ASSESSMENT OF THE LITTORAL MACROPHYTE COMMUNITY IN JACKSON LAKE, GRAND TETON NATIONAL PARK, WYOMING FOLLOWING RECONSTRUCTION OF THE JACKSON LAKE DAM

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Introduction

Beginning in 1978, the water level of Jackson Lake, Grand Teton National Park, Wyoming, was lowered first from 2064.5m (normal pool) to between 2060.3m-2061.8m, and then in 1985 to 2057.2m. The purpose of these drawdowns was to facilitate repair and modification of the Jackson Lake dam. In 1989, repair was completed and the reservoir was allowed to fill back to the normal pool elevation of 2064.5m Because of impacts to the littoral habitat in Jackson Lake caused by restoration of the dam at the Snake River outlet, the status of the aquatic plant community was assessed in August, 1989, to follow up to investigations conducted in 1983 (prior to reconstruction) and 1985 (immediately following drawdown to 2055.4m) by Brewer (1986). This report summarizes findings from the 1989 study on impacts to the littoral macrophyte community caused by the repair-related drawdowns. A detailed report assessing current physical and biological conditions in Jackson Lake was submitted to the U.S. Fish and Wildlife Service in October (Brewer, 1989). To evaluate the current status of the plant community in Jackson Lake, the following objectives were addressed during August, 1989:

1) Identify a representative subsample of transects originally measured in 1983 (Brewer, 1986) for re-evaluation and sample submerged vegetation;

2) Identify key areas not sampled previously and establish transects to sample submerged vegetation and for future monitoring;

3) Examine sites revegetated during the summer of 1989 by the Bureau of Reclamation.

COMPARISON OF PAST AND PRESENT CONDITIONS

Lake Bed Sediments

Sediment composition is much the same as described in 1986. However, a film of fine silts covered all sediments at the study sites. This film of silt seems easily mobilized by disturbance and plays a role in lowering the transparency of the water body. In the borrow area, especially in the sedimentation ponds, unconsolidated, flock-like silt covers the lake bed. Any slight disturbance suspends this material easily into the water column and reduces visibility and transparency considerably.

Light Penetration

Secchi transparency data collected in 1989 were compared with historical data of Brewer (1983 and 1984 unpublished) and of Hayden in 1968 (Hayden, 1969). Secchi disk transparency values varied considerably for the three summers surveyed (Table 1). In general, the bottom limit of the photic zone was approximately the same during August 1989 as it was in the past for many locations in the lake. Important exceptions where the bottom limit was in more shallow water than in the past are in the northern part of the lake and in the Hermitage/Donoho Island areas (areas which previously supported dense macrophyte beds; Brewer, 1986). In the borrow area, transparency dropped from 6.0 m or more in 1968 and 1983 to only 3.3 m in 1989. This change translates to roughly a 10 m decrease in the photic zone. The decrease in the extent of the photic zone in this area was attributed to increased suspended sediments; wind generated turbidity may be responsible for local differences in transparency in the most southerly parts of the lake. Based on field observations, it appears that the decrease in the extent of the photic zone is likely caused by increased turbidity due to inundation of unvegetated fine sediments when the reservoir was filled. In addition, a possible plankton bloom in the Donoho/Hermitage area may have also lowered transparency. Prior to 1985, the presence of a dense macrophyte community trapped small-sized particulates (silts and sands) and also slowed water currents, particularly in the northern part of the lake. Consequently, water clarity was better in past years.

Macrophyte Community Distribution and Composition

Evaluation of historical transects and of new sites explored in 1989 revealed extremely low plant density in the photic zone. In fact, density was below detection limits for the

Table 1. Secchi disk transparency data and approximate bottom limit of the photic zone during the summer of 1968 by Hayden (1968), and during the summers of 1983, 1984, and 1989 by Brewer (1986 and this report). Values are in meters. The range for the bottom limit of the photic zone around the lake each year is estimated in the last row.

	SECCHI TRANSPARENCY VALUE (meters)			
Site	August 1989	July 1984	July 1983	August 1968
N of Lizard Point	0.8		1.0	
NW of Arizona Island	1.4		1.1	
W of Arizona Island	2.2		1.2	3.3
Sargent's Bay	2.6		3.1	
UW-NPS Center	2.9	2.9	3.5	
Pelican Bay			3.5	
NE of Elk Island		4.5	3.0	
E of Waterfalls Canyon	3.8		4.2	6.0
S of Pilgrim Creek	1.5			
Donoho Island	3.3		6.0	7.6
South Landing Bay	5.0	4.3	5.1	
Deadman's Point	4.1	4.8	5.0	6.0
Bottom Limit of Photic Zone	2.4-15.0	8.7-14.4	3.0-18.0	10.0-18.0

Daubenmire canopy coverage method used in the past. Remnant beds exist in sheltered bay habitat, yet they have been left at depths too great for photosynthesis when the water level is above 2058.8m and will likely die off. On exposed shorelines, the littoral habitat is essentially devoid of aquatic vegetation. On most of the shallow marshy lake bed only remnant terrestrial grasses, forbs, and willows remain. The only exception is the development of planted beds of Potamogeton pectinatus in the Hermitage area. During his 1968 survey, Hayden (1969) reported 8 species of aquatic macrophytes in Jackson Lake (Table 2) during a collection effort limited to shallow water in Colter and Halfmoon Bays and near Donoho Island. During more extensive surveys of the lake in 1983, 1984 and 1985 (Brewer 1986), the species list for Jackson Lake was increased by 14 species bringing the total species count for the lake to 22 species. In 1989, I was able to find only 9 species of aquatic macrophytes in the habitats sampled in Jackson Lake. Elodea was quite rare and only one species of Potamogeton (Potamogeton pectinatus) was collected. While the sampling effort was not as intensive as in previous years, there can be no doubt that species richness has been severely impacted by water level fluctuations associated with reconstruction of the dam.

During surveys and dives in 1989, I was unable to find any substantial source areas for propagule material (e.g., seeds, stolons, rhizomes, vegetative fragments) in Jackson Lake. After previous disturbances such as lowering the lake level, propagule material was abundant because plants originally in deeper water were left in shallower water at the new, lower lake elevation. These plants were then subject to higher water movement and exposure; thus plant breakage was high and vegetative propagules were common. In the early 1980's, the presence of floating mats of vegetation that had formed after rooted macrophytes had been broken provided ample propagule material after the first drawdown. In addition, plants left in shallow water could easily extend their distribution downslope in the littoral habitat by producing seeds (in the case of Potamogeton and Ranunculus species) and/or vegetatively with rhizomes, stolons or pieces of broken shoot material. Finally, a viable seed bank existed in the littoral habitat for many species, especially Potamogeton species. In the same manner, natural revegetation had started in 1985 after the lake was lowered to 2057.2m.

In contrast to natural revegetation mechanisms of the early 1980's after drawdown, in 1989 plants remaining in the littoral habitat were left in far deeper water after the reservoir elevation was raised by roughly 9.2m. Moreover,

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. + 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
Alismataceae			
Sagittaria cuneata Shel.	-	+	-
Callitrichaceae			
Callitriche sp.	-	+	-
Ceratophyllaceae			
Ceratophyllum demersum L.	+	-	-
Characeae			
Chara sp.	+	+	+
Nitella sp.	-	+	-
Cyperaceae			
Eleocharis acicularis (L.)R.&S.	-	+	-
Haloragaceae			
Myriophyllum exalbescens Fern.	-	+	-
Myriophyllum spicatum L.	+	+	+
Hippuridaceae			
Hippuris vulgaris L.	+	+	-
Hydrocharitaceae			
Elodea canadensis Michx.	+	+	+
Elodea nuttallii (Planch)St.John	-	+	-
Polygonaceae			
Polygonum amphibium L.	-	+	+
Potamogetonaceae			
Potamogeton alpinus Balb.	-	+	-
Potamogeton filiformis Pers.	+	+	-
Potamogeton foliosus Raf.	-	+	?
Potamogeton pectinatus L.	-	+	+
Potamogeton pusillus L.	-	+	?
Potamogeton richardsonii	+	+	-
Potamogeton sp.	-	+	+
Ranunculaceae			
Ranunculus aquatilis L.	+	+	+
Ranunculus reptans L.	-	+	-
Sparganiaceae			
Sparganium sp.	-	+	+
Zannichelliaceae			
Zannichellia palustris L.	-	+	-
Total species reported	8	22	9

the only natural bed of vegetation I located was rooted in over 18.3m of water, well below the bottom limit of the photic zone. The Bureau of Reclamation established in 1988 that no viable seed bank existed in the lake bed so natural revegetation from seeds has been essentially eliminated. Natural revegetation in Jackson Lake will occur very slowly and it may take many years for species richness to reach historical levels.

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