2000 WOOD RIVER WETLAND ANNUAL MONITORING REPORT

Wood River Delta January 2001

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PROJECT TIME LINE

This project is designed to restore approximately 3,000 acres of wetland habitat and 2.5 miles of river channel. The Bureau of Land Management's (BLM) project goals include improved water quality and quantity, and improved habitat for two endangered fish species, as well as other wildlife. The money spent in FY 2000 went for final design, construction and monitoring of the second and third phases of project plan implementation.

Phase 1 components:

a) the construction of 2 miles of dike and associated water control structures,
b) the creation of two ponds in the northeast corner of the property,
c) replacement of an existing pump station,
d) design of a new drainage system to emulate original stream courses across the property,
e) the reconstruction of 0.5 mile of existing levee.

Ducks Unlimited completed construction of the new pump station in September 1996, expending $125,000. In July of 1997, Ducks Unlimited completed two miles of dike construction (approximately 65,000 cubic yards of material), installed four new water control structures (full-round risers with screw gates and flash boards, and created two ponds (approximately 20 acres total), worth approximately $400,000.

The U.S. Fish and Wildlife Service contributed labor and equipment worth approximately $100,000 to create 6 miles of meandering drainage channels and repair 0.5 mile of existing levee in August of 1997.

Phase 2 components:

a) reconstruction of a levee for 1.8 miles with 60,000 cubic yards of material across the middle of the project area.
b) construction of two settling ponds in front of the two pump stations. These ponds will serve as final treatment for water to be pumped from the property.
c) installation of three water control structures associated with this middle levee and ponds were completed in February 1998.
d) installation of four water control structures by June 1998.

Phase 3 components:

Oregon Trout is the lead partner providing technical and financial support to restore the lower 1.8 miles of the Wood River to its historic form and function, from the confluence of Crooked Creek south to the dike road bridge. Construction of this project began in September of 1997, with the stockpiling of materials and creation of approximately two acres of wetland habitat. Approximately 40% of the construction work was completed in 1998. The remainder of this work was completed in 1999. This phase of the project is designed to improve refugial habitats for the early life stages of endangered suckers, fish passage, and instream habitat for trout, and provide a wider flood plain with improved riparian and wetland habitat for waterfowl and neotropical migrant birds.

The restoration of a 3,300 foot section of historic channel south of the dike road bridge, was completed in January of 2001. The design of this portion of the project was modified, during implementation, to include two hydraulic grade control structures. These structures were constructed by placing fill material in two side channels downstream of the Dike Road bridge. The restoration of this delta stream channel could greatly improve refugial habitat for fish and water quality in the northeast portion of Agency Lake.

Phase 4

The final phase of the Wood River Wetland restoration project will be to develop a more sinuous and diverse interface along Sevenmile Canal. This would involve a two mile reach of existing levee. This phase of the project will provide improved refugial habitat for larval and juvenile fish, as well as improved nesting and brood-rearing habitat for waterfowl and neotropical migrant birds. Potential partners include Ducks Unlimited, Oregon Trout, Water for Life, U.S. Fish and Wildlife Service, Trout Unlimited, and the Bureau of Reclamation. Studies are underway to examine the feasibility of this portion of the project.

Partners

A diverse group of partners, committed to restoring the Klamath Basin Ecosystem, is making the Wood River Wetland restoration a reality. To date, Federal partners are Klamath Basin Working Group, Bureau of Land Management, U.S. Fish and Wildlife Service (Klamath Basin Refuges), Klamath Basin Ecosystem Restoration Office, National Fish and Wildlife Foundation, Winema National Forest, U.S. Forest Service Redwood Sciences Lab, and the Bureau of Reclamation.

Non federal partners to date are Ducks Unlimited, Oregon Trout, Oregon Watershed Enhancement Board, Oregon Department of Transportation, Oregon Department of Environmental Quality, The Klamath Tribes, The Nature Conservancy, Jim Root Ranch, The Rocky Mountain Elk Foundation, The Usual Suspects, Oregon Department of Fish and Wildlife, Klamath Basin Audubon Society, Oregon Institute of Technology, Henley High School, Lost River High School, Tulelake High School, Butte Valley High School, Chiloquin Elementary School, High Desert Learning Center, and Oregon Wetlands Joint Venture.

More information about this project is available by contacting Wedge Watkins at the Klamath Falls Resource Area (541) 885-4110, or email wwatkins@or.blm.gov.

Waterfowl

Historic Management

From 1985 through 1994, this property was managed as irrigated pasture land for beef cattle production. Under this management objective, the mode of operation was as follows. Water that had accumulated on the property over the winter would be pumped off beginning in February or March. Pumping would continue until the property was without surface water except in the drainage canals. This condition was usually achieved by approximately May 1. Cattle were trucked into the ranch beginning in April and turned out on the north half of the property. Approximately 1,300 cow/calf pairs grazed the property through November with some variation in these dates due to weather. Irrigation of the property was usually conducted during July, August and September. Under this management scenario, open water was limited to a few areas that were not grazed in the previous year. Spring and fall forage for migrating geese was abundant. Vegetation on the property was dominated by grasses, sedges and weeds. In 1995, much of the property remained wet, resulting in dramatic changes in vegetation (away from grasses), and increased waterfowl use, primarily by ducks.

Field Observations in 1998

Waterfowl and shorebirds appeared to respond well to the water management in 1998. Goose production appeared to be improved over 1997. In 1998, an attempt was made to quantify duck production for the first time. The brood count conducted during August was impressive both in the number of birds and in the variety of species observed with broods.

The acquisition of approximately 7,000 acres to the west of Wood River Wetland by the Bureau of Reclamation (BOR)

greatly influenced waterfowl during 1998. Because of the timing of the acquisition, the BOR property was not grazed during 1998. In fact, it was flooded with approximately 18 inches of water throughout the summer and fall. This provided excellent habitat for resident and migrating waterfowl, with peak numbers exceeding 300,000 birds.

Periodic flights have been made over the property during the past five years (except May-August) by the U.S. Fish and Wildlife Service. Results of those flights are displayed in Table 3.

Wood River Wetland Waterfowl Brood Count 1998

On August 4, 1998 a waterfowl brood count was conducted on the south half of the Wood River Wetland. The survey was conducted between 8:00 a.m. and 12:00 p.m., on approximately six miles of channels using a combination of canoe and pick-up trucks. Two observers, used binoculars to determine species, number of young, age of young, and presence of adult birds with the brood. Table 1 reflects the data collected during this one day of observation. The survey did not count young of the year birds observed in flight. Gadwall hens were observed incubating eggs during the time of survey. As a result, early broods and late broods are not represented in this data.

Table 1. Brood Count Data 8/4/98

Species	Total Young	Misc. Notes
Gadwall	541	Many Gadwall hens were still on nests
Cinnamon Teal	174	
Mallard	84	Several mallard broods were already able to fly, and were not counted.
Shoveler	19	
Ruddy Duck	19	
Ring-necked Duck	14	
Scaup	14	
Coot	4	
Horned Grebe	2	
Eared Grebe	2	
Total Production	873	

Several family groups with young of the year birds were observed in flight. No attempt was made to estimate production based on these observations. These family groups included Canada geese, mallards, cinnamon teal, pintails, black-necked stilts, common snipe, long-billed dowitcher and white-faced ibis.

Management in 1999

Water management in 1999 began with the property being inundated in January. Approximately 2,500 acres was covered by 3"-36" of standing water from January-May. Water was pumped from the property for approximately 14 days between March and April. Water levels were allowed to recede during the growing season (May through September) from evapotranspiration. This drying allowed for wetland plants to be transplanted from the interior wetland to the restoration area adjacent to the Wood River channel. Water levels were increased from September to December, through irrigation and precipitation.

Field Observations in 1999

Despite a cool wet spring ,that delayed plant growth as well as waterfowl nesting, waterfowl broods observed in

August seemed to indicate increased brood production (see Tables 1and 2) The diversity of habitats available for waterfowl and shorebirds was good, and should continue to increase over the next several years. A nesting colony of white- faced ibis (approximately 100 nesting pair) was observed for the first time. Other birds observed nesting include black- necked stilts, common snipe, Sandhill cranes, Virginia rail, yellow rail, and black terns. The overall number of species using the property in 1999 increased slightly over past years, but the overall numbers of waterfowl was less than in 1998 and significantly less than 1995.

Waterfowl habitat, around Agency Lake, has greatly improved, as the result of other restoration efforts (Tulana Farms, Agency Lake Ranch). This improved habitat has also changed waterfowl distribution.

Periodic flights have been made over the property during the past eight years (except May-August) by the U.S. Fish and Wildlife Service. Results of those flights are displayed in Table 4.

Conclusions

A longer period of inundation, along with a cold wet spring, resulted in a change in vegetation and use by waterfowl. While no far-reaching conclusions can be drawn from this limited data, the ability of both vegetation and waterfowl to respond to changes in water management on the property, has already been demonstrated. Wetland Managers now have the ability to flood each half of the property to different water depths. This should greatly increase management options and habitat effectiveness. BLM Managers hope to see waterfowl use and numbers responding to this new management during 2000.

Field Observations in 2000

An early and relatively mild spring ,set the stage for an excellent waterfowl production year. Waterfowl broods observed in August indicate that brood production doubled for the second consecutive year (see Tables 1, 2and 3) The diversity of habitats available for waterfowl and shorebirds was good, and should continue to increase over the next several years. A nesting colony of white- faced ibis (approximately 100 nesting pair) was observed for the second year. Other birds observed nesting include black- necked stilts, common snipe, Sandhill cranes, Virginia rail, and black terns. The overall number of species using the property in 2000 remained similar to past years. The overall peak numbers of waterfowl increased slightly in the spring (19,280 in 99 vs. 20900 in 2000) and decreased in the fall (22,200 in 99 vs. 14,030 in 2000) . Fall waterfowl numbers were lower throughout the basin in 2000, and the majority of the property was frozen over from November 20th through December. These peak numbers were less than in 1998 and significantly less than 1995.

Waterfowl habitat, around Agency Lake, has greatly improved, as the result of other restoration efforts (Tulana Farms, Agency Lake Ranch). This improved habitat has also changed waterfowl distribution.

Periodic flights have been made over the property during the past eight years (except May-August) by the U.S. Fish and Wildlife Service. Results of those flights are displayed in Table 4.

Conclusions

A longer period of inundation, along with a mild spring, resulted in a change in vegetation and use by waterfowl. While no far-reaching conclusions can be drawn from this limited data, the ability of both vegetation and waterfowl to respond to changes in water management on the property, has already been demonstrated. BLM expects that waterfowl production will continue to increase as cover increases. We expect that peak use of the property by migrating waterfowl will remain in the 10,000 - 20,000 range.

Wood River Wetland Waterfowl Brood Count 1999

Table 2. Brood Count Data 8/5/99			
Species	**Total young counted**	**Number of broods**	**Avg. young per brood**
Cinnamon Teal	500	60	8.3
Gadwall	492	62	7.9
Mallard	97	13	7.5
Shoveler	66	9	7.3
Eared Grebe	38	25	1.5
Ringneck	34	6	5.6
Greenwing teal	28	5	5.6
Widgeon	8	1	8
Ruddy Duck	8	2	4
Wood Duck	6	1	6
Scaup	3	1	3
Coot	35	unknown	unknown
Total	**1324**	**188**	**6.9**

Table 3. Brood Count Data 8/2000			
Species	**Total young counted**	**Number of broods**	**Avg. young per brood**
Cinnamon Teal	1339	173	7.7
Gadwall	1212	136	8.9
Mallard	308	37	8.3
Shoveler	4	27	6.7
Eared Grebe	117	73	1.6
Pied Bill Grebe	18	10	1.8
Ringneck	8	2	4
Greenwing teal	70	14	5
Widgeon	26	5	5.2
Ruddy Duck	23	5	4.6
Pintail	81	10	8.1
Scaup/Redhead	8	3	2.6
Coot	252	65	3.9
Total	**3,466**	**560**	**6.2**

Table 4. Total Ducks and Geese (Aerial Surveys)					
Date	**Total Ducks**	**Date**	**Total Ducks**	**Date**	**Total Ducks**
03/19/93	400	10/02/97	29,100	09/05/00	7,710
04/04/93	20,100	10/16/97	2,500	09/27/00	4,790
09/03/93	150	01/07/98	830	10/10/00	14,030
01/09/94	1,040	02/26/98	3,520	10/25/00	540
02/25/94	16,300	03/18/98	24,020	11/07/00	2,960
09/02/94	6,950	04/20/98	13,100	11/22/00	0 (frozen)
03/02/95	7,300	09/02/98	3,790	01/13/01	0 (frozen)
04/14/95	20,100	09/30/98	24,400	02/14/01	0 (frozen)
09/07/95	35,160	10/12/98	5,300		
09/19/95	104,700	10/28/98	10,130		
10/04/95	54,900	11/16/98	16,900		
10/25/95	4,180	12/11/98	1,560		
11/01/95	5,210	01/04/99	470		
11/22/95	21,800	03/01/99	21,630		
01/22/96	470	03/15/99	19,280		
02/05/96	980	09/07/99	3,240		
03/03/96	3,400	09/22/99	22,200		
03/21/96	32,370	10/05/99	0		
09/03/96	13,800	10/20/99	4,660		
09/19/96	8,500	11/02/99	3,400		
10/03/96	14,400	11/15/99	8,200		
10/16/96	6,400	12/04/99	1,160		
10/30/96	4,500	01/07/00	300		
11/06/96	4,500	02/04/00	700		
01/06/97	0(frozen)	02/18/00	18,410		
03/03/97	39,010	03/07/00	20,900		
09/09/97	4,800	04/21/00	8,400		

NEOTROPICAL MIGRATORY BIRD AND YELLOW RAIL SURVEYS

Introduction

Collection of baseline data by the Bureau of Land Management was completed in 1997; however, monitoring efforts for neotropical migratory birds conducted by the Pacific Southwest Research of the U.S. Forest Service and the Klamath Bird Observatory continued in 2000. This data is collected at the "Monitoring Avian Productivity and Survivorship" (MAPS) site. The MAPS site at Wood River is one of many in the Upper Klamath Basin and surrounding area, which includes several along the west side of Upper Klamath Lake. The goal of the collective sampling at several sites is to evaluate the reproductive success and population health of neotropical migratory birds

and to maintain a long term monitoring effort for tracking population trends. This study is being conducted under a cooperative agreement between the Bureau of Land Management, Pacific Southwest Research, the Klamath Bird Observatory, and several other partners.

Surveys for yellow rails were conducted by The Nature Conservancy on the northeast portion of the property where restoration work has been completed. In addition, mid-winter bald eagle counts have been conducted by BLM personnel on the property for the past four years.

Methods

Sampling at the MAPS site at Wood River is intended to collect data on reproductive success, use of the area during fall migration, and overall trend for neotropical migratory birds. The methods involved for monitoring under this study include mist netting, point counts associated with the mist net site during the breeding season, and area search at the mist net site during fall migration. The site is sampled from mid-May through the end of October.

Yellow rail surveys are conducted at night in preferred habitat types to locate territorial males. Males are captured and banded where it is feasible to do so. Nest searches take place during the day in suitable habitat within likely breeding territories.

Mid-winter counts for bald eagles are conducted annually on a nationwide basis during target dates in January. The route at Wood River consists of a six-mile route around the perimeter of the property.

Results and Discussion

Neotropical Migratory Birds

A total of 170 bird species were documented at Wood River as of November 2000 (Table 1). This list includes species detected during the MAPS study. Three new species, which are unusual in the Basin, were detected. An American redstart and least flycatcher were detected at Wood River during the summer of 2000. These birds are considered vagrants in the Klamath Basin. The term vagrant refers to birds which appear in areas outside of their normal range. The least flycatcher has not been previously documented in the Klamath Basin. The American redstart has been documented in the basin fewer than six times (Summers 1993). A snow bunting was documented by BLM personnel in November of 2000. According to Summers (1993), this species is considered rare in the Klamath Basin.

The greatest number of bird species captured through mist-netting at Wood River during the 2000 breeding season was 18, which occurred in late July. The peak number of bird species captured during the fall migration season (14) occurred by mid-September. A riparian site on the west side of Upper Klamath Lake at Odessa Creek was sampled approximately the same number of days as Wood River during the 2000 season. Although this site differs somewhat from Wood River, it is the most similar of the all the sites being sampled along Klamath and Agency Lakes, which have similar sampling effort. For comparison, this site had a peak number of 20 species during the breeding season in mid-June. During the fall migration, a peak of 21 species occurred in mid-September.

The five most common landbird species captured in the mist nets during the breeding/post breeding period, in order of abundance, were the song sparrow, marsh wren, American robin, red-winged blackbird, and yellow warbler (Table 2).

The six most common bird species captured through mist netting during the fall migration period, in order of abundance, were the yellow-rumped warbler, hermit thrush, marsh wren, Lincoln sparrow, ruby-crowned kinglet, and song sparrow (Table 2). The song sparrow and marsh wren nest at Wood River and were detected during the breeding season surveys conducted by BLM during 1995, 1996, and 1997. These species are also year-round residents. The yellow-rumped warbler, hermit thrush, and ruby crowned kinglet likely utilize the area only during their migration. These three species nest in coniferous and/or coniferous/deciduous forests.

A comparison of the five most abundant species captured during the breeding and fall migration periods over the last four years is also presented in Table 2. The most abundant species during the breeding season, over the four years combined, were the song sparrow, American robin, red-winged blackbird, yellow warbler, and brown-headed cowbird. The most abundant species during the fall migration season, over the four years combined, were the yellow-rumped warbler, hermit thrush, song sparrow, orange-crowned warbler, and marsh wren.

The abundance of brown-headed cowbirds captured during the breeding season over the four year period is disturbing because this species is a brood parasite. Brown-headed cowbirds affect the reproductive success of less common birds, many with declining population trends. Brood parasites lay eggs in the nests of other species and the parasites' young are raised by the unsuspecting host species. Brown-headed cowbird parasitism was documented for several yellow warbler nests at Wood River in 2000.

The data presented above is preliminary and no conclusions on the relative importance of the Wood River Wetland for neotropical migratory birds (as compared to other sites along Upper Klamath Lake), or overall trend for these birds, can be made at this point in time.

Table 5. Relative abundance of the five most common landbird species captured at Wood River, by year, between 1997 and 2000 during both the breeding/post breeding and fall migration periods. Data was collected by the Klamath Bird Observatory and Redwood Sciences Laboratory, U.S. Forest Service.

Table 5					
Bird Species	**Bird Abundance During the Breeding/Post Breeding Season**				
	1997	**1998**	**1999**	**2000**	**1997-2000**
Song sparrow	1	1	1	1	1
American robin	2	2	2	3	2
Red-winged blackbird	4	3	3	4	3
Yellow warbler	5	3	4	5	4
Brown-headed cowbird	3	4	5		5
Marsh wren				2	
Wilson's warbler		5			
Bird Species	**Bird Abundance During the Fall Migration Season**				
	1997	**1998**	**1999**	**2000**	**1997-2000**
Yellow-rumped warbler	1		1	1	1
Hermit thrush	2	1	5	2	2
Song sparrow	5	2	2	5	3
Orange-crowned warbler	3	3			4
Marsh wren			4	3	5
Lincoln sparrow			3	4	
Ruby-crowned kinglet	4			4	
Fox sparrow		5	5		
Varied thrush		4			

Yellow Rail

A total of ten surveys of the Wood River Wetland were conducted in 2000. Two rails were detected on May 6 and three were detected on the May 15 visit. One of these birds was banded. No other birds were heard calling on the remainder of the site visits. This compares to 6 rails heard in 1998 and 7 rails heard in 1999. Lower water levels were observed in 1999 and 2000 as well as a shorter duration of flooding. There were also different observers in 2000 than in previous years. This information was taken from an annual report on yellow rail monitoring that is produced by The Nature Conservancy in cooperation with U.S. Fish and Wildlife Service, Winema National Forest, Oregon Department of Fish and Wildlife and BLM. Copies of this report can be obtained by contacting the Klamath Falls Resource Area of BLM.

The survey for yellow rails will be repeated in cooperation with The Nature Conservancy in the 2001 field season.

Bald Eagle

1998&1999

Mid-winter bald eagle counts were conducted during 1998 and 1999. Mid-winter counts are conducted annually on a nationwide basis during target dates in January. The route at Wood River consists of a 6-mile route around the perimeter of the property. In 1998, five immature bald eagles and one adult bald eagle were observed along the route. In 1999, two adult bald eagles and two immature eagles were documented.

2000

Mid-winter bald eagle counts were conducted for the fourth year in 2000. In 2000, three immature bald eagles and two adult bald eagles were observed along the route. Bald eagles also have been frequently observed hunting at Wood River during the spring and summer months.

FUTURE MONITORING

The MAPS study of neotropical migratory birds by the KBO and RSL, and the surveys of yellow rails by The Nature Conservancy, will continue as funding is available. Bald eagle mid-winter counts will continue indefinitely. Monitoring of landbirds by BLM using point counts will resume in the spring/summer of 2001.

Table 6. List of All Bird Species Documented at the Wood River Wetland as of November 2000.

American avocet	Brant	Common merganser	
American bittern	Brewer's blackbird	Common nighthawk	Golden-crowned sparrow
American coot	Brown creeper		
American goldfinch	Brown-headed cowbird	Common raven	Goldeneye
American kestrel	Bufflehead	Common snipe	Grasshopper sparrow
American redstart*	Bullock's oriole	Common yellowthroat	Great blue heron
American robin	California gull	Cooper's hawk*	Great egret
American white pelican	California quail	Dark-eyed junco	Great horned owl
American wigeon	Canada goose	Double-crested cormorant	Great-tailed grackle*
Bald eagle	Canvasback	Downy woodpecker	Greater scaup*
Barn swallow	Caspian tern	Dusky flycatcher	Greater white-fronted goose
Belted kingfisher	Cassin's vireo	Eared grebe	Greater yellowlegs
Black-billed magpie	Cedar waxwing	European starling	Green-backed heron
Black-capped chickadee	Chestnut-backed chickadee	Evening grosbeak	Green-tailed towhee
Black-crowned night heron	Chipping sparrow	Ferruginous hawk	Green-winged teal
Black-headed grosbeak	Cinnamon teal	Forster's tern	Hairy woodpecker
Black-necked stilt	Clark's grebe	Fox sparrow	Hermit thrush
Black tern	Cliff swallow	Franklin's gull	Hermit warbler
Blue-winged teal	Common barn owl	Gadwall	Hooded merganser*
Bonaparte's gull	Common loon	Golden-crowned kinglet	Horned grebe

Horned lark
House finch
House wren
Killdeer
Lazuli bunting
Least flycatcher*
Least sandpiper
Lesser scaup
Lesser yellowlegs
Lincoln sparrow
Loggerhead shrike
Long-billed dowitcher
Long-eared owl
MacGillivray's warbler
Mallard
Marsh Wren
Merlin
Mountain bluebird
Mountain chickadee
Mourning dove
Nashville warbler
Northern flicker
Northern harrier
Northern pintail
Northern rough-winged swallow
Northern saw-whet owl
Northern shoveler
Olive-sided flycatcher
Orange-crowned warbler Osprey
Peeps
Peregrine falcon
Pied-billed grebe
Pine siskin
Prairie falcon
Purple finch
Pygmy nuthatch
Red-breasted sapsucker
Redhead
Red-naped sapsucker
Red-tailed hawk
Red-winged blackbird
Ring-billed gull
Ring-necked duck
Ross' goose
Ruby-crowned kinglet
Ruddy duck
Sandhill crane
Savannah sparrow
Say's phoebe
Sharp-shinned hawk
Short-billed dowitcher
Short-eared owl*
Snow bunting*
Snow goose
Snowy egret
Song sparrow
Sora
Spotted sandpiper
Spotted towhee
Stellar's jay
Swainson's thrush
Tree swallow
Tri-colored blackbird
Tundra swan
Turkey vulture
Varied thrush
Violet-green swallow
Virginia rail
Warbling vireo
Western flycatcher
Western grebe
Western kingbird
Western meadowlark
Western sandpiper
Western tanager
Western wood-pewee
White-crowned sparrow (gambelii)
White-throated sparrow
White-faced ibis
Willow flycatcher
Willet
Wilson's phalarope
Wilson's warbler
Winter wren
Wood duck
Yellow-breasted chat
Yellow-headed blackbird
Yellow rail
Yellow-rumped warbler
Audubon's warbler
Myrtle warbler
Yellow warbler

Total number of species = 168
*Species not previously documented at Wood River which were detected during 2000.

VEGETATION

Data were collected from 30 vegetation monitoring plots on the Wood River Wetland properly during 1999. Twenty of the plots were originally established in 1995, and 9 plots were first established in 1996 to complete the planned plot design for vegetation monitoring. One new plot was established in 1999 within the riparian wetland created by filling a portion of the dredged Wood River channel. This completed the initial monitoring for vegetation change following the establishment of restoration water levels in the interior of the Wood River Wetland in 1998, and established baseline data for monitoring vegetation change within the created riparian wetland. Therefore, no vegetation monitoring plots were sampled during 2000.

The monitoring plan contained in the Upper Klamath Basin and Wood River Wetland RMP/EIS called for vegetation monitoring every three to five years after the collection of baseline data. Therefore, vegetation data will next be collected in 2002.

A list of plant species that have been identified on the Wood River property is available in the botany files at the Klamath Falls Resource Area office.

RIPARIAN RESOURCES

Photo Points

Photos were taken at the 12 established photo points along the Seven Mile dike and the Wood River (see Map 1). The riparian photo points are located approximately 1000 meters apart. At each point four photos are taken, one in each of the four cardinal directions (North, South, East, and West) using a compass to determine the direction. The photos are taken during the middle to end of June.

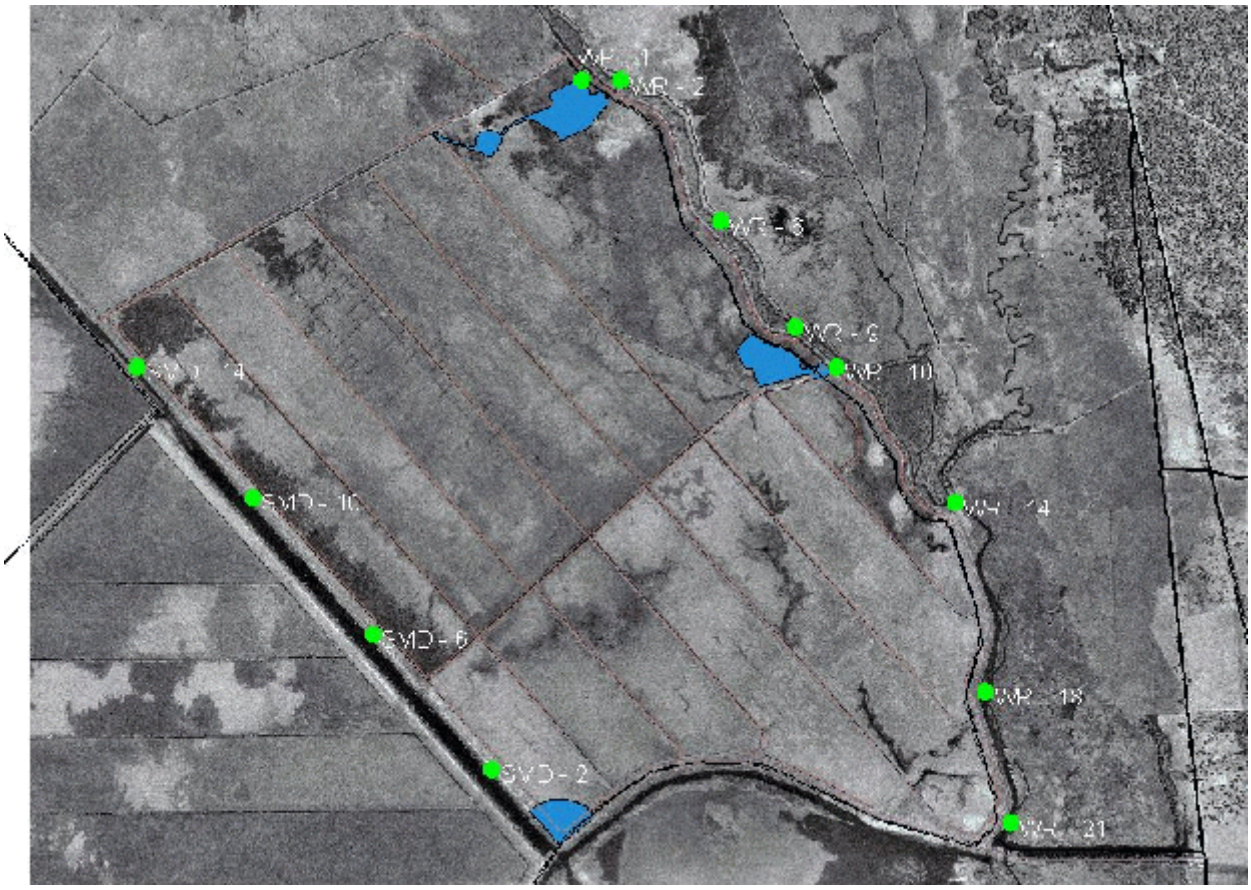


Figure a. Vegetation monitoring photo points

The photo points were first taken in 1995, the first year after livestock were removed from the property. In reviewing the photos, there is an obvious increase in the total amount of vegetation present in succeeding years. The 1995 photos show patches of bare ground that are no longer evident in the 2000 photos. Changes in the species composition are not immediately evident from the photos. These photo points will continue to be valuable as water levels and channel configurations are manipulated. Vegetation amounts and species composition will likely change with different moisture regimes.

The location of the photo points and copies of the photos are located in the Wood River Photo Points binder located at the Klamath Falls Field Office.

These photos will be retaken in 2001. Additional photo points will also be added along the south dike and the Petric dike.

Water Quality

Wood River channel temperature.

Methods: Water temperature data loggers were deployed at two stations in 1997 (North Boundary Station and Bottom of Project Station (fig (c)). A third water temperature station was added in 1998 below the confluence of Crooked Creek. This logger leaked in 2000 and no data was retrieved for this station. The objective of these data loggers was to accurately measure how the narrowing and deepening of the Wood River affects the rate of stream warming through the project reach. Calibration and deployment of temperature loggers followed methods described in "*Water Quality Monitoring Technical Guide Book, Oregon Plan for Salmon and Watersheds, 1999*". Analysis in this year focused on mean daily warming rates through the project reach in July. The first major change in surface area occurred in October 1998 when surface area was reduced from 36 acres to 26 acres (figure (d)). The second change occurred in mid-August, 1999 when surface area was reduced from 26 acres to 17 acres. This was the year that data was available for summer in the fully restored condition.

Results: Hourly recordings of instantaneous water temperatures were reduced to maximum and mean daily water temperatures for the summer months of June, July, and August. Other climatic and environmental variables used in the analysis include: Maximum and minimum daily air temperature at Chiloquin NW (Chiloquin Hatchery); Mean daily discharge at Weed Road. Figure (b) illustrates daily maximum water temperate and warming that occurs over the entire length of the BLM property. Table (a) shows monthly mean and maximum warming rates.

Table _7. Warming rates in project reach by summer month for 1997-2000.

Year	Mean warming June	Max June	Mean warming July	Max July	Mean warming August	Max August
1997	3.48	5.26	3.73	5.28	4.45	6.43
1998	5.67	7.12	8.51	11.81	5.20	8.28
1999	5.09	6.12	4.23	6.44	2.11	3.58
2000	5.55	6.62	3.58	5.13	2.90	3.45

Because numerous physical and climatological factors affect rates of stream warming, caution should be used in comparing differences in mean values between years. Several regression analyses were performed to ascertain how channel morphological changes from restoration activities affected warming rates in July while taking into consideration climatological factors, flow, and ambient water temperatures. Data from 1997 was not used in this analysis because no flow data was available. Data from July only was used to reduce temporal variation. When data was combined for all three years, **channel width** carried the most weight in predicting stream warming using simple linear regression.. Figure (f) shows the how the regression model predicts warming rate for each of three years. A non-linear regression was used to predict mean warming rates for the three different channel widths (Figure (f)). The interpretation is limited by several factors: First, there were poor r^2 values for year 2000 and secondly, when data are fitted to the USGS SSTEMP model (Bartholow 1989), 1998 predicted values are considerable less than what was measured. Thirdly, climatological factor may be important in determining warming rates.

Table 8. Comparison of measured values and SSTEMP model predictions (JULY)

Year	Measured Mean Temp	Measured Max Temp	Measured ^{a}T	SSTEMP Mean Temp	SSTEMP Max Temp	SSTEMP ^{a}T
1997	58.1		4.8			
1998	62.1	64.3	7.9	58.5	63.3	4.3
1999	57.5	59.7	4.9	56.4	61.0	3.7
2000	58.4	60.3	3.9	57.5	61.7	3.0

From the SSTEMP model, average daily warming is predicted to be reduced by approximately 1.7 ^{B}F (Table 8) when channel width is reduced from 238 ft. to 84 ft. However, a 4 ^{B}F decrease in mean warming was measured between 1998 and 2000. To take climatic variables into consideration, the relationship of warming to climatic variables for

1998 (the year with the best r^2 value) was calculated by regression. The expression, $^{a}T = -32.66 + 0.63(Outflow\ temp) + .01495(Max\ air\ temp)$ was applied to the 2000 data set. The resultant predicted mean ^{a}T of 5.3 ^{B}F is 1.4 ^{B}F warmer than the actual mean ^{a}T (3.9 ^{B}F). Thus, the 1.4 ^{B}F difference when climatic factors are taken into consideration closely resembles the 1.7 ^{B}F predicted by the SSTEMP model.

It should be noted that mean summer flows have been well above average during all years sampled. The SSTEMP model predicts that the difference in warming rate through the project reach due to channel morphological changes would be approximately 5 ^{B}F (mean outflow temp = 63 ^{B}F) when flow is reduced to 50 cfs, as happened in the 1992 drought year.

Table 9. Predicted warming rate under constant (mean values) flow and climate

Channel Width	Input temp	Mean flow	SSTEMP Mean Temp at outflow	SSTEMP ^{a}T
238 (1998)	53.8	243	58.2	4.4
157(1999)	53.8	243	57.4	3.6
84(2000)	53.8	243	56.7	2.7

Mean monthly values were used as input parameter in the SSTEMP model. These results are presented in figure (f) and Table (9). Ambient air temperature and input water temperatures weigh heavily in determining the rate of stream warming in this as in most stream reaches interpreted from USGS SSTEMP model).

Regression for individual years shows a good relationship of warming to the selected climatic variables in 1998 (adj $r^2 = 0.90$) and 1999 (adj $r^2 = 0.80$) and poor in 2000 (adj $r^2 = 0.18$) (figure (f). Although the reason for the poor relationship in 2000 is not clear from the data, it may be that the reduced channel surface area has significantly reduced the sensitivity of the stream channel to solar and convective inputs.

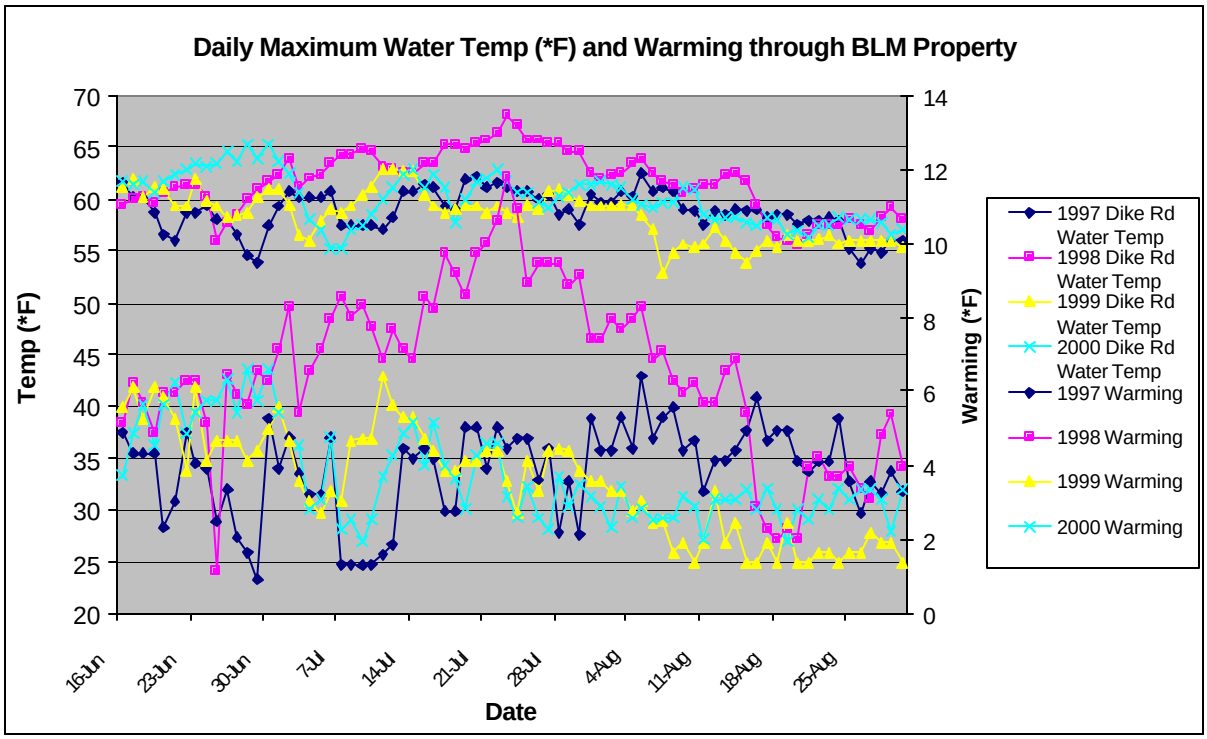


Figure (b) Daily maximum temperatures at Wood River outlet (top of graph) and daily warming (bottom of graph),

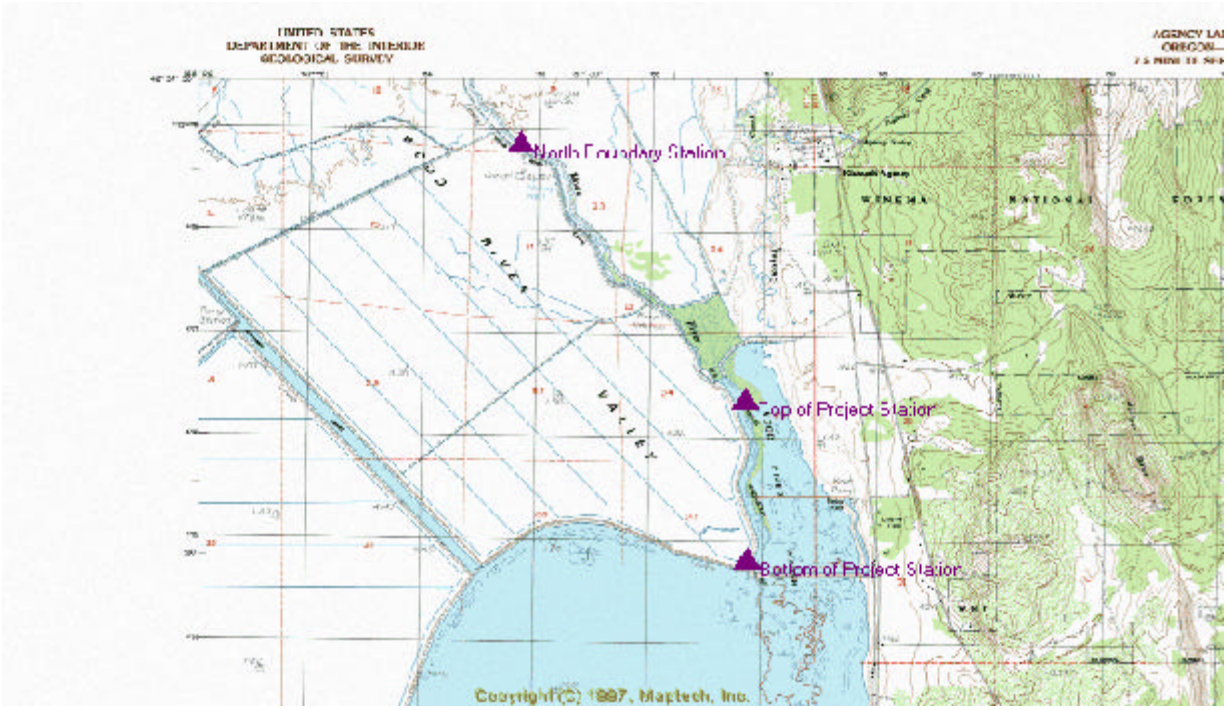
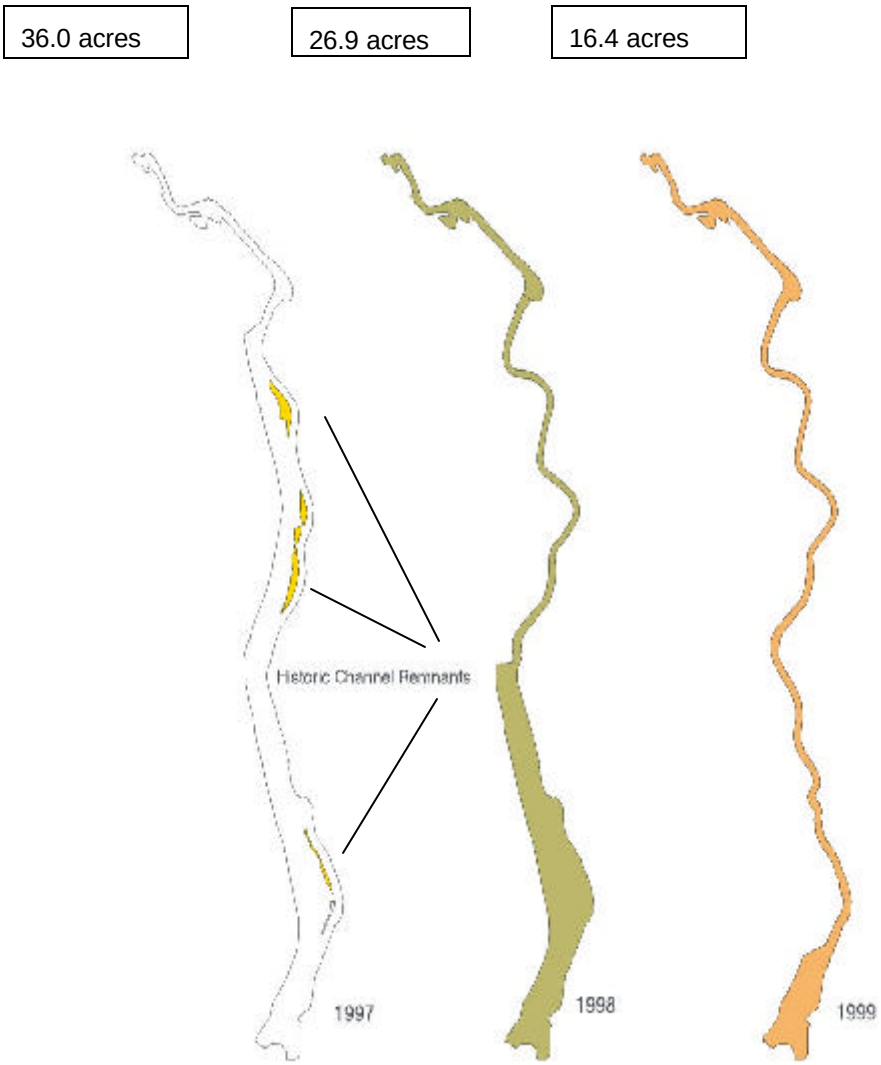


Figure (c). Map of water temperature monitoring points. Warming was measured between "North Boundary Station" and "Bottom of Project" (Weed Rd).



	1997	1998 (October)	1999 (August)
AREA (sq.ft.)	1568154	1172112	714115
AREA (acres)	36.00	26.91	16.39
Mean width (ft)	238.6	154.5	84.7

Figure (d). Graphic showing the change in water surface area after 1998 and 1999 re-construction.

Year	Channel Width (Ft)	Temp Top	Temp Bottom	^{a} T	Discharge	Max Air
		mean	mean	mean	mean	mean
1997	238.6	53.1	58.1	4.8	-	80.4
1998	238.6	54.2	62.1	7.9	283.7	86.1
1999	154.5	52.7	57.5	4.9	238.4	81.7
2000	84.7	54.5	58.4	3.9	205.7	80.5

Table 10 Mean channel width (ft), mean daily values in July for: 1) upstream and downstream water temperatures (^{B}F); warming in project reach (^{a} T); mean daily discharge (cfs), and maximum air temperature (^{B}F) recorded at Chiloquin Hatchery.

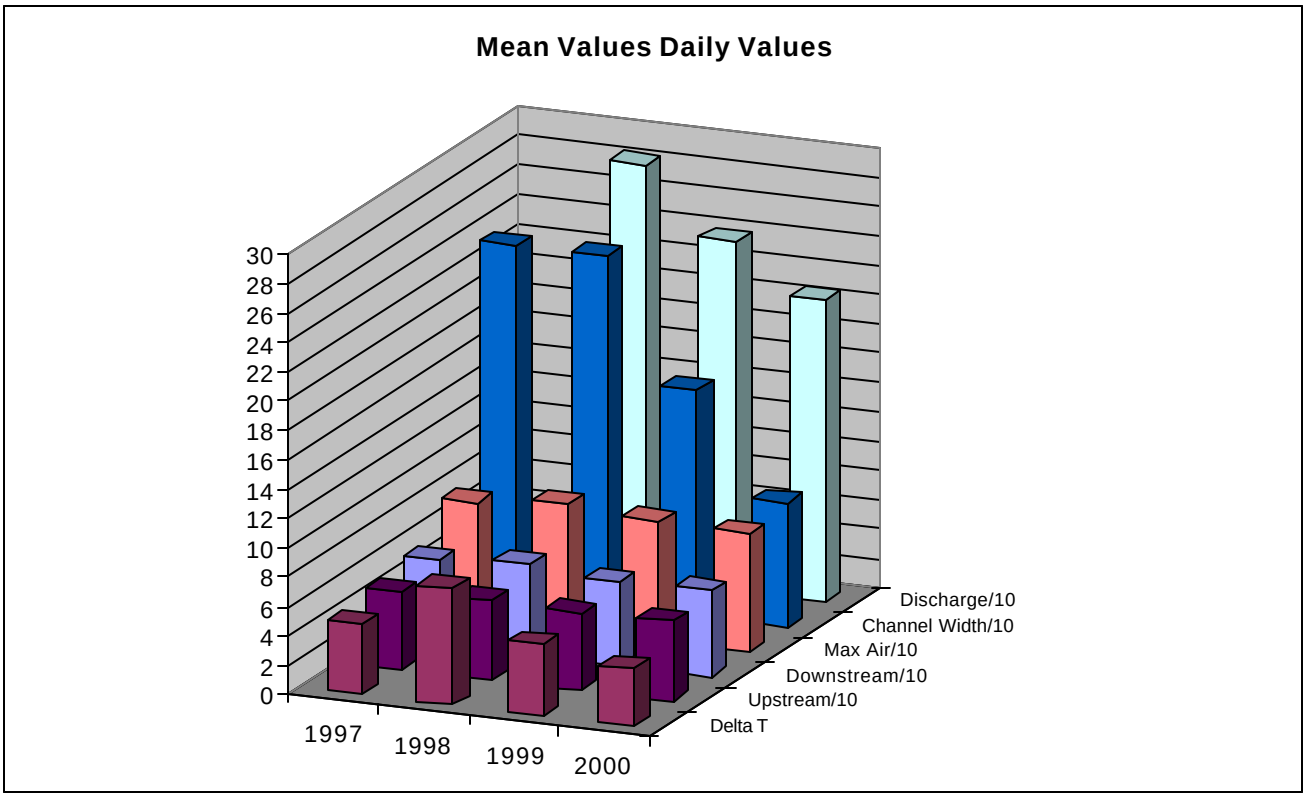


Figure (e). July daily mean values. All values except ^{a} T are plotted at 1/10 value.

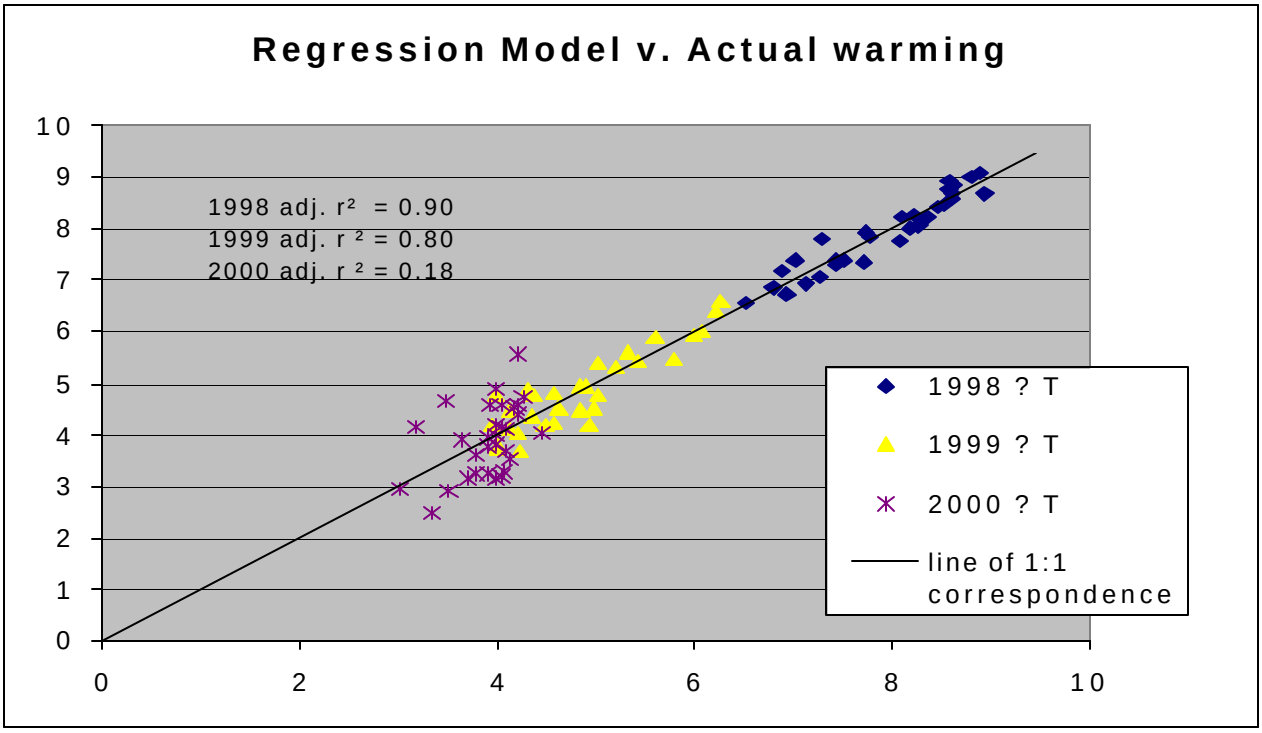


Figure (f). Regression of measured ^{a}T versus modeled ^{a}T, excluding channel width.

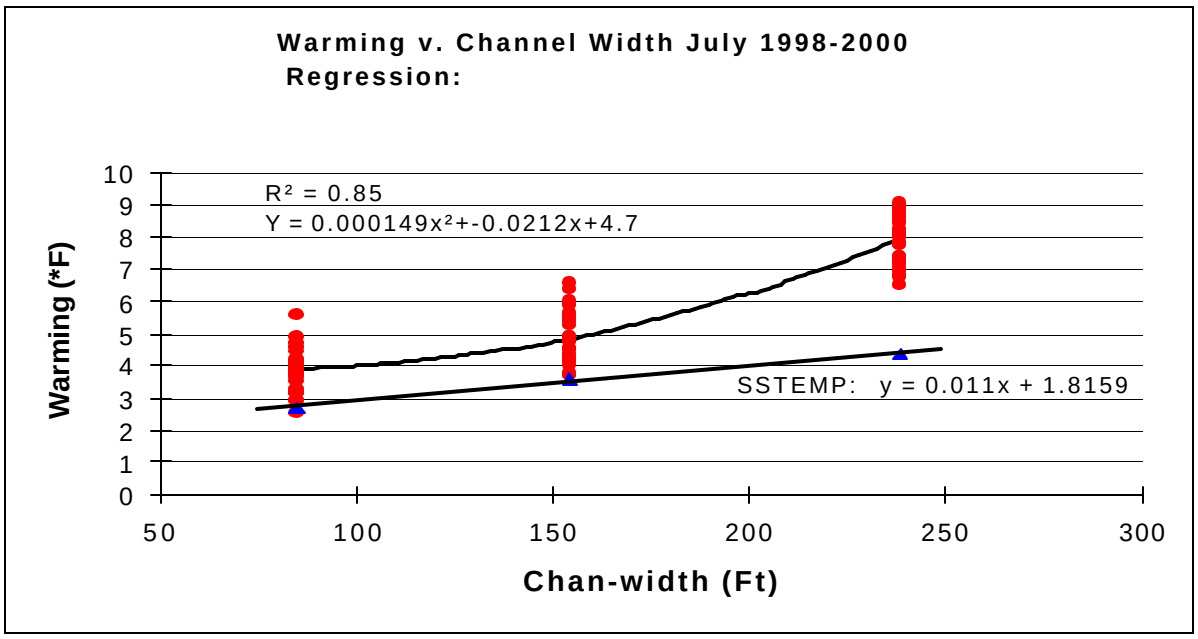


Figure (g). Relationship of mean channel width to warming (^{a}T) through project reach. Note that the 1998 data at the far right of this plot has a mean ^{a}T considerable higher that the SSTEMP predicted values.

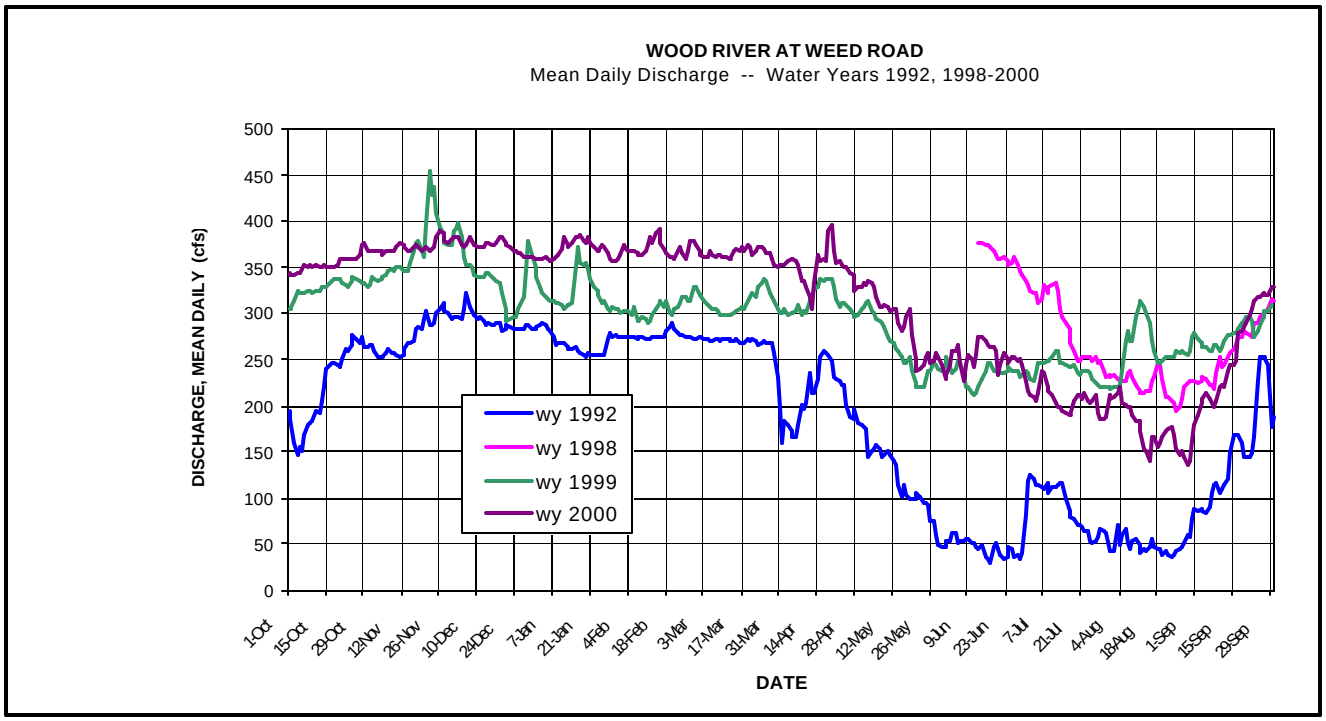


Figure (h). Flows for water years 1998-2000 at Weed Rd gage and flow for 1992, a record low water year.

Monitoring 2001:

Temperature monitoring in the Wood River Channel will be repeated using the same methods as in previous years. 2001 data will be used to further validate results.

Wood River Delta

Methods: Starting in summer, 2000, water temperature data loggers were deployed at eight stations in Agency lake in an array around the existing Wood River Delta to assess effects of channel outlet relocation on water quality. Additionally, hydrolab water quality samples were taken at weekly intervals at the temperature monitoring stations during August at the eight stations between 10 and 12 AM. Surface and bottom profiles were obtained. Hydrolab data included temperature, dissolved oxygen, pH, and conductivity.

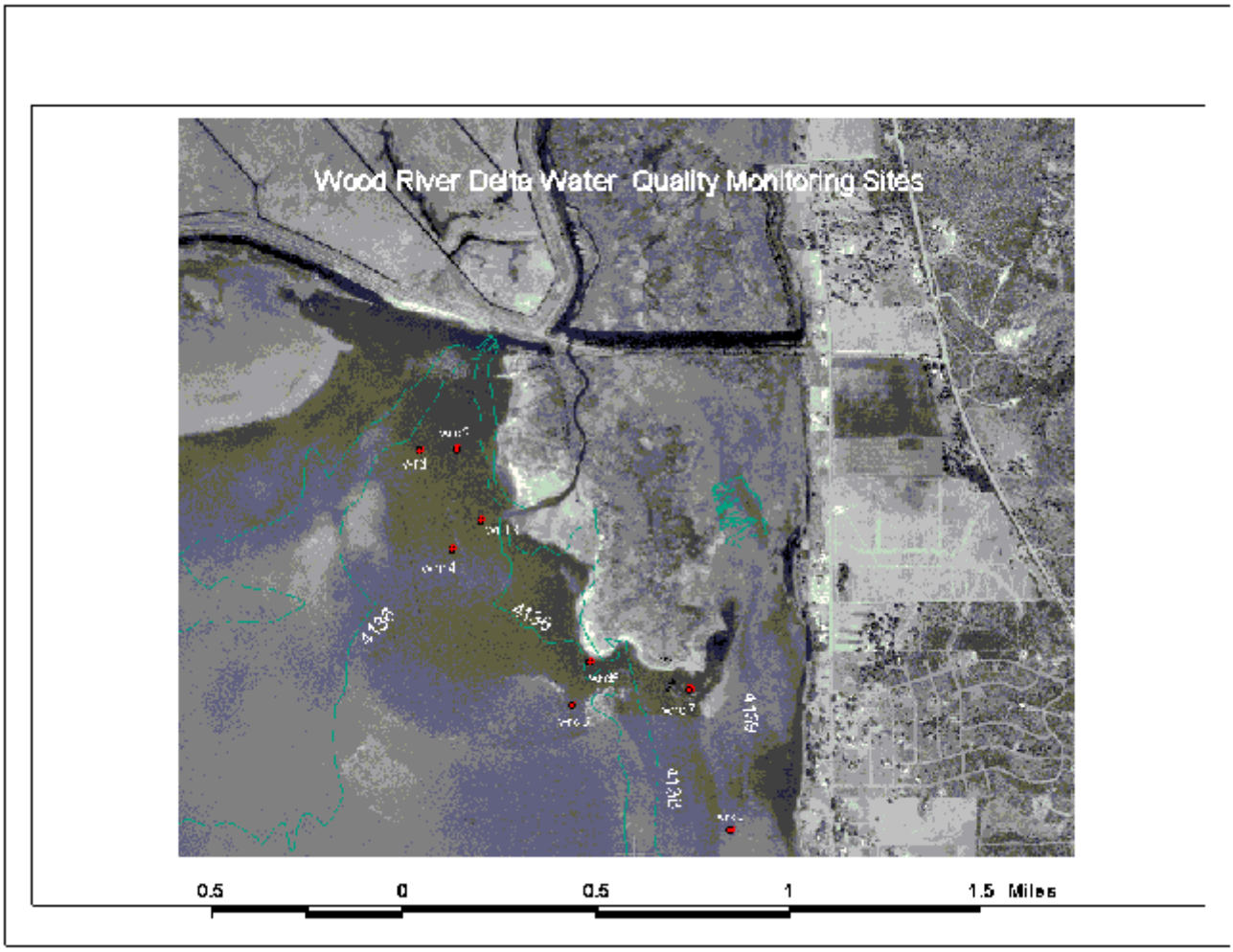


Figure (i). Water quality and temperature logger station locations, Wood River Delta.

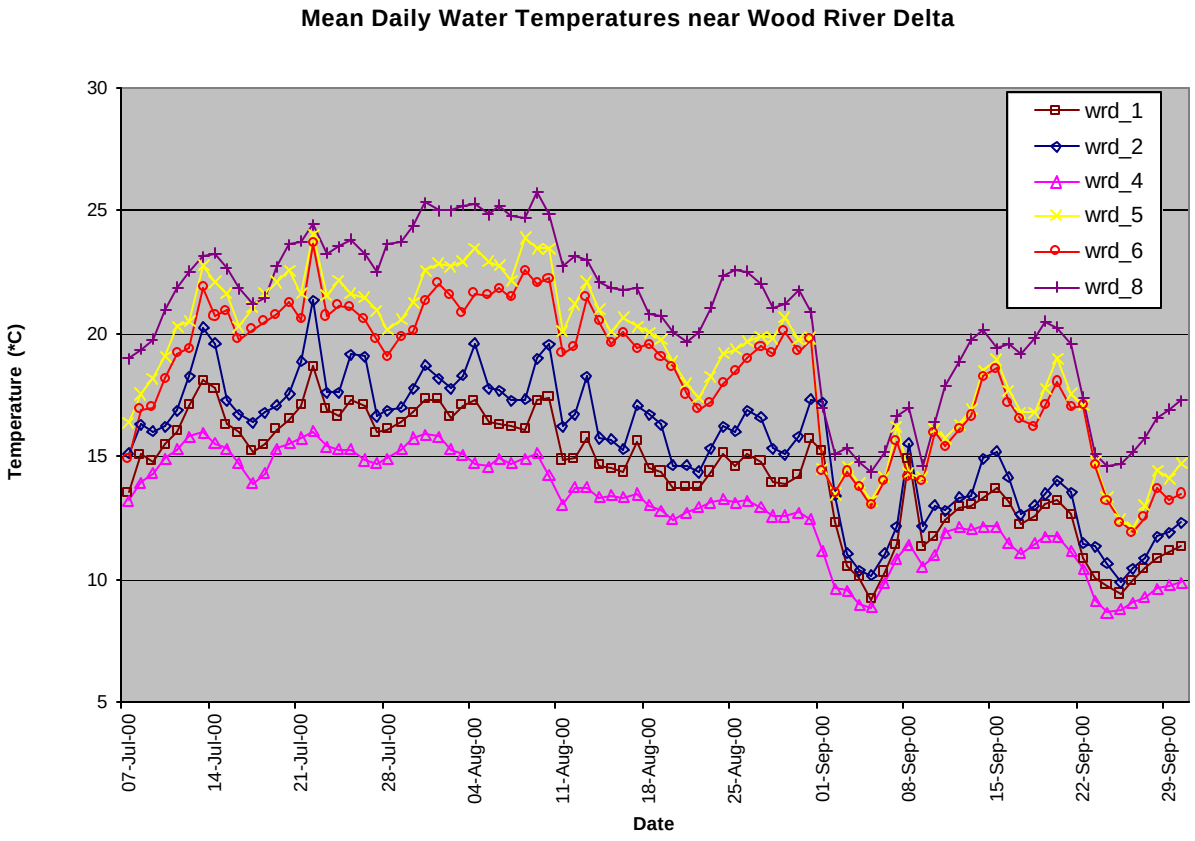
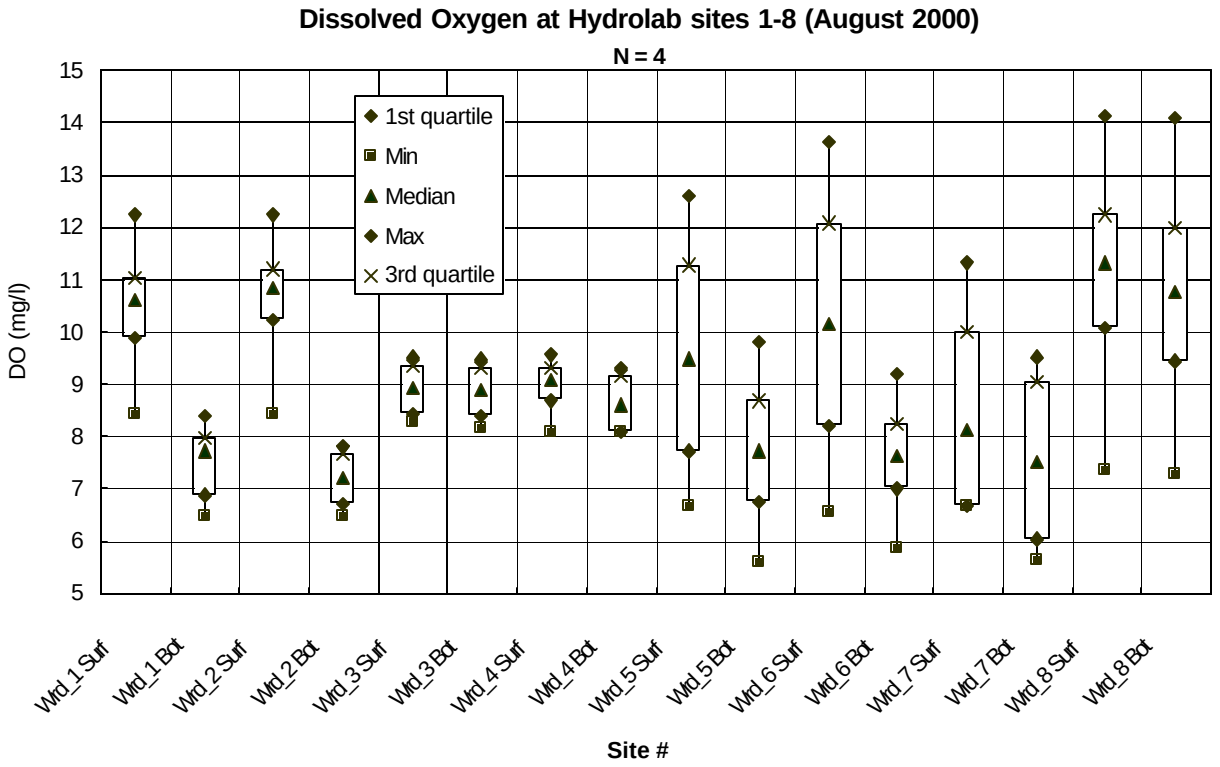


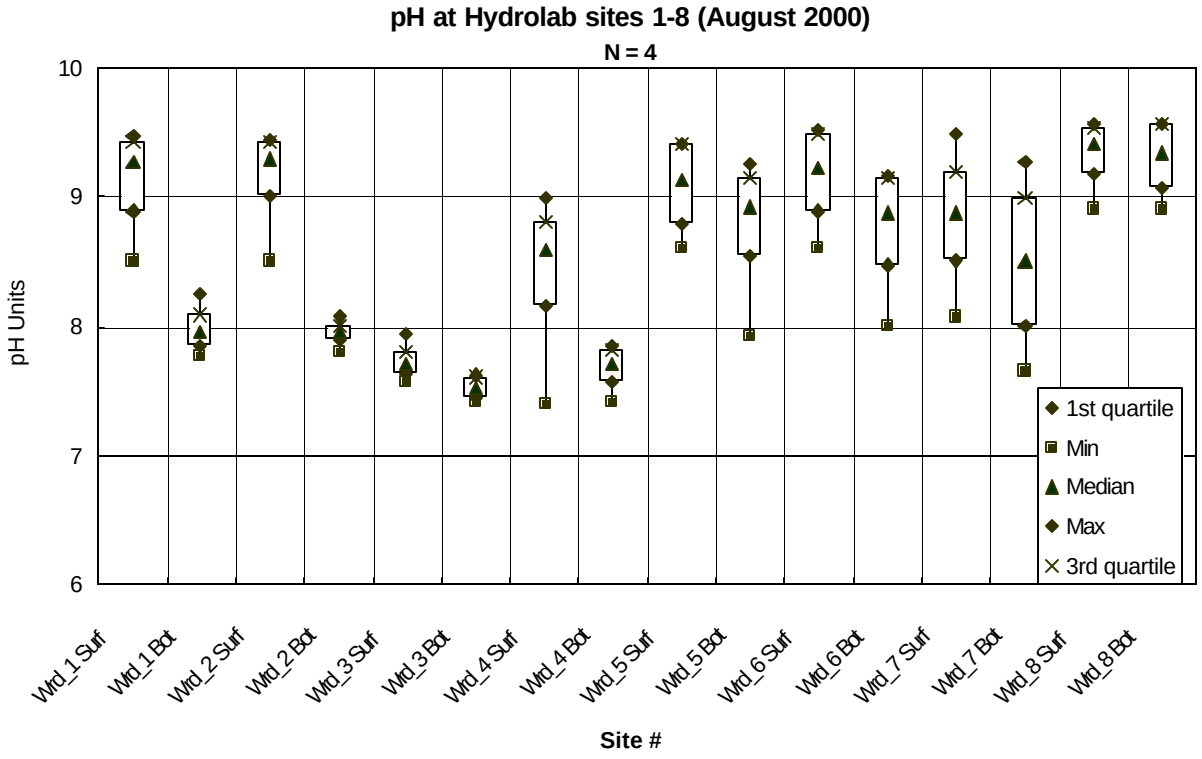
Figure (j). Daily maximum temperatures, Agency Lake, Wood River Delta.

Results: Depths of initial deployment ranged from 2.7 meters to 1.4 meters. Results of daily mean temperatures are shown in figure (j). Figure (i). Shows the location of temperature and water quality sample points. No temperature logger data was retrieved from stations wrd-3 (active mouth of Wood River) and station wrd-8 (new mouth of Wood River). Not surprisingly, results indicate that maximum daily temperatures increase as depth decreases and distance from mouth increases. Data collected in 2001 will be compared to this data to assess effects of channel relocation on mean daily temperatures.

Hydrolab measurements indicate that temperature stratification occurred in deeper water sites (1-4), even where river flow apparently affected bottom temperatures (figure (n)). Oxygen depletion was apparent at sites 1,2,5,6 and 7 but never reached below 5.5 mg/l (less than 4 mg/l is considered lethal for most fish species). However, measurements were taken well after the time of day that photosythesis would be expected to have increased O_2 levels. Measurements of pH reached levels above 9.0 (max 9.6 at wrd_7) at all sites except wrd_3, nearest to the mouth of the Wood River. However, bottom pH exceeded 9.0 only at sites 5,6,7, and 8.

Monitoring 2001: Methods and timing will be identical to the 2000 effort to allow for comparison between years. This will allow for an assessment of effects of channel relocation on water quality at the selected locations. Of particular interest will be the effect of channel relocation on site wrd_8 which is approximately 1/4 mile south of the delta near the east shore. Anecdotal accounts indicate that water quality in this region was much better before dredging occurred in the delta. Hydrolab water quality measurements will also be taken at weekly intervals in July since this is usually the time of year that water quality conditions are most severe and limit available fish habitat.


Dissolved Oxygen at Hydrolab sites 1-8 (August 2000)
N = 4
DO (mg/l)
15
14
13
12
11
10
9
8
7
6
5
1st quartile
Min
Median
Max
3rd quartile
Wrd_1 Surf
Wrd_1 Bot
Wrd_2 Surf
Wrd_2 Bot
Wrd_3 Surf
Wrd_3 Bot
Wrd_4 Surf
Wrd_4 Bot
Wrd_5 Surf
Wrd_5 Bot
Wrd_6 Surf
Wrd_6 Bot
Wrd_7 Surf
Wrd_7 Bot
Wrd_8 Surf
Wrd_8 Bot
Site #


pH at Hydrolab sites 1-8 (August 2000)
N = 4
pH Units
10
9
8
7
6
1st quartile
Min
Median
Max
3rd quartile
Wrd_1 Surf
Wrd_1 Bot
Wrd_2 Surf
Wrd_2 Bot
Wrd_3 Surf
Wrd_3 Bot
Wrd_4 Surf
Wrd_4 Bot
Wrd_5 Surf
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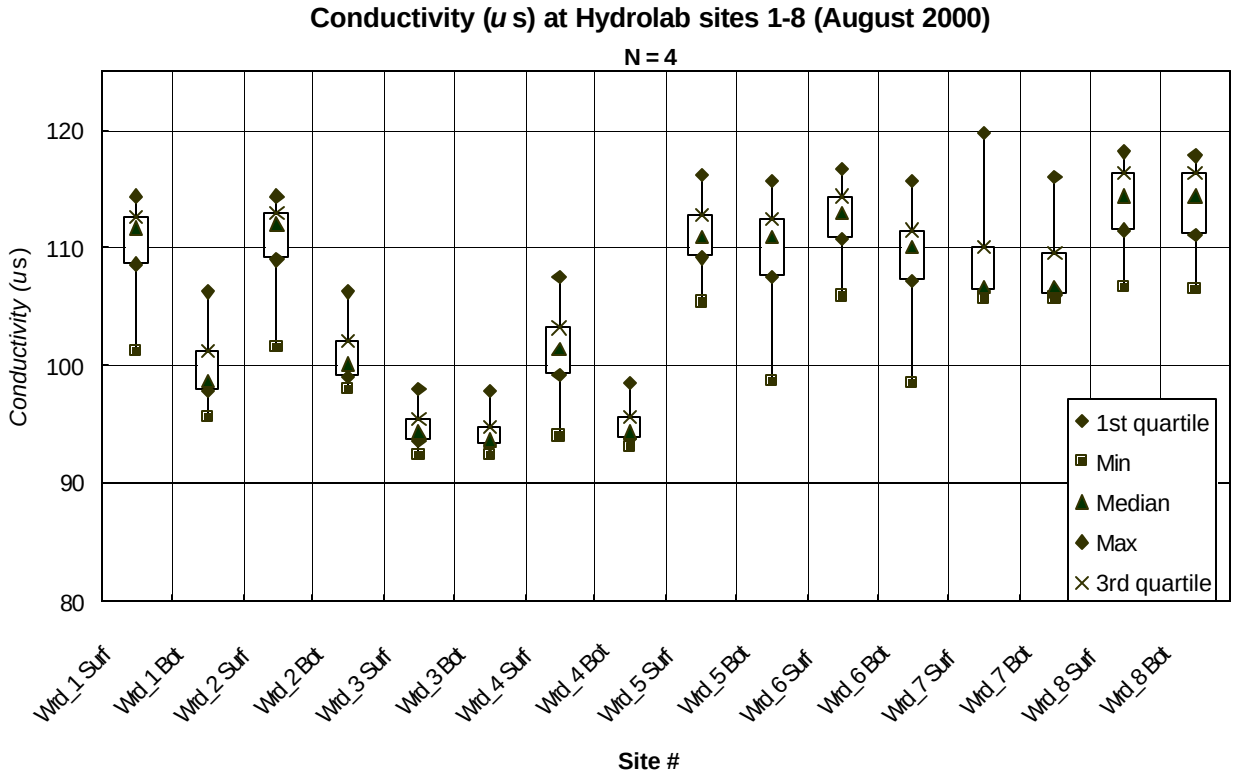
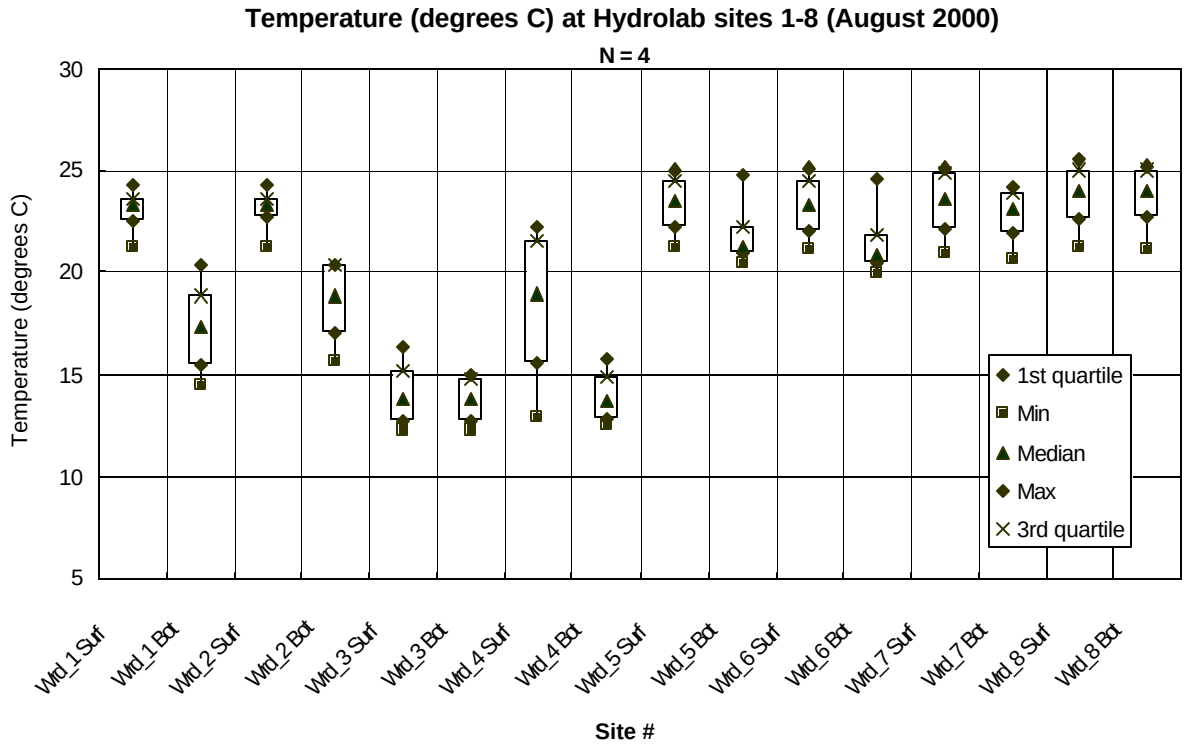
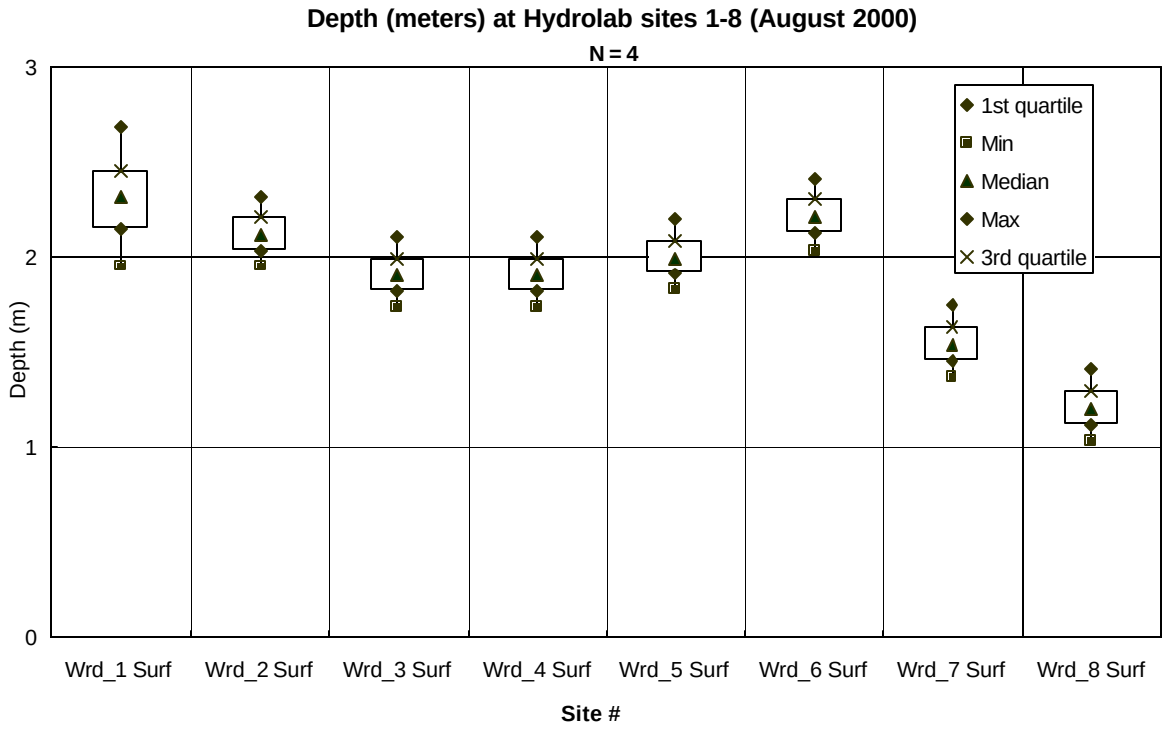
Wrd_7 Surf
Wrd_7 Bot
Wrd_8 Surf
Wrd_8 Bot
Site #


Conductivity (u s) at Hydrolab sites 1-8 (August 2000)
N = 4
Conductivity (us)
120
110
100
90
80
1st quartile
Min
Median
Max
3rd quartile
Wrd_1 Surf
Wrd_1 Bot
Wrd_2 Surf
Wrd_2 Bot
Wrd_3 Surf
Wrd_3 Bot
Wrd_4 Surf
Wrd_4 Bot
Wrd_5 Surf
Wrd_5 Bot
Wrd_6 Surf
Wrd_6 Bot
Wrd_7 Surf
Wrd_7 Bot
Wrd_8 Surf
Wrd_8 Bot
Site #


Temperature (degrees C) at Hydrolab sites 1-8 (August 2000)
N = 4
Temperature (degrees C)
30
25
20
15
10
5
1st quartile
Min
Median
Max
3rd quartile
Wrd_1 Surf
Wrd_1 Bot
Wrd_2 Surf
Wrd_2 Bot
Wrd_3 Surf
Wrd_3 Bot
Wrd_4 Surf
Wrd_4 Bot
Wrd_5 Surf
Wrd_5 Bot
Wrd_6 Surf
Wrd_6 Bot
Wrd_7 Surf
Wrd_7 Bot
Wrd_8 Surf
Wrd_8 Bot
Site #



Figures (k-o). Hydrolab measurements, August 2000.

FISH POPULATION MONITORING

- Interior wetland - Sampling of fish populations within the interior wetland. The objective is to gather baseline information on fish abundance and distribution as habitat changes over time.

- Wood River larval and juvenile out-migration - This included sampling with a shoreline orientated trap net and fishing with drift nets and Fyke nets off the Dike Road bridge. The objective is to gather baseline information on timing of early life stages and species presence of suckers and trout in the project area.

- Channel Construction Salvage - Data presented here includes capture data from efforts to collect fish that would be harmed from channel construction activities. The goal was to collect and move all fish before dredging and filling (except fathead minnows) and move them into un-impacted areas of the Wood River.

Interior Wetland: Gear deployed to sample fish presence within the interior marsh consisted a single ½ inch mesh trap net with a 100 foot lead extension. Traps were set for two nights each at two pond habitat sites between July 9, 1998 and August 6, 1998. The ponds were created from the removal of borrow material for dike building in 1996 and 1997. The ponds are located near the northeast corner the property and near the Wood River pump station. Shoreline vegetation at these sites is relatively sparse consisting mostly of recently colonized willow, *Potamogeton*, aquatic smartweed and scattered bullrush. Average and maximum depths are approximately three feet and five feet respectively. Little or no emergent vegetation was noted and bottom substrate was a mixture of peat and pumice sand. All of the fish sampled except the chub species are introduced species to the Klamath Basin.

1999 Fish Salvage

The construction sequence for the Wood River channel restoration work resulted in the flowing water to be contained within a channel that was designed to replicate the historic dimensions of the river (approximately 50' wide and 6'-8' deep). The restoration design called for the previously dredged channel to be filled to an elevation approximately the same as the original flood plain. Prior to the fill work beginning. The area to be filled was partitioned into segments, and fish remaining in these isolated segments were captured and returned to the river (salvaged). The following table displays the results of that salvage effort, and required 137 person hours to complete. During the salvage, backpack electro-fishing and dip nets were used to capture fish. Non native fathead minnows were the most abundant fish present, and were not salvaged.

Table 11 Date	Redband Trout	Sucker sp.	Yellow Perch	Speckled Dace	Tui Chub	Blue Chub	Sculpin sp.	Lamprey sp.
7/27/99	1	1	1		4		14	2
7/29/99	2	6	2		55	20	6	
8/26/99	3	2	11	1	11		20	1
8/31/99	11	6	20		17	33	25	
9/1/99		35	52		236	112	9	1
9/7/99		123	165		250	198	36	1
9/8/99		54			369	280	15	1
9/9/99		17	24		102	124	2	
913/99	1	68	165		190	133	38	2
9/14/99		39	311	1	130	148	56	4
TOTAL	**18**	**351**	**751**	**2***	**1364**	**1048**	**221**	**12**

***** The numbers of speckled dace and other species (young of the year size classes) are under estimated, because fish that appeared to be fathead minnows during the electro-fishing, were not netted for salvage.

Fish Trapping

A technical team of experts in fisheries biology, geomorphology, and engineering has been meeting during the past two years to design and coordinate the river channel restoration project. The timing of the out-migration of young fish from the river to the lake was identified as information that would help minimize the short term impacts of the construction work associated with work planned for the summer and fall of 2000. A rotating drum screw trap was obtained through the cooperation of U.S. Fish and Wildlife Service, U.S. Bureau of Reclamation, Oregon Department of Fish and Wildlife the Klamath Tribes and Oregon Trout. The trap was placed approximately one mile upstream from entrance road bridge. The following table displays the results of running the trap from August through December of 1999. Trapping efforts will continue over the next two years.

2000

The screw trap was floated in the Wood River for all of 2000, however lake elevation and high debris load prevented operation of the trap a large portion of the year. The trap collected fish for 90 days. Operation during late spring and most of the summer was precluded due to lack of flow at trap site as a result of lake elevation. Most other days without fish capture were related to debris stopping trap operation and thus preventing trapping of fish.

Total number of fish captured in the trap was 2452 (Figure (m)[1]. The dominant fish species captured was redband trout (*Onchorhynchus mykiss sp*.), accounting for nearly half (n=1134) of the total fish captured. At least thirteen fish species were captured in the trap, some sculpins and all lampreys were not identified past genus level.

Redband trout movement peaked on April 14, 2000, with 143 animals captured (Figure (n). Based on the numbers collected from the trap, redband trout peak movements occurred in early March (peak number = 66), mid-April (peak number = 143), and middle to late September (peak number = 88).

One shortnose sucker (*Chasmistes brevirostris*) was captured during FY 2000 operations. Lip morphology clearly indicated a positive shortnose identification. Length of the shortnose sucker was 87 millimeters. No other suckers were captured in 2000.

[1] Data entry for 2000 screw trap data has not been verified by visual check of entered data as of 2/27/01. Therefore data summaries may be subject to change upon verification of screw trap data.

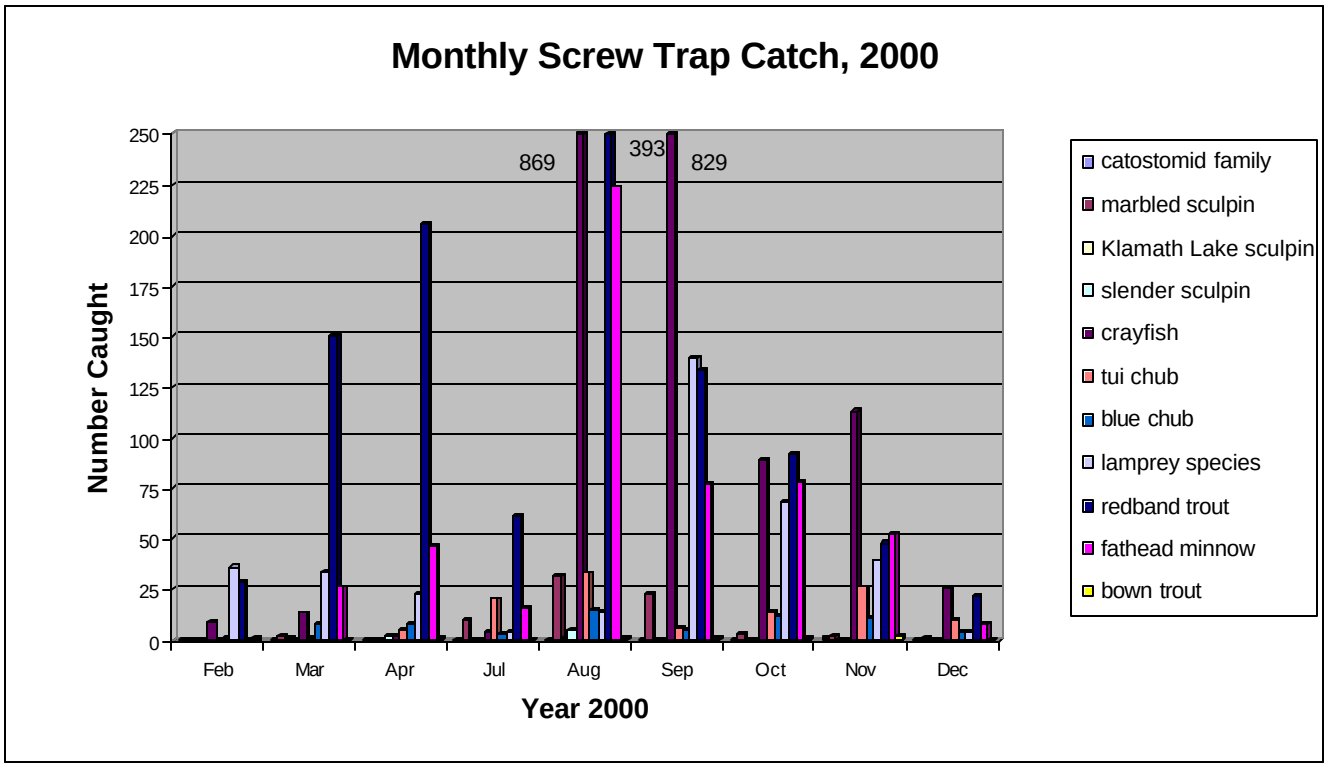


Figure (m). Total monthly catch by species, 2000

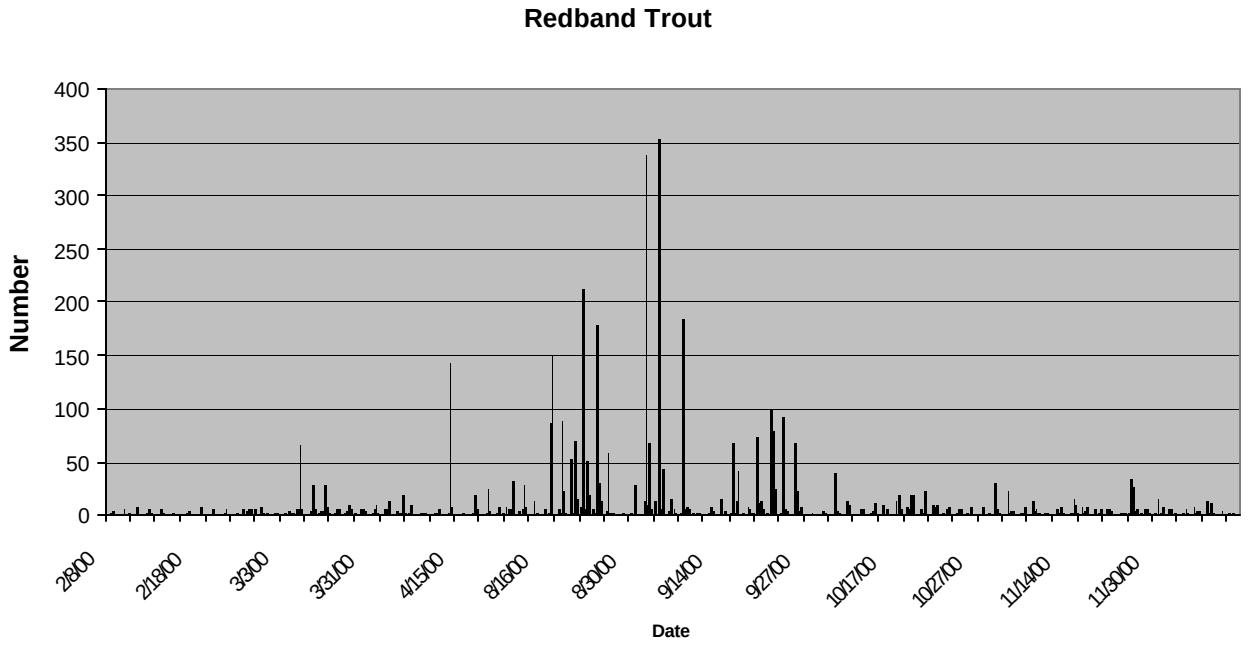


Figure (n). Daily redband trout catch, 2000.

Pulses of increased crayfish and lamprey capture were noted FY 2000 (Figure (m)). From mid-September to the end of October 1,834 crayfish were captured in the trap. This accounted for 87% of the crayfish capture FY 2000. Lamprey pulses were also noted to occur during trapping operations. The peak migration of 78 lampreys was captured on October 21, 2000. Average capture rate for lampreys across all days of fish capture was slightly more than 4 animals per day.

The peak numbers captured often accounted for a relatively large percent of total fish captured. Therefore, missing or hitting the peaks, due to debris or lack of flow, could result in a large sample error.

Comparisons between 1999 and 2000

The Wood River screw trap was installed and began operating in September of 1999. Data on fish movement in spring is not available for 1999. For comparative purposes data comparisons between FY 2000 and FY 1999 will be limited to fall operations, September 24 through December 31.

The Wood River screw trap collected fish for twenty more days in 2000 than 1999 (30 days in 1999, 50 days in 2000). High debris loads halted trap operation for parts of the analysis period in both years. Total number of fish captured in 2000 increased four fold from 1999 numbers (Figure (m). All species capture numbers increased at least two fold in 2000, accept for sculpins, yellow perch, and suckers. Sculpin capture increased in 2000, but only by 16 animals. Yellow perch captures were very low, FY2000 n=5 and FY 1999 n=4. Sucker numbers did not increase in 2000, for both years numbers were very low, FY 2000 n=1 and FY 1999 n=3.

Increases in fish capture, between 1999 and 2000, are potentially related to improved channel characteristics as a result of channel scour and vegetative recovery along the river bank. The process of channel scour and bank vegetation recovery would concentrated flow into a more confined channel when water elevation is below bankfull. A confined channel would increase stream flow. Increased stream flow and a confined channel width would increased trap efficiency by turning the screw faster and increase the percentage of the water column sampled.

Better efficiencies could explain the increase in numbers. However other biological, as well as environmental, variables between years could also account for the increase. Increases in spawner recruitment from 1999 to 2000 could increase total numbers captured in the screw trap. Comparing ODFW spawning surveys and screw trap fish captures are recommended in the future.

Species list of fish capture in Wood River screw trap for year 2000, including *scientific name* and common name.

Chasmistes brevirostris, shortnose sucker
Cottus klamathensis, marbled sculpin
Cottus princeps, Klamath Lake sculpin
Cottus spp., sculpin species
Cottus tenius, slender sculpin
Gila bicolor spp., tui chub
Gila coerulea, blue chub
Lampetra spp., lamprey species
Lepomis gibbosus, Pumpkinseed
Onchorhynchus mykiss spp., redband trout
Perca flavescens, yellow perch
Pimephales promelas, fathead minnow
Rhinichthys osculus, speckled dace
Salmo trutta, brown trout

SPOTTED FROG POPULATIONS

Oregon Spotted Frog Egg Mass Survey (see Appendix)

Methods

Egg masses were enumerated using a visual encounter survey technique at the breeding site (Crump and Scott 1994) with a minimum of two visits to ensure a complete egg count (Thoms et al. 1997). Linear aquatic habitats (ditches, streams) and large, contiguous aquatic habitats (marshes, ponds) were surveyed by at least two persons slowly walking along the edge of the aquatic habitat, enumerating egg masses and documenting locations with correctable Rockwell Plugger and Trimble GeoExplorer GPS units and a datasheet (modified "Corn" form; Olson et al. 1997).

Results

This preliminary survey is not intended to be a comprehensive, detailed survey of the entire Wood River Wetland. Habitats were searched during 2 days from 29 March 2000 to 31 March 2000. Water and air temperatures were determined with a pocket thermometer. An egg mass site is defined as a site with at least one egg mass that is at least 4 m from another egg mass. Egg masses were recorded at 26 sites along the Wood River Ditch, a small parallel ditch and 3 sites in the northeast pond (Figure O). Egg mass numbers ranged from 1 to 29 egg masses per site. A total of 171 egg masses were enumerated within the Wood River Ditch and adjoining sites.

Discussion

This brief survey suggests the presence of a *Rana pretiosa* population on the WRW that is larger than previously thought and habitat previously believed unoccupied. Hayes (1994) surveyed representative portions of the WRW and did not report them from lower Wood River Ditch. BLM's survey in 1998 reported 106 frogs from the North Canal and the upper Wood River Ditch. Additional emergent wetlands and riparian wetlands, both public and private ownerships, along and east of the Wood River could be surveyed to document occupancy. Egg masses or adult frogs were not observed in lentic habitats that were darkly stained, although many such habitats appeared structurally similar to non-darkly-stained waters. Egg survival and recruitment in *Rana pretiosa* appears to be limited by nitrate and nitrite (Marco et al. 1999). A preliminary water quality analysis of nitrate-nitrite, pH, ammonia, and temperature concentrations could identify potential factors limiting habitat use by *Rana pretiosa*. Future surveys of adult frogs and tadpoles during the summer season is expected.

Bullfrog Removal

In May, an adult bullfrog and bullfrog tadpoles were discovered in a pond associated with the pump station adjacent to Wood River. An effort to remove tadpoles incorporating nets, electrofishing, and trapping was conducted from mid-May through July. The results are displayed in table 12.

Table 12

Date	Bullfrog Tadpole	Pump-kinseed	Tui Chub	Fathead Minnow	Yellow Perch	Brown Bullhead	Adult Spotted Frog	lamprey sp.	garter snake
May	1451	47	0	183	2	6	0	1	0
June	56	63	1	522	4	59	0	0	3
July	30	23	2	37	1	31	2	0	0
Totals	**1537**	**133**	**3**	**742**	**7**	**96**	**2**	**1**	**3**

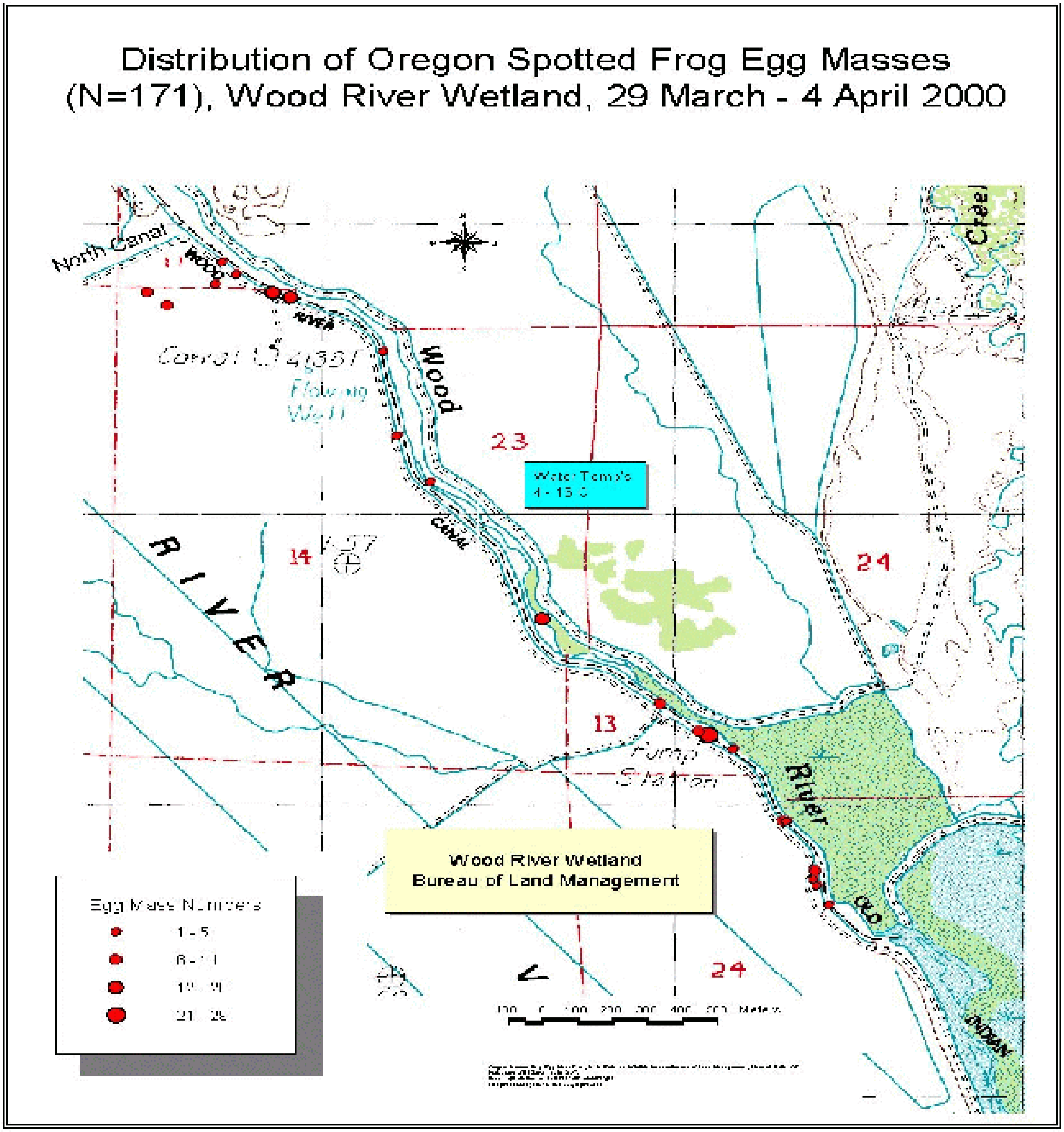

Distribution of Oregon Spotted Frog Egg Masses
(N=171), Wood River Wetland, 29 March - 4 April 2000
North Canal
Wood
23
14
24
13
R I V E R
River
Wood River Wetland
Bureau of Land Management
Egg Mass Numbers
1 - 5
24
OLD
INDIAN

Figure (o)

RECREATION

1999-2000

The Klamath Falls BLM conducted several different recreation monitoring efforts throughout 1999 and 2000 . Through monitoring, the BLM is continuing to gain valuable information about the types and levels of recreation use occurring on the wetland property. As the recreation use pattern picture becomes clearer, the efforts in providing adequate and proper facility development become better defined.

Informal monitoring and observations of recreation visitors occurred on a fairly regular basis throughout the year by BLM employees visiting the wetland property. Additional monitoring occurs through more formal, personal contacts with visitors. Based on these informal observations and other monitoring, some general conclusions from the 1999 and 2000 recreation use season can be made: 1) The heaviest use of the wetland area occurs during the early season of waterfowl hunting. The opportunities for finding waterfowl and hunting success continue to improve, as the former pasture lands within the wetland property provided good cover and open water for waterfowl. 2) Use of the property by non-hunters (fisherman, sightseers, wildlife viewers, hikers, etc.) continues to greatly exceed use by hunters. 3) Use of the area during the non-hunting season increased over the same period in 1998, but overall year-round use remains light (estimated to average 5-6 visitors per day). 4) Average group size remains small, probably less than three individuals per group. 5) Local residents (Agency Lake area) represent the largest visitor group using the property on regular basis.
For 2001, the BLM will be working with the Native American Student Union of Oregon Institute of Technology to develop more formalized monitoring methods. A survey form will be developed and survey box will be installed to better monitor visitation.

A variety of outreach activities occurred at Wood River in 2000. Nine events took place, involving tours with various groups, including local high school teachers, elementary, high school and college students, and Ducks Unlimited. In addition, local Henley High School students participated in a work day where they planted trees and removed fences .

In 1999, a contract was completed for the design and fabrication of six interpretive display panels. The displays orient visitors, interpret wildlife, wetland function and other resources to visitors. The interpretive contract and trail work were partially funded with a wetland restoration grant received through the Klamath Falls Bureau of Reclamation. Also, several floating canal crossings were installed to facilitate access to the wetland area.

In 2000, a second contract was awarded for design and fabrication of an additional eight interpretive display panels. This second phase is designed to provide additional information to visitors regarding migratory birds, seasonal changes to the wetlands, the river restoration efforts and fishes of the Wood River area. In addition, an environmental education area is being designed, with additional informational panels highlighting historical, pre-historical and future uses of the area. This education area will provide a gathering area for local schools and public groups to study the wetland environment. A wetland loop trail system is also planned for the gathering area. These additional developments are being funded by grants from the Oregon Watershed Enhancement Board and the U.S. Fish and Wildlife Service.

Additional facility development occurred in 2000. A floating canoe launch platform and gang plank were installed at the boat ramp area. A small storage building was constructed next to the restroom, for maintenance purposes. For 2001, the BLM plans to pave the existing trail leading from the parking area to the Wood River bridge area, to reduce the weed problem on the trail. Also, the BLM has entered into a volunteer agreement with a group of local volunteers called “The Usual Suspects”, who will be caretakers for the recreation facilities and landscaping at Wood River.

VISUAL RESOURCES

1999-2000

The Wood River channel restoration project was completed at the end of year 2000. The areas next to the river that were re-vegetated in 1999 are recovering rapidly as willows, cat tails and other vegetation becomes established. The wetland area continues to show significant improvement in scenic quality and is more naturally appearing now that the native vegetation is becoming established. It is expected that these improvement in scenic quality will continue as additional areas along the river are re-vegetated and the disturbed areas show recovery.

LANDS

Land Sales

When Congress instructed the Bureau of Land Management (BLM) to purchase the Wood River property, it also instructed the BLM to dispose of public lands in Klamath County to offset losses in property tax revenue that could occur from the acquisition. In 1998 the Klamath Falls Resource Area sold 1,600 acres of public land to the American Land Conservancy for the appraised fair market value of $625,400.00. The American Land Conservancy subsequently sold the property to the Jeld-Wen corporation. The mineral estate, except for the oil, gas and geothermal resources, was also conveyed.

Lands Actions in Support of Restoration

Land surveys by the BLM Cadastral Surveyors were programmed for the summer of 1999. The surveys will identify small slivers private lands that need to be acquired to facilitate the completion of phase 3 of the Wood River channel restoration. Difficulties in the timing of construction work and the availability of the Cadastral Surveyors have delayed the survey until the 2001 field season.

GRAZING

The BLM is currently in the process of assessing all grazing allotments to ascertain if current grazing use is meeting the 5 Standards for Rangeland Health and meeting the Guidelines for grazing management (S&G's). This process is required by the grazing regulations resulting from the Bureau's "Healthy Rangelands" initiative (aka "Rangeland Reform '94"). An S&G assessment analyses existing information (i.e. rangeland monitoring studies or surveys, riparian studies, etc.) to characterize the general health of a grazing allotment within the framework of the 5 Standards for Rangeland Health. The 5 Standards are summarized as follows: Standard 1 - Watershed Function - Uplands; Standard 2 - Watershed Function - Riparian/Wetland Areas; Standard 3 - Ecological Processes; Standard 4 - Water Quality; and Standard 5 - Native, T&E, and Locally Important Species. The S&G's assessments identify if the Standards are being met and if not, the significant factors contributing to failure to meet Standards. The S&G's process is, by policy, currently directed at only livestock grazing.

The Wood River ROD/RMP states that "If and where appropriate, use livestock grazing as a vegetation management tool to support the primary goal of wetland restoration." Since 1994, livestock use has been considered incompatible with the ongoing wetland restoration activities and is expected to continue to be considered such in the foreseeable future. However, since the Wood River property is still a potential grazing allotment - and grazing could be used as a management tool - a S&G's assessment was scheduled and completed in FY00. Since no licensed grazing use has been authorized on the property since November 1994, livestock were not considered to be a factor in the current attainment or non-attainment of any of the 5 Standards. A copy of the Wood River property S&G's assessment is posted on the Klamath Falls R.A. website or is available upon request. (Wood River S&G's Assessment is available at following URL: **http://www.or.blm.gov/Lakeview/kfra/whatwedo/Range/Rangeland_Health/Assessment-WoodRiver.pdf** and must be viewed in Adobe Acrobat.)

CULTURAL RESOURCE MANAGEMENT

Thee BLM Cultural Resources Program continued to provide support for restoration activities conducted at the Wood River Wetlands during 2000. Activities largely concentrated on managing cultural resources encountered during restoration construction along the Wood River in 1998.

The National Historic Preservation Act, in addition to other laws and regulations, requires that potential impacts to cultural resources be addressed prior to and during the implementation of construction. Cultural resource surveys had been conducted along and near the Wood River prior to river restoration construction. Though no cultural resources were located during these surveys, four archaeological sites were encountered during phase I and II construction in 1998. Construction impacts were minimized at all four of these cultural sites.

Phase III Wood River restoration construction commenced in 2000. Phase III involved the dredging of more recently deposited sediments along the historic course of the Wood River downstream from the Agency dike bridge. It appeared unlikely that sites would be encountered along the confines of the historic river, however, the discovery of the four sites north of the Agency dike bridge in 1998 prompted an additional pedestrian surface survey in the phase III area. During this survey a fifth cultural site was found. Fortunately, the site's location was in an area that would not be impacted by phase III construction. No new sites were encountered during phase III restoration construction.

In addition to the river channel restoration construction, several locations were proposed for constructing duck nesting islands. A pedestrian surface survey was conducted in 2000 in response to this proposal. No cultural resources were found during the survey.

The Klamath Tribes have been active participants throughout this entire process. A Memorandum of Agreement between the Klamath Tribes and Oregon Trout had been previously signed which provided for monitoring support and the protection of cultural sites. Extensive monitoring by Klamath tribal members was conducted in 1998 and continued through 2000.

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Wood River Wetland Appendices

Appendix A - Breeding Ecology of Yellow Rails at Fourmile Creek, Mares Egg Spring, and additional areas in the Klamath Basin, Klamath Co., Oregon, 1998

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Abstract

During May - July 1998, we investigated the breeding ecology of the Yellow Rail (*Coturnicops noveboracensis*) in the Upper Klamath Basin in south-central Oregon for the fourth year. We focused our efforts in the Fourmile Creek and Mares Egg Spring areas in the Wood River Valley, Klamath Co. We found 6 Yellow Rail nests, one of which was active and successful, for a total of 34 nests (including 8 active nests) found in the Fourmile Creek area during the last four years. *Carex simulata* and a layer of senescent vegetation characterized vegetation at nest sites. The maximum number of calling male Yellow Rails detected on a full two night survey of Fourmile Creek was 73, and a maximum of 2 were calling at Mares Egg Spring, compared to 49 and 5 rails, respectively, in 1997, and 37 and 5 rails in 1996. Water depth at 91 male Yellow Rail calling sites in 1998 averaged 8.1 cm (SD = 4.1) compared to 6.8 cm (n = 470, SD = 3.44) over the previous three years. As in previous years, water levels in the Fourmile Creek study areas fell dramatically during the breeding season, but water depths at Yellow Rail calling sites dropped only slightly. The rails moved their territories around and eventually off the area as their particular breeding site dried up.

We captured 58 males at Fourmile Creek and Mares Egg Spring in 1998, but only recaptured 7 of 41 birds banded the previous year, and none of 48 males banded in 1995 and 1996. We had no returns at other banding locations including the BLM Wood River Wetland and Sycan Marsh. Over the last three years, 13 of the 14 returns were an average of only 173 m from where they were captured the previous year. The extremely high level of site fidelity exhibited by these birds is in contrast to the low number of total returns we have, despite intensive banding efforts. This evidence, along with no rails returning in two successive years points to low survivorship.

Although the population of Yellow Rails in south-central Oregon appears to have grown in the last few years, it is very susceptible to changes in its habitat due to probable low survivorship. A single low breeding year could affect the population size drastically. Their reliance on specific levels of shallow water habitat with large amounts of sedge cover and senescent vegetation means that their habitat and population numbers can be easily altered, and their long term stability is questionable. Continued study will help answer this and other population viability issues, helping to ensure survival of this disjunct population.

INTRODUCTION

The Yellow Rail (*Coturnicops noveboracensis*) primarily breeds in the northern United States and southern Canada from the Dakotas east to Maine and New Brunswick. Wintering populations occur in the southeastern United States (Bookhout 1995). Historically, there were also disjunct breeding populations in southern Oregon and eastern California. There were two or three southern Oregon nesting records in 1926 (Contreras 1983, Griffee 1944) and four others in Mono County, California from 1922-1950 (McCaskie et al. 1980). However, the Yellow Rail was thought to be extirpated from the western United States until its rediscovery in the Wood River Valley on 19-20 June 1982 (Rogers 1982). The Yellow Rail is currently classified as Threatened or Endangered in some eastern and Midwestern states (Bookhout 1995), Sensitive Critical under Oregon's Sensitive Species Rule as developed by the Oregon Department of Fish and Wildlife, and as a Sensitive Species by the Pacific Northwest Region of the Forest Service (Oregon Natural Heritage Program 1995).

While there is some knowledge of the breeding populations in the central and eastern states (Bookhout and Stenzel 1987, Stalheim 1974, Walkinshaw 1939) and Canada (Robert et al. 1995), there is very little information concerning the breeding population of the Yellow Rail in Oregon. Previous information on the Oregon birds consists primarily of censuses completed after 1982 (Stern et al. 1993). The wintering area of rails breeding in Oregon is unknown. Historical sightings in coastal and freshwater marshes in California including the San Francisco Bay (Grinnell and Miller 1944), and more recent sightings along the coast in Humboldt and Mendocino Cos. (Harris 1996) suggest that the Oregon birds may migrate to coastal California marshes for the winter. The lack of information is due to a small population size and secretive nature of a bird that calls primarily at night and rarely flushes from the concealing marsh vegetation.

We initiated this study in May 1995 to increase the existing information on this sensitive species in the Fourmile Creek and Mares Egg Spring areas in the Wood River Valley and elsewhere in the Klamath Basin in south-central Oregon. The objectives in 1998 were to: determine the number of male calling Yellow Rails by nighttime censussing and banding, assess site fidelity and return rates of rails banded in previous years, search for rail nests, and describe nest placement, structure, and success.

STUDY AREAS

The two main study areas are located in the Wood River Valley, Klamath County, Oregon (Fig. 1). The Fourmile Creek area (referred to as Jack Spring in the 1996 report) includes parts of sections 1,2,11,12 and 13 at T34S, R6E. Land ownership is Bureau of Land Management (BLM), United States Forest Service (USFS), and private. Fourmile Creek divides the site into two relatively even areas we call Fourmile Creek North and Fourmile Creek South. The Mares Egg Spring area is in section 35, T33S, R6E and section 2, T34S, R6E. Land ownership is USFS and private. Both the Fourmile Creek and Mares Egg Spring areas are sedge and rush meadows flooded by cool springs and crossed by creeks and ditches. The western edges of the study areas are adjacent to stands of quaking aspen (*Populus tremuloides*) and willow (*Salix* sp.). The eastern edges of both study areas are bordered by canals and private lands used for grazing cattle. Sixteen other sites were surveyed in the Wood River Valley including the BLM's Wood River Wetland. Two sites outside the Wood River Valley surveyed were Klamath Marsh in the Klamath Forest National Wildlife Refuge, and Sycan Marsh, a preserve owned by The Nature Conservancy (Fig. 2).

METHODS

Censussing for Yellow Rails

From 9 May - 21 July 1998, we surveyed for Yellow Rails at the Fourmile Creek North, Fourmile Creek South, and Mares Egg Spring study sites between 21:30 and 05:00 hrs. We attempted to survey each area thoroughly at least once every ten days at night, getting to within 0.5 km of all Yellow Rail habitat. Full surveys of the Fourmile Creek area required three nights (two night north of the creek) during the peak of the breeding season due to the large number of males calling, rather than the two night surveys in 1996 and 1997 (Popper and Stern 1996, 1997). Surveys at other sites were usually conducted from roads or dikes, stopping every 0.5 km if in a vehicle. Consecutive night surveys lower the possibility that a rail would move across the creek between surveys. Weather sometimes precluded survey work because heavy rain and wind made listening for calling rails difficult. Because only males call during the breeding season, the surveys only reflect the number of male Yellow Rails present (Bookhout 1995). Our techniques followed those used in previous years and suggested by Bart et al. (1984) and Robert and Laporte (1997), slogging through the marsh, clicking two stones together. When a rail was heard calling, its exact position was determined by approaching it carefully until the calling site was reached. The position of this site was then usually recorded

using a Global Positioning System (GPS) (Pathfinder Basic Plus, Trimble Navigation, Sunnyvale, CA). The GPS files were differentially corrected and then mapped.

Capturing birds

We trapped and banded rails by approaching calling males to within 25 m and clicking rocks together to imitate the Yellow Rail call. A headlamp was used to illuminate the area in front of the observer. When the rail moved to within 1.5 m, an oversized butterfly net (.7 m x .5 m with a 1.5 m handle) or a smaller hand net was brought down over the bird. Rails were banded with a USFWS aluminum band (size 2) and weighed to the nearest 0.5 g. Usually only a few minutes of imitating the call was necessary to draw the bird in. However, sometimes the bird either did not come close enough, or simply would not approach. It was then necessary to slowly approach the clicking bird, hoping to see and capture it before it flushed. If the bird did flush, one or two more attempts were made that night, not always resulting in success. If a female or juvenile Yellow Rail was seen, an attempt was made to capture and band the bird. Newborn chicks were not banded because size 2 bands do not stay on the small legs.

Nests

We searched for nests while doing other fieldwork during the day and night. We also organized nest searching teams of two to five people and searched for nests in likely habitat areas. Due to the highly secretive locations and structure of a nest, active lifting of dead vegetation was required wherever the possibility of a nest existed (Peabody 1922). A number of times we searched for nests in a specific area after finding a Yellow Rail eggshell or seeing a female or a chick. If a nest was suspected of being active, its location was marked nearby and it was observed every other day for activity. After a nest was determined to be non-active any remaining eggs were measured, and vegetation within a 1 m^2 plot surrounding the nest was sampled. We measured percent cover and average maximum height.

Water depths

We measured water depth in areas of Yellow Rail activity using two methods. First, when calling rails were visually located, we measured water depth at each of the 4 cardinal directions 0.5 m from the site, and recorded the average of the 4 readings. Second, we installed seven permanent 'stream' gauges (3.33 feet tall) in the Fourmile Creek area (Fig. 3). The gauges were spread out over the study area along fence lines (for ease of relocation). These replaced the 19 temporary water stations used in 1996 and 1997 (Popper and Stern 1996, 1997). Water depths were measured approximately every ten days during the rail surveys. Six temporary water stations were also measured at Mares Egg Spring located as close as possible to the same spots used in the 1995 and 1996 field seasons. One permanent stream gauge was placed at both the Mares Eggs Spring study site and the Wood River Wetland site late in the breeding season (See Figs. 5 and 8).

RESULTS

Censussing and banding of Yellow Rails

In total, we heard 152 calling Yellow Rails in 8 surveys of Fourmile Creek South, 204 rails in 8 surveys of Fourmile Creek North, and 12 rails in 9 surveys at Mares Egg Spring. The maximum number of calling male rails heard on one night at each of the three sites were 24, 49, and 2, respectively (Table 1). The highest number of rails heard calling when Fourmile Creek North and South were surveyed on consecutive nights was 73 on 1 - 3 June.

We captured 54 males in the Fourmile Creek area (including 7 of 38 banded in 1997), and 4 males in the Mares Egg Spring area (no returns from 4 banded in 1997) (Figs. 4 and 5). The seven recaptures we had in 1998 returned very close to the same locations they were banded in 1997 (Fig. 6). The average difference in the two locations was 171 m. Return locations in 1996 and 1997 averaged about 750 m from the original capture spot (Fig. 7). For the 14 recaptures, the mean distance between locations was 461 m. None of the 41 males that had been banded in 1995 or 1996 were recaptured. One female and three juveniles were also banded at Fourmile Creek in 1998. The mean weight of 52 male Yellow Rails banded was 57.6 g (SD = 3.4). The seven recaptures mean weight was 58.2 g (SD = 3.7) in 1998 and 56.4 g (SD = 2.8) in 1997.

At the Wood River Wetland site, we heard up to 6 males calling, and banded 4 males, with an additional 2 captured which had been banded at Fourmile Creek the same year (Table 2 and Fig. 8). At 10 other Wood River Valley locations, a total of 41 male Yellow Rails were heard, including 26 north of Dixon Road late in the breeding season in July. Two of these males were captured north of Dixon Road and had been banded earlier in the year at Fourmile Creek and the Wood River Wetland.

Within the Wood River Valley, there were two other sites in addition to Fourmile Creek, Mares Egg Spring, Wood River Wetland, and north of Dixon Road where Yellow Rails were heard over a period of at least a month and breeding is suspected. Two Yellow Rails were heard on 30 May, 30 June, and 7 July north of Hwy 62 at Wood River just east of the Sun Pass Ranch. This is a newly discovered site. Also, one rail was heard north of Hwy. 62 near mile post 87 on 30 May and 30 June.

Outside the Wood River Valley, Klamath Marsh and Sycan Marsh were the only two sites where rails were heard in 1998. Yellow Rails were not heard during surveys at Big Marsh in 1998 (Graff 1998), making the other three areas the only sites with breeding Yellow Rails known west of the Rocky Mountains.

We heard a total of 12 male Yellow Rails calling at Sycan Marsh during a 5 night survey from 16 – 20 June (Fig. 9). A male was also heard at Coyote Creek below the research station on and prior to 13 June, but not during the survey period. Seven of the males were captured and banded, with no recaptures of the two males banded in 1997. Water depths and structure of cover were similar to that at Fourmile Creek.

A total of 22 males were heard calling at Klamath Marsh from 25 – 27 May (Fig. 10). Surveys were limited by bad weather (snow and rain) and time available. No surveys were conducted off the roads and dikes, although some of the surveying was still done on foot. The same number were heard in the north half of the marsh as in 1997. Weather conditions probably contributed to the lower number of rails heard in the south half. From the partial survey that was completed, we assume the population numbers were similar to 1997.

Movements of individual rails were documented when a suspected unbanded male turned out to be a rail already banded in 1998. Four males were recaptured after traveling from the north side of Fourmile Creek to the south side – about 1.5 km. None were captured after going the other way because we concentrated banding efforts on the north side of the creek first. Another male was recaptured south of Fourmile Creek a month and a half after being banded about 4 km north at Mares Egg Spring. Two males were recaptured at the Wood River Wetland on July 15 after being banded in early June about 7.5 km away, north of Fourmile Creek. The greatest movements documented within the breeding season were two rails recaptured north of Dixon Road on 8 July. Each bird had moved a minimum of 14 km from their original capture locations at the Wood River Wetland on 18 May and Fourmile Creek on 2 June.

Yellow rail nests

In 1998, we found 6 Yellow Rail nests in the Fourmile Creek area, bringing the total over the last four years to 34 (Fig. 11). No nests were found at any other site, although we suspect breeding takes place at Mares Egg Spring, Wood River Wetlands, and Dixon Road in the Wood River Valley, as well as at Klamath Marsh and Sycan Marsh. The nests generally fit the description of nests found in previous years (Popper and Stern 1996, 1997), located in sedges and rushes surrounded by about 5 cm of water, with a senescent canopy concealing the nest cup and eggs (Table 3).

In 1998, *C. simulata* was the only species present within the 1 m^2 plot surrounding all of the Yellow Rail nests found (n=6), and averaged 21% cover (Table 4). Combining all 1 m^2 plots from 1996 - 1998 (n=31), habitat surrounding nests contained 26% cover of *C. simulata*, 6% *C. utriculata*, and 6% *Eleocharis palustris*. Species ranging between 2 and 3% cover were *C. vesicaria*, *Juncus balticus*, and *J. nevadensis*. The average total cover of live vegetation was 48.7%. Senescent vegetation accounted for almost the rest of the cover (49.7%), with only 1.6% bare ground showing, on average. The heights of the main species at the nests in 1998 averaged about 65 cm, with *C. simulata* at 63 cm tall (Table 5). From 1996-1998, *C. simulata* averaged 60 cm (n=29, SD=11.6), *C. utriculata* 69 cm (n=13, SD=9.7) and *Eleocharis palustris* 49 cm (n=14, SD=7.6).

One nest was active when found on 13 July, and was discovered during a nighttime survey due to the observation and subsequent banding of a female close to the nest. After the female had been caught and identified, the nest was found about 0.5 m away. The nest had hatched when it was next visited on 16 July, with one chick observed leaving the nest cup. This hatching date is well within the 8 June - 9 August range determined in 1996 (Popper and Stern 1996). Four of the other nests found were discovered after seeing small pieces of eggshell, and may have been predated. The sixth nest was found after lifting the covering of senescent vegetation and appeared to have been successful.

Water depths

The water depths at 91 Yellow Rail locations in 1998 varied from 0 (damp ground) to 18 cm, with a mean of 8.1 cm (SD = 4.1). This was similar to the average in 1997 (8.6 cm, n = 93, SD = 34.2). The last two years were higher than the averages for calling rails in 1995 (6.4 cm, n = 217, SD = 3.17) and 1996 (6.4 cm, n = 160, SD = 3.08) but not significantly so, given the standard deviations. Over the four years of the study, the average water depth at a Yellow Rail location was 7.0 cm (n = 561, SD = 3.60). Grouping the measurements by the seven complete nighttime surveys of Fourmile Creek in 1998 shows that the average water depth at Yellow Rail locations varied from 10.8 – 7.3 cm (Fig. 12). There were only two water depth readings on adult males during the 21 July survey, so that average (6.3 cm) was not plotted.

The six permanent water gauges installed in the meadow and marsh at the Fourmile Creek study site all exhibited a decline in water depths during the breeding season except for Gauge 2 and to a lesser extent Gauge 3. The Creek Gauge (Gauge 4 - placed in Fourmile Creek) showed a minor decline overall, but rose dramatically (over 10 cm) twice. The average of the six gauges placed on the marsh dropped from 14 .0 cm on 11 May to 2.9 cm on 20 July, with a peak of 15.3 cm on 3 June (see Fig. 12). This was similar to the rate of decline in water levels experienced in previous years as measured at the temporary water stations (Popper and Stern, 1996, 1997). The six Mares Egg Spring water stations dropped dramatically during the breeding season, going from an average of 4.2 cm on 11 May down to 1.2 cm on 11 and 18 July, with a maximum of 5.1 cm on 31 May (Fig. 13). This was different from past years when water levels at Mares Egg Spring were relatively level.

DISCUSSION

Numbers and returns of breeding males

The maximum numbers of male Yellow Rails calling in a complete survey at Fourmile Creek was 73 in 1998 compared to 49 in 1997 and 37 in 1996 (Fig. 14). This is a 49% increase from 1997 and a 97% increase from 1996. We believe this increase is at least partially accounted for by continued relatively wet weather and strong snow pack, which results in good water levels and cover of vegetation in the Fourmile Creek study area. Since 1995 Oregon has experienced above average precipitation after eight years below average (NOAA 1998, OCS 1999). The BLM property on the Fourmile Creek study area has also not been grazed by cattle since 1994, allowing for a high level of senescent vegetation to build up and serve as cover for both the rails and their nests (BLM 1998). The majority of the rails have been on the BLM property, particularly the northwest portion that had high numbers of rails in past years as well. The main area which was unused by the rails was the central portion of the BLM property north of Fourmile Creek, where water levels were too high for Yellow Rails. Also, only one rail was heard on the private lands south of Fourmile Creek until the 3 June survey, when four rails were heard. This is likely due to the heavy levels of grazing pressure, which leave almost no senescent vegetation, and therefore little cover early in the breeding season (Figs. 15a and 15b). The number of rails heard in the Fourmile Creek area began to drop in mid June as in past years, and fell sharply as water levels dropped.

Although we captured 4 males in the Mares Egg Spring area, only two males were heard calling during any one survey (Fig. 16). This appears to reflect males which may have been simply passing through, possibly to/from Fourmile Creek, located about 3.5 km south, or other areas. This may be related to the water levels in the wet meadow north of Mares Egg Spring which dropped starting the beginning of June and never rose back to levels similar to past years. In the previous 3 years, water levels in the area were relatively stable.

The total of 14 returns, for a 15.7% recapture rate, is relatively low, considering that we captured 74% of the maximum number of rails heard calling near Fourmile Creek in 1998, 82% in 1997 and 73% in 1996. Sixteen percent of the males banded in 1997 were recaptured the following year, as were 10% of the males banded in 1996, and 17% of those banded in 1995. This is a relatively low recapture rate for a rare bird that utilizes scarce habitat, and is likely the result of a combination of two possibilities.

First, the Yellow Rail may be a very short lived bird. We have very little information on its life span, and know only that it lives at least 2 years from our 14 returns and the 2 returns at Seney National Wildlife Refuge in Michigan (Bookhout 1995). No one has recaptured any Yellow Rails later than the year after they were originally banded.

Second, the rails in Oregon may have relatively low site fidelity or philopatry. It is possible that they return to one of the other suspected breeding areas in Oregon or even to as yet unknown additional breeding areas in Western North America. The mean distance between return locations and original banding locations is 461 m (SD = 696 m) when using locations closest in time of year. If location information for multiple captures within the same year for two of these returns are considered, and the closest two locations are chosen, the mean distance drops to 337 m. Taking out an outlier of 2,470 m gives a mean of 173 m (range =

3 – 465 m)for the remaining 13 returns – extremely strong site fidelity for these individuals.

However, we also have evidence of movement during the breeding season between study areas, up to 14 km. Many of the Yellow Rails located north of Dixon Road on 7 July were likely on the Fourmile Creek site earlier in the breeding season. This movement appears to be the result of dropping water levels.

Yellow rail habitat

In 1996, we showed that male Yellow Rails were probably moving their territories during the breeding season in response to changes in water levels (Popper and Stern 1996). In 1997, although water levels in the Fourmile Creek area dropped significantly, water levels at calling locations did not (Popper and Stern 1997). We observed a similar relationship in 1998, with water levels at the water gauges dropping at a steep rate, while the depths at calling locations stayed relatively level (see Fig. 12). Also, as the water levels dropped, so did the number of rails heard calling.

As in 1997, areas of the Fourmile Creek site were affected by water management activities on adjacent lands. This was especially apparent north of the creek near where Crane Creek enters from the canal between the private and federal lands. When fields north of the BLM property were being flood irrigated, the water levels on the BLM lands rose. Similarly, when the fields were being drained, water levels dropped on the study site, even to the extent that water was flowing backward out of Crane Creek north into the (now low) canal. This type of water level fluctuation can drastically affect a critical aspect of Yellow Rail habitat.

The cover of vegetation at the Fourmile Creek site has been high, especially the senescent cover on BLM lands. All nests found in 1998 had at least 40% cover of senescent vegetation. Also, only one rail was located on private lands through May, even though water levels were not a problem. The main reason for the low level of use appeared to be a lack of sufficient cover from senescent vegetation due to heavy grazing the previous year. Once the vegetation had a chance to grow and provide cover for the adults in June, more rails began to occupy the private lands.

Recommendations

Continued banding and monitoring of Yellow Rails at Fourmile Creek and elsewhere will assist in better understanding its life history. Questions which need to be answered include site fidelity and life span. Now that 161 males have been banded over the last 4 years, one of, if not the largest existing population of banded Yellow Rails is available to answer population viability questions. The banding of 3 juveniles in 1998 is a unique opportunity to catch a Yellow Rail in 1999 whose age we will be able to determine. Also, we have the opportunity to study the presence of probable breeding populations at the Wood River Wetland and Sycan Marsh after a first year of intensive censussing and banding at both locations. Only by continuing the banding and monitoring will we be able to address these issues and adequately manage for this rare species.

The two important habitat characteristics that are under control of land managers are water levels and cover of vegetation. Permanent water gauges were installed at the Fourmile Creek, Mares Egg Spring, and Wood River Wetland sites. These gauges can assist in monitoring the effects of dams and dikes, both on federal and adjacent private lands. The management of dikes, head gates, and check dams is a critical environmental factor affecting habitat of breeding Yellow Rails, and one which land managers have the ability to control. Using dikes for flood irrigation can result in flooded nest sites, and cleaning of dikes can result in the lowering of water tables, as seen at Dixon Road, Fort Klamath Historical Monument, Crooked Creek, Fourmile Creek, and the BLM Wood River property (Popper and Stern 1996, Stern et al. 1993).

Vegetative cover is the other extremely important factor for good Yellow Rail habitat, and both amount of cover and type of cover should be considered. If grazing occurs, the levels should be relatively light to allow sufficient senescent and live vegetative cover (averaging almost 100% at known Yellow Rail nest sites) and height to be available for the next year. We continue to recommend that grazing not begin in areas utilized by breeding Yellow Rails until mid August. If the proposed action in the BLM Fourmile Property Grazing EA (#OR-014-96-03) is accepted, we strongly advocate that appropriate monitoring and management occur to examine how and if the levels of grazing are impacting breeding Yellow Rails. This would include building more fences to allow decisions on grazing to be made on a smaller scale, as well as rest pastures for various lengths of time from one to at least three years. Accurate forage utilization data including frequent checks of enclosures and grazing levels and patterns need to be collected to allow for comparison between years. Yellow Rail surveys should be completed before cattle are placed in the pastures.

Conclusion

We heard a maximum number of 73 Yellow Rails calling in the Fourmile Creek area in 1998 compared to 49 in 1997 and 37 in 1996. Reasons for this increase may be associated with more rain and snowfall in recent years which may have created better habitat conditions. This is the most densely populated breeding area of Yellow Rails west of the Rocky Mountains, and probably throughout its range. The small number of areas where Yellow Rails breed in Oregon suggests that site fidelity would be high, but we have only 14 returns of 89 banded in the previous 3 years at Fourmile Creek and Mares Egg Spring. This low number of recaptures with a high degree of individual site fidelity indicates low annual survivorship.

There are three general areas where we believe Yellow Rails bred in Oregon in 1998: Wood River Valley, Klamath Marsh, and Sycan Marsh. By adding the maximum survey counts for all the sites located in these areas, we estimate a minimum population of 153 males in 1998 in Oregon. However, only a partial survey was done in bad weather at Klamath Marsh, so we will increase the count to equal those heard in 1997 at that site for a total of 170. However, we determined that maximum survey counts probably underestimate the number of rails using an area by 30% (Popper and Stern 1996). Therefore we estimate the total breeding population at known sites in Oregon in 1999 to be 200 – 250 pairs.

A population of this size and low survivorship is extremely susceptible to year to year changes in its habitat. Their reliance on specific levels of shallow water habitat with large amounts of sedge cover and senescent vegetation means that their habitat and population numbers can be easily altered, and their long term stability is questionable. The Yellow Rail banding effort in the Fourmile Creek area is the most intensive effort undertaken in the United States, and continuation will assist in understanding population dynamics and patterns of movement of this disjunct population.

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