

Science and Environment Education: Aquaculture in Focus

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SEAFDEC has always recognized the need for enhanced human resource capabilities at all levels and greater involvement by stakeholders to achieve sustainable fisheries development. As one of the mandates of SEAFDEC, human resource development (HRD) has been the focus of its training and extension efforts for 40 years. In the Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region, adopted during the Millennium Conference in November 2001, HRD was emphasized in the policy documents strengthening the efforts of SEAFDEC, viz: *“Acknowledge the need for enhanced human resource capabilities at all levels and encourage greater involvement by stakeholders to facilitate consensus and compliance in achieving sustainable fisheries (Resolution 3)”*.

The Aquaculture Department (AQD) for example, since its establishment in 1973, has conducted various training courses about different aspects of aquaculture and has graduated more than 5000 fisheries officers, aquafarmers, trainers, and students. With aquaculture being an important industry in the Philippines, a unique HRD activity was developed at AQD teaching aquaculture to children while they are still young, and this has been carried out through the SEAFDEC FishWorld at AQD’s Main Station in Tigbauan, Iloilo, Philippines.

SEAFDEC FishWorld

The SEAFDEC FishWorld program spawned when in the 1990s, groups of schoolchildren started visiting AQD year after year, and it soon became obvious that AQD had a separate clientele to serve the general public. In 1998, then AQD Chief Dr. Rolando Platon committed funds and broke ground for a facility that would highlight the work of

Box 1: Objectives of SEAFDEC FishWorld

- To provide a venue for visitors to learn about SEAFDEC’s research, training, and technology transfer programs for responsible aquaculture
- To inform the general public about aquatic ecosystems and biodiversity, responsible aquaculture and fisheries, biodiversity conservation, environment protection, and sustainable development.
- To operate a museum of aquatic biodiversity and provide taxonomic identification service
- To conduct aquatic biodiversity research and train students, teachers, and researchers in systematics
- To help strengthen science and environment education in schools and inspire students into careers in the aquatic sciences
- To build among citizens a deeper knowledge, understanding, and sense of stewardship towards the oceans, and the environment in general

Box 2: HRD Opportunities in aquaculture and environmental sciences

• Aquaculture Week

Sci-Art Competitions for High School Students

- Teaching aquaculture in High School
- Ecology and aquaculture quiz
- Proposals for High School Aquaculture Projects
- Biodiversity for livelihood
- Collect and document biodiversity
- Install a FishWorld Exhibit
- Seafood dish
- T-shirt design

Sci-Art Competitions for High School Students and Elementary School Pupils

- Easy writing
- Painting

Sci-Art Competitions for Elementary School Pupils

- Collect, Show and Tell
- Bring, Show and Tell
- Write a Fish Story
- Write and recite a Fish Poem
- Nutrition and aquaculture quiz
- Aquarium quiz

• International Coastal Cleanup and Fish Conservation Week

- R&D Internships
- FishWorld Ecology Camp
- Visitor Services

The SEAFDEC FishWorld has since then been proudly working with schools, students, and teachers in the Philippines to enhance their science and environment education. This article therefore describes SEAFDEC FishWorld's initiatives and experiences in providing various HRD opportunities (**Box 2**) through informal education in environmental sciences. The science and art competitions are held during AQD Aquaculture Week every July. A large number of schools, students, and teachers in the towns and cities neighboring AQD have participated and benefited from the various FishWorld events and competitions. In addition to the annual celebration of the Aquaculture Week, other activities include participation in International Coastal Cleanup and Fish Conservation Week, conduct of R&D Internships, arranging FishWorld Ecology Camp, and offering visitors' services, etc. The experiences at SEAFDEC FishWorld could offer examples of projects and activities to other HRD workers around Southeast Asia as to be included in their own educational programs.

Aquaculture Week

FishWorld's science and environment education program includes several science and art contests during Aquaculture Week in July as part of AQD's anniversary celebration. The sci-art competitions seek to build understanding and appreciation among students and teachers of the importance of aquatic ecosystems and biodiversity, and of responsible aquaculture and fisheries to food security and sustainable development. The contests require students to study and learn by themselves and with coaches and parents the specified topics and themes (aquaculture, fisheries, environment, biodiversity, etc.), to demonstrate special skills (painting, writing, speaking, quiz, field work, handicraft, cooking, etc.), and to produce some output (photojournalism posters, installations, research proposals, specimen collections, biodiversity reports, shell products, seafood entrees, etc.).

SEAFDEC and the importance of aquatic ecosystems, fisheries, and aquaculture. Thus was established the SEAFDEC FishWorld, a museum-aquarium-visitor center dedicated to science and environment education of the general public, children, adults, students, teachers, researchers, public officials, tourists, local residents, etc. The SEAFDEC FishWorld was opened to the public on 7 July 2000 during the 27th anniversary of AQD. Its objectives (**Box 1**) slowly crystallized over the past six years as various projects and activities were carried out.



Opening of Aquaculture Week (above); and high school teams preparing their biodiversity collections (right)



The Sci-Art Contests

The Aquaculture Week competitions started in 1995 and since then has expanded over the years. On average, 350 students and teacher-coaches from 35 schools participate with tremendous spirit every year. All participants and coaches receive Certificates of Participation. Winners and their coaches get Certificates of Merit and cash prizes (ranging from US\$6 to \$14). Certificates from FishWorld are much sought-after by students and teachers who use them to improve their resumes for higher grades and higher pay, respectively. To get FishWorld Certificates, contestants study about aquaculture, fisheries and the aquatic sciences, and display that knowledge and understanding through some output at the SEAFDEC FishWorld.

Teaching Aquaculture in High School

Given the importance of aquaculture to the Philippines, it should be taught earlier than in fisheries colleges, it should be taught in science or technology classes in high school, and even introduced in elementary school. This contest challenges teachers of science, technology, work education, home economics, and livelihood to learn the fundamentals of aquaculture and teach these to high school students. Teachers study the aquaculture production cycle, from choosing the seafood species and farm site, producing the seedstock in the hatchery, growing out the seafood in farms (ponds, pens, cages, or tanks), until harvest and marketing. They prepare a 30-minute lecture with appropriate and effective audio-visual aids. On contest day, they deliver their lecture to about 30 high school students from different schools and a group of AQD researchers. Teachers are scored for research done (20%), comprehension and elaboration of the topics (20%), audio-visual aids (20%), clarity of speech (10%), logic and order of presentation (10%), ability to answer questions (10%), and assessment by the students (10%).

Ecology and Aquaculture Quiz

This multiple-choice quiz for high school students includes questions about aquatic ecology, aquaculture, fisheries, and conservation. Contestants study and learn that natural ecosystems and their proper functioning support all human economic activities, including fisheries and aquaculture. They learn about responsible and sustainable aquaculture, in which resources are used carefully and adverse impacts on the environment and on local communities are prevented. They gain a working familiarity with the species and products from fisheries and aquaculture, including some main statistics.

Proposals for High School Aquaculture Projects

This contest is intended to train high schools to engage in small-scale fish farming projects and also encourage them to conduct research projects on aquatic ecosystems and

biodiversity, aquaculture and fisheries, and related aquatic sciences. This familiarizes students with the practice and methods of science, develop the students' creativity and analytical mind, and help disseminate science and technology and their applications in daily life. For this contest, students with their research advisers prepare proposals for school-based projects in aquaculture. First, contestants learn the basics of aquaculture, that is, that fish are bred and reared in hatcheries (or the larvae may be collected from beaches), grown to market size in water farms (ponds, pens, or cages), then harvested, taken to market, bought by consumers, and eaten at home, in restaurants, etc. Second, they figure out what aquaculture project can be done in school and they make a good plan. Third, they write a three-page proposal. Fourth, they prepare Powerpoint slides (maximum 10 slides) about the proposed project.

The proposals should explain the why, how, and when the project will be undertaken, who will do it, and how much it will cost. Contestants write a three-page proposal following the prescribed format shown in **Box 3**: On contest day, copies of the written proposals are submitted to SEAFDEC

Box 3: Format of Proposal for High School Aquaculture Projects

- Title (must be descriptive, 10 selected words or less)
- Proponents (2 students, 1 adviser)
- High School name and address (where the project will be based or located)
- Rationale for the Project (why do the project? cite two scientific papers from journals)
- Methodology (how is project to be carried out? cite two scientific papers from journals)
- References (what S&T work has been done before? List the four selected and relevant scientific papers)
- Schedule of work (what will be done when?)
- Budget (cost equipment, materials, supplies, transportation, computer work, analysis, etc.)



Presentation of Project Proposal

FishWorld for evaluation by AQD aquaculture specialists. Each team is allowed 20 minutes for slide presentation. The proposals are scored for research done (20%), written proposal (30%), oral presentation (30%), and do-ability and capacity to meet the students' interest and intellectual needs (20%).

Biodiversity for Livelihood

Teams of high school students go to beaches or markets and collect good-looking unbroken shells of mollusks, clean them, and put together in a collection of at least 20 species excluding oysters and endangered species. The shells are identified by English or local names and by scientific names. To determine the scientific names, contestants bring their collections to SEAFDEC FishWorld for careful comparison with reference collections. A list of species in the collection is submitted to SEAFDEC FishWorld with the specimens on contest day.

Contestants then process, value-add, and package the shells for sale. Processing and value-adding can take many forms, as seen at several handicrafts stores. The shells are cleaned and presented in their natural form with no paint or varnish. Contestants bring the processed and packaged shells to SEAFDEC FishWorld for sale. Teams are scored for set of at least 20 different species (20%), printed list of correct scientific names (20%), printed description of the methods of collection, processing, value-adding, and packaging (20%), quality of the processed and packaged shells (20%), and sales after eight hours (20%).

Collect and Document Biodiversity

This contest for high school students involves biological collection for the school and to deposit some important specimens at SEAFDEC FishWorld. Contestants survey aquatic habitats, collect as many species (at least 10) of resident plants and animals, preserve and identify the specimens, and present the collection at SEAFDEC FishWorld. Teams prepare biodiversity reports that contain information and are scored (**Box 4**).

Box 4: Contents of Biodiversity Report

- Locality and date of collection
- Aquatic habitat type, description, and photos (20 points)
- Sampling method and processing of specimens (20 points)
- Research done, taxonomic references used (20 points)
- Table of species collected (common names, scientific names, classification) (5 points per species correctly identified)



Value-adding and packaging of shells

Photojournalism Contest

High school students prepare photo-posters about aquaculture as an important producer of seafood, provider of jobs and income, and contributor to the economy. Contestants do research to prepare for the photo essay by learning first which species are produced from aquaculture, as opposed to those from capture fisheries.

The contestants are expected to learn the basics of aquaculture, i.e., that fish is bred and reared in hatcheries (or the larvae may be collected from beaches), grown to market size in water farms (ponds, pens, or cages), then harvested, taken to market, bought by consumers, and eaten at home, in restaurants, etc. They also learn about the grow-out process: farm preparation, stocking, feeding, water change, and growth monitoring. They visit aquaculture farms and take pictures, and then write a short story or perspective.

On contest day, contestants bring their loose photos, printed story and captions, and other materials to SEAFDEC FishWorld, which provides 75 cm x 100 cm illustration boards and glue to set up the posters. Contestants lay out their best photos on the board and view the whole poster for quality of graphics and impact of story. The photo-posters are scored for story and perspective (20%), research done (20%), writing style (20%), quality of photos (20%), and overall visual impact of poster (20%).

Install a FishWorld Exhibit

For this contest, high school students are invited to conceptualize and install hands-on or interactive exhibits demonstrating the idea that marine biodiversity is important to people. The science installation includes an explanatory poster and a set of activities, or plants and animals, or devices, or artwork, or similar such items that can be manipulated to facilitate teaching and learning.



High school students preparing posters for exhibit

The teams first learn about the plants and animals that live in the sea and how they provide goods and services to people. Each team is allowed a 1 m x 2 m floor space and a whole day to install exhibits, and these are scored for theme or storyline (20%), research done (20%), quality of explanatory poster (20%), workability of hands-on and interactive items (20%), and overall teaching-learning impact (20%).

Seafood Dish Contest

This contest is open to student cooks from high schools, where a prospective cook may enter one main dish (not appetizers or salads) made with farmed seafood in the competition. The cooks prepare at school or at home a plate of each dish entry enough for several judges and other test tasters. The cooks type and print the recipe (listing ingredients and describing how to cook) on a 5"x 8" board and bring it with the dish. Entries are prepared for lunch

and judging by 5-10 AQD researchers and staff. Entries are scored for printed recipe (10%), farmed species used (10%), sufficient quantity (10%), freshness (10%), health value (10%), presentation (10%), novelty (20%), and taste (20%).

T-Shirt Design Contest

This is a variation of the painting contest for high school students. Contestants draw simple but striking story-telling T-shirt designs (two designs for front and back, each 30 cm x 20 cm in size) depicting the importance of aquaculture, fisheries, and aquatic biodiversity. Designs are scored for the same criteria as the paintings.

Essay Contest

Separate essay contests are conducted among elementary school and high school students. The contestants do background research, interview SEAFDEC/AQD scientists, and then write perspectives about aquatic ecosystems and biodiversity, responsible aquaculture, fish conservation, and food security. Essays are in English, about 2-5 handwritten pages long, and are scored for research done (20%), information content (20%), organization and logic of arguments (30%), and grammar and writing style (30%).

Painting Contest

Separate painting contests are held for high school and elementary school students. Contestants paint in full color the importance of aquaculture to Filipinos as producer of seafood, provider of jobs and income, and generator of arts and traditions. In preparation for the contest, the contestants read about aquaculture and how it contributes to food security, economic development, and the arts and culture in the Philippines. They also learn the appearance, behavior, habitat, and other characteristics of farmed aquatic organisms and depict them accurately in the painting. In July 2001, FishWorld conducted the ASEAN-SEAFDEC



Among the winning seafood entrees (above); and some of the winning paintings (right)





Drawing Contest: Fish and the Filipino Culture and selected one student, Alex Ordoyo, who produced the painting that became part of the art exhibition during the ASEAN-SEAFDEC Millennium Conference “Fish for the People” in Bangkok in November 2001. FishWorld has also conducted contests to select mangrove paintings for the International Children’s Art Calendar produced by the Mangrove Action Project in Seattle, USA.

The painting size is 45 cm x 30 cm among elementary school pupils and 56 cm x 76 cm among high school students. Illustration boards, drawing paper, pencils, and pentel pens are provided by FishWorld, but contestants bring coloring and other materials they want to use. Contestants are allowed 4-8 hours to paint their entries and submit them with titles and short descriptions. Paintings are scored for research done (20%), context and message or story value (30%), details and accuracy (20%), and style, color, and visual impact (30%).

Collect, Show and Tell

This is a biodiversity contest among elementary school pupils, where contestants and coaches go to beaches near them and collect shells of mollusks, select good-looking unbroken shells, clean them, and put together a collection of at least 20 species. The specimens must NOT be endangered species. The shells in the collection are identified by English or local names and by scientific names. To determine the scientific names, contestants bring their collections to FishWorld for careful comparison with the reference collections. The specimens are then labeled and arranged on illustration board, or in some box or glass container, for display and presentation. The shell collection is donated to the school to become part of their Learning Resource Center or their biology collection. The teams then prepare a 10-minute oral presentation about the particular shells in the collection.

On contest day, teams bring their collections to FishWorld, show them to the public for one hour, and then tell the audience about the natural history of shells in 10 minutes. Presentations are scored for collection of at least 20 different

species (20%), quality of specimens (20%), research done for correct identification and labeling (20%), packaging for show and display (20%), public speaking and showmanship (20%).

Bring, Show and Tell

This contest among elementary school pupils intends to encourage children to learn about the plants and animals that live in aquatic habitats, particularly those harvested by fisheries and aquaculture. When contestants find interesting plants and animals, they bring them to FishWorld preferably alive and healthy, show them to an audience, and tell their natural history. Endangered species are excluded. Contestants record the collection information: locality, date, and means of collection, specimen name, size, what plants and animals were found with it, and collector’s name and address. Contestants do research on the selected species and compose a short (one page long) factual story about them.

To determine the scientific names, contestants bring specimens to FishWorld for identification by taxonomic books. Each team is allowed 10 minutes for show-and-tell during which the contestants talk like enthusiastic science teachers to a group of pupils. Presentations are scored for research done (20%), story line (20%), interest value of the species and quality of the specimens (30%), and public speaking and showmanship (30%).

In a rather popular variation of this contest, elementary school students find three seafood species, identify them,



Bring, show and tell (top); and T-shirt design (above)

write a story about them, cook them, and bring them to FishWorld for show-and-tell. Presentations are scored three correctly identified species (20%), natural history and story line (20%), cooking and presentation of the seafood (20%), pictures and other visual aids for show and display (20%), and public speaking (20%).

Write a Fish Story

Elementary school pupils learn which fishes and invertebrates are produced from aquaculture. Then they write stories about aquafarm animals and their encounters with them in farms, in the market, in the kitchen, or the dinner table. Stories are scored for research done (20%), storyline (30%), grammar and writing style (30%), emotional impact (20%).

Write and Recite a Fish Poem

Elementary school pupils learn about fish, mangroves, other coastal ecosystems, marine debris and pollution, and fish conservation. They compose poems about what they learned and on contest day, they write the poems down and recite them out loud. Poems are scored for research done (20%), storyline (20%), writing style (30%), and recitation and showmanship (30%).

Nutrition and Aquaculture Quiz

AQD's Aquaculture Week fits right with the Philippine Department of Education's Nutrition Month activities in July when elementary schools hold a Nutrition Quiz. About 30-40 Grade V and VI pupils join the FishWorld quiz. The contestants learn the basic concepts in nutrition, and coaches help them study the fundamentals of agriculture, fisheries, and aquaculture and their importance to food security. Contestants also learn to recognize good food items, including different species of fish and other aquatic products.

Aquarium Quiz

Grade V and VI pupils join this quiz where contestants learn about the plants and animals that live in the sea, particularly those harvested by fisheries and aquaculture. They also come to FishWorld and observe and become familiar with the animals in aquaria, which are provided information labels. During the quiz, contestants go around the FishWorld aquaria and answer the multiple-choice questions, including local or common names, scientific names, morphology, habitats, feeding habits, whether it is fished or farmed, and about fish conservation.

International Coastal Cleanup and Fish Conservation Week

The International Coastal Cleanup (ICC) is a yearly event every third Saturday of September in over a hundred countries where volunteers work for the reduction of marine debris and pollution and for the conservation of the ocean's biodiversity, beauty, and productivity. AQD has participated in the ICC since 1998 and FishWorld coordinates with schools, local government units, and other organizations to conduct ICC events in several localities in Iloilo.

The SEAFDEC FishWorld also organizes competitions among ICC volunteers from schools where the students learned that fish conservation is the sustainable use of fishery resources through the protection of aquatic habitats (natural ecosystems like coral reefs, mangroves, seagrass-seaweed beds, rivers, lakes) and through the regulation of human activities and marine pollution. The FishWorld competitions built awareness and understanding of the importance of fish conservation to food security and the contribution of aquaculture to both.



International Coastal Cleanup collection (left) and R&D Internship participants (above)

R&D Internships

Since 2003, FishWorld has offered a 20-day internship course in research and development for high school science students during the April-May school break in the Philippines. Students learn aquatic biodiversity, ecology, aquaculture, and fisheries through hands-on demonstrations, field trips, and some lectures from AQD scientists.

Already 60 students from the Philippine Science High School Western Visayas and the University of the Philippines High School in Iloilo have spent their summer internships at FishWorld. The internships seek to inspire and guide students into research projects, college degrees, and careers in fisheries, aquaculture, and the aquatic sciences.

FishWorld Ecology Camp

Empowerment of people through leadership training is an important step towards generating positive action for environment protection and sustainable development. Since April 2002, FishWorld has conducted 3-day live-in Ecology Camps that enables high school students and teachers to gain knowledge, understanding, and appreciation of the situation of the environment in the Philippines; marine ecosystems and biodiversity; responsible aquaculture and fisheries; ecological waste management, the greening of

schools; and what individuals and schools can do to achieve environment protection and sustainable development.

Visitor Services

In its six years of active commitment, FishWorld has added value to SEAFDEC and to AQD. FishWorld receives about 10,000 visitors a year, mostly students from schools all over Panay and the neighboring islands. Indeed, FishWorld has become an Iloilo landmark in itself and many tourists now come to visit. The FishWorld tour includes a briefing or video about SEAFDEC and the Aquaculture Department, going around the visitor center and museum, and visiting the hatcheries and laboratories. Visitors also drop by the Sea Store to buy aquaculture publications and a variety of sea-inspired souvenirs.

About The Author

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