A DEPARTMENT OF ECOLOGY UPDATE REPORT

Washington Lakes

WASHINGTON STATE DEPARTMENT OF ECOLOGY

August 1997

The Lacamas Monster

by Kirk Smith

Ecology has been monitoring Lacamas Lake in Clark County for several years now. The lake has suffered from non-point pollution for decades. Run-off from agriculture operations increased the nutrient load into the lake. Phosphorus and fecal coliform concentrations were unusually high causing the lake to eutrophy at a rapid rate. In 1988, a lake restoration project was initiated in an attempt to restore the lake. Millions of dollars of local and state moneys were spent in this effort. So how does Lacamas appear now after nearly a decade has passed since the restoration? Not very well.

What is the problem and what happened after the restoration? The diagnostic study conducted before the lake restoration showed that 97% of the phosphorus loading was coming from agriculture run-off in the lake basin. Ecology funded an effort to implement best management practices (BMPs) but these practices were only voluntary. Unfortunately, some farms couldn't afford the 25% matching funds to pay for the BMPs so they declined to participate based on finances. Much of the vegetation planted during the restoration were not of the variety recommended and therefore died. As a consequence, much phosphorus is still entering the lake. Additionally, the lake's fecal coliform counts have reached as high as 2400 MPN/ml, nearly 50 times the water quality standard.

Lacamas Lake, a lake in need of restoration.

To complicate matters, the head of dairy cattle increased from 4000 to 8000 in the last decade. Also, the number of hobby farms has increased along with the increase in residential units. The rate of growth was not projected when the original plans for the restoration were designed. Millions of dollars have been spent on increasing local government staffing, planting vegetation destined to die and developing BMPs that were not uniformly applied throughout the watershed.

...the lake's fecal coliform counts have reached as high as 2400 MPN/mL

Future efforts are desperately

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needed to save Lacamas Lake from

Stayin' Alive- - - - For Now

by Kirk Smith

The Lake Water Quality Assessment Program has just received a grant of over $128k for the federal fiscal year of 1998. This will enable the program to stay solvent until October 1998. We've been struggling for years to keep this program afloat and have managed to be creative every step of the way just to keep us in the field testing your lakes.

The grant money will allow us to try some innovative techniques that will change the program considerably. Next year we will most likely change our sampling methods. Lakes with volunteers will continue doing Secchi dips throughout the growing season. Some of you have already begun to sample for pH and others will soon be sampling for fecal coliforms. Ecology personnel will sample fewer lakes more intensely. It is proposed that more parameters be measured by Ecology personnel such as zooplankton and fish. Surveys will also include measurements of lake uses and potential attainable uses. Since all lakes are not alike, data concerning lake condition should not be qualified alike. In other words, we shouldn't expect an urban lake to have the same pristine features as an alpine lake. Past lake assessments have grouped all lakes to

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gether with very little attempt to cat-

If you have special accommodation needs, please contact Barbara Tovrea (360) 407-6696 (voice) or the Ecology's TDD number at headquarters (360) 407-6006.

Lacamas Lake
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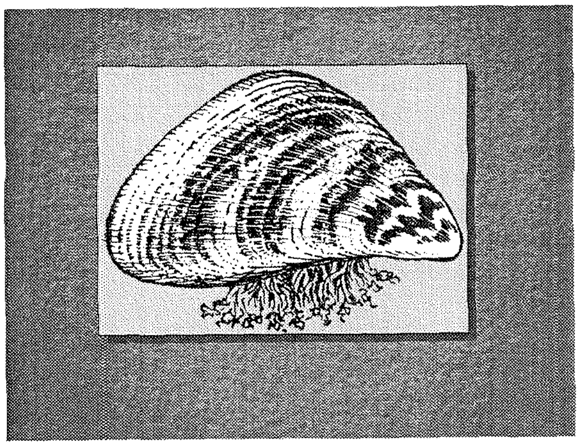
further degradation. Non-point pollution must be reduced substantially if improvements to the water quality are to be realized. While sampling Lacamas this spring, it appeared that the lake was so saturated with phosphorus that nitrogen may now be the nutrient limiting plant growth. Substantial phosphorus concentrations most likely exist *in the lake sediments and are released* into the water column in the summer thereby contributing to horrific algal blooms.

The Lacamas Monster does exist. I saw him this spring and he is human.

Zebra Mussels
by Kevin Aitkin

The zebra mussel, *Dreissena polymorpha,* is an introduced freshwater bivalve (two matching shell halves) mollusk native to eastern Europe and western Asia near the Aral, Black, and Caspian Seas. They are thought to have been introduced into North America in 1986 via the exchange of ballast water from commercial shipping. Zebra mussels have interrupted the flow of water at power, industrial, and municipal water treatment plants as well as private resident water intakes. It is estimated that monitoring and control of zebra mussels cost Great Lakes water users $30 million annually.

Zebra mussels reproduce (spawn) via external fertilization. Spawning begins when water temperature attains 12-16°C (54-61°F) and may last 3-5 months (latitude dependent). A mature female is capable of producing up to one million eggs per season. The life cycle begins with a free floating, planktonic larval stage (veliger) which is mobile for up to four weeks before it must settle on a suitable substrate. Zebra mussels produce byssal threads (fibers) for attaching themselves to the substrate. Adults range in size from 0.8-5.0 cm (0.3-2.0 in) and the average life span is 3 to 5 years. They are filter feeders which feed mainly on algae. An adult zebra mussel may process at least 1 liter (33.8 fl oz) of water per day. Zebra mussels have been found in colonies with densities as high as 30,000 to 100,000 mussels/m^2 (3.3 ft^2).



Zebra mussel: notice the common striping and byssal hairs that can be used to identify this mussel.

Zebra mussels thrive in good quality water. They prefer water temperatures ranging from 8-25°C (46-77°F), but can tolerate from 1-30°C (33.8-86°F). They prefer visibilities from 40-200 cm (16-79 inches) as measured with a Secchi disk. Zebra mussels are generally found between 2 and 7 m (6-23 ft) deep, but adults have been found as deep as 55 m (180 ft). Adult zebra mussels can survive desiccation (drying out) for more than 10 days in moist, cool (<15°C / 59°F) conditions, but survival times are both temperature and humidity dependent.

In addition to the impacts of zebra mussels previously mentioned, they can also completely plug raw water pipes (up to 0.6 m (2 ft) in diameter), cooling and condenser tubes, and raw water intake screens. The zebra mussels have also caused recreational impacts such as reducing boat performance by blanketing the hull, overheating of boat motors by clogging cooling water intakes, and creating an aesthetic nuisance and health hazard by the build up of decomposing shells on beaches. Changes in the aquatic community structure are an important environmental concern. For example, zebra mussels can reduce zooplankton abundance, *whereas some benthic* forms of invertebrates are increased. The abundance of freshwater mollusks is reduced. The long term effect of zebra mussels on fisheries is unknown, but short term effects have been minimal in the Great Lakes.

Zebra mussels were first discovered in the Great *Lakes in 1988* and Have since firmly established themselves east of the Rocky Mountains in the United States and Canada. They now impact 19 states and 2 provinces ranging from Quebec south to Louisiana and from Vermont west to Oklahoma and are still expanding their range. The California Department of Food and Agriculture check stations have been looking for zebra mussels on boats and boat trailers entering the states since 1992. They have had 10 dead and 2 live zebra mussel sightings as of June 1997. It was also discovered that one of the infected boats had passed through the state of Washington. Therefore, the risk of zebra mussel introduction to Washington state is very real as shown by the California data.

...control of zebra mussels costs the Great Lakes water users $30 million annually

Due to the fact that Washington state has yet to be invaded by zebra mussels, it is important that we all take part in prevention and monitoring activities. Prevention activities include following the same suggestions given

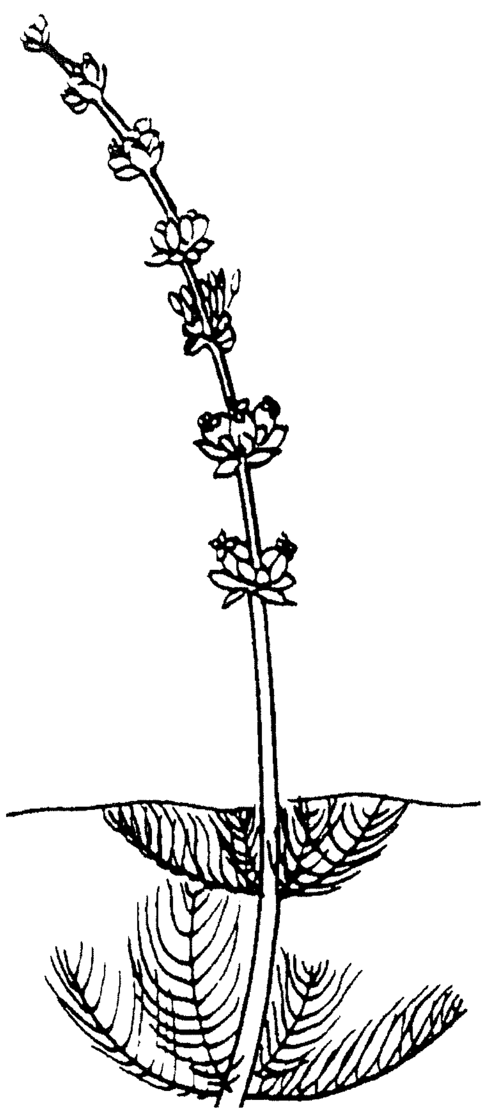
Eurasian Watermilfoil- our most infamous water plant

by Jenifer Parsons

Eurasian watermilfoil (*Myriophyllum spicatum*) is the most widespread nuisance nonnative aquatic plant found in Washington. It originated in Europe, Asia and Northern Africa. This plant was introduced to the eastern United States at least as long ago as the 1940's, but it may have arrived as early as the late 1800's. It was used in those days as a hardy aquarium plant, and was probably introduced to the wild from discarded aquarium contents. In Washington the earliest known record of Eurasian watermilfoil is from Lake Meredian, near Seattle, in 1965. By the mid 1970's it was also found in Lake Washington. During this same time period Eurasian watermilfoil became established in central British Columbia, and traveled downstream to Lake Osoyoos and the Okanogan River in central Washington. Currently it has been identified in more than 70 locations throughout the state, mostly along the I-5 corridor and near infested rivers (the Columbia, Pend Oreille, and Okanogan Rivers).

Eurasian watermilfoil has several traits which causes it to be a nuisance. During spring it grows quickly to the water surface where it branches profusely to form a dense mat. This surface mat shades out the lower growing native plants and also wreaks havoc with boaters and swimmers who become tangled in the long strands of vegetation. It also spreads to new locations easily through fragmentation. In the late summer and fall the plants become brittle and naturally break apart. The fragments will float to other areas sink and start new plants. It will also grow from fragments created by boaters or other disturbance during any time of year. These fragments are often accidentally carried to other lakes and introduced from boats or fishing equipment.

Identification of Eurasian watermilfoil is sometimes difficult because it is easily confused with its native cousins. In fact. for many years it was classified as the same species as the native northern watermilfoil (*Myriophyllum sibircum*, which used to be called *M. exalbescens*). Currently, botanists seem to be in agreement that the two are separate species, though often they look very similar. In addition to northern watermilfoil, there are several other native watermilfoils which are easily confused with one another. Over the last several years researchers have begun to utilize DNA analysis to help distinguish the different species. All watermilfoil generally has four leaves that occur in whorls around the stem. Eurasian watermilfoil generally has four leaves per whorl, and more than 12 pairs of leaflets on each leaf. It has reddish flower stem which rises above the water surface. The flowers are tiny, and each tiny green leak-like bract below it.



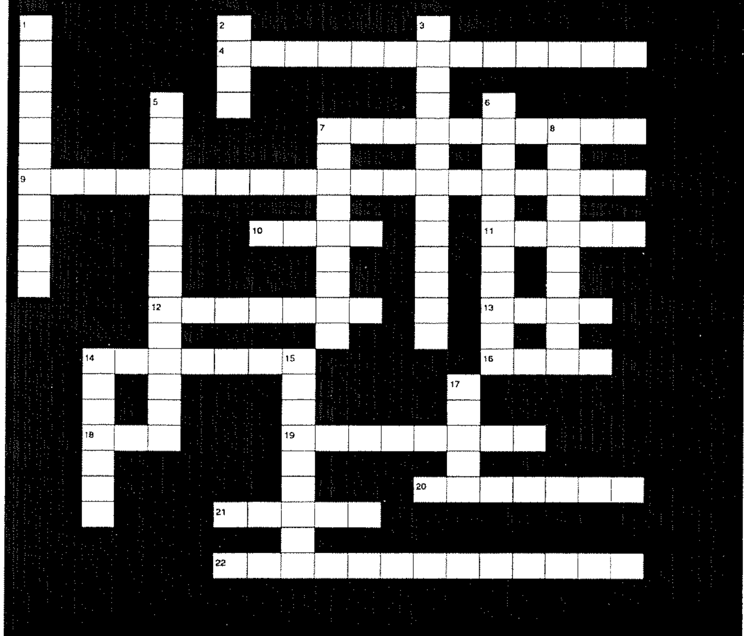
Eurasian Watermilfoil's reddish flower stem rises above the water surface.

Introduction of Eurasian watermilfoil can drastically alter lake ecology. It will usually crowd out native plants, creating habitat that is less desirable for fish, water fowl and aquatic invertebrates. The dense mats of vegetation can also increase the lake sedimentation rate by trapping sediments, and will alter the dissolved oxygen and nutrient content of the water. Many efforts to control Eurasian watermilfoil have been made over the years, including under water rototillers, combine like plant harvesters, aquatic herbicides and hand pulling. Some have been successful in eliminating the plant from individual lakes (if strict vigilance is maintained!) while others seem to barely stay even with the pants ability to grow and spread. Currently, the Department of Ecology is funding research on using a native aquatic weevil which eats this exotic watermilfoil as means of controlling its growth.

Identification of Eurasian watermilfoil is an important part of lake care. If the plant is discovered at an early stage, the chance of eliminating it from a lake is much higher. If you think you have seen this plant in a lake, please contact me and send in a sample of your suspected plant. My phone number is (360) 407- 6657, e-mail is jenp461@ecy.wa.gov.

Washington Lakes

Try this crossword puzzle for fun!



Down:

1. A measure of water clarity. (2 words)
2. An inland body of standing freshwater.
3. A survey of the biological components of an area in order to come to a conclusion on water quality.
5. The natural aging process in lakes.
6. The green pigment in plants.
7. K - (a mineral measured in water).
8. A scientific name for the division of algae known as "red algae."
14. A bottom dwelling fish that uses "whisker-like" feelers to get around.
15. The study of lakes.
17. An aquatic plant that is freefloating and is commonly associated with a degradation of water. quality.

Across

4. A decrease in the pH of a lake is known as __________.
7. P - (a nutrient measured in water quality).
9. A state agency whose main concerns are environmental. (3 words)
10. An aquatic organism that swims.
11. One of the major automobile emissions (O_3)
12. Ca - (a mineral found in hard water).
13. A toy.
14. A plant found in marshes.
16. A heavy metal that is a major health concern.
18. Fish use this to move around.
19. N- (a nutrient measured in water quality).
20. A temperature scale.
21. A bacteria found in animal wastes (abb.).
22. A microscopic floating aquatic plant.

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W Z E B M F B W H O I S I T Z F G N T L F
A L P E R T E R W N L X M R E D T A L K S
G E I P H O T E N L Q T W I B A S S Z O I
C A R O E S A B Y L D R A T E R D T E R N
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T B A N K J Q D A E I O U M B F V A H X P
D I S S O L V E D O X Y G E N S E T R A D
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WORDS:

DISSOLVED OXYGEN
EVAPORATE
MILFOIL
CHLOROPHYLL
MONITOR
TROUT
ZEBRA MUSSEL
BOAT
LAKE
BASS
PHOTOSYNTHESIS
ECOLOGY
DARTER
WATER

Find us on the Net! by Andrea Barry

Some of you may not be aware that the Department of Ecology has a web page. The address is <***http://www.wa.gov/ecology/***>. In order to access the lakes monitoring portion of the ecology web page from this point you would need to look under the title Ecology Activities By Function and then click on Environmental Monitoring. Inside the environmental monitoring section you would need to click on Lake Water Quality Monitoring. On our web page you can find a list of the lakes we monitor (past and present), bathymetric maps of the lakes, and most recent lake data. Also look for two other websites: 1) NatureMapping educational program on the Internet, about monitoring wildlife and water at, <***http://salmo.cqs.washington.edu/ ~wagap/nnml/***>

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Lake Monitoring: What We Measure and Why

by Bryan C. Farmer

The Lake Water Quality Assessment Program (LWQA) currently monitors lakes for the purpose of gathering general water quality information on publicly-owned lakes in Washington. The purpose of monitoring is to help determine water quality trends in the state, and to try and preempt major changes in water quality through the identification of problems and the development of management plans. By monitoring lakes, the LWQA Program helps to maintain the safety of water for humans and other inhabitants, as well as maintaining "beneficial uses" of the lakes.

In monitoring the lakes the LWQA Program measures a number of water quality parameters. These parameters are:

1) Water Temperature - is important because it influences the types of organisms that can survive in a lake. For example, some species of fish require low temperatures to survive. Water temperature also influences the amount of oxygen that can be dissolved in the water. Aquatic organisms need oxygen just like humans so increases in temperature can also have serious effects on oxygen concentration.
2) Dissolved Oxygen - as stated above dissolved oxygen plays an important role in the survival of aquatic organisms. However, dissolved oxygen also has another influence. Dissolved oxygen levels influence the rate of many chemical reactions that are important to lake functions.
3) pH - as with dissolved oxygen and temperature, pH influences the types of organisms that can live in a lake. However, pH has a more subtle influence on water quality. The pH of a lake influences the amounts of nutrients and the forms that the nutrients take on in a lake. It can also indicate productivity.
4) Secchi Disk depth - is a measure of water clarity. Water clarity is important because it influences the amount of light that penetrates into the water. This influences the amount of photosynthesis that can occur in a lake. Secchi depth is also used to estimate the amount of algae/productivity that occurs in a lake.
5) Nutrient Concentrations - nutrients are an important part of lake systems. They determine the amount of growth and productivity that can occur in a lake. They are also good indicators of urban and non-point pollution sources in lakes.
6) Turbidity - is a measure of the amount of solids that are suspended in the water. This is important because it affects the amount of light that can penetrate into the water. This in turn influences the level of productivity that a lake has as well as the amount of existing suitable habitat in a lake.
7) Chlorophyll *a* - is a measure of active photosynthetic processes in a lake. Photosynthetic activity has influences on pH, dissolved

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Grant

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egorize them according to their attainable use. New water quality criteria has been introduced for lakes and our new approach will allow us to monitor for these criteria.

A future sampling schedule for your lake might be as follows:

A. 1998--Ecology samples your lake four separate times during the year while you continue your efforts with the Secchi dips.

B. 1999-2002--You continue your Secchi dips. Ecology visits to check your Secchi accuracy once a year and resupplies you as needed.

C. 2003--Ecology personnel returns to sample your lake four times a year.

It is believed a more intense study year will allow for better lake assessments, because year to year changes in water quality are typically small, a 5 year rotation of intense lake assessment, with yearly Secchi data, will actually improve the quality of the overall assessments.

Zebra

(continued from page 2)

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by Washington State Department of Ecology (WDOE) to prevent the spread of aquatic nuisance plants when boating or educating your neighbor about the threat of zebra mussels. Monitoring Washington lakes and rivers for zebra mussels is also very important so that control or eradication efforts can be initiated as soon as possible if zebra mussels are discovered. For more information on zebra mussel monitoring protocols contact Kirk Smith with the WDOE at (360) 407-6680. For more information on zebra mussels contact the author.

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Washington Lakes

Monitoring

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oxygen, available nutrients and Secchi Disk depth. Chlorophyll *a* activity is also used as an estimate of productivity within a lake.

8) Coliform Bacteria - Fecal Coliform Bacteria is deposited in lakes as a result of excretion from warm blooded animals. It is measured as an indicator of fecal contamination and is an indicator of the potential presence of disease carrying organisms. Coliform Bacteria are kept under surveillance because some types are known to have health risks to humans.

Together these parameters portray an accurate picture of lake water quality for the purposes of determining the general well being of the lake.

Web

(continued from page 4)

and 2) the new "Watch Over Washington" (or WOW) website <***http://www.wa .gov/ecology/wq /wow.html***>. The WOW website will feature a statewide roster of volunteer monitoring coordinators, announcements of events and resources, tips for better monitoring, and frequently asked questions and answers. So, next time you are on the web — surf on in and check us out!

Data Card Inconsistencies

by Bryan C. Farmer

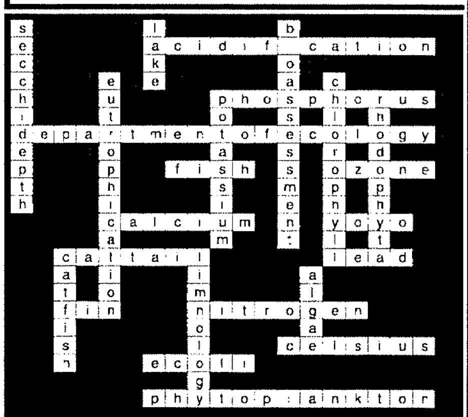
Just a quick note to our lake sampling volunteers. Lately we have been getting back some of the cards with some important things blank. For example the boxes asking if you used a viewing tube for your Secchi disk readings, and whether or not Zebra mussels are present. Also, lake level has been left blank on a number of occasions. It is very important that the cards be filled out as completely as possible so that the incoming data can be interpreted properly. If you are unsure how to answer one of the questions on the card please contact us and we will explain what the question is addressing more clearly.

Also, we at the Department of Ecology would like to say thank you for your grand efforts. We realize that you are taking time out of your days to carry out the sampling tasks, and your time is appreciated. We would not be able to achieve what we do without your help. Keep up the good work.

Watch us on TV!

Kirk and the Mason Lake Volunteers will be on KOMO TV 4 news, August 28. The time of the segment will either be 5:00 PM.

If you have any questions regarding this newsletter please contact Kirk Smith at (360) 407-6680



A Quote to Remember

While giving Bill Young (a lake volunteer who happens to be an Ecology employee) of Island Lake (Mason County) orientation this spring, he told me of an interesting exchange he had with last year's volunteer for Island Lake. While picking up the Secchi disk from the former volunteer, who happens to be an attorney, Bill did receive some training. They were going over lake level and the old volunteer explained that once the lake got below the marker you had to "guess" the lake level. Bill replied, "Well, I guess that's the difference between a lawyer and a scientist."

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