

# **Changes in vegetation in Plum Lake as a result of Rusty Crayfish invasion: Status after 2007**

**\*A Report to the Town of Plum Lake  
Chris and Jan Wise with Bill Sloey**

## **Background**

For the past two summers, we have been attempting to get some measure of the aquatic vegetation present in Plum Lake before it was invaded by the rusty crayfish (*Orconectes rustica*) sometime in the late 1960s or 1970s. In December of 2006, we submitted a preliminary report (Wise, Kurth and Sloey) which was based on the earliest map we could find showing aquatic plants- a 1998 "Fishing Hotspots" map. The approximate locations of the sites sampled are seen in Figure 1. Inasmuch as the rusty crayfish entered the system sometime in the 1960s or 70s, however, the best we could hope to do was to record any change for the better or worse since 1998. Even those results were inconclusive. Some areas showed increased vegetation, while others seemed to show further losses.

## **2007 Studies**

In an attempt to utilize local expertise and get some sort of estimate of where vegetation was established in the 1960s and 70s, we asked Vernon "Junior" DeWitt, long-time Plum Lake resident and fisherman (as well as the Chairman of the Town of Plum Lake) to revisit some of his old haunts and point out where he remembered weed beds to be. This was accomplished in fall of 2006 when Mr DeWitt visited some 17 sites on the lake in the company of Chris Wise. We also discovered a 1974 (DNR Aquatic Survey Map) map of Plum Lake which purported to show aquatic vegetation. On July 24 and 25, 2007, Chris and Jan Wise sampled vegetation and sediments at those seventeen sites and recorded the data and approximate location of the sites on the 1974 map (Figure 2). The exact location of each site sampled is listed by G.P.S. coordinates, along with sediment type and vegetation in Appendix A.

At fourteen of the seventeen sites, no submergent vegetation was found, although most of these sites had emergent and or floating vegetation in shallow, near-shore water. The absence of submerged vegetation at these fourteen sites was common across all bottom types: muck, muck/ sand, sand and rubble. Also, crayfish were seen at all types of bottom where submerged vegetation was lacking.

In order to establish a little larger data set to work from, the data from the 2006 study were combined with the data from the 2007 study and are tabulated in Table 1. It is important to remember that all of these sites are located where aquatic vegetation was reported to have been present in the past. It is a bit surprising that more than one third of the sites (12 of 31) have a rock and rubble substrate. It is not likely that any vegetation stands on such substrate would have ever been very dense as the plants could only grow

in the interstitial spaces between the rocks. That does not mean that they were not important fish holding or ecological structures, only that any plants there would have been very exposed to intense crayfish grazing - crayfish thrive on rock and rubble. What is not surprising is that with the known excessive crayfish population, there are no plants on any of these sites today! **Clearly, Plum Lake has not yet recovered from the rusty crayfish invasion. When we start to see re-vegetation of the harder substrates, we can, only then, assume that Plum Lake is gaining some control over the rusty crayfish!**

Only one sample was taken on sand (site 16), likely because plants seldom successfully colonize open sandy areas. Sand is found in the higher energy locales like beaches and on the tops of saddles or humps. Because of the wave action on the plants, sand bottoms seldom support substantial plant stands. This site, however, is in a sheltered bay (Reddy's Bay) east of Aurora Creek and protected from strong northwesterly winds. It well could have supported a sizable stand. Again, crayfish can navigate freely on sand and would aggressively attack any plants present and none were found there last summer.

Of the nine stands previously reported on muck/sand mixed substrates, four currently support submergent aquatic plants. This is a satisfying observation because no plants were found on similar substrata in the open waters of Star lake ( Sloey and Haberle, 2006). **This further supports the modest evidence that Plum Lake is in better ecological condition than Star Lake.**

Five of the nine reported stands found on muck bottom currently support plant communities. Crayfish do not travel well on muck bottoms - their sharp, pointed feet cannot take purchase and the easily re-suspended silt interferes with their gills. In fact, it is somewhat surprising that all of the sites on silt do not support plant colonies. The reasons are unclear, but may be related to the limited nutrient supply and flux in these cool-water, early mesotrophic lakes, or that the sediments are more firm than in the bays of Star Lake. Recall, also, that crayfish were observed moving about at both muck-bottom sites where vegetation was lacking!

Use of the 1974 map turned out to be of very limited value. On the map, the submergent vegetation was simply denoted via a "s.v.". All the sites so denoted were tight to shore in shallow water along steep shorelines, and to our knowledge, no plant sample were collected for verification. The map shows few, if any, plant stands in the areas identified by Mr DeWitt, on the 1998 "Fishing Hotspots" map, or where we have recorded weed beds in the past two years. It is unknown how the submergent beds were observed or sampled. The emergent and floating vegetation shown on the map (Figure 2), however, do represent the current situation quite well. This is not entirely surprising because emergent and surface plants are easily observed, contain much more cellulose (for support) and are much more robust than submergents. They would be avoided by the crayfish until all other food is gone. It is not likely that anything would be gained by going back and trying to resample all the sites labeled s.v. on the map.

Blue Water Science consulting service conducted two surveys of Plum Lake at the behest

of the Plum Lake Riparian Homeowners Association in 199? And 200? While these were professional water quality studies, the plant survey data are not useful for our purposes because they only monitored plants to the eight-foot contour. This left half of the plant community un-sampled!

In 2007, the Environmental Protection Agency, in cooperation with state DNRs and tribal agencies, initiated a comprehensive analysis of the water quality and ecological health of some 909 randomly selected lakes nation-wide (National Lake Survey, NLS). The agencies have or will analyze for a host of physical and biological parameters, as well as shoreline development and conditions. **Two TPL lakes, Crystal and Plum, are included in this study.** The Wisconsin DNR added several parameters to the study, including doing a Floristic Quality Index (FQI) of 75 selected Wisconsin lakes (including the NLS lakes and others of interest). The Floristic Quality Index value is a calculated number based on the number of species, density and species composition of aquatic plants; with each species assigned a value based on recognized ecological sensitivity.

This past summer, the DNR's local lake monitoring crew conducted the sediment and plant survey portion of the survey on Plum Lake by sampling 405 of the 1078 sites (one/acre of lake) from a predetermined, equidistant grid with GIS formatting (Hauxwell, et. al., 2008). All sites where the sediments are above the compensation depth were sampled. The compensation depth (the depth at which plants can generate positive annual growth) was established at 15.2' of water. In January 2008, Sandy Wickman, DNR contact person for Lake Monitoring Volunteers in Vilas County, sent us the raw field data and in March, Dr. Jennifer Hauxwell, from DNR's Integrated Science Services, gave permission for us to use all the data and sent along the entire interactive Excel spreadsheet and a plant sampling summary (Hauxwell, Jennifer & Michelle Nault, Pers. Comm., appended). We will cite only a small part of the findings here (we have taken the liberty to do some massaging of raw field data).

In brief summary, on 66 sites with rock and rubble sediments, they found vegetation on only 4 sites (6.2%). This is similar to our data (0/12). On 211 sites underlain with muck, they found plants in 84 samples. That is a 40% colonization rate. Our data showing a 5 of 9 ratio is reasonably comparable. On 128 sand based sites, they found 23 containing plants (16%). We had separated sand from silt/sand, but when combined, we had a 4 of 10 colonization rate. The survey data clearly show that the majority of the plants are currently found on the shallow, muck-bottomed flats on the East and West ends of the lake. The DNR found 41 species of plants in only 111 samples yielding plants. That is a very high species richness and speaks well for the overall water quality. The Floristic Quality Index cannot be calculated until the species identifications of the plants have been confirmed by the UW-Mad. Herbarium.

**We believe that our very minimal data set is fairly representative of the general current plant colonization conditions throughout the lake and should be of some use in assessing future lake changes. More importantly, if all the sites that we sampled did, in fact, support aquatic vegetation prior to the rusty crayfish invasion (as anecdotal evidence suggests), and only nine of thirty one sites now have plants, then**

**we will need to experience at least a two-fold increase in the distribution of aquatic plants across the lake and an unknown, but great increase in plant biomass before we can conclude that Plum Lake has recovered** (this statement should be taken as a ballpark guess only, not as a scientific finding!).

**In cooperation with the EPA and the DNR, the Great Lakes Indian Fish and Wildlife Commission conducted plankton net tows for spiny and fishhook water fleas as well as sampling for zebra mussels on Plum Lake. They found none.**

**In spite of the presence of exotics in both Plum (rusty crayfish) and Crystal (rainbow smelt) both our TPL lakes will almost certainly rank among the highest quality lakes in the U.S.! It is not known whether or if the EPA or the DNR will repeat the National Lake Survey or FQI studies anytime soon. One thing is certain, the mass of data generated in the 2007 NLS and FQI studies will provide a solid data base for measuring changes in the future. Now, if we only had such data from the 1960s or 70s!**

### **References Cited**

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