

ASSESSMENT OF THE AQUATIC PLANT COMMUNITY IN JACKSON LAKE, GRAND TETON NATIONAL PARK, WYOMING: 1991 STATUS REPORT

CAROL BREWER ♦ DEPARTMENT OF BOTANY
UNIVERSITY OF WYOMING ♦ LARAMIE

♦ INTRODUCTION

Since the construction of the first dam at the Snake River outlet at Jackson Lake in the early 1900's, the littoral habitat has been subjected to numerous perturbations of varying intensities. Changing water levels, a consequence of reservoir drawdown schedules, alter plant community species composition and distribution over time. From the perspective of a plant, water level changes present a challenge to growth and community persistence. A plant which begins the growing season 2 m deep may be under 4 m of water after spring runoff fills the reservoir. Later in the summer, the same plant may be left at a depth of only 1 m as water is removed from the reservoir during summer drawdown.

The magnitude and timing of water level fluctuations may be one of the most important factors regulating macrophyte community processes upslope on the vertical gradient in Jackson Lake (Brewer and Parker 1990). Under normal regulation, annual changes of 3-4 m are sufficient to select for a plant community with a typically weedy phenology (e.g., *Elodea canadensis*). In natural lakes with substantially lower annual changes in water levels, species that produce seeds annually are favored (e.g., *Potamogeton* species). Moreover, drawdowns greater than several meters substantially reduce the lake bed area suitable for the development of extensive shallow water plant beds.

The most recent perturbations to the littoral habitat in Jackson Lake began in 1978, when the water level was lowered first from 2065 m (normal pool) to somewhere between 2060 - 2062 m. Then in 1985, the surface elevation of Jackson Lake was further lowered to 2057 m to facilitate repair and modification of the Jackson Lake dam. The entire lake bed was seriously impacted during the four years that the dam was being restored. While the lake bed in the borrow zone and the area adjacent to the dam were obviously impacted by repair activities, the entire shallow littoral zone was severely perturbed when previously inundated sediments were exposed for four years. In 1989, repair was completed and the reservoir was allowed to fill back to the normal pool elevation of 2065 m.

Because of severe impacts to the littoral habitat and significant reduction of the submergent plant community caused by restoration of the dam, the status of the aquatic plant community was monitored during the summers of 1989-1991. This report summarizes the status of the aquatic plant community three years after repair of the dam was completed.

SUMMARY OF LAKE CONDITIONS IN 1991

Photic Zone

In general, the bottom limit of the photic zone was deeper in August 1991, compared to previous

Table 1. Secchi disk transparency data and approximate bottom limit of the photic zone during the summer of 1968 by Hayden, and during the summers of 1983, 1984, 1989, 1990 and 1991 by Brewer. Values are in meters. The range for the bottom limit of the photic zone at various locations in the lake each year is estimated in the last two rows.

SECCHI TRANSPARENCY VALUE (meters)							
Site	Aug 1968	July 1983	July 1984	Aug 1989	Aug 1990	June 1991	Aug 1991
Lizard Creek		1.0		0.8	0.8	0.5	1.8
Wilcox Point					1.5	0.5	2.5
NW of Arizona Island		1.1		1.4	1.5	0.5	5.8
North Sargent's Bay					2.5	1.0	3.2
UW-NPS Center		3.5	2.9	2.9	3.5	0.8	5.9
Half Moon Bay					2.9	1.8	3.2
NE of Elk Island		3.0	4.5		5.6	0.8	6.5
E of Waterfalls Canyon	6.0	4.2		3.8	6.0	0.9	4.5
S of Pilgrim Creek				1.5	2.1	1.3	2.2
W of Donoho Island					6.0	1.8	7.0
South Landing Bay		5.1	4.3	5.0	5.5	1.3	6.0
Deadman's Point	6.0	5.0	4.8	4.1	6.5	1.0	5.5
Bottom Limit of Photic Zone (meters)	10.0- 18.0	3.0- 18.0	8.7 14.4	2.4- 15.0	2.4- 19.5	1.5- 5.4	5.4 21.0

years for most locations in the lake (Table 1). The bottom limit of the photic zone was still less than 2.5 meters in shallow water in both the northern part of the lake and in the Hermitage Point and Donoho Island areas. Low transparency values are attributed to increased suspended sediments in shallow areas due to high water movement during severe August thunderstorms.

Lake Bed Sediments

Sediment composition is much the same as

described in 1986. The film of fine silts which covered all sediments at the study sites in 1989 seems to have settled and is not easily mobilized by disturbance.

Community Composition

In 1991, nineteen rooted species were collected from Jackson Lake (Table 2). This value is higher than the value for 1989 when only eight species were collected. One new species, *Fontinalis* sp., a small aquatic moss, was collected for the first time in

Table 2. Names of families and species collected from Jackson Lake in 1968 by Hayden, reported by Brewer in 1986, and collected by Brewer in 1989, 1990 and 1991. + indicates present, - indicates not reported, and ? indicates that the species may have been present but positive identification was not possible based on the plant material collected.

Family and Species	Years reported in collections				
	1968	1986	1989	1990	1991
NONVASCULAR AQUATIC MACROPHYTES					
CHAROPHYCEAE (Macrophytic green algae)					
Characeae					
<i>Chara</i> sp.	+	+	+	+	+
<i>Nitella</i> sp.	-	+	-	+	+
MUSCI (Aquatic mosses)					
Fontinalaceae					
<i>Fontinalis</i> sp.	-	+	-	-	+
VASCULAR AQUATIC MACROPHYTES					
TRACHEOPHYTA					
Alismatacea					
<i>Sagittaria cuneata</i> Shel.	-	+	-	+	+
Callitrichaceae					
<i>Callitriche</i> sp.	-	+	-	+	+
Ceratophyllaceae					
<i>Ceratophyllum demersum</i> L.	+	-	-	-	-
Cyperaceae					
<i>Eleocharis acicularis</i> (L.)R.&S.	-	+	-	+	+
Haloragaceae					
<i>Myriophyllum sibiricum</i> Kom.	-	+	+	-	+
<i>Myriophyllum spicatum</i> L.	+	-	-	-	-
Hippuridaceae					
<i>Hippuris vulgaris</i> L.	+	+	-	-	-
Hydrocharitaceae					
<i>Elodea canadensis</i> Michx.	+	+	+	+	+
Polygonaceae					
<i>Polygonum amphibium</i> var. <i>stipulaceum</i>	-	+	+	+	+
Coleman					
Potamogetonaceae					
<i>Potamogeton alpinus</i> Balb.	-	+	-	-	+
<i>Potamogeton filiformis</i> Pers.	+	+	-	?	?
<i>Potamogeton gramineus</i> L.	-	+	-	-	?
<i>Potamogeton pectinatus</i> L.	-	+	+	+	+
<i>Potamogeton pusillus</i> L.	-	+	?	-	+
<i>Potamogeton richardsonii</i> (A.Benn)	+	+	-	-	+
Rydberg					
<i>Potamogeton</i> sp.	-	+	+	+	+

Table 2. Continued

Family and Species	Years reported in collections				
	1968	1986	1989	1990	1991
Ranunculaceae					
<i>Ranunculus aquatilis</i> var. <i>capillaceus</i> (Thuill.)DC	+	+	+	+	+
<i>Ranunculus flamula</i> L.	-	+	-	?	+
Scrophulariaceae					
<i>Limosella aquatica</i> L.	-	-	-	+	+
Sparganiaceae					
<i>Sparganium</i> sp.	-	+	+	+	+
Zannichelliaceae					
<i>Zannichellia palustris</i> L.	-	+	-	+	+
Total species reported	8	21	8	13	19

Jackson Lake in 1991. This species was found in 1.5 - 3 m of water in the northern part of the lake.

Community Distribution

In general, plant density was low in the photic zone. On exposed shorelines, the littoral habitat was still devoid of aquatic vegetation in 1991. On most of the shallow marshy lake bed in the north part of the lake, decaying willows were still present. Blooms of a filamentous green algae (*Spirogyra* sp.), were commonly associated with the dead terrestrial vegetation that remains in the lake. At Wilcox Bay, near Arizona Island, in the borrow area, North Sargent's Bay and at the Snake River outlet near Lizard Creek, algae blooms were locally prominent.

By August 1991, the distribution of plants had spread considerably compared to 1989 and 1990, especially in bays. Dense submersed plant beds were present in North Sargent's Bay, the southern most end of Spaulding and Half Moon Bays', and the south and west shores of Moran Bay. Sargent's Bay and South Landing Bay were exceptions. Plant density was low in Sargent's Bay and there was no evidence of rooted macrophytes in South Landing Bay.

Parts of the northern shallow zone (the area of the shoreline extending from Arizona Island to the northern most part of the lake and then south to

Wilcox Point) were planted in 1990 with *Elodea canadensis* and *Potamogeton pectinatus*. Unfortunately, there was an extensive bloom of *Spirogyra* sp. and planted material did not survive into 1991. Natural revegetation, though slow because of high turbidity and low water clarity, has finally started in this region of the lake. Ultimately, the development of a stable aquatic plant community in this area will benefit wildlife and be instrumental for reducing turbidity as particulate material settles out in plant beds. These areas are normally in shallow water and it will be important that the lake level not be drawn down so low that these beds desiccate and die.

REVEGETATION EFFORT

Potamogeton pectinatus and *Elodea canadensis* planted by the Bureau of Reclamation have been important in the development of plant beds in the Hermitage area and North Sargent's Bay. In addition, these assisted plantings most likely provided propagule materials which have been important for establishing new beds at other locations in the lake. However, the successful development of macrophyte beds in the many new areas identified during the summer of 1991 was facilitated by the unusually stable water levels. In past summers (e.g., 1983), water level fluctuations ranged from a low surface elevation in June of 2060 m, to a high surface

elevation in July of 2063 m (unpublished data from the Bureau of Reclamation Pacific Northwest Regional Office). By September 1983, at peak macrophyte standing crop, the surface elevation was lowered to 2060 m. Therefore, water level fluctuations were more than 3 m in 1983. During the summer of 1991 however, the surface elevation only varied from 2063 m in June, to 2064 m in July at peak runoff, and then down to 2062 m in mid-October. For most of the growing season the surface elevation was greater than 2063 m in 1991, a change of only 1 m. Consequently, stable water levels coupled with good water clarity in many habitats around the lake resulted in better than expected recovery of the submergent plant community in 1991.

Assisted revegetation was locally successful in Jackson Lake. This was especially true in shallow, sheltered bays where substrates were stable, and light penetration was high by midsummer. Substrate texture may have been important in the success or failure of plantings. Sites with high success, e.g., North Sargent's Bay and Pilgrim Creek, had relatively fine grained substrates such as silts mixed with sands. Plantings were not successful in Half Moon Bay directly west of the inlet to Heron Pond where the sediments were more coarse and hard-packed. Moreover, plantings were not successful in areas such as Wilcox Point where there was an extensive filamentous algal bloom. In the future, it may be possible to select more appropriate sites for assisted revegetation based on our experience at Jackson Lake. While the recovery of the submergent plant community was slightly accelerated by the replanting effort, it would seem that natural revegetation processes are far more important for recovery of an aquatic plant community in a large water body like Jackson Lake. Replanting efforts of the magnitude executed at Jackson Lake are probably more effective in smaller water bodies.

◆ ACKNOWLEDGMENTS

This study was funded by the Bureau of Reclamation with coordination through the Wyoming Game and Fish Department and the U.S. Fish and Wildlife Service. The field assistance of Tom Thompson (Wyoming Game and Fish Department) and the staff at the UW-NPS Research Station are gratefully acknowledged. The efforts of Steve Torbit, Art Anderson and Steve Odden from the U.S. Fish and Wildlife Service, and Tom Collins and Larry Gabriele from the Wyoming Game and Fish Department are appreciated.

◆ LITERATURE CITED

- Brewer, C.A. 1986. An investigation of the aquatic macrophyte community in Jackson Lake, Wyoming: distribution, effect of moving water, and species-specific tensile properties. M.S. thesis - University of Wyoming (unpublished).
- Brewer, C.A. and M. Parker. 1990. Adaptations of macrophytes to life in moving water: upslope limits and mechanical properties of stems. *Hydrobiologia* 194:133-142.
- Hayden, P.S. 1969. Jackson Lake limnological investigations. National Park Service Progress Report 1968-1969 (unpublished).