

# ARCHIPELAGO

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news, views, reviews & interviews on island community & conservation



Archipelago is published by the Galiano Conservancy Association in the interests of pooling knowledge, encouraging respect and inspiring affection for our natural heritage and for each other.

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## **EDITORIAL**

### **Jillian Ridington**

Saving – whether it be seeds, grey water, or democracy – is a theme that runs through many of the articles in this issue of Archipelago. That's not surprising, I suppose, in a journal published by a Conservancy Association. Still, in a society where the economy is based on planned obsolescence, the value of treasuring what we have is worth pointing out.

Barbara Moore's article on seed saving doesn't seem at first glance to bear any relationship to Meg Holden's account of events in Quebec City. However, if we remember that Free Trade agreements reinforce the right of multinationals to restrict use of their seeds, and to engineer seeds so that they cannot be reused, the connections become more obvious. Saving and sharing seeds do not seem to be political acts – nor should they be. Still, such acts can create bonds between members of a community, which can foster independence and interdependence – the antithesis of the goals of the multinationals.

Children who grow up on Galiano are privileged to grow in beauty. It would be hard for a child raised here not to assimilate an appreciation of the natural world, and an understanding of his or her place in it. If we do not know what nature is, we cannot comprehend why it is worth saving. Angela Jean Louis's report on Steve Van Matre's workshop increased my understanding of just what environmental education is and what its principles are. The Galiano Conservancy is working with school boards on the lower mainland and Vancouver Island to provide environmental education for children from less intact environments than Galiano's. I hope that Angela's article will deepen your understanding of the importance of this project.

Brenda Beckwith's recent visit to Retreat Island taught me, once again – for I often need reminding – how fortunate I am to live in the midst of an intact Garry Oak meadow. Paul LeBlond is back with more insights into the wonders of our Gulf Islands, while Dana Weber reminds us of the beauty of all creatures – even those, like beavers, who have been considered "nuisances." To point out that the sea as well as the land is worth saving, Richard Chase tells us of a strange and wonderful deep marine environment, and Robin Ridington reviews Terry Glavin's *The Last Great Sea* – the one that sustains our coast.

The old Joni Mitchell song said, "You don't know what you've got 'til it's gone." Fortunately, we have educators and writers, such as those who appear here, who can remind us of what we have, while there is still something to save.

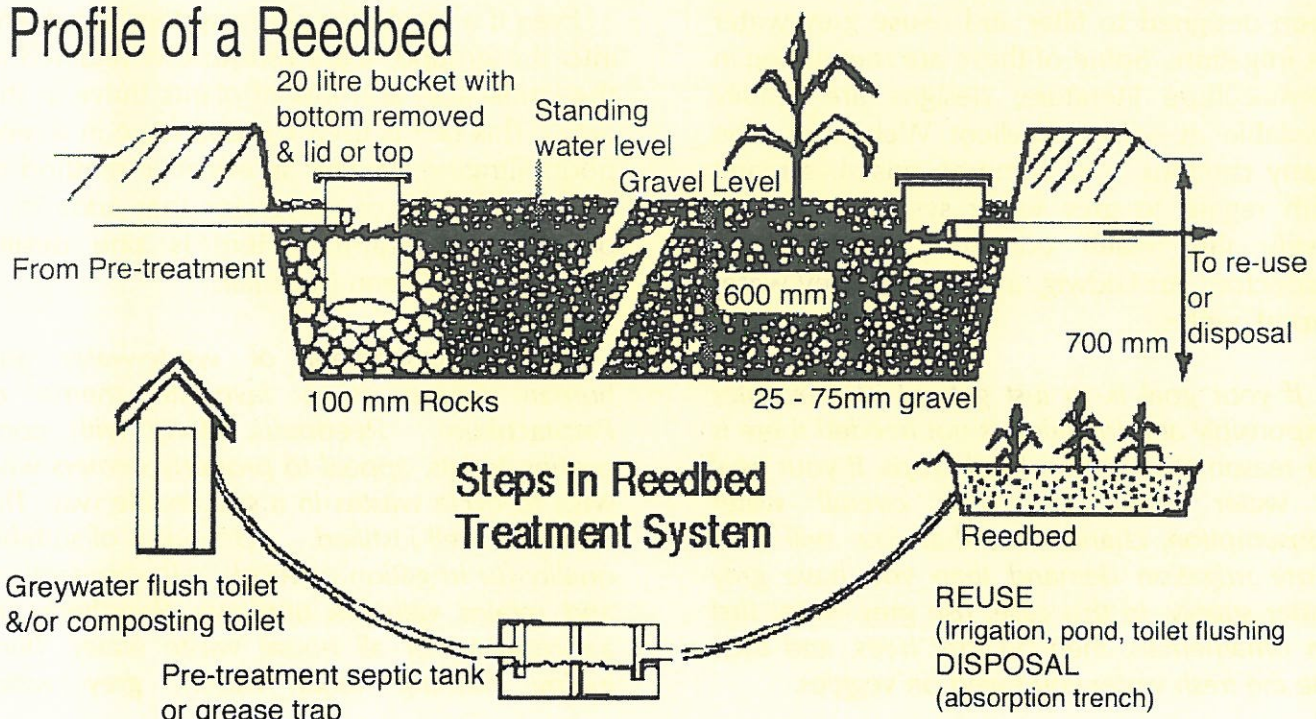
# A GREY WATER SOLUTION

Gary Moore

While California struggles to maintain liveability in the face of water shortages, we here on Galiano have an opportunity to make the most of our limited water supplies. For one thing, it is not always appropriate or necessary to install an expensive septic field and tank when building a residence or accessory building. Living off-grid, (where pumps and pressure tanks are an energy-consuming luxury), or in areas where water is in low supply, renders it impractical to flush gallons per use, or to waste valuable water – water that can benefit the landscape in a dry season by being re-used as filtered grey water. Grey water includes the drainage from kitchen and bathroom sinks, bathtub and laundry water. In the past in the Gulf Islands, it has been necessary to install a septic tank and field if water is supplied to the house, even if only for washing and drinking. A building with a water supply and an outhouse or composting toilet was an anomaly for the CRD Health and Building Inspectors. In practice, this made it mandatory to have an indoor toilet to obtain an occupancy permit. Recent changes in owner building codes – and perhaps an increasing appreciation for water conservation – now allow the inspectors some discretion in approving systems without septic fields or indoor toilets.

Refusing the best advice (don't EVER move into an unfinished house!) we built our house to code and under a proper building permit, but moved into a pink walled paradise rather than pay rent while our unfinished house was already warm, dry and comfortable. We opted for an outhouse out of necessity, thinking to install a septic field and tank later, when other priorities had been handled. For years we drained our sinks and bathtub into a wooden box with a filtering screen that collected compostable solids and allowed the water to drain into the gravelly soil.

## Profile of a Reedbed



When the house was completed, and we applied for our occupancy permit, the question of wastewater had to be addressed. To our surprise, we discovered that the inspectors were amenable to an alternative system that precluded the necessity of the septic system. We replaced the old grey water box with a large, improved, but very simple design, in consultation with the CRD Health Inspector. We dug a large wooden box with no bottom into gravelly soil, then fitted it with a removable lid. To filter large solid wastes, we put in a large, fine-meshed screen embedded in several layers of stones and sand. Grey water passes through this, and sinks into the ground after standing in the box for a few minutes. An overflow to a secondary pit was added to satisfy the inspector, but does not seem to have been necessary.

A CRD Health Inspector said that while he had some discretion in approving such a site-specific system, he could not approve of a system where the filtered grey water was used to irrigate food crops in a nearby garden. In other parts of the world where water is in short supply, many excellent systems have been designed to filter and re-use grey water for irrigation. Some of these are mentioned in Permaculture literature; designs are readily available at some excellent Web sites. The many cautions, and common mistakes made with regard to grey water systems seem to justify the health concerns of the local inspector. Art Ludwig, a California grey water expert, writes:

*If your goal is to just get rid of greywater responsibly and irrigation is not needed there is no reason to put it on food crops. If your goal is water reuse to lower overall water consumption, chances are that you will have more irrigation demand than you have grey water supply. In this case, use grey water first on ornamentals, then on fruit trees, and then use the fresh water you saved on veggies.*

*With the greywater systems I recommend there are several layers of protection, each capable of preventing the spread of infectious microorganisms on its own. When irrigating veggies with greywater the only possible protection is from 1) not happening to have anything nasty in the water, 2) not splashing greywater on the edible portions, 3) washing veggies, 4) cooking and 5) not getting sick even if you eat something nasty. Each of these offers tenuous protection. Additionally, greywatering vegetables is often manual, which inevitably results in some direct contact with greywater. If you're going to engage in this reckless practice, pay attention to what's happening with this slim margin of safety. If anyone in your household has an infectious disease, protection 1) is not operative and you should stop using greywater on veggies. For 2), exercise care in applying greywater, and give crops which are splashable and eaten raw a wide berth, even more so as harvest time approaches (e.g., carrots, salad greens). Always wash greywatered raw veggies with soap, iodine, or equivalent. Try not to splash too much, and wash your hands after greywatering (this extra wash water has to be considered in the irrigation efficiency for this system.)'*

Even if a local grey water system just drains into the ground, extra moisture is retained in the landscape, and lots of plants thrive in the area. This fact is used to advantage in a reed pond filtration system, an effective method of bio-remediation of greywater that adds to a beautiful landscape. Here is one design described by Glenn Marshall:

*Better management of waste-water and human wastes is a favourite theme of Permaculture. Reedbeds, along with composting toilets, appeal to property owners who wish to cycle wastes in a sustainable way. The choice is well justified. . . .Effluent is of suitable quality for irrigation or toilet (with disinfection) and retains valuable nutrients. Reedbeds are appropriate for all house waste water (including flushing toilet water), grey water*

only, or grey water combined with excess liquid from a composting toilet. Authorities in most Australian states have approved trial reedbed system in non-sewered areas, paving the way for further legal reedbed installation. Two trial systems have also been approved in sewerred towns of Hepburn (Victoria) and Lismore (New South Wales). If you are living outside Australia, you will have to check with local authorities as to what is possible.

A reedbed is basically a hole in the ground, lined to stop water loss, filled with gravel and wastewater, and planted with reeds (which grow hydroponically). Inlet and outlet wastewater pipes are positioned below the gravel surface, so the standing wastewater level is always below the gravel. This stops mosquitoes and children accessing the wastewater, and stops odours escaping the reedbed. As untreated wastewater enters the reedbed, it pushes treated wastewater out the other end.

Beneficial micro-organisms (bugs) provide most of the wastewater treatment in a reedbed. There are two types of bugs: aerobic and anaerobic. Aerobic bugs breathe oxygen supplied by reeds. Reeds pump oxygen to their roots, surrounding them with a thin layer of air to stop them drowning. Aerobic bugs live here and capture passing pollutants. Anaerobic bugs live away from the roots, coating gravel surfaces as a slime. They too capture pollutants.

Pre-treatment is required before wastewater enters a reedbed. This is to remove solids from wastewater which would clog the reedbed gravel.<sup>ii</sup>

Whether the water is cleansed and re-used on the surface for irrigation or simply drains, filtered into the ground, moisture around the pond or box will create a diverse growth of natural or planted vegetation. Salmonberries, black raspberries or blackberries will all thrive around a grey-water box, attracting birds, creating flowers for pollination or offering at least a few handfuls of berries in season.

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<sup>i</sup> Art Ludwig, Common Greywater Mistakes, [www.oasisdesign.net](http://www.oasisdesign.net)

<sup>iii</sup> Glenn Marshall, How to Construct a Reedbed for on-site waste Water Management [www.nwnet.co.uk/earthwise/10articl/gmreedbed](http://www.nwnet.co.uk/earthwise/10articl/gmreedbed).

**Gary Moore** is a Galiano resident and innovator.



**artwork by Diana Lynn Thompson**

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## SAVING SEEDS

**Barbara Moore**

Every year, as I pull out my seeds and regard the miniscule bits of bio-matter that comprise them, I realize that gardening is a test of faith. I always over plant, never quite trusting that the seeds will actually produce huge plants, masses of food, overabundance.

Seeds are, for me, a symbol or metaphor for hope, life and the future. How much more satisfying it is to be one important link in continuing the cycle yourself, rather than entrusting it entirely to a seed company. Seed saving is ancient, simple, important for self-sufficiency, and enormously satisfying.

I began, almost unconsciously, saving beans and garlic. I was influenced by Dan Jason of Salt Spring Seeds. Saving seeds just made sense, and was so obvious once I started. Dan passed on the experience and wisdom of his seed company. I recall now with amusement (and a little embarrassment) how, in my early years of gardening, I proudly sent off a long seed order and a substantial cheque, feeling that I was certainly a 'real' gardener now.

Gradually, over the years, I became more adventurous, and would gather a wider variety of seeds. I added seed saving to the scores of tasks in each gardening cycle. Increasingly, I felt part of this crucial and historic link with past and future generations. Then permaculture came to permeate my thinking. I read of how the old varieties of plants were disappearing, as they were replaced by modern, more efficient hybrids. Seed companies were amalgamating, and the new, larger companies usurped greater and greater control and influence over what we grew. Happily, increasing numbers of ordinary gardeners were simultaneously taking on the role of conserving and keeping alive these old,

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open-pollinated varieties. These days my own seed bank has grown, and I order far fewer seeds; I save money as well as seeds.

In 1998, a few people on Galiano, with support from Seeds of Diversity Canada and some Salt Spring Islanders, hosted the first Seedy Sunday event here. It was a simple seed exchange. Heartened by the response, and by the fun and enthusiasm of the day, we have continued. Seedy Sundays are now supported and organized by the Galiano Garden Club. Over the last three years, Galiano has seen a renewed and increased interest in saving seeds and growing them out. We have joined a trend all across the country, as more and more Seedy Saturdays and Sundays are springing up every year. Seeds of Diversity Canada offers active support and materials to communities hosting these events.

There are many excellent resources on the reasons for, and mechanics of, seed saving. Dan Jason of Salt Spring Seeds has written extensively about the importance of seed saving, and is on the Board of Seeds of Diversity Canada. He is one of the best local sources of good open-pollinated varieties.

The 'Bible' of seed saving seems to be *Seed to Seed* by Suzanne Ashworth, published by the Seed Savers Exchange in the U.S. Comprehensive and attractively illustrated, it is hugely informative without being intimidating for the novice.

Abundant Life Seed Foundation in Port Townsend, Washington has an excellent seed catalogue of open-pollinated varieties. They have also reprinted a charming little book, *Save Your Own Seeds* by Lawrence D. Hills

Seeds of Diversity Canada has an attractive and informative web site: [www.seeds.ca](http://www.seeds.ca) which will give you all you need to know to begin seed saving. The Galiano Conservancy Library is a good place to find resources, and

if they do not have exactly what you are looking for, they will probably know where to find it



### NESTO - NETTLE PESTO

You don't have to save seeds to find a wonderful crop of Nettles; they are available in early spring, all over Galiano. They are a wonderful source of nutrients. Here is a recipe to tuck away until they begin to flourish again, next year. Pam Freir is to be credited with dubbing this recipe 'Nesto'. The recipe is an adaptation of a basic pesto recipe, which I have experimented with. Initially, I steamed the nettles and let them cool thoroughly before blending them. But a more adventurous and knowledgeable herbalist friend, Dora Fitzgerald, pointed out that when one crushed or pureed the nettles, they lost their sting, so one can use them fresh and retain all the nutrients. The taste is quite strong, but it is such an amazing jolt of chlorophyll and vitamins that your body will

welcome it. The nettles are best picked from when they first appear (sometimes they poke up their plump buds in early January) until about late April - before they begin to flower and go to seed. The first four leaves or so are all that I use for eating, as they are the most tender. The plant will usually recover from being picked by sending up a double shoot. Just remember the general rule of thumb; don't harvest more than 10% of any wild plant. With nettles, this gives us lots of leeway.

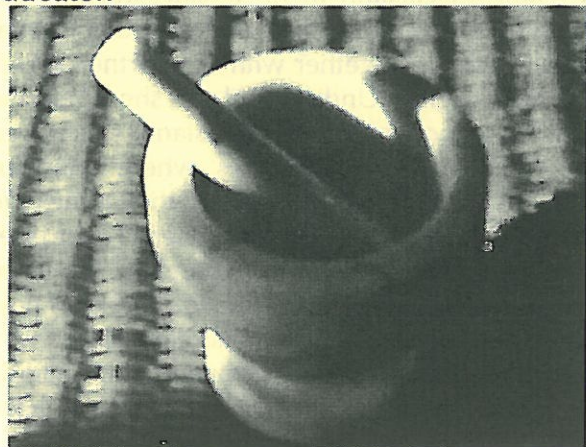
### NESTO

3 cups (packed) fresh picked nettle tips  
3-4 plump garlic cloves  
1/2 - 1 cup Olive oil  
1/4 c. Nuts - almonds, cashews, pine nuts  
3/4 cup Parmesan cheese  
1/2 teaspoon salt.

Puree everything in a blender or food processor until smooth. Nesto is particularly tasty served with cream cheese and a dab of mayonnaise to smooth the flavours. Great as an appetizer spread on tortillas, rolled up and sliced into pinwheels, or just tossed with pasta.

Another way to use nettles is in a quiche. I use the Moosewood Cookbook basic quiche recipe and try a potato crust. Use the nettles as you would spinach. They really shrink when steamed, so pick lots.

**Barbara Moore** is a Galiano gardener and educator.





## **FRESH VISION & FRESH FLOWERING: AN ETHNOBOTANIST VISITS RETREAT ISLAND**

**Jillian Ridington**

When we take friends to places we know well, we see those beloved places with fresh vision. In looking closely to point out the features that make our place "home", we learn to appreciate that home all the more. When the visitor is a knowledgeable teacher, our vision and our wisdom are both enhanced. So it was when Brenda Beckwith came to Retreat Island on March 23<sup>rd</sup> and 24<sup>th</sup>.

Brenda is a Ph.D. candidate at the University of Victoria's School of Biology and Environmental Studies, and an expert on Garry Oak meadows. She came to Galiano to do a slide show at the Galiano Conservancy Office, and stayed at Retreat Island Cottage. Together with her partner Karen, my granddaughter Undine, and me, she spent the Friday afternoon exploring the island. I showed the visitors the damp niches where *Mimulus alsinoides* (Little Monkey Flower) thrives next to black-stemmed ferns; the spots where Fawn Lilies are flourishing and their sites expanding; the place where a deer died and Chocolate Lilies now thrive (bone meal is a great natural fertilizer!) We all admired the way the Chocolate Lilies, *Collinsia* (blue-eyed Mary), Sea Blush and Paintbrush have

flourished in areas once covered in broom. Nature is resilient, given half a chance.

Then Brenda showed me much more, for she has a fine eye for nature's subtleties. I am just beginning to learn the difference between native and introduced grasses; Brenda helped me distinguish Idaho fescue, a native grass that proliferates on Retreat, from invasive species - I learned what to pull, and what to encourage. I can easily distinguish between alum root and snake root when both are in flower, but in early spring, when only the leaves have emerged from the duff, I have found it difficult. Now I know that identification can require all our senses, not simply sight. Feel the leaves; snakeroot's leaves are smooth, alumroot's are fuzzy. Easy, when you know how.

On the Saturday, a small group of members of the Galiano Conservancy Association, which now owns half of Retreat, joined us for another tour. As we passed the stake that marks the boundary between our lot and the Conservancy's, Brenda looked down, and spied the leaves of several stands of Camas - a native plant that should grace the Garry Oak meadow, but that we had not found here. There they were, several plants tiered on the bluff ledges, safe from all hazards except the wind and sea. Perhaps they are the last remnants of larger, old stands; Clara Stevens once told me that, when her father farmed at Retreat Cove in the 1920s, goats foraged on Retreat Island. In future, we will encourage the camas to migrate up to the meadow. Now that the goats are gone and the broom is almost eradicated, there is safe space for camas.

There are many minute climatic zones on this small island, and each plant chooses the one where it will best thrive. Down near the small shell beach, and along the lee shore, white fawn lilies grow thicker every year. Along the lower otter trail from the beach and west along the bluffs below our house, Evergreen Huckleberry, Oregon Grape, Sea Blush and Chocolate Lilies predominate, interspersed with Miner's Lettuce and Fringe Cup. As we walk through the Garry Oak meadow towards the south-west corner of the island, the Chocolate Lilies thicken. Further on, Paintbrush appears; it forms thick yellow and flame stands above the tiny pale Starflowers that



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carpet Retreat's southern end. At the top of the island, where the Garry Oaks become interspersed with Douglas fir, orchids appear. Only the leaves of Slender-spire Orchid and Rattlesnake Orchid are visible in March, and the leafless Coralroots don't announce their presence that early. But Brenda found stands of orchids that I had not noticed before. As we examined those, others in the group called to her to identify their finds. Aided by her well-thumbed copy of Pojar and MacKinnon's *Plants of Coastal British Columbia*, Brenda managed to give names to them all.

Her lessons have lasted. I'm taking Pojar and MacKinnon with me these days, when I walk down to the beach or along the bluff. Thanks, Brenda, for teaching me to see more clearly, and for sharing your knowledge with all who came to the slide show or the tour of Retreat. And come back and see the Camas next April, when it will be in bright blue bloom!

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a "smoker" on the ocean floor

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## HOTSPRINGS AND STRANGE LIFE FORMS ON THE OCEAN FLOOR

**Richard Chase**

Oceanic hotsprings are found along the 80,000 kilometres of the system of spreading ocean ridges that girdles our planet. In the part of the Pacific ocean floor claimed by Canada, which extends 370 kilometres west of the coast of Vancouver Island, hotsprings exist on the actively spreading Explorer and Juan de Fuca ridges. Not too distant from Galiano, then, there exist some life forms that are unlike anything we see on the islands, or in the waters of Georgia Strait.

The hotsprings in the deep sea have been discovered and explored in the past four decades. A site called Middle Valley has been intensively studied by the Canadian Geological Survey and by the international earth science community, operating from the unique scientific drill ship JOIDES Resolution. Large deposits of metallic sulphides have been drilled beneath the Middle Valley hotsprings. These sulphide minerals are deposited from the hot fluids as the fluids rise to the seafloor.

The existence of the hotsprings was first predicted in the 1960s when metalliferous sediments were brought up in cores from the soft mud of the ocean floor near spreading ocean ridges. In the same regions, the flow of heat through the seafloor from the interior of the Earth, measured by probes that took the temperature of the mud, was lower than expected. This indicated that heat was not escaping via conduction, but likely was being carried up to the seafloor by hot fluids.

In 1977, the U.S. submersible 'Alvin', exploring the central part of the Galapagos Ridge, discovered warm springs; around the springs clustered a previously unknown fauna of tubeworms, large clams, mussels, and crabs. In 1979, the first really hot vent system was found during a dive by 'Alvin' on the East Pacific Rise at 21° N latitude, west of Mexico. The two geologists and the pilot in the submersible encountered a jet of roiling fluid at a temperature

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of 350° C , issuing from a chimney on the seafloor several metres high. The fluid was so hot that it melted the plastic covering of the submersible's temperature probe and raised fears, fortunately groundless, that it might melt the perspex portholes. Had they melted, it would have meant a quick invasion of seawater into the submersible and an equally quick, watery death for the crew.

Minerals dissolved in the hot fluid were precipitating, as it mingled with the cold ocean water (bottom water at these depths typically is at a temperature of only a few degrees C). This formed what looked like a plume of black smoke when the vent was illuminated in the floodlights of the submersible. The name "black smoker" was given to this new phenomenon. Subsequently samples of the hot fluid, captured in stainless steel receptacles by scientists in the submersible, were raised and analysed. The fluid was remarkably different from seawater. Apart from the huge difference in temperature, the fluid was strongly acid whereas seawater is typically very slightly alkaline. While the seawater contained dissolved oxygen, the hot fluid was devoid of oxygen. The metal magnesium, found dissolved in seawater, was absent from the fluid. And metals such as iron, manganese, zinc, and copper, almost absent in seawater, were present in abundance in the fluid. The element sulphur, present in seawater as harmless sulphate, was dissolved as the poisonous gas hydrogen sulphide in the fluid.

The chimneys from which the hot fluid issues are growing at a rate of millimetres to centimetres a day. An individual chimney may have a life of several years. Chimneys are composed of sulphide minerals (pyrite, sphalerite, chalcopyrite, galena), sulphates (barite and anhydrite) and oxides of iron, manganese and silicon. Silver and gold occur in the chimneys in concentrations that would be attractive to miners if they were on land, but the depth of the overlying ocean makes recovery of these metals uneconomic with present day technology.

Animal life at the springs is spectacular. Worms up to several metres long are attached in hundreds to the bases of chimneys. They wave gills brilliantly red with haemoglobin in the current of mixed seawater and springwater, to pick up the dissolved gases oxygen and hydrogen sulphide.

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Inside the worms are slave bacteria, which collect the gases, chemically combine them and extract energy to fuel their metabolism and that of the worms. Mussels and limpets attach themselves to the substrate, and feed off clots of free bacteria wafting about in the cloudy water. Crabs lurk around the springs, consuming fallen worms. Octopuses eat the crabs. Fish are present, including large rays. The animals have become immune to the toxic metals and gases dissolved in the hot water they inhabit, and present in the flesh of their prey.

What is the source of heat driving the hot springs? Geophysicists have located pools of molten rock one or two kilometres below the seafloor. The temperature of such a melt is around 1200° C. The spreading apart of the seafloor at the ridge opens up cracks along which seawater penetrates downward towards the molten rock. The water is heated, chemically changed, and made less dense as it descends. It then rises along other cracks and exits as hot fluid.

The life of a field of hot springs is finite, for it will die as the melt below solidifies and cools. The constant spreading apart of the ocean floor, however, brings new melt, and a new group of hot springs, but perhaps to a part of the ridge many kilometres distant. The young of animals fixed to the ocean floor at the dying hot springs have to find and settle at the new springs. Scientists are now studying how they manage to do this.

Hot springs have existed for as long as the ocean has existed on Earth, likely more than four billion years. Bacteria and other microscopic life forms called Archaea, which occur at hot springs, are thought to be of great antiquity. Some scientists even hypothesize that life on Earth may have originated at oceanic hot springs.

**Richard Chase** is Professor Emeritus of Earth and Ocean Science at UBC, and a Galiano resident.

***The Galiano Conservancy Association congratulates Galiano's Audrey Thomas on winning the 2001 W.O. Mitchell prize. The prize is awarded to a Canadian writer in recognition of an outstanding body of work, and the contributions she has made to encouraging young writers. Bravo, Audrey!***

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## *FRACTAL ISLES*

by PAUL LEBLOND  
Galiano Island (one of the above)



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Today, the word is fractal. What do you mean, you haven't yet digested 'tafone'? You have no room for new words? Well, a picture may be worth a thousand words, but it is also true that a single word can evoke a thousand pictures. 'Tafone' brings to mind all these curvaceous sandstone structures of Gulf Island shores. 'Fractal' will suggest a myriad new vistas to your mind's eye. Make room!

When I look at a chart of the southern Gulf Islands, I am struck by the alignment of parallel reefs. Long lines of pale blue shallows, the home of dwindling rockfish populations, follow the shores of Galiano and Mayne Islands on the Strait of Georgia side. Points of land dive underwater as ridges, and reappear as a series of islands (Parker, Wise, Ballingalls). Land features also line up in a general east-of-south trend, steep cliffs facing southwest, with a gentle backslope. A grand and ragged sawtooth pattern characterizes the scenery.

The rocks that are the Gulf Islands started as sand and other sediments and became rocks under the pressure of tons and tons of more stuff and the glue of dead algae. Think of them as a pack of cards, each card a geological layer. Now imagine a gigantic hand pushing the pack sideways. The layers slip against each other and end-up like a sheared pack of cards: a staircase, each step one or more cards thick, each followed by a gentle downhill slope. A lot like the Gulf Islands.

Layers come in many thicknesses; there are a few very high cliffs and lots of smaller ones, all sharing in some way the same general sawtooth pattern. The pattern has considerable irregularity. Ridges are interrupted, some features do not fit into the picture at all. Nevertheless, if one was to take the average of a lot of sections across the Gulf Islands, it would look a lot like a bunch of sawtooths of different sizes on top of each other.

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Vegetation masks the finer details of the ground surface. On the beach there are places that are bare, where the stacking of layers can be clearly seen. Come to Montague Harbour. Park at the boat ramp and take a walk at low tide on the white shell beach on your left. You will soon be climbing over a rock spur. Take a close look: a stack of layers, steep on one side, gently sloping on the other, varying in thickness from an inch to a yard (I am speaking to the pre-metric part of your brain). A smaller version of the Gulf Islands themselves. A pattern made of a sum of similar patterns, ranging from small to large, is called a fractal. Add sawtooths of all sizes together and you have a fractal. The Gulf Islands have a fractal shape. A perfect mathematical fractal looks the same no matter how fine a magnifier you use to look at it. For real things, the fractal pattern is far from perfect and holds only over a range of scales: for the Gulf Islands, from one centimetre to a few kilometres (the idea has probably by now migrated to your metric brain).

Fractals are all around us. Rivers are fractal. Flying upstream in a river basin (or simply letting your eye cross the page on a map) you can see tributaries joining the main stream in a branching pattern, which repeats upstream in a hierarchy of ever smaller rivulets. The rim of the Grand Canyon, made up of a succession of nearly vertical steps, looks a lot like the Devil's Staircase fractal discussed by Benoit Mandelbrot, the father of fractals. Coastlines, the edge of clouds, the structure of ferns, craters on the moon, have fractal characteristics. Many plants grow in a sequence of similar patterns, division of the trunk into branches being copied on successive orders of branches: a fractal sequence.

In 1967, mathematician Benoit Mandelbrot wrote a paper entitled: "How long is the coast of Britain?" A strange question, one might think: the answer is probably on the first page of the atlas. Failing that, take a ruler and

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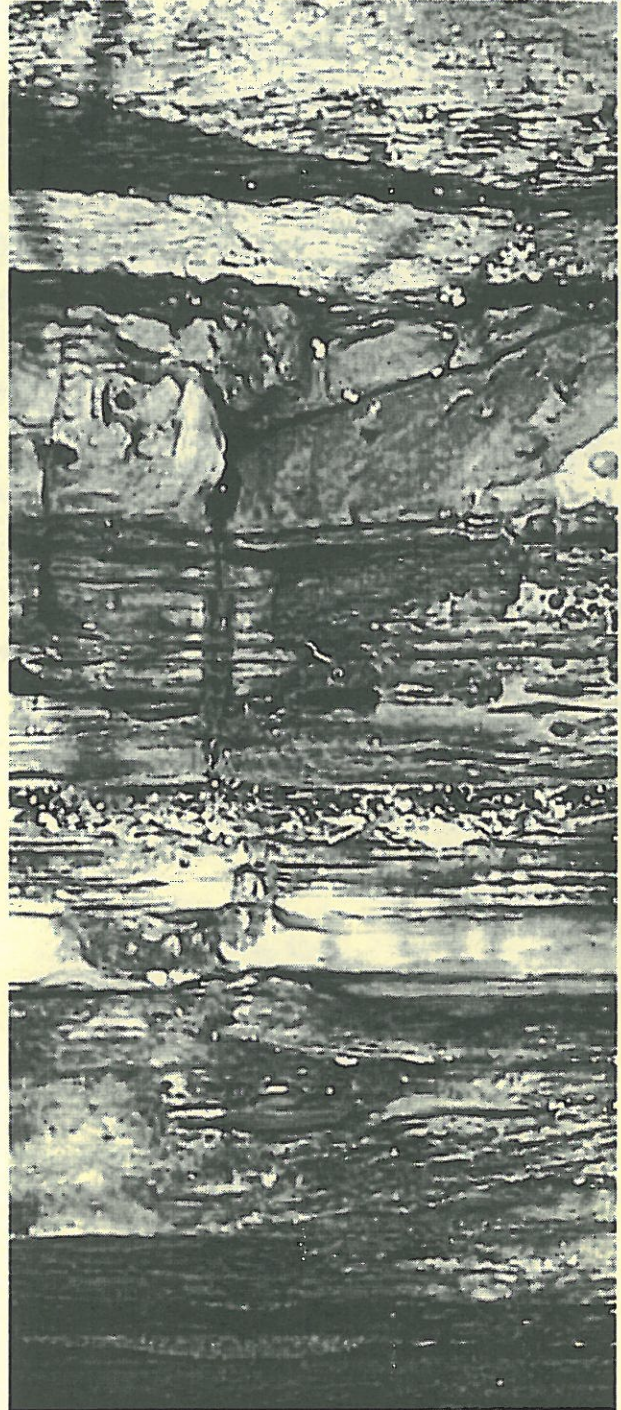
measure it on the map. But wait a second, pointed out Mandelbrot. How long is your ruler? A coastline is made up of large bays, within which nest smaller bays; of capes, studded with smaller capes on their sides; all the way down, to boulders, pebbles and grains of sand. The length of a fractal depends on the size of the measuring stick used! Who cares? A hiker might. Just imagine you want to cross Galiano Island - a mere kilometre as the crow flies, across its northern end. Once on the ground, you discover that that kilometre is a series of sawtooth hills - up and down and up and down! There is a lot more than one kilometre to cross on the measuring scale of your footstep.

In 1975, Mandelbrot published a book called "Les objets fractals", soon translated into English and many other languages. Doesn't sound like a best-seller? You should see the pictures. Mandelbrot explained fractals to a general public and created a zoo of fractals resembling natural objects, bringing into practicality a branch of mathematics formerly thought to be full of 'monstrous functions'. The most beautiful picture is that of a mathematical creation of infinite complexity now called the Mandelbrot Set. There are books as well as computer software devoted to it. People who use it as a screensaver have been known to be caught in the contemplation of its ever deeper repeating complexity, trapped in a trance from which only a power failure saved them.

Fractals surround us. There are fractals all over the Web. For a tutorial and guided tour, see [www.geocities.com/CapeCanaveral/2854/](http://www.geocities.com/CapeCanaveral/2854/). There is a beautiful picture gallery at ; [.www.graffiti.u-bordeaux.fr/MAPBXroussel-fractals/mandel.html](http://www.graffiti.u-bordeaux.fr/MAPBXroussel-fractals/mandel.html)

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**Paul LeBlond** is Professor Emeritus of Earth and Ocean Sciences at UBC, and a Galiano resident.



**above & p.11: fractal formations at Montague Harbour. Photos by Larry Foden**



## A LAUGHLIN LAKE DIARY

Dana Weber

Some older maps of Galiano show Grieg Creek flowing unimpeded through the area we now know as Laughlin Lake. But years ago the creek was dammed by beavers. The resulting lake was named for the family that once logged and farmed around it.

There are conflicting stories of how the beavers came to reside on a small island separated from the mainland by several miles of salt water. Someone told us an employee of the Vancouver Aquarium once brought a pregnant beaver to Galiano; the beaver got loose and the island beavers are her descendants. Other islanders insist that's a story they tell to pull the legs of week-enders

from Vancouver like us. They say the beavers have simply "always been here."

We had begun to wonder if the beavers themselves were apocryphal until, on one of our nightly walks to the lake, we heard them diving and slapping the water with their tails. And tonight for the first time we actually saw them.

We pushed our way to the edge of the lake through a thicket of broom. The broom is another story. Unlike the beavers, its provenance is not in dispute. The first seeds were planted at Sooke in the 1850s by a Scottish captain named W. Colquhoun Grant. He got the

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seeds from the British Consul in the Sandwich Islands, so they were already well travelled by the time they arrived here.

From Grant's three surviving plants, broom has spread to dominate open, sunny areas everywhere in south coastal B.C. and the U.S. Northwest. Much of the time we spend here restoring our previously neglected land involves pulling or lopping the pernicious stuff from tree-high stands as dense as grass. Our hope is to turn part of the property into a Garry Oak meadow – one of the native ecosystems seriously endangered by encroaching broom.

Birdwatching walks to the nearby lake have become one respite from broom-pulling. During the spring and fall migrations, hooded and common mergansers, widgeons, loons, mallards, ring-necked ducks and Canada geese all pass through. By midsummer, only a few resident buffleheads remain on the water, joined by the kingfishers, pileated woodpeckers, and eagles in the trees along the shore.

We were lamenting the lack of bird life one night, when a solitary beaver swam into view. It was soon joined by another, and then a third. They swam in oval laps, looping each lap closer to the point of land where we were watching; watching us back. Occasionally they made a show of diving down with a loud splash, but most of the time they seemed more curious than alarmed.

We eyed each other for all of twenty minutes, their full heads, dark noses and small pointed ears clearly visible above the water and their long sleek bodies rippling its surface. If we'd had any doubts about what we were seeing, they were dispelled when one beaver lumbered up the opposite bank for a bite to eat, dragging its broad flat tail behind it. Finally, those still in the water also tired of the game and headed back to their lodge. One

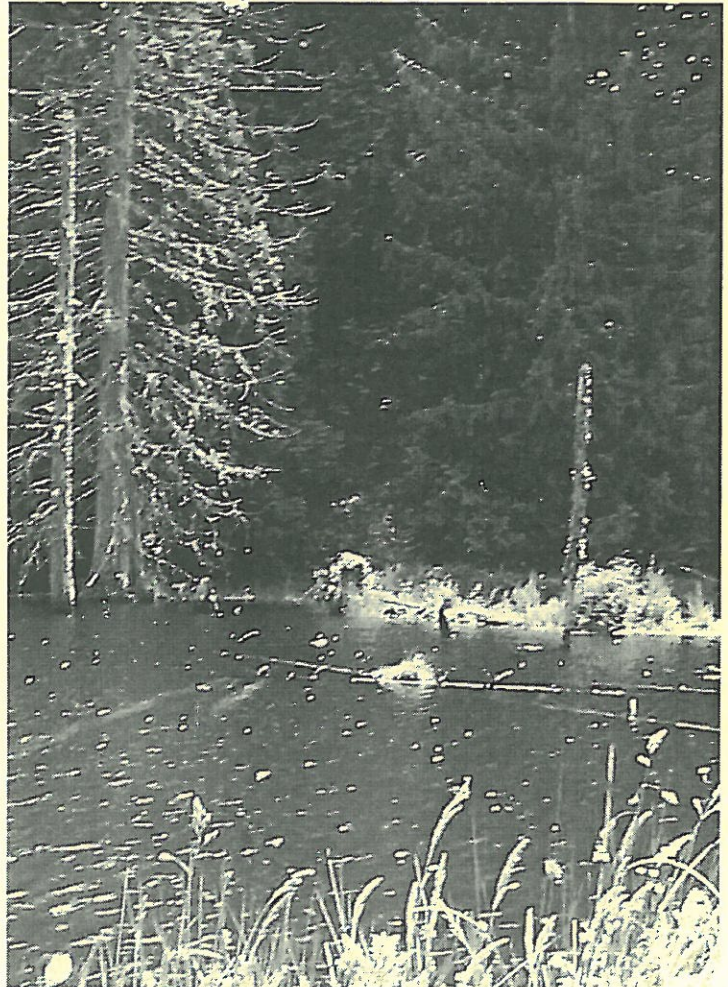
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swam away with a branch of young alder in its mouth.

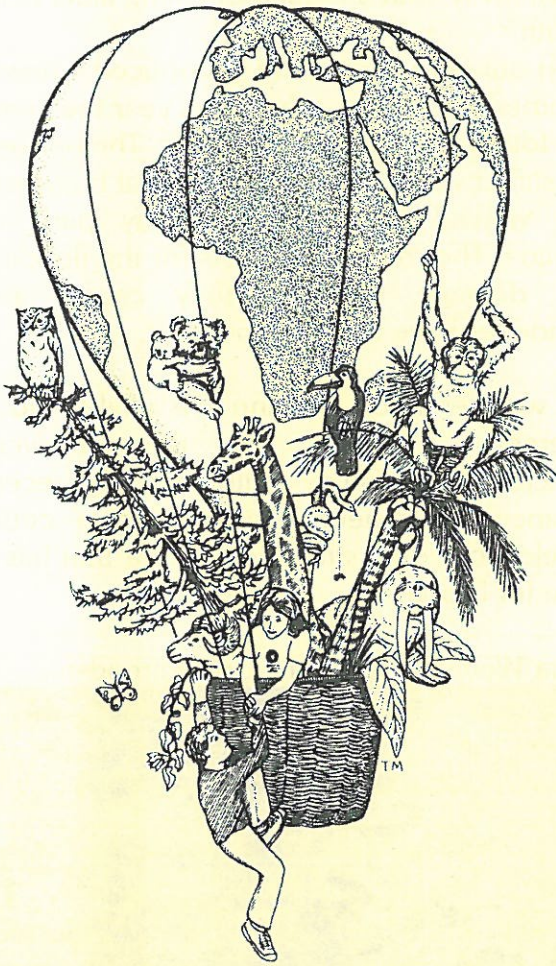
On our own way home we noticed a newly dammed backwater, where last year the creek had found its outlet from the lake. The beavers are still at work, but their proverbial busy-ness isn't viewed favourably in many parts of Canada. They're seen as pests for the flooding and damage to trees they cause, and authorities have them trapped out.

I wonder if on Galiano we might find a different solution to the beaver's voraciousness. Surely with all the recent advances in genetic engineering we could develop our own strain here – one that has a taste for broom.

**Dana Weber** is a part-time Galiano resident.



**Laughlin Lake photos by Jillian Ridington**



## **EARTH EDUCATION: For All Who Love this Planet and its Life.**

**Angela Jean-Louis**

*In March, I travelled to Alberta to attend a workshop offered by Steve Van Matre. Steve is founder of the Institute for Earth Education, a non-profit international network of individual volunteers and member organizations. In the past twenty-five years, the institute has become the world's largest group of educators dedicated to helping people live more lightly on the earth. The weekend was filled with amusing anecdotes, inspiring stories and poignant messages. Steve spoke of the history and the future of Earth Education. Here's some of what I gained from the experience.*

In the early 1970s, as awareness of environmental problems grew, the environmental education movement began. Somewhere along the way, it started to become everything to everyone. Soon, almost anything could fit into the category of Environmental Education, from kayaking to water testing, horseback riding to orienteering. Some environmentalists saw that the concept of environmental education was being trivialized; they felt that it must be a serious educational response to the ecological crisis on the earth. They set to work to develop an alternative. This was the beginning of Earth Education.

Earth Education offers a way to help people improve their cognitive and affective relationship with the earth's natural communities and life support systems, and to begin crafting lifestyles that will lessen impact upon those places and processes. Of course, there is nothing wrong with teaching kids orienteering or kayaking. These are wonderful skills, and exciting activities, and they get kids outdoors. But they should be called what they are: field studies, or outdoor recreation. Education that teaches people about the environment, without asking them to make some changes in their lives, is not Environmental Education; it's natural science.

*"Earth Education is...the process of helping people live more harmoniously and joyously with the natural world".\**

Earth Education offers focused, sequential, cumulative environmental education programs that have specific learning outcomes. It is not simply curriculum activities, together with outdoor pursuits and socialization experiences. Rather, it is a genuine, highly participatory, instructional program that immerses the learners in an engaging experience and shows them how to lighten their environmental footprint.



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## THE PRINCIPLES OF EARTH EDUCATION

### *The WHYS*

Preserving: *"We believe the earth as we know it is endangered by its human passengers."\**

I don't need to belabour this point; the health of this planet is at great risk. Earth Education exists to preserve the extraordinary richness and biotic health of the planet by changing the perspective and habits of its human inhabitants.

Nurturing: *"We believe people who have broader understandings and deeper feelings for the planet as a vessel of life are wiser and healthier and happier."*

We can't understand the world by intellect alone. Wisdom lies in fully grasping our ecological relationship with the earth – using both our head and our heart. Earth education exists primarily to help people develop a better sense of relationship with the natural world. Because many humans have become estranged from the places and processes that sustain them, improving on this personal contact and connection lies at the heart of Earth Education.

Training: *"We believe earth advocates are needed to serve as environmental teachers and models, and to champion the existence of earth's nonhuman passengers."*

The Institute for Earth Education provides both introductory training and an organizational home for those who want to become earth educators. It provides the framework and the tools, and encourages people to create their own earth education programs. Earth educators have designed and published several complete programs that are being taught in hundreds of locations around the world.

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## *The WHATS*

Understanding: *"We believe in developing in people a basic comprehension of the major ecological systems and communities of the planet."*

To better understand our place in the biosphere, and comprehend what that means for us, Earth Education focuses on the "big picture" – the ecological processes of life on planet earth. Four key understandings explain the basic functions of life on this planet: the flow of energy, the cycling of matter, the interrelating of life, and the changing of forms. These four concepts are the underlying focus of all programs.

Feeling: *"We believe in instilling in people deep and abiding emotional attachments to the earth and its life."*

Earth Education exists to introduce people to the natural world, to get them in contact with it, and in so doing, to cultivate positive feelings towards it. These include: joy at being in touch with the elements of life; kinship with all living things; reverence for natural communities; and a love for the earth.

Processing: *"We believe in helping people change the way they live on the earth."*

Understanding and feeling are not enough; people must incorporate them into their personal lives. Earth Education is about processing and absorbing insights, and relating them to their own lives. Again, there are four components: assimilating understanding of how life works on the earth; enhancing feelings for the earth and its life; crafting more harmonious lifestyles; and participating in environmental planning and action.

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In essence, Earth Education is about the head (understandings), the heart (feelings) and the hands (processing). Earth Education is about change.

## **The WAYS**

**Structuring:** *"We believe in building complete programs with adventuresome, magical learning experiences that focus on specific outcomes."*

This is where things become complex. Structuring is the framework for Earth Education programs. This means building programs that include the three WHATS (understanding, feeling and processing) and designing the learning experiences for each of those components, in a focused, sequential, cumulative fashion. It also means making these activities interactive and dynamic, to serve as powerful springboards for experiences that take place at school and at home. Finally, it means the way those pieces fit into a whole – an overall program that is so carefully crafted and so rich in detail that it becomes synergistic, or more than the sum of its parts.

The following are some structural guidelines for crafting and conducting Earth Education programs. Earth Education creates magical learning adventures, focuses on sharing; emphasizes rewards, reinforcement, and relationships; and provides models of positive environmental behaviour. On the downside, these programs are very complex, highly dependent on props, and leader intensive.

Here's an example: Can you remember being taught photosynthesis? You were probably shown a formula in a book and told "Remember this, it's really important". Perhaps you did remember it, but I bet very few of you really "got it". Compare that with this – a condensed version of an Earth Education activity that deals with conveying the process of photosynthesis.

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The kids are led to a "top secret" area; signs announce that it is restricted to "authorized personnel only." They arrive at a large, cave-like structure made of green canvas and thatched with branches (to represent a giant leaf). After some lead in about the basic process of the sun's energy being transformed into a form that we can eat, and a little prompt about the importance of the mission they are about to go on, each child is handed a green hard hat and asked to enter the 'leaf'. Once they are all inside, a mysterious voice comes from the outside, "Prepare for your shift at the food factory." The students are then faced with the task of becoming chloroplasts; they set to work breaking down molecules of carbon dioxide and water (ping-pong balls are sent down a tube from the outside of the 'leaf'. Molecules are velcroed together and labelled appropriately, C, H, O). Next, they try to build food 'sugar' from these individual molecules. The velcro is placed so that this task is impossible without the missing part: sunlight. Down comes the sun-energy ball through a tube that has the appropriate placement of velcro to build a sugar. The oxygen by-products are sent back out of the leaf. After the students emerge from their shift at the food factory, they are rewarded with a slice of orange, a product of their labour in the leaf.

Wouldn't you remember the process of photosynthesis if you actually had the chance to become part of the process? This is just one activity in Sunship Earth, a five-day residential program.

**Immersing:** *"We believe in including lots of rich, firsthand contact with the natural world."*

Earth Education strives to get people in direct contact with wild and growing things – the elements of life. It enriches people's perception of what is around them. Finally, it encourages pleasurable experiences in a natural environment.

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**Relating:** *"We believe in providing individuals with time to be alone in natural settings where they can reflect upon all life."*

This reflection includes introspection; participants are encouraged to reflect upon their lives. Earth Education tries to help learners relate both with and to other life of the earth. This means relating with other life on an affective level, relating to it individually on a cognitive level, and then examining their own lives in light of both experiences. Providing some time in solitude helps to accomplish these things.

So, there you have it; the nuts and bolts of Earth Education. Be assured, it is not namby-pamby, airy-fairy, 'let's-go-hug-some-trees' activities. Its programs are highly structured, and get children in touch with nature, having fun while participating in exciting learning experiences. They appeal to children's sense of adventure and discovery, and stimulate their minds while encouraging a deep respect for the earth. The programs offer tools and skills that, however difficult to measure, are of paramount importance for the life of the planet.

At present, there are three published programs: Sunship Earth, Earth-keepers and Sunship III. These programs took from five to fifteen years to develop – years spent in planning, before the designers were sure that they worked. Those who have used them say that they do work, and work well. In fact, the Scottish government has committed long-term funding to monitor the impacts these programs are having on Scottish youth. Earth Education all began with a handful of concerned people, who decided that the environmental education movement was not offering enough, nor providing the right skills to help ensure any positive change in the environmental problems the earth is facing. These programs just might save the world.

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\*All quotations (in italics) are from: Van Matre, Steve. *Earth Education: A New Beginning*. The Institute for Earth Education, Greenville, WV. 1997

The illustration on page 16 is from: Van Matre, Steve & Bruce Johnson. *Sunship III: Perception and Choice for the Journey Ahead* Greenville, West Virginia; Institute for Earth Education, 1997

Both these publications are available at the Galiano Conservancy Library.

**Angela Jean-Louis** is a Galiano mother and educator.



**Calypso Bulbosa** by Ronaldo Norton



photo collage: Larry Foden

## ***Classroom and War zone: Dissent in New York and Quebec City***

**Meg Holden**

Manhattan is on the major flyway of human ideas. When minds stop here to congregate, the result can be one of the most intense intellectual privileges of New York City life. For two solid days in late February, the words and ideas of revolution bounced off the big walls of Hunter College and a thousand participants anxiously tried to catch them. We talked about Technology and Globalization, and how these things are neither natural nor inevitable. Here at last were the leaders and members of the mass popular opposition to globalization, finding new words

and ways of exposing its absurdities and its challenges. The Hunter Teach-in speaks to the great potential of change, on a local and global scale.

Two months later (April 18-22) they surfaced again: the ideas and the leaders from the teach-in, and 50,000 or so more of their friends. The new venue was Quebec City, site of the 2001 Summit of the Americas, where the leaders of 34 nations in the Western Hemisphere (Cuba excluded) met to sign the Free Trade of the Americas Agreement. The national leaders remained behind the 3-metre high security fence, along with 6000 police in riot

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gear, the largest police mobilization in Canadian history.

The leaders and supporters of the revolution were locked out, flooding the streets, churches, synagogues, university buildings, and the tents set up for our parallel People's Summit of the Americas. The volley of new ideas in Quebec was cut short by 4709 canisters of tear gas (so much they had to order more from the US), many launched deliberately into designated peaceful protest areas, at civilians and medics; 822 plastic bullets; water cannons laced with pepper spray; at least 500 arrests; thousands of injuries; and the deadly oppressive fear that comes from police omnipresence. The story of Quebec is neither rational nor coherent; it is best told through the horrendous images that document the very real personal risks of simply demanding discussion about change.

**Privatizing Lives, Privatizing Debate:** At Hunter College, Jeremy Rifkin, from the Foundation on Economic Trends, described the fusion of computer and genetics technologies. The 1970s breakthrough in using computers to manage and exploit genes, when scientists successfully began recombining slices of genetic material, has been compared in significance to the first capture of fire. Still, this isn't engineering. Engineering processes have standard production methods and predictable outcomes. Genetic recombination is neither standard nor predictable; genetic tinkering and tampering yields constantly surprising results. These include mice that grow to twice their size when injected with human genes, and the tobacco plants, crossed with the gene for firefly light, that glow in the dark.

Anuradha Mittal (Food First) explained how genetic engineering allows foreign genes, bacterial and viral vectors, viral promoters, and antibiotic marker systems to be engineered into food. Each engineering event may contribute to genetic pollution, or the proliferation and continued mutation of new creatures that pass modifications to their offspring. This could make disease-causing bacteria resistant to current antibiotics, and increase the spread of infection and disease. Despite the biotechnology industry's threats and lawsuits launched to stifle scientific test results, 22 leading scientists still say their tests suggest

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genetically engineered food suppresses human immune systems.

Biotech companies are competitors in a well-financed race to map the 30,000 or so human genes and the proteins each gene codes for. Once isolated, each gene can be placed under monopoly product patent. It's legal – and the technology exists. It is just a matter of time before ownership of human genes, of entire human beings from the moment of conception, will be possible. Patenting life forms is the most frightening example of the broader trend in global rules for corporate activities and intellectual property rights. Tony Clarke, of Ottawa's Polaris Institute, explains other ways global trade agreements protect technology and enforce their rules. Pharmaceutical corporations prevented South Africa from passing legislation to ensure affordable access to drugs. Europe is getting its arm twisted over its ban on hormone-treated beef through an onslaught of trade sanctions.

Clearly, the rules that fit these practices, scripted in our international trade agreements, have more to do with constraining citizens' and governments' rights than with "free trade." Lori Wallach (the Public Citizen), pointed out what a free trade agreement would look like: "It would be one page long. It would say No Rules." Instead, NAFTA, the WTO, and the new Free Trade of the Americas Agreement (FTAA) establish rules for corporate protectionism, like 20-year monopoly marketing rights for patents, and investor-state dispute resolution mechanisms that ensure investors their future profits will not be undermined by regulations. Harmonization is another key to global trade agreements. It means the burden of proof is on governments to show that requirements and incentives are the least trade restrictive. It means striving for the lowest common denominator of human rights and environmental protections.

Under NAFTA, the US has lost over a million jobs from factories relocating to Mexico, a million more Mexicans are working for less than the \$3.40 per day minimum wage, and 8 million Mexicans have fallen into poverty from the middle class. The FTAA will expand the effects of NAFTA to 34 nations of North, Central, and South America and the Caribbean. The FTAA will also provide a back-

door ratification of the WTO's Multilateral Agreement on Investment, which was only stalled, not stopped, in Seattle. Corporations will be permitted to sue governments directly for the removal of standards or laws designed to protect health, safety, and the environment wherever these things increase corporate operating costs. It's already happening. When Canada opposed a toxic additive to gasoline (MMT), the US-based Ethyl Corporation sued for imposing unfair trade barriers; Canada was forced not only to lift the ban on this additive but also to pay the corporation \$13 million in damages for the time that sale of the stuff had been prevented. Nonetheless, Canada graciously hosted the FTAA meeting this April in Quebec City.

**This is What Democracy Could Look Like:** We need bold new policies. We should be able to agree, for starters, that certain goods should not be traded, others should not be commodified at all, and that life forms should not be patented. Leaders like Chee Yoke Ling of the Third World Network support dissolving the Bretton-Woods trio: the World Trade Organization, the International Monetary Fund, and the World Bank. They can be replaced by indigenous people's movements, like that led by Vandana Shiva (Research Foundation for Science, Technology, and Ecology), which aims to protect and perpetuate agricultural practices, and accompanying cultural rites. John Cavanagh, from the Institute for Policy Studies, proposed rules on capital flows to ensure human rights and environmental protection goals are given equal attention to trade in international agreements. These would include country-readiness criteria prior to trade, consensus certification that goals are being met, and abolishing the fast track agreement process and freelance trade negotiations.

At the Hunter College teach-in, Paul Hawken took a circumspect and enthusiastic look around at the forty some speakers and many hundreds of participants and saw the movement happening. He made everyone attending look at themselves as part of largest, most united front in world history – a movement that included people from diverse backgrounds, life histories and ethnicities. Many times over the weekend, the crowd sat so silent and captivated that speakers had to stop and

scratch their heads: "You know, usually by the time I say this I'm getting food thrown at me." In Quebec, the movement showed itself to be about 50 times larger, both more diverse and more unified. The experience of Quebec, however, was less therapeutic, leaving many with a sinister conviction: that the movement will not advance without many more of us trading in our reading glasses for gas masks. That the place we'll find we most belong is together in our diverse humanity, sometimes in safe university auditoriums, but also in the streets, putting ourselves and our ideas at risk in order to keep safe our dissent.

**Meg Holden** is a former and future resident of Galiano who is currently completing her doctorate at the New School for Social Research in New York.

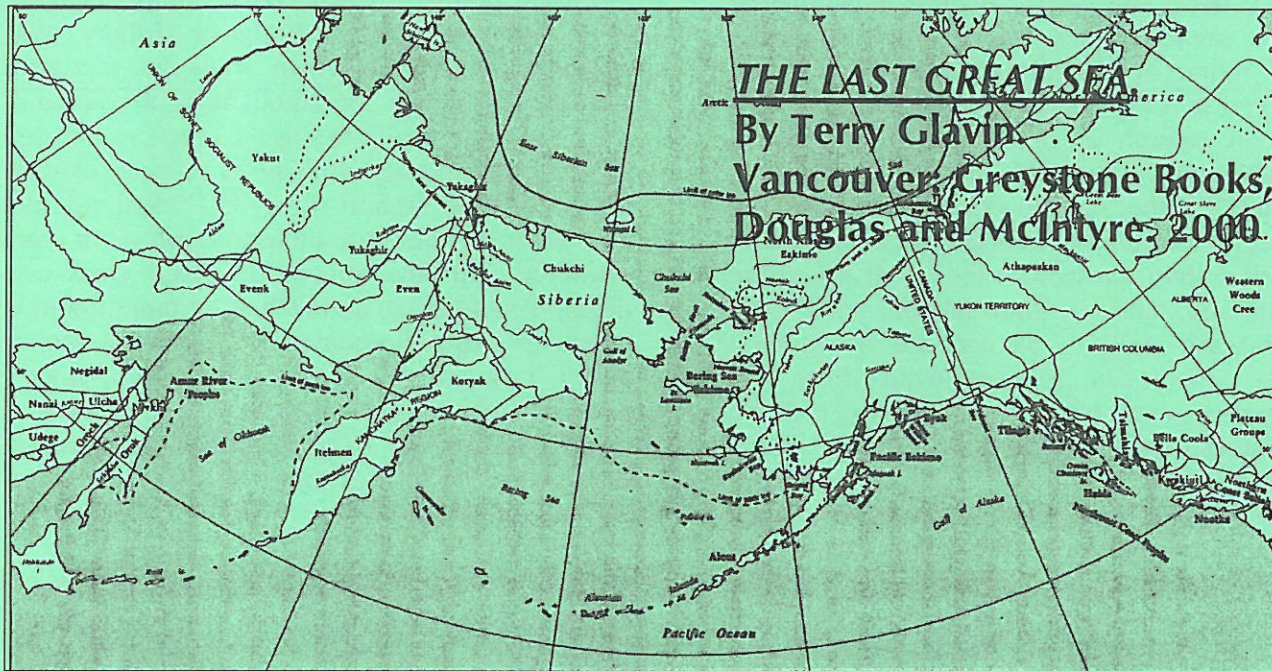


*photos courtesy of the anti-FTAA collective*

### **Write to Archipelago**

Have you noticed an interesting landform on Galiano? Do you have comments on saving seeds or grey water, or on environmental education? What do you think about free trade, globalization, the way our government handled the Quebec summit? Send the Editor your responses on any article published here, and we will try to print them in the next issue.

## Reviews



Reviewed by **Robin Ridington**

Webster defines a sea as:

*One of the larger bodies of salt water, less than an ocean, on the earth; a body of salt water of second rank, more or less landlocked and generally forming part of, or connecting with, an ocean or a larger sea.*

If a sea is a landlocked body of salt water, Terry Glavin suggests that a Great Sea is both open to an ocean yet in intimate contact with adjacent shores. Our sea, the North Pacific, is in Glavin's words, "The last Great Sea." The shores of this sea stretch in a generous arc into from California to Japan. These sea-lands once supported a continuum of salmon-bearing streams and rivers, and a continuous series of human societies exquisitely adapted to this resource.

From Vancouver Island to the Gulf of Alaska, the North Pacific reaches far inland to nourish a wealth of coastal and intertidal life. Throughout the entire North Pacific Coast, rivers great and small reach deep into continents, while smaller streams penetrate islands from Japan's Hokkaido to our own Gulf Islands.

Salmon, who spend their adult lives at sea, are nourished, through a complex food chain, by plankton gardens blooming far from shore. When they return to spawn in the rivers and streams of their birth, they bring that pelagic energy with them.

In this engagingly written book, fellow Gulf Islander Terry Glavin reminds us that the wealth the Salmon bring inland has an impact far beyond the obvious one of enabling humans to develop and maintain complex societies. Glavin writes:

*The contribution that salmon make to terrestrial ecosystems deep within the continents surrounding the North Pacific has never been fully acknowledged by science. It has never been taken into account in fisheries management regimes. ... The picture that emerges is of animals that arise from the depths of the Pacific to make journeys that take them inland, often far beyond the coastal landscape, and that do not stop migrating when they spawn and die. Indeed, they continue on through the countryside, wraithlike, and long after death they remain key participants in an ongoing conversation occurring throughout terrestrial ecosystems (54-55).*

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Glavin introduces us to Tom Reimchen, a biologist who specializes in the relationships between salmon, bears, and a whole range of species found in coastal rain forests. He has discovered that marine derived nitrogen from the bodies of salmon is distributed throughout a salmon-bearing watershed. The "famously insane fecundity" of the rain forests results from the presence of salmon and bears, who "act as a kind of transit system throughout the forest for all the nitrogen and nutrients that salmon bring back from the sea" (62). Salmon are no more a resource that can be removed from an environment with impunity than are the old growth trees they help sustain.

The North Pacific environmental zone extends well beyond its salt-water shorelines. Damage to the inshore ecology effects the pelagic environment, and industrial extraction of offshore "resources" has an impact far inland. Glavin's book goes on to document the horrendous effects that unsustainable whaling, sealing and fishing has had on the North Pacific ecosystem. As one species is hunted to near extinction, the industrial behemoth moves on to other "resources." Sea otters, whales, walrus, fur seals, salmon, and finally pollock, are pillaged and abandoned as the commercial catches fall to nil. What is a commercial collapse is far more significant ecologically. The last great sea is rich, but finite in its capacity to withstand industrial exploitation.

Glavin's book ends with a description of the energy source that sustains life in the last great sea. Tiny photosynthetic cyanobacteria pull down energy from the sun. Zooplankton consume them as they reproduce and die within hours. Copepods take up the chain of energy, and eventually other fishes and salmon stream the energy back to bears and cedars and human beings on the pacific shores. Since the end of the Pleistocene, humans have been part of this cycle of energy. Glavin quotes studies that estimate the aboriginal harvest of salmon as being close to that of the late nineteenth-century commercial fishery. Aboriginal societies that take this level of catch, he says, develop a complex social organization and an elaborate division of labour. A similar transformation of hunter-gatherer societies, he

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notes, can be documented on the Asian side of the North Pacific.

Glavin points out that despite its overall high level of catch, the aboriginal fishery was ecologically quite different from an industrial fishery. Fishing was spread out along the salmon's migratory route, and site specific practices ensured "the genetic and spatial diversity so necessary for the survival of salmon runs" (93). Systems that had been in place for thousands of years were disrupted with the advent of mixed stock and ocean based fishing, and with the establishment of canneries along the coast. The business plan, as Glavin notes, was, "You screw up, you open a cannery farther up the coast, you get the public to pay for hatcheries, or you reinvest your capital, once the salmon are gone, in another industry altogether" (94).

Industrial exploitation of the last great sea is not confined to salmon fishing. Drift net fleets and huge pollack trawlers have torn great holes in the North Pacific ecosystem. Long-lived rockfish are almost gone from our inland waters. Over the past hundred and fifty years, populations of sea otters, fur seals, sea lions and various species of whale have been hunted to near extinction. But despite the enormous interactions between human activity and North Pacific ecosystems, natural cycles also influence changes in the ecological balance in ways that marine biologists and climatologists still understand only imperfectly. When one "regime" ends and another begins, "everything in the ecosystem responds, from plankton to whales and everything in between" (196).

Glavin uses a vivid series of vignettes, anecdotes and historical notes to remind us that the sea we know today was once a much richer and more complex ecosystem. He ends with the hopeful note that with care and understanding, humans can learn to reintegrate themselves into the living world of the last great sea.

**Editor's Note:** On May 4<sup>th</sup>, 2001, *The Last Great Sea* won the Hubert Evans prize for the best non-fiction book published in BC in 2000.

**Robin Ridington** is Professor Emeritus of Anthropology at UBC, and a Galiano resident. His *Trail to Heaven* is a previous winner of the Hubert Evans prize.