Effects of Recreational Activity on Overwintering Bald Eagles on the Skagit Wild and Scenic River System, Washington 1985-86

by

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EFFECTS OF RECREATIONAL ACTIVITY ON OVERWINTERING BALD EAGLES ON THE SKAGIT WILD AND SCENIC RIVER SYSYTEM, WASHINGTON

Report of Research Activities

1985-86

Pacific Northwest Research Station

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Notice of Study Status

The contents of this report are the preliminary results of research conducted for the Pacific Northwest Research Station, U. S. Forest Service, under Federal Grant No. PNW-86-470. Results reported herein are the preliminary analyses of an ongoing study and interpretations are tentative.

This report is divided into 7 sections, each describing the results of 7 tasks as outlined in the research study plan and grant award. These 7 tasks are:

(1) Observational Monitoring of Human-Eagle Interactions;
(2) Food Analysis;
(3) Weather Monitoring;
(4) Simulated Disturbances and River Censuses;
(5) Heart Rate Monitoring;
(6) Recreational Use Survey; and
(7) User Attitude Evaluation.

The Heart Rate Monitoring task, as described in the research study plan, will not be conducted.

The objectives of this project are to gather information on the effects of recreational activities on bald eagles on the Skagit and Sauk rivers, to synthesize these data into a workable model to predict impacts on eagles, and to suggest appropriate management recommendations.

The following is the proposed schedule for the study:

Fiscal Year 1985 - Equipment Purchases, Development of Study Plans, and Preliminary Data Collection.

Fiscal Year 1986 - Data Collection and Analysis.

Fiscal Year 1987 - Data Collection and Analysis.

Fiscal Year 1988 - Data Collection on Unfinished Tasks and Special Problems, Compilation and Pooling of Data, and Construction of the Management Model.

This schedule assumes that data collection will proceed at least as well in 1986-87 as was the case in 1985-86. A final report would be available in September 1988.

This document is a progress report for FY 86. It is meant to provide interested parties with information concerning the direction and progress of this project to date. It is not a complete report of all data collected during FY 86. The following major data sets are still being analyzed and are not included in this report:

(1) Flight distance and flushing response analyzed for each activity type by sequence during each day, by each hour of the day, and by season.

(2) Length of times for resumption of feeding activity after human disturbance partitioned by type of activity, time of day, and age of eagle.

(3) Shifts in distribution and behavior following a human activity event partitioned by type of activity, time of

day, and age of eagle.

(4) Effects of food abundance and weather patterns on all of the above.

(5) Effects of age on population trends and distribution patterns throughout the SW&SRS.

(6) Distances and directions of avoidance flights as affected by type of activity, age, and eagle activity.

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INTRODUCTION

In the early 1970s, the Skagit River became recognized as an important overwintering area for the bald eagle (Haliaeetus leucocephalus). In 1976, the Nature Conservancy bought several parcels of land along the upper reaches of the Skagit River to preserve critical habitat and to protect eagles from the influences of human activity. These lands, together with property owned by the Washington Department of Game, were set aside as the Skagit River Bald Eagle Natural Area (SRBENA). This eagle preserve, encompassing 3700 ha between Marblemount and Concrete, was one of the first sanctuaries established to protect bald eagles.

In 1978, the Congress of the United States designated the Skagit, Sauk, Suiattle, and Cascade rivers as a National Wild and Scenic River System (P.L. 95-625). The occurrence of hundreds of overwintering eagles on this Skagit Wild and Scenic River System (SW&SRS) was one reason for this federal classification. The U.S. Forest Service was appointed as the agency responsible for managing the SW&SRS. In 1983, the final management plan for SW&SRS was completed and an action plan was developed to initiate the proposed management plans. These plans described the necessity for determining the effects of any federally-implemented plans on bald eagles.

Also in 1978, The U.S. Fish and Wildlife Service reclassified the bald eagle in the state of Washington to a threatened species status. As a threatened species, the bald

eagle is protected by the Endangered Species Act. Under Section 7 of this Act, any federal action which may affect the "continued existence" of a threatened or endangered species requires consultation with the U.S. Fish and Wildlife Service to ensure that such actions are not detrimental to the species or its habitat. This consultation usually consists of a biological assessment conducted by the responsible agency to determine impacts of the proposed action.

Since the establishment of the SRBENA, recreational use on the Skagit River has increased, primarily as a result of visitation by eagle watchers. Float trips on SRBENA for viewing eagles and fishing for steelhead are common. Because of the potential for these activities to disturb bald eagles, the Nature Conservancy has expressed the need for research to determine if human activities are detrimental to eagles on the sanctuary.

To accomplish the biological assessment for consultation with the U.S. Fish and Wildlife Service and to meet the concerns of The Nature Conservancy, the Pacific Northwest Research Station of the U.S. Forest Service initiated this study. This report describes the preliminary results of this research for work conducted during the winter of 1985-86.

TASK 1 - Observational Monitoring of Human-Eagle Interactions

Methods

An observation point was established on a hillside overlooking the Washington Eddy (River Mile 69 to 70) on the SRBENA. Observations were made at this location dawn to dusk for 80 days from 1 December to 22 February (excluding 8, 15, and 25 December and 1 January). Information was collected using 10X binoculars and recorded on audio tapes and data sheets.

Scans of eagles perching on shoreline trees (within 50 meters of river), off-river trees (beyond 50 meters of river), and at a communal roost (Barnaby) were made every 10 minutes and scans of eagles feeding and standing on the ground were made every 5 minutes. For each scan, the number, age (adult or subadult), and minutes spent feeding or standing were recorded.

Whenever a human activity occurred, its type, duration, time of day, and number of persons involved were recorded. The responses of all eagles present to the human activity included: age (adult or subadult), activity (perching, feeding, or standing), flushing response (whether eagle flew from the activity or not), flight distances of eagles that flushed (distance between eagle and activity when flushing occurred), and distance of avoidance flight. Flight distances were measured by using distance markers erected in the observation area at 100 meter intervals or by plotting

the activity and flushed eagle on a grid map.

Analyses

Feeding Activity.-- Statistical comparisons of feeding activity during each day of the week was by ANOVA using Newman-Keuls Multiple Range Tests for individual comparisons. Student's t-tests compared feeding activity between weekdays and weekend. Least squares linear regression determined the relationship between the extent of feeding activity and the number of recreational activities.

Flight Distances.-- Differences in flight distances from the nine human activity types were tested using ANOVA and Newman-Keuls Multiple Range Tests for adults, subadults, and total (all ages combined). These tests also were used to compare responses of adults to subadults and to compare responses of eagles engaged in three activity types: perching, standing on the ground, and feeding on the ground.

Flushing Responses.-- Differences in flushing responses from the nine human activity types were tested using 2 x 2 chi-square contingency table (ANOVA was originally used but this test failed to meet variance assumptions and was discarded). This test also was used to compare responses of adults and subadults and to compare responses of eagles in three activity types: perching, standing on the ground, and feeding on the ground.

Ranking.-- Ranking of activities using the "flight index" was done simply by dividing the overall percent of

eagles flushed by each activity type by the percent of occurrence of that particular activity type.

Results and Discussion

Feeding Activity.-- The time of day when feeding activity occurred at Washington Eddy is listed in tables 1, 2, 3, and 4 and displayed in figures 1, 2, 3, and 4 for December, January, February, and Total, respectively.

Generally, most feeding activity occurred in the morning hours with a peak between 900 and 1100 hours. There was a much smaller peak, though often not noticeable, occurring in late afternoon. Feeding could happen during any time of the day, but there was little activity before 800 hours and virtually none after 1700 hours. These patterns were apparent during all 3 months. All season, 64 percent of feeding activity occurred before 1200 hours and 36 percent thereafter.

Human activity may have influenced the timing of feeding, as evidenced by a comparison of feeding histograms for each month. Human activity was high in January, intermediate in February, and low in December (see Task 5 for details). Ostensibly, this allowed eagles to feed with greater consistency throughout the day in December (Figure 1), it reduced feeding activity in the afternoons in January (Figure 2), and caused midday feeding depressions in February (Figure 3).

Age did not appear to influence the timing of feeding;

Table 1. Minutes of feeding activity by bald eagles at the Washington Eddy on the SRBENA during 28 days in December of 1985-86.

Hour of Day	December					
	Adult		Subadult		Total	
	n	%	n	%	n	%
7 - 8	77	1.1	42	1.3	119	1.1
8 - 9	437	6.0	320	10.3	757	7.3
9 - 10	738	10.1	432	13.9	1170	11.2
10 - 11	1120	15.4	452	14.5	1572	15.1
11 - 12	1248	17.1	490	15.7	1748	16.8
12 - 13	808	11.1	202	6.5	1010	9.7
13 - 14	832	11.4	266	8.5	1098	10.6
14 - 15	516	7.1	342	11.0	858	8.2
15 - 16	945	13.0	366	11.7	1311	12.6
16 - 17	563	7.7	206	6.6	769	7.4
17 - 18	0	0.0	0	0.0	0	0.0
Totals	7284	100.0	3118	100.0	10402	100.0

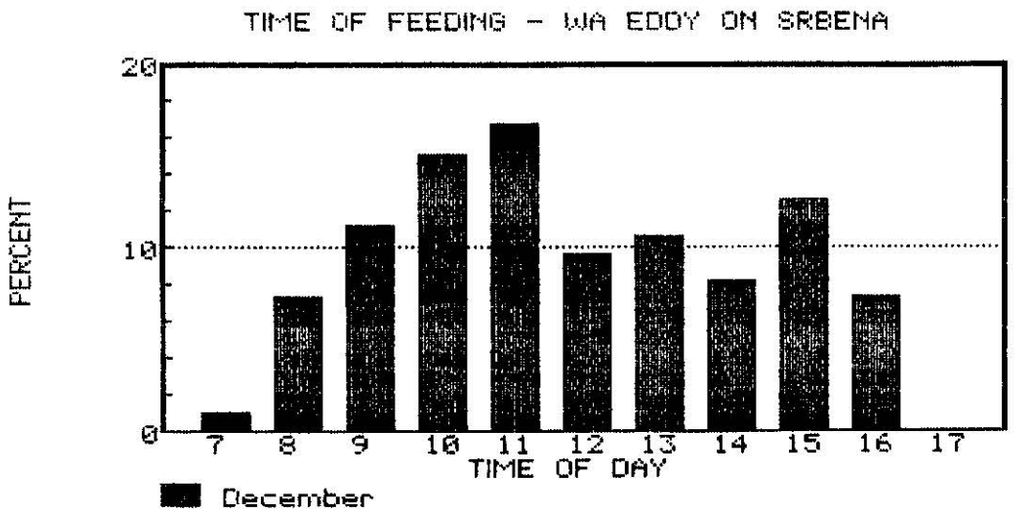

Figure 1. Time of feeding activity at Washington Eddy during December 1985 (see Table 1).

Table 2. Minutes of feeding activity by bald eagles at the Washington Eddy on the SRBENA during 30 days in January of 1985-86.

Hour of Day	January					
	Adult		Subadult		Total	
	n	%	n	%	n	%
7 - 8	30	0.3	15	0.3	45	0.3
8 - 9	746	8.7	936	16.3	1682	11.7
9 - 10	2370	27.6	1392	24.3	3762	26.2
10 - 11	1831	21.3	1092	19.0	2923	20.4
11 - 12	1186	13.8	811	14.1	1997	13.9
12 - 13	956	11.1	600	10.5	1556	10.9
13 - 14	552	6.4	461	8.0	1013	7.1
14 - 15	253	2.9	212	3.7	465	3.2
15 - 16	313	3.6	83	1.4	396	2.8
16 - 17	342	4.0	132	2.3	474	3.3
17 - 18	23	0.3	5	0.1	28	0.2
Totals	8602	100.0	5739	100.0	14341	100.0

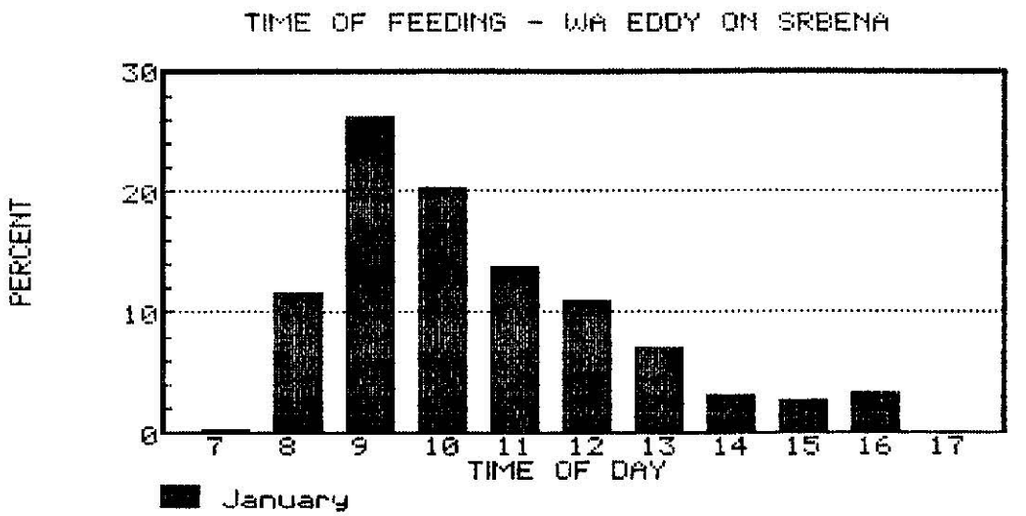

Figure 2. Time of feeding activity at Washington Eddy during January 1986 (see Table 2).

Table 3. Minutes of feeding activity by bald eagles at the Washington Eddy on the SRBENA during 22 days in February of 1985-86.

Hour of Day	February					
	Adult		Subadult		Total	
	n	%	n	%	n	%
7 - 8	0	0.0	2	0.5	2	0.3
8 - 9	22	7.2	66	17.1	88	12.8
9 - 10	43	14.1	56	14.5	99	14.4
10 - 11	96	31.6	91	23.6	187	27.1
11 - 12	42	13.8	43	11.2	85	12.3
12 - 13	5	1.6	19	4.9	24	3.5
13 - 14	3	1.0	15	3.9	18	2.6
14 - 15	42	13.8	34	8.8	76	11.0
15 - 16	28	9.2	38	9.9	66	9.6
16 - 17	19	6.3	21	5.5	40	5.8
17 - 18	4	1.3	0	0.0	4	0.6
Totals	304	99.9	385	99.9	689	100.0

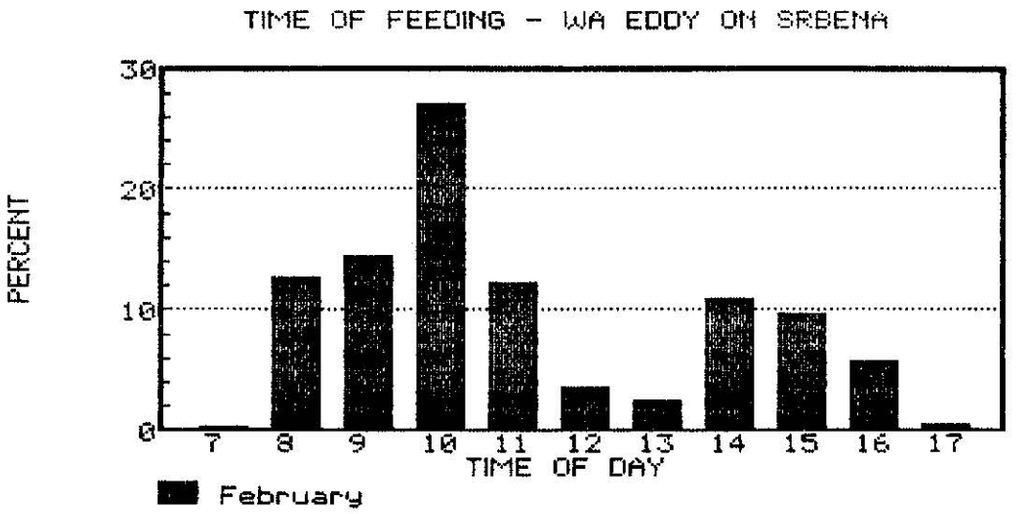

Figure 3. Time of feeding activity at Washington Eddy during February 1986 (see Table 3).

Table 4. Minutes of feeding activity by bald eagles at the Washington Eddy on the SRBENA during 80 days in December, January, and February of 1985-86.

Hour of Day	December, January, and February					
	Adult		Subadult		Total	
	n	%	n	%	n	%
7 - 8	107	0.7	59	0.6	166	0.7
8 - 9	1205	7.4	1322	14.3	2527	9.9
9 - 10	3151	19.5	1880	20.3	5031	19.8
10 - 11	3047	18.8	1635	17.7	4682	18.4
11 - 12	2476	15.3	1344	14.5	3820	15.0
12 - 13	1769	10.9	821	8.9	2590	10.2
13 - 14	1387	8.6	742	8.0	2129	8.4
14 - 15	811	5.0	588	6.4	1399	5.5
15 - 16	1286	7.9	487	5.3	1773	7.0
16 - 17	924	5.7	359	3.9	1283	5.0
17 - 18	27	0.2	5	0.1	32	0.1
Totals	16190	100.0	9242	100.0	25432	100.0

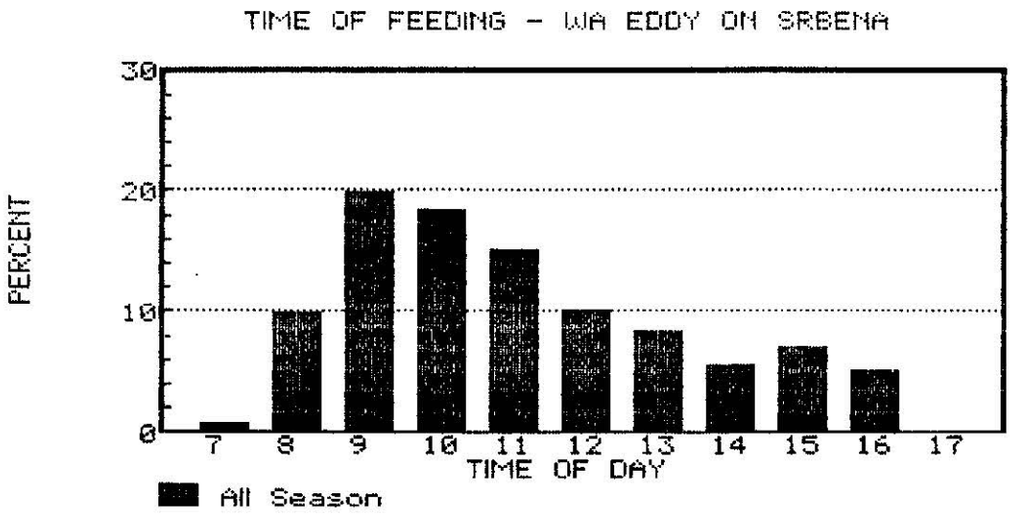

Figure 4. Time of feeding activity at Washington Eddy all winter season 1985-86 (see Table 4).

adults and subadults fed at similar times.

These data substantiate previously-suspected feeding patterns on the Skagit River. They support the management strategy of restricting human activity in the morning (before 1000 hours) because of brisk early-day feeding. Feeding is, however, common until 1200 hours and, in the absence of activity, feeding may persist throughout the day.

During the winter season, there was a negative correlation between the extent of recreational activities and the time spent feeding by eagles (Table 5, Figure 5). Both adults and subadults fed less each day during periods of human activity. This relationship was significant only in January, especially with subadults, but was negative throughout the season. Much variation occurred in this data set, but the trend implicating human activity in depressing feeding is evident (Figure 5).

Least squares regression analysis predicted the number of recreational activities which would cause complete termination of feeding by eagles at Washington Eddy (Y = 0 values in Table 5). For the entire winter season, this value is 82 for all ages combined (Figure 5). Substantial differences occurred, however, among the 3 months (Figure 6). The number of activities that stopped feeding increased as the winter season progressed. Whether this pattern is a result of partial habituation of eagles during the season or a quirk in the data set is not known. The effects of human activity to subadults in February were particularly low.

Table 5. Least squares regression statistics of feeding activity (minutes/day) at the Washington Eddy on the SRBENA as a function of the daily number of recreational activities.

Age	n	Regression Equation	Y=0	r	P
DECEMBER					
Adult	28	Y=302.1 - 7.524X	40.2	-0.157	NSD
Subadult	28	Y=130.1 - 3.372X	38.6	-0.218	NSD
Total	28	Y=432.2 - 10.896X	39.7	-0.180	NSD
JANUARY					
Adult	30	Y=374.0 - 3.884X	96.3	-0.352	NSD
Subadult	30	Y=250.7 - 2.645X	94.8	-0.362	0.05
Total	30	Y=624.7 - 6.529X	95.7	-0.366	0.05
FEBRUARY					
Adult	22	Y= 16.9 - 0.158X	107.0	-0.236	NSD
Subadult	22	Y= 20.0 - 0.125X	160.0	-0.130	NSD
Total	22	Y= 36.9 - 0.283X	130.4	-0.181	NSD
TOTALS					
Adult	80	Y=251.7 - 3.122X	80.6	-0.247	0.05
Subadult	80	Y=142.3 - 1.694X	84.0	-0.241	0.05
Total	80	Y=394.0 - 4.816X	81.8	-0.255	0.025

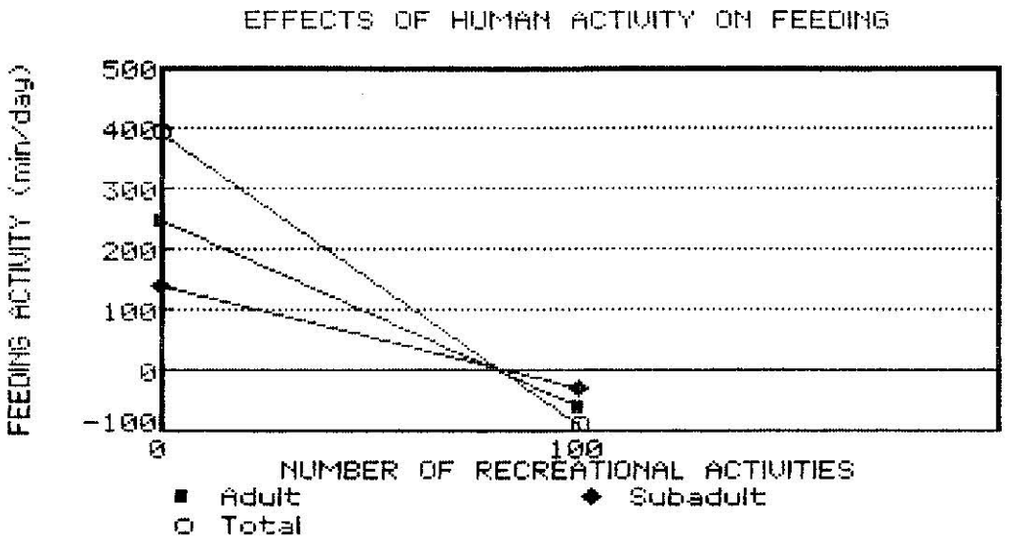

Figure 5. Relationship between daily recreational activity and daily feeding activity during the winter season 1985-86 at Washington Eddy (see Table 5). During days with 82 human activities or more, eagle feeding activity is completely stopped.

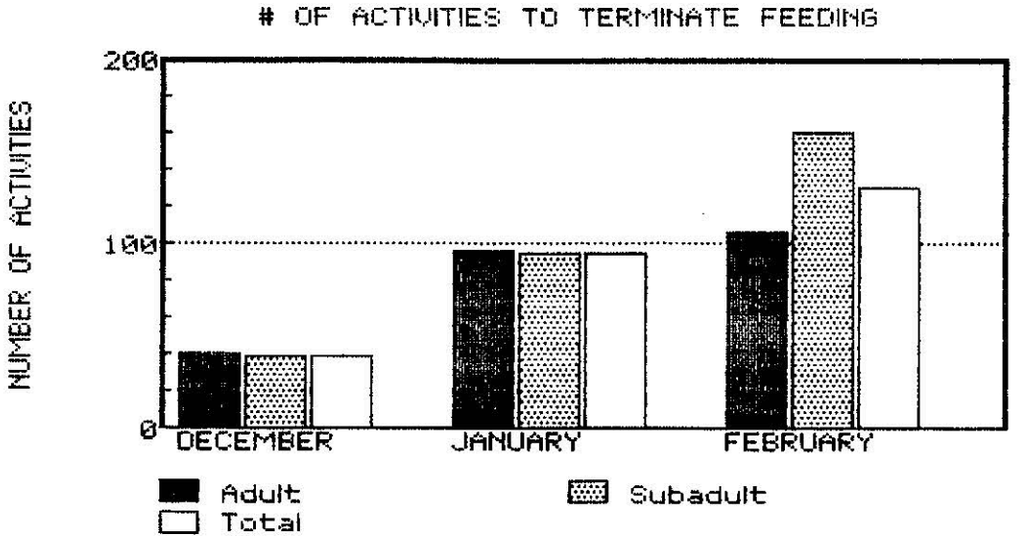

Figure 6. Number of recreational activities which cause a complete termination of feeding by eagles at Washington Eddy by month and age (Y = 0 value in Table 5).

There was considerable variability in the daily amount of feeding by eagles at Washington Eddy (Table 6). Although statistical treatments failed to show any significant differences in feeding activity among the days of the week, ostensibly because of a same sample size and high variability, a trend was evident. Bearing in mind these constraints, feeding activity was lowest on Sundays, highest on Mondays and Tuesdays, intermediate on Wednesdays, Thursdays, and Fridays, and low on Saturdays (Figure 7). Weekends (Sat-Sun) were not favored for feeding, pre-weekend days (Thu-Fri) had intermediate feeding intensity, and post-weekend days (Mon-Tue) had high levels of feeding (Figure 8). Overall, less feeding occurred per day on weekends than on weekdays (Figure 9). These trends were most evident in January and February, and less so in December.

These data suggest, but do not establish, that recreational activity forced eagles to feed less often on weekends when human activity levels were high, and then feed more often for several days following the weekend when activity levels were lower.

Daily feeding activity was brisk in December and January, but low in February. Loss of salmon carcasses due to January flooding caused low feeding rates in February.

Flight Distances.-- Average flight distances of perched eagles ranged from 109 meters from canoes to 217 meters from bank fishers, and considerable variation was recorded (Table 7, Figure 10). There were no significant differences in

Table 6. Daily feeding activity (minutes/day) by bald eagles at the Washington Eddy on the SRBENA in December, January, and February by day; grouped prior to the weekend (Thu/Fri), during the weekend (Sat/Sun), and after the weekend (Mon/Tue); and between weekdays and weekend. *

	December			January		
Grouping	n	Mean	SE	n	Mean	SE
DAY						
Sunday	3	146a	33.6	4	250a	249.4
Monday	5	281a	152.8	4	838a	533.2
Tuesday	5	563a	358.5	4	633a	267.7
Wednesday	3	401a	129.2	4	463a	300.1
Thursday	4	266a	113.8	5	464a	285.1
Friday	4	413a	69.2	5	577a	225.7
Saturday	4	456a	192.2	4	145a	72.5
PAIRED DAYS						
Thursday/Friday	8	340a	68.0	10	521a	166.0
Saturday/Sunday	7	324a	121.1	8	176a	123.4
Monday/Tuesday	10	421a	189.5	8	736a	279.2
TIME OF WEEK						
Weekend	7	377a	118.7	8	173a	123.4
Weekday	21	387a	92.9	22	588a	133.3

* Statistical comparisons among the groupings by month are denoted by lower case letters and comparisons among totals are by upper case letters (all NSD).

Table 6. Continued.

Grouping	February n	February Mean	February SE	Totals n	Totals Mean	Totals SE
DAY						
Sunday	3	27a	26.7	10	152A	96.8
Monday	3	69a	33.0	12	414A	195.6
Tuesday	3	49a	5.8	12	458A	176.5
Wednesday	3	4a	4.3	10	307A	132.5
Thursday	3	22a	11.6	12	261A	104.1
Friday	3	31a	7.3	12	386A	104.3
Saturday	4	21a	21.0	12	193A	84.3
PAIRED DAYS						
Thursday/Friday	6	27a	6.4	24	337A	81.4
Saturday/Sunday	7	23a	15.1	22	175A	62.3
Monday/Tuesday	6	59a	15.4	24	436A	129.0
TIME OF WEEK						
Weekend	7	23a	15.1	22	174A	62.3
Weekday	15	35a	8.5	58	372A	66.4

* Statistical comparisons among the groupings by month are denoted by lower case letters and comparisons among totals are by upper case letters (all NSD).

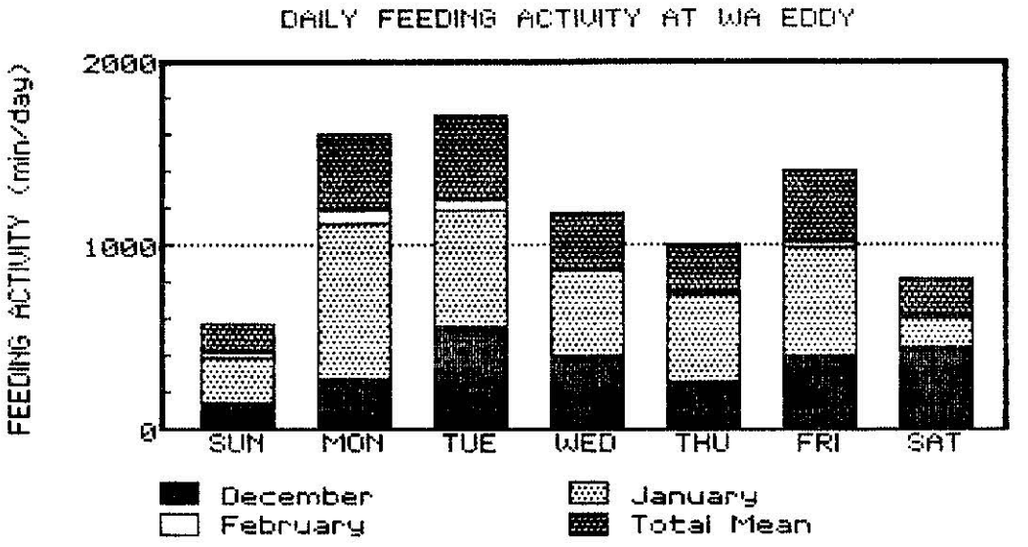

Figure 7. Average daily feeding activity (minutes/day) at Washington Eddy during each day of the week (see Table 6).

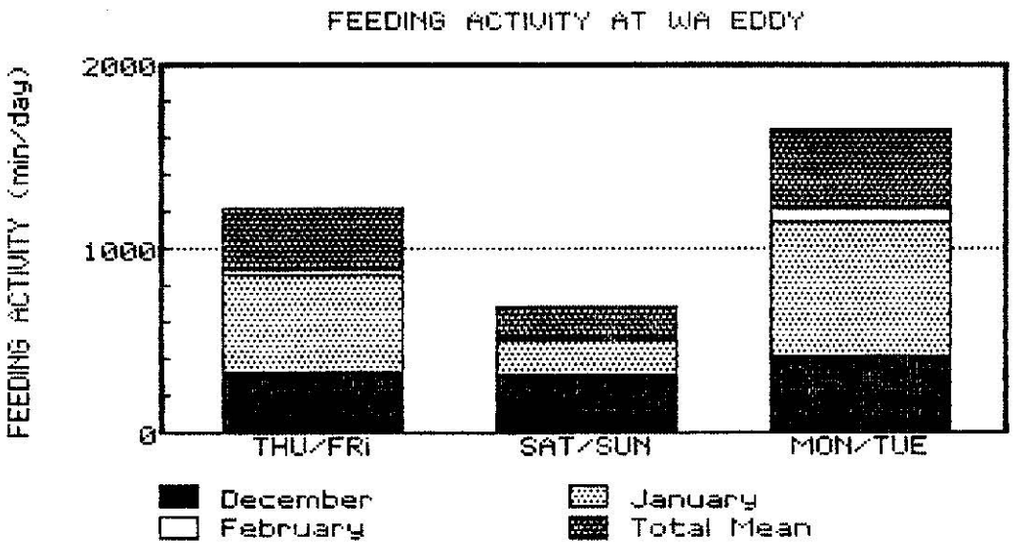

Figure 8. Average daily feeding activity (minutes/day) at Washington Eddy for paired days prior to, during, and following the weekend (see Table 6).

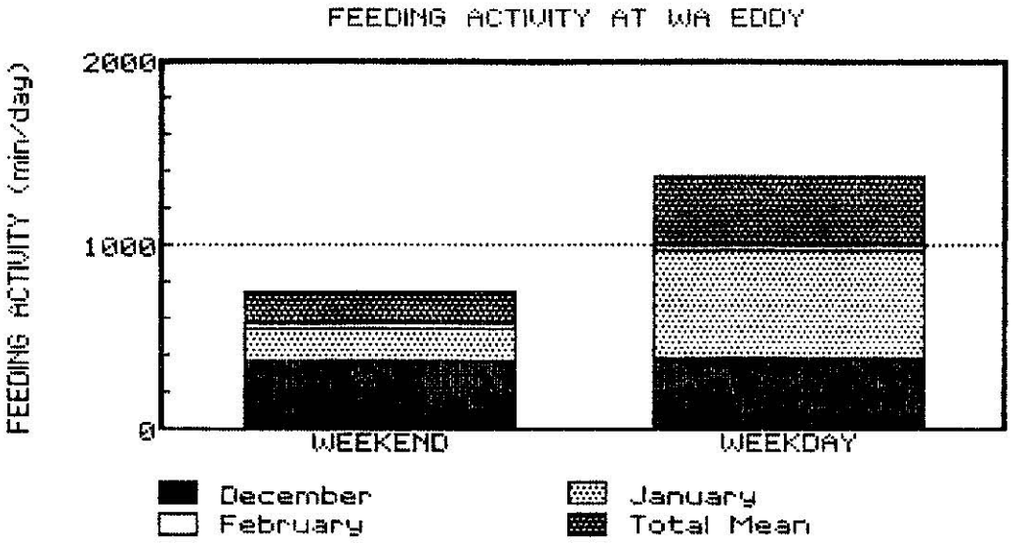

Figure 9. Average daily feeding activity (minutes/day) at Washington Eddy during weekends and weekdays (see Table 6).

Table 7. Flight distances (meters) of bald eagles from nine human activity types while perched at the Washington Eddy on the SRBENA.

	Adult			Subadult			Total	
	n	Mean	SE	n	Mean	SE	n	Mean	SE
Motorboat (Running)	121	141.0	7.57	85	134.1	7.18	206	138.2	5.34
Motorboat (Drifting)	65	122.0	10.06	54	114.1	10.37	119	118.4	7.21
Raft (Recreation)	81	149.0	15.14	43	143.3	20.33	124	147.0	12.10
Raft (Research)	78	124.9	8.79	49	135.3	12.95	127	128.9	7.34
Dory or Drift	85	115.6	9.55	63	130.6	9.31	148	122.0	6.77
Canoe	6	148.3	26.38	5	62.0	19.60	11	109.1	21.08
Kayak	6	126.7	56.14	1	40.0	-	7	114.3	49.03
Bank Fisher	21	219.5	16.07	7	208.6	24.15	28	216.8	13.29
Hiker	35	203.7	19.77	16	208.1	31.00	51	205.1	16.52

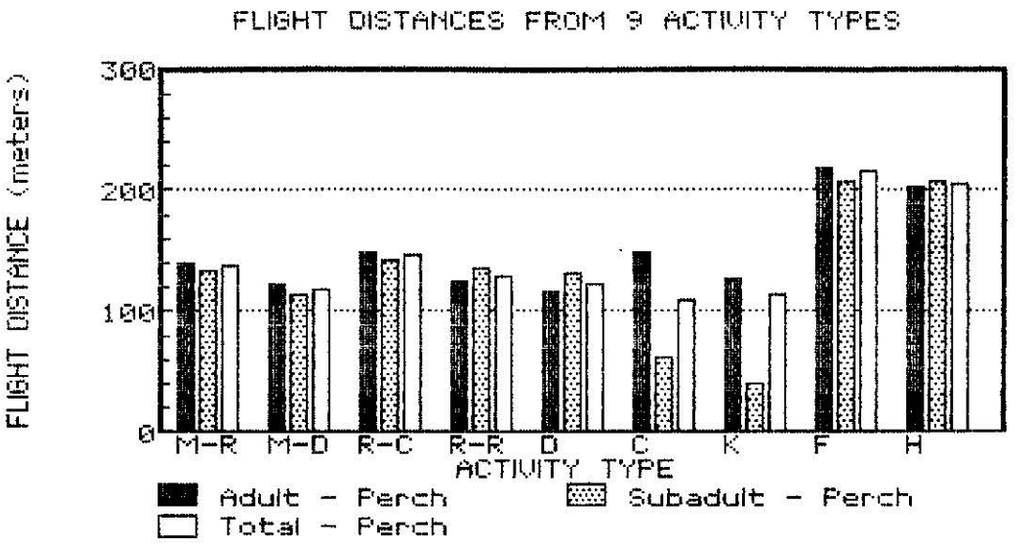

Figure 10. Flight distances (meters) of bald eagles perching at Washington Eddy from nine human activity types (see Table 7). M-R = Motorboat-Running, M-D = Motorboat-Drifting, R-C = Raft-Recreation, R-R = Raft-Research, D = Dory or Drift, C = Canoe, K = Kayak, F = Bank Fisher, and H = Hiker.

flight distances between any types of boating activity (Table 8). There was, however, considerable differences in flight distances from foot activity compared to boating activity (Table 8). Flight distances from bank fishers were higher than from all boat types except kayaks (owing to a small sampling), especially with adults. Flight distances from hikers also were higher than from all boat types except kayaks, and this was the case with both adults and subadults.

Average flight distances of eagles feeding on the ground ranged from 146 meters from recreational rafts to 326 meters from hikers, and considerable variation was recorded (Table 9). Flight distances from hikers, bank fishers, and running motorboats were especially long (Figure 11). Although distances from bank fishers was significantly longer than for only recreational rafts, distances from hikers and running motorboats were significantly longer than for 4 boat types (Table 10). All of these differences were especially true for adults; there were no significant differences in flight distances of subadults to all activity types.

Average flight distances of eagles standing on the ground ranged from 127 meters from recreational rafts to 289 meters from running motorboats, and considerable variation was recorded (Table 11, Figure 12). Flight distances from running motorboats and hikers were particularly long and significantly different from a number of other activity types, especially with adults, but several other differences were recorded (Table 12). Most significant differences

Table 8. Statistical probability values comparing the effects of nine human activity types on the flight distances of bald eagles perching in trees at the Washington Eddy on the SRBENA.

Human Activity Comparison	Probability		
	Adult	Subadult	Totals
Bank Fisher-Canoe	NSD	NSD	0.05
Bank Fisher-Kayak	NSD	NSD	NSD
Bank Fisher-Motorboat (Drift)	0.05	NSD	0.001
Bank Fisher-Dory/Drift	0.05	NSD	0.001
Bank Fisher-Raft (Research)	0.05	NSD	0.001
Bank Fisher-Motorboat (Run)	0.05	NSD	0.001
Bank Fisher-Raft (Recreation)	0.05	NSD	0.001
Bank Fisher-Hiker	NSD	NSD	NSD
Hiker-Canoe	NSD	0.05	0.05
Hiker-Kayak	NSD	NSD	NSD
Hiker-Motorboat (Drift)	0.05	0.05	0.001
Hiker-Dory/Drift	0.05	0.05	0.001
Hiker-Raft (Research)	0.05	0.05	0.001
Hiker-Motorboat (Run)	0.05	0.05	0.001
Hiker-Raft (Recreation)	0.05	0.05	0.001
Raft (Recreation)-Canoe	NSD	NSD	NSD
Raft (Recreation)-Kayak	NSD	NSD	NSD
Raft (Recreation)-Motorboat (Drift)	NSD	NSD	NSD
Raft (Recreation)-Dory/Drift	NSD	NSD	NSD
Raft (Recreation)-Raft (Research)	NSD	NSD	NSD
Raft (Recreation)-Motorboat (Run)	NSD	NSD	NSD
Motorboat (Run)-Canoe	NSD	NSD	NSD
Motorboat (Run)-Kayak	NSD	NSD	NSD
Motorboat (Run)-Motorboat (Drift)	NSD	NSD	NSD
Motorboat (Run)-Dory/Drift	NSD	NSD	NSD
Motorboat (Run)-Raft (Research)	NSD	NSD	NSD
Raft (Research)-Canoe	NSD	NSD	NSD
Raft (Research)-Kayak	NSD	NSD	NSD
Raft (Research)-Motorboat (Drift)	NSD	NSD	NSD
Raft (Research)-Dory/Drift	NSD	NSD	NSD
Dory/Drift-Canoe	NSD	NSD	NSD
Dory/Drift-Kayak	NSD	NSD	NSD
Dory/Drift-Motorboat (Drift)	NSD	NSD	NSD
Motorboat (Drift)-Canoe	NSD	NSD	NSD
Motorboat (Drift)-Kayak	NSD	NSD	NSD
Kayak-Canoe	NSD	NSD	NSD

NSD = No Significant Difference ($P < 0.05$).
\- = No Data.

Table 9. Flight distances (meters) of bald eagles from nine human activity types while feeding at the Washington Eddy on the SRBENA.

	Adult			Subadult			Total	
	n	Mean	SE	n	Mean	SE	n	Mean	SE
Motorboat (Running)	46	274.1	15.18	22	297.7	26.86	68	281.8	13.40
Motorboat (Drifting)	13	198.5	29.80	7	215.7	41.91	20	204.5	23.71
Raft (Recreation)	15	131.3	22.36	5	190.0	27.20	20	146.0	18.69
Raft (Research)	22	181.4	22.84	6	228.3	72.68	28	191.4	23.29
Dory or Drift	28	173.2	19.79	10	200.0	43.69	38	180.3	18.34
Canoe	4	215.0	52.99	0	-	-	4	215.0	52.99
Kayak	0	-	-	0	-	-	0	-	-
Bank Fisher	3	333.3	88.19	1	300.0	-	4	325.0	62.92
Hiker	15	318.0	14.97	7	342.9	38.47	22	325.9	15.58

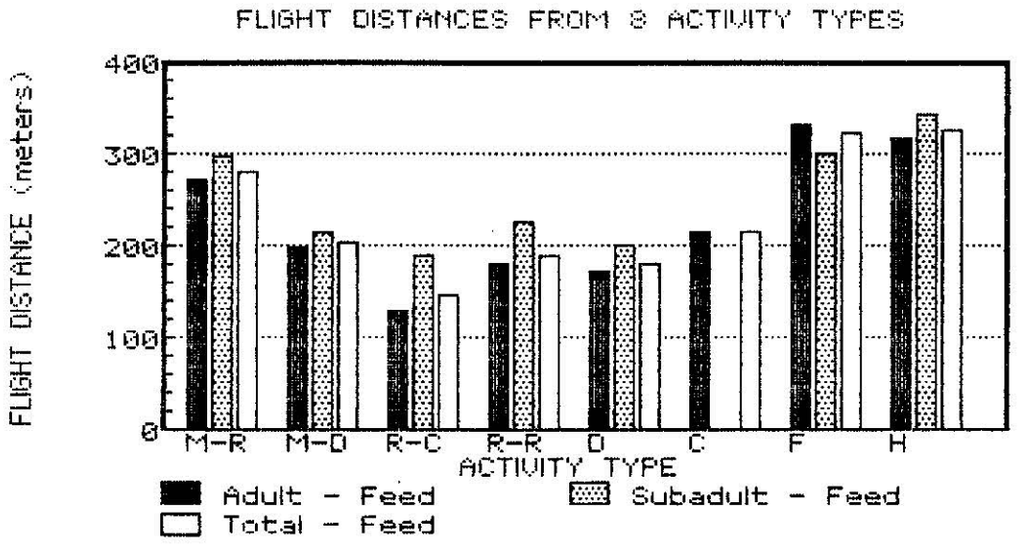

Figure 11. Flight distances (meters) of bald eagles feeding at Washington Eddy from eight human activity types (see Table 9). M-R = Motorboat-Running, M-D = Motorboat-Drifting, R-C = Raft-Recreation, R-R = Raft-Research, D = Dory or Drift, C = Canoe, F = Bank Fisher, and H = Hiker.

Table 10. Statistical probability values comparing the effects of nine human activity types on the flight distances of bald eagles feeding on the ground at the Washington Eddy on the SRBENA.

Human Activity Comparison	Probability		
	Adult	Subadult	Totals
Bank Fisher-Canoe	NSD	-	NSD
Bank Fisher-Kayak	-	-	-
Bank Fisher-Motorboat (Drift)	NSD	NSD	NSD
Bank Fisher-Dory/Drift	NSD	NSD	NSD
Bank Fisher-Raft (Research)	NSD	NSD	NSD
Bank Fisher-Motorboat (Run)	NSD	NSD	NSD
Bank Fisher-Raft (Recreation)	0.05	NSD	0.05
Bank Fisher-Hiker	NSD	NSD	NSD
Hiker-Canoe	NSD	-	NSD
Hiker-Kayak	-	-	-
Hiker-Motorboat (Drift)	0.05	NSD	0.005
Hiker-Dory/Drift	0.05	NSD	0.001
Hiker-Raft (Research)	0.05	NSD	0.001
Hiker-Motorboat (Run)	NSD	NSD	NSD
Hiker-Raft (Recreation)	0.05	NSD	0.001
Raft (Recreation)-Canoe	NSD	-	NSD
Raft (Recreation)-Kayak	-	-	-
Raft (Recreation)-Motorboat (Drift)	NSD	NSD	NSD
Raft (Recreation)-Dory/Drift	NSD	NSD	NSD
Raft (Recreation)-Raft (Research)	NSD	NSD	NSD
Raft (Recreation)-Motorboat (Run)	0.05	NSD	0.001
Motorboat (Run)-Canoe	NSD	-	NSD
Motorboat (Run)-Kayak	-	-	-
Motorboat (Run)-Motorboat (Drift)	0.05	NSD	0.025
Motorboat (Run)-Dory/Drift	0.05	NSD	0.001
Motorboat (Run)-Raft (Research)	0.05	NSD	0.001
Raft (Research)-Canoe	NSD	-	NSD
Raft (Research)-Kayak	-	-	-
Raft (Research)-Motorboat (Drift)	NSD	NSD	NSD
Raft (Research)-Dory/Drift	NSD	NSD	NSD
Dory/Drift-Canoe	NSD	-	NSD
Dory/Drift-Kayak	-	-	-
Dory/Drift-Motorboat (Drift)	NSD	NSD	NSD
Motorboat (Drift)-Canoe	NSD	-	NSD
Motorboat (Drift)-Kayak	-	-	-
Kayak-Canoe	-	-	-

NSD = No Significant Difference ($P < 0.05$).
- = No Data.

Table 11. Flight distances (meters) of bald eagles from nine human activity types while standing at the Washington Eddy on the SRBENA.

	Adult			Subadult			Total	
	n	Mean	SE	n	Mean	SE	n	Mean	SE
Motorboat (Running)	67	284.2	14.25	32	300.0	21.63	99	289.3	11.87
Motorboat (Drifting)	23	190.0	16.09	12	245.8	19.44	35	209.1	13.14
Raft (Recreation)	22	116.8	13.18	16	141.3	19.91	38	127.1	11.35
Raft (Research)	34	196.5	19.67	3	230.0	64.29	37	199.2	18.62
Dory or Drift	26	163.9	18.57	14	125.0	27.35	40	150.3	15.49
Canoe	12	178.3	31.50	0	-	-	12	178.3	31.50
Kayak	0	-	-	0	-	-	0	-	-
Bank Fisher	2	200.0	100.00	1	200.0	-	3	200.0	57.74
Hiker	32	268.8	14.47	12	214.2	25.60	44	253.9	13.01

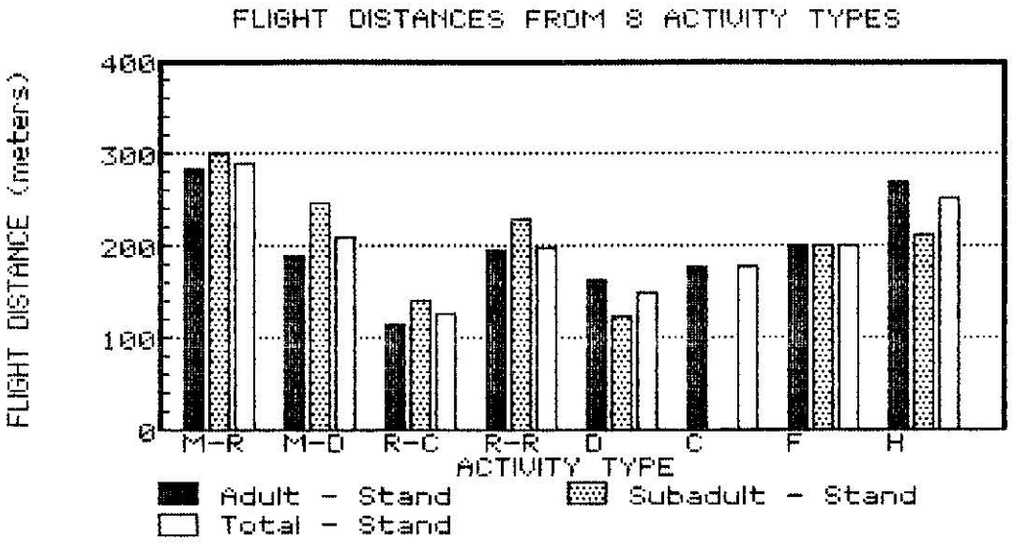

Figure 12. Flight distances (meters) of bald eagles standing at Washington Eddy from eight human activity types (see Table 11). M-R = Motorboat-Running, M-D = Motorboat-Drifting, R-C = Raft-Recreation, R-R = Raft-Research, D = Dory or Drift, C = Canoe, F = Bank Fisher, and H = Hiker.

Table 12. Statistical probability values comparing the effects of nine human activity types on the flight distances of bald eagles standing on the ground at the Washington Eddy on the SRBENA.

Human Activity Comparison	Probability		
	Adult	Subadult	Totals
Bank Fisher-Canoe	NSD	-	NSD
Bank Fisher-Kayak	-	-	-
Bank Fisher-Motorboat (Drift)	NSD	NSD	NSD
Bank Fisher-Dory/Drift	NSD	NSD	NSD
Bank Fisher-Raft (Research)	NSD	NSD	NSD
Bank Fisher-Motorboat (Run)	NSD	NSD	NSD
Bank Fisher-Raft (Recreation)	0.05	NSD	NSD
Bank Fisher-Hiker	NSD	NSD	NSD
Hiker-Canoe	NSD	-	NSD
Hiker-Kayak	-	-	-
Hiker-Motorboat (Drift)	0.05	NSD	NSD
Hiker-Dory/Drift	0.05	NSD	0.001
Hiker-Raft (Research)	0.05	NSD	NSD
Hiker-Motorboat (Run)	NSD	NSD	NSD
Hiker-Raft (Recreation)	0.05	NSD	0.001
Raft (Recreation)-Canoe	NSD	-	NSD
Raft (Recreation)-Kayak	-	-	-
Raft (Recreation)-Motorboat (Drift)	NSD	NSD	0.01
Raft (Recreation)-Dory/Drift	NSD	NSD	NSD
Raft (Recreation)-Raft (Research)	0.05	NSD	0.025
Raft (Recreation)-Motorboat (Run)	0.05	0.05	0.001
Motorboat (Run)-Canoe	0.05	-	0.005
Motorboat (Run)-Kayak	-	-	-
Motorboat (Run)-Motorboat (Drift)	0.05	NSD	0.001
Motorboat (Run)-Dory/Drift	0.05	0.05	0.001
Motorboat (Run)-Raft (Research)	0.05	NSD	0.001
Raft (Research)-Canoe	NSD	-	NSD
Raft (Research)-Kayak	-	-	-
Raft (Research)-Motorboat (Drift)	NSD	NSD	NSD
Raft (Research)-Dory/Drift	NSD	NSD	NSD
Dory/Drift-Canoe	NSD	-	NSD
Dory/Drift-Kayak	-	-	-
Dory/Drift-Motorboat (Drift)	NSD	0.05	NSD
Motorboat (Drift)-Canoe	NSD	-	NSD
Motorboat (Drift)-Kayak	-	-	-
Kayak-Canoe	-	-	-

NSD = No Significant Difference ($P < 0.05$).
- = No Data.

occurred with adults, but in 3 instances, differences occurred with subadults. Distances from research rafts were longer than from recreational rafts.

Generally, eagles were less tolerant of foot traffic (hiking and bank fishing) than boating traffic; they flew away from these activities at great distances. They also were sensitive to running motorboats when either feeding or standing on the ground. Sample sizes were particularly small for kayaks and canoes; results for these types are inconclusive. Foot traffic is an unusual occurrence which suggests that eagles are more sensitive to activity types that they are unfamiliar with. Because boating traffic is more common, eagles may be partially habituating to it. The sound created by running motorboats could be elevating flight distances, but because only birds on the ground showed longer distances, the "surprise" of a boat quickly entering the feeding grounds could also explain this variation. Also, motorboats are more common in early morning; eagles may show more sensitivity at these times. This is the apparent explanation for the disparity in distances between research rafts and recreational rafts; the former occur in morning and late afternoon and the latter occur mostly in midday.

A comparison of the flight distances of the 2 age groups to each other showed only a few significant differences (Table 13). While perched, adults had longer distances from canoes than subadults, but the sampling was small. While standing, subadults had longer distances than adults in the

Table 13. Probability values comparing the flight distances of adult and subadult bald eagles from nine human activity types while perched, feeding, and standing at the Washington Eddy on the SRBENA.

Activity Type	Adult-Subadult Comparison		
	Perching	Feeding	Standing
Motorboat (Running)	NSD	NSD	NSD
Motorboat (Drifting)	NSD	NSD	0.05
Raft (Recreation)	NSD	NSD	NSD
Raft (Research)	NSD	NSD	NSD
Dory or Drift	NSD	NSD	NSD
Canoe	0.05	NSD	NSD
Kayak	NSD	NSD	NSD
Bank Fisher	NSD	NSD	NSD
Hiker	NSD	NSD	NSD
Totals	NSD	0.05	NSD

presence of drifting motorboats. For all activities combined, feeding subadults had distances that were 16 percent longer than those for adults (Table 14, Figure 13). Why adults are more tolerant while feeding and subadults are more sensitive during feeding is difficult to answer. Perhaps subadults have not yet learned to habituate to some human activities some of the time.

Eagles of any age perched in trees had significantly shorter flight distances than eagles feeding or standing on the ground (Table 14, Figure 13). There was no significant difference in distances between feeding and standing eagles, though distances of feeding subadults were somewhat high.

Eagles are more sensitive to human activity when they are on the ground ostensibly because they are more vulnerable to danger there and have a reduced visual field so that determining the potential effects of any danger is more difficult. Because salmon on the SW&SRS are too large to carry, eagles must eat them on the ground thereby exposing themselves to potential danger and creating a situation where feeding is difficult when human activity occurs.

Flushing Responses.-- Flushing responses (percent of eagles flushed/100) of perched eagles ranged from a low of 0.033 from kayaks to a high of 0.636 from bank fishers (Table 15, Figure 14). There were considerable significant differences among most activity types for perched eagles (Table 16). Foot traffic caused a large proportion of eagles to fly away as was the case for research rafts. Dories also

Table 14. Flight distances (meters) of bald eagles from nine human activity types combined while perched, feeding and standing at the Washington Eddy on the SRBENA. *

	Adult			Subadult			Total	
n	Mean	SE	n	Mean	SE	n	Mean	SE
Perching								
498	140.6a	4.45	323	135.4a	5.00	821	138.5A	3.34
Feeding								
146	223.5b	9.49	58	260.0b	17.03	204	233.9B	8.42
Standing								
218	220.5b	7.75	90	222.4b	12.65	308	221.0B	6.62

* Statistical comparisons among the three eagle activities is denoted by lower case letters for the two age classes and upper case letters for totals (differences between age are not shown).

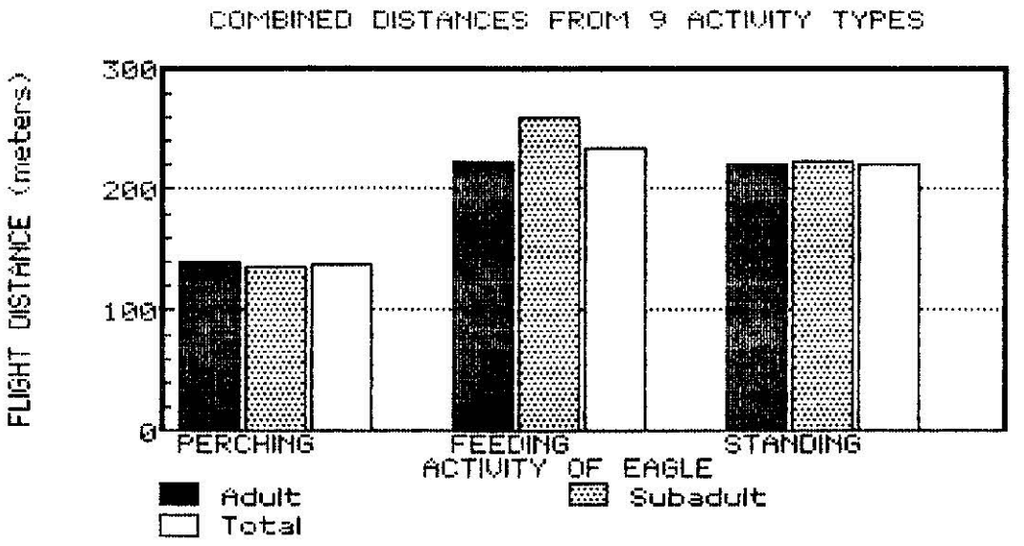

Figure 13. Flight distances (meters) of bald eagles from nine human activity types combined while perching, feeding, and standing at Washington Eddy (see Table 14).

Table 15. Flushing responses of bald eagles to nine human activity types while perched at the Washington Eddy on the SRBENA.

Adult		Subadult		All Ages	
n	Mean	n	Mean	n	Mean
Motorboat (Running)					
583	0.218	346	0.237	929	0.225
Motorboat (Drifting)					
247	0.287	185	0.351	432	0.315
Raft (Recreation)					
526	0.177	194	0.284	720	0.206
Raft (Research)					
151	0.470	91	0.538	242	0.496
Dory or Drift					
264	0.345	156	0.442	420	0.381
Canoe					
125	0.056	45	0.125	170	0.071
Kayak					
135	0.037	47	0.021	182	0.033
Bank Fisher					
32	0.656	12	0.583	44	0.636
Hiker					
83	0.434	36	0.500	119	0.454

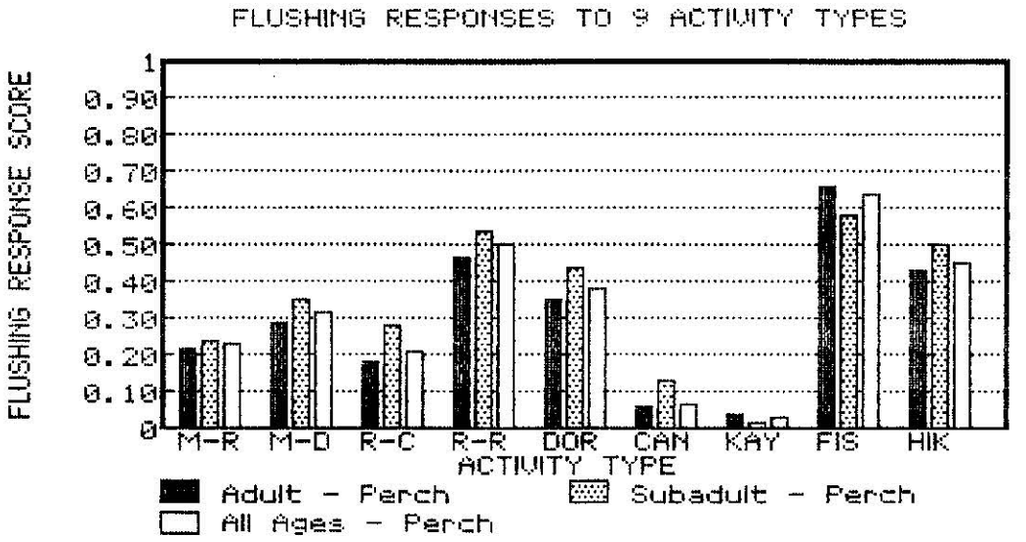

Figure 14. Flushing response scores of bald eagles perching at Washington Eddy to nine human activity types (see Table 15). M-R = Motorboat-Running, M-D = Motorboat-Drifting, R-C = Raft-Recreation, R-R = Raft-Research, DOR = Dory or Drift, CAN = Canoe, KAY = Kayak, FIS = Bank Fisher, and HIK = Hiker.

Table 16. Statistical probability values comparing the effects of nine human activity types on the flushing responses of eagles while perched in trees at the Washington Eddy on the SRBENA.

Human Activity Comparison	Probability		
	Adult	Subadult	Total
Bank Fisher-Canoe	0.001	0.005	0.001
Bank Fisher-Kayak	0.001	0.001	0.001
Bank Fisher-Motorboat (Drift)	0.001	NSD	0.001
Bank Fisher-Dory/Drift	0.005	NSD	0.005
Bank Fisher-Raft (Research)	NSD	NSD	NSD
Bank Fisher-Motorboat (Run)	0.001	0.025	0.001
Bank Fisher-Raft (Recreation)	0.001	NSD	0.001
Bank Fisher-Hiker	NSD	NSD	NSD
Hiker-Canoe	0.001	0.001	0.001
Hiker-Kayak	0.001	0.001	0.001
Hiker-Motorboat (Drift)	0.025	NSD	0.001
Hiker-Dory/Drift	NSD	NSD	NSD
Hiker-Raft (Research)	NSD	NSD	NSD
Hiker-Motorboat (Run)	0.001	0.005	0.001
Hiker-Raft (Recreation)	0.001	0.025	0.001
Raft (Recreation)-Canoe	0.005	NSD	0.001
Raft (Recreation)-Kayak	0.001	0.001	0.001
Raft (Recreation)-Motorboat (Drift)	0.001	NSD	0.001
Raft (Recreation)-Dory/Drift	0.001	0.005	0.001
Raft (Recreation)-Raft (Research)	0.001	0.001	0.001
Raft (Recreation)-Motorboat (Run)	NSD	NSD	NSD
Motorboat (Run)-Canoe	0.001	NSD	0.001
Motorboat (Run)-Kayak	0.001	0.005	0.001
Motorboat (Run)-Motorboat (Drift)	0.005	0.01	0.001
Motorboat (Run)-Dory/Drift	0.001	0.001	0.001
Motorboat (Run)-Raft (Research)	0.001	0.001	0.001
Raft (Research)-Canoe	0.001	0.001	0.001
Raft (Research)-Kayak	0.001	0.001	0.001
Raft (Research)-Motorboat (Drift)	0.001	0.005	0.001
Raft (Research)-Dory/Drift	0.025	NSD	0.001
Dory/Drift-Canoe	0.001	0.001	0.001
Dory/Drift-Kayak	0.001	0.001	0.001
Dory/Drift-Motorboat (Drift)	NSD	NSD	NSD
Motorboat (Drift)-Canoe	0.001	0.01	0.001
Motorboat (Drift)-Kayak	0.001	0.001	0.001
Kayak-Canoe	NSD	NSD	NSD

NSD = No Significant Difference ($P < 0.05$).

caused high flushing responses. Motorboats, both drifting and running, had intermediate effects; kayaks and canoes had minimal effects. Significant relationships were evident with both adults and subadults.

The many differences in flushing responses of perched eagles to various activities is caused by several circumstances; the following is an initial interpretation of these results. Foot traffic is highly avoided by eagles because many birds may not have habituated to this type of unusual activity, the long duration of time of such activity causes many birds to fly, and/or most activity occurs on feeding areas (gravel bars) thus precluding any opportunity to eat there. Research rafts are especially disruptive because they run the river early in the morning and in late afternoon. Assuming that the first few activities of the day are most disruptive to eagle behavior, research rafts should therefore cause high flushing responses. This also may be the case with dories. Drifting motorboats might be more disturbing than running motorboats because their duration of stay in the vicinity of eagles is longer. Recreational rafts, canoes, and kayaks tend to run the river in midday and in large groups which minimizes flushing by eagles.

Flushing responses of eagles feeding on the ground were all very high, ranging from 0.909 to 1.000, no matter what type of human activity was involved (Table 17, Figure 15). There were no significant differences of flushing responses among any of the human activity types (Table 18). No data

Table 17. Flushing responses of bald eagles to nine human activity types while feeding at the Washington Eddy on the SRBENA.

Adult		Subadult		All Ages	
n	Mean	n	Mean	n	Mean
Motorboat (Running)					
49	0.939	24	0.958	73	0.945
Motorboat (Drifting)					
13	0.846	9	1.000	22	0.909
Raft (Recreation)					
16	1.000	7	0.714	23	0.913
Raft (Research)					
21	1.000	6	1.000	27	1.000
Dory or Drift					
32	0.938	12	0.917	44	0.932
Canoe					
4	1.000	0	-	4	1.000
Kayak					
0	-	0	-	0	-
Bank Fisher					
3	1.000	1	1.000	4	1.000
Hiker					
15	1.000	9	1.000	24	1.000

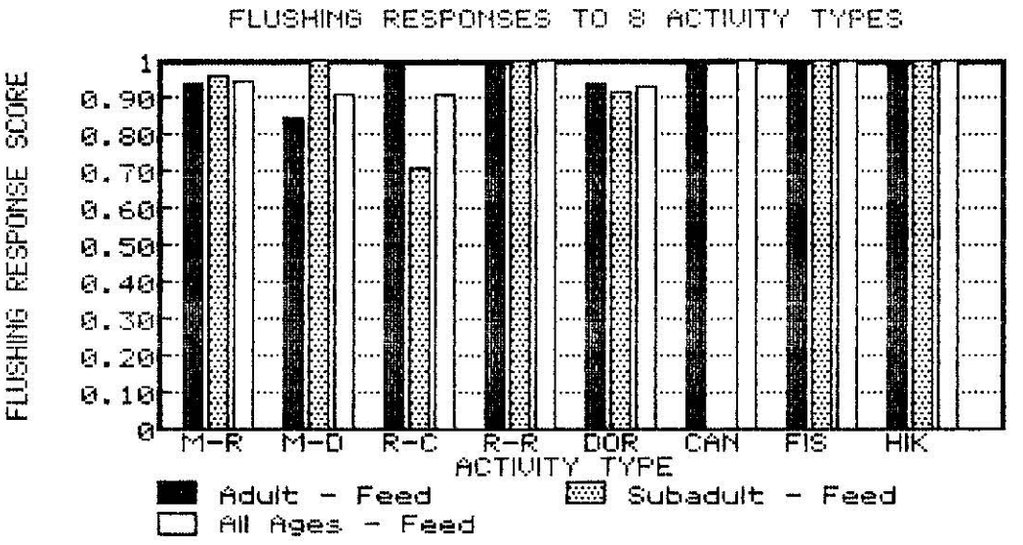

Figure 15. Flushing response scores of bald eagles feeding at Washington Eddy to eight human activity types (see Table 17). M-R = Motorboat-Running, M-D = Motorboat-Drifting, R-C = Raft-Recreation, R-R = Raft-Research, DOR = Dory or Drift, CAN = Canoe, FIS = Bank Fisher, and HIK = Hiker.

Table 18. Statistical probability values comparing the effects of nine human activity types on the flushing responses of eagles while feeding on the ground at the Washington Eddy on the SRBENA.

Human Activity Comparison	Probability		
	Adult	Subadult	Total
Bank Fisher-Canoe	NSD	-	NSD
Bank Fisher-Kayak	-	-	-
Bank Fisher-Motorboat (Drift)	NSD	NSD	NSD
Bank Fisher-Dory/Drift	NSD	NSD	NSD
Bank Fisher-Raft (Research)	NSD	NSD	NSD
Bank Fisher-Motorboat (Run)	NSD	NSD	NSD
Bank Fisher-Raft (Recreation)	NSD	NSD	NSD
Bank Fisher-Hiker	NSD	NSD	NSD
Hiker-Canoe	NSD	-	NSD
Hiker-Kayak	-	-	-
Hiker-Motorboat (Drift)	NSD	NSD	NSD
Hiker-Dory/Drift	NSD	NSD	NSD
Hiker-Raft (Research)	NSD	NSD	NSD
Hiker-Motorboat (Run)	NSD	NSD	NSD
Hiker-Raft (Recreation)	NSD	NSD	NSD
Raft (Recreation)-Canoe	NSD	-	NSD
Raft (Recreation)-Kayak	-	-	-
Raft (Recreation)-Motorboat (Drift)	NSD	NSD	NSD
Raft (Recreation)-Dory/Drift	NSD	NSD	NSD
Raft (Recreation)-Raft (Research)	NSD	NSD	NSD
Raft (Recreation)-Motorboat (Run)	NSD	NSD	NSD
Motorboat (Run)-Canoe	NSD	-	NSD
Motorboat (Run)-Kayak	-	-	-
Motorboat (Run)-Motorboat (Drift)	NSD	NSD	NSD
Motorboat (Run)-Dory/Drift	NSD	NSD	NSD
Motorboat (Run)-Raft (Research)	NSD	NSD	NSD
Raft (Research)-Canoe	NSD	-	NSD
Raft (Research)-Kayak	-	-	-
Raft (Research)-Motorboat (Drift)	NSD	NSD	NSD
Raft (Research)-Dory/Drift	NSD	NSD	NSD
Dory/Drift-Canoe	NSD	-	NSD
Dory/Drift-Kayak	-	-	-
Dory/Drift-Motorboat (Drift)	NSD	NSD	NSD
Motorboat (Drift)-Canoe	NSD	-	NSD
Motorboat (Drift)-Kayak	-	-	-
Kayak-Canoe	-	-	-

NSD = No Significant Difference ($P < 0.05$).
- = No Data.

were collected on kayaks and several other samplings are small.

Flushing responses of eagles standing on the ground were all very high, ranging from 0.878 to 1.000, similar to the situation with feeding eagles (Table 19, Figure 16). There were no significant differences of flushing responses among any of the human activity types (Table 20).

Eagles on the ground were highly susceptible to flushing whenever humans were present regardless of the mode of travel, purpose, timing, or duration of the activity. The reasons for this pattern presumably are similar to the effects seen with flight distances as previously discussed. Again, because eagles must feed on the ground, human activity is more disruptive to feeding birds than perching birds, all other variables being equal.

Subadults had higher flushing responses than adults while perching in trees (Table 21). This was highly evident during recreational raft activity for some unknown reason. No significant differences in age-related flushing responses existed while eagles were feeding and standing on the ground.

One speculative reason why adults are more tolerant of human activity is that they have learned that persecution by humans in the area is low and they have partially habituated to human activities (as long as they are on tree perches). Perhaps subadults are too inexperienced to realize that they need not fly away from humans.

Combined flushing response scores shows many of the

Table 19. Flushing responses of bald eagles to nine human activity types while standing at the Washington Eddy on the SRBENA.

Adult		Subadult		All Ages	
n	Mean	n	Mean	n	Mean
Motorboat (Running)					
71	0.972	35	0.971	106	0.972
Motorboat (Drifting)					
25	0.920	12	1.000	37	0.946
Raft (Recreation)					
24	0.958	17	0.941	41	0.951
Raft (Research)					
38	0.868	3	1.000	41	0.878
Dory or Drift					
33	0.879	18	0.889	51	0.882
Canoe					
12	1.000	1	1.000	13	1.000
Kayak					
0	-	0	-	0	-
Bank Fisher					
2	1.000	1	1.000	3	1.000
Hiker					
34	0.941	15	0.933	49	0.939

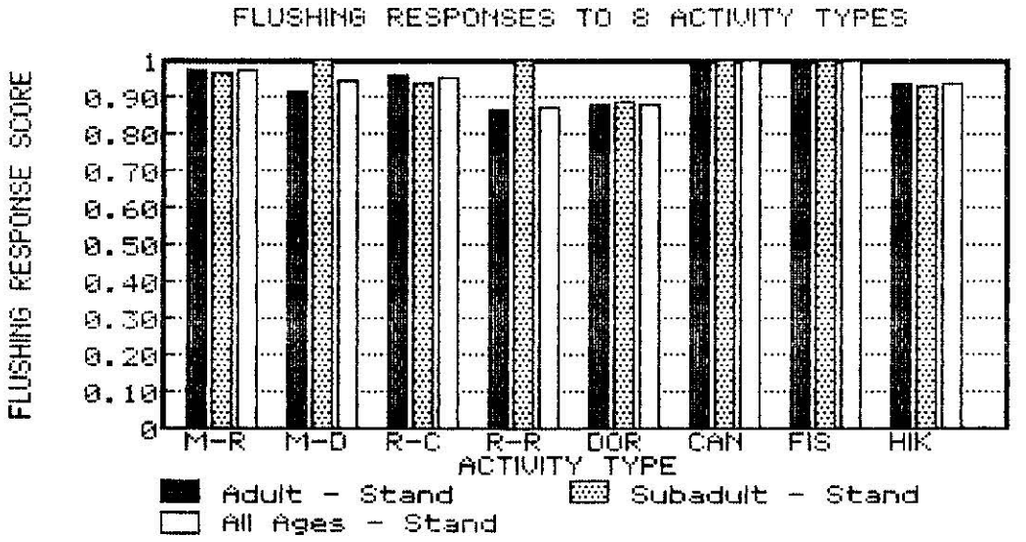

Figure 16. Flushing response scores of bald eagles standing at Washington Eddy to eight human activity types (see Table 19). M-R = Motorboat-Running, M-D = Motorboat-Drifting, R-C = Raft-Recreation, R-R = Raft-Research, DOR = Dory or Drift, CAN = Canoe, FIS = Bank Fisher, and HIK = Hiker.

Table 20. Statistical probability values comparing the effects of nine human activity types on the flushing responses of eagles while standing on the ground at the Washington Eddy on the SRBENA.

Human Activity Comparison	Probability		
	Adult	Subadult	Total
Bank Fisher-Canoe	NSD	NSD	NSD
Bank Fisher-Kayak	-	-	-
Bank Fisher-Motorboat (Drift)	NSD	NSD	NSD
Bank Fisher-Dory/Drift	NSD	NSD	NSD
Bank Fisher-Raft (Research)	NSD	NSD	NSD
Bank Fisher-Motorboat (Run)	NSD	NSD	NSD
Bank Fisher-Raft (Recreation)	NSD	NSD	NSD
Bank Fisher-Hiker	NSD	NSD	NSD
Hiker-Canoe	NSD	NSD	NSD
Hiker-Kayak	-	-	-
Hiker-Motorboat (Drift)	NSD	NSD	NSD
Hiker-Dory/Drift	NSD	NSD	NSD
Hiker-Raft (Research)	NSD	NSD	NSD
Hiker-Motorboat (Run)	NSD	NSD	NSD
Hiker-Raft (Recreation)	NSD	NSD	NSD
Raft (Recreation)-Canoe	NSD	NSD	NSD
Raft (Recreation)-Kayak	-	-	-
Raft (Recreation)-Motorboat (Drift)	NSD	NSD	NSD
Raft (Recreation)-Dory/Drift	NSD	NSD	NSD
Raft (Recreation)-Raft (Research)	NSD	NSD	NSD
Raft (Recreation)-Motorboat (Run)	NSD	NSD	NSD
Motorboat (Run)-Canoe	NSD	NSD	NSD
Motorboat (Run)-Kayak	-	-	-
Motorboat (Run)-Motorboat (Drift)	NSD	NSD	NSD
Motorboat (Run)-Dory/Drift	NSD	NSD	NSD
Motorboat (Run)-Raft (Research)	NSD	NSD	NSD
Raft (Research)-Canoe	NSD	NSD	NSD
Raft (Research)-Kayak	-	-	-
Raft (Research)-Motorboat (Drift)	NSD	NSD	NSD
Raft (Research)-Dory/Drift	NSD	NSD	NSD
Dory/Drift-Canoe	NSD	NSD	NSD
Dory/Drift-Kayak	-	-	-
Dory/Drift-Motorboat (Drift)	NSD	NSD	NSD
Motorboat (Drift)-Canoe	NSD	NSD	NSD
Motorboat (Drift)-Kayak	-	-	-
Kayak-Canoe	-	-	-

NSD = No Significant Difference ($P < 0.05$).
- = No Data.

Table 21. Probability values comparing the flushing responses of adult and subadult bald eagles to nine human activity types while perched, feeding, and standing at the Washington Eddy on the SRBENA.

Activity Type	Adult-Subadult Comparison		
	Perching	Feeding	Standing
Motorboat (Running)	NSD	NSD	NSD
Motorboat (Drifting)	NSD	NSD	NSD
Raft (Recreation)	0.005	NSD	NSD
Raft (Research)	NSD	NSD	NSD
Dory or Drift	NSD	NSD	NSD
Canoe	NSD	NSD	NSD
Kayak	NSD	NSD	NSD
Bank Fisher	NSD	NSD	NSD
Hiker	NSD	NSD	NSD
Totals	0.001	NSD	NSD

relationships discussed (Table 22, Figure 17).

Ranking.-- Ranking of each activity type to its effects to perching, feeding, and standing eagles is listed in tables 23, 24, and 25, respectively. Generally, there was little difference in the ranks comparing the 3 different activities of the eagles (whether perching, feeding, or standing). Ranking by amount of human activity (per amt) is the most meaningful statistic. For this rank, research rafts were most disturbing to eagles followed by motorboats; bank fishers, hikers, and dories also were more disturbing in proportion to their occurrence. Canoes, kayaks, and recreational rafts disturbed eagles far less than expected based on their numbers of occurrence.

Time of day, sequence of occurrence, and mode of travel seem to have caused these differences. Research rafts are especially (purposely) disturbing because they run the river in early morning and late afternoon, coinciding with peak feeding activity, but they often are the first activity of the day. Motorboats and dories also occur early in the day when activities are suspected to be most disruptive to normal behavioral patterns. Motorboats also cover larger distances and, like dories, remain in the area or move up and downstream, for long periods. There seems to be little implicative evident that noise increases the disturbing effects of running motorboats. Foot traffic, as previously discussed, is highly disturbing to eagles hence the higher than expected ranking for bank fishers and hikers. Canoes,

Table 22. Flushing responses of bald eagles to nine human activity types combined while perched, feeding and standing at the Washington Eddy on the SRBENA. *

Adult		Subadult		All Ages	
n	Mean	n	Mean	n	Mean
Perching					
2146	0.243a	1112	0.316b	3258	0.268A
Feeding					
153	0.954c	68	0.941c	221	0.950B
Standing					
239	0.933c	102	0.951c	341	0.938B

* Statistical comparisons between the two ages is denoted by lower case letters and comparison among the three eagle activities is denoted by upper case letters.

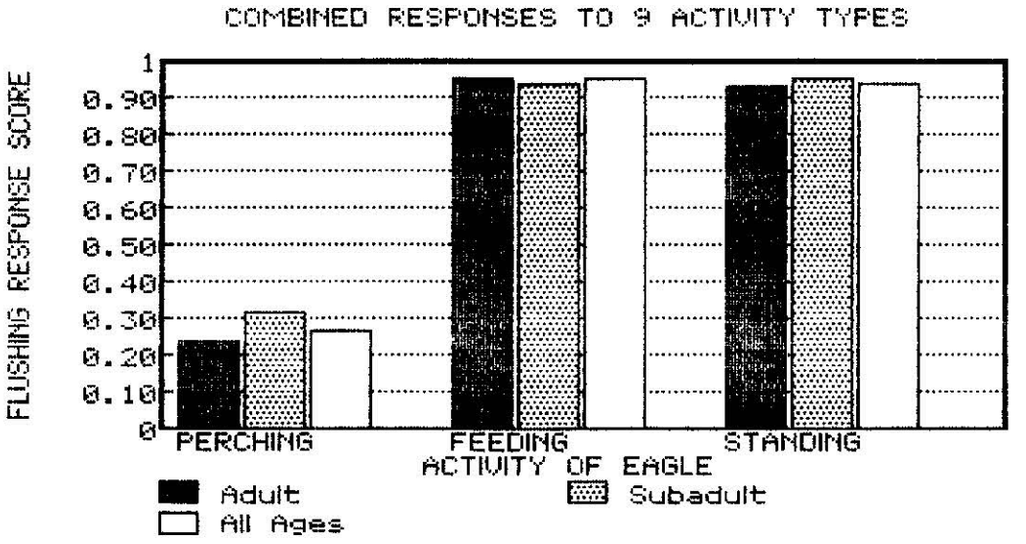

Figure 17. Flushing response scores of bald eagles to eight human activity types combined while at Washington Eddy (see Table 22).

Table 23. Comparison of recreational activity and extent of disturbance caused to perched eagles at the Washington Eddy on the SRBENA in 1985-86. A "disturbance" occurs when an eagle is displaced from its tree perch. The flight index is the ratio of disturbance to occurrence; values greater than one indicate higher than expected disturbance. Each activity type is ranked by its degree of disturbing qualities relative to its type of activity (per act), amount (per amt), and number of persons engaged in the activity (per num). *

Activity Type	Activity Occurrence		Eagle Disturbance		Flight Index	Ranking		
	n	%	n	%		Per Act	Per Amt	Per Num
Motorboat								
First run	171	13.4	209	24.0	1.79	5		
First drift	27	2.1	136	15.6	7.43	1		
Subtotal	198	15.5	345	39.5	2.55	3	2	2
All runs	318	25.0	209	24.0	0.96	9		
All drifts	217	17.0	136	15.6	0.92	11		
Subtotal	535	42.0	345	39.5	0.94	10		
Raft								
Recreation	292	22.9	148	17.0	0.74	12	6	6
Research	44	3.5	120	13.8	3.94	2	1	1
Subtotal	336	26.4	268	30.7	1.16	8		
Dory/Drift	124	9.7	160	18.3	1.89	4	3	4
Canoe	114	8.9	12	1.4	0.16	13	7	8
Kayak	80	6.3	6	0.7	0.11	14	8	7
Bank Fisher	25	2.0	28	3.2	1.60	6	4	3
Hiker	60	4.7	54	6.2	1.32	7	5	5
Totals	1274	100.0	873	100.0				

* For "number of persons," flight indexes are weighted (divided) by the average number of persons engaged in each activity type.

Table 24. Comparison of recreational activity and extent of disturbance caused to feeding eagles at the Washington Eddy on the SRBENA in 1985-86. A "disturbance" occurs when an eagle stops feeding and is displaced from its food. The flight index is the ratio of disturbance to occurrence; values greater than one indicate higher than expected disturbance. Each activity type is ranked by its degree of disturbing qualities relative to its type of activity (per act), amount (per amt), and number of persons engaged in the activity (per num). *

Activity Type	Activity Occurrence		Eagle Disturbance		Flight Index	Ranking		
	n	%	n	%		Per Act	Per Amt	Per Num
Motorboat								
First run	171	13.4	69	32.9	2.46	4		
First drift	27	2.1	20	9.5	4.52	1		
Subtotal	198	15.5	89	42.4	2.74	3	2	2
All runs	318	25.0	69	32.9	1.32	7		
All drifts	217	17.0	20	9.5	0.56	11		
Subtotal	535	42.0	89	42.4	1.01	8		
Raft								
Recreation	292	22.9	21	10.0	0.44	12	6	7
Research	44	3.5	27	12.9	3.69	2	1	1
Subtotal	336	26.4	48	22.9	0.87	10		
Dory/Drift	124	9.7	41	19.5	2.01	6	4	3
Canoe	114	8.9	4	1.9	0.21	13	7	6
Kayak	80	6.3	0	0.0	0.00	14	8	8
Bank Fisher	25	2.0	4	1.9	0.95	9	5	5
Hiker	60	4.7	24	11.4	2.43	5	3	4
Totals	1274	100.0	210	100.0				

* For "number of persons," flight indexes are weighted (divided) by the average number of persons engaged in each activity type.

Table 25. Comparison of recreational activity and extent of disturbance caused to standing eagles at the Washington Eddy on the SRBENA in 1985-86. A "disturbance" occurs when an eagle is displaced from its ground perch. The flight index is the ratio of disturbance to occurrence; values greater than one indicate higher than expected disturbance. Each activity type is ranked by its degree of disturbing qualities relative to its type of activity (per act), amount (per amt), and number of persons engaged in the activity (per num). *

Activity Type	Activity Occurrence		Eagle Disturbance		Flight Index	Ranking		
	n	%	n	%		Per Act	Per Amt	Per Num
Motorboat								
First run	171	13.4	103	32.2	2.40	5		
First drift	27	2.1	35	10.9	5.19	1		
Subtotal	198	15.5	138	43.1	2.78	4	3	2
All runs	318	25.0	103	32.2	1.29	7		
All drifts	217	17.0	35	10.9	0.64	10		
Subtotal	535	42.0	138	43.1	1.03	8		
Raft								
Recreation	292	22.9	39	12.2	0.53	11	5	7
Research	44	3.5	36	11.3	3.23	2	1	1
Subtotal	336	26.4	75	23.4	0.89	9		
Dory/Drift	124	9.7	45	14.1	1.45	6	4	4
Canoe	114	8.9	13	4.1	0.46	13	7	6
Kayak	80	6.3	0	0.0	0.00	14	8	8
Bank Fisher	25	2.0	3	0.9	0.47	12	6	5
Hiker	60	4.7	46	14.4	3.06	3	2	3
Totals	1274	100.0	320	100.0				

* For "number of persons," flight indexes are weighted (divided) by the average number of persons engaged in each activity type.

kayaks, and recreational rafts are thought to be less disturbing to eagles because they occur mostly in midday and are grouped together both on a daily basis as well as being grouped on weekends.

When considering ranking per activity (necessary to account for multiple runs of motorboats), some interesting differences become apparent. Drifting motorboats are more disturbing than running motorboats suggesting that the greater duration of stay of drifting is more disruptive than a quick passage by a noisy motorboat. First runs of both drifting and running motorboats are more disruptive than subsequent runs, thus supporting the contention that the first recreational use on the river every day is most disturbing.

When considering ranking per number (weighted to account for the number of persons involved in each activity type), there are minor adjustments in the previously-discussed ranking. In particular, recreational rafts tend to be less disturbing because rafting groups are the largest of any activity.

TASK 2 - Food Analysis

Methods

Six transects were walked each week of the winter season to determine the number and species composition of salmon carcasses at the Washington Eddy on SRBENA. Notes on the condition of each carcass were made including degree of use (consumed, partially consumed, whole), species, depth in water, distance from river and road, and specific location on each transect. Weights of most whole carcasses were measured with a Pesola hanging scale.

Analyses

For the purpose of this report, all salmon carcasses tallied on all six transects were grouped together. Total biomass available was the total sum of the mass of all whole and partially consumed carcasses. Edible biomass is total biomass less 21 percent to account for the amount of each salmon that is not edible by eagles.

Results and Discussion

The number of salmon carcasses recorded never exceeded 100 at any one time which was far below historical counts of salmon at this same location (Table 26). This season was an odd-numbered year; the chum salmon escapement was expected to be low, whereas the pink salmon escapement was expected to be high, and this seemed to be the case. As expected, counts

Table 26. Availability of chum, coho, and sockeye salmon carcasses on six transects (1.75 km total length) on gravel bars at the Washington Eddy on the SRBENA in 1985-86. (Pink salmon were not surveyed due to their advanced stage of decomposition and insignificant food value to eagles. No chinook salmon were present.)

Date	Species			Total	Total Biomass (kg)*	Edible Biomass (kg)**
	Chum	Coho	Sockeye			
4 Dec	7	0	0	7	38.0	29.9
11 Dec	8	0	0	8	30.4	23.9
18 Dec	14	0	0	14	49.7	39.1
26 Dec	77	0	1	78	313.9	247.0
1 Jan	79	0	0	79	319.3	251.3
8 Jan	82	1	0	83	354.1	278.7
16 Jan	51	0	1	52	196.0	154.3
23 Jan	18	0	0	18	72.8	57.3
30 Jan	16	2	0	18	72.8	57.3
6 Feb	8	0	0	8	32.3	25.4
12 Feb	3	0	0	3	12.1	9.5
19 Feb	2***	0	0	2	8.1	6.4
26 Feb	1***	0	0	1	4.0	3.1
Totals	366	3	2	371	1503.5	1183.2

* Whole carcass masses were: N = 206, Mean = 4.04 kg, SE = 0.115, Range = 0.90 to 9.20 kg.

** Edible Biomass = Total Biomass X 0.787 (See Text).

*** Artificially supplied.

of coho and sockeye salmon were very low, representing an incidental food source for eagles at this location.

Peaks counts of salmon were made from late December to mid-January (Figure 18). Salmon were scarce in the first 3 weeks of December and after late January. Two floods late in the season removed many carcasses from the transects and, by mid-February, virtually none were left.

Peak counts of salmon biomass were poorly correlated with the influx of the eagle population on the SRBENA and SW&SRS (see Task 4 for population curves). There was an early influx of eagles to the area this season with peak counts in most river sections occurring in early December. This extremely unusual phenomenon was presumably caused by the extraordinary cold, snowy weather in November and early December of 1985. These data suggest that weather greatly influences fall migration and that many eagles had previous knowledge of the food supply on the Skagit River; they arrived before the bulk of the food became available.

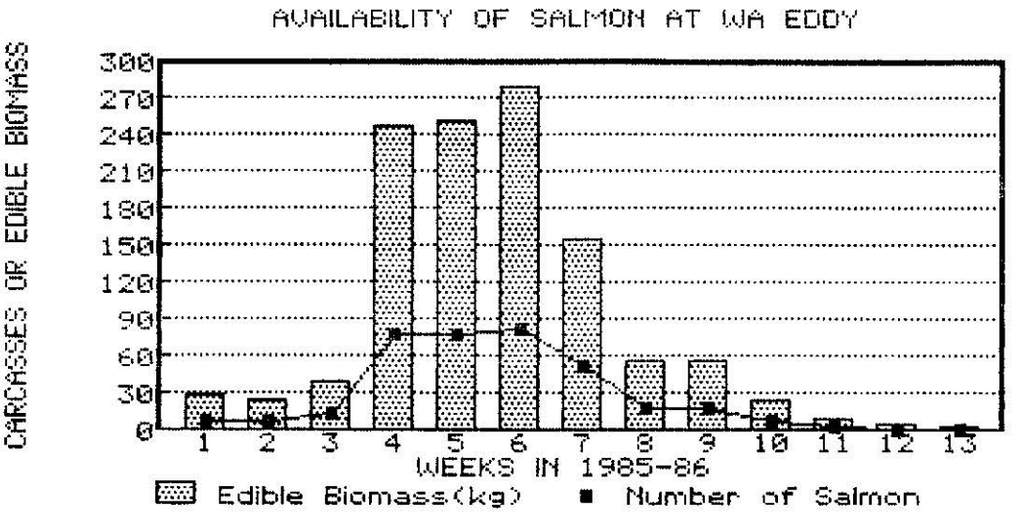

Figure 18. Number of salmon carcasses and edible salmon biomass (kg) recorded on 1.75 km of transects at Washington Eddy from 1 Dec 1985 to 28 Feb 1986 (see Table 26).

TASK 3 - Weather Monitoring

Methods

A weather monitoring station was established at Clark's Cabins on SRBENA at River Mile 75.5 approximately 200 meters from the river and was continuously monitored from 1 December 1985 to 28 February 1986.

Ambient temperature was measured at 2-hour intervals with a hygrothermograph positioned 1.5 meters above the substrate shielded from the sky and sun. Wind velocity was measured with a sensitive 3-cup anemometer positioned 5 meters above the substrate. Cumulative readings were taken at dawn and dusk of each day so that a comparison between day and night could be made. Rainfall was measured with a rain gauge with a 300 square centimeter collecting area positioned 1 meter above the substrate. Readings also were taken at dawn and dusk to compare day and night rainfall patterns. Cloud cover was visually estimated at 3-hour intervals when convenient.

Analyses

Basic statistics (sample size, mean, standard error) were calculated for all weather readings. For the purpose of this report, monthly totals are provided, but daily readings are on file for further analyses.

Results and Discussion

Ambient temperature patterns show unusual lows for December, unusual highs for January, and moderate weather for February (Table 27). This early winter caused an earlier-than-expected arrival of the bulk of the eagle population in early December.

Wind was highest in January and February, but particularly low in December (Table 28). This may have been related to the low pressure systems in December and high pressure systems later in the winter season.

Rain also was low in December, though snow was common, and rainfall increased later in the winter season (Table 29). Rain late in the season caused 2 floods.

Cloud cover was low in December but higher in January and February (Table 30). Low cloud cover in December contributed to cold temperatures and heavy cloud cover later contributed to rain and flooding.

Weather data are being collected to analyze eagle activity patterns and to predict eagle energetics; these aspects will be compiled at a later date.

Table 27. Ambient temperatures (C) recorded at Clark's Cabins on the SRBENA in 1985-86. *

	Day		Night			Total		
	n	Mean	SE	n	Mean	SE	n	Mean	SE
December									
	155	-0.5	0.22	217	-1.7	0.13	372	-1.2	0.12
January									
	155	3.9	0.18	217	3.1	0.15	372	3.4	0.12
February									
	168	2.4	0.28	168	0.8	0.24	336	1.6	0.18

* Recorded at 2-hour intervals 1.5 meters above ground.

Table 28. Wind velocity (m/sec) recorded at Clark's Cabins on the SRBENA in 1985-86. *

	Day		Night			Total		
n	Mean	SE	n	Mean	SE	n	Mean	SE
December								
31	0.14	0.46	31	0.08	0.03	62	0.10	0.03
January								
31	0.22	0.03	31	0.18	0.02	62	0.19	0.02
February								
28	0.29	0.04	28	0.16	0.03	56	0.20	0.03

* Recorded continuously 4 meters above ground.

Table 29. Rainfall (cm/day) recorded at Clark's Cabins on the SRBENA in 1985-86. *

Day			Night			Total		
n	Mean	SE	n	Mean	SE	n	Mean	SE
December								
29	0.22	0.10	28	0.20	0.11	57	0.21	0.08
January								
30	1.04	0.40	31	1.17	0.21	61	1.09	0.19
February								
24	1.54	0.31	27	1.08	0.21	51	1.28	0.26

* Recorded continuously 1 meter above ground.

Table 30. Sky conditions recorded at Clark's Cabins on the SRBENA in 1985-86. *

Sky conditions	Dec		Jan		Feb		Total	
	n	Mean	n	Mean	n	Mean	n	Mean
Clear	41	34.2	6	4.6	28	20.7	75	19.5
Partly Cloudy	49	40.8	41	31.5	31	23.0	121	31.4
Overcast	30	25.0	83	63.9	76	56.3	189	49.1
Percent Cloud Cover During Partly Cloudy Skies		43.9		63.2		63.9		55.5

* Recorded at 3-hour intervals by visual observation.

TASK 4 - Simulated Disturbances and Eagle Censuses

Methods

A total of 104 float trips were conducted from 1 December 1985 to February 1986 on SRBENA and the SW&SRS to record eagle avoidance behavior in response to our rafting activity and to census eagles. Six river stretches were floated totaling approximately 69 river miles (Table 31).

Except for minor deviations, the following float schedule was used every week for 13 weeks:

Sunday - 2 floats on SRBENA, morning and afternoon;
Monday - 1 float on the Upper Sauk;
Tuesday - 1 float on the Lower Sauk and Upper Skagit;
Wednesday - No float;
Thursday - 2 floats on SRBENA, morning and afternoon;
Friday - 1 float on the Middle Skagit;
Saturday - 1 float on the Lower Skagit.

On SRBENA, floats were made from 900 to 1100 hours in the morning and from 1300 to 1500 hours in the afternoon. All other floats were started between 900 and 1000 hours.

Float trips were taken in a 13-foot gray raft with blue rowing oars normally by 2 persons. One researcher rowed and spotted eagles while the other measured flight distances with an optical range-finder and recorded data.

For each eagle sighting, the following data were

Table 31. Characteristics of float trips used to simulate boating activity and census eagles.

River Section	River Miles			Put-in	Take-out
	From	To	Total		
SRBENA	75.5	67.5	8.0	Clark's	Rockport
Upper Skagit	67.5	62.0	5.5	Rockport	Faber's
Middle Skagit	62.0	47.0	15.0	Faber's	Presentin
Lower Skagit	40.5	24.0	16.5	Hamilton	Pipeline
Upper Sauk	24.0	13.0	11.0	Darrington	Suiattle
Lower Sauk	13.0	0.0	13.0	Suiattle	Skagit

tallied: age (adult or subadult), flight distance or closest distance approached without flying, flushing response (yes or no), direction of flight, location (tree or ground perch), grouping (within 25 meters of other eagles or not), and location by river mile.

Analyses

Censuses.-- Notes were kept of eagles passed on the river more than once to exclude them from census counts and of those flying downstream after flushing. Censuses were divided into 2 count figures: one exluding those flying downstream after flushing and one including them. For the purposes of this report, only the second type of count (including downstream flyers) is given; it includes a small percentage of duplicate counts. Duplication is higher on the Sauk River because flushing responses there were higher.

Differences in counts among the four day and time periods on SRBENA were tested with ANOVA and the Newman-Keuls Multiple Range Test.

Flight Distances.--Differences in flight distances of the four time periods on SRBENA and five other river stretches were tested using ANOVA and Newman-Keuls Multiple Range Tests for adults, subadults, and total (all ages combined). These tests also were used to compare responses of adults and subadults while either on tree perches or ground perches with all river times and locations combined. Student's t-tests determined if there were significant

differences between the two age classes. Least squares linear regression analyzed seasonal trends in flight distances for birds both perched in trees and on the ground.

Flushing Responses.-- Differences in flushing responses of the four time periods on SRBENA and five other river stretches were tested using 2 x 2 chi-square contingency tables (ANOVA was orginally used but this test failed to meet variance assumptions and was discarded). This test also was used to compare responses of adults and subadults and to compare responses of eagles while either on tree or ground perches with all times and locations combined. Least squares linear regression analyzed seasonal trends in flushing responses for birds both perched in trees and on the ground. For these tests, flushing responses were pooled weekly.

Results and Discussion

Censuses.- Counts of eagles on SRBENA during Sunday mornings were moderate in December, high in the first third of January, and low from mid-January to the end of February (Figure 19). Distribution was somewhat uniform between miles 68 to 73, but lower in the remaining river miles (Figure 20).

Counts of eagles on SRBENA during Sunday afternoons were moderate in December, high in January with two distinct peaks, and low in February (Figure 21). Distribution was highest between river miles 70 and 73 (Figure 22).

Counts of eagles on SRBENA during Thursday mornings were moderate in December except for one sharp peak, consistently

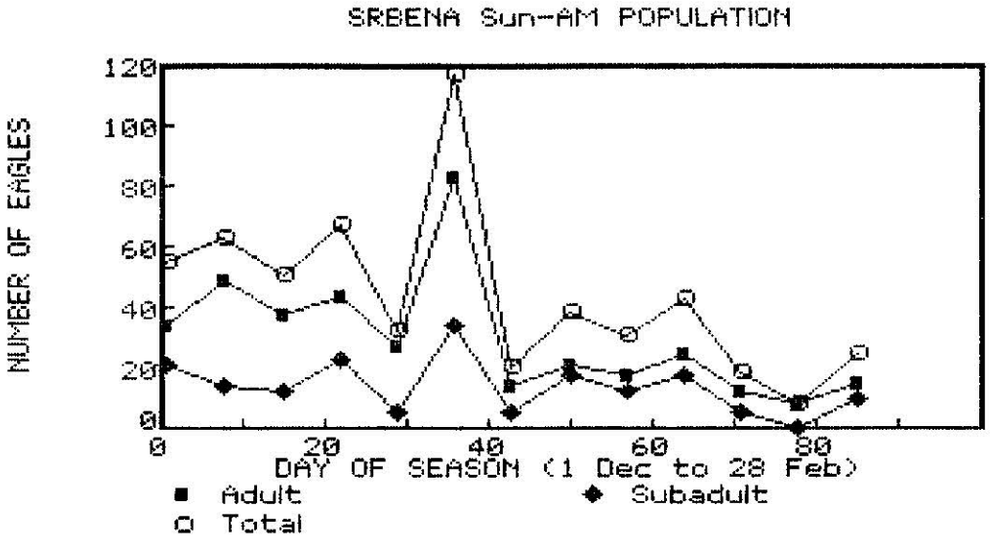

Figure 19. Number of eagles counted during river floats on SRBENA during Sunday mornings in 1985-86.

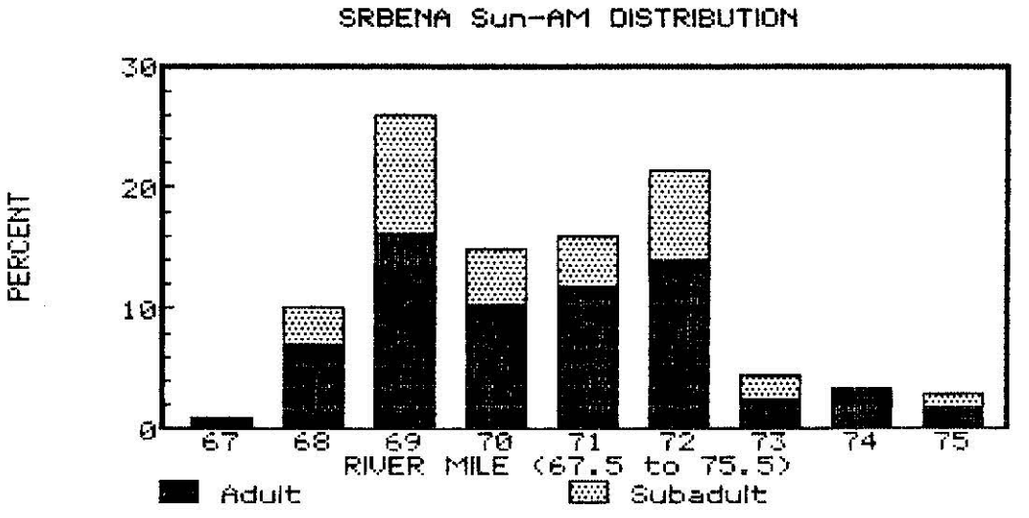

Figure 20. Distribution of eagles observed during river floats on SRBENA during Sunday mornings in 1985-86.

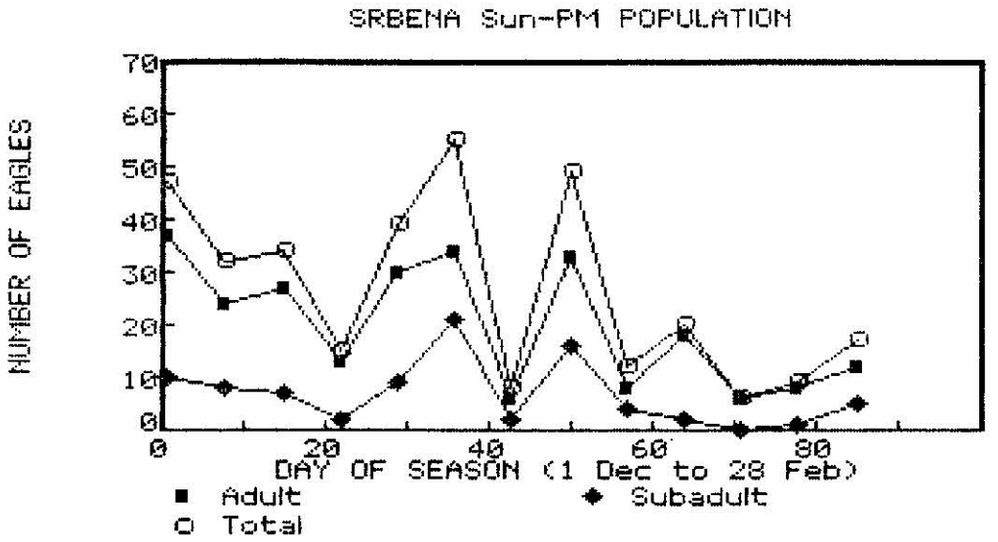

Figure 21. Number of eagles counted during river floats on SRBENA during Sunday afternoons in 1985-86.

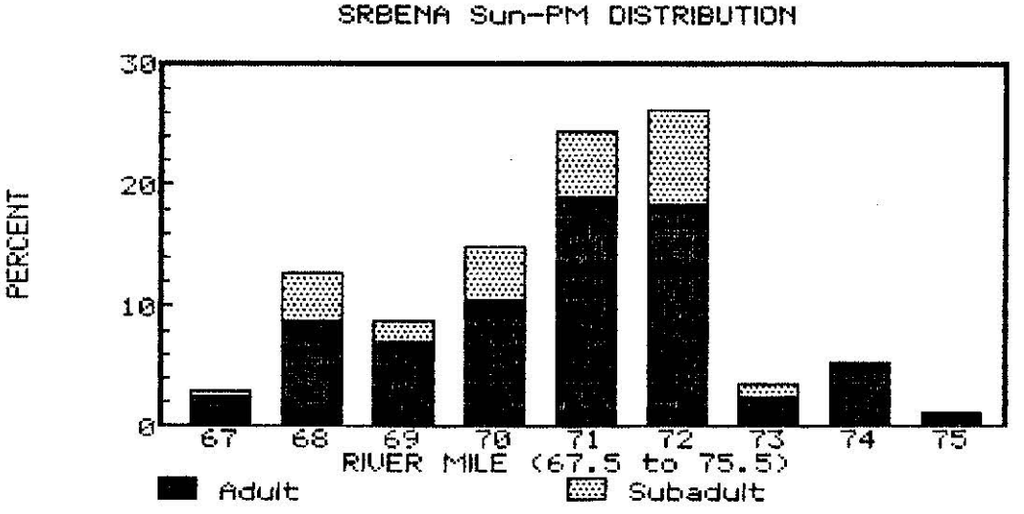

Figure 22. Distribution of eagles observed during river floats on SRBENA during Sunday afternoons in 1985-86.

high in January, and much lower throughout February (Figure 23). Distribution was highest on river mile 70 to 71 with the concentration declining up and downstream from there (Figure 24).

Counts of eagles on SRBENA during Thursday afternoons were high but variable in December, high in early January and moderate in late January, and much reduced in February (Figure 25). Distribution was highest on river mile 70 to 71 with the concentration declining up and downstream from there (Figure 26).

Counts of eagles on the Upper Skagit gradually increased from early December to the end of January and then declined faster than the population built (Figure 27). Distribution was strikingly concentrated on river mile 66 to 67 (Figure 28). (Note: Part of this river mile occurs within the SRBENA in a disjunct parcel downstream from Rockport.)

Counts of eagles on the Middle Skagit were exceptionally high in early December, but declined during the remainder of the month (Figure 29). The January population was moderately high and the February population was low. Distribution was concentrated between river miles 57 and 61 (Figure 30).

Counts of eagles on the Lower Skagit showed 3 peaks: early December, late December, and late January (Figure 31). In contrast to other river sections, this population increased until the end of the season; February counts were especially high. Distribution was concentrated between river miles 28 and 34 (Figure 32).

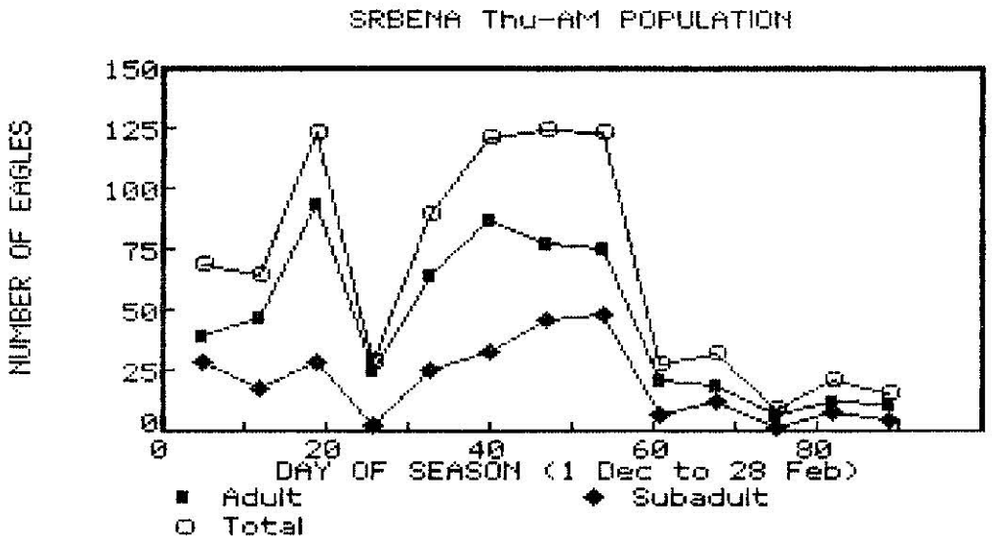

Figure 23. Number of eagles counted during river floats on SRBENA during Thursday mornings in 1985-86.

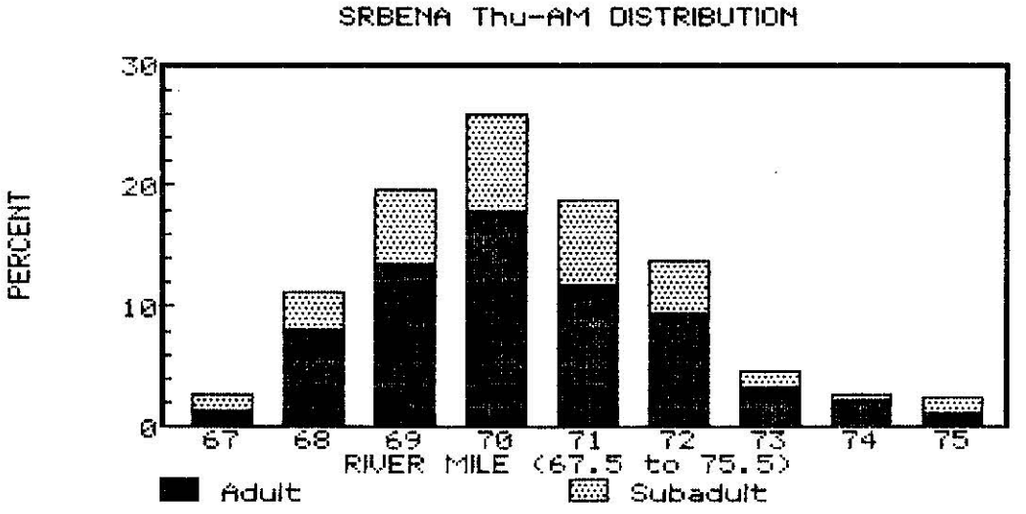

Figure 24. Distribution of eagles observed during river floats on SRBENA during Thursday mornings in 1985-86.

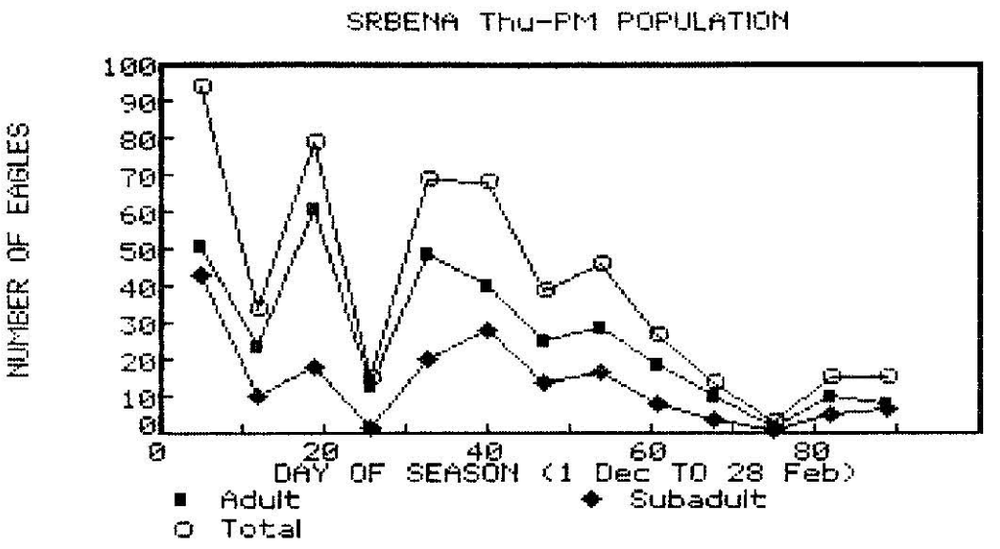

Figure 25. Number of eagles counted during river floats on SRBENA during Thursday afternoons in 1985-86.

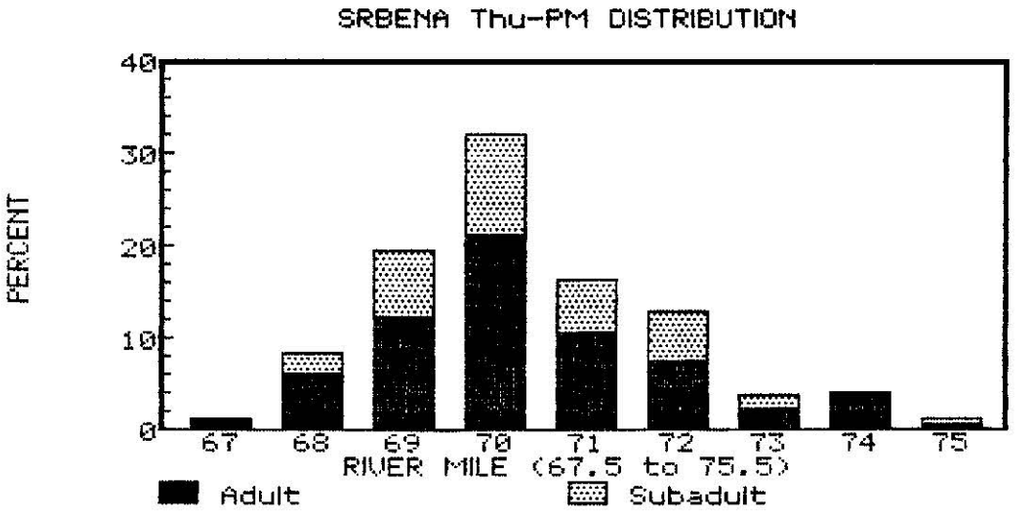

Figure 26. Distribution of eagles observed during river floats on SRBENA during Thursday afternoons in 1985-86.

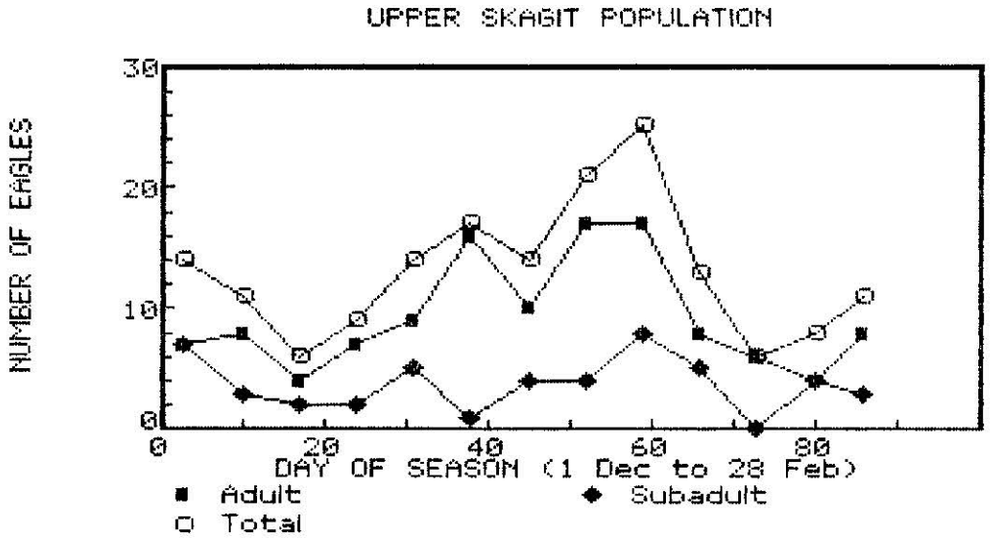

Figure 27. Number of eagles counted during river floats on the Upper Skagit River during Tuesdays in 1985-86.

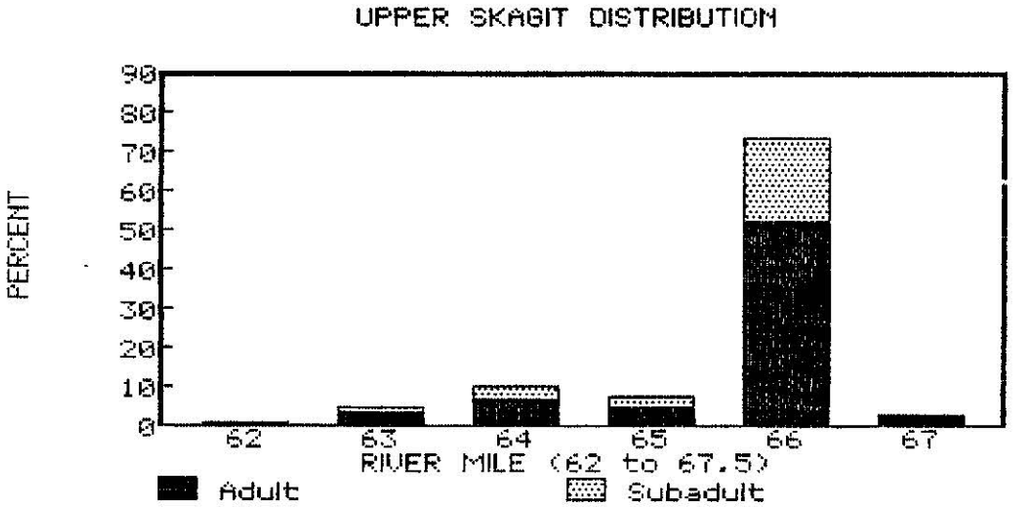

Figure 28. Distribution of eagles observed during river floats on the Upper Skagit River during Tuesdays in 1985-86.

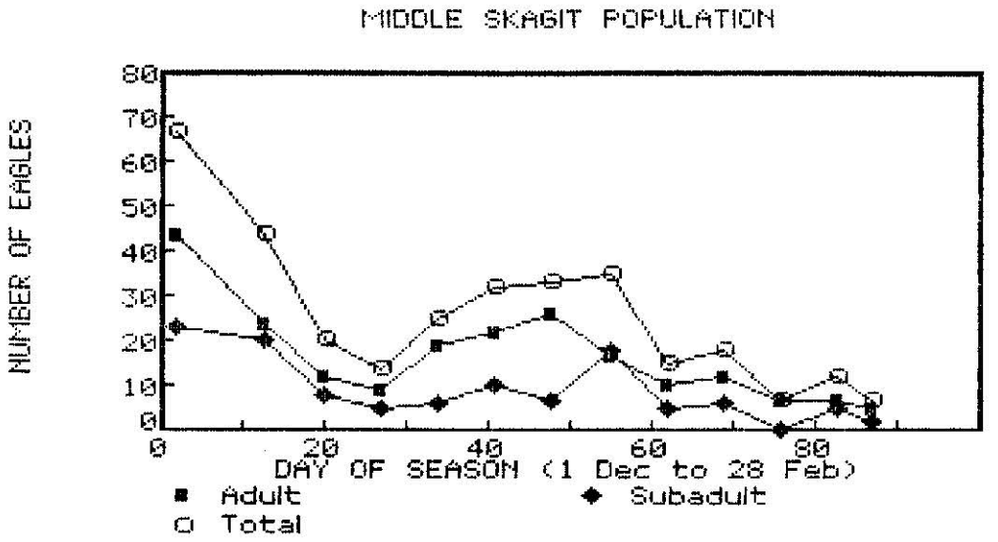

Figure 29. Number of eagles counted during river floats on the Middle Skagit River during Fridays in 1985-86.

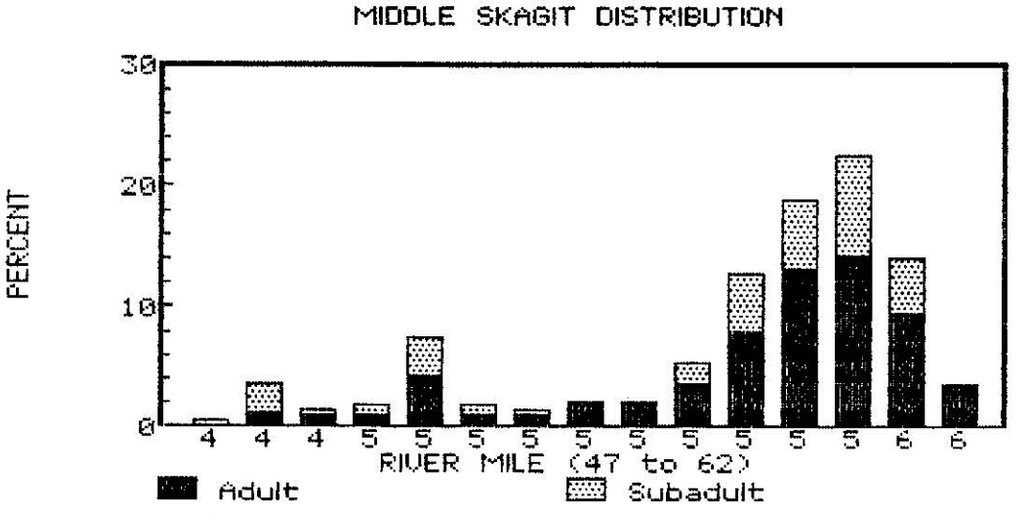

Figure 30. Distribution of eagles observed during river floats on the Middle Skagit River during Fridays in 1985-86.

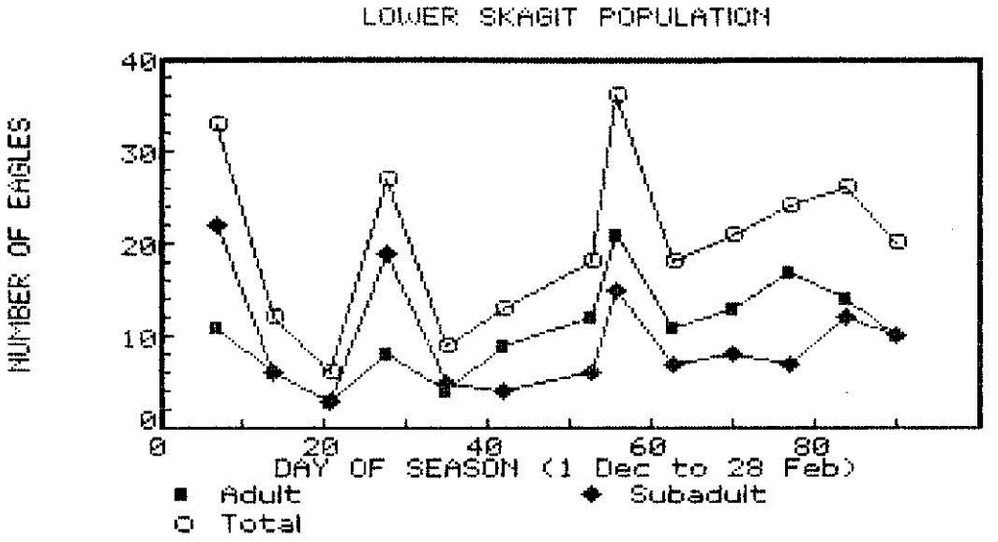

Figure 31. Number of eagles counted during river floats on the Lower Skagit River during Saturdays in 1985-86.

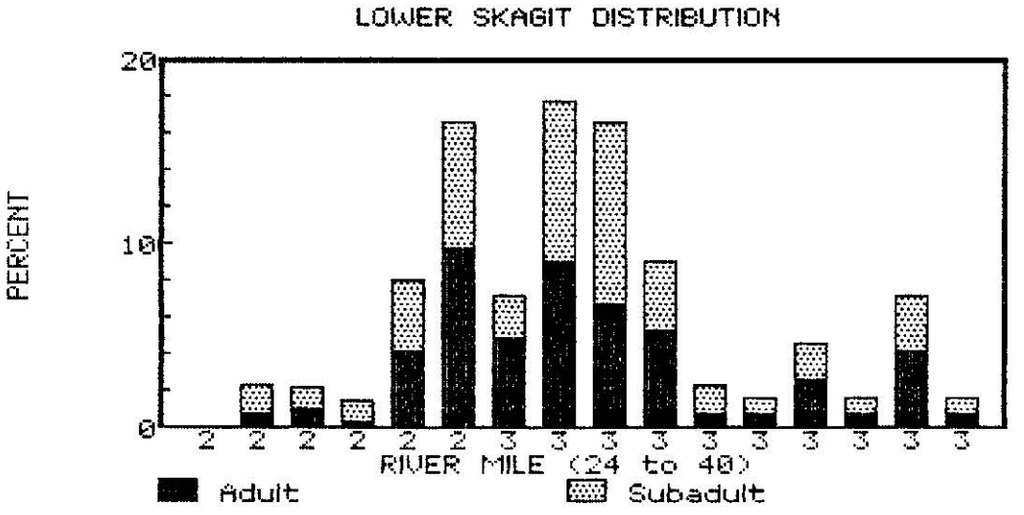

Figure 32. Distribution of eagles observed during river floats on the Lower Skagit River during Saturdays in 1985-86.

Counts of eagles on the Upper Sauk were high in the early half of December and consistently moderate throughout the remainder of winter, except during the last week of February (Figure 33). Distribution was concentrated on the upper half of this river section, especially between river miles 15 and 19 (Figure 34).

Counts of eagles on the Lower Sauk were high in December, especially late December, and consistently moderate throughout the remainder of the winter (Figure 35). Distribution was concentrated in two areas: between river miles 0 and 4, close to the Skagit River, and between miles 8 and 12 (Figure 36).

Density of eagles was highest on SRBENA (only morning censuses included), moderate on the two sections of the Sauk River, and low on the Skagit River (upper Figure 37). Density declined in river stretches further downstream from SRBENA. (Note: Sauk River density may be slightly higher than is real because flushing responses, and hence duplication, was higher there.)

On SRBENA, Thursday morning counts were highest, Sunday morning and Thursday afternoon counts were intermediate, and Sunday afternoon counts were lowest (lower Figure 37). The count difference between Thursday mornings and Sunday afternoons was the only showing statistical significance.

Bald eagles arrived unusually early on the SW&SRS in 1985-86 as evidenced by most of these population curves. This early fall movement was ostensibly caused by cold, snowy

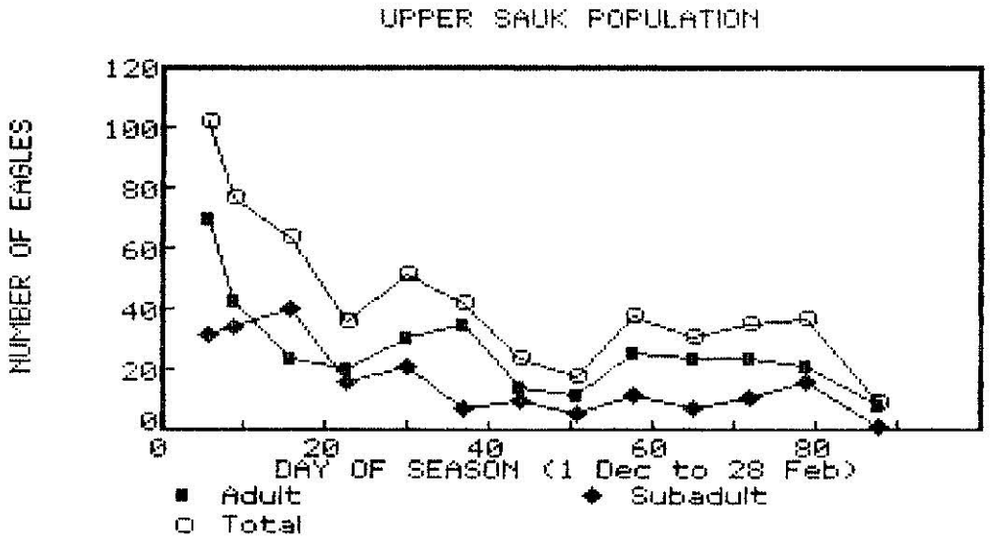

Figure 33. Number of eagles counted during river floats on the Upper Sauk River during Mondays in 1985-86.

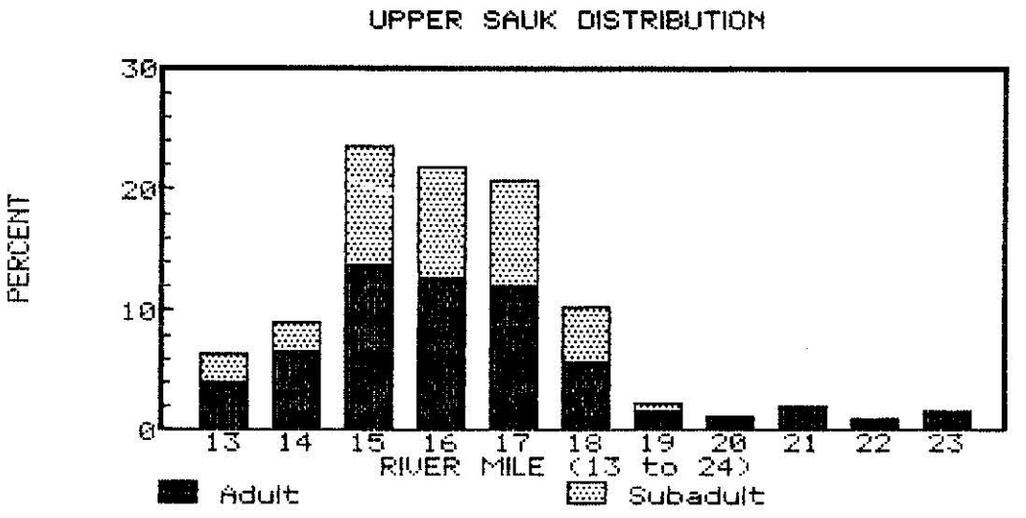

Figure 34. Distribution of eagles observed during river floats on the Upper Sauk River during Mondays in 1985-86.

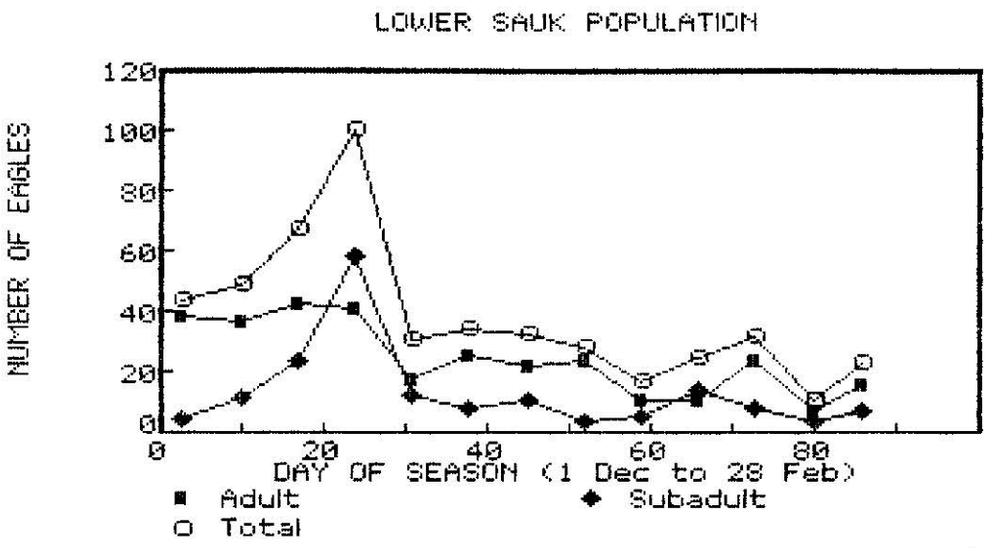

Figure 35. Number of eagles counted during river floats on the Lower Sauk River during Tuesdays in 1985-86.

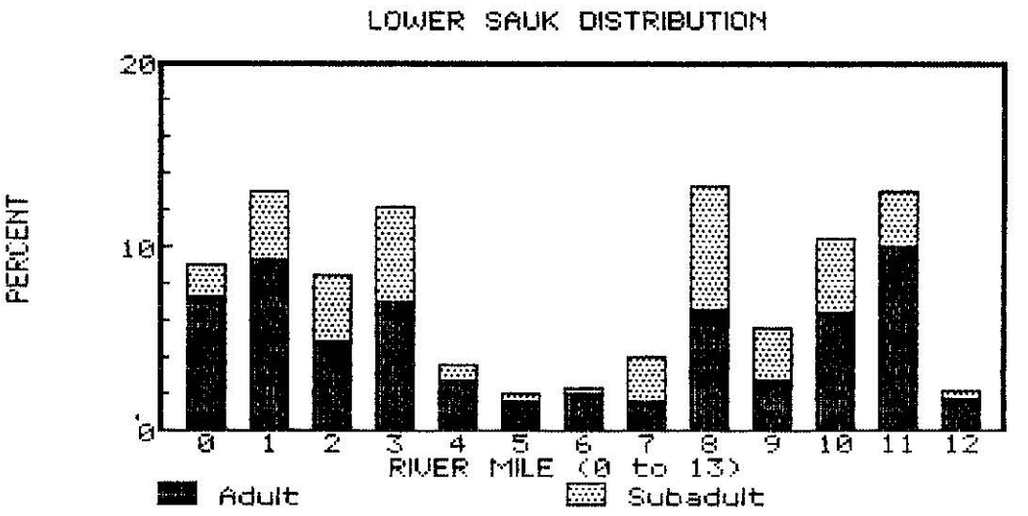

Figure 36. Distribution of eagles observed during river floats on the Lower Sauk River during Tuesdays in 1985-86.

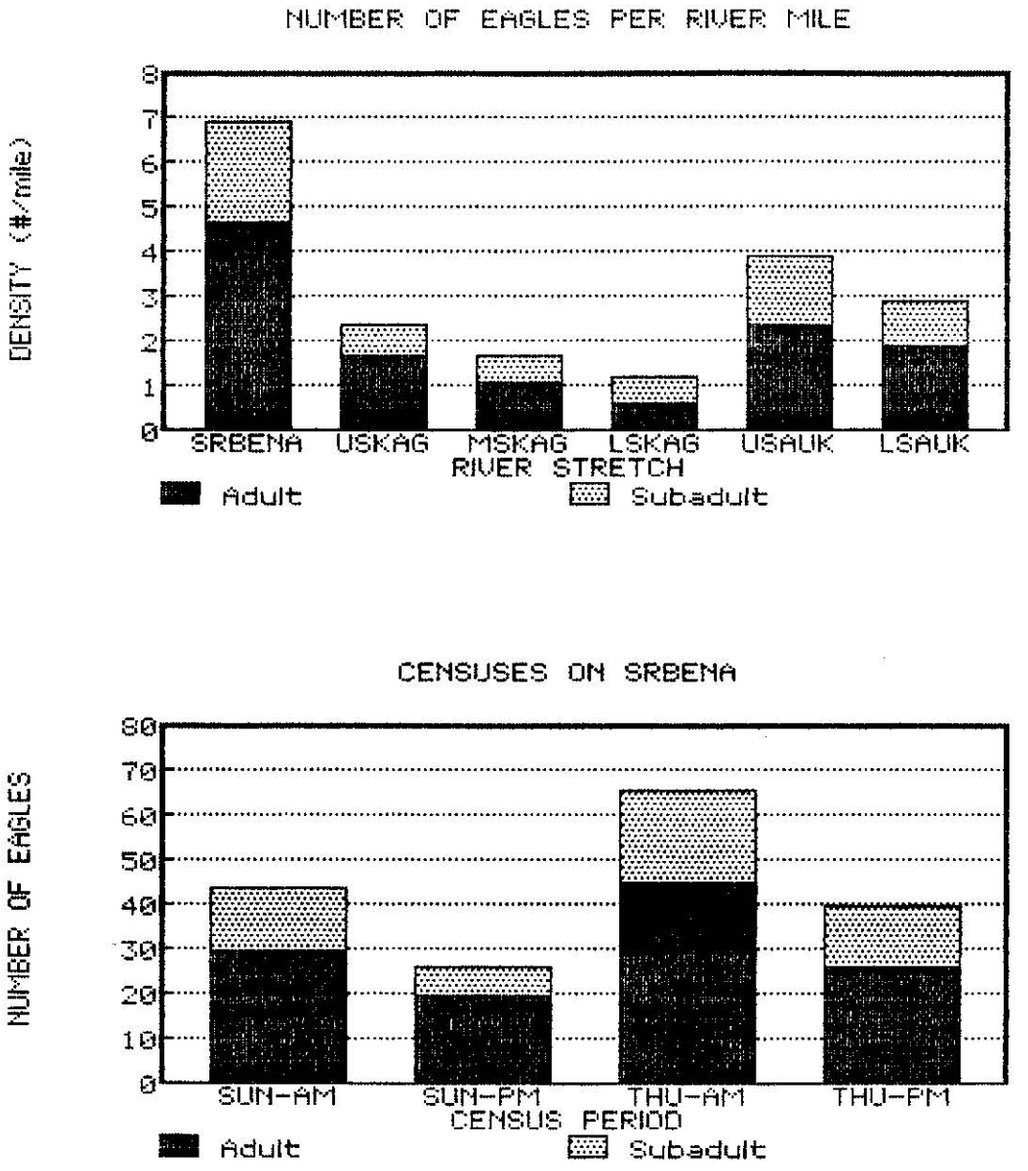

Figure 37. Mean number of eagles recorded per river mile on 6 river stretches of the SW&SRS during 13 weeks of censusing in 1985-86 (upper graph) and censuses of SRBENA subdivided by the four time periods (lower graph).

weather in November and December. Several populations peaked in number (early December) well before the peak in food abundance (early January; see Task 2). Flooding in January and early February, which floats many salmon carcasses downstream and/or makes them unavailable, caused an early departure from the study area.

Eagle use of the Upper Skagit seemed somewhat delayed compared to the SRBENA population, perhaps because carcasses washed there from SRBENA late in winter. This was not the case with the Middle Skagit, but on the Lower Skagit, the population increased over the course of the winter presumably because flooding washed many carcasses from up-river and deposited them there. The Sauk population were initially high, but declined rapidly thereafter for unknown reasons.

Distribution of eagles is highly correlated with the availability of food, especially salmon. Areas of high concentration as shown on the graphs also are the locations of preferred feeding sites.

As expected, eagles were most dense on SRBENA, but the Sauk River population also was high, even though there was a declining population there over the course of the season. A densely populated river mile on the Upper Skagit is also part of SRBENA. The Middle and Lower Skagit had less eagles presumably because there is less salmon spawning habitat.

Differences in counts on SRBENA seem highly correlated with human activity. It was initially hypothesized that counts on weekends would be lower than on weekdays because

human activity would cause many birds to leave and seek more secluded habitat. This was the observed pattern. It was also hypothesized that the differences in morning and afternoon counts would be much greater on weekends than on weekdays for the same reason. Although afternoon counts were lower than morning counts during both weekends and weekdays, the disparity did not appear greater on weekends.

Flight Distances.-- Mean flight distances of bald eagles perched in trees varied between 96 and 141 meters for the six river stretches and four time periods on SRBENA (Table 32). Flight distances were significantly different between a number of river stretches, especially with SRBENA compared to other stretches and with adults rather than subadults (Table 33). Generally, many of the differences were attributable to lower than expected distances for adults on SRBENA and higher than expected distances for adults on all other river sections (Figure 38). Distances for subadults were more consistent and, statistically, no differences were discerned.

Speculating on these differences, the following observations are offered. Because human activity is high on SRBENA, many eagles there have habituated to humans, but adults habituate faster than subadults. In contrast, it also could imply that adults are more sensitive to activity and thus leave the river when activity occurs, leaving behind the more tolerant adults, thereby explaining the recorded pattern. Distances are higher on the Sauk River because human activity is rare there and eagles have not habituated

Table 32. Flight distances (meters) of bald eagles from simulated rafting activity while perched in trees on the SRBENA during four time periods and on five other river sections of the SW&SRS.

Adult			Subadult			Total		
n	Mean	SE	n	Mean	SE	n	Mean	SE
SRBENA - Sunday AM								
109	118.9	6.33	92	112.3	6.26	201	115.9	4.46
SRBENA - Sunday PM								
54	99.6	5.79	21	114.8	17.53	75	103.9	6.42
SRBENA - Thursday AM								
196	107.8	4.23	118	109.7	5.68	314	108.5	3.39
SRBENA - Thursday PM								
97	93.7	6.25	62	98.7	7.73	159	95.7	4.85
Upper Skagit								
16	96.3	11.79	16	103.1	17.09	32	99.7	10.23
Middle Skagit								
92	142.2	8.58	57	124.4	7.76	149	135.4	6.10
Lower Skagit								
33	131.5	15.99	39	127.7	13.73	72	129.4	10.37
Upper Sauk								
206	149.7	5.85	114	124.3	6.58	320	140.6	4.48
Lower Sauk								
207	143.9	5.52	106	131.6	7.20	313	139.7	4.39

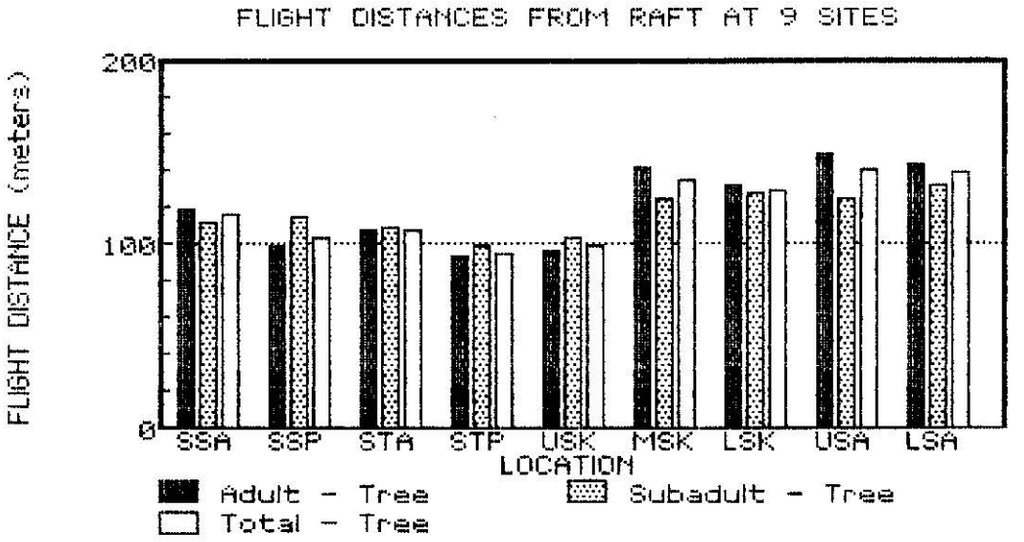

Figure 38. Mean flight distances (meters) of eagles perching in trees from the research raft on SRBENA during four time periods and on five river sections of the SW&SRS (see Table 32). SSA = SRBENA/Sunday AM, SSP = SRBENA/Sunday PM, STA = SRBENA/Thursday AM, STP = SRBENA/Thursday PM, USK = Upper Skagit, MSK = Middle Skagit, LSK = Lower Skagit, USA = Upper Sauk, and LSA = Lower Sauk.

Table 33. Statistical probability values comparing the flight distances of adult and subadult bald eagles from simulated rafting activity while perched on trees on the SRBENA during four time periods and on five other river sections of the SW&SRS.

River Comparison	In Trees		
	Adult	Subadult	Totals
SRBENA/Sun/AM-SRBENA/Sun/PM	NSD	NSD	NSD
SRBENA/Sun/AM-SRBENA/Thu/AM	NSD	NSD	NSD
SRBENA/Sun/AM-SRBENA/Thu/PM	NSD	NSD	NSD
SRBENA/Sun/AM-Upper Skagit	NSD	NSD	NSD
SRBENA/Sun/AM-Middle Skagit	NSD	NSD	0.05
SRBENA/Sun/AM-Lower Skagit	NSD	NSD	NSD
SRBENA/Sun/AM-Upper Sauk	0.05	NSD	0.05
SRBENA/Sun/AM-Lower Sauk	0.05	NSD	0.05
SRBENA/Sun/PM-SRBENA/Thu/AM	NSD	NSD	NSD
SRBENA/Sun/PM-SRBENA/Thu/PM	NSD	NSD	NSD
SRBENA/Sun/PM-Upper Skagit	NSD	NSD	NSD
SRBENA/Sun/PM-Middle Skagit	0.05	NSD	0.05
SRBENA/Sun/PM-Lower Skagit	NSD	NSD	NSD
SRBENA/Sun/PM-Upper Sauk	0.05	NSD	0.05
SRBENA/Sun/PM-Lower Sauk	0.05	NSD	0.05
SRBENA/Thu/AM-SRBENA/Thu/PM	NSD	NSD	NSD
SRBENA/Thu/AM-Upper Skagit	NSD	NSD	NSD
SRBENA/Thu/AM-Middle Skagit	0.05	NSD	0.05
SRBENA/Thu/AM-Lower Skagit	NSD	NSD	NSD
SRBENA/Thu/AM-Upper Sauk	0.05	NSD	0.05
SRBENA/Thu/AM-Lower Sauk	0.05	NSD	0.05
SRBENA/Thu/PM-Upper Skagit	NSD	NSD	NSD
SRBENA/Thu/PM-Middle Skagit	0.05	NSD	0.05
SRBENA/Thu/PM-Lower Skagit	NSD	NSD	0.05
SRBENA/Thu/PM-Upper Sauk	0.05	NSD	0.05
SRBENA/Thu/PM-Lower Sauk	0.05	NSD	0.05
Upper Skagit-Middle Skagit	NSD	NSD	NSD
Upper Skagit-Lower Skagit	NSD	NSD	NSD
Upper Skagit-Upper Sauk	NSD	NSD	0.05
Upper Skagit-Lower Sauk	NSD	NSD	0.05
Middle Skagit-Lower Skagit	NSD	NSD	NSD
Middle Skagit-Upper Sauk	NSD	NSD	NSD
Middle Skagit-Lower Sauk	NSD	NSD	NSD
Lower Skagit-Upper Sauk	NSD	NSD	NSD
Lower Skagit-Lower Sauk	NSD	NSD	NSD
Upper Sauk-Lower Sauk	NSD	NSD	NSD

NSD = No Significant Difference ($P < 0.05$).

to humans as much as on the Skagit. Adults are more sensitive on the Sauk; are they the less tolerant birds that were frightened from the Skagit and flew to the Sauk to find solitude? If so, this would explain the pattern on both SRBENA and the Sauk. Distances on the Upper Skagit are low because human activity is very high there and because this section was floated in afternoons when less tolerant birds presumably had moved from the river and habituation, perhaps on a daily basis, had developed. The Middle and Lower Skagit have low to moderate human activities levels and moderate flight distances.

Mean flight distances for bald eagles feeding or standing on the ground varied between 128 and 193 meters for the six river stretches and four time periods on SRBENA (Table 34, Figure 39). Sample sizes were low on the Upper Skagit. Only three significant differences were recorded: between Sunday morning and Thursday morning floats on SRBENA for adults and all ages, and between Sunday morning SRBENA floats and Lower Sauk floats just for adults (Table 35).

Habituation and redistribution of sensitive and tolerant birds could explain these patterns, as discussed above. Adults on SRBENA the Sunday morning after the high activity of a Saturday are tolerant and/or habituated to humans to a greater extent than those on Thursday mornings and on the relatively secluded Lower Sauk.

The difference in flight distances between adults and subadults perching on the Upper Sauk was so high that

Table 34. Flight distances (meters) of bald eagles from simulated rafting activity while feeding or standing on the ground on the SRBENA during four time periods and on five other river sections of the SW&SRS.

Adult			Subadult			Total		
n	Mean	SE	n	Mean	SE	n	Mean	SE
SRBENA - Sunday AM								
54	123.9	7.65	30	145.0	15.89	84	131.4	7.53
SRBENA - Sunday PM								
22	151.8	19.11	13	116.2	10.89	35	138.6	12.89
SRBENA - Thursday AM								
106	162.5	9.97	57	180.4	13.51	163	168.8	8.02
SRBENA - Thursday PM								
29	121.7	10.73	8	150.0	37.80	37	127.8	11.57
Upper Skagit								
13	174.6	29.80	0	-	-	13	174.6	29.80
Middle Skagit								
21	167.6	17.73	16	179.4	22.92	37	172.7	13.95
Lower Skagit								
13	169.2	16.23	13	216.9	53.05	26	193.1	27.59
Upper Sauk								
27	145.6	15.90	19	163.7	33.46	46	153.0	16.51
Lower Sauk								
29	186.6	18.14	15	173.3	14.76	44	182.1	12.89

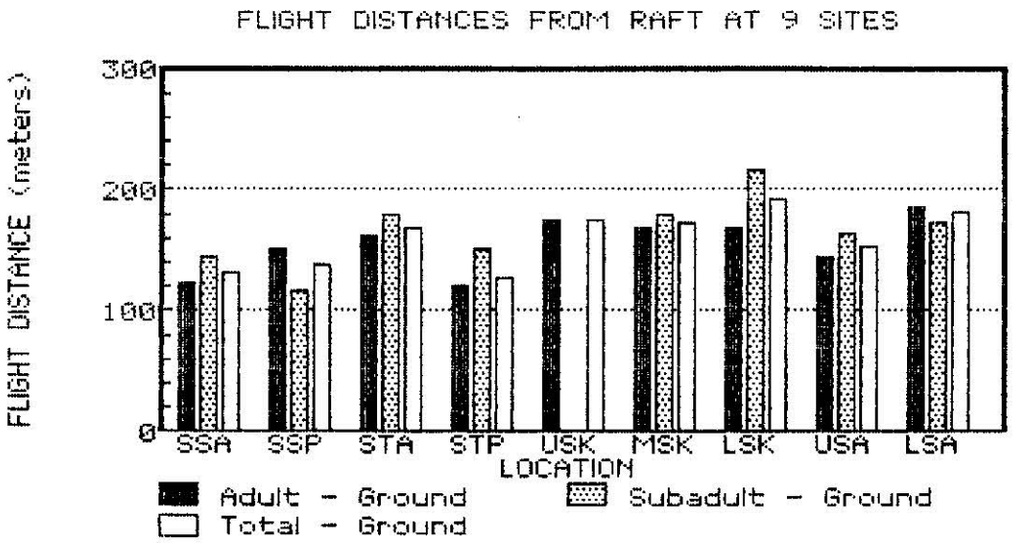

Figure 39. Mean flight distances (meters) of eagles feeding or standing on the ground from the research raft on SRBENA during four time periods and on five river sections of the SW&SRS (see Table 34). SSA = SRBENA/Sunday AM, SSP = SRBENA/Sunday PM, STA = SRBENA/Thursday AM, STP = SRBENA/Thursday PM, USK = Upper Skagit, MSK = Middle Skagit, LSK = Lower Skagit, USA = Upper Sauk, and LSA = Lower Sauk.

Table 35. Statistical probability values comparing the flight distances of adult and subadult bald eagles from simulated rafting activity while feeding or standing on the ground on the SRBENA during four time periods and on five other river sections of the SW&SRS.

River Comparison	On Ground		
	Adult	Subadult	Totals
SRBENA/Sun/AM-SRBENA/Sun/PM	NSD	NSD	NSD
SRBENA/Sun/AM-SRBENA/Thu/AM	0.05	NSD	0.05
SRBENA/Sun/AM-SRBENA/Thu/PM	NSD	NSD	NSD
SRBENA/Sun/AM-Upper Skagit	NSD	NSD	NSD
SRBENA/Sun/AM-Middle Skagit	NSD	NSD	NSD
SRBENA/Sun/AM-Lower Skagit	NSD	NSD	NSD
SRBENA/Sun/AM-Upper Sauk	NSD	NSD	NSD
SRBENA/Sun/AM-Lower Sauk	0.05	NSD	NSD
SRBENA/Sun/PM-SRBENA/Thu/AM	NSD	NSD	NSD
SRBENA/Sun/PM-SRBENA/Thu/PM	NSD	NSD	NSD
SRBENA/Sun/PM-Upper Skagit	NSD	NSD	NSD
SRBENA/Sun/PM-Middle Skagit	NSD	NSD	NSD
SRBENA/Sun/PM-Lower Skagit	NSD	NSD	NSD
SRBENA/Sun/PM-Upper Sauk	NSD	NSD	NSD
SRBENA/Sun/PM-Lower Sauk	NSD	NSD	NSD
SRBENA/Thu/AM-SRBENA/Thu/PM	NSD	NSD	NSD
SRBENA/Thu/AM-Upper Skagit	NSD	NSD	NSD
SRBENA/Thu/AM-Middle Skagit	NSD	NSD	NSD
SRBENA/Thu/AM-Lower Skagit	NSD	NSD	NSD
SRBENA/Thu/AM-Upper Sauk	NSD	NSD	NSD
SRBENA/Thu/AM-Lower Sauk	NSD	NSD	NSD
SRBENA/Thu/PM-Upper Skagit	NSD	NSD	NSD
SRBENA/Thu/PM-Middle Skagit	NSD	NSD	NSD
SRBENA/Thu/PM-Lower Skagit	NSD	NSD	NSD
SRBENA/Thu/PM-Upper Sauk	NSD	NSD	NSD
SRBENA/Thu/PM-Lower Sauk	NSD	NSD	NSD
Upper Skagit-Middle Skagit	NSD	NSD	NSD
Upper Skagit-Lower Skagit	NSD	NSD	NSD
Upper Skagit-Upper Sauk	NSD	NSD	NSD
Upper Skagit-Lower Sauk	NSD	NSD	NSD
Middle Skagit-Lower Skagit	NSD	NSD	NSD
Middle Skagit-Upper Sauk	NSD	NSD	NSD
Middle Skagit-Lower Sauk	NSD	NSD	NSD
Lower Skagit-Upper Sauk	NSD	NSD	NSD
Lower Skagit-Lower Sauk	NSD	NSD	NSD
Upper Sauk-Lower Sauk	NSD	NSD	NSD

NSD = No Significant Difference ($P < 0.05$).

statistical significance was realized; no other comparisons were as great (Table 36). Adults, as measured by how close they could be approached on the Upper Sauk, were less tolerant of rafting activity than subadults (Figure 38).

When all data for all floats on all river sections and times are combined, there is no significant difference between flight distances of adults and subadults whether in trees or on the ground (Table 37, Figure 40). Flight distances of eagles, both adult and subadult, are significantly higher when flushed from the ground than from trees. Eagles appear more sensitive to humans when they are forced to feed on the ground.

Flight distances of perched subadults flushed on Sunday mornings significantly declined over the course of winter (Table 38). Because this was the only difference to occur in 27 tested cases for perched birds, it is considered a statistical fluke. There were no seasonal changes in flight distances for 27 tested cases for eagles feeding or standing on the ground as well (Table 39).

Flushing Responses.-- Flushing response scores (percent flushed by approaching raft/100) of eagles perched in trees ranged widely among the six river stretches and four time periods on SRBENA (Table 40, Figure 41). Less than 20 percent flushed on the Upper Skagit, but more than half flushed on the Sauk River. More often than not, these differences were significant (Table 41). These many trends indicate that there are numerous factors affecting the

Table 36. Probability values comparing the flight distances of adult and subadult bald eagles to simulated rafting activity while perched in trees and feeding or standing on the ground on the SRBENA during four time periods and on five other river sections of the SW&SRS.

	Adult-Subadult Comparison	
Location - Time	In Trees	On Ground
SRBENA - Sunday AM	NSD	NSD
SRBENA - Sunday PM	NSD	NSD
SRBENA - Thursday AM	NSD	NSD
SRBENA - Thursday PM	NSD	NSD
Upper Skagit	NSD	NSD
Middle Skagit	NSD	NSD
Lower Skagit	NSD	NSD
Upper Sauk	0.01	NSD
Lower Sauk	NSD	NSD
Totals	NSD	NSD

Table 37. Flight distances (meters) of adult and subadult bald eagles from simulated rafting activity while perched in trees and feeding or standing on the ground on the SRBENA during four time periods and on five other river sections. *

Adult		Subadult		Total	
n	Mean	n	Mean	n	Mean
Perched in Trees					
1010	126.9a	625	117.8a	1635	123.4a
Feeding or Standing on Ground					
314	153.2b	171	168.1b	485	158.5b

* Statistical comparisons between the two ages, two locations, and ages and locations are denoted by lower case letters.

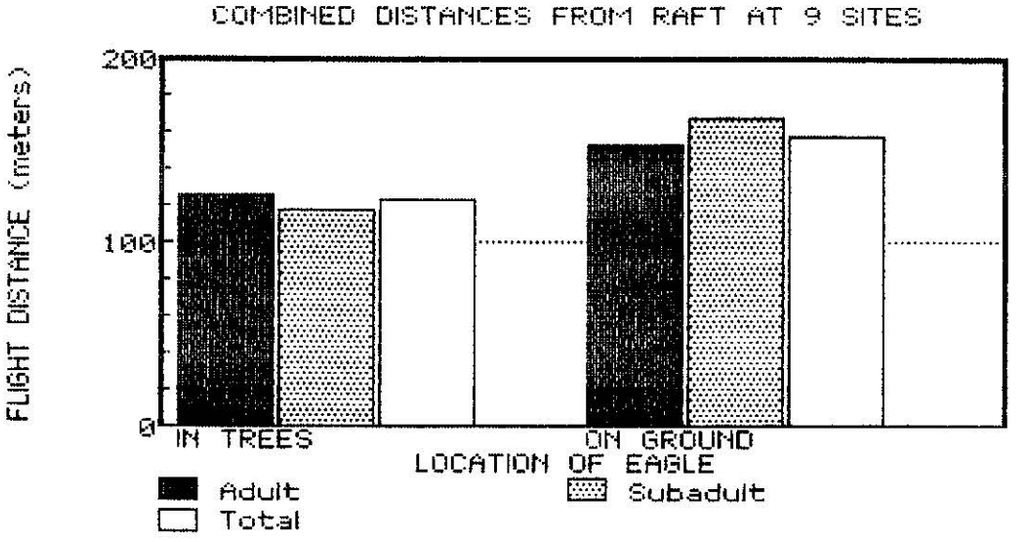

Figure 40. Mean flight distances (meters) of adult and subadult eagles while in trees or on the ground from the research raft for all river sections combined (see Table 37).

Table 38. Least squares regression statistics of flight distances (meters) of eagles from simulated rafting activity while perched in trees as a function of time (80-day winter season).

Location & Age	n	Regression Equation	r	P
SRBENA-Sun-AM				
Adult	109	Y=112.1 + 0.259X	0.078	NSD
Subadult	92	Y=129.3 - 0.517X	-0.206	0.05
Total	201	Y=121.4 - 0.188X	-0.065	NSD
SRBENA-Sun-PM				
Adult	54	Y= 96.2 + 0.221X	0.084	NSD
Subadult	21	Y= 88.8 + 1.343X	0.285	NSD
Total	75	Y= 94.1 + 0.588X	0.174	NSD
SRBENA-Thur-AM				
Adult	196	Y=121.4 - 0.424X	-0.138	NSD
Subadult	118	Y=110.3 - 0.017X	-0.013	NSD
Total	314	Y=114.2 - 0.174X	-0.058	NSD
SRBENA-Thur-PM				
Adult	97	Y= 93.6 + 0.002X	0.001	NSD
Subadult	62	Y= 97.3 + 0.056X	0.022	NSD
Total	159	Y= 95.1 + 0.020X	0.008	NSD
Upper Skagit				
Adult	16	Y= 73.8 + 0.566X	0.311	NSD
Subadult	16	Y=106.9 - 0.112X	-0.050	NSD
Total	32	Y= 93.8 + 0.159X	0.076	NSD
Middle Skagit				
Adult	92	Y=147.9 - 0.249X	-0.077	NSD
Subadult	57	Y=125.8 - 0.051X	-0.024	NSD
Total	149	Y=140.3 - 0.200X	-0.070	NSD
Lower Skagit				
Adult	33	Y=136.9 - 0.103X	-0.028	NSD
Subadult	39	Y=116.5 + 0.227X	0.081	NSD
Total	72	Y=123.8 + 0.111X	0.036	NSD
Upper Sauk				
Adult	206	Y=135.5 + 0.425X	0.124	NSD
Subadult	114	Y=125.0 - 0.023X	-0.007	NSD
Total	320	Y=130.6 + 0.312X	0.094	NSD
Lower Sauk				
Adult	207	Y=134.3 + 0.316X	0.100	NSD
Subadult	106	Y=142.7 - 0.351X	-0.091	NSD
Total	313	Y=135.0 + 0.154X	0.046	NSD

Table 39. Least squares regression statistics of flight distances (meters) of eagles from simulated rafting activity while feeding or standing on the ground as a function of time (80-day winter season).

Location & Age	n	Regression Equation	r	P
SRBENA-Sun-AM				
Adult	54	Y=103.3 + 0.785X	0.216	NSD
Subadult	30	Y=145.4 - 0.015X	-0.004	NSD
Total	84	Y=121.0 + 0.377X	0.103	NSD
SRBENA-Sun-PM				
Adult	22	Y=123.8 + 0.101X	0.154	NSD
Subadult	13	Y=131.9 - 0.981X	-0.427	NSD
Total	35	Y=130.0 + 0.390X	0.076	NSD
SRBENA-Thur-AM				
Adult	106	Y=163.8 - 0.030X	-0.015	NSD
Subadult	57	Y=145.3 + 0.767X	-0.115	NSD
Total	163	Y=167.0 + 0.042X	0.018	NSD
SRBENA-Thur-PM				
Adult	29	Y=110.8 + 0.446X	0.118	NSD
Subadult	8	Y= 99.7 + 1.656X	0.343	NSD
Total	37	Y=103.5 + 0.942X	0.226	NSD
Upper Skagit				
Adult	13	Y=173.3 + 0.056X	0.008	NSD
Subadult	0			
Total	13	Y=173.3 + 0.056X	0.008	NSD
Middle Skagit				
Adult	21	Y=147.9 + 0.506X	0.166	NSD
Subadult	16	Y=204.0 - 0.692X	-0.183	NSD
Total	37	Y=171.5 + 0.032X	0.010	NSD
Lower Skagit				
Adult	13	Y=171.6 - 0.044X	-0.020	NSD
Subadult	13	Y= 96.6 + 2.157X	0.295	NSD
Total	26	Y=133.7 + 1.072X	0.195	NSD
Upper Sauk				
Adult	27	Y=165.1 - 0.583X	-0.189	NSD
Subadult	19	Y=209.1 - 1.732X	-0.302	NSD
Total	46	Y=185.1 - 1.053X	-0.246	NSD
Lower Sauk				
Adult	29	Y=160.5 + 0.861X	0.198	NSD
Subadult	15	Y=151.6 + 0.539X	0.204	NSD
Total	44	Y=159.7 + 0.664X	0.174	NSD

Table 40. Flushing responses of eagles to simulated rafting activity while perched in trees on the SRBENA during four time periods and on five other river sections of the SW&SRS.

Adult		Subadult		All Ages	
n	Mean	n	Mean	n	Mean
SRBENA - Sunday AM					
347	0.317	165	0.570	512	0.393
SRBENA - Sunday PM					
251	0.219	80	0.263	331	0.230
SRBENA - Thursday AM					
544	0.358	251	0.462	795	0.391
SRBENA - Thursday PM					
335	0.296	186	0.382	521	0.326
Upper Skagit					
112	0.143	53	0.302	165	0.194
Middle Skagit					
239	0.381	180	0.322	419	0.356
Lower Skagit					
136	0.257	118	0.331	254	0.291
Upper Sauk					
376	0.551	231	0.494	607	0.529
Lower Sauk					
363	0.570	181	0.586	544	0.575

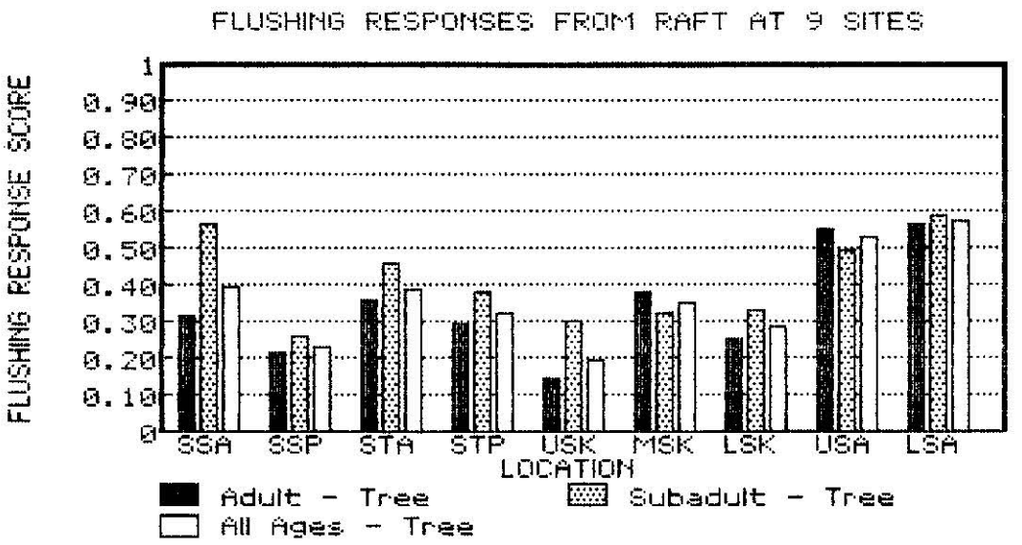

Figure 41. Flushing response scores of eagles perching in trees from the research raft on SRBENA during four time periods and on five river sections of the SW&SRS (see Table 40). SSA = SRBENA/Sunday AM, SSP = SRBENA/Sunday PM, STA = SRBENA/Thursday AM, STP = SRBENA/Thursday PM, USK = Upper Skagit, MSK = Middle Skagit, LSK = Lower Skagit, USA = Upper Sauk, and LSA = Lower Sauk.

Table 41. Statistical probability values comparing the flushing responses of adult and subadult bald eagles to simulated rafting activity while perched on trees on the SRBENA during four time periods and on five other river sections of the SW&SRS.

River Comparison	In Trees		
	Adult	Subadult	All Ages
SRBENA/Sun/AM-SRBENA/Sun/PM	0.025	0.001	0.001
SRBENA/Sun/AM-SRBENA/Thu/AM	NSD	NSD	NSD
SRBENA/Sun/AM-SRBENA/Thu/PM	NSD	0.005	0.05
SRBENA/Sun/AM-Upper Skagit	0.001	0.005	0.001
SRBENA/Sun/AM-Middle Skagit	NSD	0.001	NSD
SRBENA/Sun/AM-Lower Skagit	NSD	0.001	0.01
SRBENA/Sun/AM-Upper Sauk	0.001	NSD	0.001
SRBENA/Sun/AM-Lower Sauk	0.001	NSD	0.001
SRBENA/Sun/PM-SRBENA/Thu/AM	0.001	0.005	0.001
SRBENA/Sun/PM-SRBENA/Thu/PM	0.05	NSD	0.005
SRBENA/Sun/PM-Upper Skagit	NSD	NSD	NSD
SRBENA/Sun/PM-Middle Skagit	0.001	NSD	0.001
SRBENA/Sun/PM-Lower Skagit	NSD	NSD	NSD
SRBENA/Sun/PM-Upper Sauk	0.001	0.001	0.001
SRBENA/Sun/PM-Lower Sauk	0.001	0.001	0.001
SRBENA/Thu/AM-SRBENA/Thu/PM	NSD	NSD	0.025
SRBENA/Thu/AM-Upper Skagit	0.001	0.05	0.001
SRBENA/Thu/AM-Middle Skagit	NSD	0.005	NSD
SRBENA/Thu/AM-Lower Skagit	0.05	0.025	0.01
SRBENA/Thu/AM-Upper Sauk	0.001	NSD	0.001
SRBENA/Thu/AM-Lower Sauk	0.001	0.025	0.001
SRBENA/Thu/PM-Upper Skagit	0.005	NSD	0.005
SRBENA/Thu/PM-Middle Skagit	0.05	NSD	NSD
SRBENA/Thu/PM-Lower Skagit	NSD	NSD	NSD
SRBENA/Thu/PM-Upper Sauk	0.001	0.05	0.001
SRBENA/Thu/PM-Lower Sauk	0.001	0.001	0.001
Upper Skagit-Middle Skagit	0.001	NSD	0.001
Upper Skagit-Lower Skagit	0.05	NSD	0.05
Upper Skagit-Upper Sauk	0.001	0.025	0.001
Upper Skagit-Lower Sauk	0.001	0.001	0.001
Middle Skagit-Lower Skagit	0.025	NSD	NSD
Middle Skagit-Upper Sauk	0.001	0.001	0.001
Middle Skagit-Lower Sauk	0.001	0.001	0.001
Lower Skagit-Upper Sauk	0.001	0.01	0.001
Lower Skagit-Lower Sauk	0.001	0.001	0.001
Upper Sauk-Lower Sauk	NSD	NSD	NSD

NSD = No Significant Difference ($P < 0.05$).

decision to flush or not; avoidance behavior of eagles is complex.

Flushing was highest on the Sauk. Perhaps eagles are not habituated to humans there because it is a relatively secluded area compared to other river stretches. But the river channel is narrow; the raft passes closer to eagles there than in other areas thereby causing more birds to fly.

On the Skagit, flushing was high on the Middle, low on the Upper, and intermediate on the Lower. Responses on the Middle and Lower were not statistically different, but the Upper was much lower than the other two. This is likely for two reasons: eagles on the Upper have habituated to humans to a greater extent and eagles there were approached in the afternoon when the flushing response would be expected to be lower.

On SRBENA, differences there supported several hypotheses concerning the effects of human activity on eagle behavior. First, flushing response was lower in the afternoon for both Sundays and Thursdays. This suggests that some eagles partially habituate to humans on a daily basis and/or the more sensitive eagles leave the river after the morning disturbances. (The pattern is supported by census information previously discussed.) Second, because human activity is more prevalent on weekends, the drop in flushing response is more pronounced on Sundays; more birds are forced to leave on Sundays or habituate to activity. Responses were similar during mornings when comparing Sundays to Thursdays,

but they changed in the afternoon suggesting adjustments attributable to human activity.

Flushing responses of eagles feeding or standing on the ground varied less than for eagles perched in trees (Table 42, Figure 42). From 63 to 98 percent of all birds on the ground flushed; this is much higher than birds in trees. Most significant differences were attributable to the low response on the Lower Skagit and the high response on the Sauk (Table 43). Because the river channel is very wide on the Lower Skagit, many birds on the ground can be passed in a boat without encroaching on the space that they need to keep between humans in order to carry out normal activities. On the Sauk, the river channel is narrow which ostensibly causes more encroachment on the eagles' spaces. On SRBENA, the flushing responses on afternoon floats on Thursdays were lower than on Sunday afternoons; this pattern does not support the habituation hypothesis previously discussed.

Important differences in flushing occurred between adults and subadults (Table 44). For birds perched in trees (Figure 41), subadults flushed at higher rates than adults on SRBENA in the mornings. This also was the case on the Upper Skagit, where part of SRBENA is located, and for the entire population when all rivers are combined. The effect is most pronounced on SRBENA. For ground birds, subadults flushed more often only on SRBENA during Thursday mornings (Figure 42); the combined test for all rivers failed to reach statistical significance. The difference noted on the Upper

Table 42. Flushing responses of eagles to simulated rafting activity while feeding or standing on the ground on the SRBENA during four time periods and on five other river sections of the SW&SRS.

Adult		Subadult		All Ages	
n	Mean	n	Mean	n	Mean
SRBENA - Sunday AM					
63	0.857	34	0.912	97	0.876
SRBENA - Sunday PM					
23	0.957	14	0.929	37	0.946
SRBENA - Thursday AM					
147	0.796	59	0.983	206	0.850
SRBENA - Thursday PM					
40	0.775	11	0.727	51	0.765
Upper Skagit					
14	0.929	2	0.500	16	0.875
Middle Skagit					
23	0.913	18	0.889	41	0.902
Lower Skagit					
19	0.684	24	0.583	43	0.628
Upper Sauk					
28	0.964	20	0.950	48	0.958
Lower Sauk					
30	0.967	15	1.000	45	0.978

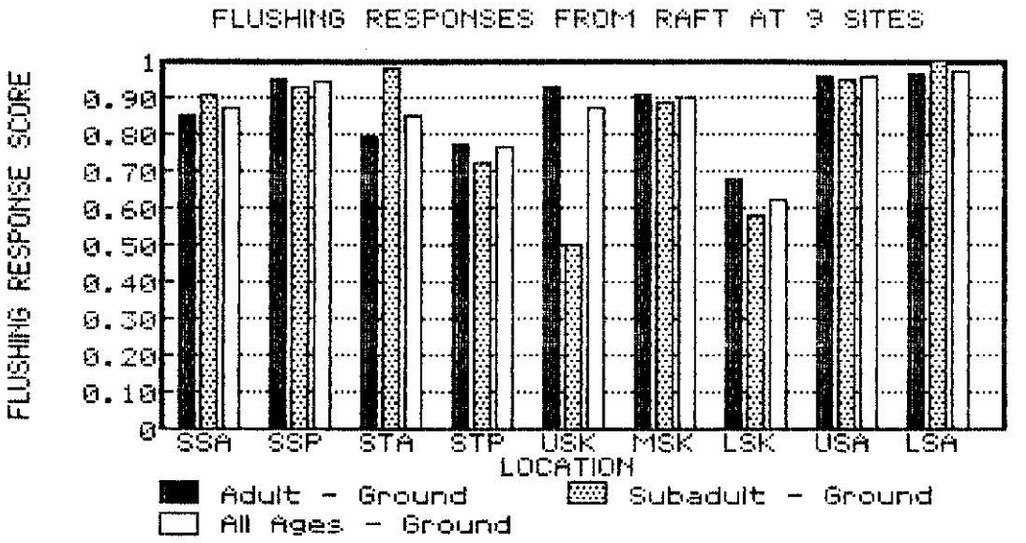

Figure 42. Flushing response scores of eagles feeding or standing on the ground from the research raft on SRBENA during four time periods and on five river sections of the SW&SRS (see Table 42). SSA = SRBENA/Sunday AM, SSP = SRBENA/Sunday PM, STA = SRBENA/Thursday AM, STP = SRBENA/Thursday PM, USK = Upper Skagit, MSK = Middle Skagit, LSK = Lower Skagit, USA = Upper Sauk, and LSA = Lower Sauk.

Table 43. Statistical probability values comparing the flushing responses of adult and subadult bald eagles to simulated rafting activity while feeding or standing on the ground on the SRBENA during four time periods and on five other river sections of the SW&SRS.

River Comparison	On Ground		
	Adult	Subadult	All Ages
SRBENA/Sun/AM-SRBENA/Sun/PM	NSD	NSD	NSD
SRBENA/Sun/AM-SRBENA/Thu/AM	NSD	NSD	NSD
SRBENA/Sun/AM-SRBENA/Thu/PM	NSD	NSD	NSD
SRBENA/Sun/AM-Upper Skagit	NSD	NSD	NSD
SRBENA/Sun/AM-Middle Skagit	NSD	NSD	NSD
SRBENA/Sun/AM-Lower Skagit	NSD	0.01	0.005
SRBENA/Sun/AM-Upper Sauk	NSD	NSD	NSD
SRBENA/Sun/AM-Lower Sauk	NSD	NSD	NSD
SRBENA/Sun/PM-SRBENA/Thu/AM	NSD	NSD	NSD
SRBENA/Sun/PM-SRBENA/Thu/PM	NSD	NSD	0.05
SRBENA/Sun/PM-Upper Skagit	NSD	NSD	NSD
SRBENA/Sun/PM-Middle Skagit	NSD	NSD	NSD
SRBENA/Sun/PM-Lower Skagit	NSD	NSD	0.005
SRBENA/Sun/PM-Upper Sauk	NSD	NSD	NSD
SRBENA/Sun/PM-Lower Sauk	NSD	NSD	NSD
SRBENA/Thu/AM-SRBENA/Thu/PM	NSD	0.01	NSD
SRBENA/Thu/AM-Upper Skagit	NSD	NSD	NSD
SRBENA/Thu/AM-Middle Skagit	NSD	NSD	NSD
SRBENA/Thu/AM-Lower Skagit	NSD	0.001	0.005
SRBENA/Thu/AM-Upper Sauk	NSD	NSD	NSD
SRBENA/Thu/AM-Lower Sauk	0.05	NSD	0.05
SRBENA/Thu/PM-Upper Skagit	NSD	NSD	NSD
SRBENA/Thu/PM-Middle Skagit	NSD	NSD	NSD
SRBENA/Thu/PM-Lower Skagit	NSD	NSD	NSD
SRBENA/Thu/PM-Upper Sauk	NSD	NSD	0.025
SRBENA/Thu/PM-Lower Sauk	NSD	NSD	0.01
Upper Skagit-Middle Skagit	NSD	NSD	NSD
Upper Skagit-Lower Skagit	NSD	NSD	NSD
Upper Skagit-Upper Sauk	NSD	NSD	NSD
Upper Skagit-Lower Sauk	NSD	NSD	NSD
Middle Skagit-Lower Skagit	NSD	NSD	0.01
Middle Skagit-Upper Sauk	NSD	NSD	NSD
Middle Skagit-Lower Sauk	NSD	NSD	NSD
Lower Skagit-Upper Sauk	0.005	0.025	0.001
Lower Skagit-Lower Sauk	0.005	0.025	0.001
Upper Sauk-Lower Sauk	NSD	NSD	NSD

NSD = No Significant Difference ($P < 0.05$).

Table 44. Probability values comparing the flushing responses of adult and subadult bald eagles to simulated rafting activity while perched in trees and feeding or standing on the ground on the SRBENA during four time periods and on five other river sections of the SW&SRS.

Location - Time	Adult-Subadult Comparison	
	In Trees	On Ground
SRBENA - Sunday AM	0.001	NSD
SRBENA - Sunday PM	NSD	NSD
SRBENA - Thursday AM	0.01	0.005
SRBENA - Thursday PM	NSD	NSD
Upper Skagit	0.05	NSD
Middle Skagit	NSD	NSD
Lower Skagit	NSD	NSD
Upper Sauk	NSD	NSD
Lower Sauk	NSD	NSD
Totals	0.001	NSD

NSD = No Significant Difference.

Skagit was great, but not significant, owing to a small sample size.

Can habituation and redistribution again explain why subadults are less tolerant to boating than adults? Adults are more tolerant of humans where human activity is more common; they could be the tolerant individuals left after the more sensitive ones have left the river and/or they could be habituating faster than subadults. Subadults may be unsure how to react to boats and tend to flush more often than adults, but they may also be more tolerant of humans and remain on the river to a greater extent; this would elevate their flushing responses because moderately sensitive birds choose to remain rather than seek secluded habitat.

In summary, subadults flushed more often than adults and birds on the ground flushed more often than birds perched in trees (Table 45). On the average, 40 percent of all perched eagles flushed and 86 percent of all feeding and standing eagles flushed (Figure 43).

Seasonal changes in flushing responses were evident in many instances for eagles perched in trees (Table 46). All relationships showed a decline in response as winter progressed, but trends were significant for five of nine river sections and times. The decline in responsiveness was dramatic for birds on SRBENA during Sundays, especially in afternoons (Figure 44). During the last 4 weeks of winter, no eagles flushed from the approaching raft during all Sunday afternoons! The decline during Sunday mornings was not as

Table 45. Flushing responses of bald eagles to simulated rafting activity while perched in trees and feeding or standing on the ground on all nine river sections combined. *

	Adult		Subadult		All Ages	
	n	Mean	n	Mean	n	Mean
In Tree						
	2703	0.376a	1445	0.437b	4148	0.397A
On Ground						
	387	0.845c	197	0.888c	584	0.860B

* Statistical comparisons between the two ages is denoted by lower case letters and comparison between the two eagle locations is denoted by upper case letters.

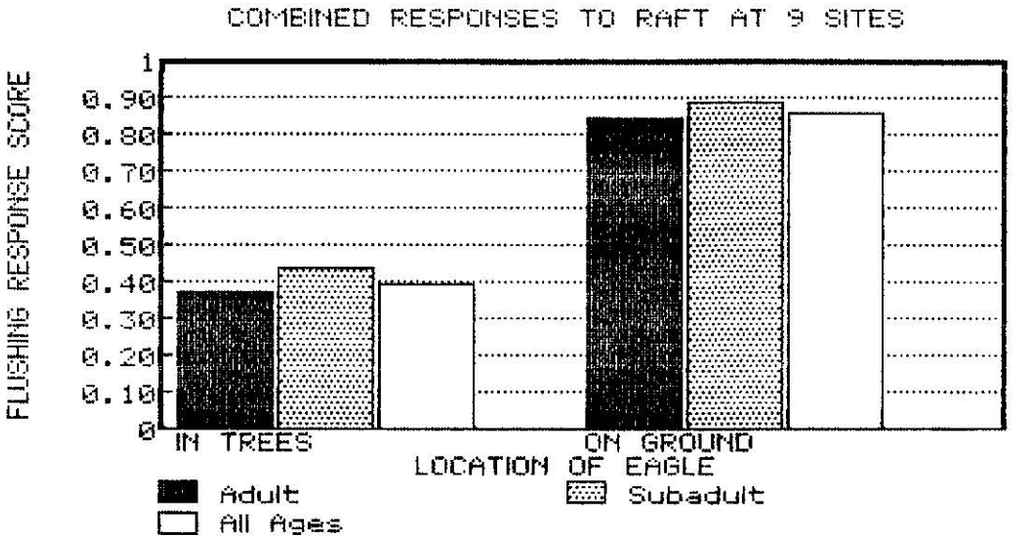

Figure 43. Flushing response scores of adult and subadult eagles while in trees or on the ground from the research raft for all river sections combined (see Table 45).

Table 46. Least squares regression statistics of the flushing responses of eagles to simulated rafting activity while perched in trees as a function of time (80-day winter season).

Location & Age	n	Regression Equation	r	P
SRBENA-Sun-AM				
Adult	13	Y=0.455 - 0.0049X	-0.740	0.005
Subadult	12	Y=0.615 - 0.0034X	-0.387	NSD
All Ages	13	Y=0.524 - 0.0047X	-0.701	0.01
SRBENA-Sun-PM				
Adult	13	Y=0.417 - 0.0058X	-0.842	0.0005
Subadult	12	Y=0.572 - 0.0081X	-0.740	0.01
All Ages	13	Y=0.450 - 0.0063X	-0.867	0.0001
SRBENA-Thur-AM				
Adult	13	Y=0.445 - 0.0032X	-0.680	0.025
Subadult	13	Y=0.695 - 0.0052X	-0.594	0.05
All Ages	13	Y=0.492 - 0.0034X	-0.749	0.005
SRBENA-Thur-PM				
Adult	13	Y=0.336 - 0.0011X	-0.230	NSD
Subadult	13	Y=0.433 - 0.0027X	-0.426	NSD
All Ages	13	Y=0.364 - 0.0015X	-0.395	NSD
Upper Skagit				
Adult	13	Y=0.271 - 0.0025X	-0.433	NSD
Subadult	12	Y=0.472 - 0.0043X	-0.408	NSD
All Ages	13	Y=0.357 - 0.0034X	-0.446	NSD
Middle Skagit				
Adult	13	Y=0.512 - 0.0046X	-0.598	0.05
Subadult	13	Y=0.530 - 0.0041X	-0.388	NSD
All Ages	13	Y=0.530 - 0.0044X	-0.563	0.05
Lower Skagit				
Adult	13	Y=0.289 - 0.0001X	-0.018	NSD
Subadult	13	Y=0.240 - 0.0013X	-0.143	NSD
All Ages	13	Y=0.242 - 0.0009X	-0.149	NSD
Upper Sauk				
Adult	13	Y=0.639 - 0.0025X	-0.508	NSD
Subadult	13	Y=0.555 - 0.0023X	-0.278	NSD
All Ages	13	Y=0.607 - 0.0021X	-0.436	NSD
Lower Sauk				
Adult	13	Y=0.668 - 0.0037X	-0.573	0.05
Subadult	13	Y=0.705 - 0.0040X	-0.397	NSD
All Ages	13	Y=0.699 - 0.0039X	-0.641	0.01

Table 47. Least squares regression statistics of the flushing responses of eagles to simulated rafting activity while feeding or standing on the ground as a function of time (80-day winter season).

Location & Age	n	Regression Equation	r	P
SRBENA-Sun-AM				
Adult	9	Y=0.833 - 0.0034X	-0.205	NSD
Subadult	11	Y=0.915 + 0.0003X	0.048	NSD
All Ages	11	Y=0.846 + 0.0002X	0.032	NSD
SRBENA-Sun-PM				
Adult	5	Y=1.118 - 0.0083X	-0.704	NSD
Subadult	5	Y=0.905 + 0.0025X	0.575	NSD
All Ages	6	Y=1.009 - 0.0036X	-0.501	NSD
SRBENA-Thur-AM				
Adult	9	Y=0.838 - 0.0030X	-0.202	NSD
Subadult	11	Y=1.047 - 0.0020X	-0.361	NSD
All Ages	12	Y=0.791 + 0.0002X	0.019	NSD
SRBENA-Thur-PM				
Adult	7	Y=0.876 - 0.0032X	-0.494	NSD
Subadult	6	Y=0.964 - 0.0066X	-0.443	NSD
All Ages	9	Y=0.908 - 0.0030X	-0.335	NSD
Upper Skagit				
Adult	6	Y=0.845 + 0.0042X	0.564	NSD
Subadult	2	Insufficient Data		
All Ages	7	Y=0.806 + 0.0035X	0.650	NSD
Middle Skagit				
Adult	9	Y=0.815 + 0.0035X	0.689	0.05
Subadult	7	Y=0.643 + 0.0059X	0.350	NSD
All Ages	9	Y=0.774 + 0.0039X	0.716	0.025
Lower Skagit				
Adult	8	Y=1.064 - 0.0093X	-0.621	NSD
Subadult	9	Y=0.517 + 0.0016X	0.129	NSD
All Ages	11	Y=0.800 - 0.0040X	-0.366	NSD
Upper Sauk				
Adult	7	Y=1.011 - 0.0008X	-0.435	NSD
Subadult	8	Y=1.123 - 0.0059X	-0.502	NSD
All Ages	9	Y=1.142 - 0.0064X	-0.543	NSD
Lower Sauk				
Adult	10	Y=0.945 + 0.0010X	0.479	NSD
Subadult	7	Y=1.000 + 0.0000X	1.000	NSD
All Ages	10	Y=0.945 + 0.0010X	0.479	NSD

great. A more gradual decline was evident during Thursday mornings on SRBENA, but there was no significant trend during Thursday afternoons (Figure 45). The Middle Skagit showed a decline in flushing over the season, but this was not the case with the Upper and Lower Skagit (Figure 46). Likewise, the decline on the Lower Sauk was significant, but not so on the Upper Sauk (Figure 47). For eagles feeding or standing on the ground, only the Middle Skagit had a significant change in flushing response over the course of the season (Table 47). This pattern was, however, the opposite trend than for birds perched in trees; eagles flushed more often as winter progressed.

Seasonal habituation by eagles appears to be the best explanation for the recorded decline in flushing responsiveness. This trend was most evident on SRBENA where human activity is most common; human activity is perhaps so common as to necessitate some habituation in order for eagles to engage in normal daily activities. Habituation could also have developed on the Middle Skagit and Lower Sauk, even though human activities there are lower in intensity (see Task 6). An additional influential factor could be food abundance; as food declines over the course of the season, eagles may be more tolerant of human activity in order to stay on the river and feed. But because the flushing responses for many river stretches declined in December (Figures 44 to 47), and because the food supply was increasing during this same period (Figure 18), it seems that

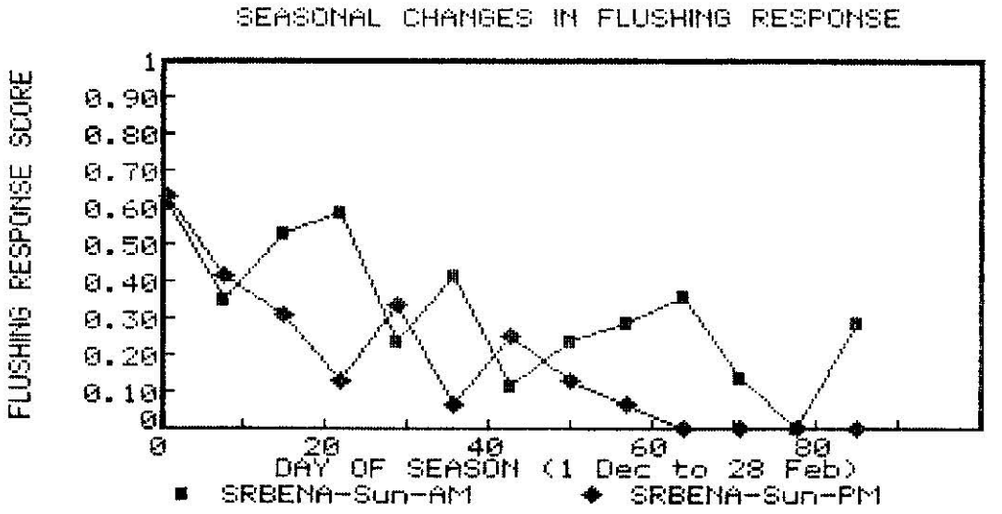

Figure 44. Seasonal changes in the flushing response of bald eagles perched in trees on SRBENA on Sunday mornings and afternoons (see Table 46).

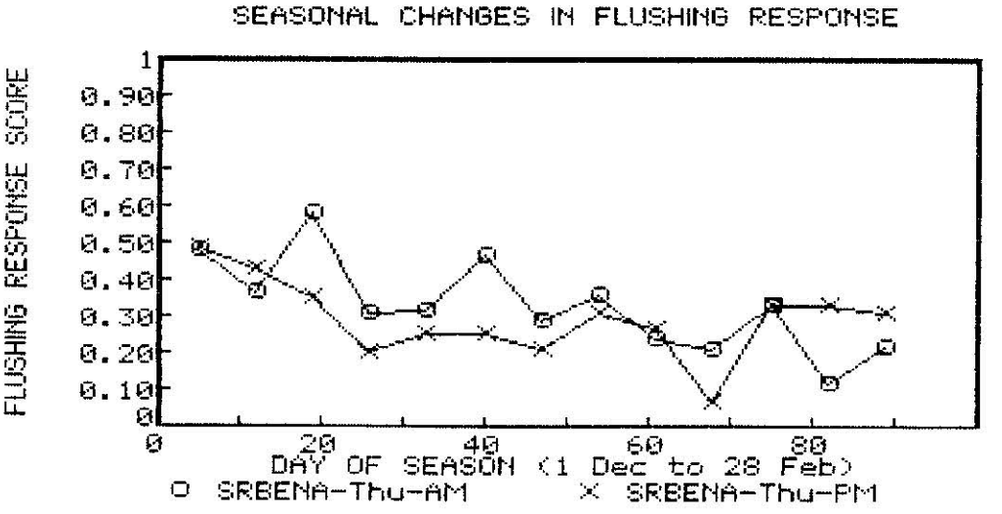

Figure 45. Seasonal changes in the flushing response of bald eagles perched in trees on SRBENA on Thursday mornings and afternoons (see Table 46).

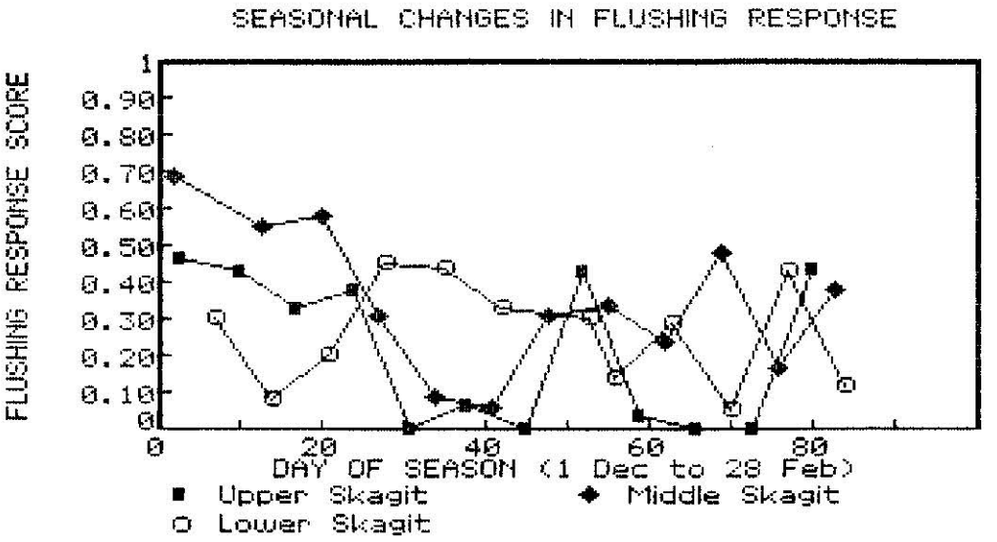

Figure 46. Seasonal changes in the flushing response of bald eagles perched in trees on the Upper, Middle, and Lower Skagit River (see Table 46).

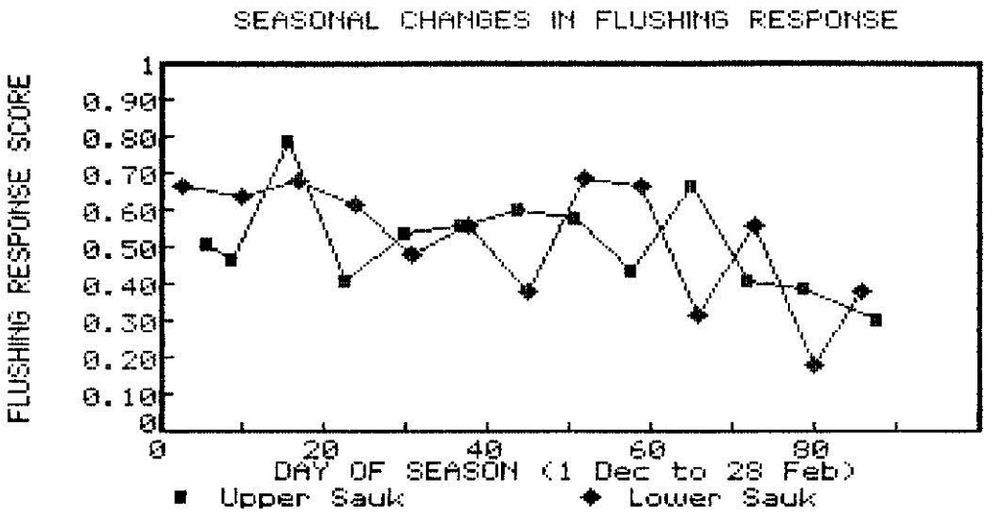

Figure 47. Seasonal changes in the flushing response of bald eagles perched in trees on the Upper and Lower Sauk River (see Table 46).

food availability may be a secondary factor influencing the flushing response. The increase in flushing for birds on the ground on the Middle Skagit may be another statistical fluke; a larger sampling may refute this phenomenon.

TASK 5 - Heart Rate Monitoring

This task was discontinued because of inadequate funding.

Previous discussions per Tasks 1 and 4 indicate the complexity of eagle responses to varying human activities. By using flight distances and flushing responses as indices to understand eagle avoidance behavior, many questions will remain unresolved or, at least, poorly understood.

Heart rate monitoring may very well be the only means of refining this approach and analyzing the intricate response patterns of eagles. It is the best means to acquire a physiological (and psychological) index of an eagle's perception of its environment and the many components there that it must contend with.

This approach should be considered in future studies of the bald eagle where human activity is thought to be influencing their behavior.

TASK 6 - Recreational Use Survey

Methods

Observations on SRBENA.-- During continuous observations at Washington Eddy on SRBENA (per Task 1), the following recreational data were collected for all activities seen: (1) type of activity, (2) date, (3) time of day, and (4) number of persons in each activity event.

Observations during Float Trips.-- During the floats trips on SRBENA and the SW&SRS (per Task 4), the following recreational data were collected for all activities seen: (1) type of activity, (2) date, (3) location by river mile, and (4) number of persons in each activity event.

Time-lapse Photography.-- Three time-lapse cameras (Minolta Super-8, Models 401 or 601) were placed on the Upper and Lower Sauk River and Upper Skagit River to record the amount, type, date, and time of day of all recreational activities. The Upper Sauk and Upper Skagit cameras were stolen early in the season and the incomplete data sets for these two river stretches are not reported here.

Analyses

Observational data were compiled according to the above parameters. Time-lapse film was analyzed by playing film on a Lafayette Super-8 Film Analyzer. Because specific times were not recorded during time-lapse photography, daily sequences are divided into quarter days based on when the

camera was turned on and off.

Results and Discussion

Observations on SRBENA.-- During the winter season, 1274 recreational activities were recorded at Washington Eddy on SRBENA; 157 in December, 681 in January, and 436 in February (Tables 48 to 51). Of these 1274 acts, 54 percent were consumptive users (fishermen) and 46 percent were naturalistic users (eagle watchers); this trend was remarkably similar for each month. Motorboating was the most common type of activity (42 %) followed by recreational rafting (23 %) (Table 51, Figure 48). Each of the other activities comprised less than 10 percent of total.

The amount, type, and purpose of activities depended on the day of the week when they occurred (Tables 48 to 51, Figure 49). Most activity (68 %) happened on weekends, especially in January and February. Consumptive use was proportionally higher on weekdays; naturalistic use was higher on weekends. Recreational rafts, canoes, and kayaks were more common on weekends (Figure 50); a higher percentage of motorboats and dories occurred on weekdays (Figure 51).

The amount, type, and purpose of activities also was related to the hour of occurrence (Table 52). Activity peaked in early-afternoon, especially between 1200 and 1500 hours, but consumptive activity was generally consistent throughout the day, whereas naturalistic activity happened mostly in afternoons (Figure 52). As a percent of total,

Table 48. Extent of recreational activities recorded at Washington Eddy on the SRBENA on each day of the week for 28 days in December of 1985-86.*

Activity Type	Day of Week: Sun (n = 3)		Mon (n = 5)		Tue (n = 5)		Wed (n = 3)	
	n	%	n	%	n	%	n	%
Motorboat								
First run	3	16.7	9	39.1	2	33.3	4	40.0
First drift	0	0.0	0	0.0	0	0.0	2	20.0
Subtotal	3	16.7	9	39.1	2	33.3	6	60.0
All runs	3	16.7	12	52.2	3	50.0	5	50.0
All drifts	0	0.0	2	8.7	0	0.0	2	20.0
Subtotal	3	16.7	14	60.9	3	50.0	7	70.0
Raft								
Recreation	5	27.8	5	21.7	1	16.7	0	0.0
Research	6	33.3	0	0.0	0	0.0	0	0.0
Subtotal	11	61.1	5	21.7	1	16.7	0	0.0
Dory/Drift	1	5.6	1	4.3	1	16.7	0	0.0
Canoe	0	0.0	0	0.0	1	16.7	0	0.0
Kayak	0	0.0	0	0.0	0	0.0	0	0.0
Bank Fisher	3	16.7	2	8.7	0	0.0	1	10.0
Hiker	0	0.0	1	4.3	0	0.0	2	20.0
Consumptive	7	38.9	17	73.9	4	66.7	8	80.0
Naturalistic	11	61.1	6	26.1	2	33.3	2	20.0
Totals	18	100.1	23	99.9	6	100.1	10	100.0

* Excluding 12/8, 12/15, and 12/25.

Table 48. Continued.

Activity Type	Day of Week: Thu (n = 4) n	%	Fri (n = 4) n	%	Sat (n = 4) n	%	Totals (n = 28) n	%
Motorboat								
First run	6	20.7	8	30.8	6	13.3	38	24.2
First drift	0	0.0	0	0.0	0	0.0	2	1.3
Subtotal	6	20.7	8	30.8	6	13.3	40	25.5
All runs	7	24.1	9	34.6	9	20.0	48	30.6
All drifts	1	3.5	1	3.8	3	6.7	9	5.7
Subtotal	8	27.6	10	38.5	12	26.7	57	36.3
Raft								
Recreation	3	10.3	5	19.2	+18	40.0	37	23.6
Research	8	27.6	0	0.0	0	0.0	14	8.9
Subtotal	11	37.9	5	19.2	18	40.0	51	32.5
Dory/Drift	4	13.8	6	23.1	3	6.7	16	10.2
Canoe	0	0.0	0	0.0	7	15.6	8	5.1
Kayak	0	0.0	0	0.0	0	0.0	0	0.0
Bank Fisher	2	6.9	2	7.7	3	6.7	13	8.3
Hiker	4	13.8	3	11.5	2	4.4	12	7.6
Consumptive	14	48.3	18	69.2	19	42.2	87	55.4
Naturalistic	15	51.7	8	30.8	26	57.8	70	44.6
Totals	29	100.0	26	100.0	45	100.1	157	100.0

* Excluding 12/8, 12/15, and 12/25.
\+ 1 raft fishing.

Table 49. Extent of recreational activities recorded at Washington Eddy on the SRBENA on each day of the week for 31 days in January of 1985-86.

Activity Type	Day of Week: Sun (n = 4)		Mon (n = 4)		Tue (n = 4)		Wed (n = 5)	
	n	%	n	%	n	%	n	%
Motorboat								
First run	10	4.7	1	6.3	6	15.8	11	22.9
First drift	3	1.4	0	0.0	1	2.6	1	2.1
Subtotal	13	6.1	1	6.3	7	18.4	12	25.0
All runs	30	14.1	2	12.5	21	55.3	16	33.3
All drifts	30	14.1	1	6.3	14	36.8	11	22.9
Subtotal	60	28.2	3	18.8	35	92.1	27	56.3
Raft								
Recreation	40	18.8	2	12.5	+2	5.3	4	8.3
Research	8	3.8	0	0.0	0	0.0	0	0.0
Subtotal	48	22.5	2	12.5	2	5.3	4	8.3
Dory/Drift	13	6.1	8	50.0	1	2.6	7	14.6
Canoe	46	21.6	0	0.0	0	0.0	5	10.4
Kayak	36	16.9	0	0.0	0	0.0	0	0.0
Bank Fisher	2	0.9	1	6.3	0	0.0	0	0.0
Hiker	8	3.8	2	12.5	0	0.0	5	10.4
Consumptive	75	35.2	12	75.0	37	97.4	34	70.8
Naturalistic	138	64.8	4	25.0	1	2.6	14	29.2
Totals	213	100.0	16	100.1	38	100.0	48	100.0

+ 1 raft fishing.

Table 49. Continued.

Activity Type	Day of Week: Thu (n = 5) n	%	Fri (n = 5) n	%	Sat (n = 5) n	%	Totals (n = 31) n	%
Motorboat								
First run	14	23.0	13	52.0	36	12.9	91	13.4
First drift	0	0.0	2	8.0	4	1.4	11	1.6
Subtotal	14	23.0	15	60.0	40	14.3	102	15.0
All runs	22	36.1	13	52.0	64	22.9	168	24.7
All drifts	17	27.9	7	28.0	48	17.1	128	18.8
Subtotal	39	63.9	20	80.0	112	40.0	296	43.5
Raft								
Recreation	4	6.6	0	0.0	+92	32.9	++144	21.1
Research	10	16.4	0	0.0	0	0.0	18	2.6
Subtotal	14	23.0	0	0.0	92	32.9	162	23.8
Dory/Drift	5	8.2	4	16.0	15	5.4	53	7.8
Canoe	0	0.0	0	0.0	22	7.9	73	10.7
Kayak	0	0.0	0	0.0	29	10.4	65	9.5
Bank Fisher	1	1.6	0	0.0	3	1.1	7	1.0
Hiker	2	3.3	1	4.0	7	2.5	25	3.7
Consumptive	45	73.8	24	96.0	131	46.8	358	52.6
Naturalistic	16	26.2	1	4.0	149	53.2	323	47.4
Totals	61	100.0	25	100.0	280	100.2	681	100.0

\+ 1 raft fishing.
++ 2 rafts fishing.

Table 50. Extent of recreational activities recorded at Washington Eddy on the SRBENA on each day of the week for 22 days in February of 1985-86. *

Activity Type	Day of Week: Sun (n = 3)		Mon (n = 3)		Tue (n = 3)		Wed (n = 3)	
	n	%	n	%	n	%	n	%
Motorboat								
First run	19	12.4	2	20.0	3	12.5	9	34.6
First drift	7	4.6	1	10.0	0	0.0	2	7.7
Subtotal	26	17.0	3	30.0	3	12.5	11	42.3
All runs	28	18.3	6	60.0	8	33.3	14	53.8
All drifts	31	20.3	2	20.0	7	29.2	10	38.5
Subtotal	59	38.6	8	80.0	15	62.5	24	92.3
Raft								
Recreation	34	22.2	0	0.0	1	4.2	1	3.8
Research	6	3.9	0	0.0	0	0.0	0	0.0
Subtotal	40	26.1	0	0.0	1	4.2	1	3.8
Dory/Drift	21	13.7	1	10.0	5	20.8	0	0.0
Canoe	13	8.5	0	0.0	0	0.0	0	0.0
Kayak	9	5.9	0	0.0	0	0.0	0	0.0
Bank Fisher	1	0.7	1	10.0	1	4.2	0	0.0
Hiker	10	6.5	0	0.0	2	8.3	1	3.8
Consumptive	81	52.9	10	100.0	21	87.5	24	92.3
Naturalistic	72	47.1	0	0.0	3	12.5	2	7.7
Totals	153	100.0	10	100.0	24	100.0	26	99.9

* From 2/1 to 2/22.

Table 50. Continued.

Activity Type	Day of Week: Thu (n = 3) n	%	Fri (n = 3) n	%	Sat (n = 4) n	%	Totals (n = 22) n	%
Motorboat								
First run	3	11.1	2	11.8	14	7.8	42	9.6
First drift	0	0.0	0	0.0	4	2.2	14	3.2
Subtotal	3	11.1	2	11.8	18	10.1	56	12.8
All runs	6	22.2	9	52.9	31	17.3	102	23.4
All drifts	3	11.1	5	29.4	22	12.3	80	18.3
Subtotal	9	33.3	14	82.4	53	29.6	182	41.7
Raft								
Recreation	+1	3.7	0	0.0	74	41.3	+111	25.5
Research	6	22.2	0	0.0	0	0.0	12	2.8
Subtotal	7	25.9	0	0.0	74	41.3	123	28.3
Dory/Drift	7	25.9	3	17.6	18	10.1	55	12.6
Canoe	0	0.0	0	0.0	20	11.2	33	7.6
Kayak	0	0.0	0	0.0	6	3.4	15	3.4
Bank Fisher	1	3.7	0	0.0	1	0.6	5	1.1
Hiker	3	11.1	0	0.0	7	3.9	23	5.3
Consumptive	18	66.7	17	100.0	72	40.2	243	55.7
Naturalistic	9	33.3	0	0.0	107	59.8	193	44.3
Totals	27	99.9	17	100.0	179	100.1	436	100.0

+ 1 raft fishing.

Table 51. Extent of recreational activities recorded at Washington Eddy on the SRBENA on each day of the week for 81 days in December, January and February combined in 1985-86. *

Activity Type	Day of Week: Sun (n = 10) n	%	Mon (n = 12) n	%	Tue (n = 12) n	%	Wed (n = 11) n	%
Motorboat								
First run	32	8.3	12	24.5	11	16.2	24	28.6
First drift	10	2.6	1	2.0	1	1.5	5	6.0
Subtotal	42	10.9	13	26.5	12	17.6	29	34.5
All runs	61	15.9	20	40.8	32	47.1	35	41.7
All drifts	61	15.9	5	10.2	21	30.9	23	27.4
Subtotal	122	31.8	25	51.0	53	77.9	58	69.0
Raft								
Recreation	79	20.6	7	14.3	+4	5.9	5	6.0
Research	20	5.2	0	0.0	0	0.0	0	0.0
Subtotal	99	25.8	7	14.3	4	5.9	5	6.0
Dory/Drift	35	9.1	10	20.4	7	10.3	7	8.3
Canoe	59	15.4	0	0.0	1	1.5	5	6.0
Kayak	45	11.7	0	0.0	0	0.0	0	0.0
Bank Fisher	6	1.6	4	8.2	1	1.5	1	1.2
Hiker	18	4.7	3	6.1	2	2.9	8	9.5
Consumptive	163	42.4	39	79.6	62	91.2	66	78.6
Naturalistic	221	57.6	10	20.4	6	8.8	18	21.4
Totals	384	100.1	49	100.0	68	100.0	84	100.0

* Excluding 12/8, 12/15, 12/25, and 2/23 through 2/28.

Table 51. Continued.

Activity Type	Day of Week: Thu (n = 12) n	%	Fri (n = 12) n	%	Sat (n = 13) n	%	Totals (n = 81) n	%
Motorboat								
First run	23	19.7	23	33.8	56	11.1	171	13.4
First drift	0	0.0	2	2.9	8	1.6	27	2.1
Subtotal	23	19.7	25	36.8	64	12.7	198	15.5
All runs	35	29.9	31	45.6	104	20.6	318	25.0
All drifts	21	17.9	13	19.1	73	14.5	217	17.0
Subtotal	56	47.9	44	64.7	177	35.1	535	42.0
Raft								
Recreation	+8	6.8	5	7.4	++184	36.5	+++292	22.9
Research	24	20.5	0	0.0	0	0.0	44	3.5
Subtotal	32	27.3	5	7.4	184	36.5	336	26.4
Dory/Drift	16	13.7	13	19.1	36	7.1	124	9.7
Canoe	0	0.0	0	0.0	49	9.7	114	8.9
Kayak	0	0.0	0	0.0	35	6.9	80	6.3
Bank Fisher	4	3.4	2	2.9	7	1.4	25	2.0
Hiker	9	7.7	4	5.9	16	3.2	60	4.7
Consumptive	77	65.8	59	86.8	222	44.0	688	54.0
Naturalistic	40	34.2	9	13.2	282	56.0	586	46.0
Totals	117	100.0	68	100.0	504	99.9	1274	100.0

* Excluding 12/8, 12/15, 12/25, and 2/23 through 2/28.
\+ 1 raft fishing.
++ 2 rafts fishing.
+++ 4 rafts fishing.

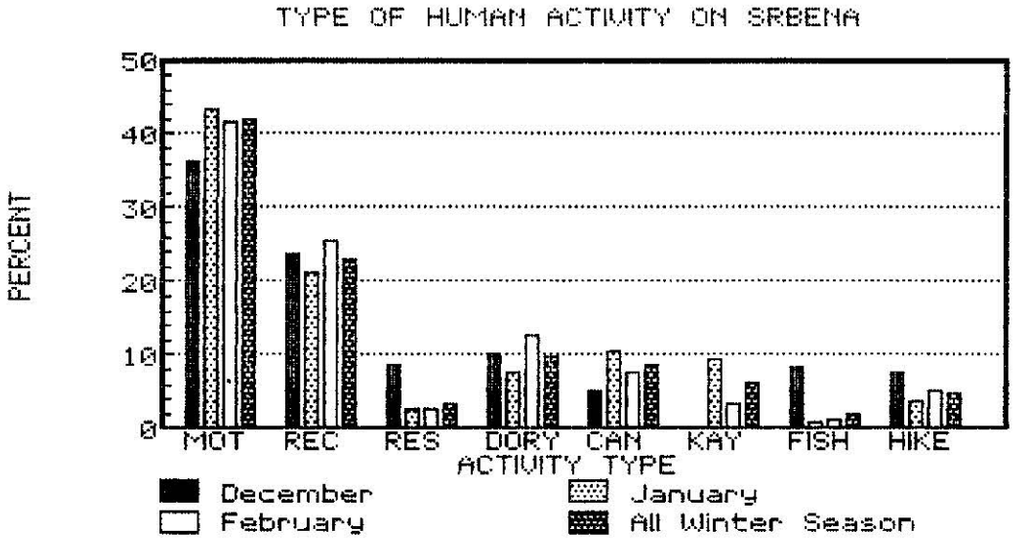

Figure 48. Type of recreational activity recorded by observation at Washington Eddy on SRBENA during the winter of 1985-86 (see Tables 48 to 51). MOT = Motorboat, REC = Recreational Raft, RES = Research Raft, DORY = Dory or Drift, CAN = Canoe, KAY = Kayak, FISH = Bank Fisher, and HIKE = Hiker.

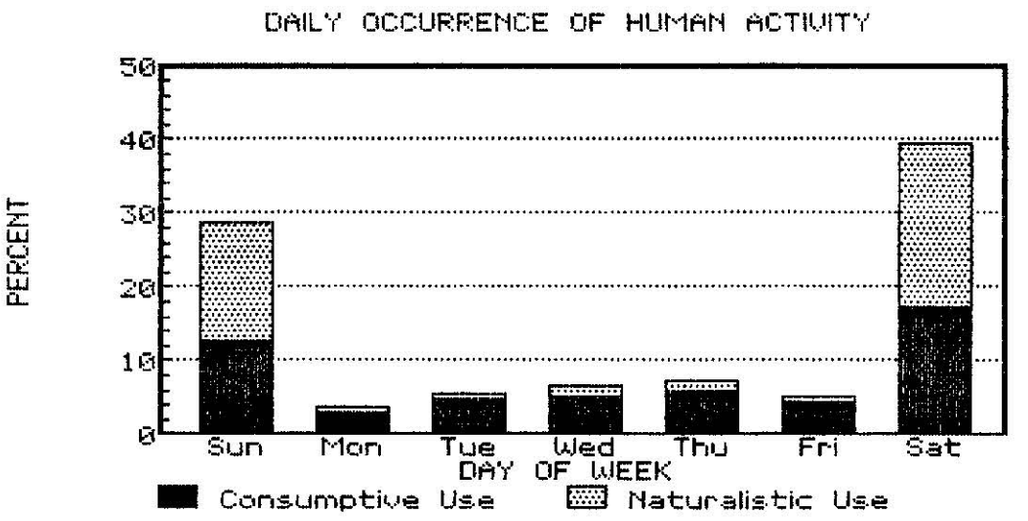

Figure 49. Percent occurrence of recreational activity at Washington Eddy on SRBENA during each day of the week partitioned by consumptive (fishing) and naturalistic (eagle viewing) use. Excludes research rafts.

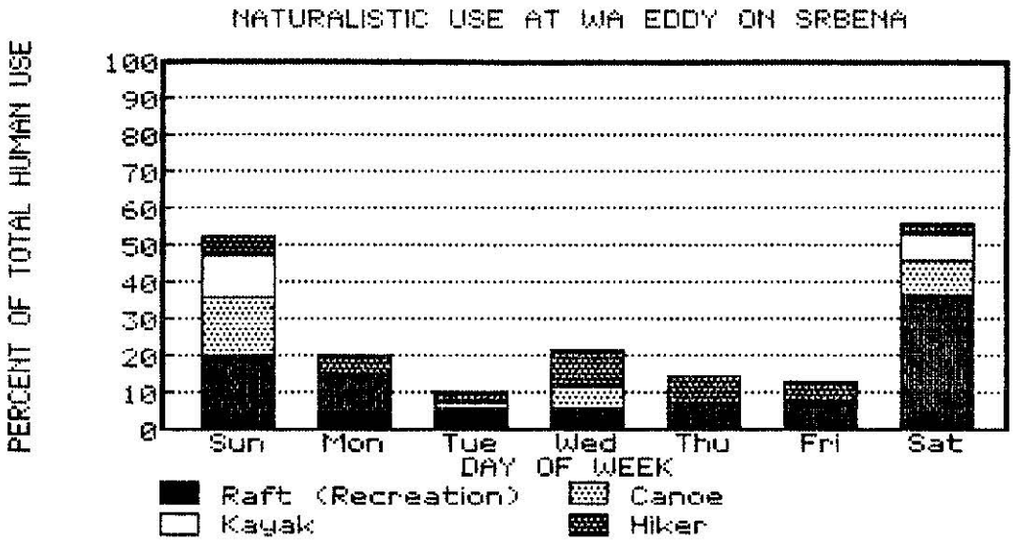

Figure 50. Recreational use patterns by visitors viewing eagles (naturalistic users) at Washington Eddy on SRBENA partitioned by day of week (see Table 51). Values are percent of total human activity, excluding research rafts. Compare to figure 51.

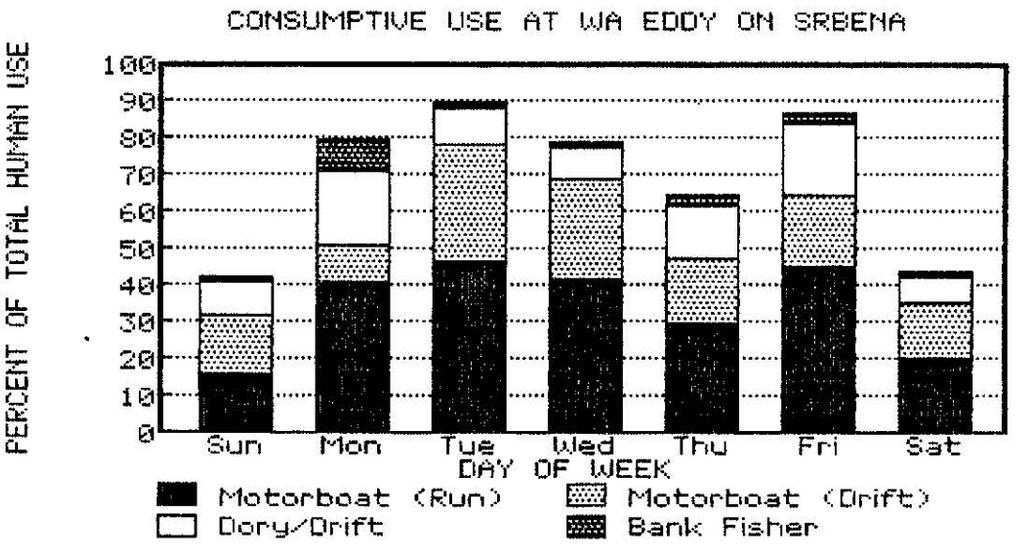

Figure 51. Recreational use patterns by visitors fishing (consumptive users) at Washington Eddy on SRBENA partitioned by day of week (see Table 51). Values are percent of total human activity. Compare to figure 50.

Table 52. Extent of recreational activities recorded during each hour of day at the Washington Eddy on the SRBENA for 80 days from 1 December to 22 February 1985-86.

Activity Type	Hour of Day 8 - 9 n	%	9 - 10 n	%	10 - 11 n	%	11 - 12 n	%
Motorboat								
First run	22	36.7	26	32.5	24	20.0	26	16.4
First drift	2	3.3	0	0.0	0	0.0	5	3.1
Subtotal	24	40.0	26	32.5	24	20.0	31	19.5
All runs	29	48.3	40	50.0	48	40.0	44	27.7
All drifts	11	18.3	21	26.3	34	28.3	29	18.2
Subtotal	40	66.7	61	76.3	82	68.3	73	45.9
Raft								
Recreation	+3	5.0	2	2.5	++4	3.3	46	28.9
Research	0	0.0	2	2.5	20	16.7	0	0.0
Subtotal	3	5.0	4	5.0	24	20.0	46	28.9
Dory/Drift	14	23.3	6	7.5	6	5.0	24	15.1
Canoe	0	0.0	1	1.2	0	0.0	5	3.1
Kayak	0	0.0	0	0.0	0	0.0	2	1.3
Bank Fisher	1	1.7	4	5.0	2	1.7	4	2.5
Hiker	2	3.3	4	5.0	6	5.0	5	3.1
Consumptive	58	96.7	71	88.8	91	75.8	101	63.5
Naturalistic	2	3.3	9	11.2	29	24.2	58	36.5
Totals	60	100.0	80	100.0	120	100.0	159	99.9

\+ All 3 rafts fishing.
++ 1 of 4 rafts fishing.

Table 52. Continued.

Activity Type	Hour of Day							
	12 - 13		13 - 14		14 - 15		15 - 16	
	n	%	n	%	n	%	n	%
Motorboat								
First run	26	12.6	32	12.3	8	3.4	6	5.0
First drift	5	2.4	3	1.2	9	3.8	1	0.8
Subtotal	31	15.0	35	13.5	17	7.2	7	5.8
All runs	48	23.3	60	23.1	27	11.4	13	10.8
All drifts	30	14.6	37	14.2	36	15.3	9	7.5
Subtotal	78	37.9	97	37.3	63	26.7	22	18.3
Raft								
Recreation	79	38.3	76	29.2	58	24.6	20	16.7
Research	0	0.0	1	0.4	19	8.1	2	1.7
Subtotal	79	38.3	77	29.6	77	32.6	22	18.3
Dory/Drift	14	6.8	21	8.1	18	7.6	20	16.7
Canoe	8	3.9	35	13.5	36	15.3	24	20.0
Kayak	11	5.3	16	6.2	27	11.4	23	19.2
Bank Fisher	4	1.9	4	1.5	3	1.3	2	1.7
Hiker	12	5.8	10	3.8	12	5.1	7	5.8
Consumptive	96	46.6	122	46.9	84	35.6	44	36.7
Naturalistic	110	53.4	138	53.1	152	64.4	76	63.3
Totals	206	99.9	260	100.0	236	100.0	120	99.9

Table 52. Continued.

Activity Type	Hour of Day: 16 - 17 n	16 - 17 %	Totals n	Totals %
Motorboat				
First run	1	3.0	171	13.4
First drift	2	6.1	27	2.1
Subtotal	3	9.1	198	15.5
All runs	9	27.3	318	25.0
All drifts	10	30.3	217	17.0
Subtotal	19	57.6	535	42.0
Raft				
Recreation	4	12.1	292	22.9
Research	0	0.0	44	3.5
Subtotal	4	12.1	336	26.4
Dory/Drift	1	3.0	124	9.7
Canoe	5	15.2	114	8.9
Kayak	1	3.0	80	6.3
Bank Fisher	1	3.0	25	2.0
Hiker	2	6.1	60	4.7
Consumptive	21	63.6	688	54.0
Naturalistic	12	36.4	586	46.0
Totals	33	100.0	1274	100.0

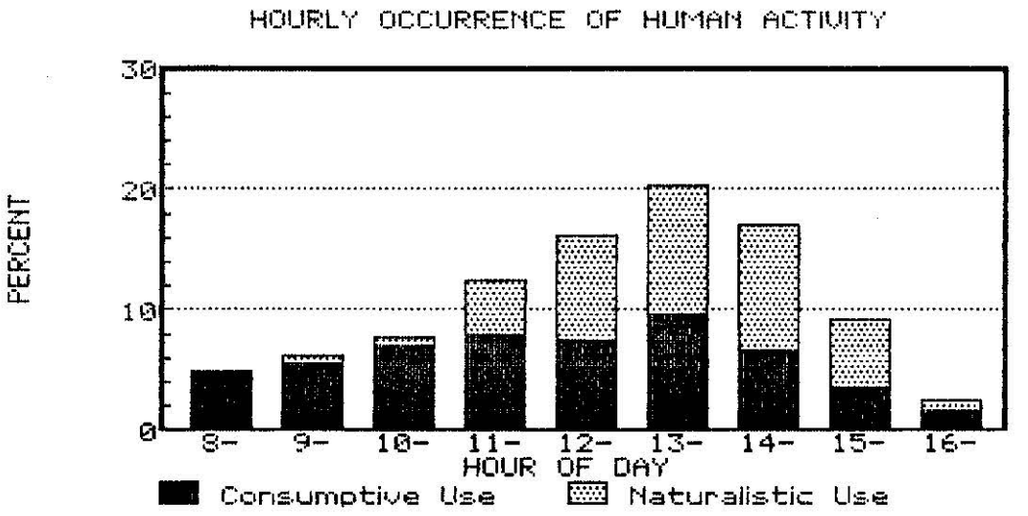

Figure 52. Percent occurrence of recreational activity at Washington Eddy on SRBENA during each hour of the day partitioned by consumptive (fishing) and naturalistic (eagle viewing) use. Excludes research rafts.

naturalistic activity did not start in appreciable numbers until after 1100 hours (Figure 53); consumptive activity was more prevalent in the morning (Figure 54). Rafts peaked in mid-day, but canoes and kayaks increased throughout the afternoon.

Seasonal changes in activity were evident (Figure 55). Activity increased slightly in the fourth week of December, but increased further in January and remained high until late-February. Most of this increase was attributable to weekend visitation (Figure 56). A high count of 115 activities was made on 11 January 1986.

Counts of vehicles of eagle-watchers showed a dramatic rise in visitation in mid-January, but by February, their numbers had dropped (Figure 57).

Recreational rafts had the largest number of persons in each individual activity simply because rafts accommodate more passengers (Table 53). Kayaks were the opposite of this pattern. Hiking groups were larger than bank-fishing groups.

In summary, there are two distinct groups of recreationists on SRBENA: fishermen (consumptive users) and eagle-watchers (naturalistic users). Fishermen occur consistently throughout the season, week, and day (depending on water conditions that affect fishing success). They do not follow the guidelines prohibiting boating before 1000 hours. Eagle-watchers occur mostly in late-January and early-February (when eagle numbers peak), during weekends, and in early-afternoon. Nearly all follow the activity-

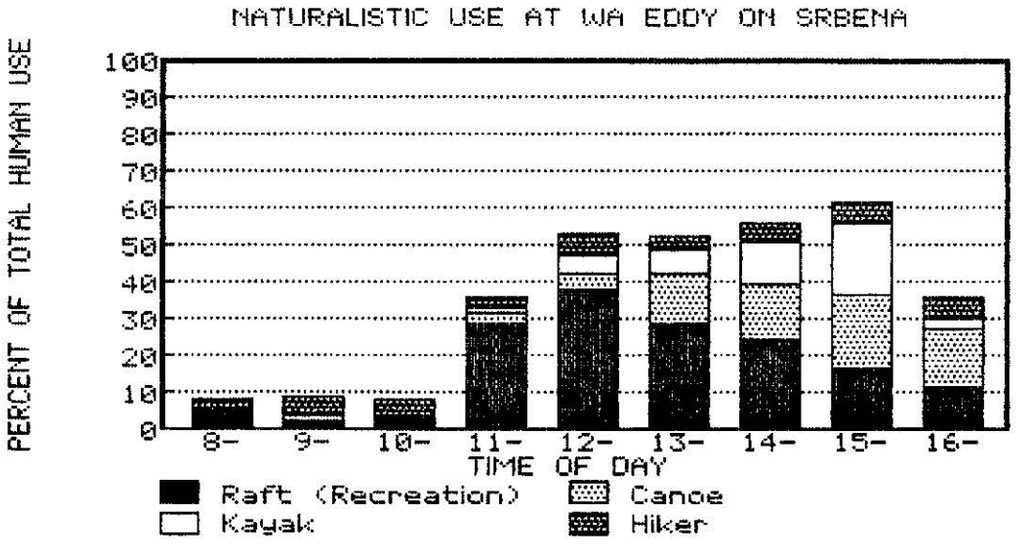

Figure 53. Recreational use patterns by visitors viewing eagles (naturalistic users) at Washington Eddy on SRBENA partitioned by hour of the day (see Table 52). Values are percent of total human activity, excluding research rafts. Compare to figure 54.

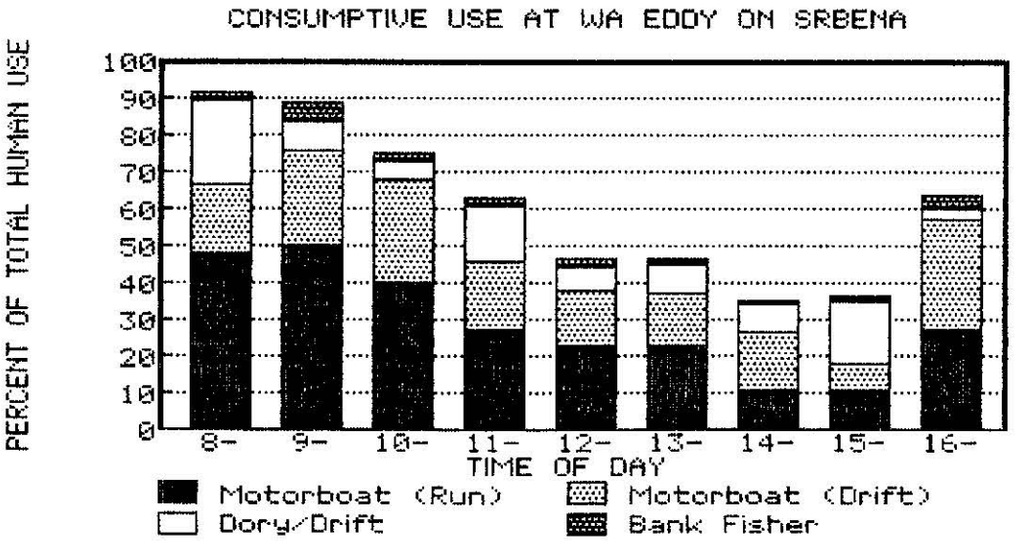

Figure 54. Recreational use patterns by visitors fishing (consumptive users) at Washington Eddy on SRBENA partitioned by hour of the day (see Table 52). Values are percent of total human activity. Compare to figure 53.

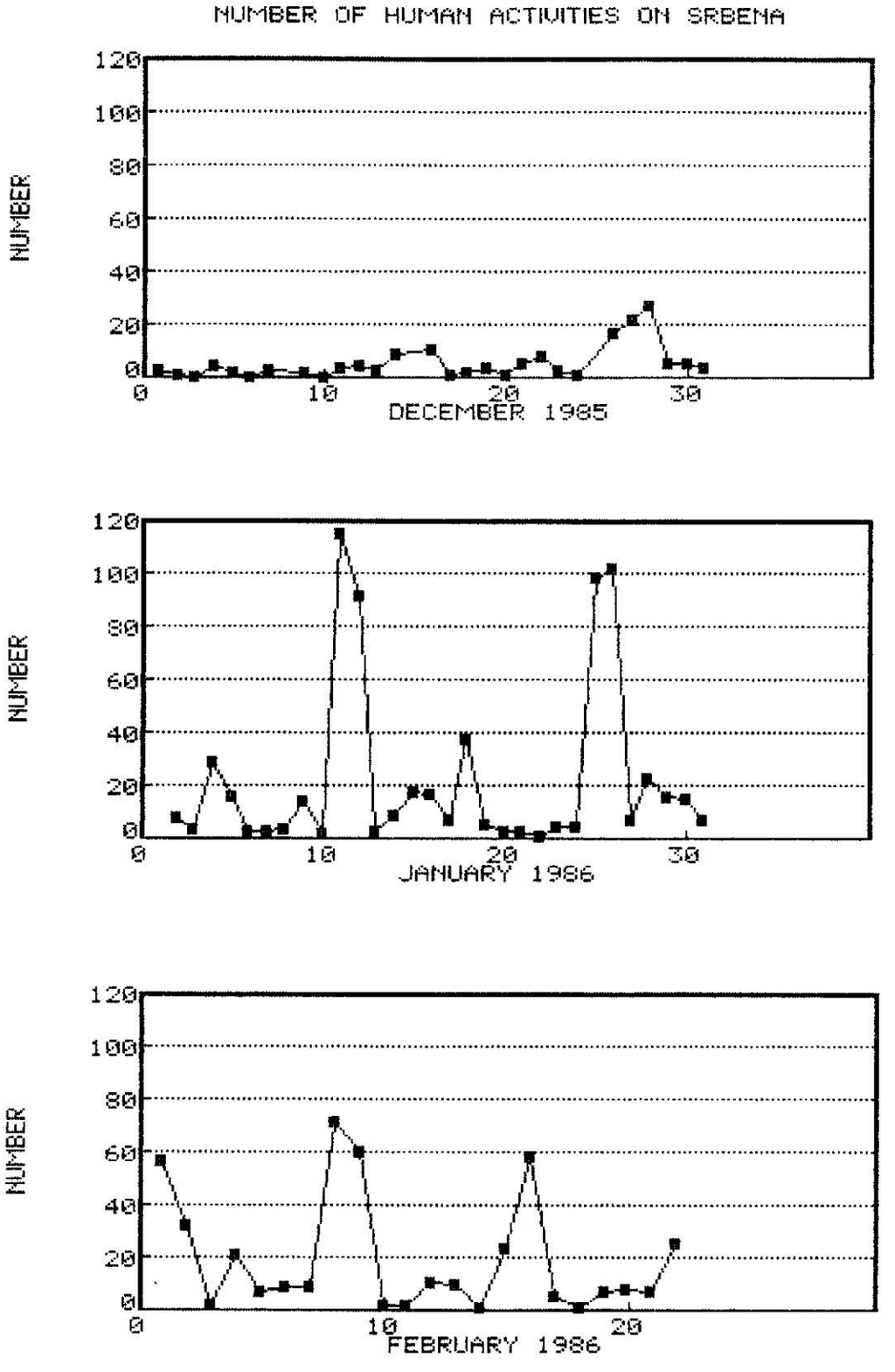

Figure 55. Number of recreational activities recorded at Washington Eddy on SRBENA during December (upper), January (middle), and February (lower) in 1985-86.

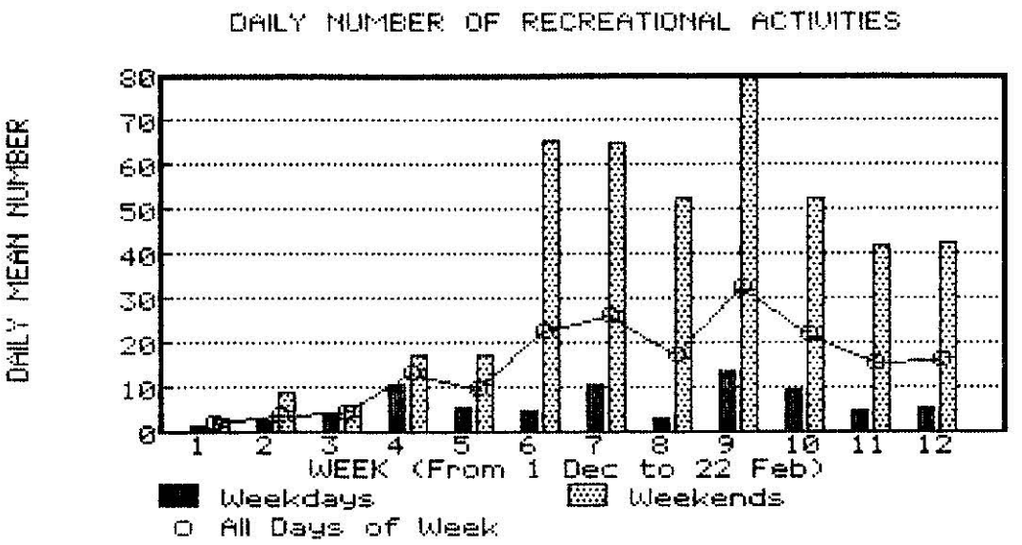

Figure 56. Mean number of daily recreational activities occurring at Washington Eddy on SRBENA partitioned for weekdays and weekends during the winter of 1985-86.

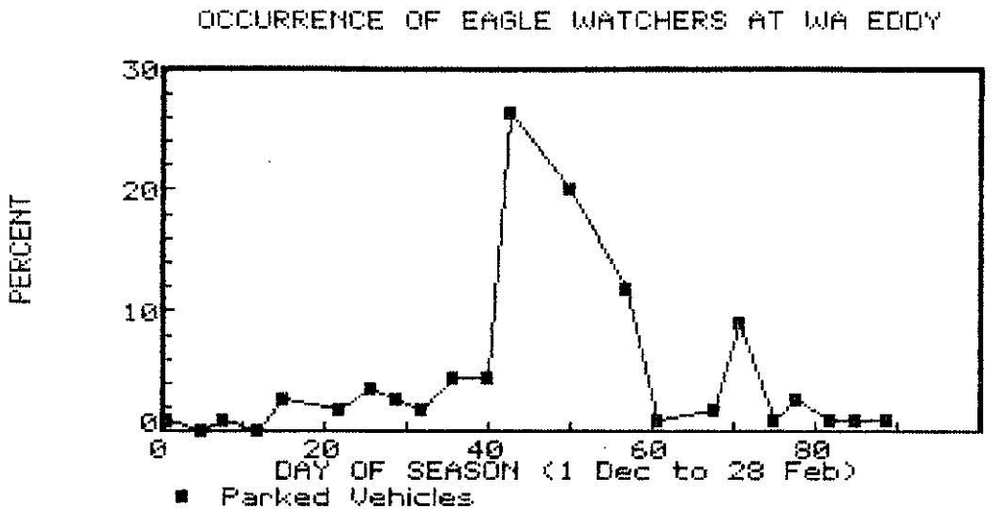

Figure 57. Occurrence of eagle watchers during the winter season at Washington Eddy as determined by counting parked vehicles there on Sundays and Thursdays.

Table 53. Number of persons in each human activity type at the Washington Eddy on the SRBENA in 1985-86.

Activity Type	Persons in Activity Type			
	n	Mean	SE	Range
Motorboat				
First run	167	2.6	0.07	1 - 6
First drift	27	2.4	0.16	1 - 4
Subtotal	194	2.5	0.07	1 - 6
Raft				
Recreation	290	6.3	0.16	1 - 13
Research	40	2.7	0.16	1 - 5
Subtotal	330	5.9	0.15	1 - 13
Dory/Drift	124	2.4	0.06	1 - 4
Canoe	113	2.2	0.05	1 - 4
Kayak	80	1.3	0.05	1 - 2
Bank Fisher	26	1.8	0.14	1 - 3
Hiker	59	3.1	0.44	1 - 23

restriction guideline; they launch after 1000 hours. As was discussed per tasks 1 and 4, these differences explain much about how these two groups affect eagles.

Observations during Float Trips.-- Activity types and purposes of activity were different among several river stretches (Table 54). On SRBENA, both fishermen and eagle-watchers occurred, but the latter were very rare in any other river sections (Figure 58). Eagle watchers have not discovered that other river stretches can be used for viewing eagles. The Sauk River, for example, can provide eagle viewing as well as solitude and more white-water. On the Sauk River, dories and bank fishermen were, by far, the most common activities (Figure 59). Presumably, the shallow waters precluded extensive use by motorboats. On the Upper, Middle, and Lower Skagit River, most activity is motorboating followed by bank fishing and a smaller number of dory fishermen (Figure 60). The wide and deep Skagit lends itself to powerboating.

Time-lapse Photography.-- There were 97 recreational activities recorded on the Lower Sauk River, 63 percent of which occurred in February and 19 percent each in December and January (Table 55). Dory activity was most common followed by rafts and bank fishers (Figure 61). Boating activity was concentrated in mid-day, but foot traffic occurred in the morning (Table 56).

Table 54. Human activities seen during float trips on the SW&SRS during 1985-86. *

Activity Type	SRBENA (weekend)		SRBENA (weekday)		Upper Sauk		Lower Sauk	
	n	%	n	%	n	%	n	%
MOTORBOAT								
December	0	0.0	8	10.5	2	8.0	0	0.0
January	22	11.2	16	21.1	0	0.0	1	2.9
February	16	8.1	3	3.9	0	0.0	0	0.0
Subtotals	38	19.3	27	35.5	2	8.0	1	2.9
DORY/DRIFT								
December	0	0.0	3	3.9	0	0.0	5	14.7
January	16	8.1	2	2.6	4	16.0	2	5.9
February	22	11.2	5	6.6	6	24.0	8	23.5
Subtotals	38	19.3	10	13.2	10	40.0	15	44.1
RAFT								
December	0	0.0	1	1.3	0	0.0	0	0.0
January	7	3.6	1	1.3	0	0.0	0	0.0
February	10	5.1	0	0.0	0	0.0	0	0.0
Subtotals	17	8.6	2	2.6	0	0.0	0	0.0
CANOE								
December	0	0.0	0	0.0	1	4.0	0	0.0
January	11	5.6	0	0.0	0	0.0	0	0.0
February	5	2.5	0	0.0	0	0.0	0	0.0
Subtotals	16	8.1	0	0.0	1	4.0	0	0.0
KAYAK								
December	0	0.0	0	0.0	0	0.0	0	0.0
January	5	2.5	0	0.0	0	0.0	0	0.0
February	1	0.5	0	0.0	0	0.0	0	0.0
Subtotals	6	3.0	0	0.0	0	0.0	0	0.0

Table 54. Continued.

Activity Type	SRBENA (weekend) n	SRBENA (weekend) %	SRBENA (weekday) n	SRBENA (weekday) %	Upper Sauk n	Upper Sauk %	Lower Sauk n	Lower Sauk %
BANK FISHER								
December	6	3.0	6	7.9	3	12.0	1	2.9
January	18	9.1	12	15.8	1	4.0	7	20.6
February	22	11.2	12	15.8	7	28.0	9	26.5
Subtotals	46	23.4	30	39.5	11	44.0	17	50.0
HIKER								
December	0	0.0	1	1.3	0	0.0	0	0.0
January	31	15.7	1	1.3	1	4.0	1	2.9
February	5	2.5	5	6.6	0	0.0	0	0.0
Subtotals	36	18.3	7	9.2	1	4.0	1	2.9
TOTALS								
December	6	3.0	19	25.0	6	24.0	6	17.6
January	110	55.8	32	42.1	6	24.0	11	32.4
February	81	41.1	25	32.9	13	52.0	17	50.0
Totals	197	99.9	76	100.0	25	100.0	34	100.0

* From 12/23 to 2/28.

Table 54. Continued.

Activity Type	Upper Skagit n	Upper Skagit %	Middle Skagit n	Middle Skagit %	Lower Skagit n	Lower Skagit %	Totals n	Totals %
MOTORBOAT								
December	8	14.3	0	0.0	12	7.4	30	5.1
January	17	30.4	7	16.7	17	10.5	80	13.5
February	13	23.2	10	23.8	51	31.5	93	15.7
Subtotals	38	67.9	17	40.5	80	49.4	203	34.3
DORY/DRIFT								
December	3	5.4	0	0.0	0	0.0	11	1.9
January	2	3.6	1	2.4	2	1.2	29	4.9
February	4	7.1	2	4.8	0	0.0	47	7.9
Subtotals	9	16.1	3	7.1	2	1.2	87	14.7
RAFT								
December	0	0.0	0	0.0	0	0.0	1	0.2
January	1	1.8	0	0.0	0	0.0	9	1.5
February	0	0.0	0	0.0	0	0.0	10	1.7
Subtotals	1	1.8	0	0.0	0	0.0	20	3.4
CANOE								
December	0	0.0	0	0.0	0	0.0	1	0.2
January	0	0.0	0	0.0	0	0.0	11	1.9
February	0	0.0	1	2.4	0	0.0	6	1.0
Subtotals	0	0.0	1	2.4	0	0.0	18	3.0
KAYAK								
December	0	0.0	0	0.0	0	0.0	0	0.0
January	0	0.0	0	0.0	0	0.0	5	0.8
February	0	0.0	0	0.0	0	0.0	1	0.2
Subtotals	0	0.0	0	0.0	0	0.0	6	1.0

Table 54. Continued.

Activity Type	Upper Skagit n	Upper Skagit %	Middle Skagit n	Middle Skagit %	Lower Skagit n	Lower Skagit %	Total n	Total %
BANK FISHER								
December	1	1.8	0	0.0	15	9.3	32	5.4
January	6	10.7	7	16.7	22	13.6	73	12.3
February	1	1.8	10	23.8	43	26.5	104	17.6
Subtotals	8	14.3	17	40.5	80	49.4	209	35.3
HIKER								
December	0	0.0	0	0.0	0	0.0	1	0.2
January	0	0.0	3	7.1	0	0.0	37	6.3
February	0	0.0	1	2.4	0	0.0	11	1.9
Subtotals	0	0.0	4	9.5	0	0.0	49	8.3
TOTALS								
December	12	21.4	0	0.0	27	16.7	76	12.8
January	26	46.4	18	42.9	41	25.3	244	41.2
February	18	32.1	24	57.1	94	58.0	272	45.9
Totals	56	99.9	42	100.0	162	100.0	592	99.9

* From 12/23 to 2/28.

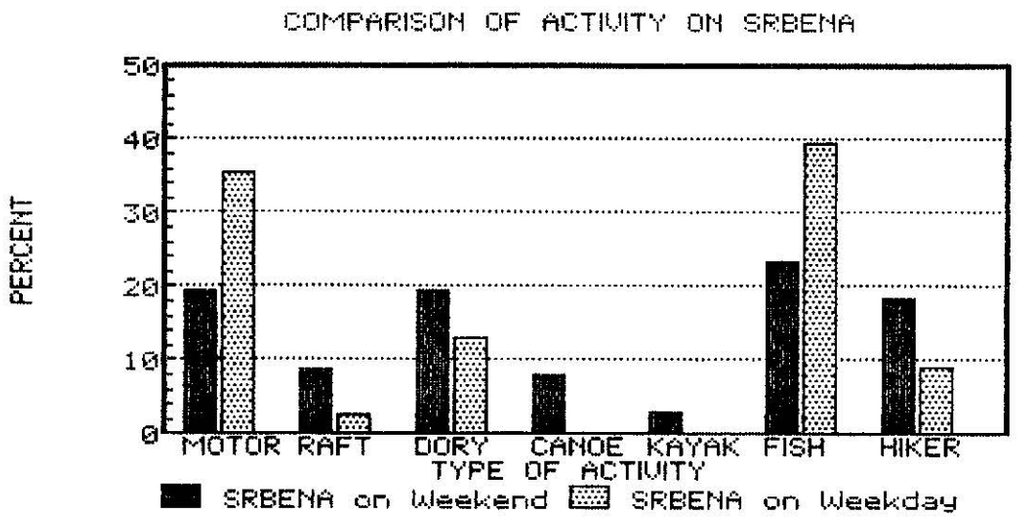

Figure 58. Type of human activity seen during floats trips on SRBENA both on the weekend (Sunday) and on weekdays (Thursday) during 1985-86 (see Table 54).

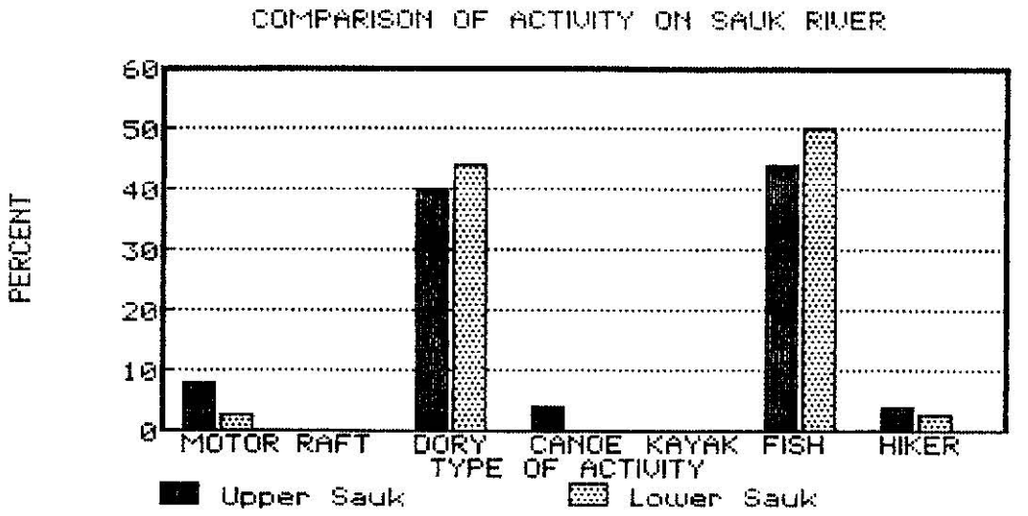

Figure 59. Type of human activity seen during floats trips on the Upper and Lower Sauk River during 1985-86 (see Table 54).

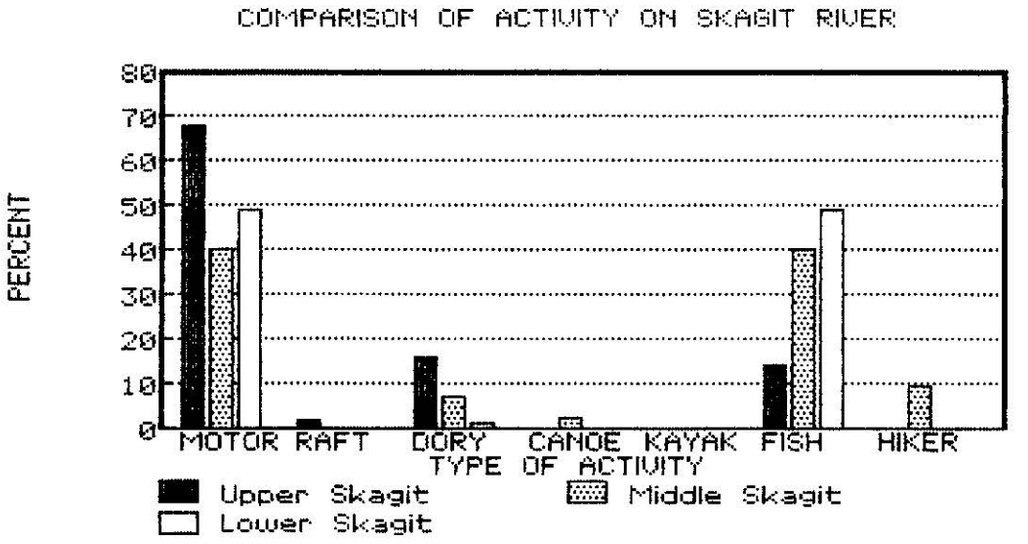

Figure 60. Type of human activity seen during floats trips on the Upper, Middle, and Lower Skagit River during 1985-86 (see Table 54).

Table 55. Extent of recreational activities recorded by time-lapse photography on the Lower Sauk River from 10 December 1985 to 28 February 1986.

Activity Type	Month						Total	
	Dec		Jan		Feb			
	n	%	n	%	n	%	n	%
Motorboat	1	5.6	0	0.0	6	9.8	7	7.2
Raft								
Recreation	1	5.6	5	27.8	11	18.0	17	17.5
Research	3	16.7	1	5.6	3	4.9	7	7.2
Subtotal	4	22.2	6	33.3	14	23.0	24	24.7
Dory/Drift	10	55.6	10	55.6	34	55.7	54	55.7
Canoe	1	5.6	0	0.0	1	1.6	2	2.1
Kayak	0	0.0	0	0.0	0	0.0	0	0.0
Bank Fisher	2	11.1	1	5.6	6	9.8	9	9.3
Hiker	0	0.0	1	5.6	0	0.0	1	1.0
Totals	18	100.1	18	100.1	61	99.9	97	100.0

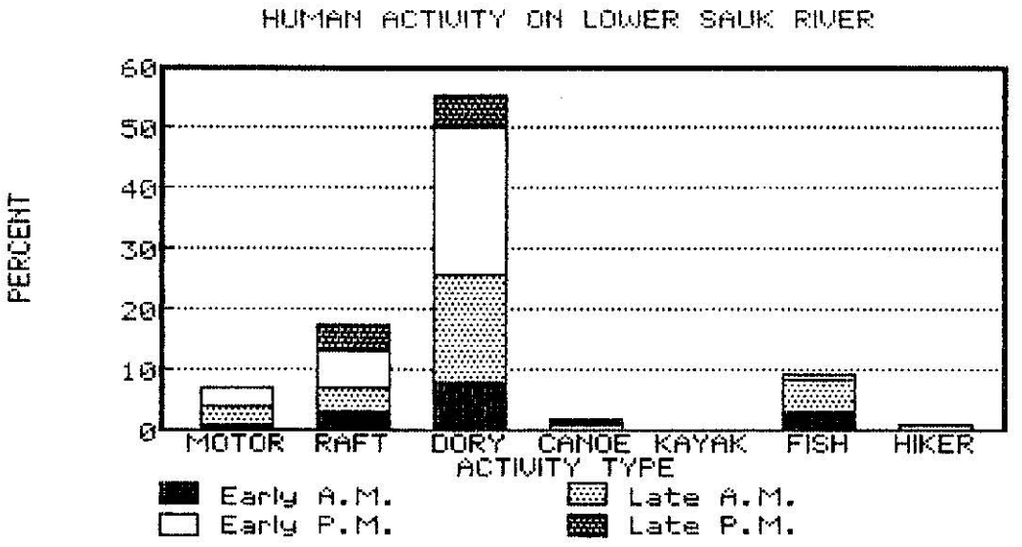

Figure 61. Type and timing of 97 recreational activities on the Lower Sauk River as determined by time-lapse photography from 10 December 1985 to 28 February 1986 (see Tables 55 and 56). Excludes research rafts.

Table 56. Extent of recreational activities recorded by time-lapse photography on the Lower Sauk River during four time periods of the day in 1985-86.

Activity Type	Time of Day: Early AM n	Early AM %	Late AM n	Late AM %	Early PM n	Early PM %	Late PM n	Late PM %
Motorboat	1	5.6	3	8.8	3	8.6	0	0.0
Raft								
Recreation	3	16.7	4	11.8	6	17.1	4	40.0
Research	3	16.7	4	11.8	0	0.0	0	0.0
Subtotal	6	33.3	8	23.5	6	17.1	4	40.0
Dory/Drift	8	44.4	17	50.0	24	68.6	5	50.0
Canoe	0	0.0	1	2.9	0	0.0	1	10.0
Kayak	0	0.0	0	0.0	0	0.0	0	0.0
Bank Fisher	3	16.7	5	14.7	1	2.9	0	0.0
Hiker	0	0.0	0	0.0	1	2.9	0	0.0
Totals	18	100.0	34	100.0	35	100.1	10	100.0

Task 7 - User Attitude Evaluation

Methods

Visitors were contacted on the river and asked if they would be willing to participate in an anonymous recreational survey. If they answered "Yes", they were given a questionnaire and asked to complete it at their convenience and return it by mail using the self-addressed, stamped envelope provided. Nearly all individuals agreed to participate, but only 154 of the 300 questionnaires (51 percent) were returned. A separate register was kept of pertinent information of each visitor contact. Interviews began in late January and stopped in late February.

Analyses

Summary statistical procedures (n, mean, standard deviation, percentages) were used to evaluate all patterns of public opinions.

Results and Discussion

Profile of Visitors.-- The average age of interviewees was 42 years and ranged from 22 to 72 years. The average participant was well educated with a mean of 15.4 years of schooling. More than 29 percent spent 4 years in college; an additional 28 percent had more than 4 years of college. Most participants were very interested in the survey; 85 percent said they would be interested in learning about the findings

of the study.

A wide range of user groups was surveyed. The 153 participants were eagle-viewers in boats (26 %), fishermen in motorboats (19 %), eagle-viewers on road (17 %), eagle-viewers on shore (14 %), fishermen in drift boats (11 %), fishermen on shore (9 %), hikers (5 %), and river runners (1 %).

Most participants have been visiting the river for a number of years, especially the fishermen. Eagle-viewers have been visiting for an average of 5.9 years, whereas fishermen have been returning an average of 20.5 years. Of eagle-viewers on shore and in boats, 87 and 70 percent of them were first-time visitors, respectively. This compares to fishermen on shore and in boats who were first-time users only 8 and 25 percent of the time, respectively.

Participants learned about the Skagit River from several sources (Table 57). A great majority of fishermen (> 90 %) live in the area or visited the area on the advice of a friend or relative. In contrast, eagle-viewers used a number of sources of information: most in boats (53 %) were informed by a friend or relative or lived in the area (20 %), whereas those on shore relied both on word-of-mouth and media sources.

Generally, the recreational experience of survey participants was better than expected (Table 58). This was especially true of eagle-viewers while either in boats or on shore. Fishermen in boats had high ratings, but those on

Table 57. Percent of sources of information by which visitors learned about the area and the recreational opportunity that they participated in.

	Eagle Viewer (n = 87)		Steelhead Fishermen (n = 58)	
Information Source	Shore	Boat	Shore	Boat
By living in the area	15	20	69	67
Friend or relative	30	53	23	22
Newspaper	28	8	0	0
Television	11	0	0	0
Magazine	2	3	0	2
Radio	2	0	0	2
Other	13	17	8	7

Table 58. How recreationists rated their experience while visiting the river.

Type of Activity	Better than expected	About as expected	Poorer than expected
Viewing from shore (n = 47)	55	34	11
Viewing from boat (n = 40)	53	37	10
Fishing from shore (n = 13)	23	54	23
Fishing from boat (n = 45)	42	45	13
Viewing subtotal (n = 87)	54	36	10
Fishing subtotal (n = 58)	38	47	15
Grand total (n = 153)	47	41	12

shore were rated their experience close to their expectation. This occurred perhaps because fishermen have been visiting the river for longer periods than eagle-viewers.

Perception of Problems.-- On average, 21 percent of survey participants believed there were conflicts between different groups of river recreationists (Table 59). This was especially true with eagle-viewers. More viewers in boats thought a conflict existed than other groups; few fishermen in boats expressed this opinion. There was a tendency for long-term fishermen and early-term eagle-viewers in boats to think that more conflicts were occurring at greater rates.

On average, 26 percent believed that the river environment is being degraded by recreational use (Table 60). Many eagle-viewers had this impression, especially boaters, particularly first-time boaters. There was a tendency for repeat visitors to believe that degradation was not occurring. This might imply that first-time users perceive problems easier and/or repeat visitors accept conditions as they are.

A greater number, 33 percent, thought that recreational use was adversely affecting bald eagles (Table 61). This opinion was strongest with eagle-viewers, especially those in boats. Few fishermen in boats thought impacts were occurring, but twice as many shore fishermen perceived this as true. Although sample sizes are low, there again was a tendency for repeat visitors to believe that impacts were not

Table 59. Percent (and number) of respondents answering "Yes" to the following question: "For the area of river that you visited, do you feel there were conflicts between different groups of river recreationists?"

User Group	Length of Experience on River			
	1st Yr. Visitor	1-5 Yr. Visitor	> 5 Yr. Visitor	Totals
Viewing from boat	40 (11)	41 (17)	0 (10)	30 (38)
Viewing from shore	18 (11)	27 (22)	21 (14)	23 (47)
Fishing from boat	0 (2)	0 (5)	11 (37)	9 (44)
Fishing from shore	- (0)	0 (3)	30 (10)	23 (13)
Total	26 (24)	28 (47)	14 (71)	21 (142)

Table 60. Percent (and number) of respondents answering "Yes" to the following question: "Do you feel that the river environment is being degraded or damaged by recreational use?"

User Group	Length of Experience on River			
	1st Yr. Visitor	1-5 Yr. Visitor	> 5 Yr. Visitor	Totals
Viewing from boat	55 (11)	33 (17)	30 (10)	39 (38)
Viewing from shore	27 (11)	32 (22)	21 (14)	27 (47)
Fishing from boat	50 (2)	0 (5)	19 (37)	18 (44)
Fishing from shore	- (0)	33 (3)	10 (10)	15 (13)
Total	42 (24)	29 (47)	20 (71)	26(142)

Table 61. Percent (and number) of respondents answering "Yes" to the following question: "Do you feel that recreational use is having adverse effects on bald eagles on the river?"

User Group	Length of Experience on River			
	1st Yr. Visitor	1-5 Yr. Visitor	> 5 Yr. Visitor	Totals
Viewing from boat	63 (11)	56 (17)	50 (10)	56 (38)
Viewing from shore	40 (11)	48 (22)	25 (14)	40 (47)
Fishing from boat	0 (2)	0 (5)	14 (37)	11 (44)
Fishing from shore	- (0)	0 (3)	30 (10)	23 (13)
Total	45 (24)	42 (47)	23 (71)	33(142)

as prevalent.

A ranking of problems as perceived by eagle-viewers is provided in Table 62. Most boaters (> 50 %) thought that "motorboats scaring eagles" was the major problem followed by "crowding at boat launches," "litter," "unsightly roads," "inadequate information services," and "too many buildings." Those on shore (> 50 %) thought that the major problem was "inadequate information services," followed by "too few toilets," "litter," "too few parking areas," and "motorboats scaring eagles."

A ranking of problems as perceived by steelhead fishermen is provided in Table 63. "Crowding at boat launches" and "litter" were the main concerns of most (> 50 %) boaters. "Litter," "crowding at boat launches," and "motorboats creating waves" were the concerns of most (> 50 %) shore fishermen.

Perception of problems was about one-third higher for eagle-viewers than fishermen (Tables 62 and 63). More eagle-viewers in boats perceived problems than those on shore, but the opposite was true with fishermen; less in boats thought a problem existed than shore fishermen.

It appears that more problems were perceived by eagle-viewers with intermediate experience as compared to first-time and long-term visitors (Table 64). This pattern, however, is not supported by previously described data. For fishermen, long-term visitors perceived more problems than short-term visitors (Table 65).

Table 62. Percent of visitors viewing eagles from shore and boat agreeing that a particular problem exists, ranked in order of the degree of problem for the total column.

Type of Problem	Shore (n=44)	Boat (n=39)	Total (n=83)
Motorboats scaring eagles	52	76	64
Inadequate information services	67	57	62
Litter in river and on shore	55	61	58
Inadequate toilet facilities	61	49	55
Too few parking areas	55	39	48
Roads within sight of river	32	59	45
Crowding at boat launches	15	67	43
Too many buildings along river	33	54	43
Motorboats creating waves	38	46	42
Utility poles and lines	37	44	41
Logging activities	33	39	36
Drift boats scaring eagles	27	34	31
Crowding at eagle viewing areas	26	36	31
People on shore scaring eagles	24	34	29
Roadside viewers scaring eagles	15	34	24
Anglers on shore scaring eagles	22	24	23
To few rules and regulations	15	31	23
Too many boats affecting fishing	12	31	21
Livestock along river	12	28	20
Too many rules and regulations	10	19	15
Too many anglers reducing success	6	18	12
Frightening rapids	0	5	3
Mean	30	40	35

Table 63. Percent of visitors steelhead fishing from shore and boat agreeing that a particular problem exists, ranked in order of the degree of problem for the total column.

Type of Problem	Shore (n=13)	Boat (n=44)	Total (n=57)
Crowding at boat launches	54	64	61
Litter in river and on shore	77	48	55
Inadequate toilet facilities	46	33	36
Too many boats affecting fishing	38	33	35
Motorboats creating waves	54	29	35
Too many rules and regulations	42	27	31
Too many anglers reducing success	23	30	29
Motorboats scaring eagles	38	23	27
Inadequate information services	31	26	27
Too few parking areas	23	26	25
Logging activities	23	26	25
Too many buildings along river	8	26	21
Crowding at eagle viewing areas	23	12	15
Too few rules and regulations	33	10	15
People on shore scaring eagles	23	12	15
Roads within sight of river	15	14	14
Livestock along river	8	14	13
Drift boats scaring eagles	23	9	13
Roadside viewers scaring eagles	15	7	10
Utility poles and lines	8	9	9
Anglers on shore scaring eagles	0	5	4
Frightening rapids	0	0	0
Mean	28	22	23

Table 64. Percent of visitors viewing eagles agreeing that a particular problem exists, subdivided by the length of time that they have been visiting the river.

Type of Problem	Length of Experience on River		
	1st Yr. Visitor	1-5 Yr. Visitor	> 5 Yr. Visitor
Motorboats scaring eagles	59	65	64
Inadequate information services	60	69	50
Too few parking areas	43	57	41
Crowding at boat launches	35	45	40
Drift boats scaring eagles	24	38	32
Crowding at eagle viewing areas	29	30	27
Anglers on shore scaring eagles	24	24	24
Roadside viewers scaring eagles	20	26	27
Too few rules and regulations	16	28	23
Too many boats affecting fishing	25	17	26
Too many rules and regulations	14	23	4
Too many anglers reducing fishing	10	7	21
Mean	30	36	32

Table 65. Percent of visitors steelhead fishing agreeing that a particular problem exists, subdivided by the length of time that they have been visiting the river.

Type of Problem	Length of Experience on River	
	0-5 Yr. Visitor	> 5 Yr. Visitor
Crowding at boat launches	60	61
Too many boats affecting fishing	30	34
Too many rules and regulations	10	34
Too many anglers reducing fishing	30	27
Motorboats scaring eagles	30	27
Inadequate information services	30	27
Too few parking areas	10	29
Too few rules and regulations	0	19
Crowding at eagle viewing areas	10	14
Drift boats scaring eagles	10	13
Roadside viewers scaring eagles	0	11
Anglers on shore scaring eagles	0	5
Mean	18	25

Disturbance to Eagles.-- Eagle-viewers saw more eagles than they expected, but fishermen saw less than they expected (Table 66). Not a single eagle-viewer on shore saw less eagles than expected, but the great majority of boat fishermen saw less than expected. These patterns may be explained by the experience on the river of these groups together with the low population level (see Task 4) during the interviews. Eagle watchers were impressed by the eagle numbers seen because it is a new experience for them; fishermen probably recall earlier, higher eagle numbers.

Boaters saw more eagles than visitors on shore presumably because they travel greater distances in eagle habitat (Table 67). Viewers saw more eagles in trees, but fishermen saw more on the ground. This seems likely because viewers are more aware of eagles and fishermen tend to flush more eagles from the ground. Very few eagles were seen on the ground by either group. Data per Task 4 indicates that flight distances are higher for ground birds which could explain why these birds are less frequently seen.

Viewers in boats thought eagles flew away at their approach less frequently than for other activities, which according to research data is generally true (Table 68). Viewing from shore was thought to be least disruptive. No one thought eagles always flew from them.

Recreationists believed that 10 and 14 percent of eagles perched in trees and on the ground flew away from them, respectively (Table 69). About thrice as many were thought

Table 66. Number of bald eagles seen by recreationists while visiting the river.

Type of Activity	Fewer than expected	About as expected	More than expected
Viewing from shore (n = 47)	0	30	70
Viewing from boat (n = 39)	15	15	70
Fishing from shore (n = 13)	54	23	23
Fishing from boat (n = 43)	84	7	9
Viewing subtotal (n = 86)	7	23	70
Fishing subtotal (n = 56)	77	11	12
Grand total (n = 148)	42	17	41

Table 67. Number of eagles seen by recreationists during their visit to the river.

User Group	Eagles in Perches			Eagles on Ground		
	n	Mean	SD	n	Mean	SD
Viewing from shore	47	10.2	8.8	40	2.6	3.7
Viewing from boat	40	18.6	13.3	36	0.9	1.7
Fishing from shore	12	6.7	7.0	13	1.5	1.9
Fishing from boat	45	13.3	10.1	41	4.8	5.9
Viewing subtotal	87	14.0	11.8	76	1.8	3.0
Fishing subtotal	57	11.9	9.8	54	4.0	5.4
On shore subtotal	59	9.5	8.5	53	2.3	3.4
In boat subtotal	85	15.8	11.9	77	2.9	4.9
Grand total	151	13.4	11.1	138	2.9	4.7

Table 68. Extent to which recreationists believed their own presence caused eagles to fly away.

Type of Activity	Eagles Flew Away			
	None	Sometimes	Often	Always
Viewing from shore (n = 43)	68	30	2	0
Viewing from boat (n = 40)	37	48	15	0
Fishing from shore (n = 10)	50	40	10	0
Fishing from boat (n = 44)	59	39	2	0
Viewing subtotal (n = 83)	53	39	8	0
Fishing subtotal (n = 54)	57	39	4	0
Grand total (n = 145)	54	40	6	0

Table 69. Percent of eagles seen by recreationists that flew away at their approach.

User Group	Eagles in Perches			Eagles on Ground		
	n	Percent	SD	n	Percent	SD
Viewing from shore	46	4.6	10.7	35	4.8	20.0
Viewing from boat	40	16.3	23.6	29	27.4	43.7
Fishing from shore	12	6.2	10.3	9	13.3	33.2
Fishing from boat	45	9.5	16.2	37	10.3	19.7
Viewing subtotal	86	10.0	18.7	64	15.0	34.6
Fishing subtotal	57	8.8	15.1	46	10.9	22.5
On shore subtotal	58	4.9	10.6	44	6.5	23.1
In boat subtotal	85	12.7	20.2	66	17.8	33.3
Grand total	149	9.7	17.4	117	14.2	31.4

to flush from boats compared to visitors on shore. Viewing from boats is perceived to be the most disruptive activity.

Many more eagles flushed from human activity than the public perceived (Figures 62 and 63). With the exception of the effects of boat viewers on perched eagles, flushing response is several to many times the rate as recreationists perceived. This is especially true with eagles feeding or standing on the ground; disruption of feeding activity is thought to have more impact than the flushing of birds perched in trees. This comparison lends doubt to other public opinions on this subject.

Distances that recreationists believed eagles were flying away from them (the avoidance flight) are in Table 70. Eagles flying from perches were perceived to fly farther distances than those from the ground and eagles flushed from the ground flew farther away than for other activities. No comparison with actual data can be made because, at this writing, avoidance flight data are not yet analyzed.

When asked to rank twelve human activity types by the degree to which they caused eagles to fly away and/or to stop feeding, results were somewhat consistent among all user groups (Table 71). Helicopter flights and motorboating was perceived as most disturbing; viewing from shore or road and driving on road were thought to be least disturbing. Fishermen in boats seemed to believe their activity was of little consequence to eagles, but they also thought that motorboating was particularly disruptive to eagles. It

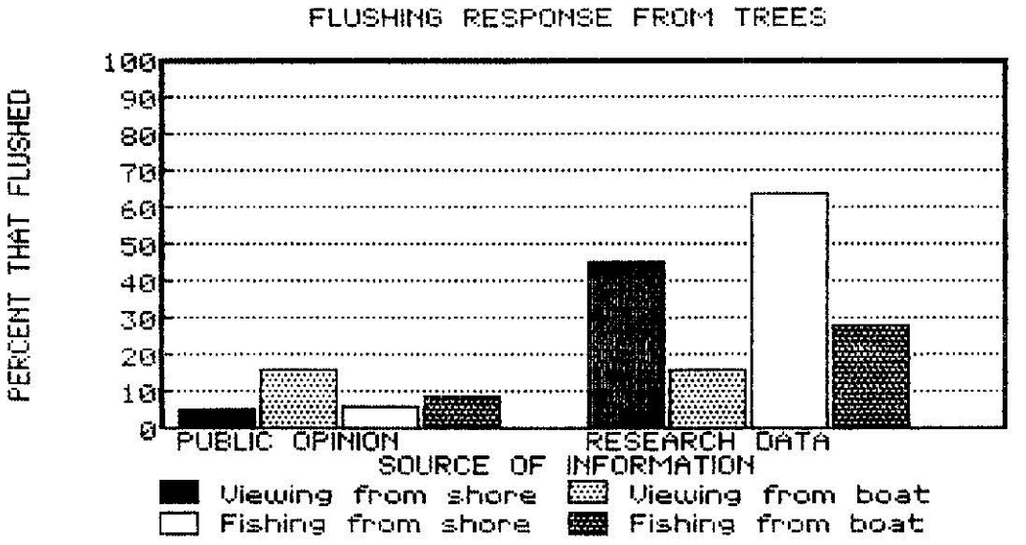

Figure 62. Comparison of the flushing responses (percent that flushed) of eagles perched in trees between what the public perceived and what actually occurred.

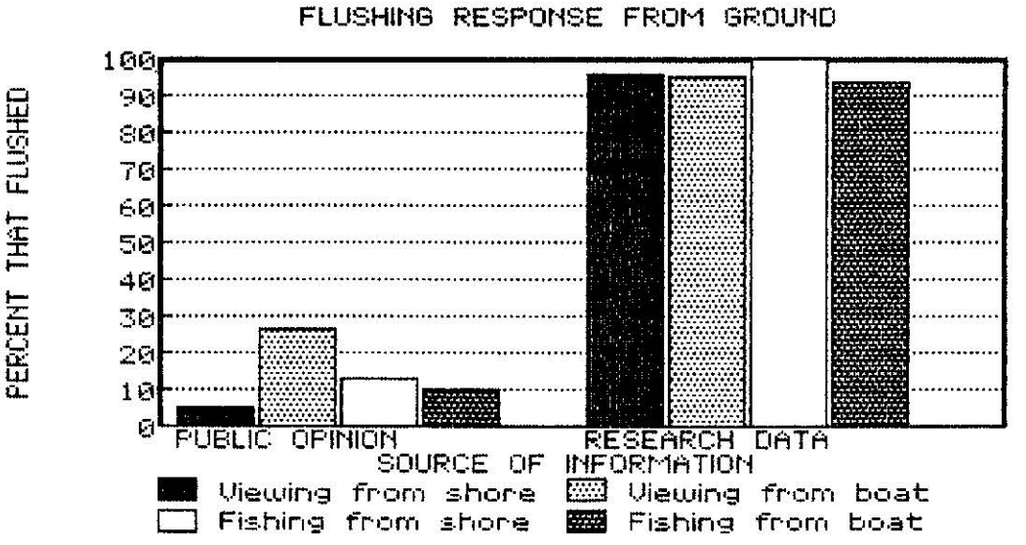

Figure 63. Comparison of the flushing responses (percent that flushed) of eagles feeding or standing on the ground between what the public perceived and what actually occurred.

Table 70. Distances (meters) that recreationists perceived eagles to fly away after flushed by their approach (the avoidance flight).

User Group	Eagles in Perches			Eagles on Ground		
	n	Mean	SD	n	Mean	SD
Viewing from shore	15	80.7	117.3	8	30.5	65.2
Viewing from boat	24	79.3	129.9	13	47.1	48.6
Fishing from shore	6	87.4	110.5	5	68.3	64.6
Fishing from boat	20	72.0	91.4	17	34.3	43.5
Viewing subtotal	39	79.8	123.6	21	40.8	54.5
Fishing subtotal	26	75.6	94.0	22	42.0	49.5
On shore subtotal	21	82.6	112.6	13	45.0	65.1
In boat subtotal	44	76.0	112.8	30	39.9	45.4
Grand total	65	78.1	111.9	43	41.4	51.4

Table 71. Ranking of the degree to which recreational activity is perceived to cause eagles to fly away and/or to stop feeding by both eagle viewers and steelhead fishermen, in order of degree of disturbance.

Type of Activity	Eagle Viewer (n = 76)		Steelhead Fishermen (n = 53)	
	Shore	Boat	Shore	Boat
Helicopter flights	1	1	1	1
Motorboating	2	2	2	2
Eagle viewing from boats	4	7	4	5
Rafting	6	4	3	7
Angling from boats	5	5	5	8
Hiking along river	9	3	9	3
Drift boating	3	6	6	10
Canoeing or kayaking	7	9	7	9
Angling from shore	8	8	11	6
Eagle viewing from shore	10	11	12	4
Driving along river	11	10	10	11
Eagle viewing from road	12	12	8	12

should be noted that many respondents voiced complaints about the noise created by motorboats and its potential for disturbing eagles. Motorboats are indeed relatively more disturbing than other activities, however, their noise does not seem to be the cause of this pattern (see Task 4). Many of these opinions, excluding boat fishermen's opinions of themselves, are in general agreement with preliminary research data.

Ranking data are further refined in table 72 for eagle viewers and table 73 for fishermen. Again, helicopter and motorboat activity is believed to be exceptionally disruptive to eagles.

Management Actions.-- When asked to express their opinions regarding possible management actions to protect eagles, eagle-viewers (Table 74) supported activity restriction much more than fishermen (Table 75). Most viewers (> 50 %) strongly supported the development of eagle interpretative displays, but also supported the restriction of boat fishing and rafting, limitation of boating to certain areas and times, and the posting of regulations. Opposition by fishermen to any restriction on their activity was high. They support more boat launching facilities but, surprisingly, also support the development of eagle interpretive displays.

Specific Opinions on Potential Problems.-- Interview participants were asked to write specific comments in regards to three questions concerning possible conflicts and problems

Table 72. Extent to which eagle viewers believed specific recreational activities caused eagles to fly away and/or to stop feeding, ranked according to degree of disturbance (n = 76).

Human Activity	Eagles Fly Away/Stop Feeding			
	None	Sometimes	Often	Always
Helicopter flights	25	15	19	41
Motorboating	16	33	33	18
Drift boating	35	38	21	6
Eagle-viewing from boats	39	30	25	6
Angling from boats	40	32	24	4
Rafting	41	32	22	5
Hiking along river	43	35	20	2
Angling from shore	44	39	14	3
Canoeing or kayaking	47	35	15	3
Eagle-viewing from shore	53	39	8	0
Driving along river	59	29	9	3
Eagle-viewing from road	64	32	4	0
Mean	42	32	18	8

Table 73. Extent to which steelhead fishermen believed specific recreational activities caused eagles to fly away and/or to stop feeding, ranked according to degree of disturbance (n = 53).

Human Activity	Eagles Fly Away/Stop Feeding			
	None	Sometimes	Often	Always
Helicopter flights	36	24	20	20
Motorboating	30	45	17	8
Hiking along river	42	46	10	2
Eagle-viewing from boats	44	40	12	4
Angling from boats	46	40	12	2
Rafting	48	38	10	4
Eagle-viewing from shore	48	42	8	2
Angling from shore	49	41	10	0
Drift boating	51	39	8	2
Canoeing or kayaking	55	31	14	0
Eagle-viewing from road	56	40	4	0
Driving along river	58	36	6	0
Mean	47	39	11	3

Table 74. Opinions of visitors viewing eagles concerning possible management actions to reduce conflicts between eagles and recreationists, ranked according to the most support.

Management Action	Percent (n = 87)		
	Oppose	Neutral	Support
Develop eagle interpretive displays	12	10	78
Limit boating to certain hours	7	23	70
Post more regulation signs	14	22	64
Limit boats to certain river stretches	12	25	63
Reduce or restrict boat fishing	21	23	56
Reduce or restrict rafting	26	22	52
Use river-rangers to enforce rules	20	31	49
Prohibit camping	23	29	48
Develop hiking trails along river	47	10	43
Provide more parking facilities	35	24	41
Reduce or restrict shore fishing	34	28	38
Reduce or restrict canoeing/kayaking	34	29	37
Reduce boat launch facilities	33	40	27
Reduce or restrict shore eagle viewing	55	20	25
Enlarge boat launch facilities	57	30	13
Increase camping facilities	62	28	10
Mean	31	24	45

Table 75. Opinions of visitors steelhead fishing concerning possible management actions to reduce conflicts between eagles and recreationists, ranked according to the most support.

Management Action	Percent (n = 56)		
	Oppose	Neutral	Support
Develop eagle interpretive displays	22	35	43
Enlarge boat launch facilities	28	30	42
Increase camping facilities	38	33	29
Provide more parking facilities	32	40	28
Post more regulation signs	51	25	24
Limit boats to certain river stretches	64	12	24
Reduce or restrict rafting	45	32	23
Reduce or restrict shore eagle-viewing	56	28	16
Use river rangers to enforce rules	68	16	16
Develop hiking trails along river	48	37	15
Limit boating to certain hours	77	11	12
Reduce or restrict boat fishing	80	9	11
Reduce or restrict canoeing/kayaking	57	34	9
Prohibit camping	69	25	6
Reduce boat launch facilities	84	14	2
Reduce or restrict shore fishing	89	11	0
Mean	57	24	19

on the river. These comments follow. Comments are subdivided by the four main groups of river users and others, and numbers preceding each comment is the reference number of the questionnaire. (Reader: Please note that no editorial corrections have been made on any of the following comments.)

(Question #1) If interviewees stated that they thought conflicts were occurring between different groups of river recreationists, they were asked "what conflicts existed between which groups?"

Comments of Eagle Viewers on Shore:

10 Motors boats and eagle watchers; Motors scare birds

45 Boat anglers and Eagle-watchers. Saw or heard two occasions of guns being fired from boats which scared eagles away. Don't know what they were shooting at. Also boats with motors were very noisy.

69 Motorboats too loud

72 Eagle watchers--motorboats; Loud motorboats scaring off eagles

77 motor boats and eagle watchers and eagles; noise frightens eagles away

79 shore eagle watchers and boaters; it is distracting to both watchers and eagles to have a power boat moving on the river at this time of year

107 Eagle watchers -- motorboats; Noise disturbance of power

boat motors

134 the noise of boats disturbed me I think the eagles

265 Shore Eagle-Watchers and Boaters in general; Too much water activity! It just has to disturb the eagles.

279 Eagle watchers and motorboats; We were advised not to walk even out on the river bars for fear of disturbing the eagles but I feel that motorboats zooming up and down river were more likely to disturb the eagles than people quietly sneaking up just to get a view. Eagle watchers and fisherman. I feel that fishing should be prohibited at least during the morning and evening hours when the eagles feed. Any people on the shore or in the water will disturb the birds wanting to land and feed.

Comments of Eagle Viewers in Boats:

56 Motor Boaters and all other groups; Motor Boaters, scared Eagles away Detracted significantly from peace and quite

73 Eagle watchers and Motor Boats; Motor Boats flushing eagles

74 eagle watchers and motorboat-fisherman; motorboat noise

85 motorized and non-motorized boats; noise, waves

112 Motor and Paddle boats; Motors are inappropriate and dangerous in the eagle stretch of the river

114 Canoeists and powerboats; Powerboat offends canoeists. We wonder about disturbing eagles.

115 Motorized boats and non-motorized; Motorized boats are

very noisy and detract from scenery

133 Motorboats and canoes; canoist were quiet watching eagles; and loud motorboats disrupted that

174 Motorboats and everyone else; noise; conflict betwn. fishers w/motor/jet boats and those using drift/paddle boats.

251 Canoe vs motors vs rafters; Canoe and rafts wish to experience a quiet river - drifting and viewing - motorboats too noisy, smelly

293 River rafters/fisher people; Put-in and parking space

294 boat anglers and boat eagle watchers; shore eagle watcher's boaters; Anglers and rafters get into each others way on the river; shore watchers and boaters watchers seem to walk in and try to get better view

Comments of Fishermen on Shore:

219 Shore Anglers and Motorboats; to noisey

241 shore anglers, boat Eagle watchers; share of the fishing holes and respect of the angler fishing

274 Jet power boats and bank fisherman; jet power boats crowding bank fishermen

Comments of Fishermen in Boats:

66 Fly Fisherman and Boon doggers; Fly Fishing on wrong sections of river

186 Between boat anglers and boat eagle watchers; crowding

at boat launches, both for parking of vehicles and launching boats. Fishermen do not like to see boats full of eagle-watchers go through the fishing holes ahead of them and spook the fish.

286 Eagle watchers in rafts float over fishing water instead of easily floating around it.

Comments of Other River Users:

8 landowners--eagle-watchers; shoreline usage

106 motor boats an bank fishermen

(Question #2) If interviewees believed the river environment was being degraded by recreational use, they were asked "what kinds of environmental damage were occurring?"

Comments of Eagle Viewers on Shore:

24 litter

33 dogs doing their bathroom duty along the roadside areas and quite some amount of litter in these areas also

45 noise pollution, litter, general degradation of the area due to ignorant or uncaring individuals

78 Noise from fishing boats disturbs eagle watchers

82 I feel I did not see enough of the river environment to come to a conclusion-perhaps viewing from a boat would have helped conclude.

97 road ruts and garbage

134 A gunshot was fired from the location of a resort

159 litter

184 If people are scaring the birds, it would be damaging.

256 There are too many boats on the river and trash along it. Motor use should be prohibited and rafting greatly restricted in the eagle area. (visual damage and trash)

265 Too much human activity will eventually destroy this area for the eagles.

279 Anywhere people go, the environment will be damaged to some extent. We picked up little litter along the road. That is always a problem - along the road and shore and in the river itself. Also pollution from motor boats - it may not be a problem now but it will in the future. Also, having no toilet facilities in such a high-use area will eventually become a problem.

Comments of Eagle Viewers in Boats:

17 disturbance to eagles

50 some evidence of pollution - saw bottle floating down river

63 the use of motorboats in the eagle nesting area

74 noise pollution

88 noise pollution by jet/motor craft consequently disturbing the wildlife.

92 Any amount of garbage in or along the river disturbs me -

and I always find some.

111 Motor boats make too damn much noise which ruins the tranquil pleasures of a quiet float along the river.

112 Noise pollution from the motor boats

133 noise damage from boats

171 Power boats "Noise"

174 Don't know

223 We saw a large amount of waste plastic, "littering"

249 human activity preventing eagles from feeding

251 Litter, oil and gas leaks

277 pollution - wastes, cars

293 Bald eagle populations on the river have dwindled dramatically since I began commercial trips there (1979)

294 Noise pollution from the outboard motors; impact on land from people landing on shore

Comments of Fishermen on Shore:

145 Pepole dumpin brush along shore so when river come's up they don't have to look at it

274 Power boats, noise, bank errossion over fishing for to few fish

Comments of Fishermen in Boats

29 only environmental damage is caused by indians commercial fishing river

62 litter, some pollution, modifications of the land for human access and recreation, noise, human intrusion

132 Too much human presence for birds and mammals.

186 Pollution of the water by garbage and by boat motor oil and tons of litter along the banks of the river and along the highway.

247 Garbage - Styrofoam Containers

272 Generally not - but there should be some limits on #'s - especially the upper river.

286 Too many people eagle watching from shore/raft

297 Garbage being dumped or thrown into the river -sewage waste in river, mainly below Nookachamps near Burlington

300 Noise pollution of loud outboard motors

Comments of Other River Users:

8 more littering and destruction

94 disturbing eagles and Indians taking salmon, the primary eagle food.

(Question #3) If interviewees believed that recreational use was adversely affecting bald eagles on the river, they were asked "what specific problems were happening?"

Comments of Eagle Viewers on Shore:

23 Motor boats disturbing eagles

44 Noise is disturbing

45 Boat anglers and Eagle watchers. Saw or heard two occasions of guns being fired from boats which scared eagles away.

68 Time limit for boating; no boating between 8:30-11:30 am feeding time for eagles

75 Heavy boat fishing

79 It would appear that the eagles are upset by the power boaters, but not to much

97 no eagles on Mondays after excessive flushing from boats and shore on weekends

134 the shooting caused the eagles to leave the area

159 Nothing specific. Mankind generally has an adverse affect wherever we go

161 some people don't know that their noise and by going out into the gravel bars for a closer look disturbed the eagles

183 very slight though

184 no, but I could see how it could happen w/noise and garbage, etc...

256 No, but the boats do go very close to the eagles and if one boat stops so do several others. This seems to make the eagles nervous.

265 Too many humans! Develop specific on shore view points for eagle-watching and leave the balance of all land and all the river for the eagles

268 seems to scarring them

279 I don't know any specific facts on the problems but I'm sure they exist.

Comments of Eagle Viewers in Boats:

? They move off the rivers edge - too many boats try to get close to them

2 Eagles are being distrubed by to much river activity

17 too much activity thus birds normal activities are interupted

56 Motor boats scared eagles away

63 The increasing traffic on the river must be making the eagles nervous

73 Eagles feeding is disturbed by boats

74 disturbance: feeding displacement, greater movements

88 Noise pollution inevitably disturbs the eagles. Note: I feel little disturbance is caused by drift/paddle craft.

114 Perhaps on weekends when human traffic may be high

135 Don't know if anything specific; however the numbers of eagles we've seen have dropped in the past several years

137 possibly too many motor boats - however I was on the river when the activity level was elevated

174 Too many float trips and motorboats and fishing in area that is restricted

190 dogs

248 motor noise

249 as above: human activity preventing eagles from feeding.

251 Noise - scaring off feeding eagles

277 How could it not? Though I don't know enough yet to be specific

293 Bald eagle population on the river have dwindled dramatically since I began commercial trips there (1979)

294 Disturbing the Eagles with their presence too many people.

Comments of Fishermen on Shore:

95 Boats run the eagles from the bars when they are feeding. All boats and rafts

241 Eagles are moving out of main areas of feeding to more seculded areas

274 power boats, noise, bank erosion over fishing for to few fish

Comments of Fishermen in Boats:

62 Eagles are probably less inclined to feed in the presence of humans and will stay in the trees or move to an area with less people.

186 no (They know of no specific problems)

272 Probably some but have not observed any specifics.

Comments of Other River Users:

3 not sure

8 Shore people disturbing nesting

94 only hearsay but feel that too many people are frequenting the Skagit river especially, consequently disturbing eagles. Have personally seen many motor and float boats at one time on Skagit as we drove past

106 get motors off river above Rockport

206 Motor boat or boat with motors shouldn't be use between Marble Mt. and Rockport and I fish the Sauk River mostly the lower Sauk River and there deffentely shouldn't be any (motor boat) boat with motors between the Gov. Bridge and the mouth of the Sauk joining the Skagit River, they do disturb the eagle, I have fish that river approx. 24 to 30 days each year for the past 38 yrs. Bank fishing.

Specific Comments on Management Actions.-- Interview participants were asked to write specific comments on "what management actions they believe would be most helpful to prevent eagles from being disturbed?" These comments follow.

Comments of Eagle Viewers on Shore:

? Area visited seemed quite adequate for viewing, did not encourage any other eagle watching.

4 Keeping off road vehicles out of the area. No outboards or boats in eagle areas.

10 Ask people to remain at roadside and not go down to river

edge or in woods.

11 Keep motor boats and cars at a distance.

12 No commercial float trips, no power boats, view only from roadside.

15 Limit areas of access to river, limit types of access (motor boats, cars). Increase educational displays and posting of regulations, develop areas where people can see eagles with least disturbance.

23 Restriction on boats with motors, did not see float party so cannot judge, but imagine noisy group would be just as disturbing as motors-but would not like to see them prohibited

24 Good pamphlets explaining habits of eagles such as: feeding time, feeding materials, perching, etc...and how visitors should conduct themselves.

25 Move information on eagles and what to do to prevent from being disturbed.

30 I saw no evidence of harassment by viewers. Most of us were senior citizens. The young men I saw were interested only in photography. I would hope that with education of public it will be possible for people to continue to view eagles

31 Not allowing people to approach to close to the eagles. We mainly saw them from across the river except one who flew across to the north side by the road to the top of a big tree and sat there while many people walked from their cars to see him and photograph him.

33 Keep people out of nesting areas and perching areas across the river from the highway 20.

44 No boats on river until eagles have fed in morning.

45 Reduce motor boat use on river. Restrict guns on river.

46 We heard shooting in the area which was probably disruptive to the eagles.

68 More education to the public, how to view them, what is best time to see them without bothering them.

72 Viewpoints with blinds away from cars and road. Signs that give info about eagles and how to not scare them (ex. Don't wear red and scream). Limit use of motorboats. Habitat preservation, nesting and perching sites.

75 Control heavy boating on rivers, both fishing and recreation.

77 Restrict noise from boats and limit rafting

78 1. Eliminate helicopters and small aircraft low altitude flights 2. Better signing at viewing areas. 3. Permit system for boats and rafts if traffic is heavy

79 The use of power boats of all types should be restricted upstream from the bridge at Rockport during the winter months

80 I do not know.

82 Provide lots of trees along river suitable for bald eagles to perch in and to feel protected; provide cover along river so eagles are able to feed without being disturbed by people in boats getting to close to them; post signs to designate areas for viewing, and of possible hazards to bald eagles if people disturb them

97 Boating of any kind should be prohibited on weekends until after eagles are through feeding in the morning i.e. until after 10am

107 See asterick under 19 (which refers to: Limit different boats to different river stretches)

134 Noise abatement- motor boats - firearms

159 restrict activities during times when eagles are present in great numbers (Jan-Feb?) eliminate motor boats completely increase educational signage

162 You tell us! Are there huge noisey crowds on some days? If so, shoot 'em!

183 limit river access

184 stop motor boats and/or rafters (cut down noise)

188 control number of rafters and floaters

195 More signs about the eagle and there habit.

196 I can't answer this question as this was our first time to view the eagles and only one other couple was there and one on river

221 Perhaps allow boating and rafting, but motors not to be used in certain areas i.e. Rockport to Marblemount. (may not be practical however!)

237 To prevent the eagles form being disturbed you should restrict any motor craft from the river i.e. motor boats, helicopters, in order to allow people to still see the eagles I would like to see a trail system establish with an interpretive center at the trail head, with information on how not to disturb the eagles and why

256 close the river to boating or greatly restrict boating from Rockport to Marblemount

265 reduce human infrigement into this unique eagle wintering area. keep the area for the eagles

279 no boats during eagle season prohibit fishing/ boating/floating of all kinds during the feeding hours provide more parking prohibit people walking out to the shore or bars at least during the feeding hours if not always post the rules and regulations inform the public and enforce these rules

Comments of Eagle Viewers in Boats:

? Reduce number of boaters. Mandatory 10-3, post Illabot slough to no boating.

17 Limit number of raft trips, restrict motors boats, educating as to danger to eagles, restriction on planed, studying and possibly limiting fishing-study.

50 don't know.

56 Limit number of people, limit number partys per day, limit boating or exclude. Make signs to ask people to be quite or stay at a distance from eagles.

61 none

63 Limit party size drifting down river, limit power boats in prime nesting areas, more info on eagles-what not to do around them.

73 Limit time of boat trips restrict motorized boats to

certain portions of the river

74 minimize nest location awareness minimize morning floating activities

83 restrict launch times to limit impact as I understand is currently being done- education of visitors

88 Eliminate the use of jet/motor boats along feeding area of river.

92 enforce rules prohibiting boating during feeding times. No shore traffic in areas preferred by eagles-i.e. in sanctuary area.

105 Suggest to boaters to avoid coming too close to eagles - eliminate power boats. I would support restricted fishing if it could be done democratically. I think jet boats are the single biggest hazard and would restrict there to below Rockport or even farther; all users should be encouraged to stay away from eagles

111 Outlaw noisey motorboats; prohibit hiking along shores

112 I don't know enough about what disturbs them to offer an intelligent opinion. I doubt if other occasional users of the eagle stretch can offer any opinions that are worth anything. Money needs to be spent on a naturalist study- not on a public opinion survey.

114 No human activity on the south bank of the river.

115 Need to enforce rule that people stay in boats and do not land on shore.

133 no power boats

137 1. regulating number of vehicles on river/shore 2.

regulating areas where motorized vehicles are allowed

156 Present educational actions leading to public cooperation are helpful

163 Forbid motorized transport on river

171 No motor boats, education on eagles at put in. A large sign explaining some of the problems

174 Restrict commercial activity during peak months when eagles are there; prohibit or reduce motorized activity on the river

190 Inform the public more about how nice the area is and what they really have

222 No motors-ground viewing in designated areas only-no stopping rafts or boats in sanctuary- have toilet facility on river at entrance to sanctuary-pass an ordinance to enforce rules

223 ?

225 Get rid of motorboats

248 no motors

249 shoreline activity restriction zones - not allowing any boats on river or people near river until after eagles feed in morning - position food in area where eagles cannot be disturbed. Insure adequate food for eagles.

251 restricting motorboats upriver of Rockport

268 limit time boats can get on river. morning hours left for eagles to feed. regulate number of boats bye permits. more signs.

277 the noise from the road especially trucks was very

noticeable

294 (user) boating permits for commercial boats; restriction of hikers alongside the river bed; restriction of motor boats along a designated area, able to use bars, but no motor

Comments of Fishermen on Shore:

20 None. If the Skagit were a nesting area some restrictions would be appropiate, in a feeding area it would take a major change such as logging or a hotel operation to cause a problem. If are eagle leaves a food source due to a disturbance another will find it as soon as the disturbance removes itself.

21 none

37 I can't see where all the concern is. I've lived and fished on the river all my life and I can't see where people bother the eagles. I have come under the trees and the eagles are in with my boat and they sit right where they are.

42 I think the eagles are not disturbed by fishing or boating or drifting, but by gun shots or low flying planes or helicopters.

95 stop all boats with motors from the Rockport Bridge up river

122 Moter boats mainly - they fly over and perch near the camp ground - cars here do not seem to bother them

219 Restrict power boating along upper river: Concrete to Marblemount, to many (motorboats) for this stretch of river

233 None. Eagles have flown right over head while I was fishing; they seem to do their own thing without our presence disturbing them.

234 No problem

241 Eagle viewing at 2 to 3 points on the river that would be at a distance to protect the birds natural feeding grounds

274 no power boats on the river

291 more fish for feed

Comments of Fishermen in Boats:

18 Things are fine the way they are now. Specific designated areas for canoe and rafts for launching and picking up their equipment - these are hand loaded and in conflict with bigger water vehicles which are loaded on to trailers - traffic jam!

22 No yelling or screaming river users, most boating activity seemed to be regarded as routine river for the eagles.

29 none

38 It seems to me there doing good.

48 Develop unbiased surveys and observers.

51 No power boats above the Baker river during the months of eagle activity. Prohibit all netting of all fish on the skagit river-giving the eagles more fish to feed on, a hungry eagle is an unhappy eagle.

62 Prevent boating on critical stretches of the river, at

critical times, but I do not advocate this approach. Limit the number of commercial eagle watching tours.

66 Plant more fish

67 none

84 Please see back of last page (will be included in file for #84)

93 none

132 establish times and areas when food is available so birds can feed unmolested

136 Power boats running up and down river

143 Leave then alone they are predators; they will take care of themselves. (protect from people shooting them

149 I don't believe they are being disturbed

155 Management action is sufficiant

167 I have visited the river many times and have seen no evidence of a decline in the eagle population. In fact in the last 10 years I would say the population has increased. The people pay to support recreation. I would ask you to have people buy a license so they could help support the eagles. This license fee would be charged only to eagle viewers.

176 Stop close up observation, injoy eagles as you float by or pass at a distance don't get as close as you can and stop witch makes them uncofertable

186 I believe the quantity of eagles on the river is more closely related to the quantity of available food than anything else. If you increase the available food supplies the number of eagles will increase also. I don't believe

that mans presence or absence has much of an immediate impact on the eagles

186 Establish seasons for eagle watching the same as fishing seasons have been regulated.

203 Allow salmon to spawn and die without netting of river. Eagles will stick around where food is. Logging helicopters are a bit much. Close up flash photography isn't comforting for baldies i'm sure.

204 The eagles have got use to the boats on the river, we don't bother them, we like to look at them if there feeding on gravel bars they might fly away but usually come back and continue eating. People walking up on them will scare the birds much more such as viewers photo sessions. The boat traffic just drifts by or anchors out away from weve been living with these birds long before it became popular to look at them

214 can't think of any

218 keep hunters out

227 I believe that the eagles are not bothered any at all by the fishermen. They are just like crows and other birds they aren't bothered a bit

242 none

254 less logging around the river

255 more fish

257 Interpretive displays that explain the need for people to keep their distance from the eagles particularly those that are on the ground feeding. People also need to be quiet

when near the birds, large rafts full of people are not very conducive to this.

270 the eagles are never disturbed by anyone, or any boats. there is no problem with these birds being bothered in any way.

272 some feeding time restrictions on river use-viewing, boating etc...possibly in morning couple days a week or whatever is necessary; possibly some patrol work to deter people intentionally harassing eagles

286 too many regulations on river transportation already - please don't added more - little will help eagles - if they survive they will do it on their own like they have for years and years

289 stop commercial fishing in Puget Sound/more salmon to return to spawning beds for eagle food/don't put in trails that would really be destructive to eagles

292 I don't believe they are being disturbed

295 don't think this is a problem-if food is available and the bird is hungry-they'll eat

300 are they really being disturbed? if they are being disturbed, the obvious answer would be to restrict the disturbing activities during these times that the eagles are using the river. I believe that if the regulating agency promotes and develops the river in any way, it will create and increase management problems, and where will the money come from to pay for salaries etc? Promotion = regulations = park-like atmosphere.

Comments of Other River Users:

? Less netting of Chum, Silver, Pink and Steelhead by whites and Indian fisherman alike. It is a depletion of their food source. More fish, more eagles.

8 Set-up eagle wilderness for distant viewing and no motorized vehicles.

53 For the biologists and hikers to leave the eagles alone.

94 restict strongly the number of boats and time in the strategic areas

100 I believe management actions to prevent eagle disturbances would be detrimental to peoples enjoyment of the river. I don't percieve any detrimental imparts to eagles from present uses of the river.

106 take motor boats off river

206 Restrict motor boats from Marble Mt. to Rockport leaving drift boat only because what 2 did observe was approx. 5 eagles that we drift right under or almost under the trees they were perch and they just look at us and didn't become uneasy with the drift boat.

General Opinions and Comments.-- Interview participants were asked to write any comments they had regarding their experience on their river-visit, if they desired. These comments follow.

Comments of Eagle Viewers on Shore:

4 we went on a overcast sunday not too many people. Way more Eagles than what I expected. It was great! My Family and I went up to watch the eagles on a Sunday afternoon. I had read and clipped out an article in the Skagit Valley herald about 3 years ago. I had been meaning to go up river (Concrete-Marblemount) since then. But every year I remembered it to late in the season. The Friday before we went to watch the eagles I had a customer come in and tell me they were going to watch the eagles. So I thought I'd look for my article and take my wife and kids upriver so we could take some pictures with our 35mm camera. But I couldnt find the article. So we just drove upriver looking for them. There is a great need for signs or maps telling where to look for the eagles as we stumbled on to the eagle watching area by accident. We had a great time watching and taking pictures of the magestic birds. We saw probably 25 to 30 Bald eagles at that sight and probably 25 others along the way.

15 fewer eagles

24 Very pleasant viewing Eagles from distance

30 I was pleased that we saw Eagles both soaring and on the sand bar - though we were some distance. I enjoyed the one perched close to where we were. I really enjoyed the time we spent. I am happy for the opportunity to see wild life in natural habitat. I hope it will be possible for viewers and

viewees to remain in harmony.

31 A chance to see these beautiful birds in their natural state was an experience we will never forget.

33 I always enjoy the river and surroundings on any given day

45 Having the road next to the river makes it easy to get to but does reduce the enjoyment by having the cars so close.

46 Enjoyable, but we had hoped to see more eagles.

47 you shdn't give too much weight to the above. We were on the river only two hours almost entirely from the road. We saw no conflicts betw eagles and recreationists but suspect there is particularly if people on foot get too close to the birds

72 Most eagles were on the opposite side of the river than the road is. Perhaps they have adapted to its presence

75 We have seen more adult Eagles this winter than others. Indian net fishing and sports boat fishing appears to "overfish" the river. Reduced Salmon runs will endanger the Eagle population. The Sauk river from the Skagit to the government bridge has a strong Eagle population. A few days ago we saw 7 Eagles in one tree.

80 Had a very enjoyable day. Love eagles. Wish I could have seen more. Happy to fill out the questionnaire.

125 We saw few eagles - they were all a considerable distance away

159 Saw 16 mature eagles, 2 immatures. Spent only 2 hours or so. Saw 3 at close range along in trees in fields.

Saw a mule deer swiming the river.

162 I commend your efforts to gather opinions. Unfortunately, I am not well informed (as I suspect most are not) on the possible impact on bald eagles of us human visitors. Perhaps a brief paper to accompany this questionnaire, giving basic data, fears, eagle stats, etc., would help us be more insightful in our answers. Otherwise, and as it is now, you'll get a lot of uninformed busy-body "strong opinions" that are as useless as they are stupid.

188 Liked the area. Enjoyed seeing the bald eagles.

196 These answers are only for today and we weren't good judges on river conditions (as to litter etc.) we were only on the road for about an hour.

262 We had expected to see more eagles. Apparently we arrived too late in the season.

279 We expected to see more eagles. We saw no dead fish on shores so maybe that's why there were so few eagles at this time - no food? I would also like some information on your organization. What type of company are you and what other types of work do you perform? I'm just interested, that's all. Thanks. We had thought there was a trail to go down onto the bar (by the billboard sign) but found there wasn't. After considering, I think it's best not to go on the shore anyway, but I feel that is a poor place to have the sign and all the parking because you can't see the eagles because the river is so far away. All we could see were a few specks in the trees and fisherman and boats going up and down river.

Comments of Eagle Viewers in Boats:

? Too many people

17 I saw 40 Eagles in quiet restful float trip.

83 weather was beautiful, river was running high and people on river and shore were quiet, non disruptive, non-invasive

85 Certainly did not expect the noise of motorboats in a conservancy district

92 Some major flaws in this survey form folks: You didn't ask what day, date or hour I was on the river - an important question in interpreting the data. (Weekend, weekday, holiday, early late, etc. ...) As it happens I put in at steelhead park at 4:30 pm which is late for a day in late Jan. It was today, a Sunday which is significant. It was also a clear, beuatiful day - also a factor. Were it not so late I would have been surprised to see only 10 people or so near the years. From years of experience living near and canoeing on the Skagit I could answer this questionnaire differently, but it specifically asks me to consider today's experience only. In supporting actions listed in #19 I'd emphasize that you'd need to prove to me that good was being achieved ... and love boating on the Skagit. I don't feel that my activity adversely affects the eagles. If anything, it serves to gently "galvanize" them against being alarmed by other less-sensitive river-goers. But the eagles and river comes first, and I'd abide by rulings based on factual

observations and not simple Forest Service heavy-handed management. I appreciate your efforts to preserve the magic Skagit and her creatures ... I'm one of them.

105 Regarding fishing - consider doing what Canadians have done - restrict number of fish or number days any angler can catch or use per season. - say 2 fish per season or 2 days per season. Altenately you could say there are only so many "fisherman days" allowed per years and have a lottery. Perhaps consider a 1 (one) fish limit instead of 2.

112 If the time comes when competing uses on the river have to be regulated, I think this survey could be useful to understanding what river-users will agree to and support. The questions that solicit opinions or management that will enhance the river environment for eagles are useless because very few people answering this questionnaire have enough knowledge of eagle habitats to offer any insights. More ignorant opinions are not needed. If there are major gaps in information about eagles, then we need biological/naturalists studies that will offer insights.

114 Beautiful day. Nice wide river for novices.

137 Beautiful area but would have enjoyed seeing more eagles

156 Sue was friendly forthright and most helpful. We hope you will be able to continue using herin some capacity when this study is finished

171 I've canoed southeast Alaska and have seen eagles in a natural area. The Skagit will never be returned to that

type of condition. But we need to do what will protect the eagle winter feeding areas. The motor boats are on my get-rid-of list. They bother me so they must bother the eagles (not facts to support that)! Is this a government supported ($) survey? I would be very interested in hearing the results of the survey and what the overall plan will be.

223 Sunny "warm" afternoon is not ordinarily best time to view eagles - we were rewarded! I am not knowledgable- but do wish the Skagit River to serve eagles - and nature - and recreationistis, too, if possible.

222 Lets get all motors off this section of river. This includes chainsaws on shore. Lets also some rules (ordinances) established and enforced.

190 Very few young eagles age 2-4

268 Had an exciting time. Really enjoyed the time you spent with us and knowledge you shared answering questions.

277 Only because of the weather and because we saw so few eagles.

293 The smallest number of birds I've ever viewed, rain and snow all day - otherwise, a good day.

294 Dissappointed on the amount of humans, the motor boats with engines on. I am very glad to see this project happening. As a commercial raft guide and a student of Environmental Studies I see what happens on the river due to excess amount of people. I feel the birds do come first since man can relocate elsewhere with no troubles. Permitng the Skagit River as the Sauk is would be a good step, but I

am sure there will be an outcry from all involved. I hope all goes smoothly with your study and that a fair judgement can come out of it.

Comments of Fishermen on Shore:

42 Fishing was Terrible. the Indian Gill netters on the Skagit scare the Eagles more than anybody and kill a few Besides

95 Fishing was terrible

234 Raised on river. Fish ladders on all dams. Fish hatcheries similar to Cowlitz River. Abolish netting on and near spawning aras and nesting areas. Improve logging practice near feeder streams. Remove obstructions from feeder streams. Reduce retrictions for benefit of local users of fishing activities and hunting. Lesser emphasis on select groups, eagle watching, fly fishing only, etc.

219 No fish today! Water to low and clear.

274 Too many power boats. I'd like to see, for my children: A) No powerboats on the river. B) Salmon and steelhead release throughout the river system and tribuitaries. C) No gill netting or commercial fishing in Puget Sound or in any river. D) Other species of trout.

291 Not enough fish.

Comments of Fishermen in Boats:

18 I have used the river for a number of years. I believe that people are becoming better educated about their responsibities in the out of doors. I've seen less abuse of mother nature in recent years. I think more trash facilities in eagle viewing areas and boat launching areas are necessary.

29 No fish today. There has been a significant increase in the number of Eagles I have seen in the last 10 years, Both up river and in the islands. Probably due to enforcement of protection laws on Indian reservations.

41 We onely have less than one half the eagles that was here in the 50-60. When the nets went in the water the eagles starved for 2 years then they said the heck with it and went some where or died, they were a good run of fish this year with the humpy run but that onely hapens every 4 year. Some time you cant even count them fishing and bird watching if they are a lot of birds they will not fly from you a few in nuber they will not stay around by boat or foot.

48 NO steelhead

49 Need more enforcement of native release program on Nooksack River, check the plunkers pickups and campers There keeping a lot of natives

51 Pour Fishing Management - Fishing is better than in the years past but there is plenty of room for improvement

66 Not enough steel Head Trout

84 I have been watching the eagle's for quite some time before it was popular for the general public to view them.

The biggest determining factor is the availibility of dead salmon for them to eat. When there are plenty of dead fish on the sandbars-bank the present amount of human activity will not bother the eagles to any great extent. The most cost effective way to do the most for the least amount of money would be to hire someone to pull out the numerous dead salmon that are underwater, and put them where the eagles can reach them.

140 I have been visiting the Skagit and Nooksack Rivers for the last 15 years. The number of eagles has remained fairly constant over the years, except for one year when their was not many eagles on the Skagit due to the reason that theire were very few dead salmon. That year there was more eagles than usual on the Nooksack. Eagles are a wild bird any time you approach them wheather in a boat, on foot or in a car, you are going to disturb them. Some are more timid than others or haven't adapted to civilization.

176 Ive fished in Alaska, where I feed eagle fish by throwing it to them they would sit on the top of our crab boats and watch us work, while we were tides up at the citys dock. I work a Similk Bay for Dunlap Towing in Laconner Wash., There are two bald eagles there witch I injoy watching very much, and they don't give a dam about us as long as you don't give them to much attinstion. These birds are very smart and very territorial at times. But they definatly aren't scared of man or noise, as long as they dont feed overly threaton. Ive only fished the Skagit for three

years, but in that time Ive seen an increase of eagles and Im glad of it, but the people have increased to at lease fishing wise. Rules can be good and bad. I hope before you think of some new rules you do your home work well and not fly off half cocked on decisions. I injoy fishing, but hooking a fish is only part of the injoyment, the beuty of the river and eagles, mountains, ducks, clouds and just plain fresh air, are all worth there wait in gold. But when something as fragit as all of the is so popular, I know the population of all the out siders will probably be the end of this solitude. Rules or not.

186 I was able to enjoy viewing many types of wildlife and had a very pleasant day. I am however becoming very concerned about the amount of litter than I encountered.

203 No fish caught (steelhead). I'm from Missouri, originally, and used to float midwest waterways viewing bald eagles, Roaring River, Buffalo River in Arkansas, White River, Current River, St. Francis, Big and Little Nianguas. It would seem to me that if the government continues to allow the special few to net spawning salmon and steelhead, the eagles will diminish in number by virtue of a decreased food resource.

204 This trip was great we should be able to use this river with common sense and keep the restriction to a minimum. We used this river for years, we've been able to view the eagles, and fish at the same time. The birds don't seem to be bothered by the fishing boat traffic. Because we

don't spend much time harrassing the birds. We are fishing. What I have seen is people walking up on them to take pictures, or looking at them. I'd hate to see any restrictions put on the river that would keep boats from certain sections. But rather keep the viewing parking lots to a minimum. We were here enjoying these creatures long before it became popular to view the birds, we have a lot of respect for the birds. River section restrictions would be a waste of this river. When there is a good run of salmon there's alot of eagles, when the run is down so are the birds (Nature has its own restrictions). Please let us enjoy this river as it has been for years. It will stay this way if left alone. Come, take a trip. Enjoy. D. Leese, Guide Service.

242 Like the man said, "Don't fix it if it isn't broke."

240 Outstanding every time on the river. There is not a problem with to many people or to many boats, scaring eagles in any way. As far as I can see, everone has done a very good job of keeping the river clean, and taking care of this resourse. I have lived on this river all of my life, and I have never seen a problem with the eagles in any way. The river has been managed very well and everyone has done a good job of taking care of it.

218 2 fish.

255 There are problem from Mt. Vernon down river. But none here for some fisher men.

257 I was surprised by the number of rating parties on the

river.

272 I visit often and it is usually pleasant and relaxing sometimes I even catch a fish.

292 I am curious about the significance of the question on education. I suspect any conclusions regarding this would be highly arbitrary. Knowledge consernig wildlife is not generally taught in any detail unless one is major in wildlife management. For example I know a man who didn't get past the fourth grade who knows more of the animals of this area and their ways they interact than any one I've ever met (Ive worked professionally with biologists many times). I also know many people with college degrees that know virtually nothing about the woods. (excuse the bad writing, I dont get much practice anymore).

295 Two days and two fish for the group - had a good time anyway. Wind - rain and snow along with high and dirty water. I'm ready to go again. My turn to get a bite. The Skagit Valley needs cash flow - recreational use should be promoted. No one group should over power another. Certain parts of the river are good one time/not good at others. No rules wuld be fiar. Let it be supply and demand - if an area is to crowded - move to another spot. Encurage buffer strips - access to the river for camping/bank fishing or eagle watching if thats what people want to do. Building in flood zones should not be allowed - even for 100 year floods. Rod and reel fishing only in the river, "sport fishing". There is more money spent in this valley for fishing than any other

river use. The dams need to control water flow, more even (daily). Push for cleaner water - from poor logging and road building practices to the barm barn lot and the out dated septic systems. How about tax breaks to timer land owners, farmers and etc. to let trees grow, but still leave areas open to users (with restrictions in certain areas). If your big worry is abut the eagles - nice to look at but not really that important: except = no fish no birds. We need to see the birds! I see no reason to cut off activities that allows a few hundred or even several thousnad people to drive from the Big City to a crowded view point (that is causing traffic hazards) or floating the river in crowded rafts with unskilled people in charge to see the birds. "Thats for the birds". I would like to point out, long before the eagle watching became so popular we have seen the eagles drifting by them for years in our power/drift boats without a "killing" proble. The point I'm trying to make is: if the food is there the birds are hungry they will eat. When the food runs out they will move on. Each year a fishing boat has pulled rafters from the river and saved lives. Remove these power boats and start counting the victims. For what??

297 I lived all my life on the Skagit System. I believe that the biggest factor in the decline of eagle populations on the Skagit System is mainly due to logging throughout the region. These operations have caused snow runoff, and rain to cause too much fluctuations of water level. At the time

of year when the eagles are in the area to feed on spawning salmon. The carcasses are washed away causing feeding problems for the eagles and hatching fish. It has been my experience that boating fishing does not usually scare the eagles away. I know of no cure for the problem but reforestation of logged areas would help in future years I'm sure.

300 Fishing is not so wonderful, but I enjoy scenery, weather, and relative solitude.

Comments of Other River Users:

? It is good that we look at the impact we have on the river and the lives that make it their home. I feel that I'm on good terms with the eagles, ducks, dippers, beavers and all of the other animals that live on the river. As long as we move quietly they do not mind. I try to clean my catch on a bar point so the animals will have a chance for the food, I have had eagles on more than one occasion take the food while we were within 20 feet of them; very exciting. I try to show my guest's all of the wildlife big and small, and explain what I know of their life and habits so they will have a better understanding. I hope that when the final decision is made that boats will still be allowed to float, fish and enjoy the river, in an orderly fashion the river is my life.
Ted Lewis

53 everything on the Skagit is enjoyable no one should be

refused the right to fish, sightsee. ect on it. comment FC Hunger River traffic and people in general viewing the Eagle population of the upper Skagit have very little effect on the eagles' lifestyle. Sports fishing has very little effect on reducing the fish carcass and/or Eagle food in the River System High waters and commercial fisheries have more impact on the numbers of fish and fish carcass' in the river system, effecting the Eagles food supply. The best way to insure the survival of Eagles is to control the Indian Fisheries in the River system and the ramping of the Dam systems. Being on the Skagit River from November through April at least 5 days/week I have found very little trouble with eagle watchers - fisherman and/or other people, enjoying the beauty of this wild and scenic River.

94 as property owners we just enjoy being near the river (except when it floods)

206 As I stated I have fish these rivers for the past 39 years. Every year including this year, if a motor boat hit a fish or get a fish in the Sauk River, they go back and forth about 6 or seven times and when there is eagles around perched they will get nervous and fly away. To much noise from motorboats and the people in the boat. I have use drift boat every year and I do not think in my better judgment that the eagles worry to much in fact they seem to enjoy it when a drift boat goes by. I think that an eagle on his first trip to these rivers might get uneasy and about the 3rd or 4th time he sees a drift boat he finally realizes that

he wont be bothered. There is plenty of rivers from Rockport toward the Bay for motorboats and they are becoming a problem not only for the eagles but for raft and driftboats too.