

BRINGING THE OCEAN INTO SCHOOLS AND SCHOOLS TO THE OCEAN

By Catherine Carolsfeld (née Pennachetti) and Joachim Carolsfeld

"I like the discoveries of the sea tank each time I look at it."
(10 year old Elementary School Student)

*"Some specimens in our tank that are local I didn't even know of,
and I've been around the oceans since I was really little."*
(Grade 11 student)

Creatures as Teachers

In 1999, a group of elementary school students in Victoria noticed an empty salmon tank in their classroom. They wondered: could it be used to study a marine ecosystem?

Those students didn't stop too long to wonder. Instead, they became the driving force behind setting up and caring for a chilled, saltwater aquarium in their school. Parents and other community volunteers, some of whom were marine biologists and divers, helped find the chiller, pump and other supplies they needed to build a prototype tank. Then they obtained the necessary permits to stock it with plants and animals from their local shorelines, and students began to study their new ocean ecosystem.

Six months later, they decided to share what they had learned with the rest of their community. They chose a school assembly to make their presentations about the plants and animals they had been getting to know, and invited their parents to listen.

Jamie, a grade seven student who had been loathe to engage in classroom learning, spoke with passion and enthusiasm about a nondescript marine animal called a sea squirt for which he had gained new-found respect. A parent sitting in the audience commented, "That can't be right. They're just creatures, not animals!"

By the end of the assembly, that parent knew that creatures like the lowly sea squirt *were* animals, and they were teachers too. Students, staff and parents had already begun to think about their world in a different way, thanks to the passion and commitment of those grade six and seven students. We began to understand the power of our youth as educators, and the seed for *Seaquaria* was planted.

British Columbians are all proud of the marine and freshwater habitats that help define our province and our identity. Yet many of us under-value the aquatic wealth at our doorsteps, and are unaware of how our activities affect oceans, rivers and lakes in our own communities. As population growth continues to stress aquatic ecosystems, British Columbians who care about

maintaining their waters for future generations need to be aware, to be concerned, to act. How can educators help?

As educators, we have a duty to create opportunities for our youth to discover the beauty and complexity of their world for themselves. Only then can we expect them to begin to understand and value their world, and to want to take the steps needed to protect it.

How do we create this desire to change how we think and behave? The example of those first "Seaquaria pioneers" back in 1999 showed that the school system can be very effective, and on two levels: by reaching youth during their formative years, and through 'vertical learning' where these students, as loveable messengers, take their lessons home and to the general public. However, careful thought has to go into how we engage students as messengers. While there are many excellent educational resources and programs that can be utilized in British Columbia (Snively, 1998, 2001; Arntzen *et al*, 2001; Boire *et al*, 2003; Fisheries and Oceans Canada, 2002), many schools still rely on the "three Ps": *Passive* teaching, with *Printed* materials and *Preserved* specimens. This approach sparks little enthusiasm and often uses examples far removed from the local environment (Orion, 1993; Orion *et al*, 1997). Common problems with the "three Ps" approach include lack of a local "hook" for the students, lack of continuity with other materials, and the scarcity of integrated and easy-to-use formats.

Seaquaria in Schools is one successful example of a more effective approach that we call "active learning" (Bonwell & Eison, 1991). In active learning, students are involved in discovery through field trips and "place-based learning" (Gruenewald, 2003) that begins right in their own classrooms and communities (Cummins & Snively, 2000; McBean & Hengeveld, 2000).

Why Seaquaria?

In 2000, a group of southern Vancouver Island environmental educators decided to combine water-themed programs (e.g. "Opening Minds with Water") into a more integrated package that stressed ecosystems. They produced an integrated package of field and classroom activities which is called "Living Watersheds".

At the same time that "Living Watersheds" was starting out, WestWind SeaLab Supplies, a local biological supply company, decided to take the idea of aquaria in schools beyond the freshwater salmon tank that the previous year's students had put to such good use. Freshwater tanks had long been used to raise baby salmon as part of the Canadian Department of Fisheries and Oceans' "Salmonids in the Classroom" program (Fisheries and Oceans Canada, 1998), but Westwind decided to go a step further: -to place chilled seawater aquaria ("Seaquaria") in schools.

WestWind's first Seaquarium was just a seasonal conversion of a salmon aquarium, but the marine creatures were so popular that an aquarium designed specifically for saltwater was soon built, stocked with a local marine ecosystem, and maintained throughout the year by the students.

A new showpiece for the school had been created; ever since, students have been able to study the ocean environment "almost as if they were a part of it," and



have eagerly shared their learning along the way.

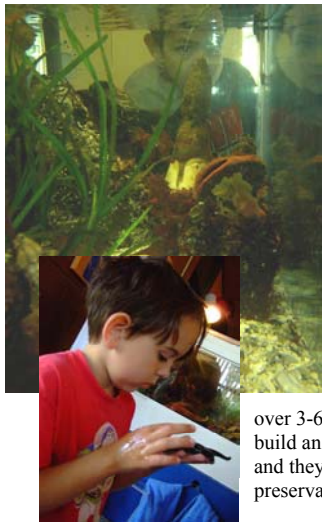
Seaquarium & display at Pleasant Valley School, Nanaimo, B.C.

Bringing the Ocean into Schools and Schools to the Ocean

"I learned about how all the different animals have a different way of life...(and) how to take care of the creatures at the shore. You need to put the rocks back for their homes."
(10 year old Elementary School Students)

"All the species are from around this area and then I go down to the beach and see the things I learned about."
(Grade 11 Student)

"The organisms in the tank were from the Pacific Coast, so we got to view creatures from our area. We got the privilege of seeing live organisms interact with the environment and other organisms around them, instead of having the teacher/textbook try to explain it to you."
(Grade 11 Student)



"Seaquaria in Schools" is about enrichment of education. In each participating school, the Seaquaria tanks are permanent fixtures that afford a unique window into the local marine environment. Because the aquaria are continually available to the students, they can be used to weave environmental awareness into the students' everyday lives – no matter what the season. Learning outcomes are met easily, in an ever more engaging fashion. They are also a springboard to new learning opportunities; their impact is limited only by the imagination of the children and their teachers.

The marine ecosystem in Seaquaria is ever-present and ever-changing, an exceptionally effective catalyst that draws students into hands-on learning. With aquaria over 60 gallons (240 litres) in size, the systems are remarkably stable, each evolving their own character over 3-6 month periods. As students care for their aquarium, they build an understanding and respect for the organisms in their care, and they develop the stewardship skills essential for the preservation of our natural resources.

Seaquaria provide a unique glimpse into the world around us.

Husbandry sheets for the different organisms and the aquaria themselves are continually evolving, with student and teacher input. As students learn to deal with everything from slowly changing conditions to sudden spawning and other unexpected emergencies, they also begin to formulate personal, ethical values and develop important problem solving skills. Related programming helps them recognize interconnectivities, and to link their insights and skills to the real world. In so doing, the aquaria foster a passion for learning and critical thinking in many areas of the students' lives, which is anchored in responsible environmental stewardship.

Cummins and Snively (2000) link success in learning to the availability of opportunities that are personally meaningful to students. The *Seaquarium* is an excellent real-world example of their findings: it has been described as a "gateway" to community-wide learning initiatives, with many "hooks" that help achieve successful learning. These hooks include local context (creates a "sense of home"), opportunities to interact with living organisms (adds a feeling of personal connection), a venue to observe the novelty and complexity of nature, and endless opportunities for acquiring and sharing special knowledge. In addition, the basic "user-friendliness" of *Seaquaria* means they have come to be appreciated as manageable tools that remove some of the 'fear of science' at the elementary and middle school levels (Carolsfeld, 2001).

Increasing awareness of environmental issues in the Asia Pacific Region suggests that these countries of immense marine riches may be another natural fit for *Seaquaria* – especially at a time when the marine environment is increasingly stressed. In Japan, for example, numerous new environmental initiatives involve school children (www.japanfs.org). An Asia Pacific-Canadian exchange based on *Seaquaria* would introduce an open-learning tool into a non-Western society. The experience would afford rich opportunities for research, helping us to better monitor, evaluate and define the most successful common approaches to meaningful environmental education.

Mentoring in Action

"I like teaching the grade ones, they look up to me..."
(Elementary School Student from district wide severe behaviour class)

"I liked the big buddies teaching me."
(Grade 1 student)

There are as many ways to use the *Seaquarium* as there are teachers. Most of the information and resources needed to support the delivery of this kind of programs can be found in Snively (2001), Snively (1998) and Arntzen *et al* (2001). Many of the important tips for preparing students, and implementing field and classroom studies have also been described in Wright (2007).

Here, we introduce a few representative classroom and field programs that illustrate the basic framework for our approach. You might think of them as open-ended recipes—each with a unique flavor that reflects individual teachers, classrooms, schools, communities and ecosystems.



Project by grade 6 students, Lansdowne Middle School, Victoria, B.C.

1. The Marine Team

The phone rings at work and the voice of an anxious elementary school student greets me. Their beautiful Painted Anemone has a death grip on their lumbering but lovable Sea Cucumber. What should they do? I suggest that they wash and rinse their hands well, so that they don't introduce

any harmful chemicals into their ecosystem, reach into the tank, and gently remove the cucumber from certain death. “No”, they say, “We need Joseph”, a younger, but experienced student who they have identified as their first line of contact in times of emergency. They say that they will take care of it and I ask them to call me back.

Ten minutes later the phone rings again. The cucumber is safe. Joseph has gently rescued their team mascot from certain death and with skill and compassion, placed the anemone into a bucket of seawater and into the refrigerator. They wonder if they should send their anemone to the WestWind seawater system. They think it is too big and aggressive to live in their *Seaquarium*. They recognized that the Painted Sea Anemone, a high level predator with stinging tentacles, was tipping the balance point of the ecosystem in their tank.

These eight to ten year old students have taken their job as *Seaquarium* guardians very seriously. Just as Cummins and Snively (2000) have documented, they are learning to work co-operatively, to learn at a deeper level and to hone their leadership skills as they encounter problems that need to be solved—largely because of the deep emotional tie they have developed with the animals and plants in their *Seaquarium*.

We begin our classroom studies by introducing our stewards to the job at hand: caring for an ecosystem full of plants and animals that share many of the needs the students have, but who have to meet those needs for food, shelter, protection, and nurturing in very different ways than we do. In this way the students also begin to think about how different creatures are adapted to the world they live in, and to appreciate the diversity of life. The conversation includes their responsibility to care for these unique neighbours and to share their new knowledge with others in the community.



Victoria West Elementary School students host Tillicum students in a morning celebrating “Scientists as Observers”.



In this way, the students begin to notice and understand how these creatures meet their needs, while also honing their observational skills. They also become very adept at troubleshooting and recognizing signs that the system is not working as well as it should, so that it can be fixed before any problems arise. The discoveries made during these routine checks prompt many interesting discussions, and often lead to new projects and announcements that help the rest of the school benefit from what they are learning.

Together, we set up teams of students who are responsible for monitoring the health and well being of their *Seaquarium*. Then we set up a marine team log book with data sheets, a feeding schedule and a list of community contacts in case of emergencies. Each day, they record the group name, date, time, temperature, salinity, water colour, water and air flow, whether the tank has been fed and any other observations that they think are important (for example, the behaviour of the animals).

Vic West Elementary Marine Lab Log-book 2001-2002												
Date	Time	Group	Temp	Sal	Water	Water	Air	skimmer	Glass	Light	Fed	Observations/Questions/Important Information & Ideas to share
No.	(C)	(ppt)	Colour	Good Flow	Cleaned	skullf	(M/W/F)					(Use as many lines as you need)
14/4/01	9:01	4	9C	✓	✓	✓	✓	✓	✓	on	✓	air stone was too far up
19/4/01	2:51	4	9C	✓	✓	✓	✓	✓	✓	on	✓	Cathey turned up the temp to 60
19/5	8:55	5	7c	✓	✓	✓	✓	✓	✓	on	✓	as sea slug has a colony that it likes to eat, they are called sea squirts
10/5	7:56	5	11C	✓	✓	✓	✓	✓	✓	on	✓	sp. animal behaviour done to SPIC (short notes)

Sample *Seaquarium* data sheet entries by Grade 6 students from Victoria West Elementary School, Victoria, B.C.

Before we know it, links to nearly all areas of study, including science, language arts, social studies, math and personal planning, begin to emerge. As students meticulously log information each day, their observational skills are honed and they begin to notice connections. Soon they begin to submit articles to the school newsletter, make announcements on the PA system, offer guided tours to teachers and younger students and start training the next teams, so that the entire school community becomes aware of the exciting events happening in the aquarium.

2. A Picture Book Project

Picture book projects have been very successful and powerful learning tools at all grade levels, because they allow students time to carefully observe, gently touch, and get to know animals and plants from their seaquarium, in a very personal and respectful way. Only after doing their own observations do they begin their research about the natural history of the creature they have chosen. They quickly realize that it’s not always easy to find answers to their questions, and that they might actually be the one to discover something that’s seldom, if ever, been seen before.

Janina, a grade six student from Victoria West Elementary School, described how they conducted their project: “For this assignment we had to observe all the animals in the Vic West *Seaquarium*, then choose one for research and observations. After researching, you had to make a picture book for younger children, giving true facts and information, in an interesting way. I am proud of it because I think it is one of my best projects. I worked very hard and learned a lot from researching it. It also made it a fun way to teach younger kids about what I learned, and I am proud of the job I did.”



Janina chose to study and write about the California Sea Cucumber. One of her illustrations (left) and some of the accompanying text (below, italics) helps demonstrate the power of creatures as teachers.

“Hi! I’m a California Sea Cucumber named Zucchini...I’m the big reddish brown, long, fat thing crawling along the bottom of the tank, vacuuming up all of the waste around

me for dinner...”

Meanwhile, Rico, a grade seven student and one of the most reluctant learners in the same class, was at an impasse, unable to turn his observations and research into a picture book story. “I’d rather be out in the skateboard park,” he said, just before he suddenly began to write. The resulting story connected the distinguishing characteristic of “his” creature (the prominent, muscular foot of the slug-like Sea Lemon Nudibranch), with a tale about a “Skateboarding Sea Lemon Dude”. A light had switched on!

This particular project was especially powerful because students used their self-published books to teach others about what they had learned. In this way, the *Seaquaria* program also helped develop students’ leadership and reading skills. We still use these books as classroom resources, and can’t begin to count the number of adults who have read them when they are on display at public events. The most common comment is “I had no idea....”

3. Liaison with field trips

The fit between *Seaquaria* and complimentary field programs of the "Living Watersheds" was a natural one, and the two have worked together ever since. New networks of community partners have provided innovative expertise and resources that make the classroom presentations and field studies relevant and exciting.



Middle school students use a transect line and quadrat to survey the intertidal zone at a local beach.

The connections between the classroom and the outside world have parallels with the connections between the aquarium and the ocean, and bringing the enhanced sensitivity and knowledge of the *Seaquarium* teams into established field programs has remarkable synergistic effects.

4. Community Connections

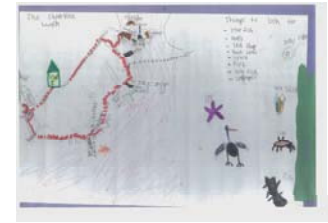
The students primed by the *Seaquaria* are exceptional resources for contributing to environmental awareness in the community and even community planning. As one example, I received a phone call from the manager of our local Community Center who informed me that the center was planning its first neighborhood celebration. Since some of their daycare students were on the *Seaquarium* Marine Team at the local school, he wondered if we could set up a display at their event.

In short order, students, staff, parents and community educators worked together to refurbish and set up a *Seaquarium* at the Community Centre. Grade six and seven students then introduced several hundred visitors to the weird and wonderful creatures they had been studying all year. Our youth were the centre of attention. At the end of the day, one of the students commented, “I didn’t know how much I knew, until I realized that I could answer a lot of questions from adults who didn’t know as much as I did”.

Since then, *Seaquaria* displays hosted by university, high school and public school students have continued to draw enthusiastic crowds not only at Vic West Fest, but also at conferences and other public venues throughout Victoria.

A second example is the development of important links between schools and their neighbourhoods, which often extend into the global community. We had been working with local teachers to develop a simplified mapping project which would help our students become better acquainted with their neighbourhood and to share this knowledge through their maps. As they walked the shoreline in their community, they recorded observations about features ranging from the temperature, salinity and turbidity (suspended particles) of the seawater at various locations, to aspects of Indigenous cultures and natural history along the waterway, and determining compass direction based on local land features and the position of the sun.

At the same time, the local community centre was embarking on a “Community Mapping Project”, in which local residents identified assets and areas of concern in their neighborhood as a basis to determine a long term vision for their community. They wanted to involve students at the local elementary school in the process, and get their input. After talking to the teacher and seeing the high quality work the students had done, the community association invited students to a community mapping workshop to teach *adults* about the important work they had been doing.



Example of Community Map by a Grade 5 student.

The result: on a beautiful spring day potentially full of other fun activities, several students presented their work to a gym full of adults from their community, proudly led them on a guided tour of their shoreline community, and highlighted the important features they had discovered on their journey that year.



Victoria West Elementary School Marine Team gathers together to help celebrate the unveiling of the Victoria West Visions map.

Some of their work has been incorporated into the “Victoria West Visions Map,” now prominently on display throughout the neighbourhood, and published by Ground Works (www.lifecyclesproject.ca/resources/map_vic_west.php). It is a glowing example of the networks that open up as we offer opportunities for our youth to become engaged in the natural world around them.

Assessment of Seaquaria in Schools

"I never thought I would learn so much until we studied with you. Thanks!"
(Elementary School Student from district wide severe behaviour class)

"It is a lot easier to understand how an organism lives and eats if you're watching it rather than just hearing about it or reading about it from a text book."
(Grade 11 Student)

"I am reaching students more deeply and successfully than ever before"
(Grade 6-7 Teacher/Vice Principal)

When we began our journey, our basic premise was that the simple learning of facts does not necessarily translate into knowledge or passion. We were convinced that the actual process of learning is much more important to the successful development of life-skills than simple memorization. While the kind of rote learning that still prevails in many parts of the world has largely been discredited, we wanted to go a step further: to show that teachers need not even know or teach all of the facts in order to use a tool like the *Seaquarium*. 'Knowing all the facts' might even be viewed as an obstacle to success!

We found the *Seaquarium* to be a model of open-ended learning: as teachers became more comfortable with it they began to find more ways to promote a spirit of enquiry and personal involvement in their students. Teachers now tell us this open-endedness has been one of the key components of the improved learning taking place in their classrooms. They also feel strongly that their students are acquiring the skills to make informed decisions about complex environmental issues, and understanding that such decisions cannot be made in isolation from social and economic realities. As a final bonus, teachers find that, by engaging so many of their previously reluctant learners, they are meeting their prescribed learning outcomes with less stress.

How do we know the *Seaquaria* program is working? First, students are eager to learn. Second, they are beginning to ask questions about connections in the world around them, using vocabulary like organism, habitat, predator-prey, food chains/webs, ecosystem, decomposition and bacteria, in a knowledgeable and understandable manner. These questions are formulated in a logical, scientific manner, often with novel insights. Finally, they are finding novel ways to share their learning with both local and global communities.

The Importance of Partnerships

"We demonstrated our sea tank knowledge with Sylvia from Brazil. She came to see how our program works."
(Elementary School Student from district wide severe behaviour class)

"Having the aquarium at our school (has) allowed students to SEE what they were hearing about in other programs, ask questions, look for more information and to want to learn"
(Grade 6-7 Teacher/Vice Principal)

Thanks to very active partnerships between teachers and other professionals in the community, there are now *Seaquaria* programs specific to elementary, middle and secondary schools. *Seaquaria* have clearly demonstrated the value of a focal tool or anchor that is relevant to communities – in this case the B.C. coast. But the same approach of local content, recognition of knowledge and enquiry, and active participative learning can be used with other aquatic or terrestrial ecosystems anywhere in the world, using tools that are relevant and practical within the particular environment. The possibilities – and the partnerships – are endless!

For example, our first overseas initiative involved trials with communities along inland waterways in Brazil as part of a CIDA-funded sustainable fisheries project (www.worldfish.org). Chilled marine aquaria were not appropriate for this location. However a combination of mapping of personal environmental spaces, local field trips, and watershed models worked well in the context of poor fishing communities on a Brazilian river, also providing opportunities for place-based, active and interactive participatory learning. The two programs operated in dramatically different situations—different languages and significantly different ecosystems. Nonetheless, the results were gratifying and eye opening as the Brazilian students responded to the *Seaquaria* approach just the same as Canadians.

In both Canadian and Brazilian projects, valuing personal knowledge and enquiry of the local environment enhances self-esteem and confidence, which leads to improved learning and emotional ties to the environment. And the learning continues to go in both directions: not only have many of the lessons learned in Canada been adjusted to suit the situation in Brazil, we are also already bringing back experiences that help our local programs evolve to new levels. We believe that the networks that are thus being established will be part of the foundation for a generation of respectful, informed and pro-active global environmental ambassadors (NEETF, 2002).



Esquimalt High School students and Brazilian youth get together for a field trip to a watershed on Galiano Island, B.C. (above) and to share their experiences using watershed models as teaching tools, in Victoria, B.C. (right).



All the teachers involved in *Seaquaria* agree that partnerships and community involvement have played critical roles in the program's overall success. The most successful individual programs were established in schools in which everyone was involved in planning and implementation right from the start. A good example was Victoria West Elementary School in

Victoria, where students, staff, administrators, parents and community facilitators worked together throughout the process.

But there is always room for improvement. We have continued to build new partnerships that create synergies between *Seaquaria* classroom activities and related field programs. There is now a teacher-driven effort to provide mentoring for new schools and teachers in the *Seaquaria* program, and to share learning, ideas, barriers and success stories. In this way, a powerful spontaneous network has begun to emerge, and we feel confident the program will soon be self-sustaining.

What are some of the concrete returns from these partnerships in learning? The list is long, but perhaps most importantly includes enthusiastic appreciation and respect for terrestrial, freshwater and marine organisms, their needs and stewardship care. Students begin to think about their world in a whole-ecosystem way. The relationships between these same organisms and humans become clearer, and this understanding promotes an enduring ethic of respect and conservation. Along the way, teachers witness increased interest in learning; improved utilization of existing educational resources; and improved academic performance.

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