Condition of Freshwaters in Washington State for the Year 2000

WASHINGTON STATE DEPARTMENT OF ECOLOGY

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Contents

Freshwater Monitoring Program

The Freshwater Monitoring Unit of the Environmental Assessment Program, Department of Ecology, routinely collects information on the aquatic resources of Washington State. Monitoring is conducted to collect data on water quality and biological health of Washington's freshwaters.

River and Stream Monitoring

The Washington State Department of Ecology has operated a long-term river and stream monitoring program since 1970. The current program conducts monthly monitoring of 14 water quality indicators at approximately 80 stations within the state.

The goals of the program are to provide:

1) water quality information that can be used to characterize past and current conditions

2) data that can be used to refine and verify water quality models or to help evaluate other site-specific water quality issues

3) data from representative river and stream segments that are used to evaluate impairment of beneficial uses and to detect violations of state water quality standards

The program consists of long-term and basin monitoring stations. Long-term stations are monitored year after year to track water quality trends, assess inter-annual variability, and collect current water quality information.

These stations are generally located near the mouths of major rivers and downstream of major cities. However, some long-term stations are deliberately located upstream of major cities and where major rivers enter the state to monitor background conditions.

Basin stations are typically monitored for one year to collect new water quality information. These stations are selected to support Ecology's basin approach to water quality management and to address site-specific water quality issues.

More information is available at Ecology's Website: *http://www.ecy.wa.gov/programs/eap/fw_riv/rv_main.html*

Department of Ecology staff collects stream insects to assess ecological health.

Biological Monitoring

Ecology collects biological information from rivers and streams throughout the state. The long-term monitoring program was established in 1993 to explore spatial patterns and identify temporal trends in stream insect communities. Gradually, the program has developed a large base of information that describes biological characteristics at reference (clean) and degraded stream sites. Reference sites are located in streams with little or no human effects.

Traditional measurements of chemical and physical conditions in rivers and streams do not provide sufficient information to detect or resolve all surface water problems. Biological evaluation of surface waters augments chemical and physical measurements, because degradation of sensitive ecosystem processes is more frequently identified. Biological assessments supplement chemical evaluation by:

1) directly measuring the most sensitive resources at risk

2) measuring a stream component that integrates and reflects human and other influences over time

3) providing a diagnostic tool that synthesizes chemical, physical, and biological disturbances

More information is available at Ecolgy's Website: *http://www.ecy.wa.gov/programs/eap/fw_benth/fwb_intr.html*

Lakes

The objectives of Washington's Citizen Lake Monitoring Program are to identify lakes with water quality problems, assess significant publicly-owned lakes by estimating the trophic status of monitored lakes, and promote public awareness of lake ecology and protection.

Volunteers participating in the program measured water clarity and surface water temperature twice a month at 71 lakes from May through October of 2000. Volunteers also completed a questionnaire on lake and watershed uses. Ecology staff visited each lake to conduct quality assurance evaluations with volunteer monitors. Weather conditions, water color, and general observations about the lake were recorded. If an obvious algal bloom was occurring, a sample was collected for later identification. Plant samples were either identified onsite or collected for later identification.

More information is available at Ecology's Website: *http://www.ecy.wa.gov/programs/eap/fw_lakes/lk_main.html*

Aquatic Plants

Ecology has been collecting information on aquatic plants from lakes and rivers throughout the state since 1994. The main objective of this program is to inventory and monitor the spread of invasive, non-native aquatic plant species through the state. These plants can cause harmful environmental and economic impacts. Other goals of the program are to provide technical assistance on aquatic plant identification and control of invasive species, and to conduct special projects evaluating the impacts of invasive non-native species and their control.

For most lakes the method used is to evaluate the shallow parts of a lake in a small boat. When a different plant or type of habitat is observed, samples are collected for identification. Notes on species distribution, abundance, and maximum depth of growth are made. In addition, water clarity and chemistry are measured.

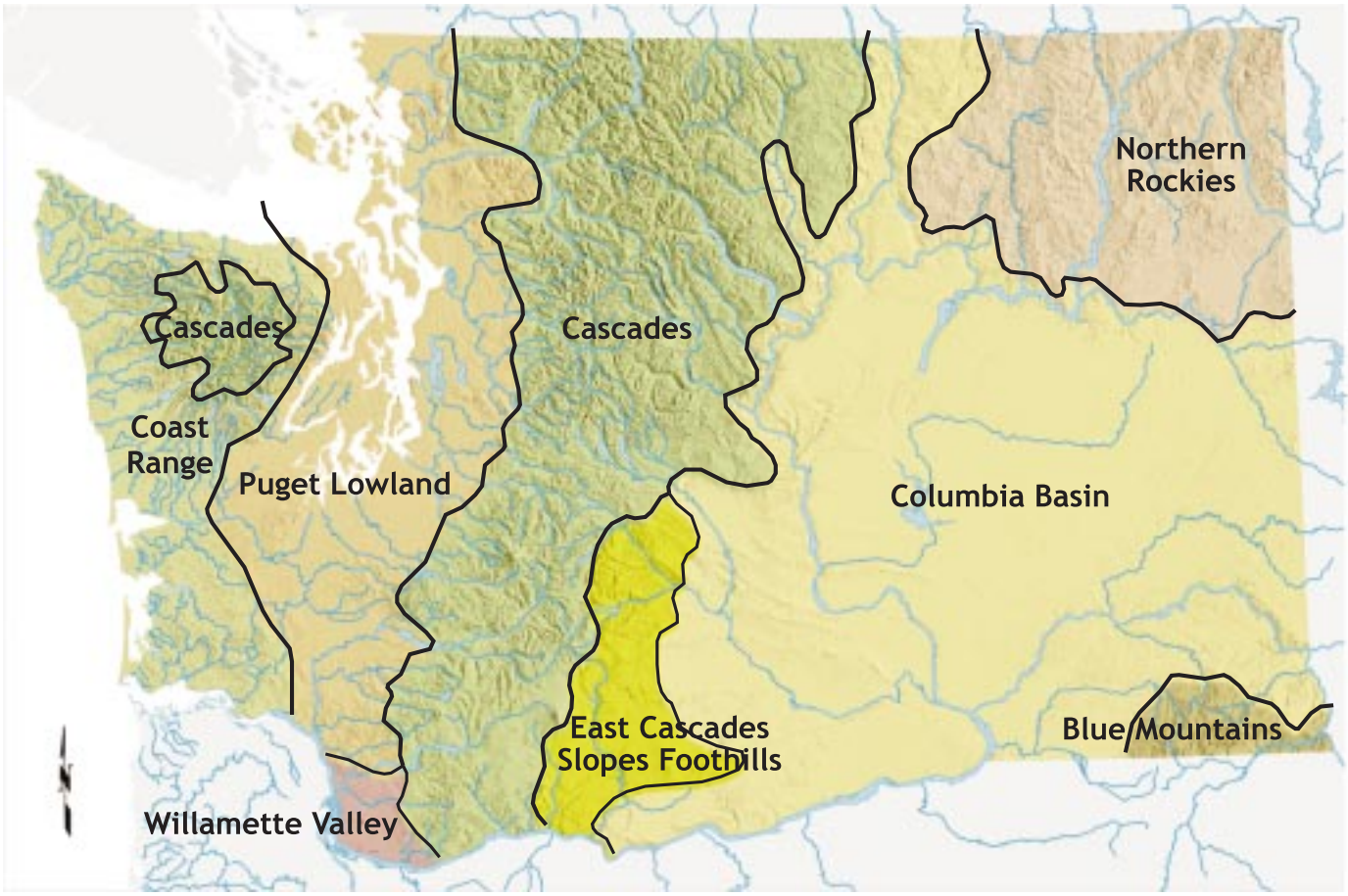
More information is available at Ecology's Website: *http://www.ecy.wa.gov/programs/eap/lakes/aquaticplants/index.html*

Introduced from South America, parrotfeather milfoil can become a nuisance, often creating dense mats on the surface of shallow water.

Washington State Ecoregions

This report summarizes water quality conditions by ecoregions, as defined by the U.S. Environmental Protection Agency. Washington State has eight ecoregions, each with different landforms and biological characteristics.

Information from freshwater sampling in the year 2000 has been compiled by ecoregion for presentation and comparison. Since water quality information was not collected in the Blue Mountain Ecoregion during the year 2000, that ecoregion is not presented in this report.



Conditions in the Year 2000

Six indicators of aquatic conditions were evaluated from data collected by Ecology. Each of the following paragraphs describes one of these indicators. Further details about the assessment methods used and sampling locations can be found in this report's technical appendix that is bound separately as Ecology Publication No. 01-03-026.

Water Quality Conditions

Data collected from the rivers and streams monitoring in 2000 were used to assess the current water quality conditions. These data were evaluated using Washington's Water Quality Index (WQI). Water quality is represented by the index using numbers ranging from 10 to 100. The higher index numbers indicate better water quality. Multiple measures of water quality are combined and the results aggregated to produce a single score for each sample station.

Results are presented for each ecoregion using an approach developed by the U.S Environmental Protection Agency. Waters of the highest concern are labeled as "Poor," those of moderate concern are "Fair," and those of lowest concern are considered "Good."

Water Quality Trends

Data collected from the rivers and streams monitoring over the last ten years (1991-2000) were used to assess trends in water quality. These data were evaluated with the use of statistical methods. Trends at each station were grouped and statistically evaluated for an overall assessment of trend for each ecoregion. This approach avoided measuring trends caused by natural changes in stream flows. Therefore, trends that are detected indicate human-caused influences.

Below: *Lake St. Clair, Thurston County*

A citizen volunteer measures lake transparency

Sanitary Conditions in Streams

Data on fecal coliform contamination collected from the rivers and streams monitored over the last five years (1996-2000) were used to assess sanitary conditions of freshwaters. Since it is not possible to test for all pathogenic organisms, fecal coliform bacteria are used as an indicator of sanitary conditions. Fecal coliform originate from the intestinal tracts of warm-blooded animals, and the levels in water are relatively easy to measure. As such, water quality standards for fecal coliform have been established to protect people who are swimming or wading in freshwaters. Measurements of fecal coliform bacteria are compared to these water quality standards. This information is being used by Ecology to help decide where pollution control efforts should be targeted to protect the health of swimmers.

Biological Health of Streams

Data collected on stream insect communities since 1993 were used to assess the biological health of streams. These data were evaluated with the use of the Benthic Index of Biotic Integrity (B-IBI). Using information from stream insect communities, this index provides an overall assessment of the condition of streams. Several measures of the stream insect community are combined to construct the single number B-IBI. Each of these measures responds to different stream conditions and together are able to identify instances where aquatic life is in decline. General conditions of biological health are presented for each ecoregion with an approach similar to the U.S. Environmental Protection Agency in its assessment reports to Congress. Waters of the highest concern are labeled as "Poor," those of moderate concern are "Fair," and those of lowest concern are considered "Good."

Lake Quality

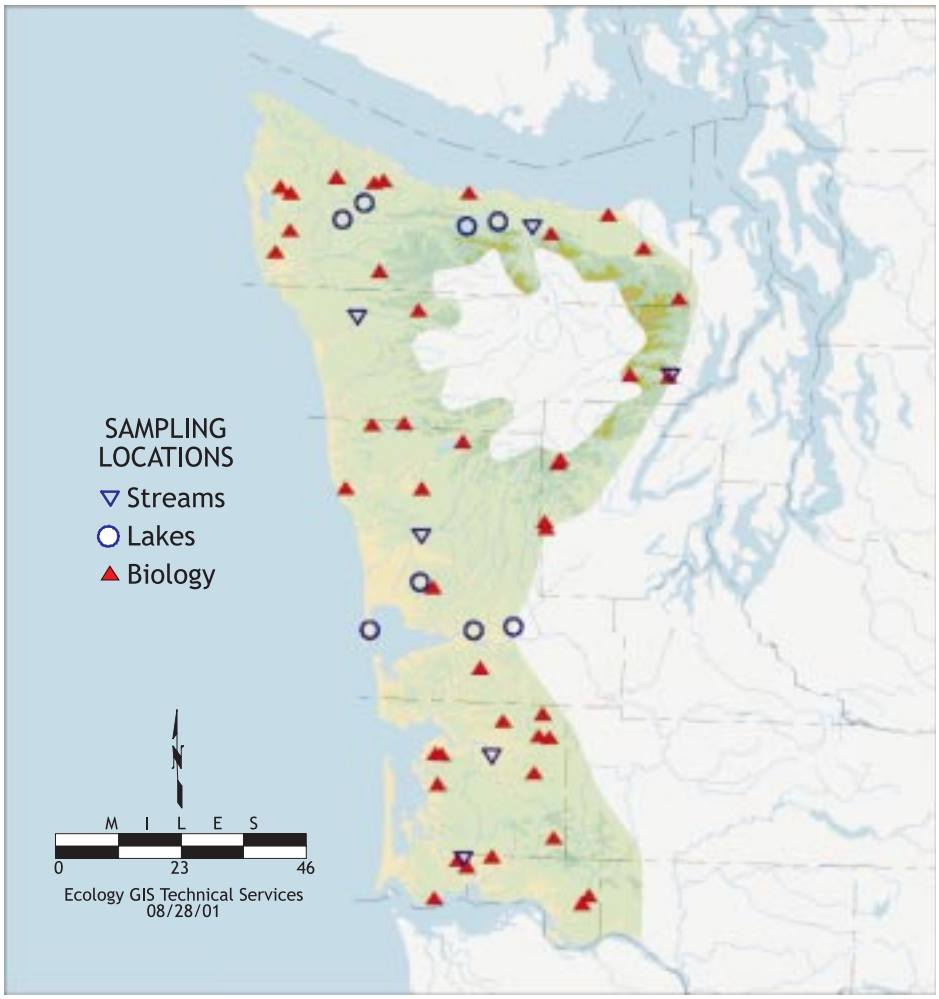
Data collected by citizen volunteers participating in the year 2000 monitoring were used to assess the quality of lakes. Using an apparatus called a Secchi disk, each volunteer periodically measured the clarity of these lakes. These data were evaluated with the use of the Trophic State Index (TSI). This index provides an overall assessment of the enrichment of the lakes. The higher-index numbers indicate lakes that are highly enriched with nutrients and abundant algae. These lakes are generally considered of poor quality. Lakes moderately enriched with nutrients and with some algae present are generally considered fair quality. Lakes with low nutrient levels and few algae present are generally considered good quality.

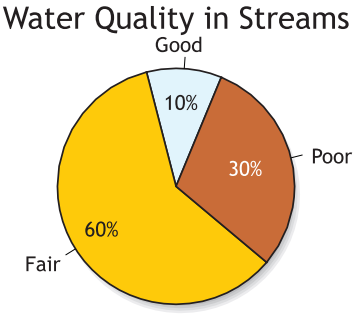
Aquatic Weeds

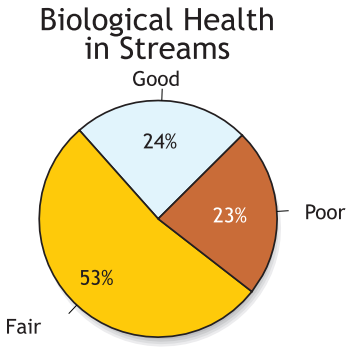
This report identifies lakes where invasive, non-native plants were discovered in the year 2000. In addition, the type of aquatic plant found is identified by its common name.

Water Smartweed often forms mats along lake margins

Coast Range Ecoregion







Water Quality Trends

- Decreasing trend for total nitrogen nutrients

Sanitary Conditions in Streams

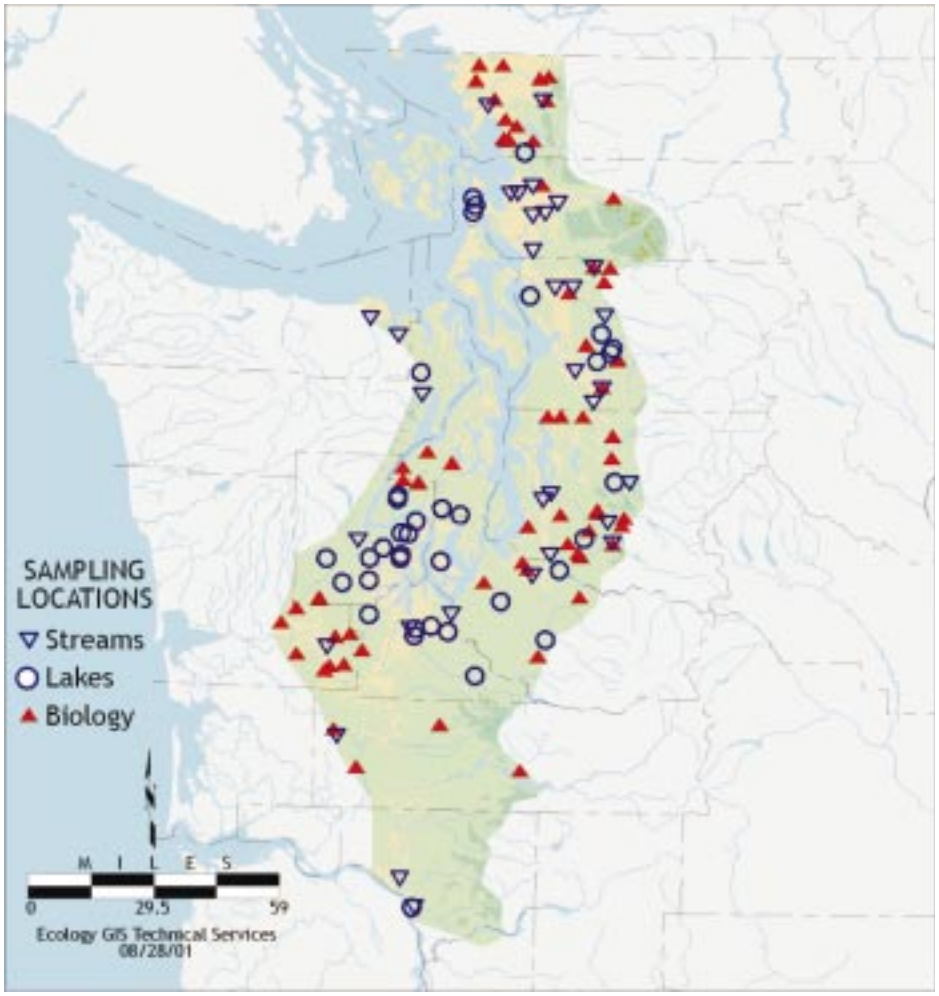
- All the streams sampled over the past 5 years met standards for swimming

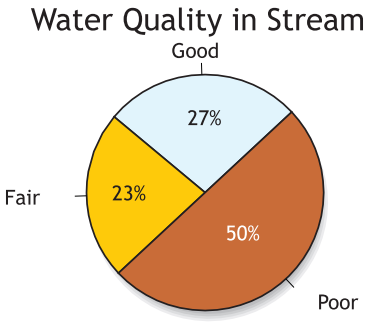
Aquatic Weeds

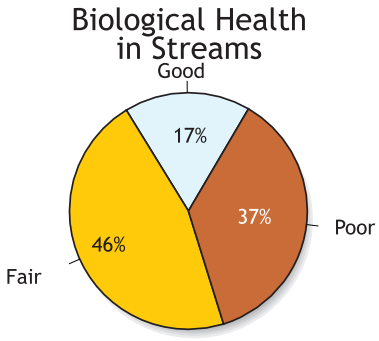
Lakes with invasive, non-native plants discovered in 2000:

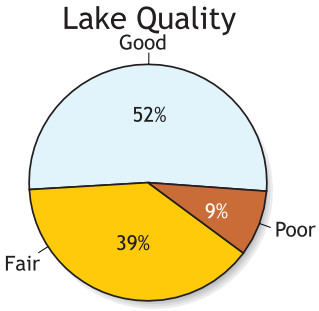
- *Sutherland Lake* (Clallam County) - Eurasian watermilfoil

Puget Lowlands Ecoregion









Water Quality Trends

- Increasing trend for pH and turbidity
- Decreasing trend for temperature, dissolved oxygen, total nitrogen nutrients, and fecal coliform bacteria

Sanitary Conditions in Streams

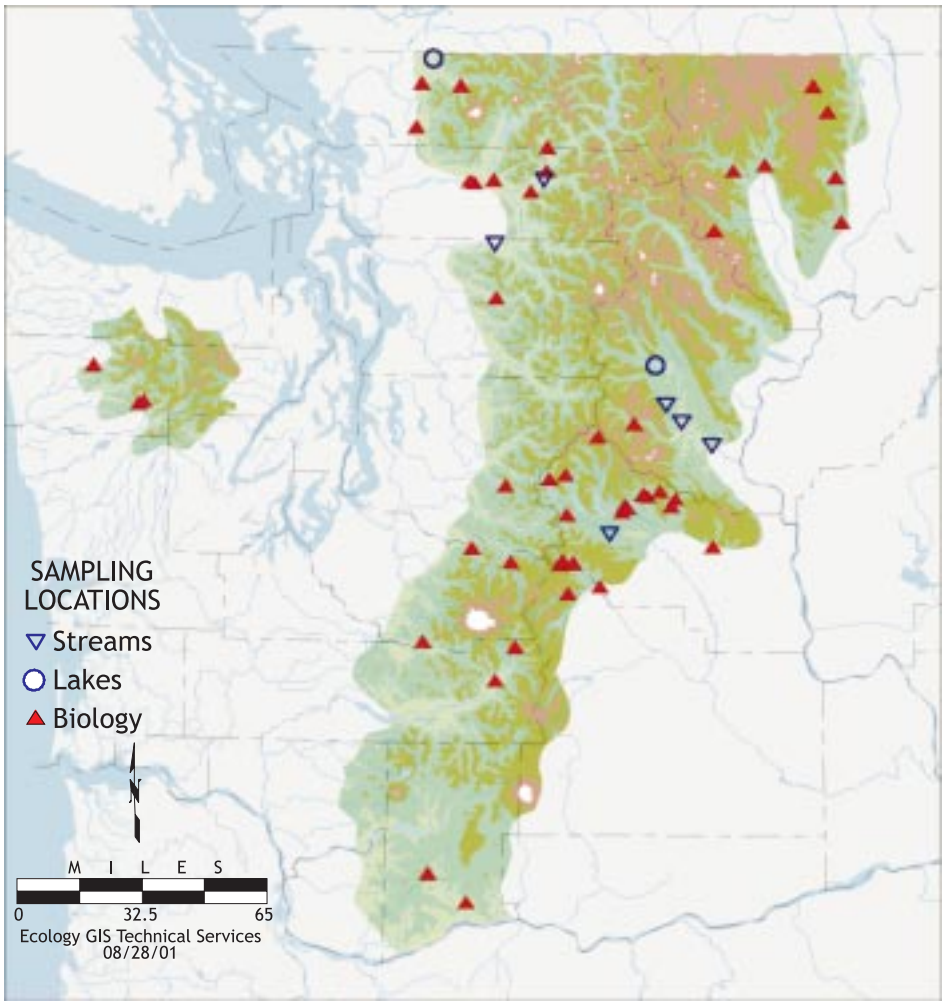
- Nookachamp Creek at the mouth = a 15 percent reduction of fecal coliform bacteria is needed to meet standards for swimming

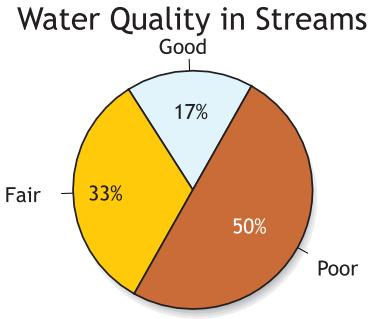
Aquatic Weeds

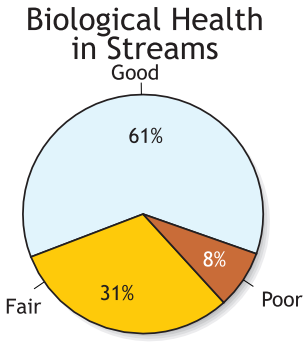
Lakes with invasive, non-native aquatic plants discovered in 2000:

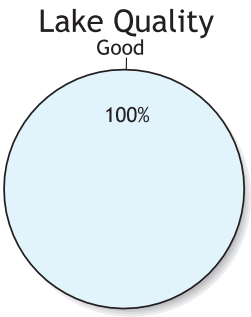
- *Bay Lake* (Pierce County) - Purple loosestrife
- *Lake Kapowsin* (Pierce County) - Narrow-leaved cattail
- *Kress Lake* (Cowlitz County) - Eurasian watermilfoil
- *Leland Lake* (Jefferson County) - Brazilian elodea
- *Limerick Lake* (Mason County) - Brazilian elodea and Big floating bladderwort
- *Lake Tapps* (Pierce County) - Eurasian watermilfoil
- *Heart Lake* (Skagit County) - Eurasian watermilfoil

Cascades Ecoregion









Water Quality Trends

No regional trends were found for streams sampled in the Cascade Ecoregion.

Sanitary Conditions in Streams

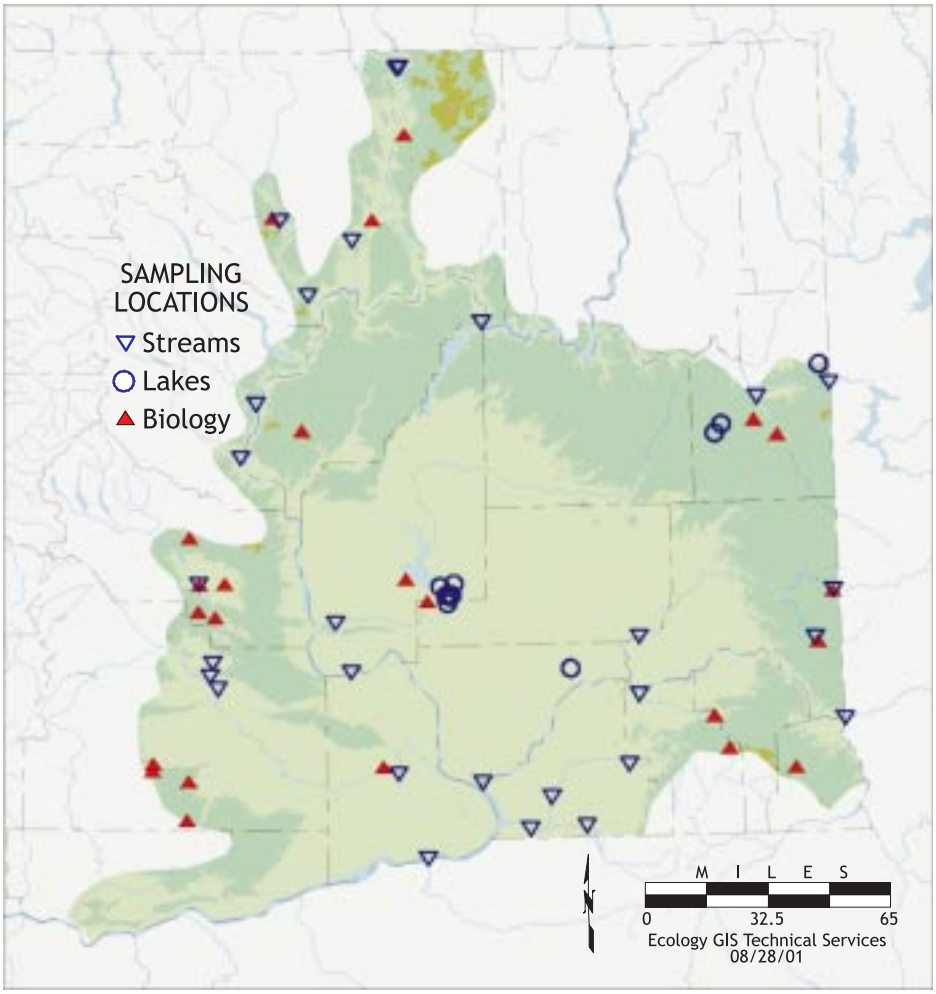
- *Brender Creek* near Cashmere = a 15 percent reduction of fecal coliform bacteria is needed to meet standards
- *Mission Creek* near Cashmere = a 1 percent reduction of fecal coliform bacteria is needed to meet standards

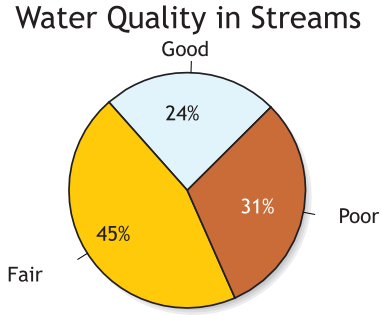
Aquatic Weeds

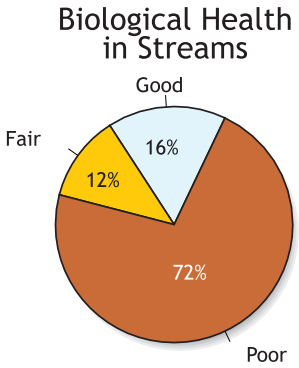
Lakes with invasive, non-native plants discovered in 2000:

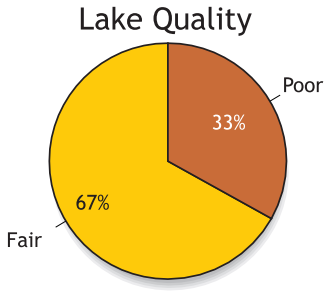
- *Silver Lake* (Whatcom County) - Flowering rush

Columbia Basin Ecoregion









Water Quality Trends

- Increasing trends for total nitrogen nutrients
- Decreasing trends for dissolved oxygen, pH, total phosphorus nutrients, turbidity, and fecal coliform bacteria

Sanitary Conditions in Streams

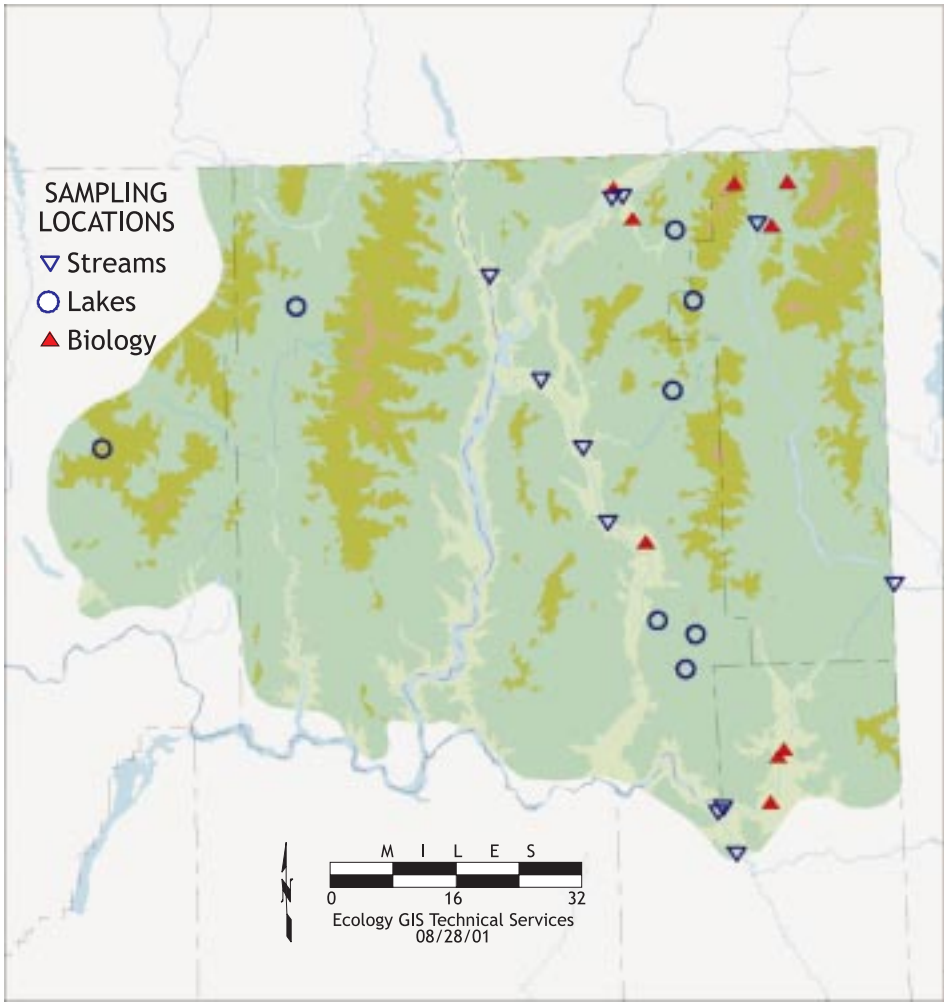
- *Hangman Creek* at the mouth = a 2 percent reduction of fecal coliform bacteria is needed to meet standards for swimming
- *South Fork Palouse River* at Pullman = a 19 percent reduction of fecal coliform bacteria is needed to meet standards for swimming

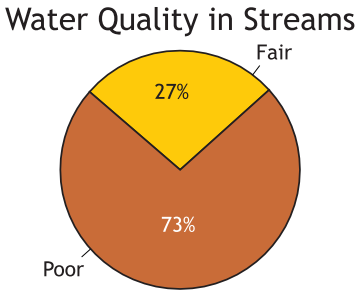
Aquatic Weeds

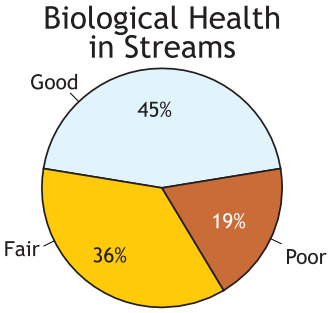
Lakes with invasive, non-native plants discovered in 2000:

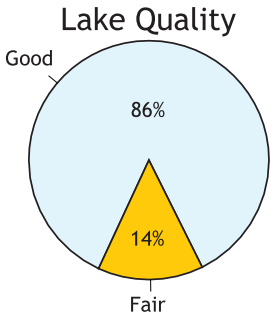
- *Canal Lake* (Grant County) - Purple loosestrife
- *Herman Lake* (Adams County) - Purple loosestrife
- *Liberty Lake* (Spokane County) - Eurasian watermilfoil
- *Windmill Lake* (Grant County) - Purple loosestrife

Northern Rockies Ecoregion









Water Quality Trends

No regional trends were found for streams sampled in the Northern Rockies Ecoregion.

Sanitary Conditions in Streams

Colville River at Blue Creek = a 21 percent reduction of fecal coliform bacteria is needed to meet standards for swimming

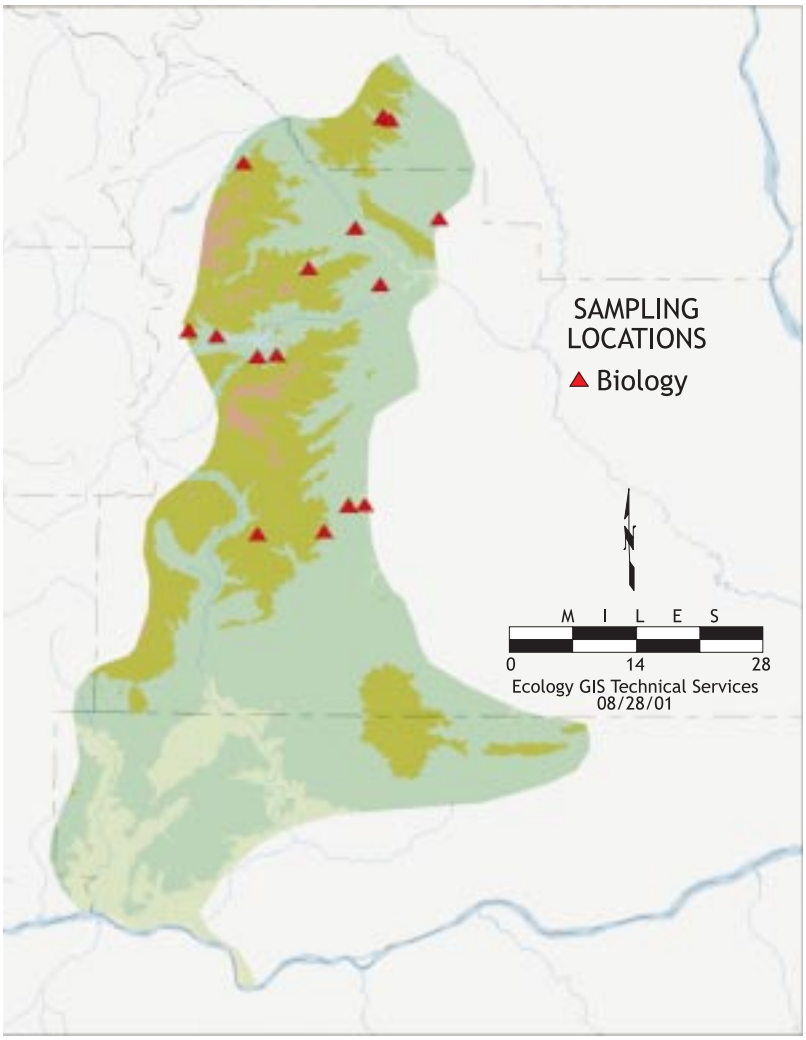
Colville River at Kettle Falls = a 13 percent reduction of fecal coliform bacteria is needed to meet standards for swimming

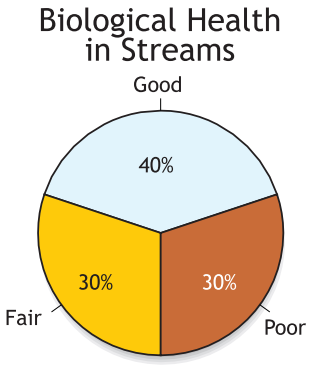
Little Pend Oreille River at Highway 395 = a 6 percent reduction in fecal coliform bacteria is needed to meet standards for swimming

Aquatic Weeds

No lakes with invasive, non-native plants were discovered in 2000.

East Cascades and Foothills Ecoregion





Water Quality Trends

No regional trends were found for streams sampled in the East Cascades and Foothills Ecoregion.

Sanitary Conditions in Streams

All the streams sampled over the last 5 years met standards for swimming.

Aquatic Weeds

No new lakes with invasive, non-native plants were discovered in 2000.

Water Quality

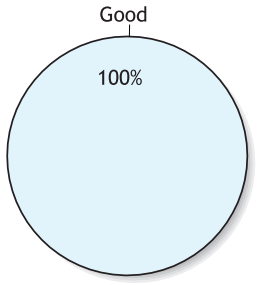
No water quality samples were collected in 2000.

Lake Quality

No lakes were sampled for transparency in 2000.

Willamette Valley Ecoregion

Water Quality in Streams



Water Quality Trends

- Increasing trend for total phosphorus nutrients
- Decreasing trend for dissolved oxygen

Sanitary Conditions in Streams

- All the streams sampled over the last 5 years met standards for swimming

Aquatic Weeds

No lakes with invasive, non-native plants were discovered in 2000.

Water Quality

Only two rivers were sampled in 2000:

- *Washougal River* below Canyon Creek was rated as Good
- *East Fork Lewis River* near Dollar's Corner was rated as Good

Biological Health

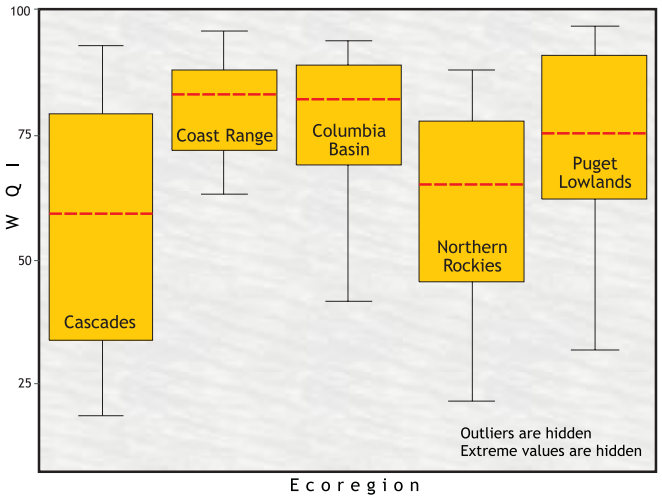
No stations have been sampled for stream insects.

Lake Quality

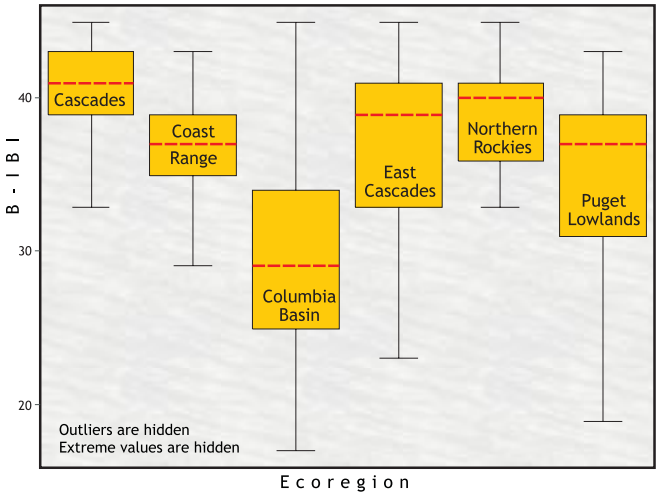
No lakes were sampled for transparency in 2000.

Comparisons Between Ecoregions

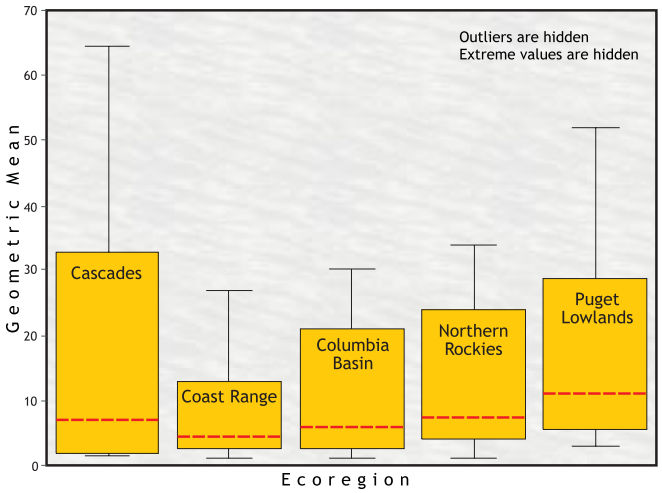
Water Quality Index Scores
(See page 5 - Water Quality Conditions)



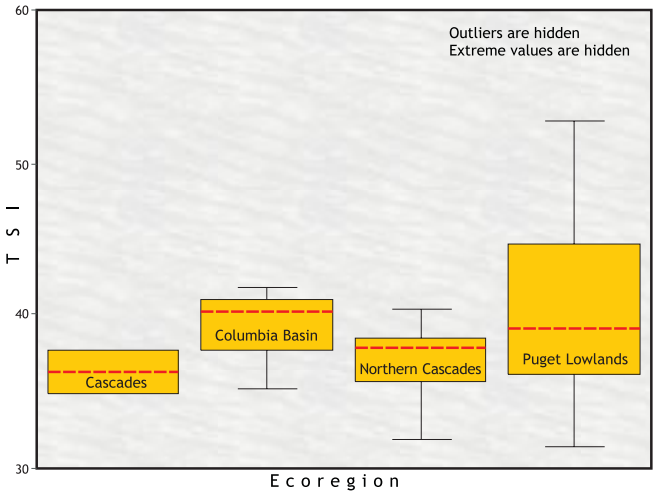
Benthic Index of Biotic Integrity
(See page 6 - Biological Health of Streams)



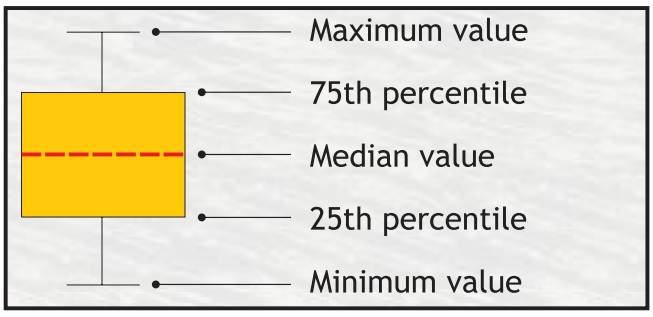
Fecal Coliform Concentrations
(See page 5 - Water Quality Conditions)



Trophic State Index for Lakes
(See page 6 - Lake Quality)



Key



Future Freshwater Monitoring Needs

Ecology is planning to enhance the current monitoring program by adding sites that are selected on a random basis throughout the state. Monitoring water quality from randomized sampling locations will provide a more statistically valid representation of stream conditions over broad areas.

Projecting results from randomly selected sampling sites requires identifying factors influencing water quality. These factors include using different types of stream habitat and watershed landscape features to enable Ecology to extrapolate knowledge of a limited number of waterbodies to a larger scale. The most important factors need to be identified before sampling locations are randomly chosen. Improving monitoring capability to allow assessment of water quality over broader areas is important if Ecology is to be successful in protecting and restoring water resources while operating on a limited budget.

The U. S. Environmental Protection Agency is assisting with this effort to enhance Ecology's monitoring design. Currently, Ecology is reviewing the possible use of ecoregions to extrapolate results from randomly selected sites. EPA is determining if sites within these naturally occurring regions can be aggregated and will generate maps that locate the randomly chosen monitoring sites.

Conconully Lake, Okanogan County

Related Publications

Freshwater Conditions for Washington State - Technical Appendix
Ecology Publication No. 01-03-026

River and Stream Ambient Monitoring Report for Water Year 1999
Ecology Publication No. 01-03-013

Water Quality Assessments of Selected Lakes within Washington State 1999
Ecology Publication No. 01-03-009

Aquatic Plants Technical Assistance Program 1999 Activity Report
Ecology Publication No. 01-03-018

Using Invertebrates to Assess Quality of Washington Streams and to Describe Biological Expectations
Ecology Publication No. 97-332

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