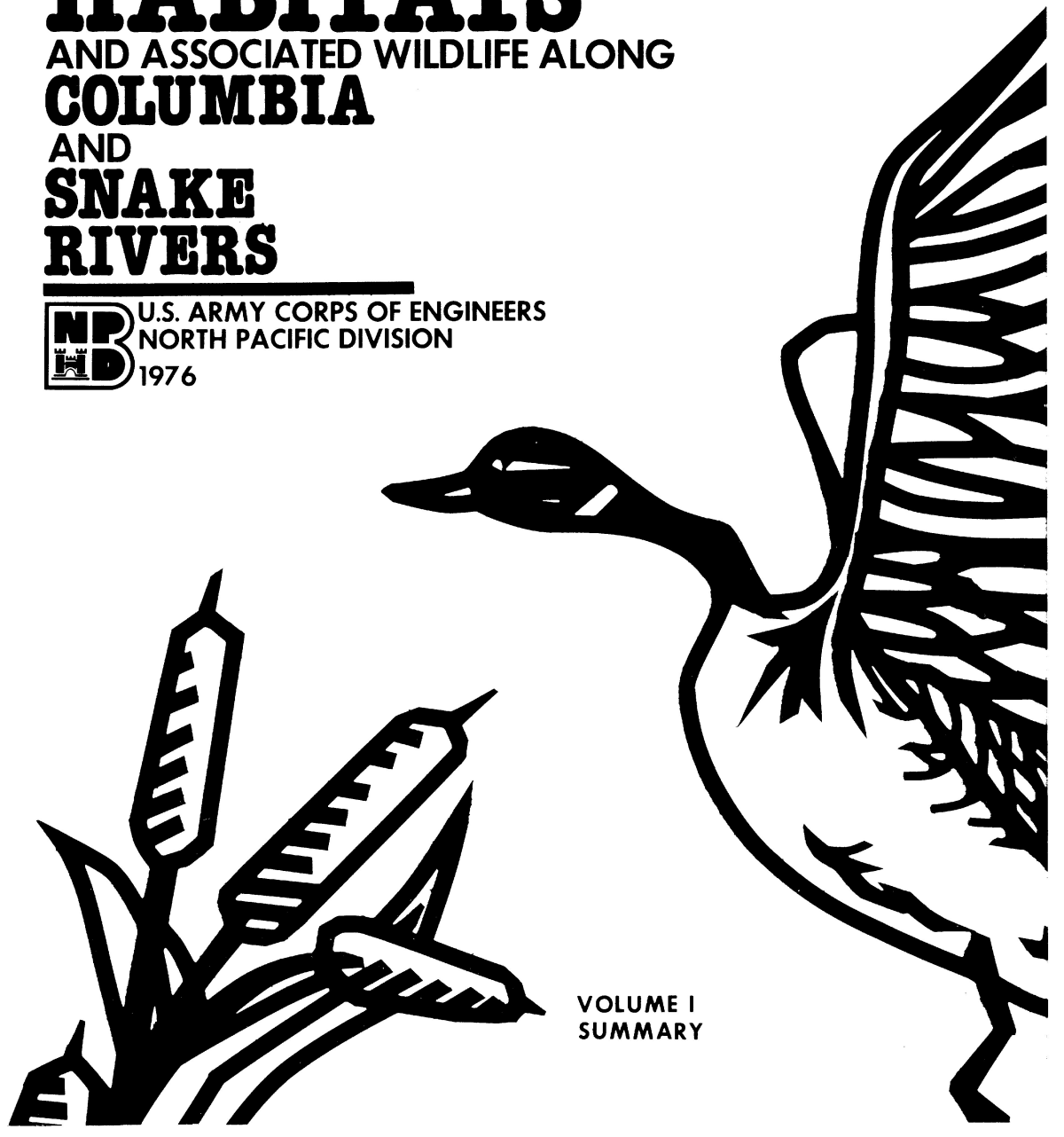
INVENTORY OF RIPARIAN HABITATS

AND ASSOCIATED WILDLIFE ALONG COLUMBIA AND SNAKE RIVERS

U.S. ARMY CORPS OF ENGINEERS
NORTH PACIFIC DIVISION
1976



VOLUME I
SUMMARY

S U M M A R Y R E P O R T

VOLUME I

INVENTORY OF RIPARIAN HABITATS AND ASSOCIATED WILDLIFE ALONG THE COLUMBIA AND SNAKE RIVERS

U. S. ARMY CORPS OF ENGINEERS
NORTH PACIFIC DIVISION

BY

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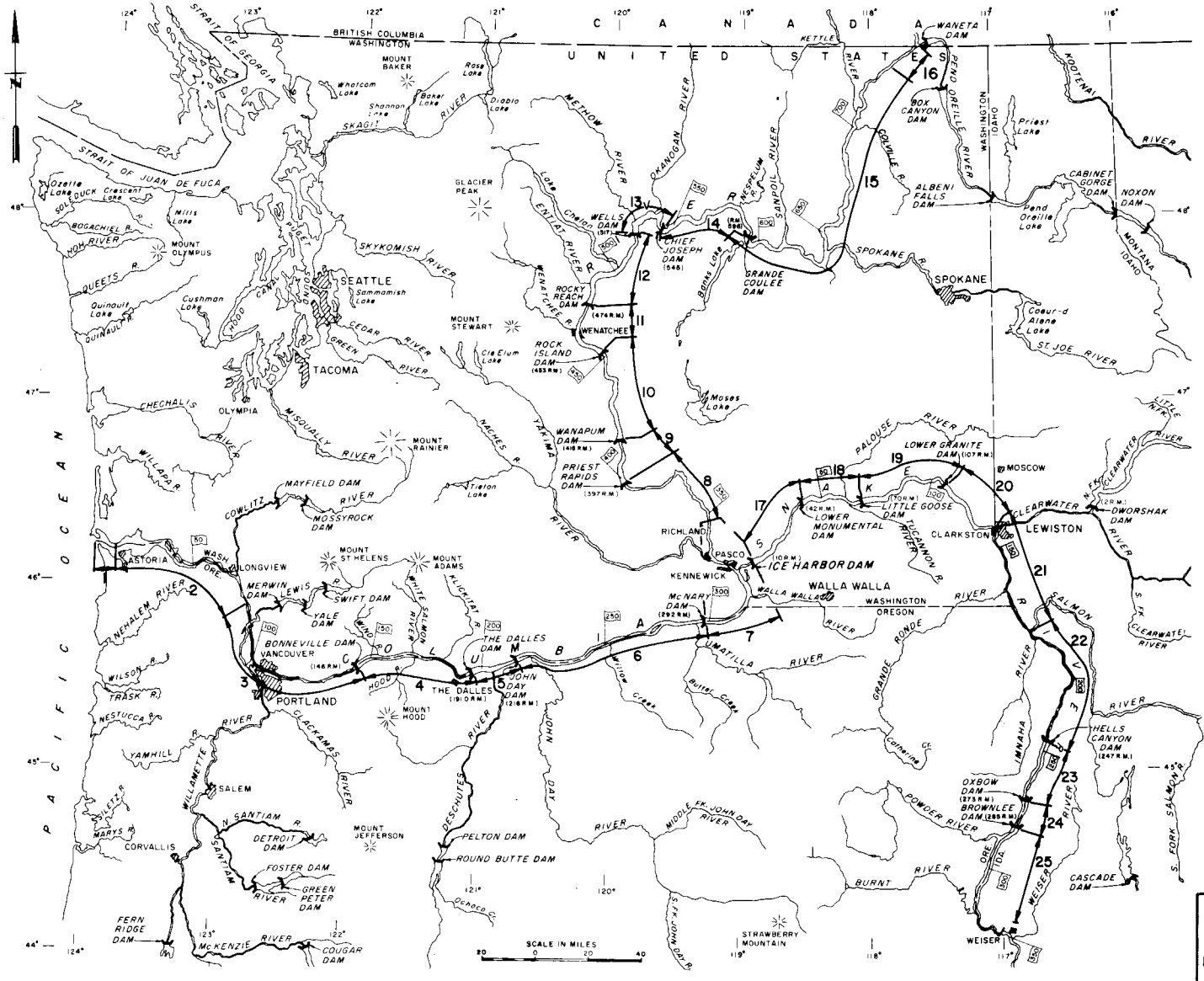
ACKNOWLEDGEMENTS

The assistance of university study team members in conducting this study was deeply appreciated, as was the guidance of the principal investigators. It seems only fitting to dedicate the seven volumes of this outstanding study to the memory of Howard M. Wight, the leader of the Oregon Cooperative Wildlife Research Unit, who passed away during the conduct of the study. A great deal of work was required to prepare materials produced by the study teams for publication. Special thanks are due to Ms. Cindy West and Ms. Jan Gilbert for their assistance in summarizing and editing data and text.

TABLE OF CONTENTS

LIST OF TABLES



NOT TO SCALE

FISHERIES ENGINEERING RESEARCH PROGRAM
INVENTORY OF RIPARIAN HABITATS
1973 - 1975
UNIVERSITIES OF WASHINGTON, IDAHO
& OREGON STATE UNIVERSITY
STUDY AREA
COLUMBIA RIVER & SNAKE RIVER MAPS
U.S. ARMY ENGINEER DISTRICT, WALLA WALLA

I. INTRODUCTION

Development of the hydroelectric potential of the Columbia River drainage has resulted in the construction of 18 major dams on the Columbia and lower and middle Snake Rivers (Frontispiece). These dams are owned and operated by the Corps of Engineers, Grant County Public Utility District, Douglas County Public Utility District, Chelan County Public Utility District, the U.S. Bureau of Reclamation, and Idaho Power Company (Table 1). Coordinated operation of these and other dams and thermal and nuclear electrical generating plants within the North Pacific Division of the Corps of Engineers and within the Northwest Grid of the Bonneville Power Administration, causes river flows and reservoir elevations to fluctuate on daily and weekly schedules as power demands are met, and seasonally as flood control measures are taken. Power demands in the future will most likely intensify daily and weekly fluctuations, while increased storage in headwater reservoirs will moderate seasonal high and low flows. This study was initiated to assess the impact of controlled water level fluctuations on present day vegetative communities and associated wildlife populations within the study area.

The Columbia River and Tributary Study sponsored by the Corps of Engineers tentatively identified impacts to fish and wildlife resources resulting from power peaking operations, and recommended the formation of two working groups to monitor research on these impacts. A wildlife Working Group, chaired by a representative of the U.S. Fish and Wildlife Service and comprised of representatives of the Oregon Department of Fish and Wildlife, the Washington Department of Game, the Idaho Fish and Game Department, and the Corps of Engineers, was formed in 1972 to coordinate and encourage wildlife research as it pertains to river regulations on the Columbia and Snake Rivers.

The first study recommended by the Wildlife Working Group was an inventory of riparian habitats and associated wildlife under existing conditions to establish baseline data for a major portion of the area affected. The specific objectives are:

1. Identify, delineate, and describe the riparian and associated upland habitats of the respective study areas.

2. Establish indices and make population estimates where possible for wild vertebrate species, exclusive of fish, using these habitats.

3. Make preliminary assessments of proposed river regulation impacts upon these habitats and their associated vertebrate populations.

4. Gather information pertinent to human use of wildlife resources.

TABLE 1: Pertinent data for dams and reservoirs in the Columbia and Snake River wildlife study area.

PROJECT/OPERATING AGENCY	IN SERVICE DATE	DRAW-DOWN (feet)	NORMAL OPERATING RANGE (MSL)	LENGTH OF RIVER (miles)	MILES OF SHORELINE MAINLAND	ISLAND	TOTAL	LAKE SURFACE AREA (acres)	PROJECT LAND (acres)	NO. UNITS KW OUTPUT	ULTIMATE UNITS/ TOTAL KW OUTPUT
				COLUMBIA RIVER							
Below Bonneville				145.5							
Bonneville Dam											
CofE, NPP	1938	5.0	71.5-76.5	46.5	134.7	9.5	144.2	20,400	9,569	10/518,000	20/1,076,000
The Dalles Dam											
CofE, NPP	1957	5.0	155.0-160.0	23.6	65.2	10.8	76.0	11,650	4,486	22/1,743,000	11/1,743,000
John Day Dam											
CofE, NPP	1968	11.0	257.0-268.0	76.4	255.8	67.8	323.6	51,000	47,360	16/2,160,000	20/2,700,000
McNary Dam											
CofE, NPW	1953	5.0	335.0-340.0	62.0	172.8	64.4	237.2	38,800	10,800	12/980,000	22/2,180,000
McNary Res. to Priest Rapids Dam				47.0	116.7	39.3	156.0				
Priest Rapids Dam											
Grant Co. PUD	1959	6.5	481.5-488.0	18.8	56.0	1.5	57.5	8,320	6,573	10/788,500	14 to 16/
Wanapum Dam											
Grant Co. PUD	1963	11.5	560.0-571.5	38.4	91.0	3.0	94.0	14,720	3,606	10/831,250	14 to 16/
Rock Island Dam											
Chelan Co. PUD	1932	4.0	602.9-606.9	21.0	43.0	0.0	43.0	3,470		10/212,100	18/644,100
Rocky Reach Dam											
Chelan Co. PUD	1961	7.0	703.0-710.0[1/]	42.1	90.3	2.7	93.0	9,800		11/1,291,000	
Wells Dam											
Douglas Co. PUD	1967	8.0	771.0-779.0	28.5	93.2	6.6	99.8	9,548	2,138	10/840,000	
Chief Joseph Dam											
CofE, NPS	1955	16.0	930.0-946.0[2/]	51.0	106.0	2.0	108.0	7,800	5,202	18/1,030,000	27/2,075,000
Grand Coulee Dam											
Bur of Reclam.	1941	82.0	1,208.0-1,290.0	149.5	657.9	2.1	660.0	83,000		22/4,842,000	27/8,867,000
Columbia River above Grand Coulee Dam				15.0							
				SNAKE RIVER							
Ice Harbor Dam											
CofE, NPW	1961	3.0	437.0-440.0	31.9	83.3	0.1	83.4	8,375	4,864	6/603,000	
Lower Monumental Dam											
CofE, NPW	1969	3.0	537.0-540.0	28.7	83.6	2.8	83.6	6,590	8,188	3/405,000	6/810,000
Little Goose Dam											
CofE, NPW	1970	5.0	633.0-638.0	37.2	91.8	1.4	93.2	10,025	6,790	3/405,000	6,810,000
Lower Granite Dam											
CofE, NPW	1975	5.0	733.0-738.0	39.3	91.0	1.0	92.0	8,900	5,440	3/405,000	6/810,000

TABLE 1: (Continued)

PROJECT/OPERATING AGENCY	IN SERVICE DATE	DRAW-DOWN (feet)	NORMAL OPERATING RANGE (MSL)	LENGTH OF RIVER (mile)	MILES OF SHORELINE MAINLAND	ISLAND	TOTAL	LAKE SURFACE AREA (acres)	PROJECT LAND (acres)	NO. UNITS KW OUTPUT	ULTIMATE UNITS/ TOTAL KW OUTPUT
Lower Granite Res to Hells Canyon Dam				100.0							
Hells Canyon Dam											
Idaho Power Co.	1964	5.0	1,683.0-1,688.0	26.0	56.4	1.0	57.4	2,500	3/	3/435,000	
Oxbow Dam											
Idaho Power Co.	1961	5.0	1,800.0-1,805.0	12.0	26.4		26.4	1,150	3/	4,250,000	
Brownlee Dam											
Idaho Power Co.	1959	101.0	1,976.0-2,077.0	57.5	157.9	11.5	169.4	15,000	3/	4,450,000	5/680,000

FOOTNOTES: 1/ Includes a 2-foot surcharge for flood control.
2/ Chief Joseph Dam will be raised 10 feet, and the lake surface will increase to 8,400 acres with completion of the additional units.
3/ Project lands acquired mostly through flowage easements.

Because of the size and nature of the study, the assistance of the Cooperative Wildlife Research Units at Oregon State University and the University of Idaho, and the College of Forest Resources at the University of Washington was elicited to provide personnel for field research and data collection. At the request of the state wildlife agencies, a study coordinator was provided by the Washington Department of Game to ensure that research would be conducted in a similar fashion by all three universities, and to ensure that data would be reported in compatible format and comparable terms.

As shown in the frontispiece, the study area was confined to the Columbia River from its mouth to the Canadian border, and the Snake River from its mouth to and including Brownlee Reservoir. The total area includes approximately 1,100 river miles, four unimpounded reaches of river, and 18 reservoirs, and falls between or within the states of Oregon, Washington, and Idaho.

The Oregon Cooperative Wildlife Research Unit was responsible for studies along the Columbia River from the seaward end of the jetties at the river mouth to McNary Dam, a distance of approximately 292 river miles. The Idaho Cooperative Wildlife Research Unit was responsible for studies along the Columbia River from McNary Dam to the Hanford Atomic Energy Commission lands and along the Snake River from the mouth to the upper end of Brownlee Reservoir, a distance of approximately 400 river miles. The College of Forest Resources was responsible for studies along the Columbia River from the Hanford Atomic Energy Commission lands to the Canadian border, a distance of approximately 400 river miles.

The primary area of inclusion, the minimum area to be considered, was established as that area where the vegetative community is influenced by proximity to the reservoirs or free flowing river. Based on probable capillary action, the area of shoreline within ten feet in elevation of the highest normal water level was selected. All portions of islands, irrespective of relief and vegetative patterns, were included, as were all Corps of Engineers project lands. For wildlife whose normal life patterns include movement into and out of riparian zones, the discretion of the university study teams was required to establish the minimum area necessary to gain meaningful information.

To ensure adequate data collection, the study was conducted over a period slightly in excess of two years with an additional period of six months for data analysis and preparation of final reports. Conduct of the study was prefaced by a thorough literature review on geologic history, recent history, climatic conditions, descriptions of flora and fauna, and the effects of water level fluctuations on flora and fauna.

Funding was provided through the Power Peaking Studies of the Corps of Engineers Fisheries-Engineering Research Program. For their participation in the study, each university received $166,000, and the Washington Department of Game received $54,000.

This report represents a brief summary of the findings of the first phase of investigations of the impacts of river regulation on wildlife and wildlife habitats. Detailed findings are presented in Volumes II A, II B, III A, III B, IV A, and IV B reports presented by the university study teams.

II. RESULTS AND DISCUSSION

SPECIFIC STUDY SEGMENTS DEFINED

Specific study segments were defined by each study team, however, they were renumbered in consecutive order and, to a minimum extent, redefined for presentation of consolidated data in this report. Changes in definition include the separation of Lower Monumental and Little Goose Reservoirs and Oxbow and Hells Canyon Reservoirs which had been grouped together, and the combination of two segments to present Grand Coulee Reservoir as one segment. A comparison and listing of study segments is provided in Table 2.

TABLE 2: A comparative listing of study segments for the Columbia and Snake River wildlife studies.

SUMMARY REPORT SEGMENT NO.	UNIVERSITY SEGMENT NO.	SEGMENT DEFINITION
1	OSU 1	Seaward end of Columbia River jetties to Youngs River (RM 12)
2	OSU 2	Youngs River (RM 12) to RM 79
3	OSU 3	RM 79 to Bonneville Dam
4	OSU 4	Bonneville Dam to The Dalles Dam
5	OSU 5	The Dalles Dam to John Day Dam
6	OSU 6	John Day Dam to McNary Dam
7	UI 8	McNary Dam to Hanford A.E.C. lands and Ice Harbor Dam
8	UW 1	Hanford A.E.C. lands to Priest Rapids Dam
9	UW 2	Priest Rapids Dam to Wanapum Dam
10	UW 3	Wanapum Dam to Rock Island Dam
11	UW 4	Rock Island Dam to Rocky Reach Dam
12	UW 5	Rocky Reach Dam to Wells Dam
13	UW 6	Wells Dam to Chief Joseph Dam
14	UW 7	Chief Joseph Dam to Grand Coulee Dam

SUMMARY REPORT SEGMENT NO.	UNIVERSITY SEGMENT NO.	SEGMENT DEFINITION
15	UW 8&9	Grand Coulee Dam to RM 730
16	UW 10	RM 730 to Canadian border
17	UI 7	Ice Harbor Dam to Lower Monumental Dam
18	UI 6	Lower Monumental Dam to Little Goose Dam
19	UI 6	Little Goose Dam to Lower Granite Dam
20	UI 5	Lower Granite Dam to Lewiston-Clarkston Bridge (RM 140)
21	UI 4	Lewiston-Clarkston Bridge to Salmon River
22	UI 3	Salmon River to Hells Canyon Dam
23	UI 2	Hells Canyon Dam to Oxbow Dam
24	UI 2	Oxbow Dam to Brownlee Dam
25	UI 1	Brownlee Dam to RM 345

RIPARIAN AND ASSOCIATED HABITATS OF THE COLUMBIA AND SNAKE RIVERS

Habitat types, including vegetative types and land form classes, were delineated on aerial mosaics, and homogeneous stands of individual types and complexes of up to four mixed types were identified and numerically coded on the basis of overstory composition. Findings from photographic interpretation were verified and elaborated upon during field surveys. The combined result was the codification of over 348 habitat types (see Appendix I), 241 of which were used for the lower Columbia River, 206 for the upper Columbia River, and 195 for McNary Reservoir and the Snake River. Vegetative type and land form codes and aerial mosaics for each study area are presented in Volumes II B, III B, and IV B.

Quantitative Analysis

Quantitative estimates of habitat types were made by measuring occupied acreage and shoreline miles. Estimate accuracy was affected by variability in the scale of aerial photographs and criteria set by team leaders. Scales of photographs range from 1:10,000 to 1:24,000 (inches:feet) for the various reaches of the river, while criteria required measurement of all habitats on Corps of Engineers lands, but only ten feet above high water on other lands.

Estimates of acreage for habitat types are provided in Appendix I and summarized in Table 3. Of 92,790 acres estimated (exclusive of the main river), 76,542 were classified in the lower Columbia River area, 13,312 in the McNary Reservoir-Snake River area, and 2,936 in the upper Columbia area. The greatest acreage of habitat was found on John Day Project where 27,032 acres represents 58 percent of the 47,360 acres of project lands. Percentage of project lands classified on Corps of Engineers projects ranged from three percent on Chief Joseph Reservoir through ten percent for Lower Granite, 13 percent for Lower Monumental, 39 percent for McNary, 48 percent for Bonneville, 50 percent for Little Goose, 55 percent for Ice Harbor, and 89 percent for The Dalles Reservoirs. Habitats contributing the greatest acreages were shrublike plant communities at 20,921 acres, deciduous forests at 19,688 acres, grasslands and meadows at 12,327 acres, and marshes and swamps at 8,369 acres. Agricultural areas and facilities, occupying 5,756 acres, were the most expansive man-made habitats, followed by urban and industrial areas at 3,565 acres.

In terms of shoreline miles, Oregon State University studied over 920 miles, the University of Washington 810 miles, and the University of Idaho 1,090 miles. Table 4 lists the predominant habitat types by acreage and shoreline miles. Comparisons show that habitats predominant by acreage were seldom predominant by shoreline miles occupied. The most notable variance between measurements was the predominance of man-made barren land in Bonneville, The Dalles, Rocky Reach, Ice Harbor, Lower Granite, and Hells Canyon Reservoirs, where rock riprap or road fill was the most common shoreline type. By acreage, vegetation predominated in most cases.

TABLE 3: Summary of habitat types measured in acres for each study segment in the Columbia and Snake River wildlife study.[1/]

GENERAL HABITAT TYPE/TOTAL ACREAGE PER TYPE	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
NATURAL VEGETATION																									
Barren or sparsely vegetated bottom lands (sand bars, gravel bars, mud flats, etc.)/3558 acres	544			13	139	1455	137	139	9	26	6	23	92	32	560	26	25	175	58	20	68	11			
Barren or sparsely vegetated slopes (rock cliffs, talus slopes, etc.) /2674 acres				14	479	1954		3	1	10	2	19	1	5	30	2	26	49	42	4		32			1
Herbaceous plant cover (forbs and forb-like plants) /2848 acres	120	139	180	224	668	361	102	6									2	120	349	262	58	47	34	2	174
Grasslands and meadows/12327 acres	1395	1592	3067	758	985	3702	237	9		5	9	22	2	11	28	3	41	18	322	16	10	2	71	4	18
Marshes and swamps /8369 acres	1183	6580	131	15	15	227	114	2					21		1		11	63	6						
Shrub-like plant communities(shrub-steppe, rabbit-brush, sagebrush, etc.)/20921 acres	11	20			512	15797	585	39	68	286	3	38	20	49	6		2005	281	152	13	347	605	52	30	2
Shrub communities (Macrophyllous shrubs and vines) /5208 acres	121	2604	731	40	124	19	568	1		6	4	82		6	11	10	19	1	2	45	365	246	26	10	167
Confierous forests /790 acres		314	28	133	3	10		1	1	1	4	5	1	37	236	16									
Deciduous forests /19688 acres	760	6122	9617	873	118	285	1431	12	50	39	74	87	6	4	13	15	38	11	11	9	73	4	13	1	23
SUBTOTAL (Natural vegetation)/80788 acres	4584	19741	14390	3011	3043	23810	3174	212	129	373	102	277	143	144	892	75	2169	718	942	369	925	996	232	52	385

TABLE 3 (Continued)

GENERAL HABITAT TYPE/TOTAL ACREAGE PER TYPE	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
MANMADE FACILITIES AND VEGETATIVE FORMS																									
Barren manmade slopes (roadfills, riprap, etc.)/ 1322 acres	10				26	3	175			1	1	4	1	1	1		393	290	167	42			152	10	45
Agricultural areas and facilities/ 5756 acres	423		771	381	713	2413	140	5	3	44	2	32	382	6	6		8	7	171		104	6	20	9	110
Urban areas (business and industrial areas)/ 3565 acres	888			1196	182	731	322	4	4	52	5	3	5	2	6		12	16	25	5	3	1	36	48	19
Recreation developments/ 1259 acres	51			43	57	75	481		1	6		10			2		88	69	109	132	9	4	24	12	86
SUBTOTAL (Manmade facilities)/11902 acres	1372		771	1620	978	3222	1118	9	8	103	8	49	388	9	15		501	382	472	179	116	11	232	79	260
TOTAL ACREAGES/ 92790 acres	5956	19741	14161	4631	4021	27032	4292	221	137	476	110	326	531	153	907	75	2670	1100	1414	548	1041	1007	464	131	645

1/ Study segments are defined in Table 2.

TABLE 4: Comparison of Habitat Types by Acreage Estimates and by Shoreline Miles of Habitat for the Columbia and Snake River Wildlife Study. Predominant types comprise over 50 percent of the total by segment.

PORTION OF STUDY AREA 1/	PREDOMINANT HABITAT TYPES BY ACREAGE ESTIMATES	PREDOMINANT HABITAT TYPES BY SHORELINE MILES
Segment 1	Tidal Marsh (18%) Beachgrass (15%) Sand (9%) Grassland (9%)	No estimate
Segment 2	Tidal Marsh (33%) Shrub Willow (13%) Willow/Cottonwood, large trees (10%)	No Estimate
Segment 3	Cottonwood, large trees (28%) Grassland (20%) Willow/Cottonwood, large trees (10%)	No Estimate
Segment 4	Pasture (15%) Grassland (14%) Industrial Area (14%) Oak/Ponderosa Pine (9%)	Rock Riprap (34%) Grassland (11%) Willow, large trees (6%)
Segment 5	Grassland (28%) Rock/Grassland (14%) Rabbitbrush (7%) Pasture (6%)	Rock Riprap (40%) Gravel (14%)
Segment 6	Rabbitbrush (35%) Rabbitbrush/Sagebrush (10%) Field Crops (8%)	Sand (39%) Rock Riprap (21%)
Segment 7	Willow/Cottonwood/ Russian Olive (28%) Rubber Rabbitbrush (16%) Shrub Willow (12%)	Shrub Willow (25%) Rock Riprap (23%) Willow/Cottonwood/ Russian Olive (16%)
Segment 8	Sand (56%)	Sand (30%) Shrub Steppe (25%)

TABLE 4: (Cont'd)

PORTION OF STUDY AREA 1/	PREDOMINANT HABITAT TYPES BY ACREAGE ESTIMATES	PREDOMINANT HABITAT TYPES BY SHORELINE MILES
Segment 9	Shrub Steppe (45%) Willow, large trees (29%)	Shrub Steppe (38%) Willow, large trees (19%)
Segment 10	Shrub Steppe (56%)	Rock/Rock Cliff (62%)
Segment 11	Willow (37%) Willow/Cottonwood (33%)	Willow/Cottonwood (30%) Willow (19%)
Segment 12	Shrub over herb (30%) Bitterbrush (8%) Grassland (8%) Willow/Cottonwood (6%)	Rock Riprap (15%) Broadleaf over Herb (8%) Grassland (8%) Willow/Cottonwood (5%) Shrub Steppe (4%)
Segment 13	Field Crops (67%)	Shrub Steppe (37%) Gravel (13%)
Segment 14	Sagebrush (27%) Sand (18%)	Sagebrush (20%) Rock/Rock Cliff (19%) Sand (11%)
Segment 15	Sand (56%)	Sand (63%)
Segment 16	Sand (22%) Willow/Cottonwood (16%) Gravel (15%)	Macrophyllus Shrub (12%) Cottonwood (9%) Rock (8%) Broadleaf over shrub (4%) Ponderosa Pine (4%) Two Species Mixed Broadleaf and Conifer (4%) Gravel (4%)
Segment 17	Rubber Rabbitbrush (74%)	Rock Riprap (46%) Rubber Rabbitbrush (30%)
Segment 18	Rubber Rabbitbrush (21%) Rock Riprap (15%) Gravel (12%) Cheatgrass Brome (11%)	Rubber Rabbitbrush (30%) Rock Riprap (23%)
Segment 19	Forbs (26%) Cheatgrass Brome (16%) Fenced Pasture (9%)	Rock Riprap (29%) Bluebunch Wheatgrass/ Sandberg Bluegrass (21%)

TABLE 4: (Cont'd)

PORTION OF STUDY AREA 1/	PREDOMINANT HABITAT TYPES BY ACREAGE ESTIMATES	PREDOMINANT HABITAT TYPES BY SHORELINE MILES
Segment 20	Forbs (45%) Public Access Areas (11%)	Rock Riprap (39%) Forbs (14%)
Segment 21	Shrub Willow (32%) Douglas Hackberry (31%)	Shrub Willow (63%)
Segment 22	Douglas Hackberry (60%)	Douglas Hackberry (72%)
Segment 23	Road Fill (32%) Bluebunch Wheatgrass/ Sandberg Bluegrass (11%) White Sweetclover (7%)	Road Fill (42%) Bluebunch Wheatgrass/ Sandberg Bluegrass (14%)
Segment 24	Power Facilities and Dams (36%) Douglas Hackberry (24%)	Antelope Bitterbrush/ Bluebunch Wheatgrass (44%) Douglas Hackberry (22%)
Segment 25	Big Sagebrush/Blue-bunch Wheatgrass (59%)	Big Sagebrush/Bluebunch Wheatgrass (41%) Shrub Willow (13%)

1/ Study segments are defined in Table 2.

Qualitative Analysis

Qualitative analysis of habitat types was accomplished by intensive sampling in homogeneous stands of single or mixed complexes of vegetative types and landform classes. Oregon State University established 82 intensive sampling areas in 21 vegetative types and two landform classes and provided detailed descriptions for each (see Volume II A and II B). All plant species found on intensive sampling areas are listed. Qualitative descriptions differentiating between the Oregon and Washington shores and islands are subdivided into similar habitat types by lengths of river over which such types occur. Detailed descriptions of sampling areas are provided in which habitat types are identified, exact location is given, the size, slope, aspect, and elevation are provided, and soil, vegetation, and ground cover are described. Vegetative composition is tabulated, listed by life form, percent frequency, percent cover, relative density, mean height, mean diameter, density of plants and mean area covered. Graphic illustrations are presented for many sampling areas.

For McNary Reservoir and the Snake River, the University of Idaho listed 83 intensive sampling areas in 24 vegetative types by study segment providing location, transect length, and vegetative types (see Volumes III A and III B). A detailed description and graphic illustration of the method of deriving plant communities was presented and a key to vegetative types and communities was developed during the course of the study (Appendix B, Volume III A). Appended information also includes an index to plant community data tables which provide identification by life form, plant community, aspect, percent slope, average percent of frequency of occurrence, average cover, average density, average mean height, and presence of habitat components. Vegetation is summarized by intensive sampling site, and identification and location of each site are provided.

For the upper Columbia, the University of Washington listed 72 intensive sampling transects grouped into nine general habitat types (see Volume IV A and IV B). A tabulation of number and length of contiguous riparian habitats, amount of riparian vegetation on islands, and a general description of habitat types are given. Vegetation is presented in tabular form by species, life form, percent frequency of occurrence, percent ground cover, shrubs and trees per hectare, shrub and tree height, and percent transects occupied. Appended data includes number and length of contiguous habitat types, estimates of acreages of landforms and vegetative types, shoreline vegetation, and vegetative composition of intensive sampling transects. Transects are identified, and species are identified by life form, percent frequency of occurrence, percent ground cover, density per unit area, and height.

In the lower Columbia area, 397 species of plants were identified, 24 of which were trees, 40 were shrubs, 282 were forbs, and 51 were grasses. On McNary Reservoir and the Snake River, 371 species of plants, including 19 species of trees, 47 shrubs, 247 forbs, 8 grasslike plants, and 50 grasses were identified. One hundred sixty six species of plants, including 19 trees, 31 shrubs, 83 forbs, 4 grasslike plants, and 29 grasses were identified on the upper Columbia River. A total of 724 species of plants, including 50 trees, 67 shrubs, 476 forbs, 36 grasslike plants, and 95 grasses were identified (Appendix II).

WILDLIFE OF THE COLUMBIA AND SNAKE RIVERS

All vertebrate wildlife exclusive of fish were inventoried in the study area. Fifty seven species of reptiles and amphibians, 308 species of birds, and 124 species of mammals were listed in the literature as being reasonably assured of occurring in the general area of the study. However, not all animals listed were associated with the riparian zone, and only 42 species of reptiles and amphibians, 263 species of birds, and 81 species of mammals were found (see Appendices III, IV, and V). For discussion purposes and identification purposes, wildlife were separated into groups including big game, upland game birds and mammals, waterfowl, furbearers, marine mammals, birds of prey, other birds, small mammals, and reptiles and amphibians.

Big Game

Big game species were inventoried by ground and aerial observation and by identification of tracks, feces, and other sign. Distribution and occurrence of ten species of big game, including Roosevelt elk, Rocky Mountain elk, black-tailed deer, mule deer, white-tailed deer, bighorn sheep, mountain goats, American black bears, mountain lion, and pronghorn antelope are presented in Table 5. Only deer associated with riparian zones with regularity and densities in major habitat types were determined by pellet group transects.

Roosevelt elk tended to avoid riparian zones, and only one sighting and one observation of signs were made in the area below Bonneville Dam. Rocky Mountain elk were observed at higher elevations in Hells Canyon, and above Hells Canyon, Oxbow, and Brownlee Reservoirs. Dependence on the riparian zone was noted only at West Bar on Wanapum Reservoir. There, a group of 150 animals was observed wintering in shrub communities, or across the river on agricultural lands or the golf course at Crescent Bar.

Black-tailed deer were found in riparian habitats from the coast inland to John Day Dam. Dependence on riparian zones was not demonstrated, as black-tailed deer tended to use all riparian and upland habitat types. Absence or decline in use was noted where highways or railroads blocked access to riparian zones, or where riprap replaced riparian vegetation, as was the case for much of the shoreline of Bonneville and The Dalles Reservoirs.

TABLE 5: Big game species of the Columbia and Snake River wildlife study area. 1/

COMMON NAME/SCIENTIFIC NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Roosevelt elk/*Cervus canadensis roosevelti*		X	X																						
Rocky Mountain elk/*Cervus canadensis*										X											X	X	X	X	
Black-tailed deer/*Odocoileus hemionus columbianus*	X	X	X	X	X																				
Mule deer/*Odocoileus hemionus*					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
White-tailed deer/*Odocoileus virginianus*		X	X				X	X						X	X	X		X	X	X	X	X	X	X	
Bighorn sheep/*Ovis canadensis*																						X			
Mountain goat/*Oreamnos americanus*																						X			
American black bear/*Ursus americanus*		X														X					X	X	X	X	X
Mountain lion/*Felis concolor*					X																X	X	X	X	
Pronghorn antelope/*Antilocapra americanus*									X																

1/ Study segments are defined in Table 2.

Mule deer, like black-tails, were infrequently found on The Dalles Reservoir. However, mule deer or signs of their presence were observed on all segments inland. Upland grass and shrub communities and riparian tree, shrub, and marsh communities were of major importance to mule deer. Islands which afforded protection from land based predators were of particular value as fawning areas in John Day and McNary Reservoirs, and in the Hanford reach. Seasonal surveys revealed winter dependence of mule deer on riparian habitats at West Bar on Wanapum Reservoir, along the lower Snake River, and from Hells Canyon to Brownlee Reservoir.

White-tailed deer were found in heavy concentrations at the Columbian White-tailed Deer National Wildlife Refuge below Portland and from Grand Coulee Dam to the Canadian border. Scattered observations were made at the mouth of the Walla Walla River on McNary Reservoir and near Pittsburg Landing in Hells Canyon. Extensive studies of the relationship of white-tailed deer to their habitat were conducted in the Columbia White-tailed Deer National Wildlife Refuge.

Mountain goats and bighorn sheep, products of transplantation attempts by state game agencies, were observed only at higher elevations in Hells Canyon. Pronghorn antelope were observed only at West Bar on Wanapum Reservoir.

Black Bears were observed only near the coast, near the Canadian border, and from Hells Canyon through Brownlee Reservoir. High use occurred in Segment 16 in cottonwood transects where heavy use of chokecherries, rotten stumps, and logs were noted. Mountain lions preferred uplands and were observed in habitats above Bonneville Reservoir and on slopes above Hells Canyon, and Hells Canyon and Oxbow Reservoirs.

Upland Game Birds and Mammals

Upland game birds were inventoried in conjunction with transects for other birds, by response to record calls, and by supplemental field observations. Upland game mammals were inventoried during small mammal studies, through use of scent and track stations, and through supplemental observations. Upland game birds expected in the study area included California quail, ring-necked pheasant, ruffed grouse, blue grouse, spruce grouse, sage grouse, sharptail grouse, turkey, gray partridge, chukar, common snipe, bandtail pigeon, and mourning dove. Upland game mammals included whitetail jackrabbit, snowshoe hare, blacktail jackrabbit, eastern cottontail, mountain cottontail, and brush rabbit. Distribution and occurrence of species found are presented in Table 6.

TABLE 6: Upland game birds and mammals of the Columbia and Snake River wildlife study area. 1/

COMMON NAME/SCIENTIFIC NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
BIRDS																									
California quail		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X
Ring-necked pheasant	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X	X	X				X
Ruffed grouse	X	X	X	X										X	X	X					X				X
Blue grouse																X									
Sage grouse								X																	
Turkey				X											X										
Gray partridge															X	X		X	X	X	X	X	X	X	X
Chukar					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Common snipe	X	X	X	X	X	X	X		X							X		X	X	X					
Bandtail pigeon	X	X	X	X	X																				
Mourning dove	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
MAMMALS																									
Whitetail jackrabbit/*Lepus townsendii*							X																		
Snowshoe hare/*Lepus americanus*	X	X		X																					
Blacktail jackrabbit/*Lepus californicus*					X	X	X	X	X	X							X								
Eastern cottontail/*Sylvilagus floridanus*		X	X																						
Mountain cottontail/*Sylvilagus nuttali*				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Brush rabbit/*Sylvilagus bachmani*	X	X	X																						

1/ Study segments are defined in Table 2.

California quail and ring-necked pheasant were generally found throughout the study area, although no quail were observed near the coast or Wells and Chief Joseph Reservoirs, or the upper half of Hells Canyon. No pheasants were found from Rock Island Dam to Wells Dam, nor from the upper half of Hells Canyon to Brownlee Dam. Quail were not common below John Day Dam, but they were commonly found in association with riparian tree and shrub communities on John Day and McNary Reservoirs, along the lower Snake River, above Oxbow Dam, and along the upper Columbia River. Pheasants were also uncommon below John Day Dam, and more plentiful further up the Columbia and Snake Rivers. Pheasants were more common than quail on the lower Snake River and most plentiful in upland and riparian communities on Brownlee Reservoir.

Of the five species of grouse expected to occur in the study area, only the ruffed grouse frequented riparian habitats and was commonly found. Ruffed grouse were found inland to The Dalles Dam, upriver from Chief Joseph Dam, in lower Hells Canyon, and on Brownlee Reservoir. Blue grouse and sage grouse were seen only as supplemental observations in the uppermost segment on the Columbia River and the Hanford Reach, respectively. Sharptail grouse and spruce grouse were expected to occur in the study area, but were not seen in association with the riparian zone.

Wild turkeys were found near Bonneville and Grand Coulee Reservoirs. One stand of willows was regularly used by turkeys on the Washington shore of Bonneville Reservoir, and turkeys were observed using riparian habitats between Fruitland and Kettle Falls during the winter and spring on Grand Coulee Reservoir.

Gray partridge and chukar were found only in dryer inland areas, with chukar occurring in all segments east of The Dalles Reservoir. Gray partridge, which were noted to be more dependent on agricultural lands up and away from the river, were locally abundant on Grand Coulee Reservoir and above Lower Monumental Dam on the Snake River. In all segments where they occurred, chukar were associated with rocklands, grasslands, and steep terrain, however, owing to their mobility, they were observed in many varied habitat types. Extensive studies of the effects of weather on distribution and production were conducted by the University of Idaho team. They noted that in 1975, a wetter year, chukar were less dependent on the riparian zone than in 1974, and were able to range to much higher altitudes as green forage was available. However, populations were lower in 1975 as a result of inclement weather during the nesting season.

Common snipe were most common in tidal zones and exhibited only localized abundance where appropriate habitats were available upstream. They were found inland through McNary Reservoir, on Priest Rapids Reservoir, above Grand Coulee Reservoir, and from Lower Monumental through Lower Granite Reservoirs.

Mourning doves were found throughout the study area, and in heavily forested areas, showed little dependence on riparian vegetation. However, in sparsely forested or unforested areas, they were dependent on riparian tree and shrub communities for nesting and roosting habitat. Dove use occurred principally in the summer, as the preponderance of the population migrated south in winter. Bandtail pigeons were common in coastal and mountain forests inland to The Dalles Dam. Douglas fir, Sitka spruce, red cedar, western hemlock, alder, cottonwood, and willow forests were the principle habitats of bandtail pigeons. Dependence of bandtails on riparian habitats was not established. Rock doves, ferral pigeons, were inventoried with wild pigeons and doves. They were found in most segments inland of Bonneville Dam where they utilized cliffs and man-made structures for nesting and roosting, and urban and agricultural areas for feeding.

Of the upland game mammals, the mountain cottontail was most widely distributed, occurring in all segments inland of Bonneville Dam. Eastern cottontails, introduced from the Eastern United States, were found in the two segments immediately below Bonneville Dam. Both species showed preference for riparian tree and shrub communities for cover and upland zones for foraging.

Whitetail jackrabbits, considered rare in Washington, were observed only on Goose Island in McNary Reservoir. Blacktail jackrabbits were observed from The Dalles Reservoir up to Wanapum Dam on the Columbia and Lower Monumental Dam on the Snake River, through occurrence was uncommon on The Dalles and Ice Harbor Reservoirs. Dependence on riparian zones was not established for either jackrabbit, as both occurred principally in upland shrub and shrub steppe vegetative types.

Brush rabbits were found in all segments below Bonneville Dam, while showshoe hares were found in the two coastal segments and along Bonneville Reservoir. Brush rabbits utilized deciduous forest and marsh habitats while showshoe hares used mixed deciduous and coniferous forest. Showshoe hares are known to inhabit coniferous forests in the upper Columbia and middle Snake River areas, but use of upland and riparian zones near the river was not documented. Dependence on riparian zones was not established for either species.

Waterfowl

Waterfowl densities were determined during migration periods by aerial census supplemented with field observations. Resident waterfowl were monitored by aerial and field observations, and breeding populations were monitored by intensive nest searches and brood counts. Distribution and occurrence of 38 species of loons, grebes, swans, geese, ducks, mergansers, and coots are presented in Table 7.

TABLE 7: Waterfowl of the Columbia and Snake River wildlife study area. 1/

COMMON NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Common loon	X		X			X	X	X	X	X	X	X	X		X	X	X	X	X	X					X
Arctic loon	X	X	X																						
Red-throated loon	X		X																						
Red-necked grebe	X			X		X				X															
Horned grebe			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X					X
Eared grebe							X	X	X	X				X	X	X		X	X	X	X				
Western grebe	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X
Pied-billed grebe		X	X			X	X		X	X	X	X	X			X	X	X	X	X			X	X	X
Whistling swan	X	X	X	X	X	X	X	X	X			X			X	X		X	X	X		X	X	X	X
Canada goose	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
White-fronted goose		X	X		X	X		X																	
Snow goose		X	X		X	X		X										X	X		X				X
Ross' goose																X									
Mallard	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Gadwall		X	X			X	X					X	X			X	X	X	X	X	X	X	X	X	X
Pintail	X	X	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Green-winged teal	X	X	X	X	X	X	X		X	X	X	X	X			X	X	X	X	X	X	X	X	X	X
Blue-winged teal		X	X		X	X	X	X		X			X			X	X	X	X	X	X	X	X	X	X
Cinnamon teal		X	X		X	X	X	X	X	X		X	X					X	X	X	X				X
European widgeon			X																						X
American widgeon	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Shoveler		X	X			X	X	X			X		X				X	X	X	X	X	X	X	X	X
Wood duck		X	X		X	X	X		X		X							X	X	X	X				X
Redhead				X		X	X		X	X	X	X	X	X			X	X	X	X	X				X
Ring-necked duck			X			X	X				X	X	X		X		X	X	X	X			X	X	X
Canvasback	X	X	X	X		X	X	X	X	X	X	X	X	X			X	X	X	X	X				X
Greater scaup																							X	X	
Lesser scaup	X	X	X	X	X	X			X				X										X	X	
Undifferentiated scaup							X	X	X	X	X	X	X	X			X	X	X	X					X
Common goldeneye							X										X	X	X	X	X	X	X	X	X
Barrow's goldeneye	X	X	X		X	X	X	X		X		X				X	X	X	X	X	X	X	X	X	X
Undifferentiated goldeneyes								X	X				X	X											
Bufflehead	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X			X	X	X
White-winged scoter	X	X	X						X																
Surf scoter	X	X	X																						
Common scoter	X		X																						
Ruddy duck		X	X			X	X					X	X	X							X		X	X	X
Hooded merganser		X	X				X					X	X				X	X	X	X			X	X	X
Common merganser	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Red-breasted merganser	X	X	X												X	X							X	X	

1/ Study segments are defined in Table 2.

Species of waterfowl normally hunted included Canada goose, white-fronted goose, snow goose, mallard, gadwall, pintail, green-winged teal, blue-winged teel, cinnamon teal, American widgeon, shoveler, wood-duck, redhead, ring-necked duck, canvasback, greater scaup, lesser scaup, bufflehead, ruddy duck, hooded merganser, and American coot. These, along with common, artic, and red-throated loons, red-necked, horned, eared, and pied-billed grebes, whistling swan, Ross-goose, common and Barrow's goldeneyes, white-winged, surf, and common scoters, and common and red-breasted mergansers were found in association with the open river. Trumpeter swans, brandt and black brandt, oldsquaw, and Harlequin ducks were not observed in the study area. European widgeon were observed only below Bonneville Dam and on Brownlee Reservoir, and are considered rare visitors. A Ross-goose was observed near the Canadian border, a rare sighting of this endangered goose. Waterfowl used all study segments at all seasons of the year, principally as wintering area, migration stopping area, or, in some cases, for summer breeding habitat. The river provided food in the forms of fish and aquatic plants, and a resting area for birds that fed in adjacent upland habitats. John Day Reservoir received the heaviest use, followed closely by the McNary Reservoir and the area below Bonneville Dam. Waterfowl management areas operated by state and Federal wildlife agencies contributed to high concentrations. High counts on Wanapum Reservoir were contributed to winter freezing of water bodies in wildlife management areas on the plateau above the river. Concentrations of waterfowl were highest during winter months, as indicated in Table 8.

Waterfowl nesting surveys and brood counts were conducted in study segments with summer resident populations. Intensive studies of the composition of nesting habitat, site selection criteria, and nesting success were conducted, and brooding areas were inventoried. Major emphasis on John Day Reservoir resulted in a separate publication, "Productivity and Nesting Habitat of Great Basin Canada Geese; Umatilla National Wildlife Refuge" by Thomas McCabe, a Masters Thesis presented to Oregon State University in 1976.

Nesting results are presented in Table 9. Most nests were on islands inaccessible to land based predators. Comparison with earlier surveys revealed an increase from 174 pairs of nesting geese in 1950 to 204 pairs in 1975 for the Columbia River from Umatilla, Oregon, to Richland, Washington. The increase apparently was due to high quality nesting habitat on Badger, Foundation, and other islands in McNary Reservoir where 229 nests were found. In the Hanford Reach, where studies have been conducted for years by Battelle Northwest Laboratories, 116 of 131 nests hatched successfully, producing 580 goslings, again, with nearly 70 percent of the nests occurring on islands. Earlier studies showed 240 goose nests from the Grand Ronde River to the mouth of the Snake River. This study recorded 75 breeding pairs of geese in the same area, a decline of 165, apparently resulting from the inundation of islands by the Lower Snake River Project. Only one nesting concentration was documented, that on New York Island in Little Goose Reservoir where 38 nests were found in 1975. Islands which afford protection from predators was the most

TABLE 8: Maximum numbers of waterfowl censused by segment by year in the Columbia and Snake River wildlife studies. 1/

SUMMARY REPORT SEGMENT NO.	MAXIMUM NO. OF WATERFOWL CENSUSED	MONTH AND YEAR OF CENSUS
1	7,464	October 1974
2	39,593	February 1975
3	149,599	December 1974
4	495	January 1975
5	5,645	January 1975
6	153,432	February 1975
7	152,480	December 1975
8	35,015	December 1974
9	1,828	December 1974
10	95,770	December 1974
11	1,935	December 1974
12	13,870	February 1975
13	11,000	October 1974
14	2,194	November 1974
15	2,107	November 1974
16		
17	433	February 1975
18	245	February 1975
19	2,445	February 1975
20	403	January 1975
21	312	January 1975
22	620	January 1974
23	65	January 1975
24	347	January 1975
25	780	January 1975

1/ Study segments are defined in Table 2.

TABLE 9: Maximum number of waterfowl nests encountered by study segment in 1973, 74, or 75 in the Columbia and Snake River wildlife studies. An asterisk (*) indicates presence of nests known or suspected, but counts were not made. 1/

WATERFOWL SPECIES	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Canada goose		8	23	23	3	175	229	131	101	33	43	13	36	44	3	*	2	*	38	*	*	*	1	*	191
Mallard	16	15	6		3	6	7			2							*	*	*	*	*	*	*	*	4
Gadwall							*																		
Pintail						4	*															*	*	*	
Green-wing teel							*															*	*	*	*
Blue-winged or cinnamon teal						2	*																		
American widgeon							*															*	*	*	
Redhead							*																		
Canvasback							*																		
Scaup							*																		
Ruddy duck							*																		

1/ Study segments are defined in Table 2.

important factor in influencing waterfowl production. This was followed by the presence of brooding habitat for the flightless young. Duck production was not well documented because they hide their nests more efficiently than geese. Water level fluctuation caused by power peaking was implicated in the erosion of nesting islands and loss of brood habitat by the intermittent flooding and drying of plant communities.

Furbearers

Aquatic furbearers were identified by shoreline searches for tracks, scat, trails, lodges or dens, feeding areas, territorial marking areas, and, where necessary, by trapping. Terrestrial furbearers were identified and estimated by visual sightings, identification of tracks and sign, and by use of scent and track stations. Harvest estimates were obtained from the records of wildlife management agencies. Associations with habitat types and relative abundance were established.

Aquatic furbearers, mink, river otter, beaver, muskrat, and nutria, occurred in localized concentrations where aquatic and riparian vegetation was available. Highest concentrations occurred below Bonneville Dam, while localized concentrations were found upstream. Where inundation by reservoirs reduced aquatic and riparian habitats, species diversity and population numbers were reduced. This was particularly true in the mid-Columbia and lower Snake River reservoirs (Table 10). All aquatic furbearers demonstrated dependence on riparian vegetation. Where water level fluctuations occurred, impacts to their habitat were evident. Aquatic furbearers showed preference for nonfluctuating reaches of the river or for subimpoundments and tributaries unaffected by fluctuations.

Of the terrestrial furbearers, the opossum, raccoon, striped skunk and gray fox were most dependent on riparian habitats. Shorttail and longtail weasels, badgers, spotted skunks, coyotes, red fox, bobcats, and porcupines were more frequently observed in upland habitats, and consequently, their distribution was not completely represented by studies of the riparian zones (Table 10).

Marine Mammals

Marine mammals were recorded during aerial waterfowl counts and during ground and water searches for other animals. Only the harbor seal was observed in the estuary of the Columbia River.

TABLE 10: Aquatic and terrestrial furbearers of the Columbia and Snake River wildlife study area. 1/

COMMON NAME/SCIENTIFIC NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
AQUATIC FURBEARERS																									
Mink/*Mustela vison*	X	X	X	X	X	X	X	X	X		X		X			X									X
River otter/*Lutra canadensis*	X	X	X	X	X	X				X			X	X		X		X	X	X	X	X	X	X	X
Beaver/*Castor canadensis*	X	X	X	X	X	X	X	X		X			X	X	X	X	X	X	X	X	X		X	X	
Muscrat/*Ondatra zibethica*	X	X	X	X	X	X	X	X		X	X	X	X	X				X	X				X	X	X
Nutria/*Myocastor coypus*	X	X	X																						
TERRESTRIAL FURBEARERS																									
Opossum/*Didelphis virginianus*		X	X	X		X																			
Raccoon/*Procyon lotor*	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Shortail weasel/*Mustela erminea*	X					X																			
Longtail weasel/*Mustela frenata*	X	X	X													X					X	X			
Badger/*Taxidea taxus*					X	X		X	X					X	X										X
Spotted skunk/*Spilogale gracilis*		X		X	X	X					X					X									
Striped skunk/*Mephitis mephitis*		X	X	X	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X
Coyote/*Canus latrans*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Red fox/*Vulpes vulpes*			X																						X
Gray fox/*Urocyon cinereoargenteus*	X	X	X																						
Bobcat/*Felis rufus*			X	X	X	X	X	X		X	X	X	X		X		X	X	X	X	X	X			
Porcupine/*Erethizon dorsatum*		X		X	X	X		X			X	X			X	X		X	X	X	X	X	X	X	X

1/ Study segments are defined in Table 2.

Birds Other than Waterfowl

Birds other than waterfowl were censused in established sampling areas where replicate samples were obtained during each of four different seasons. Plotless circle counts and transects on ground and water were used, and birds were identified by sight or call. Raptors were censused by vehicle transects, and owls were censused by observation and response to recorded calls at night. Rails were censused by response to recorded calls during evening and morning hours. Association with habitat types was established, and seasonal counts were used to identify breeding populations and migrational concentrations.

Birds of Prey

The distribution and occurrence of birds of prey, vultures, hawks, eagles, falcons, and owls, observed in the study area are shown in Table 11. Most birds of prey demonstrated only loose dependence on riparian habitats, utlizing trees for perching and roosting. Others required trees for nesting. Yet, small birds and small mammals produced by riparian habitats were the prey of many of these larger birds. Goshawks, dwellers of coniferous forests, were observed where appropriate habitats occurred upslope from the reservoirs or river. Sharp-shinned and Cooper's hawks were commonly found in riparian zones where the small birds they preyed upon were plentiful. Red-tailed, Swainson's, rough-legged, and ferruginous hawks, while using riparian zones for roosting and perching, generally scoured upland fields, meadows, and brush fields for small rodents. The marsh hawk utilized riparian marshes and meadows as well as uplands in foraging. Osprey and bald eagles, dependent on the river and reservoirs for fish, perched and roosted in riparian trees. Though osprey were observed throughout most of the study area, nesting was observed only near the Canadian border. Bald eagles were observed generally as winter concentrations along the river and reservoirs. Prairie falcons utilized cliff ledges for nesting, and like the golden eagle and peregrine falcon, sought food along ridges and slopes above the river. The American kestrel, a tree cavity nester, was more dependent on the riparian zone than the larger, cliff nesting hawks, eagles, and falcons.

Barn, screech, great horned, long-eared, short-eared, and saw-whet owls relied heavily on riparian trees and shrubs for perching and roosting. Screech, long-eared, short-eared, and saw-whet owls nest in trees or tree cavities, while barn and great-horned owls often nest in cliff cavities. Burrowing owls were observed primarily in upland types, while snowy owls were seen only as winter visitors. Pygmy owls were seen only where coniferous forest extended down to Brownlee Reservoir.

TABLE 11: Birds of prey of the Columbia and Snake River wildlife study area. 1/

COMMON NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Turkey vulture		X	X	X	X	X				X				X	X	X		X	X	X	X	X	X	X	X
Goshawk			X			X										X							X	X	X
Sharp-skinned hawk	X	X	X			X	X					X	- X	X							X	X	X	X	
Cooper's hawk	X		X	X		X	X	X			X					X		X	X	X	X	X	X	X	X
Red-tailed hawk	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Swainson's hawk							X	X	X							X	X	X	X	X				X	X
Rough-legged hawk	X		X			X	X	X									X	X	X	X					X
Ferruginous hawk														X											
Golden eagle			X			X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X
Bald eagle	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				X	X	X	X	X	X
Marsh hawk	X		X		X	X	X	X	X	X		X	X	X	X		X	X	X	X	X	X	X	X	X
Osprey		X		X		X	X	X		X	X	X		X	X	X	X	X	X	X	X	X	X	X	X
Prairie falcon			X	X	X	X	X	X	X	X								X	X	X	X	X	X		X
Peregrine falcon	X	X	X					X															X		
American kestrel	X	X	X	X	X	X	X	X	X	X	X		X	X		X	X	X	X	X	X	X	X	X	X
Barn owl		X	X			X	X	X									X	X	X	X					X
Screech owl	X	X	X	X		X	X													X	X				
Great horned owl	X	X	X	X		X	X	X					X		X		X	X	X	X	X	X	X	X	X
Snowy owl	X		X		X																				
Pygmy owl																									X
Burrowing owl						X	X	X										X							
Long-eared owl		X	X			X	X		X			X				X	X				X				X
Short-eared owl			X			X	X	X	X	X		X					X	X	X	X					X
Saw-whet owl	X	X	X		X																				

1/ Study segments are defined in Table 2.

Open Water and Shore Birds

The distribution and occurrence of birds other than waterfowl which are commonly associated with the open water and shorelines of the river and estuary are listed in Table 12. Species diversity and populations of such birds are highest in the estuary where naturally occurring fluctuations due to tides expose mudflats and where prey in the form of invertebrates and fish are most abundant. The range of some species extended far inland, where, presumably, many fed on mudflats exposed by power peaking, and others found sufficient food in river waters. If inland mudflats and waters are as productive under man-made fluctuations as under natural fluctuations, power peaking could be beneficial. Supportive information was not gathered under this study. However, many species nested in riparian zones and were effected by peaking. Most notable were the adverse effects on colony nesting gulls and terms. Other species, such as the great blue heron and black-crowned night heron, nested in colonies in trees along the shore and on islands, and some species, such as the long-billed curlew, nested in upland meadows. Perhaps the most unusual sighting was that of an ancient murrelet on Brownlee Reservoir.

Goatsuckers, Hummingbirds, Kingfishers, and Woodpeckers

The distribution and occurrence of these groups are shown in Table 13. The goatsuckers, poor-wills and nighthawks, and the swifts depended on insects produced to some extent in riparian zones and nested in riparian trees and shrubs and cliff cavities. Hummingbirds fed on flowers of riparian vegetation, and nested in trees and shrubs. Kingfishers perched, roosted, and nested in riparian trees and fished the river. Woodpeckers utilized riparian and upland communities where they sought food and constructed nesting cavities in trees.

Perching Birds

By far, the largest group of birds inventoried, the distribution and occurrence of 109 species of perching birds are listed in Table 14. Insect eating birds, the tyrant flycatchers, swallows, nuthatches, creepers, dipper, wrens, gnatcatchers, kinglets, old world warblers, pipets, vireos, and wood warblers, depended on insects produced in water or riparian habitats for food. Omnivorous and seed and fruit eating larks, jays, magpies, crows, titmice, verdins, bushtits, catbirds, thrashers, thrushes, bluebirds, solitaires, waxwings, shrikes, and starlings depended, in part, on foods produced by riparian vegetation. Tree, tree cavity, and shrub nesting birds utilized riparian and upland habitat types extensively, while cliff, ledge and bank nesting species utilized barren land forms. Association with and seasonal use of riparian habitats on portions of the free flowing river and reservoirs are compared in Table 15.

TABLE 12: Open water and shore birds of the Columbia and Snake River wildlife study area. 1/

COMMON NAME	STUDY SEGMENT																							
	COLUMBIA RIVER															SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
White pelican						X	X	X	X	X	X	X	X	X	X	X									
Double-crested cormorant	X	X	X	X	X	X	X	X	X																
Brandt's cormorant	X																								
Pelagic cormorant	X																								
Great blue heron	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Green heron		X	X																						
Common egret	X		X																						
Snowy egret																									X
Black-crowned night heron	X		X			X	X	X	X	X			X												
American bittern	X		X			X																			
Sandhill crane		X				X		X																	
Virginia rail						X																			
Sora rail			X	X		X	X											X	X	X					
Semipalmated plover	X	X					X																		
Snowy plover	X																								
Killdeer	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
American golden plover	X																								
Black-bellied plover	X		X		X																				
Surfbird	X																								
Ruddy turnstone	X																								
Black turnstone	X																								
Common snipe	X	X	X	X	X	X	X		X							X		X	X	X					
Long-billed curlew						X	X	X	X	X															X
Whimbrel	X					X																			
Spotted sandpiper		X	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Solitary sandpiper	X																								
Wandering tattler	X																								
Greater yellowlegs	X	X	X			X	X	X	X				X	X											
Lesser yellowlegs								X																	
Knot	X																								
Pectoral sandpiper	X																								
Baird's sandpiper								X																	
Least sandpiper	X	X	X	X		X																			
Dunlin	X	X	X			X																			
Long-billed dowitcher			X			X																			
Western sandpiper	X	X	X			X		X		X								X	X	X					
Sanderling	X	X	X			X	X																		
American avocet						X	X											X	X	X		X	X	X	X
Wilson's phalarope						X	X		X									X	X	X					
Northern phalarope	X					X																			
Parasitic jaeger	X																								
Glaucus-winged gull	X	X	X		X	X																			
Western gull	X	X	X	X	X																				

TABLE 12: (Continued)

COMMON NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Herring gull	X	X	X		X		X	X		X		X	X	X			X	X	X	X				X	X
Thayer's gull	X	X	X																						
California gull	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X		X	X	X			X	X	X
Ring-billed gull	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X
Mew gull	X	X	X																						
Bonaparte's gull	X	X	X			X		X	X																
Heermann's gull	X		X																						
Black-legged kittiwake	X																								
Forster's tern						X	X	X	X												X				X
Common tern							X			X															
Caspian tern	X	X				X	X	X	X									X	X	X					
Black tern						X		X																	
Arctic tern										X															
Common murre	X																								
Pigeon guillemot	X																								
Ancient murrelet																									
Cassin's auklet		X																							X

1/ Study segments are defined in Table 2.

TABLE 13: Goatsuckers, hummingbirds, kingfishers, and woodpeckers of the Columbia and Snake River wildlife study area. 1/

COMMON NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Poor-will										X				X									X	X	
Common nighthawk						X	X	X	X	X	X	X		X			X	X	X	X	X	X	X	X	X
Vaux's swift	X	X		X				X										X	X	X		X	X	X	
White-throated swift					X		X			X	X			X	X							X			
Black-chinned hummingbird																						X	X	X	
Rufous hummingbird	X	X	X	X		X									X	X						X			
Calliope hummingbird															X							X			
Belted kingfisher	X	X	X		X	X		X	X	X		X	X	X		X		X	X	X	X	X	X	X	X
Common flicker	X	X	X	X	X	X	X	X	X		X	X	X			X	X	X	X	X	X	X	X	X	X
Red-shafted flicker								X			X	X		X	X	X									
Pileated woodpecker				X																					
Lewis' woodpecker				X		X		X					X	X	X	X						X	X	X	
Yellow-bellied sapsucker			X	X												X									
Hairy woodpecker															X	X	X	X	X	X		X	X	X	
Downy woodpecker	X	X	X	X		X					X	X		X	X	X		X	X	X		X	X	X	X
White-headed woodpecker															X										

1/ Study segments are defined in Table 2.

TABLE 14: Perching birds of the Columbia and Snake River wildlife study area. 1/

COMMON NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Eastern kingbird	X		X			X	X				X		X	X	X		X	X	X	X	X	X	X	X	X
Western kingbird					X	X	X	X		X	X	X	X	X			X	X	X	X	X	X	X	X	X
Ash-throated flycatcher				X																					
Say's phoebe								X	X	X	X		X	X	X			X	X	X	X	X	X	X	X
Dusky flycatcher																X									
Western flycatcher	X		X	X												X									
Western wood peewee		X	X	X	X	X	X	X	X		X			X	X	X		X	X	X		X			X
Olive-sided flycatcher		X																							
Horned lark	X			X	X	X	X	X	X	X							X	X	X	X	X				X
Violet-green swallow	X	X		X	X					X	X				X			X	X	X	X	X	X	X	X
Tree swallow	X	X	X	X			X			X								X	X	X			X	X	X
Bank swallow						X	X	X	X	X			X	X		X	X	X	X	X					X
Rough-winged swallow		X		X		X	X	X					X	X	X	X						X	X	X	X
Barn swallow	X	X	X	X		X	X	X	X	X	X	X	X	X		X	X	X	X	X		X	X	X	X
Cliff swallow	X	X		X	X	X	X			X		X	X	X	X	X									
Purple martin		X	X																						
Gray jay																X									
Blue jay																X									X
Steller's jay		X	X	X												X						X	X	X	
Scrub jay		X	X																						
Black-billed magpie			X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Common raven	X		X	X	X	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X
Common crow	X	X	X	X	X	X	X							X		X	X	X	X	X	X	X	X	X	X
Clark's nutcracker															X	X						X			
Black-capped chickadee	X	X	X	X	X	X	X				X			X	X	X		X	X	X	X	X	X	X	X
Mountain chickadee				X		X									X	X							X	X	X
Chestnut-backed chickadee	X	X		X																					
Common bushtit	X	X	X	X																					X
White-breasted nuthatch			X	X	X											X									
Red-breasted nuthatch	X	X	X	X		X										X							X	X	
Pygmy nuthatch															X										
Brown creeper	X	X	X	X		X										X					X	X			X
Wrentit	X																								
Dipper				X																		X	X	X	
House wren			X	X											X										X
Winter wren	X	X	X	X		X	X			X						X						X			X
Bewick's wren	X	X	X	X	X	X	X						X												
Long-billed marsh wren	X	X				X	X	X		X															X
Cañon wren				X	X							X			X			X	X	X	X	X	X	X	X
Rock wren	X		X	X	X	X		X	X	X	X	X			X			X	X	X	X	X	X	X	X
Cat bird																							X	X	
Sage thrasher	X					X			X						X								X	X	
Robin	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

TABLE 14: (Continued)

COMMON NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Varied thrush	X	X	X	X	X	X	X				X	X				X		X	X	X	X				
Swainson's thrush	X	X	X			X										X									
Veery																X									
Western bluebird				X		X							X								X	X			X
Mountain bluebird																X						X	X	X	X
Townsend's solitaire			X			X		X			X			X	X	X		X	X	X		X	X	X	X
Golden-crowned kinglet	X	X	X	X		X	X	X	X		X	X	X	X		X		X	X	X	X	X	X	X	X
Water pipit						X			X	X	X	X	X	X											
Bohemian waxwing												X				X						X			X
Cedar waxwing		X	X	X	X	X					X		X			X		X	X	X	X	X	X	X	X
Northern shrike	X	X	X	X	X	X			X	X		X		X				X	X	X	X		X	X	X
Loggerhead shrike								X	X	X		X	X					X	X	X					X
Starling	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X
Hutton's vireo	X	X	X																						
Solitary vireo				X	X	X	X		X		X					X		X	X	X					
Red-eyed vireo		X														X						X	X	X	
Warbling vireo		X				X										X									X
Orange-crowned warbler	X	X	X	X	X	X			X																
Nashville warbler															X	X							X	X	
Yellow warbler		X	X	X	X	X	X	X	X		X	X		X	X	X		X	X	X	X	X	X	X	X
Yellow-rumped warbler		X	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X
Black-throated gray warbler	X	X	X	X																					
Townsend's warbler			X			X												X	X	X					
Hermit warbler			X	X																					
Palm warbler											X														
MacGillivary's warbler		X		X				X	X		X					X		X	X	X		X	X	X	
Yellowthroat	X	X	X	X			X						X				X	X	X	X			X	X	
Yellow-breasted chat		X		X		X	X		X						X								X	X	X
Wilson's warbler	X	X	X	X	X	X		X	X		X	X					X	X	X	X			X	X	
American redstart								X								X									
House sparrow	X		X		X		X	X			X		X					X	X	X	X		X	X	X
Western meadowlark	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Yellow-headed blackbird						X	X	X	X	X			X					X	X	X					X
Red-winged blackbird	X	X	X	X	X	X	X	X	X	X		X	X	X	X		X	X	X	X	X	X	X	X	X
Northern oriole		X	X	X	X	X	X		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Bullock's oriole																X									
Brewer's blackbird	X	X	X	X		X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X
Brown-headed cowbird	X	X	X	X	X	X	X		X		X		X	X	X	X	X	X	X	X					X
Western tanager		X		X		X			X		X			X			X				X	X	X	X	
Black-headed grosbeak	X	X	X	X		X												X	X	X	X	X			
Luzili bunting					X	X	X								X	X	X	X	X	X	X	X	X	X	X
Evening grosbeak	X	X	X	X		X	X											X	X	X	X	X	X	X	X
Purple finch		X	X			X	X									X		X	X	X					

TABLE 14: (Continued)

COMMON NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Cassin's finch															X	X							X	X	
House finch		X	X	X	X	X				X	X		X	X				X	X	X	X	X	X	X	X
Pine grosbeak				X														X	X	X	X				
Gray-crowned rosy finch																		X	X	X			X	X	X
Common redpoll																					X				
Pine siskin	X	X	X	X		X	X		X		X				X	X					X	X	X	X	X
American goldfinch	X	X	X	X	X	X	X	X	X		X	X		X	X		X	X	X	X	X	X	X	X	X
Red crossbill	X	X		X											X	X									
Rufous-sided towhee	X	X	X	X		X	X	X							X	X	X	X	X	X		X	X	X	X
Lark bunting										X															
Savannah sparrow	X	X	X		X	X	X	X	X	X	X	X	X	X	X		X	X	X	X		X	X	X	X
Grasshopper sparrow																	X	X	X	X					
Vesper sparrow	X																								
Lark sparrow						X	X		X			X	X	X	X		X	X	X	X	X	X	X	X	X
Dark-eyed junco		X	X	X	X	X	X										X	X	X	X	X	X	X	X	X
Undifferentiated juncos											X	X	X	X	X	X									
Tree sparrow						X		X	X					X							X				X
Chipping sparrow				X		X		X						X	X	X		X	X	X					X
Brewer's sparrow						X																			
White-crowned sparrow		X	X	X	X	X	X	X	X	X	X	X	X		X		X	X	X	X	X	X	X	X	X
Golden-crowned sparrow		X	X		X																				
White-throated sparrow		X	X													X									
Fox sparrow		X	X			X					X							X	X	X					
Lincoln's sparrow			X	X				X	X	X							X	X	X	X	X	X			X
Song sparrow	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

1/ Study segments are defined in Table 2.

TABLE 15: Estimated total numbers for the most abundant species of birds for the free-flowing river below Bonneville Dam, Bonneville Reservoir, The Dalles Reservoir, and John Day Reservoir.

FREE-FLOWING RIVER BELOW BONNEVILLE DAM

SEGMENT 1

FALL		SPRING	
Western sandpiper	9,726	Tree swallow	5,050
Cedar waxwing	8,192	Savannah sparrow	4,862
Golden-crowned kinglet	1,898	Barn swallow	661
Purple finch	1,043	Song sparrow	589
Long-billed dowitcher	973	Red crossbill	587
Winter wren	843	Winter wren	488
Western meadowlark	795	Orange-crowned warbler	389
American robin	603	Wilson's warbler	341
Black-capped chicadee	358		

WINTER		SUMMER	
Winter wren	1,105	Savannah sparrow	3,800
Dunlin	998	Barn swallow	1,960
Western meadowlark	275	Cliff swallow	1,277
Western sandpiper	162	Swainson's thrush	1,277
		Starling	952
		Song sparrow	750
		Bewick's wren	415
		Long-billed marsh wren	399

SEGMENT 2

FALL		SPRING	
Black-capped chickadee	37,960	Tree swallow	20,509
Golden-crowned kinglet	31,084	Song sparrow	15,548
Winter wren	18,818	Black-capped chicadee	13,608
Song sparrow	5,457	American robin	9,735
Starling	4,872	Brown-headed cowbird	8,641
American robin	4,160	Wilson's warbler	7,457
Dark-eyed junco	3,250	Red crossbill	5,042
Ruby-crowned kinglet	2,070	Starling	4,420
		Orange-crowned warbler	3,443
		Yellow-rumped warbler	3,374

TABLE 15: (Continued)

FREE-FLOWING RIVER BELOW BONNEVILLE DAM

SEGMENT 2 (Continued)

WINTER		SUMMER	
Black-capped chickadee	22,173	Swainson's thrush	21,360
Golden-crowned kinglet	16,300	Starling	18,493
Song sparrow	14,517	American robin	12,422
Winter wren	5,024	Brown-headed cowbird	9,162
Bewick's wren	3,356	Tree swallow	7,432
Ruby-crowned kinglet	2,241	Yellow warbler	7,430
Downy woodpecker	2,071	Black-capped chickadee	5,958
Varied thrush	1,587	Black-headed grosbeak	5,216
Red crossbill	1,331	Barn swallow	5,062
American robin	1,093		

SEGMENT 3

FALL		SPRING	
Black-capped chickadee	37,960	Yellow-rumped warbler	87,226
Golden-crowned kinglet	31,084	Tree swallow	17,665
Winter wren	18,818	Song sparrow	15,159
Song sparrow	9,240	Black-capped chickadee	14,599
Starling	4,872	American robin	10,881
American robin	4,160	Brown-headed cowbird	6,504
Downy woodpecker	3,034	Starling	5,287
Bewick's wren	2,373	Downy woodpecker	4,514
Ruby-crowned kinglet	2,070	American goldfinch	3,148
Rufous-sided towhee	1,669	Bewick's wren	2,440

WINTER		SUMMER	
Song sparrow	12,117	American robin	14,628
Black-capped chickadee	11,494	Northern oriole	14,157
Golden-crowned kinglet	11,080	Swainson's thrush	12,967
Dark-eyed junco	10,930	American goldfinch	11,625
Winter wren	7,865	Song sparrow	10,278
Downy woodpecker	4,985	Brown-headed cowbird	9,985
Starling	3,670	Black-capped chickadee	8,889
Bewick's wren	3,040	Black-headed grosbeak	7,151
American goldfinch	2,143	Yellow warbler	6,121
		Tree swallow	3,718

TABLE 15: (Continued)

BONNEVILLE RESERVOIR

SEGMENT 4

FALL		SPRING	
Black-capped chickadee	1,122	Yellow-rumped warbler	4,637
Mountain chickadee	812	Violet-green swallow	1,879
Yellow-rumped warbler	647	Golden-crowned kinglet	1,652
Ruby-crowned kinglet	447	House finch	797
Bewick's wren	409	Song sparrow	676
Song sparrow	396	Dark-eyed junco	530
Red crossbill	378	Bewick's wren	487
Red-breasted nuthatch	253	American robin	421
Steller's jay	203	Starling	342
Downy woodpecker	188		

WINTER		SUMMER	
Red crossbill	1,344	Cedar waxwing	880
Black-capped Chickadee	741	Violet-green swallow	839
Pine siskin	660	Cliff swallow	834
Dark-eyed junco	322	American goldfinch	548
Song sparrow	308	Song sparrow	496
Bewick's wren	306	Tree swallow	492
Golden-crowned kinglet	300	Brown-headed cowbird	491
Bushtit	229	Black-capped chickadee	339
Mountain chickadee	219	American robin	331
Steller's jay	205	Yellow warbler	313
Downy woodpecker	166		

THE DALLES RESERVOIR

SEGMENT 5

FALL		SPRING	
American goldfinch	80	Red-winged blackbird	795
Song sparrow	63	Western meadowlark	59
Yellow-rumped warbler	32	Song sparrow	39
Red-winged blackbird	24	Bewick's wren	13
Bewick's wren	13	White-crowned sparrow	12
Rock wren	12		
White-crowned sparrow	10		

TABLE 15: (Continued)

THE DALLES RESERVOIR

SEGMENT 5 (Continued)

WINTER		SUMMER	
Red-winged blackbird	340	Red-winged blackbird	345
Song sparrow	52	Western meadowlark	68
American goldfinch	20	Yellow warbler	63
White-crowned sparrow	12	Song sparrow	29
Black-capped chickadee	11	Bewick's wren	25
		Starling	22

JOHN DAY RESERVOIR

SEGMENT 6

FALL		SPRING	
Yellow-rumped warbler	5,422	Western meadowlark	3,505
Red-winged blackbird	3,503	Red-winged blackbird	2,863
Pine siskin	2,610	White-crowned sparrow	2,242
Western meadowlark	1,509	Savannah sparrow	2,097
American robin	1,497	Water pipit	1,190
White-crowned sparrow	1,068	Long-billed curlew	556
Barn swallow	983	Horned lark	331
Dark-eyed junco	737	Ruby-crowned kinglet	201
Horned lark	346	Common crow	198
Common crow	284		

WINTER		SUMMER	
Horned lark	4,445	Western meadowlark	2,227
White-crowned sparrow	934	Savannah Sparrow	1,484
California quail	699	Brown-headed cowbird	1,039
American goldfinch	644	Wilson's warbler	765
Tree sparrow	430	Warbling vireo	765
Red-winged blackbird	427	Red-winged blackbird	740
Song sparrow	395	Solitary vireo	324
Black-capped chickadee	250	Towsend's warbler	176
Rufous-sided Towhee	119	Lazuli bunting	161

Small Mammals

Small mammals were censused by established trapping procedures, and indices of abundance were determined by habitat, study segment, and season. Observations of tracks, scat, and sign were recorded to supplement intensive sampling.

Distribution and occurrence of small mammals are presented in Table 16. Forest litter and deep, moist soils preferred by shrews and moles accounted for the presence of these species primarily in the coastal study segments and up to The Dalles Dam. Only vagrant shrews were found in suitable habitats inland. Many rodents, aplodontia, marmots, ground squirrels, chipmunks, gophers, jumping mice and kangaroo rats, were primarily associated with upland habitats, forests, rocklands, fields, and meadows. Tree squirrels, deer mice, woodrats, and some voles were found in association with riparian habitats.

TABLE 16: Small Mammals of the Columbia and Snake River wildlife study area. 1/

COMMON NAME/SCIENTIFIC NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Trowbridge shrew/*Sorex trowbridgii*	X	X		X																					
Vagrant shrew/*Sorex vagrans*	X	X	X	X			X									X		X	X	X					X
Dusky shrew/*Sorex obscurus*	X	X	X																						
Pacific water shrew/*Sorex bendirii*	X	X		X																					
Shrew-mole/*Neurotrichus gibbsii*	X		X	X																					
Townsend mole/*Scapanus townsendii*		X	X																						
Pacific mole/*Scapanus orarius*	X			X																					
Aplondontia/*Aplondontia rufa*		X																							
Yellowbelly marmot/*Marmota flaviventris*				X	X	X	X	X				X		X			X	X	X	X	X	X	X	X	X
California ground squirrel/*Spermophilis beecheyi*	X	X	X	X	X	X																			
Townsend ground squirrel/*Spermophilis townsendii*					X																				
Columbian ground squirrel/*Spermophilis columbianus*															X	X	X								
Townsend chipmunk/*Eutamias townsendii*	X	X	X	X										X	X	X									
Yellow pine chipmunk/*Eutamias amoenus*																									
Western gray squirrel/*Sciurus griseus*				X																					
Eastern gray squirrel/*Sciurus carolinensis*			X																						
Eastern fox squirrel/*Sciurus niger*																				X	X				
Red squirrel/*Tamiasciurus hudsonicus*																X						X	X	X	
Chickaree/*Tamiasciurus douglasi*	X	X	X	X																					
Northern flying squirrel/*Glaucomys sabrinus*		X	X	X																					
Northern pocket gopher/*Thomomys talpoides*				X	X	X	X	X	X			X		X	X	X	X	X	X	X	X	X	X	X	X
Great basin pocket/*Perognathus parvus*					X	X	X	X	X	X		X	X	X	X		X			X					X
Ord kangaroo rat/*Dipodomys ordi*						X	X	X	X								X								X
Western harvest mouse/*Reithrodontamys megalotis*	X	X	X	X	X	X	X	X	X		X	X	X	X	X		X	X	X	X	X				X
Deer mouse/*Peromyscus maniculatus*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Forest deer mouse/*Peromyscus oreas*						X	X																		
Bushytail woodrat/*Neotoma cinerea*				X	X	X			X		X			X							X	X	X	X	
Long-tailed vole/*Microtus longicaudus*			X																						
Meadow vole/*Microtus pennyslvanicus*																X									
Montane vole/*Microtus montanus*				X		X	X	X			X	X	X	X				X	X	X					X
Townsend vole/*Microtus townsendii*	X	X	X	X																					
Oregon vole/*Microtus oregoni*	X	X																							
Norway rat/*Rattus norvegicus*		X			X													X	X						
House mouse/*Mus musculus*						X	X	X		X	X		X					X	X	X	X	X			X
Pacific jumping mouse/*Zapus trinotatus*	X	X									X			X											
Pika/*Ochotona princeps*							X																		

1/ Study segments are defined in Table 2.

Bats

Bats were censused by mist netting, shooting, and by collection from day and night roosts. Relative abundance was established for specific observation periods, and seasonal use was noted.

Distribution and occurrence of bats are presented in Table 17. In general, bats were not dependent on riparian vegetation, as most roosted in caves, crevices, or buildings. However, some were found roosting in trees or tree cavities, and most fed over water deriving food from insects produced in riparian communities. Seasonal use occurred mainly in spring, summer, and fall, for those bats which did not migrate south generally hibernated during the cold winter months.

Reptiles and Amphibians

Reptiles and amphibians were inventoried by a timed-search method, including land searches, binocular scans, flush searches, and identification of vocalizations. Night searches of roads and searches of potential breeding areas for eggs, larvae, and breeding adults were used to supplement other methods.

Eight species of salamanders and newts, ten species of frogs and toads, one species of turtle, ten species of lizards, and 15 species of snakes were found (Table 17). As amphibians, salamanders, newts, frogs, spadefoots, toads, and turtles derive their entire livelihood at the water's edge or, at least, require the water's edge as a place to breed. Fluctuation of water levels can severely limit distribution of these species by unwatering their habitat or by dehydrating their spawn.

Lizards and snakes were less dependent on riparian zones, many living primarily in upland habitats. Others utilized riparian zones in seeking food or water and, in some cases like the rattlesnake, in seeking shade during the heat of the day.

Human Use of Wildlife Resources

Human use of wildlife resources was established through field observation during other inventory activities and from the record of State and Federal wildlife management agencies. Hunting was a predominant use category over much of the study area, with such groups as waterfowl, big game, and upland game bearing the brunt of the pressure. Waterfowl were most widely pursued, with major hunting areas identified at Fort Stevens State Park public hunting area near Warrenton, Oregon, Lewis and Clark National Wildlife Refuge, Sauvies Island Wildlife Management Area, Ridgefield National Wildlife Refuge below Portland, and the Washington Shore above Portland. Waterfowl hunting was permitted on Bonneville and The Dalles Reservoirs, but low waterfowl populations contributed to light hunting pressure. Closure of the river to waterfowl hunting from the Celilo, Oregon-Wishram, Washington, area upstream to the Umatilla

TABLE 17: Bats of the Columbia and Snake River wildlife study area. 1/

COMMON NAME/SCIENTIFIC NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Little brown myotis/*Myotis lucifugus*		X	X	X		X							X		X								X	X	X
Yuma myotis/*Myotis yumanensis*		X	X	X												X	X	X	X	X	X	X	X	X	X
Long-legged myotis/*Myotis volans*		X		X												X									
California myotis/*Myotis californicus*				X									-												
Small-footed myotis/*Myotis subulatus*				X	X	X																	X	X	X
Silver-haired bat/*Lasionycteris noctivagans*				X												X						X	X	X	X
Western pipistrel/*Pipistrellus hesperus*				X	X					X				X			X	X	X	X	X	X	X	X	X
Big brown bat/*Eptesicus fuscus*		X	X	X	X	X				X		X	X	X	X	X					X	X	X	X	X
Western big-eared bat/*Plecotus townsendii*		X		X												X									
Pallid bat/*Antrozous pallidus*				X	X	X											X	X	X	X			X	X	X

1/ Study segments are defined in Table 2.

TABLE 18: Reptiles and amphibians of the Columbia and Snake River wildlife study area. 1/

COMMON NAME/SCIENTIFIC NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Northwestern salamander/*Ambystoma gracile*		X																							
Long-toed salamander/*Ambystoma macrodactylum*		X	X	X	X	X										X						X			
Pacific giant salamander/*Dicamptodon ensatus*	X																								
Olympic salamander/*Rhyacotriton olympicus*		X	X	X																					
Rough-skinned newt/*Taricha granulosa*		X	X	X																					
Western red-backed salamander/ *Plethodon vehiculum*	X	X	X	X																					
Larch mountain salamander/*Plethodon larselli*				X																					
Ensatina/*Ensatina eschscholtzi*		X	X	X																					
Tailed frog/*Ascaphus truei*				X																					
Western spadefoot/*Scaphiopus hammondi*								X																	
Great basin spadefoot/*Scaphiopus intermentanus*						X												X	X						
Western toad/*Bufo boreas*			X																		X	X	X	X	X
Woodhouse's toad/*Bufo woodhousei*						X	X	X									X								
Pacific treefrog/*Hyla regilla*	X	X	X	X	X	X		X					X			X		X	X		X	X			
Red-legged frog/*Rana aurora*		X	X	X																					
Spotted frog/*Rana pretiosa*																X		X	X						
Bullfrog/*Rana catesbeiana*		X	X	X		X													X	X	X				X
Western painted turtle/*Chrysemys picta belli*			X			X	X																		
Long nosed leopard lizard/*Crotaphytus wislizenii wislizenni*																									X
Western fence lizard/*Sceloporus occidentalis*			X	X	X						X										X	X	X	X	
Sagebrush lizard/*Sceloporus graciosus*						X	X	X			X	X													
Side-blotched lizard/*Uta stansburiana*						X	X																		
Short-horned lizard/*Phrynosoma douglassi*						X		X																	
Western skink/*Eumeces skiltonianus*				X	X	X						X		X	X	X				X	X		X	X	
Great basin whiptale/*Cnemidophorus tigris tigris*																									X
Southern alligator lizard/*Gerrhonotus multicarianatus*				X	X	X																			
Northern alligator lizard/*Gerrhonotus coeruleus*		X	X	X																					
Rubber boa/*Charina bottae*			X																						

TABLE 18: (Continued)

COMMON NAME/SCIENTIFIC NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Pacific ringneck snake/*Diadophus punctatus ambilis*			X																						
Sharp-tailed snake/*Contia tennuis*				X																					
Western yellow-bellied racer/*Coluber constrictor mormon*				X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X
Striped whipsnake/*Masticophis taeniatus*						X																			
Desert striped whipsnake/*Masticophis taeniatus taeniatus*							X																		
Pacific gopher snake/*Pituophis melanoleucus catenifer*				X	X	X		X	X			X													
Great basin gopher snake/*Pituophis melanoleucus deserticola*							X										X	X	X	X	X	X	X	X	X
Mountain kingsnake/*Lampropeltis zonata*				X																					
Common garter snake/*Thamnophis sirtalis*								X										X	X		X				
Red-spotted garter snake/*Thamnophis sirtalis concinnus*	X	X	X																						
Western terrestrial garter snake/*Thamnophis elegans*																X									
Wandering garter snake/*Thamnophis elegans vagrans*						X	X											X	X		X	X			X
Northwestern garter snake/*Thamnophis ordinoides*	X	X	X	X																					
Western rattlesnake/*Crotalus viridis*				X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X

1/ Study segments are defined in Table 2.

National Wildlife Refuge restricted use. Open areas in the Umatilla National Wildlife Refuge, Willow Creek Wildlife Management Area, and Irrigon Wildlife Management Area supported most of the waterfowl hunting on John Day Reservoir. McNary Reservoir, up to the Hanford Reservation and up to U. S. Highway 12 across the Snake River was open to hunting, except for closures around islands. Public hunting areas, Walla Walla River Wildlife Recreation Area, McNary Wildlife Recreation Area, and McNary National Wildlife Refuge, received most of the hunting pressure. General access areas, Hatrock State Park, the Hover area, and the Ringold area were also popular waterfowl hunting areas. Waterfowl hunting was restricted primarily to Priest Rapids and Wanapum Reservoirs on the upper Columbia River by closures in the Hanford Reach, from Rock Island Dam to the middle of Rocky Reach Reservoir, and where the Colville Indian Reservation bordered Wells, Chief Joseph and Grand Coulee Reservoirs. The lower Snake River, closed to waterfowl hunting for 93 miles from the U. S. Highway 12 bridge to Central Ferry, and in the vicinity of Clarkston, Washington, supported limited waterfowl hunting, as did the area from Lewiston-Clarkston to Brownlee Dam. However, popular hunting areas were found on Brownlee Reservoir, especially around islands at the upper end of the reservoir.

Big game hunting was limited primarily by the loose association of these animals with the river. Black bears were hunted in coastal forest zones in Segment 2 and to a limited extent above Grand Coulee Reservoir. Black-tailed deer may have been hunted below Portland, but success was not dependent on hunting near the river. Mule deer were hunted where permitted in the Umatilla National Wildlife Refuge and in state managed wildlife areas on John Day and McNary Reservoirs. Light hunting pressure was also exerted in the lower and middle Snake River areas, but most hunters travelled the river to gain access to high quality hunting along the canyon walls and rims. Perhaps the closest link between deer hunting and the river occurred above Grand Coulee Dam where, outside closed areas, Whitetail deer were hunted along the watercourse. Roosevelt elk may have been hunted near the study area along the estuary, but the only significant occurrence of elk hunting near the river relates to special permits for harvest of Rocky Mountain elk at West Bar on Wanapum Reservoir. While popular in Hells Canyon and above the Idaho Power Company dams, elk hunting occurs primarily upslope from the river, and often along canyon rims.

Upland game hunting was prominent in many public hunting areas provided for waterfowl hunting where ring-necked pheasant and valley qual were the primary targets. Mourning doves were hunted throughout the study area, and bantailed pigeons were sought below Bonneville Dam, in both cases generally where the birds came to water. Chukars were widely sought from The Dalles Dam inland. Gray partridge were hunted incidental to Chukars, and major areas hunted for these birds included cliffs, talus slopes, and rocklands along both shores of the river up to and including croplands along canyon rims. Heavily hunted areas include steeper areas along The Dalles, John Day, the lower half of McNary Reservoir,

the Snake River above Lower Monumental Dam, and the Columbia River above Priest Rapids Dam. Ruffed grouse reached huntable numbers below Bonneville Dam and above Grand Coulee Dam, as did turkeys.

Hunting was overshadowed by nonconsumptive use of wildlife and appreciation of wildlife habitats, as visitor-day figures for state and Federal wildlife management areas indicate that wildlife observation, wildlands appreciation, nature study, and nature photography account for more days use than hunting. In most cases, the areas from which data was collected were managed in part or totally for public hunting. Other uses include gathering of fruits, mushrooms, nuts, berries, asparagus, and the like, from wildlife areas. Trapping of furbearers was concentrated near the free-flowing river, tributary streams, or where riparian habitats had become re-established. In some areas, nutria and muskrats were shot for pelts or for sport, although this was not common. Bullfrogs were popular locally, and were obtained by hook, gig, or shooting.

Other nonwildlife oriented uses include fishing, swimming, camping, waterskiing, and other forms of outdoor recreation. However, appreciation of wildlife resources is integral to the experience gained in many forms of outdoor recreation, so they are included in the use of wildlife resources as well.

PRELIMINARY EFFECTS OF WATER LEVEL CONTROL

Because individual species of plants and animals are part of complex, interacting ecosystems, predictions of the effects of power peaking on individuals cannot account for all relationships of the species in the ecosystem. Therefore, the objective of the study was to make preliminary assessments upon which further investigations would be based. These assessments were made by identifying plant and animal species occupying the zone of water level fluctuation and by extrapolating present day effects under the assumption that fluctuations will be more numerous and severe in the future for all parts of the study area from Portland, Oregon, to the head of Grand Coulee and Brownlee Reservoirs. It was assumed that tidal effects would nullify any peaking effects below Portland.

WILDLIFE HABITATS EFFECTED BY POWER PEAKING

The study teams assumed that all vegetative types adjacent to the shoreline or within the influence of the fluctuating water levels would be effected. Habitats which would be alternatively inundated and exposed include sand and gravel bars, mud flats, litter zones, rock fill and riprap, aquatic vegetation and root zones, marsh types, reed canarygrass, shrub and tree willows, cottonwoods, and mixtures of willows and other trees. The barren zones would be effected primarily by daily and weekly power peaking fluctuations, and the vegetated zones primarily by seasonal peaking. Whether water level fluctuations would beneficially or detrimentally effect habitats could not be assessed during this study.

However, throughout the impounded portions of the study area, the barrenness of fluctuation zones was noted. For run of the river reservoirs, those with limited seasonal storage capacity, the fluctuation zone was partially or fully covered several times weekly. Aquatic vegetation was found rooted below minimum reservoir level, and riparian vegetation was found growing above maximum reservoir level. For reservoirs with significant storage capacity, John Day, Grand Coulee, and Brownlee Reservoirs, seasonal drawdowns permitted limited growth of annual forbs and grasses in drawdown zones exposed for longer periods of time. However, such growth was not found to be significant to wildlife, and impacts to wildlife habitat were attributed to the riparian zone above maximum pool level.

Effects of water level fluctuation above maximum pool level fall into two categories. The first is the effect of rising and receding water levels on riparian plant communities. While detailed study of the effect of fluctuations on capillary action and resultant plant growth was beyond the scope of this study, comparison of similar riparian habitats under natural and power peaking water level fluctuations revealed significant difference. Louisiana sage and willow communities on the Salmon River extended from the natural low water line to the natural high water line, were composed of large mature plants, and exhibited 50 percent canopy coverage. Similar communities nearby on the Snake River were comprised of a narrow band of young, single stemmed plants near the low water line. While growth was dense, canopy value was only 26 percent, a reduction apparently due to the influence of controlled discharge from Hells Canyon Dam.

The second category of effects from water level fluctuation includes a variety of changes resulting from erosion. Original impoundment of each reservoir inundated vast areas of landforms and soil types unaccustomed to being saturated with water. Wind-wave action and wakes from boats and barges aggravate the erosion problem. Periodic saturation by the rise of reservoir levels and the resultant erosive action of receding reservoir levels may be a major contributor in the continuing erosion after impoundment. An example was provided in which 74 landslides were recorded for Grand Coulee Reservoir in 1967, and 135 were recorded in 1974. If this comparison represents a trend, erosion increases as fluctuations increase, for Grand Coulee Reservoir has been increasingly used for power peaking storage within the past decade. Further examples include the erosion of islands in John Day, McNary, and Ice Harbor Reservoirs, where entire islands have been levelled or significantly reduced in size.

A second significant impact of dams on erosion was noted in Hells Canyon. There it appears that sediments are being trapped by Brownlee, Oxbow, and Hells Canyon Dams, and at the same time, fluctuating water levels are eroding sand bars in Hells Canyon, and they are being transported downstream. The erosion would occur naturally, but entrapment of sediments by dams stops the recruitment of materials to form new sand bars and silt deposits which are the basis of riparian growth.

Deposition of sediments in reservoirs is beneficial to wildlife in some cases. Formation of deltas where tributaries like the Walla Walla River, Yakima River, Palouse River, and others enter contributes a significant area where riparian vegetation can naturally or through management become established. On the other hand, deposition of sediments can be detrimental to wildlife if the result is a land bridge to a nesting or fawning island. This impact was identified at Foundation Island and the Hat Rock Islands in McNary Reservoir.

WILDLIFE EFFECTED BY POWER PEAKING

Water level fluctuations caused by power peaking will have little effect on most big game species. Loss of riparian habitats utilized by mule and black-tailed deer for resting and escape cover would be a negative impact. However, a more significant loss is the erosion of islands used by mule deer for fawning. Islands on John Day Reservoir and the upper end of McNary Reservoir and the Hanford reach provide protection for fawning deer from land based predators. Erosion has reduced the number and size of islands and as safe fawning areas are lost, production will decrease.

Canada geese were found throughout the study area, and resident flocks nested in all segments inland from the coast. Islands were preferred nesting habitat and the value of protection from land based predators was documented. During the critical incubation period (March through mid-April) water levels were dropped to minimum pool level in McNary Reservoir. Land bridges formed to Foundation Island and the Hat Rock Islands. Although no predators reached Foundation Island where over 30 geese nests were located, coyotes destroyed all nests and killed four adult geese on three of the five Hat Rock Islands. Erosion of nesting islands and formation of land bridges from mainland to islands were identified as two significant impacts of water level fluctuation.

Brooding habitats were identified in conjunction with major goose nesting concentrations. Erosion of shorelines inhibits the growth of forbs and grasses and, in many cases, brooding habitats were located in protected inlets and subimpoundments. Where erosion formed steep banks, access from water to brooding habitats, alfalfa or wheat fields adjacent to reservoirs, may have been limited.

Ducks are expected to be similarly, if not as severely impacted. Efficient nest hiders, ducks nest on islands as well as along shorelines. Loss of riparian vegetation reduces the availability of nesting sites. Absence of aquatic growth in fluctuation zones reduces the potential food available to waterfowl, but since most dabbling ducks are able to fly to adjacent croplands to feed, diving ducks are more limited by this factor. Migrant waterfowl resting along the waters edge will find, in some cases, that it is necessary to relocate many times per day as water levels rise and fall.

Upland game relied heavily on riparian habitats for food and cover. Reductions in habitat would reduce populations. Animals seeking water might, at times, have to traverse expanses of mudflat where they would be exposed to predation, and young birds would be susceptible to fatigue and exposure. Extensive erosion like that encountered of Grand Coulee Reservoir would reduce riparian habitats and, considering the magnitude of some of the slides, reduce upland habitats, as well.

Both aquatic and terrestrial furbearers would suffer from losses of riparian habitat. Aquatic furbearers were higher in density and more diverse in species in unimpounded reaches of the river where shoreline vegetation was undisturbed. Where water levels fluctuated, they preferred subimpoundments and tributaries unaffected by fluctuations. Many aquatic furbearers denned near the waters edge and dens equipped with underwater openings were effected by drawdowns. Seasonal drawdown on storage reservoirs undoubtedly accounted for absence of dens, but on run-of-the-river reservoirs, animals compensated for normal drawdowns by extending underwater openings. However, abnormal drawdowns may expose aquatic furbearers to predation by coyotes or bobcat. More likely, the inundation of riparian habitats and the inhibitory effect of water level fluctuations on reestablishment of such habitats will result in long-term limitation of aquatic furbearer populations.

Terrestrial furbearers will suffer from the loss of riparian habitats generally from the loss of prey base produced there. Raccoon and opossum will be most severely affected, followed by striped and spotted skunks and gray and red foxes. Coyote and bobcat, opportunistic feeders, may, at times, benefit from conditions which are adverse to other forms of wildlife, case in point: coyote predation on goose nests and deer fawns.

Of the bires of prey, the bald eagle and osprey were most closely associated with riparian habitats where trees were used for perching. Presence of suitable nesting trees might have encouraged osprey nesting over more of the study area, or more use by eagles. If trees are lost to erosion or the effects of water level fluctuation, these species will be impacted.

Shore birds and wading birds may benefit from the periodic exposure of sand bars and mudfalts. Natural exposure of mudflats in tidal zones provide rich food sources to foraging birds and animals, but no evaluation of the productivity of fluctuation zones exposed by power peaking was undertaken. Conjecture that they are valuable to wading birds is based on observation of use.

Colony nesting gulls and terns were perhaps the most susceptible to direct effects of water level fluctuations. Preferring to nest on the ground at or near the waters edge, disastrous flooding of many nests could occur if reservoir levels rose after nest selection. This was documented on John Day Reservoir and in the Hanford reach where freshets or seasonal runoff increased flows after nesting began. Colony nesting

herons, relying on tree nests, were affected only by limitations in nesting habitat.

Song birds, small mammals, and bats relied on riparian habitats for food and shelter. Effects on these species would relate primarily to the effects of water level fluctuations on the riparian community. These animals occurred in greatest densities in riparian habitats, and formed an important prey base for larger predatory animals. Reductions in prey base would effect other species which may or may not be directly effected by power peaking.

Because the waters edge was the habitat of many amphibian species, unnatural fluctuations create habitats to which they cannot adapt. Distribution of amphibians was limited to a great extent to embayments and sub-impoundments not subject to fluctuation. Nonetheless, where amphibians were found in areas undergoing fluctuation, survival appeared tenuous as eggs were stranded and subjected to dessication. Without protection of breeding areas, the fates of the western toad in Hells Canyon Reservoir, Pacific treefrog and long-toed salamander in John Day Reservoir, Woodhouse's toad, Great Basin spadefoot toad, bullfrog, and western painted turtle in McNary Reservoir seem sealed by power peaking.

The effects of power peaking are numerous and widespread, with the influence on the riparian habitats having the most harmful effects. Loss of riparian zones from inundation by 18 reservoirs severely reduced wildlife populations along the Columbia and Snake Rivers. The effect of fluctuating water levels on plant species and communities inhibits natural replacement of riparian habitats, and erosion caused by fluctuation and wave action preclude reestablishment over vast areas. Where riparian communities remain or have become reestablished, the highest densities and greatest species diversity in wildlife populations were encountered.

EFFECTS OF POWER PEAKING OF HUMAN USE OF WILDLIFE RESOURCES

Fluctuating water levels indirectly impact human use of wildlife resources by reducing or eliminating populations as discussed previously. Direct impacts relate primarily to waterfowl hunting. Low water levels can increase access to hunting areas for hunters who wade, while reducing access for those who use boats. The reverse can also be true and lives have been lost when rising water levels or waves have overcome waders. However, the greatest problem, as documented on McNary Reservoir, occurs when hunters establish blinds, set out decoys, and to their dismay, find their decoys high and dry as water levels recede.

Most impacts to human use of reservoirs, whether for wildlife related use or for other uses, are problems of access. Most boat ramps are designed to operate over the full range of reservoir fluctuation, but sediment deposition can render them partly or entirely useless. Relocation of some ramps and moorage facilities has been necessary in some instances, and maintenance dredging is required to keep many public access points operational.

III CONCLUSIONS AND RECOMMENDATIONS

The three university study teams concurred in the opinion that riparian habitats are very valuable to wildlife populations. They agreed that once lost riparian habitats are slow to become reestablished. The effect of fluctuations on capillary action was identified as a probable factor in inhibiting reestablishment of riparian vegetation, and a need for further study of this effect was identified. Erosion of shorelines by water level fluctuations in conjunction with wind-wave action and boat and barge wakes was blamed for extensive loss of or inhibition of reestablishment of riparian habitats. Areas protected from erosion were recognized for their ability to produce riparian habitat, and recommendations were made for the protection of shorelines from erosion and for artificial reestablishment of riparian vegetation to replace habitats and wildlife populations lost to inundation and subsequent loss to power peaking.

Impacts to species of wildlife included the effect of erosion on deer fawning and goose nesting islands, silt deposition on creating land bridges to goose nesting islands, water level fluctuations on colony nesting bird nests, water level fluctuations on aquatic furbearers, and the effect of water level fluctuations on the habitat and breeding success of amphibians. Recommendations include the protection of fawning and nesting islands from erosion, removal of land bridges by dredging, and operational constraints on pool levels to protect nesting birds. Creation of subimpoundments was recommended as a way of increasing riparian habitat to increase wildlife populations, and as a way of protecting amphibians and aquatic furbearers threatened by water level fluctuations.

RECOMMENDATIONS TO OFFSET THE EFFECTS OF POWER PEAKING

1. Encourage the reestablishment of the riparian vegetation by planting tree and shrub communities.

2. Protect shorelines from erosion, armor the exposed tips of eroding islands, separate subimpoundments from fluctuating reservoirs by constructing dikes.

3. Reslope shorelines to discourage erosion and to encourage reestablishment of natural protection in the form of riparian tree and shrub communities.

4. Create new waterfowl nesting and deer fawning islands or rebuild existing islands with dredged materials.

5. Construct channels between shorelines and islands to eliminate land bridges exposed by water level fluctuations.

RECOMMENDATIONS FOR FURTHER STUDIES OF THE EFFECTS OF POWER PEAKING

1. More intensive evaluation of selected riparian habitats utilizing black and white, color, and infra-red photography to determine seasonal effects of water level fluctuations on habitats was recommended.

2. Studies were recommended to determine the effect of water level fluctuations on capillary action and the subsequent effect of plant species and plant communities in laboratory and field situations. Such studies would determine the best species for use in replacing riparian communities.

3. Further investigations were recommended for the species of wildlife to which impacts from power peaking were identified, i.e., mule deer, waterfowl, colony nesting birds, aquatic furbearers, and amphibians.

4. More intensive studies to determine the numbers of wildlife affected by power peaking were recommended.

5. Comparison of flora and fauna in areas subject to water level fluctuations with areas without fluctuations to determine the effects of power peaking on plant communities and wildlife populations was recommended.

IV SUBSEQUENT ACTIONS RESULTING FROM THE STUDY

As a result of this study, three additional studies are being conducted on the effects of power peaking on wildlife and associated habitats. The Idaho Cooperative Wildlife Research Unit is conducting an inventory of riparian habitats and associated wildlife on the lower Clearwater River and Dworshak Reservoir, a study initiated in 1976 and due to be completed in 1978. As identified in this study, more intensive studies on the effects of power peaking on mule deer, waterfowl, colony nesting birds, and aquatic furbearers are being conducted by the Washington Department of Game in a study also due to be completed in 1978. Additional objectives of this study include the comparison of flora and fauna in areas of fluctuating water levels with paired sample sites without fluctuation, and as assessment of how the expansion of powerhouse capacities at Bonneville Dam, McNary Dam, and Chief Joseph Dam will increase the effects of power peaking on wildlife and wildlife habitats. The third study, due to begin in 1978 will include a long-term assessment in a field laboratory of the effects of water level fluctuation on capillary action and the associated growth of riparian plant species and communities. This study will be conducted by the Waterways Experiment Station of the Corps of Engineers in a field laboratory constructed in the McNary Wildlife Park at Umatilla, Oregon.

Actions due in part to the increased awareness generated by this study and, in part, by the increased awareness which generated this study

are represented in part by some of the following examples. Operational constraints have been instituted to encourage waterfowl to select nest sites from rising water levels on John Day Reservoir, and to avoid the formation of land bridges to islands in McNary Reservoir. Dredged materials have been used to create three nesting islands in the upper ends of McNary and Ice Harbor Reservoirs, and dredging in 1978 will create another island in McNary Reservoir. Dredging to obtain top soil for this island will deepen the channel between the shoreline and Foundation Island, and a land bridge will be eliminated. Wildlife studies in association with the McNary Second Powerhouse include recommendations for creating subimpoundments for fish and wildlife management on McNary Reservoir and in the Umatilla National Wildlife Refuge in John Day Reservoir. In conjunction with construction of a second powerhouse at Rock Island Dam, goose nesting islands have been constructed to offset losses from a pool raise. The Lower Snake River and Fish and Wildlife Compensation Plan includes the development of 38 sites for the replacement of riparian habitats, and over 2.6 million dollars will be spent on tree and shrub plantings, food crop development, irrigation, and fencing to replace habitats lost through inundation by four reservoirs. Operational constraints have been instituted on McNary Reservoir to protect the human use of wildlife resources where, during the waterfowl season, the reservoir is held within the top foot of the operating range on weekends and holidays.

Increased awareness of the plight of wildlife species resulted in the formation of the committee which encouraged the conduct of this study. Since its inception, the Wildlife Working Group has blossomed into the Columbia Basin Wildlife Technical Committee. Membership has expanded to include the Oregon Fish and Wildlife Department, Washington Game Department, Idaho Fish and Game Department, U.S. Fish and Wildlife Service, U. S. Corps of Engineers, U. S. Bureau of Reclamation, Idaho Power Company, Grant County Public Utility District, Chelan County Public Utility District, and Douglas County Public Utility District. Coordinated effort has and will continue to produce solutions to wildlife problems associated with the construction and operation of hydroelectric generating facilities.

APPENDICES

APPENDIX I - Occurrence of and measurement of acreages for habitat types found by study segment in the Columbia and Snake River wildlife study.

CODE[1/]	HABITAT TYPE	STUDY SEGMENT																								
		COLUMBIA RIVER																SNAKE RIVER								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
100	Barren land	P[3/]	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
110	Sand dunes							P	1					1	P	P		P	P	11	P					P
120	Erosion pavement								P	P	P	1	P	P	P	1	P									
130	Rock lands				14				P	L	P	P	16	P	P	P	P									
140	Shorelines, beaches, tideflats, river banks	P	P	P	P	P	P	P	15	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
141	Rock			P	P	P	2	P	1	1	2	1	2	1	1	9	1	P	6	P	P	1	P	8	P	1
141.1	Rock cliffs								2	P	4	P	P	P	2	1	P	26	36	P	32	3	P	24		
141.2	Slides or talus										1		1		2	17			P			P				
141.3	Gravel banks										3	1														
141.4	Talus slopes														P	3	1		7		10	P		P		
141.5	Mixed types					P	P																			
141.51	Rock/grassland					479	1787																			
141.52	Rock/rabbitbrush						165																			
142	Gravel		P	P	P	P	30	99	7	6	16	1	3	41	6	16		P	150	15	17		1			
142.1	Cobble												7			3				1						
142.2	Mixed types					P	P																			
142.21	Gravel/herbaceous types					123	370																			
142.22	Gravel/rabbitbrush						50																			
143	Sand	544	P	P	P	P	865		114	P	10	4	13	5	25	521	22	P			P	P	P			
143.1	Sand bars								1	3				27		10	4	P			3	P	2			
143.2	Sand banks																	1				68	7			
143.3	Mixed types				P	P	P								P		P						P			
143.31	Sand/gravel				13	16																	1			
143.32	Sand/herbaceous types						45																			
144	Mud		P	P			95	P	1							1					P					
144.1	Mud flats							2																		
145	Shell																									
146	Coral																									
147	Road fill							3										128	108	114	11			152	10	45
148	Rock riprap	10		P	P	P	3	172	P	P	1	1	4	1	1	1		265	182	53	31		P			P
148.1	Rock riprap/grassland					14																				
148.2	Rock ripra/shrub steppe					12																				
149	Undifferentiated classes														P		P									
149.1	Seepage														1											
150	Bare ground							37	P	P	P	P	P	13	P		P	24	25	31	P					
160	Litter												P				P									
200	Water resources	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
210	Ponds, lakes, reservoirs	31	P	P	P			P	P	P	P	P	P	P	P	P	P	P	P	P	P		P	P		P
211	Ponds	14						P	P	P	P		P		P	P	P		P		P		P			
212	Lakes								P		P	P	P				P									
213	Reservoirs							P	P					P			P	P	P	P	P		P	P	P	P

APPENDIX I (Continued)

CODE[1/]	HABITAT TYPE	STUDY SEGMENT																								
		COLUMBIA RIVER																SNAKE RIVER								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
214	Embayments connected to reservoirs				P			P	P	P			P	P			P	P	P	P	P		P			P
220	Water courses			P				P	P	P	P	P	P	P	P	P	P				P	P	P			
221	Rivers							P	P	P		P	P	P		P	P				P	P	P			
222	Creeks								P	P	P	P			P	P	P									
223	Canals and ditches									P						P										
224	Sloughs			P				8	P			P										4				
300	Natural vegetation	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
310	Herbaceous plants		120	139	180	164	668	P	P			P	P	P		P	P	P	P	P	P	P	P	P	P	P
311	Lichens, cryptograms, and related communities								P																	
312	Forb types			P		P		102	6									1	120	349	262					174
312.1	Annual forb types																									
312.11	Mullein																									
312.12	Russian thistle																									
312.2	Perennial forb types																									
312.21	Balsamroot							P																		
312.22	Biscuit root																									
312.23	Clover																									
312.24	Goldenrod																									
312.25	Dock																									
312.26	Peppergrass																									
312.3	Either annual or perennial forb types																									
312.31	Smartweed																									
312.32	Daisy																									
312.4	Mixed types					P																				
312.41	Herbaceous types/marsh					21																				
312.42	Herbaceous types/grassland					39																				
313	Annual forbs							P								P	P	P	P	P	P	P	P	P	P	
313.1	Louisanna sagebrush							P														P	P			
313.2	White sweet clover																					58	47	P		
313.3	Absinthe							136																34		
313.4	Lupine							50																		
313.5	Northern buckwheat							73																		
313.6	Horsetail																	1							2	
314	Grassland	558	1592	2845	742	964	1605	P	6	P	5	9	22	2	11	28	3	P	P	P	P	P	P	P	P	P
314.1	Reed canarygrass		P	P																						
314.2	Cheatgrass brome				P			118											P	211	14	8	P	21	4	P
314.3	Sandberg bluegrass																									
314.4	Bluebunch wheatgrass																			9						
314.5	Crested wheatgrass							P												105						
314.6	Bulbous bluegrass																									

APPENDIX I (Continued)

CODE[1/]	HABITAT TYPE	STUDY SEGMENT																								
		COLUMBIA RIVER																SNAKE RIVER								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
314.7	Others	P						P											P	P			P			P
314.71	Unidentified cheatgrass																									
314.72	Unidentified bluegrass																		P							
314.73	Wildrye																		17	1						14
314.74	Medusahead wildrye																						P			P
314.75	Reedgrass							9															2			
314.76	Thickspike wheatgrass							110																		
314.77	Beachgrass	898																								
314.8	Two species mixtures																	P	P	P	P	P	P	P	P	P
314.81	Cheatgrass/Sandberg bluegrass																									
314.82	Cheatgrass/bluebunch wheatgrass																									
314.83	Cheatgrass/bulbous bluegrass																									
314.84	Bluebunch wheatgrass/ Sandberg bluegrass																	41	1	2	2	2	P	50	P	4
314.85	Bluebunch wheatgrass/ crested wheatgrass																									
314.86	Cheatgrass/crested wheatgrass																									
314.87	Cheatgrass/needlegrass																									
314.88	Mixed types						P																			
314.881	Grassland/rabbitbrush						1488																			
314.882	Grassland/sagebrush						209																			
314.9	Three species mixtures																									
314.91	Cheatgrass/sandberg bluegrass/bluebunch wheatgrass																									
314.92	Cheatgrass/Sandberg bluegrass annual fesque																									
314.93	Cheatgrass/Sandberg bluegrass/Idaho fesque																									
314.94	Cheatgrass/Sandberg bluegrass/ bulbous bluegrass																									
314.95	Cheatgrass/Sandberg bluegrass/needlegrass																									
314.96	Cheatgrass/bluebunch wheatgrass/annual fesque																									
314.97	Bluebunch wheatgrass/Sandberg bluegrass/Idaho fesque																									

APPENDIX I (Continued)

CODE[1/]	HABITAT TYPE	STUDY SEGMENT																								
		COLUMBIA RIVER																SNAKE RIVER								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
314.98	Bluebunch wheatgrass/ Sandberg bluegrass/ wildrye																									
314.99	Others																									
315	Meadows	P			P	P	113		P			P	P	P		P	P						P			
315.1	Sedge	6							1														P			
315.2	Rush					3																				
315.3	Grass				11		8		P			P	P			P	P									
315.4	Horsetail																									
315.5	Mixed types						P																			
315.51	Grass meadow/ rabbitbrush						240																			
316	Marshes	33	P	222	4	18	109	P	P					P		P		P	P	P						P
316.1	Cattail				4	2	32	128	P					21		P		11	32	2						3
316.11	Cattail/bulrush																									
316.12	Cattail/sedge							P										P	31							
316.13	Cattail/grass						119																			
316.14	Cattail/herbaceous types						18																			
316.2	Bulrush							16																		
316.3	Sedge			6			14		P											4						
316.31	Sedge/grass						42																			
316.4	Grass		P	125	11				1																	
316.5	Tidal marsh	1067	6580																							
316.51	"High" marsh (sedge/ grass)	116																								
316.52	"Low" marsh (bulrush)																									
316.6	Mixed types						P																			
316.61	Marsh/sagebrush						42																			
317	Swamps																									
318	Aquatic vegetation					13																				
319	Undifferentiated complexes of herbaceous types								P																	
320	Shrub types	11	20	P	P	2	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
325	Shrub steppe					2	201	P	39	63	273	3	5	20	11	3	P	P	P	P	P	P	P	P	P	P
325.1	Sagebrush					5	1067	P			12		7		37	1			P							P
325.11	Big sagebrush							53											1							2
325.12	Three-tip sagebrush																									
325.2	Rabbitbrush					239	9919	P								1	P	P	1	P	P	P				P
325.21	Gray rabbitbrush							489										1972	279	144	5	15				P
325.22	Green rabbitbrush																									
325.23	Mixed gray and green rabbitbrush							P																		

APPENDIX I (Continued)

CODE[1/]	HABITAT TYPE	STUDY SEGMENT																								
		COLUMBIA RIVER																SNAKE RIVER								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
325.24	Mixed types																									
325.241	Rabbitbrush/herbaceaous types					15																				
325.242	Rabbitbrush/grassland					195																				
325.243	Rabbitbrush/meadow						20																			
325.3	Bitterbrush						925	P		5	1		25		P	P	P	P						P	P	P
325.31	Antelope bitterbrush																									
325.4	Mountain mohagony																				P		15	25	P	P
325.6	Ceanothus																					P				
325.7	Others																			P	P	P	P	P	P	P
325.71	Greasewood																									
325.72	Douglas hackberry																			8	8	332	590	22	30	P
325.8	Two species mixtures					29	P	P					P		P	P		P						P	P	P
325.81	Gray rabbitbrush/big sagebrush						2879								1											
325.82	Gray rabbitbrush/antelope bitterbrush					6	629																			
325.83	Gray rabbitbrush/buckwheat																									
325.84	Big sagebrush/antelope bitterbrush					19	98	43					1			1										
325.85	Big sagebrush/bluebunch wheatgrass																	P								
325.86	Antelope bitterbrush/buckwheat																									P
325.87	Antelope bitterbrush/bluebunch wheatgrass																	33						6	P	P
325.9	Three species mixtures						P																			
325.91	Gray rabbitbrush/green rabbitbrush/big sagebrush																									
325.92	Gray rabbitbrush/green rabbitbrush/antelope bitterbrush																									
325.93	Gray rabbitbrush/green rabbitbrush/buckwheat																									
325.94	Gray rabbitbrush/big sagebrush/antelope bitterbrush						37																			
325.95	Three type mixtures						P																			
325.951	Rabbitbrush/bitterbrush/grassland						222																			
327	Macrophyllous shrub and vine types	P	P	P	P	P	P	P	1	P	1	3	1	P	1	6	6	P	P	P	P	P	P	P	P	P
327.1	Shrub willow	121	2542	702	40	124	19	568										19	1		4	360	1	2	3	167

APPENDIX I (Continued)

CODE[1/]	HABITAT TYPE	STUDY SEGMENT																								
		COLUMBIA RIVER																SNAKE RIVER								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
327.2	Blackberry			62	29																	4		1	1	
327.3	Rose										1			P												
327.4	Sumac																				24		3			P
327.5	Hawthorn														1		1				1	1		P		
327.6	Wildcherry															P							P	20		P
327.7	Snowberry																									
327.8	Elderberry															1								3	6	
327.9	Others										P	P	P		P	P	P			P	P		P			
327.91	Ninebark																									
327.92	Serviceberry										1		P			1	1			2	p		242			
327.93	Poison oak																									
327.94	Dogwood																1									
327.95	Mixed types										P	P	P		P	P										
327.951	Shrub/herbaceous types										3	1	81		2	1										
328.	Two and three species shrub mixtures													P	P	P										
328.1	Hawthorn/serviceberry													1		1										
328.2	Snowberry/serviceberry														1											
328.3	Big sagebrush/serviceberry/ elderberry																									
329	Heterogeneous shrub mixtures												1		1	1	P				16					
330	Savanna-like types				P				P		P	P	P	P	P	P	P									
331	Shrub/grass												P													
332	Broadleaf tree over herb layer				62				1		18		9			P	1									
333	Coniferous tree over herb layer				2								2		6	39	2									
334	Mixed broadleaf and coniferous tree over herb layer				25											1	P									
335	Broadleaf tree over shrub layer											P	5	P	1	6	1									
336	Coniferous tree over shrub layer										1	2	1	P	15	17	3									
337	Mixed broadleaf and coniferous tree over shrub layer												1		P	22	P									
340	Forest and woodland types	P	P	P	P	P	59	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
341	Coniferous forests		P	P	1		4		P				P	P		P	P									
341.1	Sitka spruce		256						P																	
341.2	Western redcedar																									
341.3	Douglas fir		55	28	118											1	P									

APPENDIX I (Continued)

CODE[1/]	HABITAT TYPE	STUDY SEGMENT																								
		COLUMBIA RIVER																SNAKE RIVER								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
341.4	Ponderosa pine				10								1	1	6	99	5									
341.5	Grand fir																									
341.6	Two species mixtures												P			P	P									
341.61	Sitka spruce/western redcedar																									
341.62	Sitka spruce/douglas fir																									
341.63	Western redcedar/ douglas fir																									
341.64	Douglas fir/Ponderosa pine												P			67	P									
341.65	Ponderosa pine/western juniper																3									
341.7	Three species mixtures																P									
341.71	Sitka spruce/western redcedar/Douglas fir																P									
341.8	Lodgepole pine		3														P									
341.9	Western juniper								1	1				P		13	3									
341.10	Larch															1										
342	Broadleaf forests	P	P	P	2	3	6	P	P	P	P	2	1	P	P	1	P	P		P	P	P	P	P		P
342.1	Tree willow	P	P	P	7			P	9	9	15	37	21	5	1	1										22
342.11	Small trees	36	506	300	140	24	8		1	40																
342.12	Large trees	37	1095	974	252	36	3																			
342.13	Dead snags present																									
342.14	Mixed types						P																			
342.141	Willow/cattail marsh						6																			
342.2	Poplars		P	P	P	P	P	P	P			P	P	P			P				P					
342.21	Cottonwood		66	P	P	P	P	28	P			2	2	P			10				P					
342.211	Small trees			6		2								P												
342.212	Large trees		1424	4016	59		28																			
342.213	Dead snags present																									
342.22	White poplar					15																				
342.23	Lombardi poplar										1		P	P												
342.24	Aspen															1	1									
342.3	Oak			70	229																					
342.4	Ash		46	101	P					P			P													
342.5	Maple				6																					
342.6	Alder	494	84		15	3		9	P								P	22			2	1	1	9	P	P
342.7	Other broadleaf trees					P	P	P	P	P					P	P	P	P	P	P	P					
342.71	Russian olive					P	217	25	P	P					P	P	P	1	P	P	P					
342.72	Birch																									
342.721	Paper birch																									
342.722	Water birch															3										
342.73	Locust					5	40	4	1	1					2				11	P						
342.74	Tree-of-Heaven					4	3																			

APPENDIX I (Continued)

CODE[1/]	HABITAT TYPE	STUDY SEGMENT																								
		COLUMBIA RIVER																SNAKE RIVER								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
342.75	Mulberry																									
342.76	Elm					11																				
342.8	Two species mixtures of broadleaf trees	P	P	P	P	P	P	P	P			P	1	P		1	1				P	P				P
342.81	Willow/cottonwood		29	P	P		P	89			4	34	46				P	16								P
342.811	Small trees			9	16		270																			
342.812	Large trees		1931	1492	9		15																			
342.813	Dead snags present																									
342.82	Willow/ash		338	386	17																					
342.83	Willow/alder	193	78			2																				
342.84	Cottonwood/oak			36										P												
342.85	Cottonwood/ash		333	882	7																					
342.86	Oak/ash			2	17																					
342.87	Oak/maple		3										1													
342.88	Maple/alder			32	20																					
342.89	Other two species mixtures			P		P		P	P	P	P	P		P							P	P				
342.891	Russian olive/willow							P																		
342.892	Mulberry/willow																				2	45				
342.893	Locust/tree-of-Heaven						11																			
342.894	Undifferentiated two species mixtures			P					P	P	P	1		1												
342.9	Three species mixtures of broadleaf trees		P	P	P			P			P	P													P	P
342.91	Willow/cottonwood/ash		115	1109	14			P			1	P														
342.92	Willow/cottonwood/oak																									
342.93	Willow/ash/oak																									
342.94	Cottonwood/oak/ash			102																						
342.95	Cottonwood/ash/maple				3																					
342.96	Oak/ash/maple			P																						
342.97	Willow/cottonwood/Russian olive							1276																	1	1
342.98	Undifferentiated mixtures of broadleaf trees		74			6						P			P	P				P	P	P	P	P	P	P
342.981	Deciduous tributary vegetation																			11	5	26	3	4	P	P
342.982	Four species mixtures of broadleaf trees																1									
343	Conifer-broadleaf mixed forests	P	P	P	P								P			1	P						P			
343.1	Two species mixtures	P	P	P	P											2	2									
343.11	Oak/Douglas fir		23	4	87																					

APPENDIX I (Continued)

CODE[1/]	HABITAT TYPE	STUDY SEGMENT																								
		COLUMBIA RIVER																SNAKE RIVER								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
343.12	Oak/Ponderosa pine				473																					
343.13	Ash/Douglas fir																									
343.14	Maple/Douglas fir		220	550	280																					
343.15	Alder/Sitka spruce	214	10																							
343.16	Alder/western redcedar																									
343.17	Alder/Douglas fir		200		P																					
343.18	Cottonwood/Sitka spruce		125																							
343.19	Undifferentiated two species mixtures			32																						
343.2	Three species mixtures (1 conifer/2 broadleaf speces		345	P	P													P								
343.21	Ponderosa/pine/oak/maple				11																					
343.22	Douglas fir/oak/maple		34	P																						
343.23	Douglas fir/oak/ash																									
343.24	Douglas fir/alder/maple		256		P																					
343.25	Douglas fir/ash/maple			50	19																					
343.26	Sitka spruce/cottonwood/ maple																									
343.27	Sitka spruce/alder/maple																									
343.28	Western redcedar/alder/ maple																									
343.29	Ponderosa pine/birch/ cottonwood																	1								
343.3	Three species mixtures (2 conifer/1 broadleaf species	P	P		P											P	1	1								
343.31	Ponderosa pine/Douglas fir/oak				46																					
343.32	Ponderosa pine/Douglas fir/maple																									
343.33	Douglas fir/Sitka spruce/ maple																									
343.34	Douglas fir/Sitka spruce/ alder	229																								
343.35	Douglas fir/western redcedar/maple		13																							
343.46	Douglas fir/western redcedar/alder		62																							
343.47	Sitka spruce/western redcedar/cottonwood																									
343.38	Sitka spruce/western redcedar/alder	7																								

APPENDIX I (Continued)

CODE[1/]	HABITAT TYPE	STUDY SEGMENT																								
		COLUMBIA RIVER																SNAKE RIVER								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
343.39	Other three species mixtures															P	P									
343.391	Sitka spruce/western redcedar/maple																									
343.392	Undifferentiated three species mixtures															2	P									
343.4	Four species mixtures			P	P								P			1	P									
343.41	Sitka spruce/western redcedar/cottonwood/alder		1082																							
343.5	Conifer-shrub mixtures																					P	P	P		
343.51	Ponderosa pine/Douglas hackberry																					5	49	20		
343.52	Ponderosa pine/elderberry																						P	16		
343.6	Conifer-grass mixtures																						P	P	P	
343.61	Ponderosa pine/bluebunch wheatgrass																						P	P	5	
500	Agricultural land forms	P	P	P	P	137	P	P	P	P	P	P	P	2	P	P	P	P	P	P	P	P	P	P	P	P
510	Field crops				121	8	2364	118	P	1	1	P	1		372	2	1	P		P	P		P			78
520	Vegetable truck gardens												P		P											
530	Tree, shrub, and vine crops				36	21	23		1	2	44	1	1	8	1	P	P									
530.1	Windbreaks around orchards												P													
531	Beehives																									
540	Pasture	423	P	771	224	537	3		P	2			P			P	P		P	124	P	81	P	20	4	25
541	Forested pasture																									
542	Mixed types																									
542.1	Pasture/field crops						23																			
560	Idle lands								1	P	P	P	31	1	1	5	P					P				
570	Agricultural production facilities							P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P		P	P
571	Feedlots													P								10			P	
572	Agricultural buildings							32	P	P	P	P	P	1	P	P	P	8	7	47	P	13	6		P	7
600	Urban developments and resource extraction	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
610	Residential areas and summer homes	508		P	444	99	610	P	P	1	17	1	3	2	P	1	P				P	3	P	5	3	1
620	Urban idle lands	10									23	P	P			2	P									
630	Business district							171					P	P												
640	Industrial area	280	P	P	740	81	97	122	4	2	10	4	P	3	1	2	P				4					
650	Transportation, communications, and utilities	P			P			P	P		2	P	P	P	P	1	P			P	P			P	P	
651	Railroads												P	P			P			P						
652	Roads									P		P	P	P	P	P	P			P				P		
654	Airports	90			10									P		P				P				P		

APPENDIX I (Continued)

CODE[1/]	HABITAT TYPE	STUDY SEGMENT																								
		COLUMBIA RIVER																SNAKE RIVER								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
656	Power facilities and dams							29	P	1								12	16	25	1		1	24	45	18
660	Resource extraction				2	2	P							P	P	P	P									
661	Sand and gravel pits				P		24							P	1	P	P									
662	Mines and mine waste areas																						4			
663	Fish hatchery																						3			
670	Open space and recreation facilities	P		P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
671	Developed parks or campgrounds	51		P	43	57	75	442	P	1		P	10	P	P	P	P	87	41	104	13			24	6	85
672	Undeveloped parks or campgrounds									P						1	P			P						
673	Public access areas, boat ramps							25			6					1	P	1	17	2	66	8	2		6	
674	Marinas							14											11	3	53	1	P			
674.1	Commercial outfitters																						2			

FOOTNOTES:

1. Because this table is a compilation of three similar but different classification systems used by the three universities, the code more or less follows each of the three, but cannot be directly applied to any. Therefore, when reviewing the aerial mosaics of each of the university's reports, the code accompanying the aerial mosaics should be used.

2. Study segments are defined in Table 2, page 6.

3. "P" is used to indicate the presence of a habitat type or subtype where habitats were listed but acreages were not determined.

APPENDIX II - Plants of the Columbia and Snake River wildlife study area. 1/

SCIENTIFIC NAME/COMMON NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
GRASSES																									
Agropyron caninum/Bearded wheatgrass			X	X	X																				
Agropyron cristatum/Fairway crested wheatgrass			X												X			X	X						
Agropyron dasystachyum/Thickspike wheatgrass					X	X																			X
Agropyron intermedium/Intermediate wheatgrass																		X	X						
Agropyron repens/Quackgrass							X	X	X	X	X	X	X	X		X		X	X		X				
Agropyron smithii/Bluestem wheatgrass							X																		
Agropyron spicatum/Bluebunch wheatgrass				X	X	X		X		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
Agrostis alba/Redtop	X	X	X	X		X									X	X		X	X						
Agrostis interrupta/Interrupted apera																					X				
Agrostic spica-venti/Bentgrass														X											
Aira elegans/Diffuse hairgrass	X			X																					
Aira praecox/Early hairgrass	X	X		X																					
Alopecurus aequalis/Little meadow-foxtail		X																							
Ammophila arenaria/Beachgrass	X																								
Aristida longiseta/Red threeawn			X	X																	X	X			
Avena fatua/Wild oat				X																					
Beckmannia syzigachne/Sloughgrass		X																							
Bromus brizaeformis/Rattlesnake brome															X					X	X	X	X	X	X
Bromus inermis/Smooth brome														X	X										
Bromus japonicus/Japanese brome														X	X	X		X	X	X	X	X	X	X	X
Bromus mollis/Soft brome	X		X	X	X	X														X		X	X	X	X
Bromus rigidus/Ripgut brome				X	X	X												X	X						
Bromus sterilis/Barren brome																					X	X	X	X	
Bromus tectorum/Cheatgrass brome		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Bromus vulgaris/Narrow-flowered brome				X																					
Calamagrostis rubescens/Pinegrass																X									
Cenchrus longispinus/Bur-grass						X																			
Cyperus erythrorhizos/Cyperus						X																			
Dactylis glomerata/Orchard-grass						X							X												
Danthonia spicata/Poverty oatgrass																X									
Deschampsia cespitosa/Tufted hairgrass	X	X																							
Distichlis stricta/Alkali saltgrass																		X	X						X
Echinochloa crusgalli/Watergrass																									
Elymus cinereus/Giant wildrye				X		X		X						X		X						X	X	X	X
Elymus glaucus/Blue wildrye																X							X	X	
Elymus triticoides/Creeping wildrye				X																					X

APPENDIX II - (Continued)

SCIENTIFIC NAME/COMMON NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
GRASSES (Continued)																									
Eragrostis cilianensis/Stinkgrass																							X	X	
Eragrostis hypnoides/Teal lovegrass																					X				
Eriophorum scheuchzeri/Scheuchzer's cotton grass					X																	.			
Festuca arundinacea/Reed fescue							X																		
Festuca bromoides/Six-week fescue	X			X	X	X															X				
Festuca idahoensis/Idaho fescue					X	X								X	X			X	X			X	X	X	
Festuca microstachys/Nuttall's fescue				X		X		X	X	X															
Festuca myuros/Rattail fescue																		X	X			X	X	X	X
Festuca occidentalis/Western fescue															X	X									
Festuca octoflora/Barren fescue																				X	X	X			X
Festuca pratensis/English fescue																		X	X						
Festuca rubra/Red fescue																						X			
Festuca scabrella/Rough fescue																									X
Glyceria striata/Fowl mannagrass		X																							
Holcus mollis/Velvet-grass																									
Hordeum spp./Barley				X																					
Hordeum geniculatum/Mediterranean barley			X			X																			
Hordeum jubatum/Foxtail barley		X				X											X	X	X		X		X	X	X
Hordeum murinum/Mouse barley																		X	X						
Koeleria cristata/Prairie junegrass				X					X					X	X	X									
Leersia oryzoides/Cutgrass	X	X				X																			
Lepidium perfoliatum/Clasping peppergrass						X																			
Leptochloa fascicularis/Loose-flowered sprangletop						X																			
Lolium perenne/Perennial ryegrass		X	X														X								
Oryzopsis hymenoides/Indian ricegrass					X	X		X	X	X		X	X	X			X								
Panicum capillare/Old-witchgrass		X																							
Panicum scribnerianum/Scribner panicum																		X	X		X	X	X	X	
Paspalum distichum/Knotgrass																									
Phalaris arundinacea/Reed canarygrass		X	X	X	X		X		X		X		X			X	X	X	X			X			
Phleum pratense/Timothy																X						X			
Phragmites communis/Common reed	X																								
Poa bulbosa/Bulbous bluegrass				X		X						X			X							X	X	X	X
Poa compressa/Canada bluegrass				X					X				X	X		X									
Poa gracillima/Slender bluegrass																						X	X	X	
Poa howellii/Howell's bluegrass							X																		
Poa juncifolia/Alkali bluegrass									X						X										
Poa macrantha/Seashore brome	X																								
Poa nevadensis/Nevada bluegrass							X															X			

APPENDIX II - (Continued)

SCIENTIFIC NAME/COMMON NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
GRASSES (Continued)																									
Poa palustris/Fowl bluegrass																									X
Poa pratensis/Kentucky bluegrass	X	X	X	X		X											X						X	X	
Poa sandbergii/Sandberg's bluegrass				X	X	X	X	X	X	X		X	X	X	X		X	X	X	X	X	X	X	X	X
Poa scabrella/Pine bluegrass			X	X	X																				
Poa trivialis/Roughstalk bluegrass																							X	X	
Polypogon monspeliensis/Rabbitfoot polypogon						X	X											X	X						
Puccinellia pumila/Dwarf Alkaligrass		X																							
Secale cereale/Rye																					X	X			
Sitanion hystrix/Bottlebrush squirreltail				X	X	X																			
Sparganium emersum/Simplestem bur-reed		X																							
Spartina pectinata/Prairie cordgrass																					X	X			
Sporobolus cryptandrus/Sand dropseed																		X	X		X	X			
Stipa comata/Needle-and-thread					X	X		X		X		X	X	X	X	X	X								
Stipa occidentalis/Western needlegrass				X																					
Stipa richardsoni/Richardson needlegrass														X	X	X									
Stipa spartea/Porcupine grass																X									
Stipa viridula/Green needlegrass															X										
Taeniatherum asperum/Medusahead wildrye																							X	X	X
Triglochin maritimum/Seaside arrow-grass	X																								
Triticum aestivum/Wheat						X																			
Zostera marina/Eelgrass	X																								
GRASSLIKE PLANTS																									
Carex spp./Sedge	X	X	X	X		X	X		X				X				X					X			X
Carex arcta/Northern clustered sedge			X																						
Carex aquatilis/Water sedge			X																						
Carex flava/Yellow sedge			X																						
Carex geyeri/Elk sedge				X												X									
Carex hoodii/Hood's sedge						X																			
Carex lyngbyei/Lyngby's sedge	X	X																							
Carex obnupta/Slough sedge	X	X																							
Carex oederi/Green sedge		X	X															X	X						
Carex raynoldsii/Raynold's sedge																	X								
Carex siccata/Silvertop sedge																							X	X	
Carex stipata/Sawbeak sedge		X																							
Dulichium ovata/Ovoid sedge				X																					

APPENDIX II - (Continued)

SCIENTIFIC NAME/COMMON NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
GRASSLIKE PLANTS (Continued)																									
Eleocharis spp./Spike-rush			X		X																				
Elocharis bella/Delicate sedge						X																			
Eleocharis palustris/Common spike-rush						X											X	X	X				X	X	
Elocharis parvula/Small spike-rush	X																								
Elocharis rostellata/Beaked spike-rush	X	X																							
Juncus spp./Rush	X			X																					
Juncus acuminatus/Tapered rush																									
Juncus articulatus/Jointed rush						X																			
Juncus balticus/Baltic rush						X			X					X											
Juncus brachyphyllus/Short-leaf rush																							X	X	
Juncus bufonius/Toad rush		X				X																			
Juncus effusus/Common rush		X																							
Juncus filiformis/Thread rush	X	X				X																			
Juncus lesueurii/Salt rush	X																								
Juncus nevadensis/Sierra rush																									
Juncus oxymeris/Pointed rush		X																							
Juncus supiniformis/Spreading rush		X																							
Juncus tenuis/Slender rush						X																			
Juncus torreyi/Torry's rush						X																			
Scirpus acutus/Tule bulrush		X				X	X			X			X					X	X						
Scirpus americanus/American bulrush	X	X					X										X								X
Scirpus maritimus/Seacoast bulrush		X																							
Scirpus microcarpus/Small-fruited bulrush		X				X																			
Scirpus validus/Softstem bulrush		X				X												X	X						
FORBS																									
Abronia latifolia/Yellow sandverbena	X																								
Achillea millefolium/Yarrow	X			X	X	X		X				X	X	X	X	X	X	X	X	X	X	X	X	X	X
Achlys triphylla/Vanillaleaf				X																					
Actaea rubra/Western red baneberry	X																								
Adiantum pedatum/Northern maidenhair		X	X	X																					
Agastache urticifolia/Nettleleaf gianthyssop																									
Agoseris ssp./Mountain dandylion						X				X				X	X										
Agoseris glauca/Pale agoseris				X																					
Agoseris heterophylla/False-dandylion	X	X	X																						
Alisma plantago-aquatica/American waterplantain		X				X																			
Allium spp./Wild onion																						X			
Allium acuminatum/Tapertip onion																							X	X	
Allium amplectens/Slim-leaf onion				X																					

APPENDIX II (Continued)

SCIENTIFIC NAME/COMMON NAME	STUDY SEGMENT: COLUMBIA RIVER 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	SNAKE RIVER 17	18	19	20	21	22	23	24	25
FORBS (Continued)																									
Allium bisceptrum/Palmer onion																									X
Allium cernuum/Nodding onion														X		X									
Allium schoenoprasum/Chives				X																					
Allium textile/Textile onion																									X
Alyssum alyssoides/Pale alyssum																						X			
Ambrosia acanthicarpa/Bur ragweed																		X	X						
Ambrosia artemisifolia/Common ragweed							X																		
Amsinckia lycopsoides/Tarweed fiddleneck				X	X	X	X											X	X	X	X	X			X
Amsinckia menziesii/Menzies fiddleneck							X															X	X	X	X
Amsinckia retrorsa/Rigid fiddleneck							X																		
Amsinckia tessellata/Tessellate fiddleneck																	X								X
Anaphalis margaritcea/Pearly-everlasting			X	X	X																				
Anemone piperi/Piper anemone																							X	X	X
Angelica lucida/Seacoast angelica	X	X																							
Antennaria rosea/Rose pussytoes														X	X	X									
Anthemis cotula/Mayweed chamomile		X																							
Anthriscus scandicina/Bur chervil																		X	X						X
Apocynum androsaemifolium/Spreading dogbane																X							X	X	
Apocynum cannabinum/Hemp dogbane																	X				X	X	X	X	X
Apocynum sibiricum/Indian hemp				X	X																				
Arctium minus/Common burdock																									X
Arenaria serpyllifolia/Thymeleaf sandwort																				X	X	X	X	X	
Arnica cordifolia/Heart-leaved arnica				X																					
Artemisia lindleyana/Columbia River mugwort									X																
Artemisia ludoviciana/Louisiana sagebrush				X																	X	X	X	X	X
Asclepias fascicularis/Mexican milkweed				X	X																	X			X
Asclepias speciosa/Showy milkweed						X	X	X			X							X	X		X	X	X	X	X
Asparagus officinalis/Garden asparagus						X	X				X		X			X									X
Asperugo procumbens/Catchweed																							X	X	
Aster spp./Aster												X	X	X	X										
Aster chilensis/Hall's aster		X																							
Aster modestus/Great northern aster	X	X		X	X	X																			
Aster subspicatus/Douglas' aster		X																							

APPENDIX II (Continued)

SCIENTIFIC NAME/COMMON NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
FORBS (Continued)																									
Astragalus spp./Milkvetch						X								X	X		X				X				
Astragalus cusickii/Cusick's milkvetch																						X			
Astragalus howellii/Howell's milkvetch						X																			
Astragalus inflexus/Hairy milkvetch																		X	X		X	X			
Astragalus purshii/Pursh locoweed																							X	X	X
Astragalus spaldingii/Spalding's milkvetch																		X	X						
Athtrium felix-femina/Lady fern			X																						
Balsamhorhiza sagittata/Arrowleaf balsamroot				X	X	X				X		X	X	X	X	X		X	X				X	X	X
Barbarea orthocera/American wintercress		X	X	X																					
Bergia texana/Bergia		X																							
Besseya rubra/Kittentails															X	X									
Bidens cernua/Nodding beggartick		X					X																		
Bidens frondosa/Devils beggartick																		X	X						
Bidens vulgata/Tall beggartick						X	X																		
Blechnum spicant/Deer-fern	X	X																							
Blepharipappus scaber/Blepharipappus																				X		X	X	X	X
Brachypodium distachyon/False-brome	X																								
Brassica spp./Mustard								X		X	X														
Brodiaea douglasii/Douglas brodiaea							X		X			X	X	X				X	X	X	X	X	X	X	X
Brodiaea elegans/Elegant brodiaea				X		X																			
Brodiaea howellii/Howell's brodiaea					X	X																			
Calochortus macrocarpus/Sagebrush mariposa																	X	X	X			X			
Calochortus nuttallii/Segolily														X											
Caltha asarifolia/Yellow marshmarigold		X																							
Camassia cusickii/Cusick's camas																							X	X	
Camelina microcarpa/Littlepod falseflax																							X	X	
Campanula rotundifolia/American bellflower																X									
Capsella bursa-pastoris/Shepherd's purse		X																							X
Cardaria draba/Hoary pepperwort					X																				
Cardus acanthoides/Acanthus thistle																						X			
Castilleja spp./Indian paintbrush														X											
Castilleja applegatei/Applegate paintbrush																							X	X	
Centaurea spp./Centarua, knapweed								X			X	X				X									
Centaurea cyanus/Bachelor's button				X																					
Centaurea diffusa/Tumble knapweed															X										

APPENDIX II (Continued)

SCIENTIFIC NAME/COMMON NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
FORBS (Continued)																									
Centaurea solstitialis/Yellow centaurea							X						-												
Centaurium exaltatum/Western centaury						X																			
Cerastium spp./Chickweed			X	X																					
Cerastium arvense/Starry cerastium	X						X	X						X			X	X	X	X	X	X	X	X	X
Cerastium viscosum/Sticky cerastium																				X	X	X			
Cerastium vulgatum/Mouse-ear chickweed	X	X	X	X																					
Chaenactis douglasii/Falseyarrow				X		X																	X	X	X
Chenopodium spp./Goosefoot																					X				
Chenopodium album/Lambsquarter							X											X	X		X				
Chenopodium botrys/Jerusalem-oak																					X				
Chenopodium rubrum/Red goosefoot							X																		
Chorispora tenella/Chorispora																						X			X
Chrysanthemum leucanthenum/Oxeye-daisy		X																							
Chrysopsis villosa/Hairy goldaster																					X	X			
Cichorium intybus/Common chicory		X															X				X		X	X	
Cicuta douglasii/Western water-hemlock	X	X																							
Cirsium spp./Thistle							X														X				
Cirsium arvense/Canada thistle		X	X	X			X						X				X	X	X						X
Cirsium brevistylum/Short-styled thistle																	X								
Cirsium subniveum/Jackson's hole thistle																									X
Cirsium undulatum/Wavyleaf thistle					X	X												X	X			X	X	X	X
Cirsium vulgare/Bull thistle		X	X	X																	X				X
Clarkia pulchella/Elkhorns clarkia														X	X	X									
Clematic ligusticifolia/Western virginsbower													X	X	X						X	X	X	X	X
Cleome lutea/Yellow spiderflower																	X								X
Collinsia grandiflora/Bluelips collinsia																							X	X	
Collomia linearis/Narrowleaf collomia															X	X							X	X	
Collomia macrocalyx/Bristle-flowered collomia																		X	X						
Conioselinum pacificum/Hemlock parsley	X																								X
Conium maculatum/Poison hemlock		X					X																		
Convolvulus arvensis/European morningglory							X																		
Convolvulus sepium/Hedge bindweed				X																					
Conyza canadensis/Horseweed				X	X	X												X	X						
Coreopsis atkinsoniana/Columbia coreopsis				X	X	X																			

APPENDIX II (Continued)

SCIENTIFIC NAME/COMMON NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
FORBS (Continued)																									
Cotula coronopifolia/Brass buttons		X	X																						
Crepis acuminata/Tapertip hawksbeard																							X	X	X
Crepis atrabarba/Slender hawksbeard						X												X	X						
Crepis occidentalis/Western hawksbeard																									X
Crocidium multicaule/Spring-gold					X																				
Cryptantha spp./Cryptantha								X						X	X										
Cryptantha ambigua/Obscure cryptantha																							X	X	
Cryptantha flaccida/Weak-stemmed cryptantha					X	X																			
Cryptantha intermedia/Common cryptantha																						X	X	X	
Cryptantha leucophaea/Gray cryptantha									X	X		X													
Cryptantha pterocarya/Winged cryptantha																						X	X		
Cryptantha simulans/Pine woods cryptantha				X																					
Cryptogramma spp./Rockbrake								X																	
Cymopterus terebinthinus/Turpentine cymopterus													X	X	X										
Cynoglossum officinale/Common houndstongue																							X	X	X
Datura stramonium/Jimson weed																				X					
Daucus carota/Wild carrot		X	X																						
Delphinium bicolor/Little larkspur																							X	X	
Delphinium lineapetalum/Veined larkspur						X																			
Descurainia pinnata/Pinnate tansymustard					X	X												X	X			X			X
Descurainia richardsonii/Mountain tansymustard																	X								
Descurainia sophia/Flixweed Tansymustard																									X
Dicentra cucullaria/Dutchmans Breeches																							X	X	
Digitalis purpurea/Foxglove		X																							
Dipsacus sylvestris/Teasel			X	X		X	X										X	X	X			X	X	X	
Disporum smithii/Fairy lantern				X																					
Disporum trachycarpum/Wartberry fairy bells																X									
Dodecatheon conjugens/Slimpod shootingstar																							X	X	
Draba verna/Spring draba							X										X	X	X	X	X	X	X	X	X
Elodea canadensis/Canada waterweed		X																							
Epilobium spp./Willow-weed	X																								
Epilobium angustifolium/Fireweed		X									X						X								
Epilobium glaberrimum/Smooth willow-weed																		X	X						

APPENDIX II (Continued)

SCIENTIFIC NAME/COMMON NAME	STUDY SEGMENT																								
	COLUMBIA RIVER															SNAKE RIVER									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
FORBS (Continued)																									
Epilobium hirsutum/Fiddle-grass			X																						
Epilobium minutum/Small-flowered willow-weed			X	X	X	X																			
Epilobium paniculatum/Autumn willow-weed							X											X	X				X	X	X
Epilobium watsonii/Watson's willow-weed		X				X																			
Epipactis gigantea/Giant helleborine		X																							
Equisetum spp./Horsetail		X	X	X	X												X				X	X			
Equisetum arvense/Field horsetail																	X								
Equisetum fluviatile/Water horsetail																						X			
Equisetum hyemale/Western scouringrush								X	X		X		X	X		X	X				X		X	X	
Equisetum laevigatum/Smooth scouringrush						X	X										X								
Equisetum palustre/Marsh horsetail		X																X	X						
Erigeron annuus/Annual fleabane		X																							
Erigeron asperuginus/Daisy																					X				
Erigeron compositus/Dwarf mountain fleabane																									
Erigeron divergens/Spreading fleabane																					X				
Erigeron filifolius/Thread-leaf fleabane					X	X											X	X	X						
Erigeron linearis/Lineleaf fleabane				X	X																				X
Erigeron pumilus/Shaggy fleabane																	X								X
Erigeron speciosus/Showy fleabane																						X	X	X	X
Erigeron strigosus/Daisy																							X	X	
Erigeron subtrinervis/Threenerve fleabane																X						X			
Eriogonum spp./Buckwheat				X	X	X															X		X	X	
Eriogonum compositum/Northern buckwheat								X															X	X	
Eriogonum douglasii/Douglas buckwheat														X	X	X									
Eriogonum elatum/Rush buckwheat																									X
Eriogonum heracleoides/Wyeth buckwheat																							X	X	
Eriogonum microthecum/Slenderbush buckwheat						X																			
Eriogonum niveum/Snow eriogonum					X		X	X		X	X	X	X	X	X	X	X	X	X						X
Eriogonum sphaerocephalum/Round-headed eriogonum				X																					
Eriogonum umbellatum/Sulfur buckwheat				X		X																			

APPENDIX II (Continued)

SCIENTIFIC NAME/COMMON NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
FORBS (Continued)																									
Eriogonum vimineum/Broom buckwheat																							X	X	
Eriophyllum lanatum/Woolly eriophyllum																					X		X	X	
Erodium cicutarium/Storksbill				X	X	X	X							X			X	X	X	X	X	X	X	X	X
Erysimum asperum/Plains wallflower					X			X														X	X	X	
Euphorbia glyptosperma/Ridgeseed euphorbia																					X	X			
Filago arvensis/Field filago						X						X	X	X	X	X	X								
Fragaria chiloensis/Coastal strawberry	X																								
Fragaria vesca/Woods strawberry																X									
Fritillaria pudica/Yellow fritillary																		X	X		X		X	X	
Gaillardia aristata/Gaillardia				X																X	X				
Galium spp./Bedstraw				X																					
Galium aparine/Cleavers bedstraw	X	X	X	X	X	X														X	X	X			
Galium asperrimum/Rough bedstraw																						X	X	X	X
Galium boreale/Northern bedstraw		X	X	X										X	X	X									
Galium cymosum/Pacific bedstraw	X	X	X	X																					
Galium trifidum/Small cleavers	X	X		X																					
Gaura parviflora/Velvet weed																		X	X						
Geranium bicknellii/Bicknell geranium																						X			
Geranium molle/Dovefoot geranium			X																						
Germaium pusillum/Small-flowered crane's-bill				X																	X		X	X	
Geranium viscosissimum/Sticky purple geranium			X																						
Geum triflorum/Prairiesmoke avens															X										
Gilia aggregata/Skyrocket gilia																X									
Gilia sinuata/Shy gilia																									X
Glecoma hederacea/Creeping charlie		X	X																						
Glehnia leiocarpa/American glehnia	X																								
Glycyrrhiza lepidota/American licorice				X	X	X											X				X	X	X	X	
Gnaphalium chilense/Cottonbatting cudweed																	X								
Gnaphalium palustre/Lowland cudweed						X																			
Gratiola ebracteata/Bractless hedge-hyssop			X																						
Grindelia nana/Low gumweed																							X	X	
Habenaria dilatata/White bog-orchid		X																							
Hackelia diffusa/Diffuse stickweed						X																			
Hackelia floribunda/Showy stickweed														X											
Haplopappus aberrans/Idaho goldenweed																						X			
Haplopappus carthamoides/Largeflower goldenweed																									X

APPENDIX II (Continued)

SCIENTIFIC NAME/COMMON NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Helenium autumnale/Sneezeweed		X																							
Helianthus annuus/Common sunflower																	X	X	X	X	X	X	X	X	X
Heliotropium curassavicum/Salt heliotrope							X																		
Heracleum lonatum/Cow parsnip	X					X																			
Heuchera spp./Alumroot																X									
Heuchera cylindrica/Roundleaf alumroot																					X				
Hieracium albertinum/Western hawkweed																							X	X	
Holosteum umbellatum/Jagged chickweed					X	X																			
Hypericum formosum/Western St-John's wort		X																							
Hypericum perforatum/Goatweed		X															X	X	X		X	X	X	X	
Hypochaeris parvula/Smooth cats-ear				X																					
Hypochaeris radicata/Gosmore																									
Idahoa scapigera/Scalepod				X	X	X																			
Impatiens spp./Balsam			X																						
Impatiens capensis/Oregon balsam		X	X																						
Impatiens ecalcarata/Spurless balsam		X																							
Iris pseudacorus/Yellow flag		X																							
Iva axillaris/Poverty sumpweed																									X
Kochia scoparia/Belvedere summer cypress																	X	X	X						
Lactuca spp./Lettuce				X																					
Lactuca canadensis/Canada wild lettuce					X																				
Lactuca serriola/Prickly lettuce				X		X	X										X	X	X		X	X	X	X	X
Lagophylla ramosissima/Slender rabbitleaf																		X	X						
Lamium amplexicaule/Henbit deadnettle																							X	X	
Lappula redowskii/Western stickweed						X																			
Lathyrus spp./Sweet-pea		X		X																					
Lathyrus japonicus/Beach pea	X	X																							
Lathyrus rigidus/Rigid peavine																									X
Lepidium campestre/Field crest						X																			
Lepidium latifolium/Broadleaved peppergrass							X																X	X	X
Lepidium perfoliatum/Clasping pepperweed								X				X		X	X		X	X	X		X	X			X
Lepidium virginicum/Tall pepperweed																				X		X			
Lewisia rediviva/Bitterroot lewisia																X									
Lilaea scilloides/Flowering quillwort		X																							
Lilaeopsis occidentalis/Lilaeopsis	X	X																							
Limosella aquatica/Mudwort		X																							
Linaria dalmatica/Butter-and-eggs																									X

APPENDIX II (Continued)

SCIENTIFIC NAME/COMMON NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
FORBS (Continued)																									
Linum perenne/Perennial flax																	X								
Lithophragma glabra/Smooth fringecup					X	X																			
Lithophragma parviflora/Smallflower woodlandstar																				X		X	X	X	
Lithospermum arvense/Stoneseed																		X	X			X	X		
Lithospermum ruderale/Western gromwell					X	X								X	X	X		X	X		X	X	X	X	X
Lomatium spp./Biscuitroot, Lomatium						X									X						X		X	X	X
Lomatium canbyi/Canby biscuitroot																						X			
Lomatium dissectum/Carrotleaf liptotaenia				X	X	X	X							X							X	X	X	X	
Lomatium grayi/Grays biscuitroot						X											X	X	X				X	X	X
Lomatium laevigatum/Smooth desert parsley																									
Lomatium leptocarpum/Bicolor biscuitroot																							X	X	
Lomatium nudicaule/Pestle parsnip				X																					
Lomatium salmoniflorum/Salmon River lomatium																							X	X	
Lomatium triternatum/Nine-leaf lomatium						X																X	X	X	
Lotus corniculatus/Birdsfoot-trefoil	X	X																							
Lotus purshianus/Spanish-clover																				X			X	X	
Lupinus spp./Lupine						X		X				X		X	X	X							X	X	
Lupinus aridus/Dry-ground lupine				X																					
Lupinus caudatus/Tailcup lupine																							X	X	
Lupinus laxiflorus/Spur lupine																									X
Lupinus leucophyllus/Velvet lupine																		X	X						
Lupinus littoralis/Seashore lupine	X																								
Lupinus micranthus/Small-flowered lupine						X																			
Lupinus polyphyllus/Large-leaved lupine		X							X																
Lupinus sulphureus/Sulfur lupine					X	X																			
Lycopodium inundatum/Marsh clubmoss		X																							
Lycopus americanus/American bugleweed						X	X											X	X			X			
Lycopus asper/Rough bugleweed		X			X												X								
Lycopus uniflorus/Northern bugleweed			X																						
Lysichitum americanum/Skunk cabbage		X																							
Lysimachia nummalaria/Moneywort		X	X																						
Machaerocarpus californicus/ Star waterplantain																									X
Madia gracilis/Common tarweed				X																					

APPENDIX II (Continued)

SCIENTIFIC NAME/COMMON NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
FORBS (Continued)																									
Malacothrix torreyi/Malacothrix																									X
Marsh oreganus/Bigroot			X																						
Marrubium vulgare/Common hoarhound						X															X	X	X	X	
Matricaria maritima/Scentless May-weed							X											X	X						
Matricaria matricarioides/Pineapple-weed																					X				
Medicago lupulina/Black medic																						X			
Medicago sativa/Alfalfa				X	X	X	X								X			X	X				X	X	
Melilotus alba/White sweetclover				X		X											X	X	X		X	X	X	X	X
Melilotus officinalis/Yellow sweetclover						X																			
Mentha spp./Mint												X													
Mentha arvensis/Field mint	X	X	X		X	X															X				
Mentha citrata/Bergamot mint		X																							
Mentha spicata/Spearmint						X																			X
Mentzelia laevicaulis/Blazingstar mentzelia							X																		
Mertensia ciliata/Broadleaf bluebells																							X	X	
Mertensia longiflora/Small bluebells																							X	X	
Microseris linearifolia/Linearleaf microseris																									X
Microseris nutans/Nodding microseris																						X			
Mimulus guttatus/Common monkeyflower	X						X											X	X			X	X	X	
Mimulus nanus/Dwarf monkeyflower																							X	X	
Mimulus washingtonensis/Washington mimulus				X																					
Montia spp./Indianlettuce															X	X									
Montia arenicola/Sand montia																					X				
Montia cordifolia/Broadleaf indianlettuce																						X			
Montia perfoliata/Miner's lettuce		X	X		X	X															X	X	X	X	
Montia sibirica/Candyflower	X	X	X																						
Moss spp./Moss		X	X	X													X			X	X	X	X	X	
Myosotis laxa/Bay forget-me-not		X	X			X	X											X	X						
Myosotis micrantha/Smallflower forget-me-not																						X			
Nemophila kirtleyi/Snake River Canyon nemophila																							X	X	
Nephrophyllidium crista-galli/Deer cabbage		X																							
Oenanthe sarmentosa/Pacific water-parsley	X	X	X																						

APPENDIX II (Continued)

SCIENTIFIC NAME/COMMON NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
FORBS (Continued)																									
Oenothera spp./Evening-primrose			X	X																					
Oenothera caespitosa/Tufted evening-primrose																							X	X	X
Oenothera erythrosepala/Red-sepaled evening-primrose																									
Oenothera hookeri/Hooker's evening-primrose		X																							
Oenothera pallida/Pale evening-primrose				X	X	X		X		X		X					X								
Opuntia polyacantha/Plains pricklypear						X	X					X		X	X						X	X			
Orobanche fasiculata/Clustered broomrape																					X	X			
Orobanche uniflora/Naked broomrape													X										X	X	
Orthocarpus castillejoides/Paint-brush owl-clover	X																								
Orthocarpus luteus/Yellow owl-clover														X											
Oxytropis spp./Crazeweed														X											
Parentucellia viscosa/Yellow parentucellia			X																						
Parietaria pensylvanica/Pennsylvania pellitory																						X			
Penstemon spp./Penstemon, Beardtongue																									
Penstemon acuminatus/Sharp-leaved penstemon						X																			X
Penstemon elegantulus/Lovely penstemon																						X			
Penstemon glandulosus/Stickystem penstemon																									X
Penstemon wilcoxii/Wilcox penstemon																							X	X	
Petalostemon ornatum/Prairie clover							X														X				
Phacelia glandulifera/Sticky phacelia						X																			
Phacelia hastata/Whiteleaf phacelia					X	X																			
Phacelia heterophylla/Varileaf phacelia																							X	X	
Phacelia linearis/Threadleaf phacelia				X	X	X															X	X			X
Phlox colubrina/Snake River phlox												X	X	X	X	X		X	X			X	X	X	
Physalis longifolia/Groundcherry																						X			
Physaria oregana/Oregon twinpod																					X	X			X
Plagiobothrys tenellus/Slender popcorn-flower																						X	X	X	
Plantago lanceolata/Buckhorn plantain	X	X		X																		X			
Plantago major/Nippleseed plantain			X	X	X	X																	X	X	X

APPENDIX II (Continued)

SCIENTIFIC NAME/COMMON NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
FORBS (Continued)																									
Plantago patagonica/Indianwheat				X		X	X	X					X			X	X	X	X		X	X			
Plectritis macrocera/Longhorn plectritis				X	X	X														X	X	X			
Polanisia trachysperma/Polanisia																							X	X	
Polygonum aviculare/Prostrate knotweed																		X	X						
Polygonum coccineum/Water smartweed						X															X				
Polygonum douglasii/Douglas knotweed																						X			
Polygonum hydropiperoides/Waterpepper		X				X																			
Polygonum majus/Wiry knotweed							X										X								
Polygonum punctatum/Dotted smartweed																		X	X						
Polystichum munitum/Sword-fern	X	X	X	X																					
Potamogeton crispus/Curled pondweed		X				X																			
Potentilla spp./Silverweed			X																						
Potentilla concinna/Early cinquefoil																							X	X	
Potentilla pacifica/Pacific silverweed	X	X																							
Potentilla rivalis/River cinquefoil				X																					
Prunella vulgaris/Self-heal		X	X													X									
Psoralea lanceolata/Lanceleaf scurfpea																		X	X						X
Pteridium aquilium/Bracken fern	X	X		X																					
Pterospora andromedea/Woodland pinedrops																X									
Ranunculus spp./Buttercup		X	X																						
Ranunculus bongardii/Woods buttercup			X				X																		
Ranunculus glaberrimus/Sagebrush buttercup																							X	X	
Ranunculus muricatus/Spiny-fruit buttercup				X																					
Ranunculus occidentalis/Western buttercup		X	X																						
Ranunculus sceleratus/Celery-leaved buttercup		X																							
Ranunculus uncinatus/Little buttercup																									
Rorippa islandica/Marsh yellow-cress		X																							
Rorippa obtusa/Bluntleaved yellow-cress		X	X																						
Rudbeckia hirta/Black-eyed susan															X			X	X						
Rumex spp./Dock, sorrel		X		X									X			X			X						
Rumex acetosa/Green sorrel			X			X																			
Rumex acetosella/Sorrel	X			X																					
Rumex conglomeratus/Clustered dock		X	X																						
Rumex crispus/Curly dock		X	X	X	X	X											X	X	X						X

APPENDIX II (Continued)

SCIENTIFIC NAME/COMMON NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
FORBS (Continued)																									
Rumex occidentalis/Western dock						X	X															X	X	X	
Rumex salicifolius/Willow dock																		X	X						
Rumex venosus/Viney dock					X	X	X	X		X															
Sagittaria latifolia/Wapato		X																							
Salsola kali tenuifolia/Russian thistle					X	X		X	X												X				X
Salvia sclarea/Clear-eye																									X
Scleranthus annuus/German knotweed																							X	X	X
Scutellaria angustifolia/Narrowleaf skullcap													X	X	X	X					X				
Sedum lanceolatum/Lanceleaved stonecrop																						X			
Sedum leibergii/Leiberg stonecrop																					X	X			
Sedum oreganum/Oregon sedum	X																								
Sedum spathulifolium/Spatula-leaf stonecrop				X	X	X																			
Sedum stenopetalum/Wormleaf stonecrop														X											
Senecio spp./Groundsel, Butterweed														X											
Senecio crassulus/Thick-leaved groundsel				X	X																				
Senecio jacobaea/Tansy Ragwort		X	X																						
Senecio triangularus/Arrowleaf groundsel		X	X																						
Sida hederacea/Alkali sida																									X
Sisymbrium altissimum/Tumblemustard				X	X	X	X										X	X	X	X	X	X	X	X	X
Smilacina racemosa/Feather solomonplume																X									
Smilacina sessilifolia/Small false Solomon's seal				X																					
Smilacina stellata/Starry solomonplume																X									
Solanum dulcamara/Bitter nightshade							X				X					X					X		X	X	X
Solidago canadensis/Canada goldenrod					X	X	X															X			
Solidago gigantea/Goldenrod		X					X											X	X			X			
Solidago missouriensis/Missouri goldenrod																	X	X	X						X
Solidago occidentalis/Western goldenrod						X	X										X	X	X						
Sonchus arvensis/Field sow-thistle		X																							
Sonchus oleraceus/Common sow-thistle							X																		
Spergularia marina/Saltmarsh sandspurry																									
Sphaeralcea munroana/Munro globemallow						X												X	X		X				X
Spirea douglasii/Spirea		X													X	X									
Spirodela polyrhize/Great duckweed		X																							
Stachys spp./Hedge-nettle				X																					
Stachys cooleyae/Cooley's hedge-nettle			X																						

APPENDIX II (Continued)

SCIENTIFIC NAME/COMMON NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
FORBS (Continued)																									
Stachys palustris/Marsh Hedge-nettle																									
Stanleya confertiflora/Biennial stanleya														X							X				
Stanleya pinnata/Desert princesplume																						X			
Stellaria alsine/Bog stitchwort	X																								
Stellaria media/Chickweed																					X	X			
Striptanthella longirostris/ Streptanthella																						X			
Swainsona salsula/Australian peavine						X	X																		
Tanacetum douglasii/Northern dune daisy	X																								
Taraxacum spp./Dandelion																					X				
Taraxacum officinale/Common dandelion													X			X							X	X	
Tellima grandiflorum/Fringecup		X		X																					
Thelypodium laciniatum/Thick-leaved thelypody					X	X																			
Thlaspi arvense/Field pennycress																							X	X	
Thysanocarpus curvipes/Sand fringed-pod				X																		X	X	X	
Tolmiea menziesii/Pig-a-back				X																					
Tonella floribunda/Large flower tonella																					X	X	X	X	
Tonella tenella/Small-flowered tonella				X																					
Tragopogan spp./Goatsbeard					X									X											
Tragopogon dubius/Yellow salsify				X	X	X						X	X	X	X	X		X	X	X	X	X	X	X	X
Tragopogon miscellus/Goatsbeard							X										X								
Tragopogan pratensis/Meadow salsify						X																			
Trientalis latifolia/Western starflower				X																					
Trifolium spp./Clover		X																					X	X	
Trifolium dubuim/Least hop clover		X	X	X						X															
Trifolium eriocephalum/Wooley-headed clover		X																							
Trifolium fragiferum/Strawberry clover						X																			
Trifolium hybridum/Alsike clover																									
Trifolium pratense/Red clover	X	X																							
Trifolium procumbens/Hop clover			X																						
Trifolium repens/White clover				X																					
Trifolium wormskjoldii/Springbank clover	X	X																							
Trillium ovatum/White trillium		X																							
Triodanis perfoliata/Venus' looking-glass																					X				
Typha angustifilia/Narrowleaf cattail	X	X					X											X	X						
Typha latifolia/Common cattail		X	X			X	X			X			X				X	X	X						X
Urtica dioica/Big stinging nettle		X	X	X							X					X		X	X		X	X	X	X	X

APPENDIX II (Continued)

SCIENTIFIC NAME/COMMON NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
FORBS (Continued)																									
Urtica lyallii/Lyall Nettle																		X	X				X	X	
Vaccaris segetalis/Cow soapwort																									
Valeriana occidentalis/Western valerian					X	X																			
Vancouveria hexandra/Inside-out-flower		X	X																						
Veratrum californicum/False hellebore		X														X						X	X	X	
Verbascum blatteria/Moth mullein								X																	
Verbascum thapsus/Flannel mullein		X	X	X							X			X	X	X						X	X	X	
Verbena bracteata/Bigbracht verbena																		X	X						
Veronica americana/American brooklime		X	X																						
Veronica anagallis-aquatica/Water speedwell						X	X											X	X						
Veronica arvensis/Common speedwell																				X	X	X			
Veronica chamaedrys/Germander speedwell	X																								
Veronica peregrina/Purslane			X																						
Vicia spp./Vetch		X																							
Vicia americana/American vetch	X	X													X	X					X				
Vicia gigantea/Giant vetch		X																							
Vicia hirsuta/Tiny vetch				X																					
Vicia villosa/Hairy winter vetch		X																X	X	X					
Viola canadensis/Canada violet																						X			
Viola orbiculata/Darkwoods violet																							X	X	
Woodsia spp./Woodsia																						X			
Woodsia oregana/Oregon woodsia																					X	X	X	X	
Wyethia amplexicaulis/Northern mule's-ear				X																					
Xanthium strumarium/Common cocklebur			X	X														X	X		X	X	X	X	
Zigadenus paniculatus/Foothill deathcamas																						X	X	X	
SHRUBS																									
Acer glabrum/Rocky Mountain maple															X	X									
Alnus sinuata/Sitka alder, mountain alder												X				X									
Amelanchier alnifolia/Serviceberry	X	X		X							X	X		X	X	X					X	X	X	X	X
Arctostaphylos uva-ursi/Bearberry																X									
Artemisia frigida/Fringed sagebrush																									
Artemisia tridentata/Big sagebrush						X	X	X	X	X	X	X	X	X											
Artemisia tripartita/Threetip sagebrush								X				X		X											
Berberis aquifolium/Tall Oregon grape				X																					

APPENDIX II (Continued)

SCIENTIFIC NAME/COMMON NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
SHRUBS (Continued)																									
Berberis nervosa/Dull Oregon grape																									
Berberis repens/Low Oregon grape				X	X	X										X									
Ceanothus integerrimus/Buckberry				X	X	X																			
Ceanothus sanguineus/Redstem ceanothus																X									
Celtis douglasii/Douglas hackberry																				X	X	X	X	X	X
Celtis recticulata/Hackberry					X	X																			
Chrysothamnus nauseosus/Gray rubber rabbitbrush					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				X
Chrysothamnus viscidiflorus/Green rabbitbrush					X	X	X	X	X	X		X		X	X		X	X	X	X	X				X
Cornus stolinifera/Red-osier dogwood		X	X	X								X				X						X			
Corylus cornuta/Hazelnut			X	X												X									
Gaultheria shallon/Salal		X																							
Grayia spinosa/Spiny hopsage									X																
Gutierrezia sarothrae/Broom snakeweed						X															X				X
Holodiscus discolor/Creambush oceanspray				X										X	X						X	X			
Humulus lupulus/Hops																					X				
Leptodactylon pungens/Granitegilia												X	X	X	X										
Lonicera involucrata/Black twinberry	X	X																							
Lycium halimifolium/Matrimony vine																					X				
Pachistima myrsinites/Pachistima, Mt. lover																X									
Penstemon deustus/Scabland penstemon																							X	X	
Penstemon fruticosus/Rush penstemon																						X			
Penstemon richardsonii/Penstemon											X														
Penstemon triphyllus/Whorled penstemon																						X			
Philadelphus lewisii/Mockorange														X	X	X				X	X	X	X	X	X
Phlox longifolia/Longleaf Phlox						X												X	X	X	X		X	X	X
Physocarpus capitatus/Pacific ninebark		X																							
Prunus emarginata/Bitter cherry																							X	X	X
Prunus virginiana/Common chokecherry				X		X		X					X	X	X	X						X	X	X	X
Purshia tridentata/Antelope bitterbrush				X	X	X	X	X	X	X		X	X	X	X	X							X	X	X
Rhamnus alnifolia/Alder buckthorn																X									
Rhus diversiloba/Poison oak				X	X	X																			
Rhus glabra/Smooth sumac											X			X	X					X	X	X	X	X	X
Rhus radicans/Poison ivy											X		X		X	X					X	X	X	X	X
Ribes aureum/Golden currant						X															X		X	X	
Ribes cereum/Wax currant								X							X							X			
Ribes divaricatum/Coast black gooseberry		X	X																						

APPENDIX II (Continued)

SCIENTIFIC NAME/COMMON NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
SHRUBS (Continued)																									
Ribes hudsonianum petiolare/Black currant							X																		
Ribes irriguum/Idaho gooseberry																					X		X	X	
Rosa spp./Rose		X	X	X	X											X									
Rosa acicularis/Prickly rose											X	X	X	X		X									
Rosa gymnocarpa/Little wild rose				X										X	X	X						X			X
Rosa nutkana/Nootka rose				X																					
Rosa woodsii/Woods rose		X	X	X				X			X			X		X		X	X	X		X	X	X
Rubus bartonianus/Bartonberry																						X			
Rubus discolor/Himalayan blackberry		X	X	X		X															X	X	X	X	
Rubus laciniatus/Evergreen blackberry	X	X	X																				X	X	
Rubus leucodermis/Western blackcap				X																					
Rubus parviflorus/Thimbleberry		X		X																			X	X	
Rubus spectabilis/Salmonberry	X	X																							
Rubus ursinus/Pacific blackberry	X	X	X	X																					
Salvia dorri/Purple sage											X		X		X										
Sambucus cerulea/Blue elderberry				X							X				X						X	X	X	X	X
Sambucus racemosa/Coast red elderberry		X	X																						
Sarcobatus vermiculatus/Black greasewood																									X
Solanum dulcamara/Climbing nightshade		X	X			X																			
Symphoricarpos albus/Common snowberry		X	X	X											X	X							X	X	
Tamarix pentandra/Tamarisk																									X
Vitis riparia/Riverbank grape-vine																						X	X	X	X
Vitis vinifera/European grape-vine																					X	X	X	X	X
TREES																									
Acer circinatum/Vine maple		X		X																					
Acer saccharinum/Silver maple																		X	X		X				X
Acer macrophyllum/Big-leaf maple		X		X																					
Acer negundo/Boxelder											X										X		X	X	
Ailanthus altissima/Tree of Heaven						X												X	X	X	X				
Alnus rhombifolia/White alder							X										X	X	X	X		X	X	X	X
Alnus rubra/Red alder	X	X	X	X																					
Betula occidentalis/Water birch														X		X						X	X	X	
Betula papyrifera/Paper birch																X									
Cornus nuttallii/Pacific dogwood				X																					
Crataegus columbiana/Columbia hawthorn											X			X	X	X							X	X	
Crataegus douglasii/Black hawthorn			X	X	X									X		X						X			X
Elaeagnus angustifolia/Russian olive						X	X		X			X					X	X	X						X

APPENDIX II (Continued)

SCIENTIFIC NAME/COMMON NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
TREES (Continued)																									
Fraxinus latifolia/Oregon ash		X	X	X																	X	X	X	X	X
Fraxinus pennsylvanica/Green ash																									
Juglans nigra/Black walnut																					X	X			
Juglans regia/English walnut																					X	X			
Juniperus occidentalis/Western juniper												X		X		X									
Larix occidentalis/Western larch																X									
Morus alba/White mulberry			X	X	X	X															X		X	X	
Morus rubra/Red mulberry											X	X	X												
Picea sitchensis/Sitka spruce	X	X																							
Pinus ponderosa/Ponderosa pine				X										X	X	X				X	X	X	X	X	
Populus deltoides/Great plains cottonwood					X	X	X																		
Populus tremuloides/Quaking aspen																X									
Populus trichocarpa/Black cottonwood		X	X	X	X			X	X		X		X			X		X	X		X		X	X	X
Prunus armeniaca/Apricot							X															X	X	X	
Prunus avium/Bird cherry																					X	X			
Prunus cerasifera/Cherry plum																					X	X	X	X	X
Prunus cerasus/Sour cherry				X																					
Prunus spinosa/Blackthorn																						X			
Pseudotsuga menziesii/Douglas fir				X											X	X									
Pyrus fusca/Western crabapple	X	X	X																						
Pyrus malus/Apple																X					X	X	X	X	X
Quercus garryana/Oregon white oak				X																					
Robinia pseudo-acacia/Black locust						X	X											X	X	X					X
Salix spp./Willow						X					X		X												
Salix amygdaloides/Peach-leaf willow				X	X	X			X			X	X			X		X	X			X	X	X	
Salix exigua/Slender willow					X	X		X	X	X	X	X	X			X									
Salix exigua exigua/Coyote willow							X	X	X	X	X	X	X			X	X	X	X	X		X	X	X	X
Salix exigua melanopsis/Dusky willow																					X				
Salis fluviatilis/Columbia River willow		X	X	X	X																				
Salix hookeri/Hooker willow	X	X																							
Salix lasiandra/Pacific willow	X	X	X	X	X	X																			
Salix lasiandra coudata/Whiplash willow							X											X	X		X				X
Salix lasiandra lasiandra/Red willow																						X			
Salix piperi/Piper's willow			X																						
Salix rigida mackenzieana/MacKenzie willow							X										X	X	X		X		X	X	X
Thuja plicata/Western redcedar		X														X									
Tsuga heterophylla/Western hemlock		X																							

1/ Study segments are defined in Table 2, page 6.

APPENDIX III - Reptiles and amphibians of the Columbia and Snake River wildlife study area as recorded by study segment 1/ (X) or as reported in previous studies (*).

COMMON NAME/SCIENTIFIC NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Tiger salamander/*Ambystoma tigrinum*				*																					
Northwestern salamander/*Ambystoma gracile*		X	*																						
Long-toed salamander/*Ambystoma macrodactylum*		X	X	X	X	X	*									X	*	*	*	*	*	X	*	*	*
Pacific giant salamander/*Dicamptodon ensatus*		X	*																						
Cope's salamander/*Dicamptodon copei*			*																						
Olympic salamander/*Rhyacotriton olympicus*		X	X	X																					
Rough-skinned newt/*Taricha granulosa*		X	X	X																					
Dunn's salamander/*Plethodon dunni*		*	*																						
Western red-backed salamander/*Plethodon vehiculum*	X	X	X	X																					
Van Dyke's salamander/*Plethodon vandykei*																									
Larch mountain salamander/*Plethodon larselli*			*	X																					
Ensatina/*Ensatina eschscholtzi*		X	X	X																					
Oregon slender salamander/*Batrachoseps wrighti*			*																						
Clouded salamander/*Aneides ferreus*			X																						
Tailed frog/*Ascaphus truei*				X																					
Western spadefoot/*Scaphiopus hammondi*								*																	
Great basin spadefoot/*Scaphipus intermontanus*						X	*										*	X	X						*
Western toad/*Bufo boreas*		*	X	*			*										*	*	*	*	X	X	X	X	X
Woodhouse's toad/*Bufo woodhousei*				*		X	X	X									X								
Chorus frog/*Pseudoacris triseriata*																									
Pacific treefrog/*Hyla regilla*	X	X	X	X	X	X	X		X				X			X	*	X	X	*	X	X	*	*	*
Red-legged frog/*Rana aurora*		X	X	X																					
Spotted frog/*Rana prestiosa*			*													X		X	X						
Cascades frog/*Rana cascadae*																									
Leopard frog/*Rana pipiens*						*																			
Bullfrog/*Rana catesbeiana*		X	X	X		X												*	X	X	X		*	*	X
Green frog/*Rana clamitans*																									
Western pond turtle/*Clemmys marmorata*				*																					
Western painted turtle/*Chrysemys picta belli*			X			X	X																		
Green turtle/*Chelonia mydas*																									
Collared lizard/*Crotaphytus collaris*																									
Long-nosed leopard lizard/*Crotaphytus wislizenii wislizenii*																									X

APPENDIX III (Continued)

COMMON NAME/SCIENTIFIC NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Western fence lizard/*Sceloporus occidentalis*			X	X	X		*				X						*	*	*	*	X	X	X	X	*
Sagebrush lizard/*Sceloporus graciosus*						X	X	X			X	X					*								
Side-blotched lizard/*Uta stansburiana*						X	X																		*
Desert horned lizard/*Phrynosoma platyrhinos*																									
Short-horned lizard/*Phrynosoma douglassi*						X		X																	
Western skink/*Eumeces skiltonianus*				X	X	X	*					X		X	X	X	*	*	*	X	X	*	X	X	*
Great basin whiptale/*Cnemidophorus tigris tigris*																							*	*	X
Southern alligator lizard/*Gerrhonotus multicarianatus*				X	X	X																			
Northern alligator lizard/*Gerrhonotus coeruleus*		X	X	X																					
Rubber boa/*Charina bottae*			X																						
Pacific ringneck snake/*Diadophus punctatus amabilis*			X																						
Sharp-tailed snake/*Contia tennuis*				X																					
Western yellow-bellied racer/*Coluber constrictor mormon*				X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X
Striped whipsnake/*Masticophis taeniatus*						X																			
Desert striped whipsnake/*Masticophis taeniatus taeniatus*							X																		
Pacific gopher snake/*Pituophis melanoleucus catenifer*				X	X	X		X	X			X													
Great basin gopher snake/*Pituophis melanoleucus deserticola*							X										X	X	X	X	X	X	X	X	X
Mountain kingsnake/*Lampropeltis zonata*				X																					
Common garter snake/*Thamnophis sirtalis*							*	X									*	X	X	*	X	*	*	*	*
Red-spotted garter snake/*Thamnophis sirtalis concinnus*	X	X	X	*																					
Western terrestrial garter snake/*Thamnophis elegans*																X									
Wandering garter snake/*Thamnophis elegans vagrans*				X		X	X										*	X	X	*	X	X	*	*	X
Northwestern garter snake/*Thamnophis ordinoides*	X	X	X	X																					
Desert night snake/*Hypsiglena torguata deserticola*							*																		*
Western rattlensnake/*Crotalus viridis*				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

1/ Study segments are defined in Table 2, Page 6.

APPENDIX IV - Birds of the Columbia and Snake River wildlife study area by study segment 1/

COMMON NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Common loon	X		X			X	X	X	X	X	X	X	X		X	X	X	X	X	X					X
Arctic loon	X	X	X																						
Red-throated loon	X		X																						
Red-necked grebe	X			X		X				X															
Horned grebe			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X					X
Eared grebe							X	X	X	X				X	X	X		X	X	X	X				
Western grebe	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X
Pied-billed grebe		X	X			X	X		X	X	X	X	X			X	X	X	X	X			X	X	X
Sooty shearwater																									
White pelican						X	X	X	X	X	X	X	X	X	X	X									
Brown pelican																									
Double-crested cormorant	X	X	X	X	X	X	X	X	X																
Brandt's cormorant	X																								
Pelagic cormorant	X																								
Great blue heron	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Green heron		X	X																						
Common egret	X		X																						
Snowy egret																									X
Black-crowned night heron	X		X			X	X	X	X	X			X												
Least bittern																									
American bittern	X		X			X																			
White-faced ibis																									
Whistling swan	X	X	X	X	X	X	X	X	X			X			X	X		X	X	X		X	X	X	X
Trumpeter swan																									
Canada goose	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Brandt																									
Black brandt																									
White-fronted goose		X	X		X	X		X																	
Snow goose		X	X		X	X		X										X	X		X				X
Ross' goose																X									
Mallard	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Gadwall		X	X			X	X					X	X			X	X	X	X	X	X	X	X	X	X
Pintail	X	X	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Green-winged teal	X	X	X	X	X	X	X		X	X	X	X	X			X	X	X	X	X	X	X	X	X	X
Blue-winged teal		X	X		X	X	X	X		X			X			X	X	X	X	X	X	X	X	X	X
Cinnamon teal		X	X		X	X	X	X	X	X		X	X					X	X	X	X				X
European widgeon			X																						
American widgeon	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Shoveler		X	X			X	X	X			X		X				X	X	X	X	X	X	X	X	X
Wood duck		X	X		X	X	X		X		X							X	X	X	X				X
Redhead				X		X	X		X	X	X	X	X	X			X	X	X	X	X				X
Ring-necked duck			X			X	X				X	X	X		X		X	X	X	X			X	X	X
Canvasback	X	X	X	X		X	X	X	X	X	X	X	X	X			X	X	X	X	X				X

APPENDIX IV (Continued)

COMMON NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Greater scaup																							X	X	
Lesser scaup	X	X	X	X	X	X			X				X										X	X	
Undifferentiated scaup							X	X	X	X	X	X	X	X			X	X	X	X					X
Common goldeneye							X										X	X	X	X	X	X	X	X	X
Barrow's goldeneye	X	X	X		X	X	X	X		X		X				X	X	X	X	X	X	X	X	X	X
Undifferentiated goldeneyes								X	X				X	X											
Bufflehead	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X			X	X	X
Oldsquaw																									
Harlequin duck																									
White-winged scoter	X	X	X						X																
Surf scoter	X	X	X																						
Common scoter	X		X																						
Ruddy duck		X	X			X	X					X	X	X							X		X	X	X
Hooded merganser		X	X				X					X	X				X	X	X	X			X	X	X
Common merganser	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Red-breasted merganser	X	X	X												X	X							X	X	
Turkey vulture		X	X	X	X	X				X				X	X	X		X	X	X	X	X	X	X	X
Goshawk			X			X										X							X	X	X
Sharp-shinned hawk	X	X	X			X	X					X	X	X							X	X	X	X	
Cooper's hawk	X		X	X		X	X	X			X					X		X	X	X	X	X	X	X	X
Red-tailed hawk	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Swainson's hawk							X	X	X							X	X	X	X	X				X	X
Rough-legged hawk	X		X			X	X	X									X	X	X	X					X
Ferruginous hawk														X											
Golden eagle			X			X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X
Bald eagle	X	X	X	X	X	X	X	X	X	X	X	X	X	X							X	X	X	X	X
Marsh hawk	X		X		X	X	X	X	X	X		X	X	X	X		X	X	X	X	X	X	X	X	X
Osprey		X		X		X	X	X		X	X	X		X	X	X	X	X	X	X	X	X	X	X	X
Prairie falcon			X	X	X	X	X	X	X	X								X	X	X	X	X	X		X
Peregrine falcon	X	X	X					X															X		
American kestrel	X	X	X	X	X	X	X	X	X	X	X		X	X		X	X	X	X	X	X	X	X	X	X
Blue grouse																X									
Spruce grouse																									
Ruffed grouse	X	X	X	X										X	X	X					X				X
Sharp-tailed grouse																									
Sage grouse								X																	
Bobwhite																									
California quail		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X
Gambel's quail																									
Mountain quail																									
Ring-necked pheasant	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X	X	X				X
Chukar					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

APPENDIX IV (Continued)

COMMON NAME	STUDY SEGMENT																							
	COLUMBIA RIVER																SNAKE RIVER							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Gray partridge														X	X			X	X	X	X	X	X	X	X
Turkey				X											X										
Sandhill crane		X				X		X																	
Virginia rail						X																			
Sora rail			X	X		X	X											X	X	X					
Yellow rail																									
American root	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Semipalmated plover	X	X					X																		
Snowy plover	X																								
Killdeer	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Mountain plover																									
American golden plover	X																								
Black-bellied plover	X		X		X																				
Surfbird	X																								
Ruddy turnstone	X																								
Black turnstone	X																								
Common snipe	X	X	X	X	X	X	X		X							X		X	X	X					
Long-billed curlew						X	X	X	X	X															X
Whimbrel	X					X																			
Spotted sandpiper		X	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Solitary sandpiper	X																								
Wandering tattler	X																								
Willet																									
Greater yellowlegs	X	X	X			X	X	X	X				X	X											
Lesser yellowlegs								X																	
Knot	X																								
Rock sandpiper																									
Pectoral sandpiper	X																								
Baird's sandpiper								X																	
Least sandpiper	X	X	X	X		X																			
Dunlin	X	X	X			X																			
Short-billed dowitcher																									
Long-billed dowitcher			X			X																			
Stilt sandpiper																									
Western sandpiper	X	X	X			X		X		X								X	X	X					
Sanderling	X	X	X			X	X																		
American avocet						X	X											X	X	X		X	X	X	X
Black-necked stilt																									
Red phalarope																									
Wilson's phalarope						X	X		X									X	X	X					
Northern phalarope	X					X																			
Parasitic jaeger	X																								
Glaucus gull																									

APPENDIX IV (Continued)

COMMON NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Glaucus-winged gull	X	X	X		X	X																			
Western gull	X	X	X	X	X																				
Herring gull	X	X	X		X		X	X		X		X	X	X			X	X	X	X				X	X
Thayer's gull	X	X	X																						
California gull	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X		X	X	X			X	X	X
Ring-billed gull	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X
Mew gull	X	X	X																						
Franklin's gull																									
Bonaparte's gull	X	X	X			X		X	X																
Heermann's gull	X		X																						
Black-legged kittiwake	X																								
Forster's tern						X	X	X	X												X				X
Common tern							X			X															
Caspian tern	X	X				X	X	X	X									X	X	X					
Black tern						X		X																	
Arctic tern										X															
Common murre	X																								
Pigeon guillemot	X																								
Ancient murrelet																									X
Cassin's auklet		X																							
Band-tailed pigeon	X	X	X	X	X																				
Rock dove			X	X	X	X	X	X		X		X	X	X	X			X	X	X	X	X			X
Mourning dove	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Yellow-bellied cuckoo																									
Black-bellied cuckoo																									
Barn owl		X	X			X	X	X									X	X	X	X					X
Screech owl	X	X	X	X		X	X													X	X				
Flammulated owl																									
Great horned owl	X	X	X	X		X	X	X					X		X		X	X	X	X	X	X	X	X	X
Snowy owl	X		X		X																				
Hawk owl																									
Pygmy owl																									
Burrowing owl						X	X	X									X								
Long-earned owl		X	X			X	X		X			X				X	X				X				X
Short-eared owl			X			X	X	X	X	X		X					X	X	X	X					X
Saw-whet owl	X	X	X		X																				
Poor-will										X				X									X	X	
Common nighthawk						X	X	X	X	X	X	X		X			X	X	X	X	X	X	X	X	X
Vaux's swift	X	X		X				X		X	X							X	X	X		X	X	X	
White-throated swift					X		X			X	X			X	X							X			
Black-chinned hummingbird																						X	X	X	
Rufous hummingbird	X	X	X	X		X									X	X						X			
Calliope hummingbird															X							X			

APPENDIX IV (Continued)

COMMON NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	32	24	25
Belted kingfisher	X	X	X		X	X		X	X	X		X	X	X		X		X	X	X	X	X	X	X	X
Common flicker	X	X	X	X	X	X	X	X	X		X	X	X			X	X	X	X	X	X	X	X	X	X
Red-shafted flicker								X			X	X		X	X	X									
Pileated woodpecker				X																					
Acorn woodpecker																									
Lewis' woodpecker					X		X		X				X	X	X	X						X	X	X	
Yellow-bellied sapsucker			X	X												X									
Williamson's sapsucker																									
Hairy woodpecker															X	X	X	X	X	X		X	X	X	
Downy woodpecker	X	X	X	X		X					X	X		X	X	X		X	X	X		X	X	X	X
White-headed woodpecker															X										
Black-bellied threetoed woodpecker																									
Eastern kingbird	X		X		X	X					X		X	X	X		X	X	X	X	X	X	X	X	X
Western kingbird					X	X	X	X		X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
Ash-throated flycatcher				X																					
Say's phoebe								X	X	X	X		X	X	X			X	X	X	X	X	X	X	X
Traill;s flycatcher																									
Hammond's flycatcher																									
Dusky flycatcher																X									
Gray flycatcher																									
Western flycatcher	X		X	X												X									
Western wood peewee		X	X	X	X	X	X	X	X		X			X	X	X		X	X	X		X			X
Olive-sided flycatcher		X																							
Horned lark	X			X	X	X	X	X	X	X							X	X	X	X	X				X
Violet-green swallow	X	X		X	X					X	X				X			X	X	X	X	X	X	X	X
Tree swallow	X	X	X	X			X			X								X	X	X			X	X	X
Bank swallow						X	X	X	X	X			X	X		X	X	X	X	X					X
Rough-winged swallow		X		X		X	X	X					X	X	X	X						X	X	X	X
Barn swallow	X	X	X	X		X	X	X	X	X	X	X	X	X		X	X	X	X	X		X	X	X	X
Cliff swallow	X	X		X	X	X	X			X		X	X	X	X	X									
Purple martin		X	X																						
Gray jay																X									
Blue jay																X									X
Steller's jay		X	X	X												X						X	X	X	
Scrub jay		X	X																						
Black-billed magpie			X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Common raven	X		X	X	X	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X
Common crow	X	X	X	X	X	X	X							X		X	X	X	X	X	X	X	X	X	X
Clark's nutcracker															X	X						X			
Black-capped chickadee	X	X	X	X	X	X	X				X			X	X	X		X	X	X	X	X	X	X	X
Mountain chickadee				X		X									X	X							X	X	X
Boreal chickadee																									
Chestnut-backed chickadee	X	X		X																					

APPENDIX IV (Continued)

COMMON NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Common bushtit	X	X	X	X																					X
White-breasted nuthatch			X	X	X											X									
Red-breasted nuthatch	X	X	X	X		X										X							X	X	
Pygmy nuthatch															X										
Brown creeper	X	X	X	X		X										X					X	X			X
Wrentit	X																								
Dipper				X																		X	X	X	
House wren		X	X												X										X
Winter wren	X	X	X	X		X	X			X						X						X			X
Bewick's wren	X	X	X	X	X	X	X						X												
Long-billed marsh wren	X	X				X	X	X		X															X
Cañon wren				X	X							X			X			X	X	X	X	X	X	X	X
Rock wren	X		X	X	X	X		X	X	X	X	X			X			X	X	X	X	X	X	X	X
Mockingbird																									
Cat bird																							X	X	
Sage thrasher	X					X			X						X										
Robin	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Varied thrush	X	X	X	X	X	X	X				X	X				X		X	X	X	X				
Swainson's thrush	X	X	X			X										X									
Veery																X									
Western bluebird				X		X							X								X	X			X
Mountain bluebird																X						X	X	X	X
Townsend's solitaire			X			X		X			X			X	X	X		X	X	X		X	X	X	X
Golden-crowned kinglet	X	X	X	X		X	X	X	X		X	X	X	X		X		X	X	X	X	X	X	X	X
Water pipit						X			X	X	X	X	X	X											
Bohemian waxwing												X				X						X			X
Cedar waxwing		X	X	X	X	X					X		X			X		X	X	X	X	X	X	X	X
Northern shrike	X	X	X	X	X	X			X	X		X		X				X	X	X	X		X	X	X
Loggerhead shrike								X	X	X		X	X					X	X	X					X
Starling	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hutton's vireo	X	X	X																						
Solitary vireo				X	X	X	X		X		X					X		X	X	X					
Red-eyed vireo		X														X						X	X	X	
Warbling vireo		X				X										X									X
Orange-crowned warbler	X	X	X	X	X	X			X																
Nashville warbler															X	X							X	X	
Yellow warbler		X	X	X	X	X	X	X	X		X	X		X	X	X		X	X	X	X	X	X	X	X
Yellow-rumped warbler		X	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X
Myrtle warbler																									
Audubon's warbler																									
Black-throated gray warbler	X	X	X	X																					
Townsend's warbler			X			X												X	X	X					
Hermit warbler			X	X																					

APPENDIX IV (Continued)

COMMON NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Palm warbler											X														
Northern waterthrush																									
MacGillivary's warbler		X		X				X	X		X					X		X	X	X		X	X	X	
Yellowthroat	X	X	X	X			X						X				X	X	X	X			X	X	
Yellow-breasted chat		X		X		X	X		X						X								X	X	X
Wilson's warbler	X	X	X	X	X	X		X	X		X	X					X	X	X	X			X	X	
American redstart								X								X									
House sparrow	X		X		X		X	X			X		X					X	X	X	X		X	X	X
Bobolink																									
Western meadowlark	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Yellow-headed blackbird						X	X	X	X	X			X					X	X	X	X				X
Red-winged blackbird	X	X	X	X	X	X	X	X	X	X		X	X	X	X		X	X	X	X	X	X	X	X	X
Northern oriole		X	X	X	X	X	X		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Bullock's oriole																X									
Brewer's blackbird	X	X	X	X		X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X
Brown-headed cowbird	X	X	X	X	X	X	X		X		X		X	X	X	X	X	X	X	X					X
Western tanager		X		X		X			X		X			X			X				X	X	X	X	
Black-headed grosbeak	X	X	X	X		X												X	X	X	X	X			
Lazuli bunting					X	X	X								X	X	X	X	X	X	X	X	X	X	X
Evening grosbeak	X	X	X	X		X	X											X	X	X	X	X	X	X	X
Purple finch		X	X			X	X									X		X	X	X					
Cassin's finch															X	X							X	X	
House finch		X	X	X	X	X				X	X		X	X				X	X	X	X	X	X	X	X
Pine grosbeak				X														X	X	X	X				
Gray-crowned rosy finch																		X	X	X			X	X	X
Black rosy finch																									
Common redpoll																					X				
Pine siskin	X	X	X	X		X	X		X						X	X					X	X	X	X	X
American goldfinch	X	X	X	X	X	X	X	X	X		X	X		X	X		X	X	X	X	X	X	X	X	X
Red crossbill	X	X		X											X	X									
Green-tailed towhee																									
Rufous-sided towhee	X	X	X	X		X	X	X							X	X	X	X	X	X		X	X	X	X
Lark bunting										X															
Savannah sparrow	X	X	X		X	X	X	X	X	X	X	X	X	X	X		X	X	X	X		X	X	X	X
Grasshopper sparrow																	X	X	X	X					
Vesper sparrow	X																								
Lark sparrow						X	X		X			X	X	X	X		X	X	X	X	X	X	X	X	X
Black-throated sparrow																									
Sage sparrow																									
Slate-colored junco																									
Dark-eyed junco		X	X	X	X	X	X										X	X	X	X	X	X	X	X	X
Oregon junco																									
Undifferentiated juncos											X	X	X	X	X	X									

APPENDIX IV (Continued)

COMMON NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Tree sparrow						X		X	X					X							X				X
Chipping sparrow				X		X		X						X	X	X		X	X	X					X
Brewer's sparrow						X							-												
Harris' sparrow																									
White-crowned sparrow		X	X	X	X	X	X	X	X	X	X	X	X		X		X	X	X	X	X	X	X	X	X
Golden-crowned sparrow			X	X		X																			
White-throated sparrow		X	X													X									
Fox sparrow		X	X			X					X							X	X	X					
Lincoln's sparrow			X	X				X	X	X							X	X	X	X	X	X			X
Song sparrow	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Snow bunting																									

1/ Study segments are defined in Table 2, Page 6.

APPENDIX V - Mammals of the Columbia and Snake River wildlife study area as recorded by study segment 1/ (X), or as reported in previous studies (*).

COMMON NAME/SCIENTIFIC NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Opossum/*Didelphis virginiana*		X	X	X		X																			
Masked shrew/*Sorex cinereus*																									
Malhuer shrew/*Sorex preblei*																									
Merriam shrew/*Sorex merriami*				*	*	*																			
Trowbridge shrew/*Sorex trowbridgii*	X	X		X																					
Vagrant shrew/*Sorex vagrans*	X	X	X	X			X									X		X	X	X					X
Dusky shrew/*Sorex obscurus*	X	X	X																						
Northern water shrew/*Sorex palustris*				*																					
Pacific water shrew/*Sorex bendirii*	X	X		X																					
Shrew-mole/*Neurotrichus gibbsii*	X		X	X																					
Townsend mole/*Scapanus townsendii*		X	X																						
Pacific mole/*Scapanus orarius*	X			X																					
Little brown myotis/*Myotis lucifugus*		X	X	X		X							X		X								X	X	X
Yuma myotis/*Myotis yumanensis*		X	X	X												X	X	X	X	X	X	X	X	X	X
Long-eared myotis/*Myotis evotis*																									
Fringed myotis/*Myotis thysanodes*																									
Long-legged myotis/*Myotis volans*		X		X												X									
California myotis/*Myotis californicus*				X																					
Small-footed myotis/*Myotis subulatus*				X	X	X																	X	X	X
Silver-haired bat/*Lasionycteris noctivagans*			*	X												X						X	X	X	X
Western pipistrel/*Pipistrellus hesperus*				X	X					X				X			X	X	X	X	X	X	X	X	X
Big brown bat/*Eptesicus fuscus*		X	X	X	X	X				X		X	X	X	X	X					X	X	X	X	X
Hoary bat/*Lasiurus cinereus*	*		*																						
Spotted bat/*Euderma maculatum*																									
Western big-eared bat/*Plecotus townsendii*		X	*	X												X									
Pallid bat/*Antrozous pallidus*			*	X	X	X											X	X	X	X			X	X	X
Big freetail bat/*Tadarida molossa*																									
Black bear/*Ursus americanus*		X														X					X	X	X	X	X
Raccoon/*Procyon lotor*	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Marten/*Martes americana*																									
Fisher/*Martes pennanti*																									
Shorttail weasel/*Mustela erminea*	X					X																			
Longtail weasel/*Mustela frenata*	X	X	X													X					X	X			
Mink/*Mustela vison*	X	X	X	X	X	X	X	X	X		X		X			X									X
River otter/*Lutra canadensis*	X	X	X	X	X	X				X			X	X		X		X	X	X	X	X	X	X	X
Badger/*Taxidea taxus*					X	X		X	X					X	X										X
Spotted skunk/*Spilogale gracilis*		X		X	X	X					X					X									
Striped skunk/*Mephitis mephitis*		X	X	X	X	X	X	X	X	X	X					X	X	X	X	X	X	X	X	X	X
Coyote/*Canus latrans*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Red fox/*Vulpes fulva*			X																						X

APPENDIX V (Continued)

COMMON NAME/SCIENTIFIC NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Kit fox/*Vulpes macrotis*																									
Gray fox/*Urocyon cineroargenteus*	X	X	X																						
Mountain lion/*Felis concolor*				X																	X	X	X	X	
Lynx/*Lynx canadensis*																									
Bobcat/*Lynx rufus*			X	X	X	X	X	X		X	X	X	X		X		X	X	X	X	X	X			
Harbor seal/*Phoca vitulina*	*	X																							
Aplodontia/*Aplondontia rufa*		X																							
Woodchuck/*Marmota monax*																									
Yellowbelly marmot/*Marmota flaviventris*				X	X	X	X	X				X		X			X	X	X	X	X	X	X	X	X
Hoary marmot/*Marmota caligata*																									
California ground squirrel/ *Spermophilis beecheyi*	X	X	X	X	X	X																			
Townsend ground squirrel/ *Spermophilis townsendii*					X																				X
Washington ground squirrel *Spermophilis washingtoni*						*																			
Idaho ground squirrel/ *Spermophilis brunneus*																									
Richardson ground squirrel/ *Spermophilis richardsoni*																									
Belding ground squirrel/ *Spermophilis beldingi*						*																			
Columbian ground squirrel/ *Spermophilis columbianus*															X	X	X								
Whitetail antelope squirrel/ *Ammospermophilus leucurus*																									
Least chipmunk/*Eutamias minimus*																									
Townsend chipmunk/*Eutamias townsendii*	X	X	X	X																					
Yellow pine chipmunk/*Eutamias amoenus*				*	*	*								X	X	X									
Gray-tailed chipmunk/*Eutamias amoenus canicaudus*																									
Redtail chipmunk/*Eutamias ruficaudus*																									
Western gray squirrel/*Sciurus griseus*				X																					
Eastern gray squirrel/*Sciurus carolinensis*			X																						
Eastern fox squirrel/*Sciurus niger*																				X	X				
Red squirrel/*Tamiasciurus hudsonicus*																X						X	X	X	
Chickaree/*Tamiasciurus douglasi*	X	X	X	X																					
Northern flying squirrel/*Glaucomys sabrinus*		X	X	X																					
Northern pocket gopher/*Thomomys talpoides*				X	X	X	X	X	X			X		X	X	X	X	X	X	X	X	X	X	X	X
Mazama pocket gopher/*Thomomys mazama*	*	*	*																						

APPENDIX V (Continued)

COMMON NAME/SCIENTIFIC NAME	STUDY SEGMENT: COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Townsend pocket gopher/*Thomomys townsendii*																									
Giant pocket gopher/*Thomomys bulbivorus*																									
Great basin pocket mouse/*Perognathus parvus*					X	X	X	X	X	X		X	X	X	X		X			X					X
Ord kangaroo rat/*Dipodomys ordi*						X	X	X	X								X								X
Great basin kangaroo rat/*Dipodomys microps*																									
Beaver/*Castor canadensis*	X	X	X	X	X	X	X	X		X			X	X	X	X	X	X	X	X	X		X	X	
Western harvest mouse/*Reithrodontomys megalotis*							X	X	X		X	X	X	X	X		X	X	X	X	X				X
Canyon mouse/*Peromyscus crinitis*					*																				
Deer mouse/*Peromyscus maniculatus*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Forest deer mouse/*Peromyscus oreas*						X	X																		
Northern grasshopper mouse/*Onychomys leucogaster*																									
Desert woodrat/*Neotoma lepida*																									
Dusky-footed woodrat/*Neotoma fuscipes*																									
Bushytail woodrat/*Neotoma cinerea*				X	X	X			X		X			X							X	X	X	X	
Mountain pheonacomys/*Phenacomys intermedius*																									
Pacific phenacomys/*Phenacomys albipes*																									
Tree phenacomys/*Phenacomys longicaudus*																									
Boreal redback vole/*Clethrionomys gapperi*																									
California redback vole/*Clethrionomys occidentalis*	*	*		*																					
Long-tailed vole/*Longicaudus*			X																						
Meadow vole/*Microtus pennsylvanicus*																X									
Montane vole/*Microtus montanus*				X		X	X	X			X	X	X	X				X	X	X					X
Townsend vole/*Microtus townsendii*	X	X	X	X																					
Richardson vole/*Microtus richardsoni*																									
Oregon vole/*Microtus oregoni*	X	X																							
Sagebrush vole/*Lagarus curtatus*					*	*																			
Heather vole/*Phenacomys intermedius*				*																					
Dusky tree vole/*Phenacomys silvicola*																									
Muskrat/*Ondatra zibethica*	X	X	X	X	X	X	X	X		X	X	X	X	X				X	X				X	X	X
Norway rat/*Rattus norvegicus*		X				X												X	X						
Black rat/*Rattus rattus*	*																								
House mouse/*Mus musculus*						X	X	X		X	X		X					X	X	X	X	X			X
Western jumping mouse/*Zapus princeps*				*	*	*																			
Pacific jumping mouse/*Zapus trinotatus*	X	X									X			X											
Porcupine/*Erethizon dorsatum*		X		X	X	X		X			X	X			X	X		X	X	X	X	X	X	X	X

APPENDIX V (Continued)

COMMON NAME/SCIENTIFIC NAME	STUDY SEGMENT																								
	COLUMBIA RIVER																SNAKE RIVER								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Nutria/*Myocastor coypus*	X	X	X																						
Pika/*Ochotona princeps*				*			X																		
Whitetail jackrabbit/*Lepus townsendii*							X																		
Snowshoe hare/*Lepus americanus*	X	X		X																					
Blacktail jackrabbit/*Lepus californicus*					X	X	X	X	X	X							X								
Eastern cottontail/*Sylvilagus floridanus*		X	X																						
Mountain cottontail/*Sylvilagus nuttali*				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Brush rabbit/*Sylvilagus bachmani*	X	X	X																						
Pygmy rabbit/*Sylvilagus idahoensis*																									
Elk/*Cervus canadensis*									X												X	X	X	X	X
Roosevelt elk/*Cervus canadensis roosevelti*		X	X																						
Mule deer/*Odocoileus hemionus*					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Black-tailed deer/*Odocoileus hemionus columbianus*	X	X	X	X	X																				
Whitetail deer/*Odocoileus virginianus*		X	X				X	X						X	X	X		X	X	X	X	X	X	X	
Moose/*Alces alces*																									
Pronghorn/*Antilocapra americanus*									X																
Mountain goat/*Oreamnos americanus*																						X			
Bighorn sheep/*Ovis canadensis*																						X			

1/ Study segments are defined in Table 2, Page 6.