BRITISH COLUMBIA
MINISTRY OF WATER, LAND AND AIR PROTECTION - 2002

Other Health and Environment Indicators

Primary Indicator: ***Mercury concentrations in Bull Trout and Lake Trout in British Columbia water bodies.***

Selection of Indicator: This is a *state* or *condition* indicator; it shows the level of mercury in Bull Trout and Lake Trout found in some of British Columbia's lakes and reservoirs.
Mercury is a naturally occurring element in soil, rock and vegetation. It is released into the environment through natural weathering, erosion, forest fires and other processes. Where soils and vegetation are inundated by water during reservoir creation, bacterial decomposition processes convert inorganic mercury into methyl mercury, resulting in elevated mercury levels in the water. Mercury concentrations in aquatic organisms are highest during the first few years after impoundment and gradually decrease to background levels within 20-30 years.
Mercury is also released into the environment from human activities, such as mining operations, coal-fired power generation, pulp and paper processing and burning of fossil fuels and garbage. Once released into the air, mercury can be transported globally through the atmosphere. Mercury contamination of the global environment is of international concern and many countries, including Canada, have taken stringent measures to regulate and reduce point-source emissions of mercury from industrial processes and manufacturing.

In British Columbia, the most important way methyl mercury is known to enter the food web is through consumption of aquatic organisms from water bodies with elevated mercury levels. Through microbial action, elemental mercury is converted to methyl mercury, which is the most toxic form of mercury. This is increasingly concentrated in the tissues of aquatic organisms as it moves through the food web. Fish at the top of the food web, such as Bull Trout and Lake Trout, tend to accumulate more mercury through bioaccumulation than a species at a lower trophic level, such as Lake Whitefish. Other wildlife that consume fish, such as herons, loons, osprey, mink and otters that eat large amount of fish also accumulate mercury in their tissues. The effect of mercury exposure on wildlife is a concern as it is known that some species are very sensitive to low levels of mercury.

Consumption of fish with elevated levels of mercury is also the main route of exposure for humans. Although exposure to high levels of methyl mercury is known to impair nervous system functioning and cause other health problems, the effects of long term exposure to the lower levels of mercury found in dietary fish are not clearly understood. Health Canada has set a guideline for the maximum average level of mercury allowed in fish for commercial sale at 0.5 part per million (ppm) (size adjusted mean mercury concentration for 550 mm long fish). This does not apply to shark, swordfish or fresh and frozen tuna because consumption rates of these species are considered to be low. Where there is concern that frequent consumption of fish with elevated mercury levels may pose a risk to human health, Health Canada may issue a fish consumption advisory for particular species. Health risks depend on frequency of exposure (how often fish is eaten), rate of exposure (how much fish is eaten), the mercury concentration in the fish and on characteristics of the consumer, such as body weight and sex. Consumption of fish with elevated mercury concentrations is of particular concern for children and for pregnant women because of the potential risk to a developing foetus.

In 2001, three fish consumption advisories because of elevated mercury levels were in effect in British Columbia (Lake Trout in Jack of Clubs Lake and Williston Reservoir; Bull Trout in Pinchi Lake). The high levels of mercury in Jack of Clubs Lake and Pinchi Lake are related to mines that have been closed for several years. The elevated levels in Williston Lake are due to flooding to create a reservoir in 1968; mercury concentrations have nearly returned to presumed pre-flood concentrations.

In British Columbia, the level of methyl mercury in freshwater fish is less of a concern than in eastern Canada or the United States because there are fewer water bodies with elevated mercury levels. For example, in the USA, in 2001 there were 41 mercury advisories in 2,242 lakes, with 13 states issuing state wide bans on the consumption of freshwater fish.

There is no specific program in place for monitoring contaminant levels in the many lakes and streams of British Columbia, therefore, there were insufficient data on fish mercury levels to analyze temporal or spatial trends. These data are not necessarily indicative of mercury levels in other British Columbia lakes and reservoirs.

Data and Sources:

The mean mercury concentrations for Bull Trout in British Columbia's reservoirs are shown in Table 1, below. There were no Bull Trout data available from reference lakes in British Columbia. All of the data presented are mean concentrations for fish of a common size (550 mm) to eliminate the bias associated with differences in fish size (i.e., larger fish have higher mercury concentrations).

Where there are several years of samples from the same reservoir, the data show decreasing mercury levels in fish. For example, mercury concentrations in Bull Trout samples from Arrow Reservoir decreased from 0.41 ppm in 1986 to 0.16 ppm in 1995. These levels are relatively low compared to fish from other reservoirs or lakes. Mercury levels in the most recently created reservoir in British Columbia (Revelstoke Reservoir, impounded in 1984) declined between 1987 (0.75 ppm) and 1995 (0.16 ppm). The average mercury concentration in Bull Trout from the Finlay Reach area of the Williston Reservoir was 0.87 in 1988, but in 2000, it was 0.56 ppm, only slightly above the Health Canada 0.5 ppm guideline.

Table 1. Size adjusted mean mercury concentration for 550 mm Bull Trout in British Columbia reservoirs.

Reservoir	Year	Sample Size	Mercury concentration (ppm wet wt)
Arrow Reservoir	1986	23	0.41
Arrow Reservoir	1987	23	0.28
Arrow Reservoir	1995	16	0.16
Carpenter Reservoir	2000	19	0.54
Kinbasket Reservoir	1995	11	0.34
Revelstoke Reservoir	1987	26	0.75
Revelstoke Reservoir	1995	17	0.16
Whatsan Reservoir	1987	22	0.32
Williston Reservoir – Akie	1980	13	0.85

Reservoir	Year	Sample Size	Mercury concentration (ppm wet wt)
Williston Reservoir – Ingenika	1980	22	0.62
Williston Reservoir - Finlay Reach	1988	42	0.87
Williston Reservoir - Parsnip Reach	1988	21	0.69
Williston Reservoir - Peace Reach	1988	23	0.71
Williston Reservoir - Finlay Reach	2000	46	0.56

Source: Baker (1999).
NOTE: There are no lake data for Bull Trout.

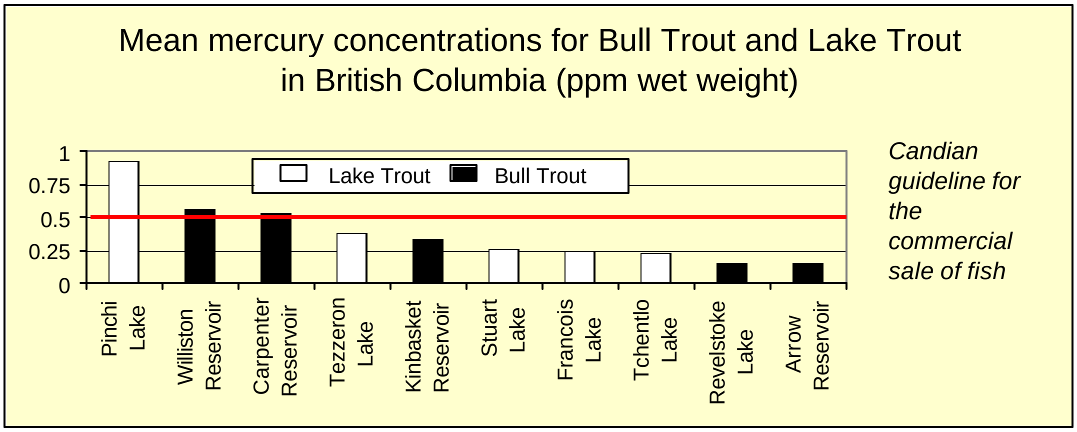
Like Bull Trout, Lake Trout also feed on other fish; they are at the top of the food web and tend to accumulate greater concentrations of mercury than other species. There are no data for mercury levels in Lake Trout from reservoirs, therefore the data below (Table 2.) are from British Columbia lakes only. In 2000, only Lake Trout from Pinchi Lakes exceeded the Health Canada guideline of 0.5 ppm mercury for sale of commercial fish (Figure 1).

Table 2. Size adjusted mean mercury concentration for 550 mm Lake Trout in British Columbia lakes.

Lake	Year	Sample Size	Mercury concentration (ppm wet wt)
Babine Lake	1979	28	0.19
Bear Lake	1979	9	0.31
Francois Lake	2000	8	0.24
Pinchi Lake	1972	5	
Pinchi Lake	1974	11	4.74
Pinchi Lake	1986	15	0.99
Pinchi Lake	2000	31	0.93
Quesnel Lake	1988	19	0.15
Stuart Lake	2000	21	0.26
Tchentlo Lake	2000	32	0.23
Tezzeron Lake	1979	28	0.45
Tezzeron Lake	2000	17	0.39
Trembleur Lake	2000	13	0.20
Tsayata Lake	1979	14	0.38
Whitefish Lake	1980	17	0.19

Source: Baker (1999). Note: There are no reservoir data for Lake Trout.

Figure 1.



Source: Baker (1999). NOTES: Data are the most recent available for the water body. All data are for 2000, except for Kinbasket Reservoir (1995) and Arrow and Revelstoke Reservoirs (1995).

Methodology and Reliability:

These data are from a report on mercury levels of fish species in BC Hydro reservoirs and selected reference lakes (Baker, 1999). The data include Bull Trout, Lake Whitefish, Burbot, Rainbow Trout and Kokanee from 11 reservoirs and 20 natural lakes. Most of the original data were collected by BC Hydro; Health Canada and the British Columbia Ministry of Water, Land and Air Protection were also sources of data.

Size-adjusted mean mercury concentrations were deemed to have a sufficient degree of accuracy if there was an adequate sample size (n>20) and full representation of fish size classes. Data were considered to be of moderate accuracy if only one of these two criteria were met. The data sets with both a high and a moderate degree of accuracy were used for this indicator. Data sets with moderate accuracy should be regarded with caution. There were not enough data available to perform trend analysis, therefore this information serves as an indicator of current status. Statistical analysis comparing size-adjusted mercury data from reservoirs and lakes was performed where enough data were available (see further analysis in Baker, 1999). Analyses were completed using standard analytical and statistical protocols based on comparisons of fish of similar size, so that unbiased comparisons between water bodies and years could be made.

Subsequent to the Baker (1999) report, Baker (2002) issued a more complete database that reports length, weight and mercury concentration data for individual freshwater fish in British Columbia reservoirs and lakes.

Secondary Measure [not included in indicator] ***Mercury Concentrations of Lake Whitefish in British Columbia***

Selection of Indicator: Lake Whitefish are an omnivorous fish, commonly found across Canada. They are a traditional food of the First Nations (although Lake Whitefish are not widely consumed in British Columbia) and therefore a great deal is known about mercury in this species across Canada. Lake Whitefish consume small fish and invertebrates such as worms, snails, bivalves and plankton.

Data and Sources:

In 1998, mercury concentrations in Lake Whitefish in Dinosaur Lake and Peace River (both associated with reservoir development) were 0.09 ppm, which was not significantly different than concentrations found in whitefish from natural lakes. In Finlay Reach of Williston Reservoir, the size-adjusted mean mercury concentration for Lake Whitefish in 2000 was 0.19 ppm, down from 0.30 ppm in1988. These levels are similar to concentrations observed in Manitoba and Quebec reservoirs. Only Pinchi Lake whitefish had elevated levels compared with other British Columbia lakes.

Table 3. Size adjusted mean mercury concentration for 350 mm Lake Whitefish in British Columbia lakes and reservoirs.

Water body	Year	Sample Size	Lake/ Reservoir	Mercury concentration (ppm wet wt)
Bear Lake	1979	12	Lake	0.17
Francois Lake	2000	10	Lake	0.09
Kazchek Lake	1981	17	Lake	0.04
Pinchi Lake	2000	32	Lake	0.26
Stuart Lake	2000	31	Lake	0.10
Tchentlo Lake	2000	25	Lake	0.12
Tezzeron Lake	1979	16	Lake	0.09
Tezzeron Lake	2000	33	Lake	0.09
Trembleur Lake	2000	31	Lake	0.10
Tsayata Lake	1979	74	Lake	0.19
Peace River	1988	20	Reservoir	0.09
Dinosaur Lake	1988	25	Reservoir	0.09
Williston Reservoir - Akie	1980	14	Reservoir	0.11
Williston Reservoir - Finlay Reach	1988	22	Reservoir	0.30
Williston Reservoir - Ingenika	1980	16	Reservoir	0.13
Williston Reservoir - Parsnip Reach	1988	23	Reservoir	0.30
Williston Reservoir - Peace Reach	1988	33	Reservoir	0.18
Williston Reservoir - Finlay Reach	2000	23	Reservoir	0.19*

*300 mm fish.
Source: Baker (1999).

Methodology and Reliability: See primary indicator for methodology and reliability.
The indicator uses Lake Whitefish data because complete, accurate data sets were available for both reservoirs and lakes. Although the majority of Lake Whitefish found in Williston Reservoir are smaller than 350 mm, the 350 mm length was used as the standardized length for consistency with other Canadian studies.

References:

Canadian Council of Ministers for the Environment. 2001. Canadian Environmental Quality Guidelines. Canadian Council of Ministers of the Environment, Winnipeg.

Baker, R.F. 1999. Status of Fish Mercury Concentrations in BC Hydro Reservoirs. Prepared by EVS Environmental Consultants, North Vancouver. Report prepared for BC Hydro, Burnaby, BC.

Baker, R. F. 2002. Fish Mercury Database -- 2001 British Columbia. Aqualibrium Environmental Consulting, Vancouver; Report prepared for BC Hydro, Burnaby, BC.

United States Environmental Protection Agency. 1997. Mercury Study Report to Congress. Volume VI: An Ecological Assessment for Anthropogenic Mercury Emissions in the United States. Office of Air Quality Planning and Standards and Office of Research and Development.

United States Environmental Protection Agency. 2001. Mercury Update—Impact on Fish Advisories. Factsheet EPA 823-F-01-011. 10 pp.

Primary Indicator: ***Landscape pesticide use in the Lower Mainland.***

Selection of Indicator: The quantity of pesticides sold and used in the province is a pressure indicator. It shows the weight of active ingredients in pesticides that were applied to manage pests in landscapes by professional landscape services in the Lower Mainland.
Pesticides are materials or micro-organisms that are used to prevent, destroy, repel or otherwise reduce pest populations. The term 'pesticides' includes insecticides and insect repellents, herbicides, fungicides, rodenticides, wood preservatives and anti-sapstain chemicals, slimicides (biocides used in cooling towers and paper making) and other compounds. Pesticides registered for use in Canada includes a wide variety of active ingredients and modes of action. These range from high toxicity, environmentally persistent compounds to low-toxicity and non-toxic substances. Biological control products containing micro-organisms (microbial products) are also registered as pesticides.

Risks to human health from pesticides may occur for pesticides applicators, farm workers, bystanders, consumers (e.g., of agricultural commodities) and site users (e.g., in lawns and landscapes). Environmental effects include harm to non-target organisms, such as beneficial insects, birds and other wildlife, as well as contamination of air, water or soil.

It is an accepted international goal to reduce risks to human health and the environment from pesticide use (OECD/FAO, 1998), however, there is not complete agreement on the best way to measure such impacts. Measurements that have been employed by researchers include: total weight of active ingredient, total number of applications per area and total area of application. Each type of measurement has disadvantages as indicators of risk to health and the environment. For example, if an applicator switches to using a higher toxicity product, the total weight of active ingredient used could decrease while the environmental impact could increase. Likewise, an increase in active ingredient weight might be desirable if a non-toxic product was used to replaced a more toxic pesticide. Various schemes for classifying pesticides into high, medium and low risk products have been proposed, but in practice it has been difficult to establish criteria that can be used to categorize all pesticides because of the wide differences in substances involved. The approach in BC has been to compile records on each pesticide active ingredient separately. This permits tracking of trends in use of individual active ingredients and provides data that can later be aggregated regardless of how pesticide are grouped into categories.

Methodology and Reliability:

The data for this indicator came from a series of three studies of pesticide sales and use in British Columbia conducted in 1991, 1995 and 1999. The studies were done by the, then, British Columbia Ministry of Environment, Lands and Parks and Environment Canada. The 1999 survey was conducted as part of the Georgia Basin Ecosystem Initiative (GBEI). Under the GBEI, Environment Canada is compiling an inventory of a limited number of priority toxic substances and quantifying their loadings to the environment. The Environment Canada 1998 Nominating List of Toxic Substances in the Lower Fraser/Georgia Basin includes 14 pesticide active ingredients or groups of active ingredients that are reported on in this indicator.

The pesticide use records from Lower Mainland services with licences to sell pesticides or to use pesticides in the landscape category were analyzed for this indicator. This subset of data was chosen because it was the most complete, the accuracy had been evaluated and it was an area of pesticide use of interest to the public. Complete records were available because licensed services must submit an annual summary of pesticide use to the Ministry as a condition of renewing their license to conduct business involving pesticides[1]. In all three pesticide studies, the survey included an evaluation of data quality. Sources of error and irregularities on the summary reports were identified, followed up with the licensees and corrected where possible (for further analyses of sources of error, see original reports). The complete reports, including original data tables for the 1995 and 1999 surveys are available online at: http://wlapwww.gov.bc.ca/epd/epdpa/ipmp/tech_reports.html.

With three years of data, spanning eight years, it was possible to see some general trends in pesticide use patterns, however, there are not enough data to perform statistical analysis. When interpreting pesticide use data, it is important to realize that pesticide use patterns can depend on weather conditions, pest populations, cost and availability of products, changes in registration status and other factors. For example, fungicide use on turf in coastal areas depends on rainfall and humidity patterns which can vary widely from year to year.

[1] The exceptions are those services that do not require a license because they use only pesticides classified as Exempted under the BC Pesticide Control Act Regulation. Exempted pesticide are generally of low-toxicity, such as insect repellents, insecticidal soap, boron compounds and swimming pool chemicals. For all other Non-exempt pesticides, service license holders must keep a daily record of pesticide use.

The following trends were identified from the limited analysis of three years of data from landscape businesses with pesticide service licenses:

- The use of pesticides by landscape services in the Lower Mainland decreased by 37% (5,769 kg) since 1991. Total uses for each year were: 15,468 kg (1991); 14,802 kg (1995) and 9,071 kg (1999).
- Landscape services' use of sodium metaborate tetrahydrate and sodium chlorate, which are formulated together in certain herbicide products, decreased by 96%; glyphosate isopropylamine (also a herbicide) use decreased by more than 1000 kg (45% reduction since 1991). In addition, the use of paraquat (a herbicide) decreased by over 600 kg (decrease of 97% since 1991).
- The use of chlorothalonil (a turf fungicide) increased 1200% from 28.5 kg in 1991 to 371 kg in 1999. The use of quintozene (another turf fungicide) increased by 326 kg (70% increase since 1991).
- The use of insecticidal soap (a least-toxicity pesticide) increased by 717 kg (227%) from 1991.

Table 4. Changes in the Top 20 Active Ingredients Used by Lower Mainland Pest Control Services Licensed in the Landscape Category, 1991-1999*

Active Ingredient	1991 Use (kg)	1995 Use (kg)	1999 Use (kg)	Change from 1991
Mineral Oil (Insecticidal or Adjuvant)	2,443	4,183	1,342	- 1,101x
Soap (Insecticidal)	314	359	1,031	+ 717
Glyphosate, Isopropylamine	2,145	1,068	1,016	- 1,129
2,4-D Amine Salts	921	1,088	863	-58
Quintozene	468	371	794	+326
Diazinon	676	539	639	-37
Mecoprop, Amine Salts	669	903	567	-102
Dichlobenil	394	636	452	+58
Lime Sulphur	328	379	428	+100
Chlorothalonil	28	72	371	+342
Dicamba	140	204	129	+11
Iprodione	50	62	128	+78
Sodium Metaborate Tetrahydrate	2,930	2,385	124	-2,806
Thiram	-	0.1	90	+90
Simazine	41	94	77	35
Copper Oxychloride	132	146	74	-58
Mancozeb	559	157	70	-489
Glyphosate Acid	-	-	68	+68
Fatty Acid	-	38	67	+67
MCPA Amine Salts	65	62	66	+1
Ferrous Sulfate	-	82	65	+65
Benomyl	111	31	59	51
Sodium Chlorate	1,321	1,076	56	-1,265

Active Ingredient	1991 Use (kg)	1995 Use (kg)	1999 Use (kg)	Change from 1991
Amitrole	91	47	44	-47
Thiophanate-Methyl	93	40	30	-63
Methoxychlor	59	67	21	-37
Paraquat	622	29	17	-605
Natural Gum Resins	87	12	8	-79
Bromacil	65	84	3	-62
Total	**15,468**	**14,802**	**9,071**	**-5,769**
Number of Licensed Services	200	235	189	-11

* Values from source table are rounded to nearest whole number. Error in 1999 report on quantity of insecticidal soap in 1991 has been corrected in this table.

Thirteen pesticide active ingredients included in the "1998 Nominating List of Toxic Substances" were sold in the Georgia Basin during 1999. Sales of these products amounted to over 41,000 kg or approximately 8.2% of the pesticides sold in the basin. Two of the nominated toxic substances, atrazine and malathion, were among the top twenty pesticides sold in the Georgia Basin.

Table 5. Pesticide Active Ingredients from the "1998 Nominating List of Toxic Substances" sold in the Georgia Basin in 1999

Active Ingredient	Type of Pesticide	Quantity sold (kg)	Percent of Total Sales
Atrazine	Herbicide	9,002	1.8%
Malathion	Insecticide	5,941	1.2%
Nonylphenoxypolyethoxyethanol	Surfactant	5,670	1.1%
Simazine	Herbicide	5,331	1.1%
Metolachlor	Herbicide	4,669	0.9%
Octylphenoxypolyethoxyethanol	Surfactant	3,950	0.8%
Parathion	Insecticide	3,751	0.7%
Trifluralin	Herbicide	1,572	0.3%
Endosulfan	Insecticide	1,076	0.2%
Lindane (Gamma-BHC)	Insecticide	103	<0.1%
Fenbutatin Oxide	Miticide	62	<0.1%
Dinoseb	Herbicide	48	<0.1%
Methoxychlor	Insecticide	38	<0.1%
Total Nominated Toxic Substances Sold		41,212	8.2%

There was no apparent trend in the overall use of "nominated toxic substances" by landscape services between 1991 and 1999, as the amounts applied in 1995 were considerably higher than the amounts used in the other two years. In 1999, applications of these chemicals totalled 123 kg or 1.4% of the pesticides applied by landscape services. The total use of these chemicals was 16% lower in 1999 than in 1991. Use of malathion, endosulphan, lindane and trifluralin showed a decreasing trend and no use of these four active ingredients was reported in 1999. Altogether, use of these substances forms a small proportion (less than 2%) of the total pesticide use in landscapes.

Table 6. Quantities of Active Ingredients That Are "Nominated Toxic Substances" Used by Landscape Services in the Lower Mainland, 1991 to 1999

Active Ingredient	**1991 Use (kg)**	**1995 Use (kg)**	**1999 Use (kg)**	**Change from 1991 (kg)**
Simazine	41.4	93.6	76.7	+35.3
Nonylphenoxypolyethoxyethanol	0.14	47.6	25.1	+25.0
Methoxychlor	58.6	67.3	21.4	-37.3
Fenbutatin Oxide	0.27	0.45	0.07	-0.20
Malathion	34.0	17.4	0	-34.0
Endosulfan	8.0	3.32	0	-8.0
Octylphenoxypolyethoxyethanol	0	1.25	0	-
Lindane (Gamma-BHC)	0.78	0.38	0	-0.78
Trifluralin	3.52	0.35	0	-3.52
Total Use	147	232	123	-23.5
Percent of Total Landscape Use	1.0%	1.6%	1.4%	0.4%

References:

OECD/FAO. 1998. Report of the OECD/FAO Workshop on Integrated Pest Management and Pesticide Risk Reduction, Neuchatel, Switzerland. 158 pp.

----. 2000. Survey of Pesticide Use in British Columbia: 1999. Environment Canada and B.C. Ministry of Environment, Lands and Parks. 110 pp.
http://wlapwww.gov.bc.ca/epd/epdpa/ipmp/technical_reports/pesticide_survey99/index.htm

Primary Indicator: *Ultraviolet (UV) exposure of British Columbians*

Selection of the Indicator: A major concern with respect to stratospheric ozone depletion is the human health impacts. The ozone layer filters out most of the sun's harmful radiation, specifically UV-B radiation. Excessive exposure to UV-B radiation is known to cause skin cancer, eye disease, and weakening of the human immune system.

This indicator represents the intensity of the UV radiation that causes sunburning (erythema) in humans, as measured by the UV Index. This index measures the intensity of radiation in relation to the amount of time required for a sunburn to develop.

Data and Sources:

Data were collected at the Saturna Island monitoring station using a Brewer Spectrophotometer. This device measures the intensity of incident solar flux on a horizontal Teflon diffuser located under a quartz dome. The instruments measure total ozone and spectral UV irradiation (290-325 nm) every 10-20 minutes. The data are collected, processed daily and entered in the World Ozone and Ultraviolet Radiation Data Centre (WOUDC) (Environment Canada 2002b; J. Kerr, pers. comm.).

Table 7. UV-Index Values at Saturna Island

Year	Number of Days of each UV index Reading				
	Missing	Low	Moderate	High	Extreme
1991	27	220	105	13	0
1992	29	202	90	45	0
1993	42	182	103	38	0
1994	42	173	113	37	0
1995	53	149	116	46	1
1996	118	119	77	51	1
1997	15	210	97	43	0
1998	6	220	101	38	0
1999	22	205	101	37	0
2000	9	212	95	48	2
2001*	8	217	117	23	0

UV Index™ Legend	
low 0-3.9	more than 1 hr to burn
moderate 4-6.9	about 30 minutes to burn
high 7-8.9	about 20 minutes to burn
extreme 9+	15 minutes or less to burn

Source: Environment Canada. World Ozone and Ultraviolet Radiation Data Centre. 2002.
Note: The UV Index is a registered trademark of Environment Canada.
*Data for 2001 are preliminary. Missing days were due to mechanical failure or extremely rainy or overcast weather.

Methodology and Reliability:

Most international organizations have adopted the CIE (Commission Internationale de l'Éclairage) standardized "action spectrum" for UV-induced erythema (sunburn in humans). The ultraviolet spectrum is weighted according to the erythemal action spectrum to take into account the fact that radiation at some wavelengths (typically shorter) in the ultraviolet are more efficient at sunburning than others.

The UV Index scale measures the intensity of the erythermally active radiation reaching the earth. The index is a dimensionless value, directly proportional to the erythemal energy. It is divided by 25 mWatts/m^2 to put it on a convenient scale from 0 (no exposure) to 10 (extreme exposure) in the summer in Canada. Values may exceed 10 in the early afternoon of summer days in the southern United States. In other parts of the world, where the sun is higher and there is less ozone (tropical regions), the index can reach 15. The scale has been divided into four groupings: low, moderate, high, and extreme risk.

For the purposes of this indicator, the daily summary data for Saturna Island (Station 290) for each month of each year was copied from the WOUDC ftp database (see: http://www.msc-smc.ec.gc.ca/woudc/) to an Excel format. The value of the daily UV Index was calculated by dividing each maximum CIE weighted ultraviolet irradiance value measured on a particular day (reported in mWatts/m^2) by 25. The UV Index value was then assigned to the corresponding category (low, moderate, high and extreme).

References:

Environment Canada. 2002a. Experimental Studies Division of the Meteorological Services of Canada. Information. http://exp-studies.tor.ec.gc.ca/e/index.htm

Environment Canada 2002b. World Ozone and Ultraviolet Radiation Data Centre (WOUDC). Experimental Studies Division, Meteorological Services of Canada (MSC). Database can be accessed at: http://www.msc-smc.ec.gc.ca/woudc/