

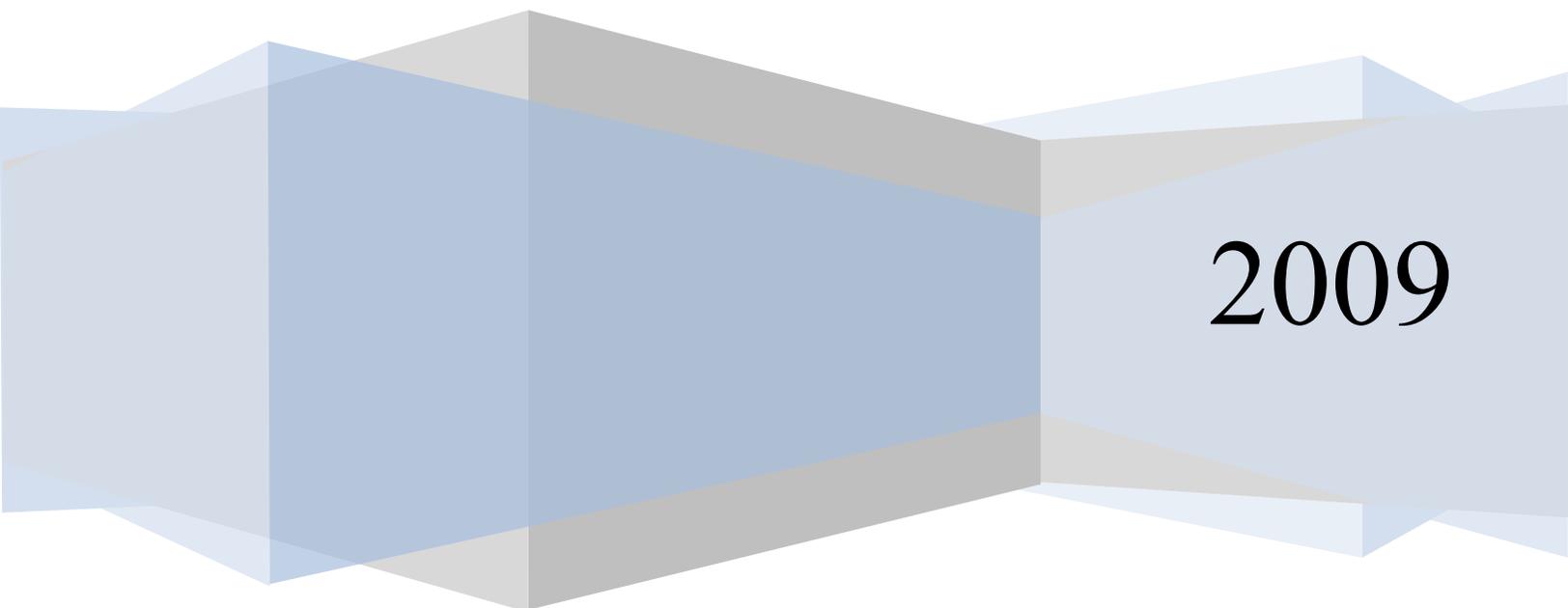
WATER FOR LIFE ON SALT SPRING ISLAND

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(HEHCI)**

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Introduction

Professor Emeritus James R. Karr notes “No water, no life; altered water, altered life” (1999). An assessment of the big picture of freshwater on Salt Spring Island (SSI) reveals that there are altered waters, but the SSI community does not wish to have an “altered” life – at least not one that requires drinking bottled water, forces beach closures and brings on water-related illnesses.

As a summer intern working for the **Healthy Ecosystems, Healthy Community Initiative (HEHCI)**¹ on Salt Spring Island, under the supervision of Dr. David Rapport, I set out to document the attitudes and beliefs of islanders about their water, and seek answers to some of their concerns from published studies and from people on the island who had expertise pertaining to these issues. The overall objective of the HEHCI is to provide a science-based integrative and ongoing assessment of the health of Salt Spring Island – taking into account the ecological, cultural, socio-economic and human health aspects.

Phase 1 of the HEHCI had already identified some of the main issues concerning three of SSI’s major watersheds (Cusheon, Maxwell and St. Mary). The Phase 1 report is available on the HEHCI website (www.hehci.com). Phase 2 of the HEHCI broadens the inquiry to address, from an island-wide perspective, the issues not only of freshwater, but also issues such as forest cover changes, agriculture, livelihoods and public health. My specific assignment focused on the island-wide water assessment aspect of Phase 2. This involved developing and carrying out a survey of attitudes of SS islanders and their needs for additional information concerning the pressures on water and the consequences of human activities on the island for the health of its lakes and streams, as well as examining the scientific literature and speaking with people knowledgeable about water to find out what is known. My goal was to bridge the gap between what was known scientifically about water on the island and what the community understood. I also sought to outline, with community input, a compelling vision for the health of Salt Spring Island’s aquatic ecosystems, and to make suggestions for implementing this vision².

In order to carry out this assignment, I utilized the framework of “**The Natural Step**”: a comprehensive, science-based approach that was constructed to help communities and businesses better understand and strive towards sustainability through integrating environmental, social and economic considerations (The Natural Step Canada, 2009). This approach is sometimes referred to as the “**A, B, C, D**” sustainability approach. “**A**” refers to *Awareness* – in this case islanders’ perceptions and concerns about freshwater issues; “**B**” refers to *Baseline*

¹ My co-op assignment was sponsored by the University of Western Ontario, where I have just completed my Master’s degree in the program on Environment and Sustainability.

² In the course of this assignment I greatly benefited not only from the existing, very well-crafted, technical reports on water, particularly those relating to Cusheon and St. Mary Lake, but also from the opportunity to meet personally with a number of members of the community who gave me the value of their knowledge about water conditions on the island. These included: Michael Ableman, Ron Bain, Charlie Eagle, Jean Gelwicks, Tangachee Goebel, Tom Gossett, Hugh Greenwood, Peter Lamb, Mike Larmour, Maureen Moore, Murray Reiss, and John Wilcox. I am very grateful to all of them for offering their very valuable time in support of my work. As well, I very much appreciated the generosity of the 100 community members who gave of their time to complete my water awareness survey. Last but not least, sincere thanks are due to Hugh Greenwood and Greg Spendjian for kindly reviewing and providing thoughtful comments on a draft of this report.

conditions, that is, what is known about freshwater from technical reports and from knowledgeable community members; “C” refers to the development of a *Compelling vision* for the health of SSI freshwater ecosystems as determined by the community. The gap between “A” (what islanders know), “B” (the baseline, or current situation) and “C” (the compelling vision) can be bridged with “D” –*Down-to-action items*: actions that islanders and local governance might undertake (or may already have initiated) in order to achieve the overall vision of an island that is a model of eco-cultural health.

“A” – Awareness

What do islanders know about freshwater on SSI? This was assessed with a comprehensive Water Awareness Survey designed to gauge Salt Spring Islanders’ awareness of critical issues related to their freshwater and activities in the watersheds that impact upon its quality and quantity [see **Appendix A**]. The survey reflects the views of some 100 islanders, who collectively donated over 100 hours to provide their views on water issues on the island [see **Appendix B**].

In the survey, I listed 14 factors that may contribute to water quality and quantity issues on SSI. These include: high bacterial counts, minerals containing arsenic or other potentially toxic substances, contamination with fertilizers and pesticides, disturbance from land development, loss of forest cover, other soil disturbances, algal blooms, changing demographics, climate change, influence of natural geology, loss of biodiversity, contamination with pharmaceuticals, and impacts of tourism.

Survey participants were asked whether or not they thought each of the 14 factors affected freshwater quality/quantity. The overwhelming response was that participants were unsure of their role in influencing water quality and quantity. However, participants did cite septic systems (74%), land clearing (60%) and development (72%) as the most likely sources of anthropogenic stress on SSI aquatic ecosystems.

Overall, by far the majority of those filling in the survey stated that the availability of potable water as well as the condition of SSI lakes and streams are of considerable concern, and that they are eager to learn more. They ranked clean drinking water (86%), healthy groundwater (78%), healthy lakes (79%), and the protection of aquatic organisms (69%) as the most important water quantity/quality issues. As well, the community would like to know more about the relationship between drinking water and health (74%), means of water conservation (53%), what actions they can take to improve the health of aquatic ecosystems (55%), and what constitutes environmentally friendly development practices (49%).

Are local governance bodies doing enough with regards to freshwater issues? Not according to 76% of participants, who believe that local governance does not put enough emphasis on water issues, while 8% think it is just right and 16% are not sure or have no opinion.

The results from the survey suggest a caring community that wants to learn more, and would like to become better informed. The following section, which draws upon existing technical reports and information from knowledgeable community members, attempts to bridge this gap.

“B” – Baseline Data

What is known about water on SSI? The following sections provide a summary of what is known about the condition of freshwater on the island. It reviews information about water quantity and the state of groundwater and surface water quality, as well as identifies data gaps.

Water water everywhere but not a drop to drink

The freshwater supply on Salt Spring Island comes from approximately 180 million cubic meters of precipitation each year, the equivalent of the volume that would be held by 11 lakes the size of St. Mary. However, 10 out of the 11 hypothetical lakes are lost in runoff to the sea or evaporation. The remaining volume of precipitation (equivalent to the volume of one St. Mary Lake) goes to replenish all of SSI surface water (lakes, streams, creeks) and to recharge groundwater (Wright, 1994).

Or, at least, this is how it has been historically. However, in recent times, with extreme precipitation and drought events becoming perhaps twice as frequent as was previously the case (Islands Trust Council, 2007), there is less certainty that precipitation will fully cover the replenishment and recharge requirements and maintain the health of our aquatic ecosystems. For example, the extremely low rainfall that SSI experienced this past summer (2009) may become more the norm than the exception. Further, such seasonal drought events coincide with significant increases in temporary residents, owing to the influx of both tourists and those who have summer homes on the island. As a consequence, water use on the island nearly doubles during the months of July and August (O₂ Environmental, 2006). Increasing frequency of summer drought, combined with the seasonal population growth, is bound to place further stress on SSI's already taxed water resources.

Another factor that may place increasing demand on water supply is the changing demographics of the island. Two major demographic trends are noticeable: the island is attracting more new residents that come from urban backgrounds and more people from an older age group. Both of these demographic sectors may be more accustomed to expecting an abundant and readily available water supply, and potentially less accustomed to a situation in which water is in limited supply and in which reducing use and conserving water is a fundamental necessity.

Approximately half of SSI residents and visitors get their water supply from groundwater (e.g., wells), and half from surface water, each of which will be further discussed below.

Groundwater

The quality and quantity of groundwater are influenced by the natural geology of the surrounding area. Groundwater on SSI is contained mainly in small fractures in sedimentary rock, not in larger aquifers as is commonly believed (Greenwood & Gilleland, 2007). The southern part of the island contains older, igneous rock where there is more significant fracturing creating greater groundwater renewal, and thus higher-quality water (Ministry of Environment, 1993). The north end contains younger rock with smaller, disconnected fractures, resulting in poor groundwater discharge and diminished quality (Ministry of Environment, 1993; Greenwood, 2009, personal communication). Due to its nature, the groundwater on SSI is more susceptible to contaminants infiltrating the water through the fractures.

The composition of groundwater reflects the bedrock that water comes into contact with. Heavy metals such as arsenic, iron, and manganese, as well as minerals such as fluoride, are known to be present in some areas of SSI in concentrations that are higher for one or more of these substances than what are considered to be safe levels. Thus these substances, which are found naturally in some of the rock beds, contribute to water being unsafe for drinking (Lapcevic, 2008). In addition, as concluded in a study about SSI groundwater conditions, the quality of groundwater that supplies households is also impacted by well siting, construction practices, and proximity to potential contamination sources, such as agricultural and industrial runoff (Lapcevic, 2008). Pesticides, fertilizers, and other chemical contaminants may seep into the groundwater storage from various activities on the island that either directly release these substances or interfere with the natural purifying capacities of ecosystems to sequester such contaminants.

As mentioned above, groundwater is the source of potable water for at least half of SSI's residents (the 1719 wells reported are likely an underestimate). Current and future development pressures, as well as an increase in tourism, coupled with concerns about lake quality issues, suggest that groundwater will be increasingly relied upon to meet new needs. Thus one can anticipate increased demands on this resource (Lapcevic, 2008). Mike Larmour, former manager of North Salt Spring Water Works and former local Islands Trust trustee, cites groundwater as one of the most contentious issues to be played out in the future of Salt Spring Island's freshwater (personal communication, 2009). However, there is already an indication of stress on groundwater supply, with some areas already strained beyond their capability to supply current demands (Greenwood & Gilleland, 2007). Further, in some areas the draw-down of groundwater has contributed to saltwater intrusion, an increasing number of abandoned wells, and general declines in water quality, particularly over the summer months (Greenwood & Gilleland, 2007).

It is particularly evident, in the context of Salt Spring Island, that groundwater is a limited and precious community resource that must be properly shared and conserved.

While property owners have the right to draw upon groundwater on their property, they should not have the right to abuse or exploit it at the expense of their neighbours. The Islands Trust Official Community Plan Focus Group on potable water recommended that a minimum lot size be established, that the area from which each well draws be large enough to capture the required amount of water, and that detailed and thoughtful planning with solid roots in hydrology be used

when creating access to groundwater for new or renovated construction (Islands Trust Council, 2007).

Surface Water

The other half of the potable water supply comes from surface water: from St. Mary Lake, Cusheon Lake, Maxwell Lake and Weston Lake. The lakes are of an unusual nature, with atypical and seasonal changes in water flow and varying sizes of drainage basins. There is rapid exchange of water during the winter and spring seasons and little exchange during the summer. The large surface areas of Weston, St. Mary and Maxwell lakes are deceptive due to their small basins and modest flows of water and recharge, thus creating an increased risk and magnification of contamination (CWMPSC, 2007).

St. Mary Lake and Cusheon Lake are showing signs of distress from non-point sources of contamination, including land clearing, road building, and septic field effluents (Ministry of Environment, 2000). St. Mary, Cusheon and Weston lakes, which together provide water for over 4,000 people (Salt Spring Conservancy, n.d.), have high levels of phosphorus, exceeding guidelines for drinking water, recreation and aquatic life, and causing outbreaks of blue-green algal blooms, a human health threat (Ministry of Environment, 2000; Capital Regional District Environmental Services, 2006; Capital Regional District, 2006). There is a high level of internal phosphorus loading from lake sediments as well as from anthropogenic sources, including residential and resort development activities (road building, septic tanks) and from forestry (land clearing) (Ministry of Environment, Lands and Parks, 1996). Loss of forest cover causes soil disturbances and increases in the runoff of pesticides, fertilizers and other chemical contaminants into bodies of water, which are normally lessened by the presence of trees.

Both St. Mary Lake and Weston Lake have had influent flows with fecal coliform counts above the Guidelines for Canadian Drinking Water (Capital Regional District Environmental Services, 2006), and the smaller Stowel Lake has elevated coliform levels at its beach. These are likely due to human or domestic animal sources or sewer discharge problems (Capital Regional District, 2006).

Where sewage treatment options exist, microbial contamination can be eliminated. However, while sewage treatment thus renders water potable, it does nothing to reduce deterioration in the aquatic ecosystem itself. In other words, it does not eliminate the excess nutrients that provide favourable conditions for pathogens that affect humans and other organisms. Further, the deterioration in biodiversity, fish and wildlife habitat and other manifestations of heavily nitrified waters, which harbour increased microbial loads, also remains. And, of course, treatment of water delivered from polluted lakes to households does not reduce risks to human health from direct contact with lake water. Several people who filled out the survey mentioned they got rashes after swimming in St. Mary Lake.

Data Gaps

There are significant data gaps both in the type and quantity of information on the current state of health of freshwater on SSI. Some of the essential indicators such as pharmaceuticals and pesticides are not being measured at all, and much of the relevant historical data on water quality and quantity is difficult to obtain. This paucity of information is a major deterrent in assessing and striving for the improvement of the health of SSI aquatic ecosystems and for safeguarding public health.

The information on SSI freshwater that is available is scattered, incomplete and difficult to obtain. The CRD even concluded in its 2006 State of the Environment Indicators Report that ‘the not-so-good news’ concerning water quality is that there is little or no current information on the quality of water in the region’s lakes and rivers (Capital Regional District, 2006). To this, one might add that there has not been an ecosystem-based health assessment of the lakes and watercourses of the island – a critical need not only in terms of public health, but as well in terms of maintaining the vitality of the natural environment, upon which public health depends.

Another significant difficulty is that the monitoring of factors affecting water quality/quantity is regulated by a multiplicity of agencies, including the Capital Regional District (stormwater discharge), the Islands Trust (land use), the Ministry of Transportation (roadways), the Vancouver Island Health Authority (drinking water), and the Provincial Ministry of the Environment (ground water). All of these agencies have varying and independent sets of water quality/quantity indicators; however there is no comprehensive body monitoring their significant relationships and interconnectedness.

As suggested above, a significant emerging water quality issue is the presence of pharmaceuticals in bodies of water. Ultimately, all the chemicals we, our pets, and farm animals ingest enter the water system, either through natural processes (urination and defecation) or disposal (flushed unused pills) (Naish, 2009). These include hormones, antibiotics, and so forth. Yet the vast majority of communities, including SSI, lack a monitoring that would detect the presence of pharmaceuticals in surface and groundwater.

Although the CRD has implemented a campaign to discourage the use of pesticides for non-essential or cosmetic reasons (Gulf Islands Driftwood, 2008), from a review of the central water monitoring documents it appears that SSI lacks systematic and comprehensive monitoring for the trends in levels of pesticides in our aquatic ecosystems and in our drinking water supplies.

A decrease in biodiversity as well as transformation of biotic communities to favour an increase in invasive species is a reflection of a decline in the health of our aquatic ecosystems. This tendency is widespread throughout Canada, and there is certainly evidence of this in the transformation of biota in SSI’s freshwater lakes and streams. Today, both St. Mary Lake and Cusheon Lake are being stocked with Cutthroat Trout, a native species in western Canada. The need for restocking of native species is an indicator that the system no longer supports key elements of its natural biodiversity (Gulf Islands Driftwood, 2009). While restocking is beneficial for sports fishing, the need to stock the lakes indicates the ecological requirements (habitat, water quality) for native fish have declined.

While substantial progress has been made in developing management plans for both St. Mary Lake and Cusheon Lake, particularly with respect to phosphorus loading, the many other stresses on these water bodies have not yet been fully addressed (e.g., factors contributing to declining biodiversity, habitat loss, inputs of pharmaceuticals etc.). Further comprehensive assessments are needed for the other lakes providing potable water, such as Maxwell and Weston, as well as for the groundwater resources of the island. In short, what is lacking is a comprehensive assessment of the multiple interconnected stresses on the quantity and quality of SSI water supply, from the standpoint of both ecosystem health and public health. One major goal of the HEHCI is to fill this gap by developing a comprehensive framework for monitoring anthropogenic stress on our freshwater aquatic ecosystems and to identify critical indicators of trends and conditions that will enable our community to put together the “big picture”.

“C” – Compelling Vision

A comprehensive island-wide vision, framework and monitoring scheme is critical in order to assess progress in maintaining and enhancing the health of Salt Spring Island’s ecosystems and community. This is no simple task, but is approachable. The vision must be one of integration and assessment of the health of our ecosystems, our community, and our rural culture.

A Challenge

The focus of this report is on freshwater on SSI; however, the scope of the HEHCI will extend to all aspects of SSI’s social and ecological systems. The HEHCI takes a holistic, integrative approach to understanding ecological and social change on SSI, taking into account the natural environment, livelihoods, rural culture, socio-economic issues, and public health. It addresses the clear need for a collective, comprehensive approach to assess the sum total of human activities that affect the health of the island’s ecosystems and community, and bring the findings of such an assessment to bear on policy and action.

There is a remarkable pool of human resources on SSI, comprising individuals with a great in-depth knowledge of various aspects that relate to assessing the health of the island’s ecosystems and community. There are progressive leaders on the island willing to incorporate an ecosystem health perspective within their respective domains, whether it is tourism, education or ecologically sustainable development. There is a local governance structure that has the mandate and the potential to provide leadership and take a stronger stance in preserving and protecting the health of the island’s ecosystems and its community. There is also a caring community that is eager to learn and very much in favour of improving the health of the island’s ecosystems and recognize that ecosystem health is vital to public health and to the economic and social well-being of islanders.

It is a community, however, that at present lacks sufficient guidelines to take positive actions, in the absence of science-based indicators of conditions and trends and clear interpretations of what this means for everyday living on the island. As a whole, the SSI community opposes changes that they believe are not in keeping with sustaining the health and vitality of the island

ecosystems. However, the need is apparent for stronger guidelines as to specific actions that are required to restore health to the island's ecosystems, and for better information as to the consequences of inaction.

SSI is already showing clear signs that its aquatic ecosystems are in distress. Indeed, the island as a whole, considering the tendency towards deterioration of its natural and cultural legacy, is on the cusp of being ranked "a mixed bag of successes and worries, with the future at risk", according to a National Geographic survey of well-known, global destination islands (Tourtellot, 2007). Without a wide-ranging and community driven plan for improving the health of SSI's ecosystems and restoring its socio-economic vitality and cultural integrity, SSI is likely to undergo further deleterious transformations. A challenge is presented to the community of SSI to take ownership of the issues and turn this diagnosis around before "paradise" is truly lost. What is needed is a compelling vision, one of an eco-culturally healthy SSI.

"D" – Down-to-Action

There are many actions that islanders and local governance are currently implementing, and there are many that can begin to be executed to move towards such a vision. Current initiatives such as the successful Public Transit line, the work of I-SEA (Institute for Sustainability Education and Action), and a number of new and retrofit "eco-homes", all are striving towards improving ecosystem health.

There are also many plans in progress to preserve and protect SSI, including a tourism management plan, a total water system, and a green accommodation initiative. All are laudable and have the potential to make an impact economically, socially and environmentally for the island. However, they are separate initiatives whose effectiveness would be greatly increased if they were linked together within an overarching framework of eco-cultural health.

With the present focus of the HEHCI on water, the survey from section "A" – Awareness asked what action individuals could undertake to improve water quantity and quality. The community came up with some thoughtful and truly Salt Spring-esque solutions including:

- Install rain collection systems for garden
- Return all outdated prescriptions to the pharmacy
- Replace toilet and appliances with low flow/energy star versions
- Let your car get dirty this summer
- Avoid the use of pesticides and herbicides
- Become better informed of water issues and pass the word
- Shower with a friend

As well, our community would like to see:

- Better public awareness and education
- Greater monitoring of septic systems

- Limiting development and sizes of houses
- Standing firm against the encroachment of commercial and industrial land uses
- Establishing an upper limit to the number of people allowed to live on the island
- Ending all chemical pesticide and fertilizer use
- Thoughtful and responsible development that does not compromise the quality and quantity of island water

As a result of the Water Awareness Survey, there also is a program, now underway in Salt Spring Elementary School, to incorporate part of the framework developed in this project, and adapt it so that 4th and 5th graders can undertake their own quantitative and qualitative assessment of their water needs and supplies. The “A” – Awareness survey from, above, was simplified and supplemented with a personal water audit to allow for the students to discover where their water was coming from, how and how much they are using and to brainstorm where to make positive lifestyle changes in order to preserve and protect the valuable resource. From here, the students will be exploring a growing picture of water, from their personal use, to their local watershed through scientific monitoring, to island wide water and lastly, the global picture of water and the current water crisis.

With respect to water, the Healthy Ecosystems, Healthy Community Initiative will provide a scientific basis for understanding the challenges of maintaining water quality and quantity, by elucidating how human activities can influence both positively and negatively the health of SSI’s aquatic ecosystems. Salt Spring has the potential for turning around its increasingly critical water situation. To accomplish that requires a science-based framework for understanding the pressures that have led to and continue to promote the current situation. Actions based on this understanding should not only be directed toward alleviating symptoms in our surface water - lakes and streams - (and also in ground water) such as high levels of phosphorus, heavy metal or microbial contamination, but as well toward reducing the pressures that have led to these undesirable conditions. This will involve setting guidelines that limit human activities within watersheds such that the aggregate stress from these activities does not compromise the health of the watershed. With respect to groundwater, it will be necessary to ensure that the density of wells and their intensity of use are in balance with the capacity of various regions to recharge ground water and avoid saltwater intrusion. While the health of SSI’s aquatic ecosystems has not yet deteriorated beyond the tipping point, a wide range of coordinated actions is essential to prevent the present situation from spiralling out of control.

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Appendix A

Water Issues Awareness Survey

This survey is designed to assess Salt Spring Islanders' awareness of issues related to its freshwater. From these results, a baseline analysis of what the community knows, as well as a compelling vision of where the community would like to be can be brought to light & subsequent down-to-action items can be created. This is part of Phase 2 of the Healthy Ecosystems Healthy Community Initiative (HEHCI) co-ordinated by Salt Spring scientists, Drs. David Rapport and Luisa Maffi. (www.hehci.com).

Your participation is sincerely appreciated.
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(A) Your Background

Sex: Female Male

Age: < 18 18-25 26-35 36-45
 46-55 56-65 66-75 75+

Occupation: _____

Years on SSI: Visitor < 1 2-5 5-10
 11-20 21-30 31-40 41+

Area of SSI: North End South End Ganges Area
 Maracaibo Long Harbour Visitor

What watershed are you in? St. Mary Okana Creek
 Sharpe Creek Maxwell Lake
 Cusheon Lake Lake Stowell
 Ford Lake Lake Weston
 Not sure Other (*please specify*): _____

Where do you get your tap water? Individual well Community well Bottles
 Water District Not sure Other



If Water District, which one? North Salt Spring Maracaibo
 Scott Point Fernwood
 Cedars of Tuam

Cedar Lane

Fulford Harbour Beddis
 Harbour View Highland
 Mount Belcher Not sure

Do you drink the water from your tap? Yes No



**If not, why not?
all that apply)**

- Bad Taste Contaminants Safety
 Poor odour Off colour Other

(Select

Have there been any changes to the *quantity* of your personal freshwater supply in the past 1-5 years?

- Less More
 No change Inconsistent

Have there been any changes to the *quality* of your personal freshwater supply in the past 1-5 years?

- Worse Better
 No change Inconsistent

Do any of the following conditions affect your personal freshwater supply quality/quantity? (Select all that apply).

- Arsenic Saltwater intrusion
 High bacterial counts Droughts
 Lead Excessive nutrients (algal blooms)
 None Not sure

Do any of the above conditions (arsenic etc.) affecting your personal freshwater supply affect your personal health? (Select all that apply).

- Arsenic Saltwater intrusion
 High bacterial counts Droughts
 Lead Excessive nutrients (algal blooms)
 None Not sure

(B) Your Environment

Which of the following conditions do you believe to affect freshwater quality/quantity on Salt Spring Island?

- | | | | |
|------------------------------------|------------------------------|-----------------------------|-----------------------------------|
| i. <i>High bacteria counts</i> | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Not sure |
| ii. <i>Minerals [i.e. calcium]</i> | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Not sure |
| iii. <i>Fertilizers/nutrients</i> | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Not sure |
| iv. <i>Pesticides</i> | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Not sure |
| v. <i>Development</i> | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Not sure |
| vi. <i>Loss of forest cover</i> | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Not sure |
| vii. <i>Algal blooms</i> | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Not sure |
| viii. <i>Changing demographics</i> | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Not sure |
| ix. <i>Soil disturbances</i> | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Not sure |
| x. <i>Climate change</i> | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Not sure |

- xi. *Natural geology* Yes No Not sure
- xii. *Biodiversity* Yes No Not sure
- xiii. *Pharmaceuticals* Yes No Not sure
- xiv. *Tourism* Yes No Not sure

In your opinion, what are the most common human causes of disturbance to freshwater quality/quantity on Salt Spring Island? (Select 3 of 10).

- Agriculture - crops
- Agriculture - livestock
- Land Clearing
- Development
- Industry
- Tourism
- Septic systems
- Recreation
- Climate change
- Pollution

Rate the importance of the below eight freshwater quality/quantity issues to you:

- i. *Clean drinking water:* Very Important Somewhat Not
- ii. *Water for household [i.e. washing]:* Very Important Somewhat Not
- iii. *Protection of aquatic organisms:* Very Important Somewhat Not
- iv. *Healthy groundwater:* Very Important Somewhat Not
- v. *Healthy lakes:* Very Important Somewhat Not
- vi. *Water for agriculture:* Very Important Somewhat Not
- vii. *Water for recreation:* Very Important Somewhat Not
- viii. *Destruction of wetlands:* Very Important Somewhat Not

(C) Your Educational Perspective

What is your learning method of choice for educating yourself about freshwater quality/quantity issues? (Select 2 of 8).

- Read printed fact sheets, bulletins, or brochures
- Read a newspaper article or series
- Radio show
- Personal observation
- Visit a website
- Television coverage
- Word of mouth
- Other (*please specify*) _____

Have you received freshwater quality/quantity information about Salt Spring Island from the following sources? (Select all that apply).

- Newspaper
- Government Environment Agencies
- Personal observation
- Word of mouth
- None
- Television
- Environmental citizen groups
- Management reports
- Websites
- Other (*please specify*) _____

Would you like to learn more about any of the following freshwater quality/quantity issues? (Select all that apply).

- Drinking water & human health you can do to help
- Environmental restoration
- Pollution assessment & prevention
- Water conservation
- Environmentally friendly development practices
- Agriculture water & waste management
- Nutrient & pesticide management
- What

(D) Your Governance

Do freshwater issues receive the right amount of emphasis from local government & elected officials on Salt Spring Island?

- No, not enough emphasis
- No, too much emphasis
- Yes, about right
- No opinion/not sure

In your opinion, who should be most responsible for protecting freshwater quality/quantity on Salt Spring Island? (Select a maximum of 2).

- Federal Government
- Islands Trust
- Local interest groups
- Water Districts
- Not sure
- Provincial Government
- Capital Regional District
- Individual citizens
- No one
- Other (*please specify*): _____

(E) Your Voice

What action items could you as an individual undertake to improve SSI's water quality/quantity?

What actions items could the island as a whole undertake to improve its water quality/quantity?

Please outline any additional comments, concerns or issues in the below section:

Appendix B

Water Issues Awareness Survey Results

(A) Your Background

Sex:

Male	Female
38	62

Age:

< 18	18 – 25	26 – 35	36 – 45	46 – 55	56 – 65	66 – 75	75 +
1	12	13	23	20	23	4	1

Years on SSI:

Visitor	< 1	2 – 5	5 – 10	11 – 20	21 – 30	31 – 40	41 +
4	10	19	23	25	15	3	0

Area of SSI:

North End	South End	Ganges Area	Maracaibo	Long Harbour	Visitor
48	28	22	1	1	1

What watershed are you in?

St. Mary	Okana Creek	Sharpe Creek	Maxwell Lake	Cusheon Lake	Lake Stowell	Ford Lake	Lake Weston	Not Sure	Other
42	0	0	4	5	3	2	6	26	14

Where do you get your tap water?

Individual well	Community well	Bottles	Water District	Not Sure	Other
32	3	1	47	14	2

If Water District, which one?

North Salt Spring	35
Maracaibo	0
Scott Point	0
Fernwood	1
Cedars of Tuam	2
Cedar Lane	1
Fulford Harbour	2
Beddis	1

Harbour View	0
Highland	2
Mount Belcher	0
Not sure	10

Do you drink the water from your tap?

Yes	No
66	34

If not, why not? (Select all that apply)

Bad Taste	Contaminants	Safety	Poor Odour	Off Colour	Other
32	7	24	8	9	3

Have there been any changes to the *quantity* of your personal freshwater supply in the past 1-5 years?

Less	More	No change	Inconsistent
4	1	92	1

Have there been any changes to the *quality* of your personal freshwater supply in the past 1-5 years?

Worse	Better	No change	Inconsistent
1	6	75	10

Do any of the following conditions affect your personal freshwater supply quality/quantity? (Select all that apply).

Arsenic	Saltwater Intrusion	High Bacterial Counts	Droughts	Lead	Excessive Nutrients	None	Not Sure
1	3	16	10	1	21	34	28

Do any of the above conditions (arsenic etc.) affecting your personal freshwater supply affect your personal health? (Select all that apply).

Arsenic	Saltwater Intrusion	High Bacterial Counts	Droughts	Lead	Excessive Nutrients	None	Not Sure
0	0	6	0	0	5	49	40

(B) Your Environment

Which of the following conditions do you believe to affect freshwater quality/quantity on Salt Spring Island?

	Yes	No	Not Sure
High Bacterial Counts	69	4	27
Minerals	47	6	47
Fertilizers/Nutrients	64	1	35
Pesticides	49	5	46
Development	80	1	19
Loss of forest cover	75	2	24
Algal blooms	78	2	19
Changing demographics	60	4	42
Soil disturbances	68	3	28
Climate change	59	4	37
Natural Geology	45	2	53
Biodiversity	30	7	63
Pharmaceuticals	37	3	60
Tourism	64	5	31

In your opinion, what are the most common human causes of disturbance to freshwater quality/quantity on Salt Spring Island? (Select 3 of 10).

Agriculture - crops	20
Agriculture – livestock	21
Septic Systems	74
Land clearing	60
Recreation	10
Development	72
Climate change	16
Industry	8
Pollution	32
Tourism	12

Rate the importance of the below eight freshwater quality/quantity issues to you:

	Very	Important	Somewhat	Not
Clean Drinking Water	86	12	0	0
Water for household	47	42	9	0
Protection of aquatic organisms	69	25	2	0
Healthy groundwater	78	19	0	0
Healthy lakes	79	19	0	0
Water for agriculture	47	43	8	0
Water for recreation	25	35	31	6
Destruction of wetlands	73	23	3	0

(C) Your Educational Perspective

What is your learning method of choice for educating yourself about freshwater quality/quantity issues? (Select 2 of 8).

Read printed fact sheets, bulletins, brochures	59
Visit a website	22
Read a newspaper article or series	54
Television coverage	7
Radio show	13
Word of mouth	30
Personal observation	44
Other	6

Have you received freshwater quality/quantity information about Salt Spring Island from the following sources? (Select all that apply).

Newspaper	85
Television	5
Government Environment Agencies	20
Environment citizen groups	46
Personal observation	62
Management Reports	16
Word of mouth	72
Websites	13
None	5
Other	4

Would you like to learn more about any of the following freshwater quality/quantity issues? (Select all that apply).

Drinking water & health	74
Water conservation	53
What you can do to help	55
Environmentally friendly development practices	49
Environmental restoration	33
Agriculture water & waste management	31
Pollution assessment & prevention	40
Nutrient & pesticide management	27

(D) Your Governance

Do freshwater issues receive the right amount of emphasis from local government & elected officials on Salt Spring Island?

No, not enough emphasis	76
Yes, about right	8
No, too much emphasis	0
No opinion/not sure	16

In your opinion, who should be most responsible for protecting freshwater quality/quantity on Salt Spring Island? (Select a maximum of 2).

Federal Government	10
Provincial Government	34
Islands Trust	57
Capital Regional District	57
Local interest groups	2
Individual citizens	18
Water districts	19
Not sure	4
Other	5

(E) Your Voice

What action items could you as an individual undertake to improve SSI's water quality/quantity?

more conservation
responsible water user and polluter
harvest rainwater
conservation
awareness
collect rainwater from roofs
return all outdated prescriptions to the pharmacy, use non-toxic cleaning supplies, use low flow appliances
I have a minimal impact on water supply/quantity
I do regular maintenance of my septic system and periodically test my well
don't buy bottled water, use that money to improve quality of water at home
install rain collection systems for garden
composting toilet, rain catchment, use not toxic chemicals
educate then regulate
only buy washing/cleaning products that are low in phosphates and do not harm our freshwater supply
personally we do all we can to conserve - being on a well has really improved sense of personal affect of actions (using cleaners, watering gardens etc)

we are in St. Mary watershed and we make no changes to property without considering water. We have reduced our footprint
being mindful what I put into the ground
putting money into safe ways to filter environmental pollutants
we are installing roof water collection to use as household water to get off st mary lake water
no idea
replace toilet and appliances with low flow/energy star
conservation, drive less, be proactive
I do what I can , I don't use a lot of water, I have a drip system for the garden, I am careful about avoiding the use of pesticides and herbicides
I think that we need an elected local board for water issues
really don't know, support those that do after they prove they know. At this point there is a lot of talking but I haven't seen anything that shows anybody knows what they are talking about
good septic system management with waste disposal
do not remove trees, install rainwater collection systems and grey water recycling systems, reduce use of water
septic monitoring and maintenance
no littering
conserve water
reduce contamination
continue on the highland water committee
become better informed of issues
continue to improve rainwater system for garden
keep mulch topped up in garden
encourage others to garden organically
stop taking hormone replacement therapy
finish testing a septic retrofit to type II from type I with a liner and aerator
I use less than 5 gal/day
septic inspection and maintenance
conservation - updated fixtures, fix leaks
use more efficient watering systems
use biodegradable household products, reduce water use
not use toxic chemical cleaners or fertilizers
conserve water use - recycle water ie. Grey water
water catchment cisterns
reduce use
grow organically, consciously
maintain septic
phosphate free detergents; environmentally friendly cleaning products
use bathwater to water garden plants
never pesticides in the garden
shower with a friend
become informed locally
pass the word (your very fine first report)
support HEHCI
not sure I don't know the real issues. I would like to know.
be more conservative in my water usage
educate myself about water issues
teach children about water issues/conservation
learn more about issues
speak out more in social conversations
personally install roof collection system and plumb circulate into toilets

use our change as an example to others for what we can do at our own homes

keep septic system up to date

be cautious with hazardous products

From water conservation to environmental conservation, land conservation covenants, local environmental citizens' groups, letter writing to local papers and politicians, I am doing pretty much everything I can think of already (while still having a life that has numerous other issues to deal with in it). I am active and contributing (not bragging about it – just informing you), and trying to act on what many other people seem content to just not bother about. Until senior levels of government start taking their responsibilities seriously and legislate a livable future into place, there is very little that the Trust, the CRD and individual citizens can do to stem the tide of inappropriate development, pollution, water-waste and deforestation that is set to take down our entire civilisation. Any suggestions? I would happily add your ideas to my “To Do” list

What actions items could the island as a whole undertake to improve its water quality/quantity?

more conservation

harvest rainwater

better public awareness

protect streams, creeks and watersheds

conservation

ban pesticides

keep animals and septic fields away from lakes

don't allow airplanes to land on our drinking water lakes

ask people to use natural cleaners

teach people the effects of pharmaceuticals in watershed

what goes down the drain comes back up the tap

greater monitoring of septic systems - especially in watershed

improved water filtration resource accessibility ie. Financial aid to improve water quality in my home

limit amount of households using water from limited supplies like st. mary's lake

research, educate, regulate, on and off island

better distribution of water info for locals (I got best info from poster on ferry)

support watershed mgmt plans

limit development and sizes of houses in areas with limited water supply

composting toilet, rain catchment, use not toxic chemicals

prohibit use of pesticides/fertilizers around lakes

more public awareness and education

conservation

collect rain water

stress water conservation at all levels. Reduce impact of development by insisting on catchment installations, reduced water use appliances etc

regular septic system evaluation; control of steep slopes, development, conservation

quit using chlorine to clean drinking water, install alternative systems

educate people on how to conserve water

allow only water conserving appliances

we should create our own local standards and comply all to abide them or suffer large penalties

keep lakes free of motor boats and float planes

do not add chlorine or fluoride

for lakeside dwellers, stop using phosphates and pump out septic systems more often

conservation, drive less, be proactive

protection of st. mary's watershed

I don't know

minimize land disturbance and impermeable surfaces

maintain septic systems and regular pumpouts

monitor sources

tax incentives to conserve water, restrictions on development in key watersheds, upper limit to the number of people allowed to live on the island through some sort of zoning, zero-net loss of wetlands regulations for development

personal water conservation

become better informed of issues

conserve water

reduce contamination

rain catchment systems

xeriscape gardens

end all chemical pesticides and fertilizer use

lakefront homeowners leave shoreline natural or replant

properly maintain septic

use water efficient appliances and showerheads

time showers

save flushes if you can't afford a low flow toilet

never use sprinklers, only drip irrigation

let your car get dirty this summer

turn off taps when brushing your teeth

use soaking pits instead of running rain water to ditches and to the ocean

less development

move septic fields back from lakes, more septic monitoring

education on groundwater protection (septic maintenance + upgrade/improvement)

developmental impacts (especially downhill from the development)

more protection for watersheds and wetlands

environmental development initiatives

thoughtful and responsible development

more catchment systems

more efficient distribution

public seminars by all those groups, locally/provincially/federally involved in your HEHCI report to spread the information you have collected over the past year and report on this questionnaire results. Sometimes issues are too big to handle but the local approach in your research overall and specifically re: water indicate there are solutions very possible to implement locally and personally without the "big stick" government although laws might follow for sustainability inform islanders about the current conditions. Keep them updated and informed on how to help.

CRD/province support and advocacy for aggressive water conservation practices and better enforcement of existing standards

trust and CRD become more public in supporting creative conservation efforts, replacement of bad septic, creativity in new development, education for local agriculture best practice methods

I think SSI has plenty of water (rain, lakes) we need a proper way to share and distribute it

Protect intact watersheds from additional development. Retain forest cover everywhere possible. Prevent paving and impermeable surface treatments, ditching, draining and surface-runoff issues. Support all the organisations that are working to prevent deterioration in water quality and quantity. Stand firm against encroachment of commercial and industrial uses that result in further pollution and eutrophication of lakes etc. Educate newcomers, visitors and all the old-timers who should know better about the importance of water, trees, watersheds, watercourses and soil. Enact effective Riparian Areas Regulations legislation. Plant trees. Teach the kids in school a complete new approach to their natural world, and their role and responsibility in keeping it that way. Force the development, construction, real-estate and logging industries to start being responsible in how they make money. Install low-flush toilets, low-flow shower heads and composting toilet systems to conserve water. Ban lawns. Encourage plantings of native species and appropriate xeriscaping instead of intensive irrigation of inappropriate non-food species solely for cosmetic landscaping. Treat clean water everywhere as if it was valuable – it is. Change the public perception that water can be just run down the drain for no

purpose. Change the notion that we are all so filthy that we need to be showered twice a day – our parents and grandparents were never so deluded. Ban washing cars with a hose – real islanders drive dusty cars. Return to drinking tap-water, not bottled water, so that we care once more about what is coming out of the tap. Teach everyone that water is real in a way that money never is – ever tried fighting a forest fire with a bank account? Or making a cup of tea, when nothing is coming out of the tap any longer? Plant more trees. Start caring about what we are (all) doing to this beautiful, precious, fragile and irreplaceable planet/island. Support the Islands Trust, and enable them with strong and effective legislation, instead of a collection of development-minded financiers and businessmen pretending to be a mayor and council. We have everything the island needs already, we just have to look after it, so preserve and protect is a pretty good idea.

Please outline any additional comments, concerns or issues in the below section:

st. mary's water stinks (literally!)

I filter the tap water

development permits are too lax and do not adequately reflect water condition realities

too little knowledge by residents on how their activities compromise the watershed by tree clearing, artificial beaches, staircases, creating massive soil disturbance and erosion

too little knowledge about the dangers of relying on technology to fix our water problems or on tap water. very little appreciation for the importance of healthy ecosystems and how to restore them so we do not have to treat our water
confusion about where our water comes from.

too little knowledge about where algal blooms come from and the difference between algal blooms and toxic algal blooms which are actually cyanobacteria

need more knowledge about the personal health dangers of exposure to toxic algal blooms

I appreciate that someone is looking out for this very important issue

cyanobacteria in st. mary's lake

new roads redirect streams - areas of large trees get droughted out

sprinklers

water protection should be a federal government issue but I don't trust the current government to act responsibly with our water resources

water should not be sold in bottles - tap water quality should improve and someone should be educating consumers to this way of thinking

to promote water collection systems, the government could provide financial incentives such as grants and tax deductions on rain collection systems

please consider promoting low tech composting toilets - I have and use one everyday, it has no moving parts and works like a charm

water is no.1 in sustaining life. As such it should be treated as no.1 and not taken for granted. Because we have so much (here in Canada) doesn't mean we shouldn't value and protect it. Thank you for your time

rate of development and weight of tourism and effects on a shrinking and increasingly contaminated water system

fluoride, that water testing costs money

I am amazed that the average island household uses 17000 gal of water every 2 months. That is way too much and indicates little conservation

I am very concerned about the affect of algal blooms on the health of my family. I have called to complain to the NSSWD and I am told that drinking water is safe. I have noticed an increase in the amount of chlorine in my water (over the past 5 years) and now showering is like swimming in a public pool, which I think is also bad for the health of my family.

thank you

I would like to know if the water I am drinking (usually boiled) that has gone through my Brita filter is of high quality for my health

It seems most feel it's to little to late and just live with it, our Government has sold us down the line for their personal pockets and that's not a party statement as they all seem just as bad these days just out for their individual selves. Solution is higher than local government, perhaps need s to be global, any way it's done, Canada is supplier and loser.

I have served on the Highland water committee for approx 6 years and am very concerned about St. Mary lake, its health as an ecosystem and as my water source. I wonder about all of the run off from North End Rd. traffic, well known out of compliance septic systems that will now be out of water even longer because of our new CRD director killing the septic

monitoring program, ever increasing recreational use resulting in removal of natural shoreline and residues from sunscreens and such. It just seems there is no respect for the importance of St. Mary Lake. I also worry that our limited water supply is not taken seriously by those in a hurry to up the local population

no - thank you!!

development, development

more watershed protection (focus on protecting the source)

anytime you may contact me to discuss these issues or if I can help you folks out

I would like to see water catchment included in building codes

tax rebates for water conservation initiatives

"there is not a water shortage on SSI, there is a distribution problem" - quote by former head of CRD building inspection
the umbrella of HEHCI is vast. Can it withstand the downpour?

I have to admit that I don't know very much about water issues (although I will be learning more about them this year) but I am concerned about environmental issues

Authors' Bionotes

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Phaedra Henley (BMSc, MES) graduated in 2009 from the Masters program in Environment and Sustainability at the University of Western Ontario (UWO). She was chosen by UWO to spend her summer co-op placement on Salt Spring, working with the HEHCI. Phaedra has an undergraduate degree in Medical Sciences, which sparked her passion for human health issues. Working as an environmental educator for seven years at the Royal Botanical Gardens in Ontario fostered her interest in environmental issues. She is about to start doctoral work at UWO in Ecosystem Health, combining her interest for environment and health issues. Currently, she is on assignment in Kenya, working on an interdisciplinary project with UWO to study the impacts of the changing environment of Lake Naivasha on the health of its residents.

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David Rapport, Ph.D, FLS, is Principal of EcoHealth Consulting and Co-Professor at the Institute of Applied Ecology, Chinese Academy of Sciences, Shenyang. From 1994 to 1998 he held the Tri-Council EcoResearch Chair at the University of Guelph, where he also held a professorship (1994-2004) in the faculty of Rural Planning and Development. He is cofounder of the Program in Ecosystem Health in the Faculty of Medicine at the University of Western Ontario, where he held an honorary professorship (1998-2004). In 2007 he was Visiting Professor in the laboratory for landscape ecology at the University of Tokyo. David has pioneered the concept and field of ecosystem health. His research on ecosystem health has focused on both terrestrial and aquatic ecosystems on four continents (Europe, North America, Asia and Australia). He also spearheaded the development of state of environment reporting in Canada and the Pressure-State-Response (PSR) statistical system, which has been adopted internationally as the basis for reporting on human activities and the environment. David was Founding President of the International Society for Ecosystem Health (1993-2000) and Founding Editor-in-Chief of its journal, *Ecosystem Health* (published by Blackwell Science 1995-2001). He serves or has served on the editorial boards of the journals *EcoHealth*, *Ecological Indicators*, *Ecological Economics* and *Aquatic Ecosystem Health Management*. He has authored over 200 scientific papers and has co-edited several books, including: *Ecosystem Health* (Blackwell Science, 1998); *Transdisciplinarity: reCreating Integrated Knowledge* (McGill/Queens U. Press, 2002); and *Managing for Healthy Ecosystems* (Lewis Publishers, 2003). With Luisa Maffi, he co-coordinates the Healthy Ecosystems, Healthy Community Initiative (HEHCI) on Salt Spring Island.

LUISA MAFFI maffi@terralingua.org www.terralingua.org

Luisa Maffi, Ph.D., is co-founder and Director of the international NGO Terralingua. Luisa is a linguist, anthropologist, and ethnobiologist. She has conducted fieldwork in

Somalia (1979-85), Highland Chiapas in southern Mexico (1988-93), and the Sierra Tarahumara in northern Mexico (2000-present), and is currently also involved in projects in China and Japan. Luisa has pioneered the concept and field of biocultural diversity. In 1996, her interest in the relationships between language, knowledge, and the environment, and in the links between linguistic, cultural, and biological diversity, prompted her to co-found Terralingua. Also in 1996, she organized the ground-breaking interdisciplinary conference "Endangered Languages, Endangered Knowledge, Endangered Environments" (University of California, Berkeley). In 2008, she co-organized a follow-up conference, "Sustaining Cultural and Biological Diversity in a Rapidly Changing World: Lessons for Public Policy" (American Museum of Natural History, New York). Luisa has collaborated with major international organizations, including WWF, UNEP, UNESCO and IUCN, on issues of biocultural diversity conservation. She has published extensively on biocultural diversity and related topics. Among her edited or co-edited books are *On Biocultural Diversity: Linking Language, Knowledge, and the Environment* (Smithsonian Institution Press, 2001) and *Ethnobotany and Conservation of Biocultural Diversity* (New York Botanical Garden Press, 2004). Her co-authored book *Biocultural Diversity Conservation: A Global Sourcebook*, the outcome of one of Terralingua's projects, is to be published by Earthscan in 2010. With David Rapport, she co-coordinates the Healthy Ecosystems, Healthy Community Initiative (HEHCI) on Salt Spring Island.