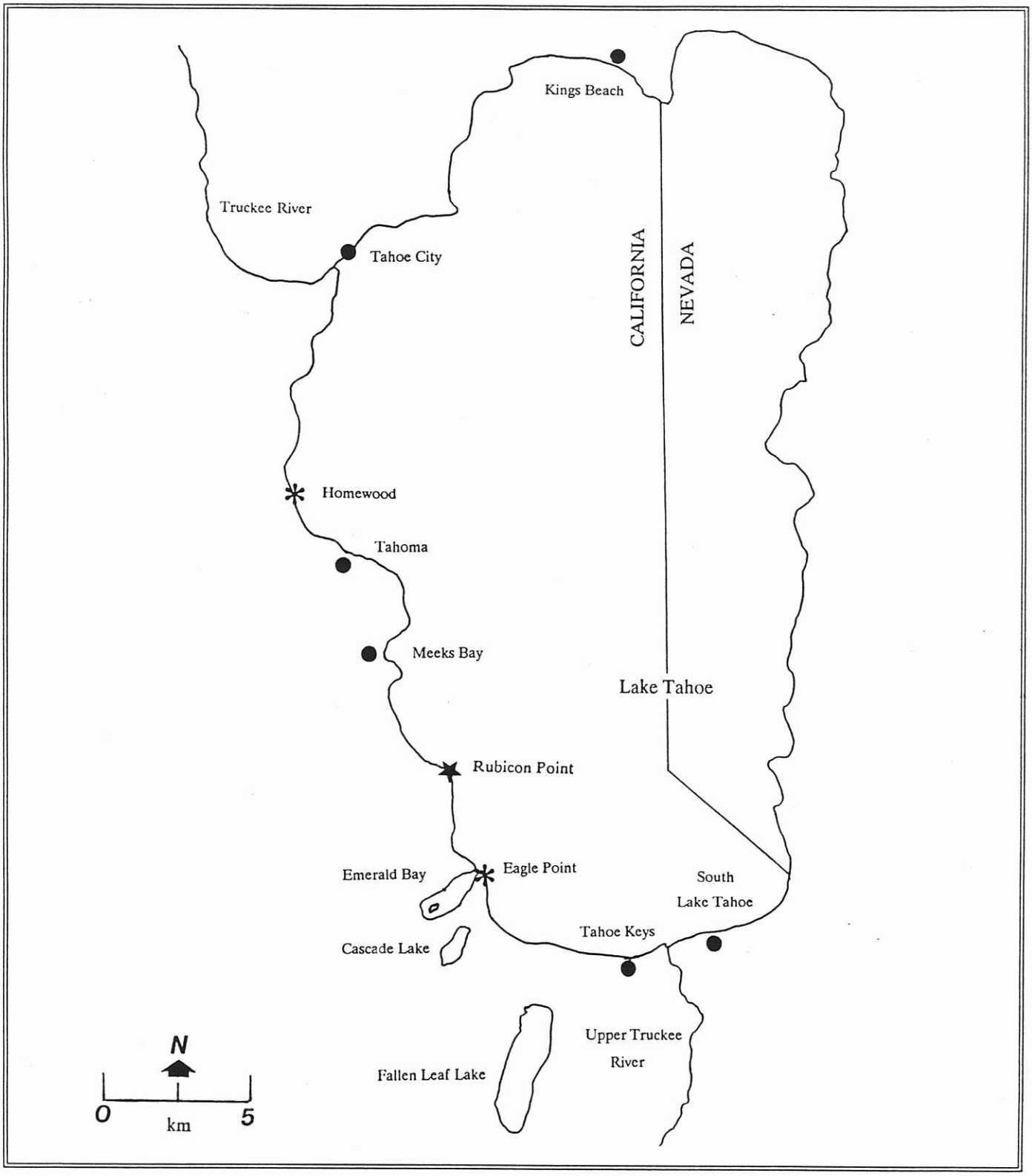

Figure 3. Location of cities (●) along the shore of Lake Tahoe, historic bald eagle nest sites (✱), and other locations (★) reported in the text.

group (Munz and Keck 1959). The yellow pine plant association characterized much of the west and southwest lake shore area. The dominant species included Jeffrey pine (*Pinus jeffreyi*), sugar pine (*Pinus lambertiana*), white fir (*Abies concolor*), and incense cedar (*Libocedrus decurrens*). Red fir (*Abies magnifica*) may appear in areas with less exposure to sunlight, while stands of lodgepole pine (*Pinus murrayana*) may occur in wet or boggy soils.

The red fir association often occurs on the ascending and east-facing slopes of the west side of Lake Tahoe (Orr and Moffitt 1971, USDA 1988). The dominant species include red fir, Jeffrey pine, lodgepole pine, western white pine (*Pinus monticola*), mountain hemlock (*Tsuga mertensiana*), and western juniper (*Juniperus occidentalis*) (USDA 1988).

The dominant species within the subalpine zone include mountain hemlock, and white-bark pine (*Pinus albicaulis*); mountain hemlock is dominant at approximately 2591 to 2743 m (Orr and Moffitt 1971, USDA 1988). Lodgepole pine may be found in some areas as high as timberline with white-bark pine and western juniper present on windswept granite ridges (Orr and Moffit 1971).

Riparian and chaparral plant associations also occur in the basin. Deciduous tree species within riparian areas include black cottonwood (*Populus trichocarpa*), mountain alder (*Alnus tenuifolia*), several willow species (*Salix sp.*), and quaking aspen (*Populus tremuloides*) (USDA 1988). Quaking aspen also occurs in meadow habitats near Fallen Leaf Lake and Taylor Creek. Chaparral vegetation appears in areas that are naturally open, and where logging occurred and trees have not regrown (Orr and Moffitt 1971). These areas consist primarily of greenleaf manzanita (*Arctostaphylos patula*), tobacco brush (*Ceanothus velutinus*), and sagebrush (*Artemesia tridentata*) (Orr and Moffitt 1971, USDA 1988).

Habitat alteration and change in the Basin from the 1800's through the present has been extensive. Strong (1984) described development of the Basin during this time period. He reported that logging began in the 1860's at Lake Tahoe and by the mid 1890's the timber supply had been depleted. In addition, a commercial fishery was established in Lake Tahoe in the 1860's. Non-native fish species were introduced and fish hatcheries were established. By 1917, when commercial fishing was banned by the California legislature, the native lahontan cutthroat trout was nearly extinct. Strong (1984) also reported that grazing and farming occurred in meadow habitat along the lake shore in the mid 1800's. Development of the Lake Tahoe shore from 1900 through the 1960s included the construction of resorts, summer homes, winter cabins and casinos. These activities increased employment opportunities and encouraged year-round occupancy of the area (Strong 1984).

The U. S. Forest Service, Lake Tahoe Basin Management Unit is the largest federal land management agency in the Basin, managing approximately 47,600 ha in California (USDA 1988). The Tahoe Regional Planning agency is the lead regulatory agency for private land in the basin which includes approximately 12,525 ha of land in California (USDA 1988). Land areas mentioned above reflect values identified in the Lake Tahoe Basin Management Unit plan (USDA 1988) and may have changed since 1988.

METHODS

Historical

Bald eagle occupation in the Tahoe Basin was reviewed to provide a historical perspective of the areas' suitability for bald eagles. A computer literature search was conducted through the Humboldt State University library to obtain references on the natural history of the Basin. The El Dorado County library, South Lake Tahoe branch, and two book stores in South Lake Tahoe were also visited to review literature. Ethnographic literature regarding the Washoe indians was reviewed and archaeologists and anthropologists in Nevada who have studied the Washoe Indians were interviewed. Published articles by naturalists and ornithologists who visited the area in the late 1800's through early 1900's were also reviewed. Unpublished reports from agencies including the U. S. Forest Service, California Department of Fish and Game, Nevada Department of Wildlife, and the Tahoe Regional Planning Agency were researched. Recent history of bald eagle occupation in the Basin was obtained through personal contacts with former and current employees of the following groups or agencies: U. S. Forest Service, California State Parks, California Department of Fish and Game, Nevada Department of Wildlife, U. S. Fish and Wildlife Service, and local bird watchers.

Common names of species as used by authors in some historical references were not provided with scientific names. This was done to avoid misleading the reader as to the accuracy of the species identification.

Availability of Nesting Habitat

We have defined nesting bald eagles as birds which initiate their breeding chronology as early as February and complete the cycle by the end of August. Reproductive activity of bald eagles (from courtship to fledging of young) requires approximately 6 months to complete (Stalmaster 1987). Variations in the nesting cycle may be affected by latitude, elevation, climate, disturbances and other factors (Stalmaster 1987).

We estimated the area of potential and suitable habitat for nesting bald eagles in the Basin. Criteria were developed based on the potential for a successful nest site to occur. Areas classified as potential nesting sites had to meet the first three criteria listed below. Areas classified as suitable nesting habitat had to meet all four of the criteria listed. The selection criteria were:

1) *Proximity to a Water Body:* Lehman (1979) found that 87 percent of all bald eagle nests characterized in California were located within 1.6 km

of a water body which ranged in size from 14 to approximately 12,140 ha. We identified all lakes in the Basin greater than 40 ha in size and delineated a boundary 1.6 km around each to define our sampling area. If a prominent ridge was found within the 1.6 km distance, the top contour of the ridge was used to define the boundary. Areas within the boundary were measured using a polar planimeter on 1:24000 scale U.S. Geological Survey topographical maps.

2) *Presence of Forest:* Throughout their range bald eagles have nested in a variety of habitat types, but typically in older coniferous forest (Anthony et al. 1982). We further reduced our sampling area by examining only those areas within 1.6 km of a water body which contained older forests or stands which had trees of suitable growth form. High resolution (1:30138) color infrared aerial photographs taken in June 1990 were used to delineate these forest areas. Aerial photographs were examined using stereoscopes and forest boundaries were drawn on mylar overlaying the photos. Aerial photos were not available for the Basin from Homewood south to Rubicon Point (Figure 3), therefore some habitat data along creeks within this area were absent.

3) *Presence of Dominant Trees:* Potential nest trees were identified by analyzing each photograph in stereo to locate dominant and co-dominant trees. Dominate and co-dominant trees were defined as trees taller and with a greater circumference of the upper canopy relative to the surrounding stand. We delineated areas containing dominant and co-dominant trees, and then measured the area of the stands containing these trees. These sites were considered to be potential nest sites. On-site visits were made to determine presence, size, and form of a sample of the trees identified by the aerial photographs; these visits were used to verify that these trees could serve as potential bald eagle nest sites. Diameter at breast height (DBH) and tree height were determined with a DBH tape and clinometer, respectively.

4) *Disturbance:* Potential nesting habitat was that area which met the criteria above. Suitable habitat for bald eagle nesting was the subset of potential habitat which also had adequate protection from human disturbance. This protection from disturbance was defined as nest sites that were: > 1000 m from the edge of population centers (Grubb and King 1991), > 550 m from clusters of 3 or more houses (Grubb and King 1991), and > 100 m from major roadways (Andrew and Mosher 1982). Distance estimates were made on U. S. Geological Survey 1:24000 topographic maps and aerial photographs.

Availability of Wintering Habitat

We defined wintering bald eagles as birds which migrate south to California, beginning in October. These birds are generally from northern breeding grounds and depart as food becomes scarce due to the onset of winter. Aggregations of bald eagles on wintering grounds usually reach their peak in January with a northward migration back to the breeding grounds occurring in March (Stalmaster 1987). The criteria used to evaluate wintering habitat were:

1) *Availability of prey:* Prey such as fish or birds should be available during the period when wintering eagles would be present in the area. Wintering bald eagles are attracted by concentrations of spawning salmon (Stalmaster 1987) and waterfowl (Keister et al. 1987)

2) *Perches near pools:* When examining streams, consideration was given to flow characteristics in different areas along their length. Bald eagles have been found to select pools less than 2 m deep over runs, riffles, or pockets of water when foraging on rivers (Biosystems Analysis 1985). Bald eagles also generally initiate a foraging attempt from tree perches along streams (Biosystems Analysis 1985); therefore we considered good tree perches as those along the streams that were sufficiently open to allow eagles easy access to the water. Lower and upper channel lengths presented are at the 10% and 85% points along the channel length from the mouth of the stream to its headwaters (Jorgensen et al. 1978).

3) *Disturbance:* Potential disturbance to wintering eagles followed the classifications of Stalmaster and Newman (1978), and are presented as high, moderate, and low. A description of each classification is listed in Appendix 1.

Annual wintering eagle counts have been conducted by U.S. Forest Service personnel since 1985 (H. Soderburg pers. comm.), and these data were used to determine eagle use of specific areas in the Basin.

Availability of Roosting Habitat

Winter roost site selection by bald eagles has been studied extensively and have been found to: 1) have a favorable microclimate (Hansen et al. 1980, Fisher and Osterfeld 1981, Knight et al. 1983, Stalmaster and Gessaman 1984), 2) be close to food sources (Grubb 1981, Keister and Anthony 1983, Keister et al. 1987), 3) be in relatively undisturbed areas (Hansen et al. 1980), 4) be traditionally used year

after year (Stalmaster 1987), and 5) be in forested areas with larger trees than surrounding areas (Hansen et al. 1980, Keister and Anthony 1983, Knight et al. 1983, Keister et al. 1987). Because these criteria were essentially the same as those for nesting eagles, stands containing nest trees were considered to be suitable for roost sites.

Availability of Prey

Potential prey items for eagles in the Basin were identified from: 1) scientific journals, 2) government agency reports, 3) personal communications with biologists working in or near the Basin, and 4) Basin bird watchers. In cases where quantitative data on the abundance of potential prey items were unavailable, subjective criteria used in the original sources were presented.

Site Visits

Two trips were made to the Basin to gather information from individuals, groups, and agencies, and to make site visits to lakes and creeks to evaluate potential nesting and wintering habitat for bald eagles. The trips were made on 24-27 October 1990 and 4-7 April 1991. Private property restricted access to some areas around streams; evaluations varied from walking 3 km of stream to viewing streams from public road access.

RESULTS AND DISCUSSION

Historical Use of the Basin by Bald Eagles

Indications of Historical Fish Resources in the Basin

Historically, the Washoe Indians occupied the Basin from the spring through summer (Downs 1966, Strong 1984). The abundance of fish and wildlife in the Basin during spring and summer provided an essential food source for the Washoe (Downs 1966). Young members of the Washoe tribe arrived at Lake Tahoe in the early spring to fish for whitefish. By early June the Washoe people had moved to the shores of Lake Tahoe to fish creeks and rivers for spawning cutthroat trout and sucker (Downs 1966, Strong 1984). Trout and sucker were reported to have spawned by the thousands in the streams while the Washoe caught them using baskets, spears, hooks, and nets (Downs 1966, Strong 1984). Downs (1966) reported that each year when spawning runs of fish declined, Washoe families left the shores of Lake Tahoe and moved up to the mountain valleys above the lake to gather food plants and to hunt mammals and birds.

Historical Presence of Bald Eagles in the Basin

Eagles were regarded as sacred birds by the Washoe indians (W. D'Azevedo, pers. comm.). Golden eagles (*Aquila chrysaetos*) were reportedly not killed or eaten by the Washoe and were believed to have supernatural attributes (D'Azevedo 1986). Downs (1966) reported that eagles nested on the highest peaks and were prized for their feathers. Eagle feathers were included with the items a shaman used during ceremonies and rituals and were reportedly taken from the tails of young eagles (Siskin 1983). Siskin (1983) reported the use of eagle feathers to make fans for moving incense during peyote ceremonies. Individuals with the eagle as their guardian spirit had exclusive access to climb up to eagle nests and acquire feathers (W. D'Azevedo pers. comm.). Orr and Moffit (1971) reported that in 1877 indians removed young bald eagles from a nest at Homewood (Figure 3) using a pole with a hook and noose at the end.

A review of published field notes of naturalists and ornithologists who visited the Basin between 1901 and 1934 resulted in no mention of bald eagles having been seen (Cooper 1870; Barlow and Price 1901; Grinnell 1915; Milton 1903, 1910a,b, 1911, 1912a,b,c, 1913; Miller 1920; Dawson 1923; DeGroot 1934; Grinnell and Miller 1944).

Historical Presence of Nesting Eagles

Records of bald eagle nests in the Basin have been few. Bald eagles were reported to have nested in 1877 in a large yellow pine (*Pinus* sp.) at Homewood (Figure 3) and a local resident reported a pair of bald eagles nesting in 1874 and 1875 near the shores of Lake Tahoe (Orr and Moffitt 1971). It is unknown whether the nest reported in 1874 and 1875 was the nest at Homewood.

Bald eagle nesting records have been reported for 26 counties in California during the period from 1900 to 1940 (Detrich 1986). Detrich (1986) reported that D. D. McLean documented 43 locations of bald eagle nests (approximately 100 bald eagle nests) within the state in 1935. McLean was a California Department of Fish and Game Biologist who traveled California collecting wildlife information (Detrich 1986). Detrich (1986) cautioned that some records gathered by McLean may have been second-hand information but suggested that other researchers considered the records reliable. There were 7 records of bald eagle nest locations reported by Detrich (1986) from 1900-1940 which were within zone 28 of the Pacific States Bald Eagle Recovery Plan (USWFS 1986) (Figure 4). The bald eagle nest location identified at Lake Tahoe between 1900 and 1940 was not specific as to county (Detrich 1986) and further details regarding the site do not appear to exist. Prior to 1900, 10 bald eagle nest locations were reported for California (Detrich 1986) including the nest sites mentioned by Orr and Moffit (1971) at Lake Tahoe in 1874-1877.

A nest was discovered at Eagle Point on Emerald Bay (Figure 3) in a pine tree (*Pinus* sp.) during the winter of 1970 (K. Legg pers. comm., Reed 1979). From November 1970 through February or March of 1971, 2 adult and 1 or 2 subadult bald eagles were observed perched in the nest at Eagle Point on many occasions; below the nest various feathers and bones were discovered (K. Legg pers. comm.). Reports of U.S. Forest Service personnel and State Park rangers mention bald eagles were observed at the nest during subsequent winters until 1976 (S. Reed pers. comm., J. Jones pers. comm.). Reports of bald eagle activity at this site prior to 1970 were not available. Reports of summer bald eagle sightings by local residents during the 1970's and early 1980's near Eagle Point were investigated by U.S. Forest Service personnel; these sightings were later identified as ospreys (*Pandion haliaetus*) which nested nearby (S. Reed pers. comm.).

A second fish-eating bird of prey, the osprey, was reported as a rare visitor to the Basin, but one nesting record was documented in 1875 near the mouth of Burton Creek (Orr and Moffitt 1971). Ospreys were seen on five occasions in four different locations in the Basin from 1917 through 1920 (Orr and Moffitt 1971). During the summer of 1990, U. S. Forest Service personnel at the Lake Tahoe Basin Management Unit reported seven osprey nests within the Basin with five of the nests in

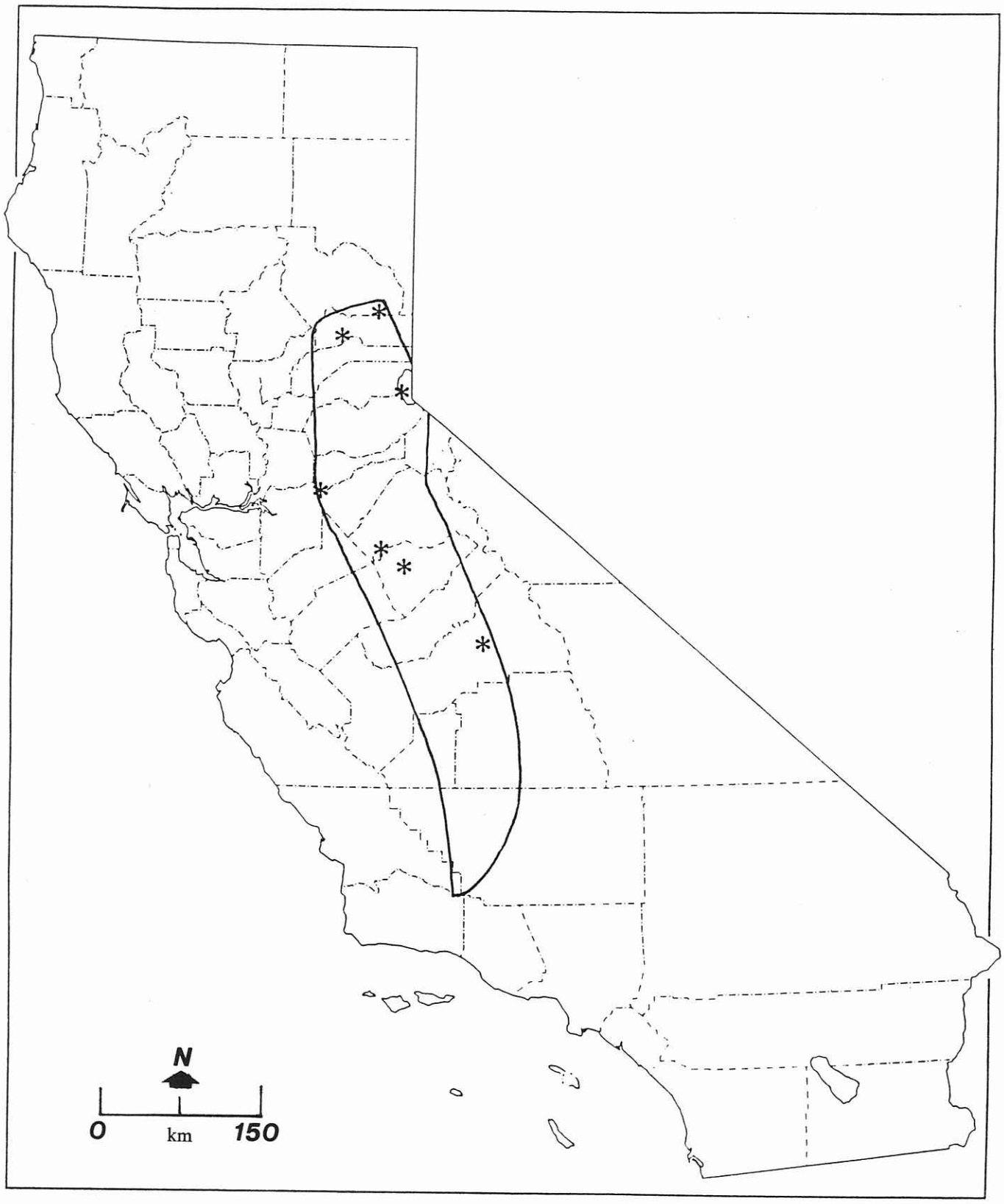

Figure 4. Bald eagle nest locations (*) in California reported between 1900 and 1940 within management zone 28 of the pacific bald eagle recovery plan. From Detrich (1986) and USFWS (1986).

California (USDA Forest Service, unpubl. data). Osprey nests located in California were reported as follows: Two at Rubicon Point, and one each at Emerald Point, Emerald Bay, and Fallen Leaf Lake. At least two of the five nests were reported to contain young (USDA Forest Service unpubl. data, K. Erwin pers. comm.).

Historic Presence of Wintering Eagles

Information regarding wintering bald eagles in the Basin was described by Orr and Moffit (1971) who reported that bald eagles were often observed in fall and winter (September through February) and were infrequent summer visitors. James (1921) stated that bald eagles were seen in the Basin but he was not specific as to time of year.

During the middle to late 1970's through 1990, bald eagles were observed in fall and winter at Emerald Bay and D. L. Bliss State Parks (J. Jones pers. comm., State Park unpubl. data). State Park rangers reported watching bald eagles chasing american coots (*Fulica americana*), and grebes (*Podiceps sp.*) (J. Jones pers. comm., K. Legg pers. comm.). Bald eagles were also observed perched in trees near Vikingsholm Castle and on Fannette Island in Emerald Bay by State Park rangers (J. Jones pers. comm.). We do not know if bald eagles were feeding primarily on waterfowl while in the bay or if eagles were also feeding on fish.

Kokanee salmon were introduced into Lake Tahoe between 1938 and 1944 (TRPA 1971, Cordone et al. 1971, Reed 1979). Bald eagles have been observed feeding on kokanee salmon along Taylor Creek during the spawning run in November through December (USDA Forest Service unpubl. data, Reed 1979). Reed (1979) reported that bald eagles arrived in the Basin as early as mid-October. Bald eagles have been observed perched in trees along Taylor Creek from November through December or until the abundance of salmon in the creek was diminished (USDA Forest Service unpubl data, Reed 1979). The eagles then reportedly dispersed to other areas throughout the Basin (Reed 1979) (Table 1).

History of Development in the Basin

Development of land surrounding the mouth of the Upper Truckee River (Tahoe Keys) area in the early 1960's, eliminated a significant portion of the largest marsh habitat in the Basin (Orr and Moffit 1971, Strong 1984) (Figures 1 and 2). The Tahoe Keys development was built on approximately 216 ha of marshland. This area was important nesting habitat to several species of waterfowl and other species of wildlife associated with marsh habitats (Orr and Moffitt 1971). While land development in the Basin is monitored and regulated by the TRPA, they did not have figures available for total land area developed in the Basin. Their current efforts

Table 1. Reported sighting locations of bald eagles in the Lake Tahoe Basin, California and Nevada, from October through March 1975-1990 (USDA Forest Service unpubl. data).

	Year															
Area[a]	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
Pope Beach to S. Lake Tahoe			1				2		1	4			2	4		1
Tallac Cr. to Kiva			4	35	7		26	28	4	6		3	17	11	12	2
Emerald Bay			2	1			2	1	3	3		1	6	3	2	
Meeks Bay								2								
McKinney Bay											1		1	2		
Truckee River									1				1			
Carnelian Bay													2			
Fallen Leaf		1		1				7	1	1			1			
Echo Lake										1				1		
Heavenly										1						
Benwood Meadow												2				
Elk Pt. to Zepher									1	3	2	2	5	7	19	4
Cave Rock								1			2		4	5	1	
Logan Shoal Deadmans Pt.							2	2	2		1	1	2		1	2
Secret Harbor							2									
Spooner Lake															1	
Sand Harbor								3					2			
Crystal Bay	1								1			1	3	5		

[a] Specific areas are identified on Figures 1, 2 & 3.

to develop a geographical information system will provide land use and land capability information in the future (K. Hill pers. comm.)

Conclusions from Historical Information

Efforts to make management decisions regarding wildlife species based solely on historical information can be difficult. Limitations to this methodology include lack of available historical information and habitat changes through time (Steenhof 1988). Steenhof (1988) reported that historic presence or absence of a species was no guarantee of site suitability. She also stated that some habitat elements may improve or deteriorate through time. For example, the decline of the native lahontan cutthroat trout in the Tahoe Basin may have eliminated an important food source for nesting or wintering bald eagles during the 1800's. Reintroduction of the non-native kokanee salmon created an abundant food resource for wintering bald eagles that may not have existed since the 1800's.

Osprey may be a reasonable indicator of fish availability for bald eagles. The depletion of the fish resource during the late 1800's and other habitat disturbances may have affected historic populations of osprey in the Basin. The number of osprey nests reported during 1990 by the U. S. Forest Service at Lake Tahoe may be a positive indicator as to to availability of fish for bald eagles during the spring and summer months.

Historic presence of bald eagles in the Basin was difficult to ascertain. We reviewed ethnographic literature on the Washoe indians to determine if bald eagles were present in the Basin before European settlers entered the area. Although eagles were part of the Washoe culture, the only mention of eagles was with reference to the golden eagle (D'Azevedo 1986). Golden eagles are known to nest in areas with high peaks and will nest on cliffs (McGahan 1968). Because Downs (1966) and D'Azevedo (1985) reported that the eagles nests from which the Washoe indians collected feathers, were on rocks and high peaks, it is probable that the Washoe were primarily using feathers from golden eagles. It is unknown whether bald eagle feathers were used by the Washoe. Discussions with anthropologists and archaeologists who study the Washoe reported no evidence in museum collections or at archaeological dig sites of eagle remains (A. Dansie pers. comm., R. Elston pers. comm.). Eagle remains (excluding bones) if originally present at dig sites would have decomposed quickly according to A. Dansie (pers. comm.).

The nest used by bald eagles at Eagle Point during the winter of 1970-1971 (K. Legg pers. comm.) was probably not used to hatch and fledge young. The time of year that activity occurred at the nest does not coincide with the nesting chronology of bald eagles in California. Detrich (1986) reported the occurrence of nest building

on wintering habitat hundreds of kilometers south of bald eagle breeding grounds; however, these nests were abandoned in spring without the initiation of incubation behavior. A possible explanation for nest building during winter may be for courtship or pair bonding purposes in preparation for nesting on northern breeding grounds (Detrich 1986).

Closest Nesting Territories to the Basin

As of May 1991, three bald eagle nesting territories are located within 60 km of Emerald Bay. Stampede Reservoir territory is located 58 km north of Emerald Bay, while Union Valley Reservoir and Topaz Lake are located 29 km southwest and 56 km southeast, respectively.

Two adult bald eagles have been observed at Marlette Reservoir, located on the east side of Lake Tahoe, during the summers of 1989 and 1990 (L. Neel pers. comm.). A helicopter survey of the area in May 1991 resulted in one adult being seen at the reservoir; the reservoir was still frozen (K. Erwin pers. comm.). These sightings might indicate eagles are either currently nesting at Marlette Reservoir, or that a nesting pair may be forming at that location.

Availability of Prey

Fish

A number of fish species occur in the Basin (Table 2); however, no direct quantification of fish biomass has been made for lakes in the area. However, the USDA (1988) estimated that the Basin was capable of producing approximately 37,000 kg of fish annually. In California, bald eagles are reported to feed commonly on nongame fish (Table 3). Abundance data on nongame fish were not often reported in the literature; available data are presented in the discussion of specific areas in the Basin.

Since 1979, creel censuses have been conducted approximately twice monthly at Cave Rock, Nevada (Nevada Dept. Wildlife 1989). During that period a mean of 0.17 fish/hour (range 0.044-0.302, s.e. = 0.12) were caught by shoreline fisherman and a mean of 0.113 fish/hour (range 0.045-0.159, s.e. = 0.036) were caught by topline (*sic*) fisherman. Thus littoral surface feeding fish are present in the lake and would likely be available to bald eagles.

Kokanee salmon occur in several creeks in the Basin; however, Taylor Creek is currently the major kokanee salmon spawning area (Cordone et al. 1971, J. Reiner and R. Wickwire pers. comm.). Abundance of kokanee within Taylor Creek has been highly variable in the past 30 years, showing no trends in abundance (Figure 5). Counts of

Table 2. Fish species present within waters of the Lake Tahoe Basin.[a]

Common Name	Scientific Name
Brown trout	*Salmo trutta*
Brook trout	*Salvelinus fontinalis*
Golden trout	*Salmo aguabonita*
Kokanee salmon	*Oncorhynchus nerka*
Lahonton Cutthroat trout	*Oncorhynchus clarki henshawi*
Lake trout	*Salvelinus namaycush*
Mountain whitefish	*Prosopium williamsoni*
Rainbow trout	*Oncorhynchus mykiss*
Brown bullhead	*Ictalurus nebulosus*
Golden shiner	*Notemigonus crysoleucas*
Mountain sucker	*Catostomus platyrhynchus*
Lahonton redside	*Richardsonius egregius*
Speckled dace	*Rhinichthys osculus*
Mosquito fish	*Gambusia affinis*
Piute sculpin	*Cottus beldingi*
Tahoe sucker	*Catostomus tahoensis*
Tui chub	*Gila bicolor*

[a] From TRPA 1977.

Table 3. Species of fish identified as food items of bald eagles at 4 locations in California.

Location	Common Name	Scientific Name	Source
Lake Berryessa	Carp	*Cyprinus carpio*	Spiegel and Anderson (1986)
	Channel catfish	*Ictularus punctatus*	
Lake San Antonio and Lake Nacimiento	Carp	*Cyprinus carpio*	Aulman and Walton (1984)
	Channel catfish	*Ictularus punctatus*	
	Largemouth bass	*Micropterus salmoides*	
	Sacramento squawfish	*Ptychocheilus grandis*	
Pit River	Black crappie	*Pomoxis nigromaculatus*	Biosystems Analysis (1985)
	Channel catfish	*Ictularus punctatus*	
	Bullhead species	*Ictularus sp.*	
	Carp	*Cyprinus carpio*	
	Largemouth bass	*Micropterus salmoides*	
	Hardhead	*Mylopharodon concephalus*	
	Minnow species	*Cyprinidae sp.*	
	Rainbow trout	*Oncorhynchus mykiss*	
	Sacramento squawfish	*Ptychocheilus grandis*	
	Sacramento sucker	*Catostomus occidentalis*	
	Tui chub	*Gila bicolor*	
	Tule perch	*Hysterocarpus traski*	
Taylor Creek Lake Tahoe Basin	Kokanee salmon	*Oncorhynchus nerka*	Reed (1979)

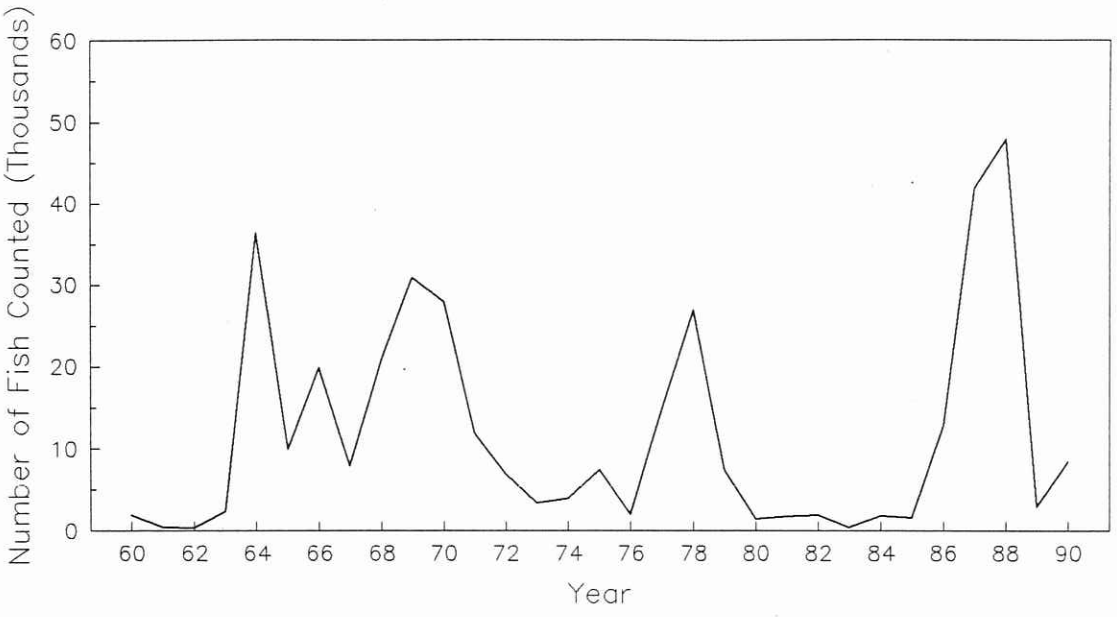

Figure 5. Kokanee salmon counted in a fish trap on Taylor Creek, near Lake Tahoe, California from 1960 - 1990.

kokanee salmon in a fish trap on Taylor Creek ranged from <50 in 1962 to 48,800 in 1988 (R. Wickwire pers. comm.).

Kokanee salmon may be an important factor influencing eagle use of the Basin. The kokanee spawning runs in Taylor Creek, which occur from late October through early November (J. Reiner pers. comm.), coincide with the arrival of wintering eagles in the Basin. Kokanee carcasses are usually completely gone from Taylor Creek by about January (R. Wickwire pers. comm.), and eagles remain in the area of the creek until late December (H. Soderburg pers. comm.). After kokanee are no longer available, eagles disperse more widely throughout the Basin.

McClelland et al. (1981) reported that at McDonald Creek, Montana, a kokanee salmon run had established "by at least" 1935, but peak eagle numbers were usually less than 50 until the early 1960's. From the early 1960s until 1978 eagle numbers steadily increased to a peak of 618 individuals in 1978. A conclusion from McClelland et al. (1981) would be that considerable time must pass before eagles respond in large numbers to super abundant prey resources. Estimates of kokanee abundance in McDonald Creek ranged from 45,000 to 125,000 spawners (Montana Dept. of Fish, Wildlife and Parks c.f. McClelland et al. 1981). These estimates are from 1 to 3 times greater than the largest estimates for Taylor Creek, but peak eagle numbers at McDonald Creek have been 10 to 19 times greater than in the Basin. Winter eagle numbers in the Basin have remained constant to slightly increasing during the past decade. If kokanee salmon numbers stay constant or increase over a prolonged period, the Basin may have more wintering eagles in future years.

Birds

Very little information is available on abundances of birds in the Basin. Contacts made with state and federal agencies regarding populations of waterfowl in the area resulted in no quantitative data. Bald eagles feed on a variety of avian species throughout their range, and this taxa, especially during the winter, can make up an important component of the eagle's diet (Table 4). Partially or completely pisciverous species such as gulls (*Larus spp.*) and grebes are fed upon by bald eagles in the Pacific Northwest (Frenzel 1984) and these species may be available to eagles wintering or nesting in the Basin. A survey of birds in the Basin to obtain species presence and population estimates on a year-round basis should be conducted to determine the availability of this food resource.

Carrion

The Basin contains 2 deer herds during part of the year; the Loyalton-Truckee herd, and the Carson River herd. The California Department of Fish and Game reports

Table 4. Potential avian prey items for bald eagles in the Lake Tahoe Basin based on prey remains identified from bald eagle nests in Oregon and Washington (Fielder 1982, Frenzel 1984). Information on occurance and seasonal abundance taken from Audubon Society checklist of birds 1978. U = Uncommon, C = Common, - = Information not available.

Species	Season [a]			
	Winter	Spring	Summer	Fall
Western grebe (*Pechmeophorus occidentalis*)	U	U	-	U
Eared grebe (*Podiceps nigricollis*)	U	C	U	C
Horned grebe (*Podiceps auritus*)	U	-	-	U
Pied-billed grebe (*Podilymbus podiceps*)	U	U	U	U
Great blue heron (*Ardea herodias*)	U	-	U	U
Least bittern (*Ixobrychusexilis*)	-	-	U	-
American bittern (*Botaurus lentiginosus*)	-	-	U	-
Canada goose (*Branta canadensis*)	C	C	C	C
Mallard (*Anas platyryhchos*)	C	C	C	C
Gadwall (*Anas stepera*)	U	U	-	U
Green-winged teal (*Anas crecca*)	U	C	U	C
Cinnamon teal (*Anas crecca*)	-	C	C	C
American wigeon (*Anas americana*)	U	-	-	U
Shoveler (*Spatula clypeata*)	-	-	-	U
Wood duck (*Aix sponsa*)	-	U	U	U
Northern pintail (*Anas acuta*)	U	U	U	C
Redhead (*Aythya americana*)	U	U	-	U
Ring-necked duck (*Aythya collaris*)	U	C	U	C
Canvasback (*Aythya valisineria*)	U	U	-	U
Greater scaup (*Aythya marila*)	U	U	-	U
Lesser scaup (*Aythya affinis*)	C	C	-	C
Common goldeneye (*Bucephala clangula*)	C	U	-	C
Bufflehead (*Bucephala albeola*)	C	U	-	C
Ruddy duck (*Oxyura jamaicensis*)	U	U	U	U
Common merganser (*Mergus merganser*)	C	C	C	C
American coot (*Fulica americana*)	C	C	C	C
Ring-billed gull (*Larus delawarensis*)	U	U	-	U
California gull (*Larus californicus*)	C	C	C	C
Foresters tern (*Sterna forsteri*)	-	U	C	U

[a] Winter = November 15 to March 15, Spring = March 16 to May 31, Summer = June 1 to July 31, Fall = August 1 to November 14

that the Basin contains 13,110 ha of summer range, but no winter range for the Loyalton-Truckee herd (Kahre and Fowler 1982). For the Carson River herd, the Basin contains 40,534 ha of summer, and 1053 ha of winter range (Fowler and Hinz 1982). Estimates of summer and winter range densities for the Carson river herd are 2.3 deer/km^2 and 7.4 deer/km^2, respectively (Fowler and Hinz 1982). Important deer fawning areas are located within the Basin (R. Callas pers. comm.).

Abundance of potential mammalian prey (other than deer) are unknown. Mammals taken as live prey generally make up a small portion of the diet of bald eagles, although they will kill small and medium sized mammals in some circumstances (Platt 1976, Frenzel and Anthony 1989). No quantified road kill information were available, although California Department of Transportation claimed that there were very few road kills in the Basin during any time of the year (Stan Ford pers. comm.). Limited hunting within the Basin further limits carrion abundance. Mammals might provide some food value for eagles during all parts of the year, but eagles would probably not subsist on mammalian prey alone during any part of the year.

Environmental Contamination

Organochlorine compounds, such as DDT are known to effect reproduction and cause declines in bald eagle populations through contamination of fish and avian food resources (Cromartie et al. 1975, Grier 1982, Frenzel 1984, Wiemeyer et al. 1984). A review of literature regarding the presence of organochlorines in fish and birds of the Tahoe Basin was conducted but information was not available on presence of these compounds. The California Water Resources Control Board (CWRCB) has tested fish and invertebrate tissue for metals and organochlorines on the Truckee River in Nevada County (north of the Basin).

Rasmussen and Belthrow (1990) of the CWRCB reported very little evidence of organochlorine contamination in the Truckee River. Brown trout collected in 1978, 1979, and 1984 showed low levels of DDE (0.025, 0.016, 0.006 ppm wet weight, respectively). Additional samples collected from 1978 through 1987 were below detectable levels. Wiemeyer (1978) sampled fish populations in Maine in 1966 and 1974 where bald eagle productivity had been low; levels of DDE reported in fish tissue ranged from 0.05 ppm to 0.86 ppm wet weight. Fish tissue of brown trout and rainbow trout sampled from southcentral Oregon in 1984 showed DDE levels of 0.008 and 0.011 ppm wet weight respectively (Frenzel 1984). Frenzel (1984) did not attribute DDE levels in fish to decreased productivity but considered concentrations of the pesticide in avian food resources as a concern. The environmental toxicants of most concern in the Truckee River were elevated levels of silver and zinc. These levels were possibly due to past mining operations, erosion and other watershed disturbances (Rasmussen and Belthrow 1990).

Nest Site Availability

Lehman (1979) reviewed nest site characteristics of 95 bald eagle nests in California and found 87% were within 1.6 km of large (> 14.4 ha) water bodies. Other researchers have also found bald eagles to nest in close proximity to large water bodies (Swenson 1975, Grubb 1980, Anthony et al. 1982, Andrew and Mosher 1982, Swenson et al. 1986). The proximity to water apparently affords nesting eagles easier access to food sources (Murphy 1965). Bald eagles typically nest in dominant or codominant trees of a stand (Grubb 1980, Anthony et al. 1982) with open vegetative structure (Andrew and Mosher 1982). Nest trees in the western U.S. are usually conifers (Murphy 1965, Swenson 1975, Anthony et al. 1982, Swenson et al. 1986) although large cottonwoods (*Populus spp.*) are known to be used (Anthony et al. 1982) along large rivers. Other important nest tree characteristics include: 1) stout limbs to support large nests (Murphy 1965, Grubb 1980, Anthony et al. 1982), 2) an open canopy to facilitate easy access by eagles (Andrew and Mosher 1982), and 3) large areas of ice-free water during nest initiation (Swenson 1975, Swenson et al. 1986); potential sites near water bodies above altitudes of 2300 m are generally considered unsuitable. Bald eagles apparently tolerate little human disturbance near nests (Murphy 1965, Andrew and Mosher 1982, Grubb and King 1991), especially during early stages of nesting (Murphy 1965, Mathesin 1968). At Besnard Lake, Saskatchewan, Gerrard et al. (1983) found that the number of active bald eagle breeding areas within 4 km of major tourist access sites significantly declined after a road was constructed allowing tourists into the area. Grubb and King (1991) classified disturbance of nesting bald eagles into 5 categories (pedestrian, aquatic, vehicle, noise, and aircraft) and found that pedestrian disturbance had a greater influence on bald eagle behavior than any other category.

what is the elevation of Mallette,

A total area of 12,550 ha was within our classification of potential habitat, which was 20% of the total area in the Basin (62,800 ha). Of the area classified as potential habitat, 5,165 ha (41%) was considered suitable nesting habitat (Table 5). Of the habitat deemed as suitable, 68% was associated with Lake Tahoe, and the remainder associated with Cascade, Fallen Leaf, and Echo lakes.

Analysis of aerial photographs resulted in locating 119 stands containing coniferous trees with dominant or co-dominant trees present. Of those 119 stands, 67 were found to be suitable for nesting eagles when potential disturbance was taken into consideration (Table 6). The mean size of the suitable stands was 2.8 ha. Grubb (1976) reported mean stand size as 48 ha (range 0.4 - 279 ha, s.d. = 47 ha) for 85 bald eagle nesting territories in Washington. However, the Washington study did not consider potential disturbance factors because the nests were already established.

Table 5. Surface area of lakes, potential habitat, and suitable habitat in the Lake Tahoe Basin as determined from aerial photographs. Potential habitat was defined as subclimax to climax coniferous forest within 1.6 km of a water body with no obstructing ridges. Suitable habitat is that portion of available habitat which was removed from potential disturbance to nesting bald eagles (see Andrew and Mosher 1982, Grubb and King 1991).

Lakes	Surface Area (ha)	Potential Habitat (ha)	Suitable Habitat (ha)
Lake Tahoe	49653	10036	3502
Fallen Leaf Lake	570	1630	1016
Echo Lake	141	884	648

Table 6. Areas in the Lake Tahoe Basin containing stands of dominant coniferous trees suitable for bald eagle nest sites, as determined from aerial photographs. Stands are comprised of trees whose members are taller than the surrounding forest.

Geographic Area	No. of Stands	Mean Stand Size (standard deviation) (ha)
Echo Lake	19	2.4 (1.8)
Cascade Lake	6	4.2 (3.0)
Fallen Leaf Lake	12	1.8 (0.6)
Emerald Bay	10	4.4 (2.4)
Baldwin Beach	4	5.7 (1.6)
Upper Truckee River	3	1.7 (0.2)
Truckee River	11	1.6 (0.5)
Blackwood Creek[a]	2	1.3 (0.03)

[a] Survey of this area was incomplete due to the lack of aerial photographs covering the area.

We subjectively chose dominant and co-dominant trees identified on the aerial photographs and measured the trees to confirm the aerial photographic interpretation. The DBH and height of 14 validation trees were measured (Table 7). The results indicated that potentially suitable nest trees could be determined from aerial photographs, as these trees were similar in size to nest trees utilized by bald eagles in the Pacific states (Table 8).

Description and Analysis of Specific Locations in the Tahoe Basin for Supporting Wintering and Nesting Bald Eagles

For each site we describe: 1) a general description of the watershed, vegetation, and potential foraging perches along the water body, 2) the prey (principally fish) available in the area, 3) the available nest trees as determined by aerial photography, 4) disturbance factors that may influence the use of the area by bald eagles, and 5) recommendations for habitat modifications or resource enhancement which might facilitate attracting or supporting bald eagles in the area. Creeks which drains less than 520 ha (Jorgensen et al. 1978) were not presented in the results because their size was considered too small to attract nesting or wintering eagles. Creeks considered too small to be included in our evaluation included Quail, Madden, Homewood, and Dollar. No site visit was made to Trout Creek, therefore no description or analysis is provided.

It is important to understand that bald eagles may nest on streams and small tributaries of rivers, but will generally forage either on larger rivers or lakes. Several of the streams evaluated in the Basin contain suitable nest trees and have an established fishery; however, eagles nesting in these areas would probably forage principally in Lake Tahoe.

Truckee River

Description: The Truckee River is the major outflow of Lake Tahoe, located at Tahoe City, California (outflow at UTM 4339100N, 747000E) (Figure 6). The Truckee River is the largest river in the Basin, draining a total watershed of 131,687 ha (McEwan et al. 1986). The river valley is characterized by a mixture of open meadow and patches of coniferous and hardwood trees interspersed with willows. Steep talus slopes and a low density of conifers occur on the north side of the river, with dense coniferous forest occurring on the south side. Potential foraging perches along the river were also present.

Availability of Prey: McEwan et al. (1986) estimated 615 trout per km in the Truckee River and reported 12 fish species present within the drainage. McEwan et al. (1986) estimated a mean biomass of 6.9 kg/ha of game fish for the drainage as a whole. However, no sections of the Truckee river, or streams feeding it, within our

Table 7. Measurements of potential bald eagle nest trees in the Lake Tahoe basin identified from aerial photographs and measured on the ground. DBH = Diameter at breast height.

UTM Coordinate	Location	Species	DBH (cm)	Height (m)
4311400N 754550E	Fallen Leaf Lake	*Pinus jeffreyi*	155	40.2
4310800N 754700E	Fallen Leaf Lake	*P. jeffreyi*	103	28.0
4310800N 754700E	Fallen Leaf Lake	*P. jeffreyi*	138	32.5
4310800N 754700E	Fallen Leaf Lake	*P. jeffreyi*	118	38.0
4311750N 754400E	Fallen Leaf Lake	*P. jeffreyi*	154	52.2
4313300N 754400E	Baldwin Beach	*P. jeffreyi*	120	33.6
4326400N 750150E	Sugar Pine Pt.	*P. jeffreyi*	167	51.0
4326450N 749400E	General Creek	*P. jeffreyi*	150	41.1
4326350N 749450E	General Creek	*P. jeffreyi*	142	49.5
4335900N 742800E	Ward Creek	*P. lambertiana*	96	40.5
4341100N 741800E	Truckee River	*P. jeffreyi*	122	24.5
4347900N 756600E	Brockway	*Abies magnifica*	133	30.5
4313000N 755550E	Upper Taylor Creek	*P. jeffreyi*	142	39.0
4312350N 755800E	Upper Taylor Creek	*P. jeffreyi*	177	36.4

Table 8. Characteristics of bald eagle nest trees in California, Oregon, and Washington, and potential nest trees in the Tahoe Basin, California.

Geographic Area/ Forest Type	Height (range) (m)	DBH (cm)	Source
California *Ponderosa pine*	40 (23-63)	109 (64-208)	Lehamn (1979)
Oregon *Pondersoa pine*	41 (29-54)	117 (84-193)	Anthony et al. (1982)
Oregon *Douglas-fir*	58 (27-87)	175 (74-272)	Anthony et al. (1982)
Washington *Douglas-fir*	35 (25-60)	127 (61-229)	Anthony et al. (1982)
Tahoe Basin	38 (24-52)	137 (96-177)	This study