



FINALISTS  
2008 STOCKHOLM  
JUNIOR WATER PRIZE

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JUNIOR  
WATER PRIZE

# The Stockholm Junior Water Prize

## Water and Young People – Linked to the Future

The international Stockholm Junior Water Prize contest aims to encourage young people's interest in issues concerning water and the environment.

The award is given annually for an outstanding water project by a young person or a small group of young people. With this, the competition seeks to inspire young people to a continued engagement in water and related subjects.

While the global water environment remains in peril, the future depends on our ability to manage this life-sustaining resource. Today's youth are indeed tomorrow's leaders and must be encouraged to pursue water-related careers or our scarce supply risk further erosion.

The finalists at the international competition are the winners of national Stockholm Junior Water Prize contests. The national and international competitions are open to pre-university people between 15–20 years of age who have conducted water related projects focusing on local, regional, national or global topics of environmental, scientific, social or technological importance.

The winner of the international Stockholm Junior Water Prize receives a USD 5,000 award and a blue crystal sculpture in the shape of a water droplet. The national competitions have inspired young people around the world to become active in water issues.



H.R.H. Crown Princess Victoria of Sweden is the Patron of the Stockholm Junior Water Prize.

## The International Nominating Committee

The international Nominating Committee includes experts within the field of water who, by committee consensus, appoint the winner of the international contest. The decision is based on the written report and a short presentation of the display material. The Stockholm Water Foundation Board appoints the Committee members.

2008 Nominating Committee members are:

- Dr. Magnus Enell (Chair), Sweden
- Dr. Mercy Dikito-Wachtmeister, Sweden
- Mr. Björn von Euler, USA
- Ms. Charlotte de Fraiture, Sri Lanka
- Dr. Nighisty Ghezae, Sweden
- Ms. Linda Kelly, USA
- Dr. Piet Lens, The Netherlands
- Ms. Tabeth Matiza-Chiuta, South Africa
- Ms. Susana Sandoz, Bolivia
- Ms. Elin Weyler (Secretary), SIWI, Sweden



## Finalists 2008

### ARGENTINA

#### **Tanacetum Vulgare – Exotic Plant which has the Property to Render Bacteriological Contaminated Water Drinkable**

*By Enzo Belloli, Ivan Mazurek and Diego Pellegrino*

In Argentina, many lack access to drinking water and sanitation services and the water available to these people is generally contaminated. The purpose of the Argentinean project was to provide an alternative treatment method for biologically contaminated water. The idea was to use indigenous knowledge to identify and test plants that are known for their medicinal uses. The group selected and tested different concentrations and found that the acetone extract in *Tanacetum vulgare* and its essential oil produced the desired effect against fungi. Experiments were carried out with pre-treated water. A 3-hour post-treatment with essential oil (0.4 percent V/V) confirmed the plants ability to make water potable. The water was rendered drinkable and safe for human consumption in accordance to official standards. The next step will be to evaluate any potentially toxic components of the essential oil. The environmental impact of its use as a decontamination agent should also be assessed. The group also plans to investigate *Tanacetum vulgare's* possible use as a substitute for chlorine in sewage treatment plants, because of the plants effect on micro-organisms.

### BELARUS

#### **Fruit Peel Recycling – Application of Fruit Biopolymers for Heavy Metal Ions and Radio Nuclides Extraction from Water Systems**

*By Tatjana Kirpicheva, Maxim Rodjkin and Arthur Sancevich*

The Belarusian team sought to find a cheap and effective method for cleaning water in local contaminated swamps. The students evaluated and undertook different methods, including GPS-mapping, pH measurements, testing of sorption capacity of fruit peels, a poll of 500 students, an estimation of copper and lead ion concentration and an estimation of Cs-137 radioactivity of water samples.

Their analysis showed that the fruit peels could be used as an effective environmental sorbent. They found, for example, that the Orange sorbent is able to bind 182 mg/g of copper and apple can accumulate 160 mg/g of lead and decreases the radioactivity of a solution from 160 to 107 Bq/l. Apple and orange peels, moreover, are able to adsorb  $1.5 \times 10^2$  CFU/g of microbes, which proves that they can be used in cases of organic contamination. The students tested their theory by adding pectin rich fruits in swamps, and evaluated the potential disturbance of local bird fauna and water characteristics. They concluded that applying fruit peels was able to reduce contamination to permissible levels without large financial inputs or disturbing the ecosystem.

### AUSTRALIA

#### **Water Filtration Utilising Sea Shells**

*By Gwylim Klippel-Cooper*

Water, in particular clean drinking water, is one of Australia's current concerns. Gwylim Klippel-Cooper began his research asking, how can Australia survive through the present drought? The answer he derived was to investigate innovative methods of water purification.

Therefore, he sought to test the effectiveness of different sea shells to neutralise the pH level and lower the hardness and opaqueness of water. Two experiments were conducted: First, a consistent 'dirty' water solution was used to test the hypothesis. A second experiment used the findings to test the ability of a shell filter to neutralise pH and lower the hardness and opaqueness of water passing through within a flowing stream. The results of the two experiments indicated an increase in the pH level of the samples containing the shells and a softening of the water. This is a cheap and environmentally friendly method of cleansing water, which Gwylim Klippel-Cooper hopes can provide an alternative to countries exploring the use of water desalination plants that use large amounts of electricity and discharge extremely salty wastewater. He concluded that the possible use of shells to purify water should be further explored.

### CANADA

#### **E-Light-Minating the Thirst – Improving a Solar Water Disinfection Method Using a Physical Approach**

*By Janie Côté and Ariane Litalien*

Waterborne diseases are currently the number one cause of death globally, killing a child every fifteen seconds. In order to provide freshwater supplies, scientists have developed a solar water disinfection method (SODIS) that uses sunlight. Unfortunately, SODIS presents several critical unsolved problems that are health-threatening for millions of people.

The purpose of Côté and Litalien's research was to improve the system in an accessible way. They reviewed scientific research in order to identify, study, and understand the SODIS problems. They designed a manual centrifuge, an insulating box and an optical system and conducted several experiments. *Escherichia coli*-contaminated water was used to compare the new system's efficiency to standard SODIS under real sunlight conditions, and the new disinfection method increased the efficiency by one hour. The results suggested that the new method improved the microbiological quality of the treated water. The Canadian project eliminates SODIS problems, such as the inability to treat large or turbid volumes of water. The results, including the designed method's future development, social, and innovative potential, were discussed. Complementary experiments conducted with several different pathogens were suggested.

CHILE

### Isolation and Action of Decontaminating Petroleum Bacteria

*By Jorge Chacón and Mario Pozzo*

Petroleum contamination of water and soil is an increasingly severe problem. Jorge Chacón and Mario Pozzo searched to solve this challenge by investigating bacterial strains capable of decontaminating contaminated soil and water bio-remediation. They gathered and isolated bacteria from hydrocarbon contaminated soils using a Bioreactor-Biodegradator. The finalists from Chile then tested the *Pseudomonas* type bacteria on agar plates that were covered by thin layers of petroleum, crude oil and ordinary sterile sea water. Sterile cellulose discs (bactediscs) were also tested and the effects of petroleum solubilisation (making the petroleum more soluble through a detergent) were investigated. The results showed that the bacteria were capable of developing even in a highly petroleum contaminated environment. The bio-remediation even occurred on bean and lentil seedlings that were soaked with crude oil and petroleum. The possible "digestive solubilisation" of these bacteria constitutes the basis of the process of bio-remediation of petroleum contamination. Jorge Chacón and Mario Pozzo hope that the strain they have isolated can be a small but concrete contribution to decontaminate our planet and make both people and ecosystems healthier.

CHINA

### The Intelligent Irrigation Control System

*By Yuqian Wu*

Yuqian Wu designed the Intelligent Irrigation Control System with the objective to provide plants with the ideal growing environment. To do this, he analysed the photosynthetic and soil respiration rates and the optimal soil moisture for different plants. By using a single chip to control the entire system, complete automatic irrigation eliminated the need for constant manual attention and improved the efficient use of water and energy. The Intelligent Irrigation Control System has been tested on a 200 m<sup>2</sup> large rooftop for the past 13 months in Guangzhou, China. The system has not required additional energy sources and has used only 5 cubic metres of tap water. It has also achieved a third objective of not requiring constant attendance, making it a completely automatic control system. The system is inexpensive and therefore may be used in the agricultural industry and in "green city" environmental promotion projects, especially those concerned with greening deserts. In future developments of the Intelligent Irrigation Control System, functions concerning seasonal variations and plant growth phases may be added to achieve effective irrigation.

DENMARK

### Fabulous Water

*By Carit Brødsgaard Hansen and Omar Oueiti*

Eutrophication frequently results from nutrient pollution caused by, for example, run-off from fertiliser used in agriculture. In many parts of Denmark, eutrophication has led to natural waters suffering from excessive plant growth and decay. Water bodies are slowly being overrun by certain invasive species of weeds that dominate over other plant species and are the likely cause of severe reductions in water quality, caused by factors such as oxygen depletion.

In this project, Carit Brødsgaard Hansen and Omar Oueiti observed domestic waters to highlight problems of oxygen depletion. The finalists found that one of the culprits of eutrophication is ammonia emissions. They decided to tackle the problem by finding ways to prevent the ammonia from leaking into the ground and water sources. Hence, they developed and tested three possible methods to trap ammonia from the air and showed that it is possible to trap airborne ammonia from manure in a water filter. With the help of the solutions presented in the project, the Danish team hopes to have played a part in the fight to protect nature from ammonia pollution.

FINLAND

### Does the River Continuum Concept Work in Small Rivers that Begin from Swamps?

*By Noora Nuutinen and Tiina Pippuri*

The River Continuum Concept predicts how biological communities might change from headwater streams to larger rivers. Noora Nuutinen and Tiina Pippuri of Finland were interested to find out if and how this concept applies to northern coniferous forest areas in their country. To do this, they made observations on the biological, hydrological and morphological factors on every part of a river in Finland. These factors were then analysed and compared with what would be expected using the theory on River Continuum. The students found that with a small exception of invertebrates in one area, their results followed the River Continuum Concept quite closely. The analysis showed that the vegetation and invertebrates displayed signs of eutrophication. This was especially strong in the lower part of the river. The students propose that the river should be monitored annually. They suggested that Finnish upper secondary students could undertake this monitoring for the local authorities to use when planning new construction. The results can be used to help maintain biodiversity and beauty of the environment and allow versatile use of the area.





FRANCE

**The Picardie Naiades – The Protection and Rehabilitation of Natural Wetlands**

*By Laura Bienfait-Lelong, Charline Carlier and Simon Goire*

The island marshes of St. Quentin, located in a nature reserve in northern France, are monitored annually in order to plan the management operations of the important habitats. The French group, students of agronomy and environment, decided to investigate methods to improve one of the central challenges that this natural reserve faces: reed-bed restoration.

To do this, they used a standardised biological index that is employed in France to assess the biogenic tendency of a water course station. Next, they made an inventory of aquatic invertebrates to assess the general quality of a stream. They then worked on methods to maintain the reed-beds which are located in a crucial area for fish (such as pike) spawning and reproduction. One method, for example, was the regular raking out of reeds to prevent decomposed material from clogging the beds. The group will follow up the current study by looking into the potential application of another, more straight-forward method of reed-bed management – grazing. They are convinced that herbivores, such as sheep, can manage the reed-beds both directly and effectively.

GHANA

**How Water Resources Can be Managed and Protected through Public Education – A Case of the Zenu Community in Ghana**

*By Isaac Barnes*

A dam has been constructed on the Zenu River to provide the Zenu community with water for irrigation and to a lesser extent household water. But the quality of the water is deteriorating rapidly. This is because inhabitants defecate and throw waste in the river, which people also use for bathing and drinking. As a result, water related diseases have tragically become prevalent in the area. Isaac Barnes' project aimed to educate the members of his local society on how water resources should be managed and protected. He studied the causes of the problems as well as the attitudes of individuals in the community towards those problems. He then produced a play that informed inhabitants on the importance of protecting the water. His project engaged local pupils, who performed it in different places in the area. A positive response from the community members resulted in them taking up a clean-up exercise. Follow up activities have shown a drastic reduction in littering and defecating on the banks of the river and dam. This proves that drama is a useful medium to reach communities, especially those with low literacy levels.

GERMANY

**Reconstruction of the Mitochondrial Metabolism in Diatoms**

*By Anika Wranke*

At least 50 percent of global photosynthesis takes place in the oceans. Relatively complex algae, called diatoms, are the main marine primary producers. Their global photosynthetic oxygen production is probably equivalent of all land plants and accounts for about 40 percent of the marine photosynthesis taking place in global oceans. The chloroplasts of diatoms have been intensely investigated, but not the mitochondria. Anika Wranke's research question asked an important question: Are mitochondria involved in the success of diatoms? To find out, she used a new method of analysing genome sequences – genomics – consisting of known genes. The research aimed to identify and determine the function of mitochondrial genes. As identifying and calculating all the individual genes was impossible due to time constraints, Anika instead applied a creative method that indicates the probability of a gene to be localised to the mitochondrion. She used this method to filter out potential mitochondrial genes, which were then identified and mapped to biochemical pathways. Her research uncovered that the mitochondrial genes control the amino acid metabolism of serine, threonine and glycine.

INDIA

**An Innovative Water Purification Technique Using Moringa Oleifera Seeds**

*By Saurabh Kumar*

During a brief survey of some of the peri-urban localities of the city Lucknow, Saurabh Kumar observed that a majority of people were compelled to use contaminated water. He decided to examine how to supply safe drinking water at affordable prices. He looked into traditional water purification techniques and worked on their feasible application in the local community.

Discussions with inhabitants and traditional knowledge practitioners revealed that methods like flocculation, coagulation and sedimentation are inappropriate because, besides being damaging to human health and the environment, chemical coagulants are difficult to come by and are expensive. Seed extracts of drumstick (*Moringa oleifera*, locally known as Sehjan) act as a natural coagulant and can be used to purify water with high levels of turbidity. When dried, crushed and powdered, drumstick seeds are added to water and binds dirt particles and bacteria at a success rate of 90-99.9 percent. The coagulated particles sink to the bottom, leaving clear, clean water which can be poured out. The process is simple, requires minimal investment, and the trees can be grown in the communities.

ISRAEL

### Contribution to Alleviation of Food and Water Scarcity by Improved Plankton Monitoring in Artificial Sea Water Ponds

*By Nitzan Ben Noun, Idan Dechner and Guy Holdengreber*

Fish farming – aquaculture – in artificial ponds may help to alleviate the problem of overfishing of the global oceans. Development of artificial sea water ponds can therefore be seen as a desired development, but salt water fish are not easy to cultivate. That is because plankton – their food – are very small and sensitive organisms. Knowledge on plankton conditions is therefore a prerequisite for salt water aquaculture. Unfortunately, however, present monitoring of plankton is done by examining samples through microscopes – a tedious and time consuming process. The Israeli project created an efficient method of plankton characterisation to apply to an autonomic sea water artificial pond. The students used a mechanical device and developed a computer programme to greatly reduce the identification and monitoring time. The group's main contribution is the adaptation and development of three algorithms, which serve to analyse microscope images of water samples, to characterise plankton needed by the fish larvae instead. This is achieved primarily by the algorithm which counts the number of bulges of the different plankton.

ITALY

### Healthy Springs

*By Ilena Avateneo, Omar Mareello and Gabriella Marengo*

Ilena Avateneo, Omar Mareello and Gabriella Marengo have aimed to compare illnesses of different organs with treatment of household water. They have also compared the chemical-physical characteristics of store-bought bottled water normally available with the spring water from their own region. They concluded that the use of the natural spring water is advantageous from both an economical and environmental perspective and could even be used in water therapy. The group described the therapeutic influence of water on conditions such a gout, calculosis, gastritis and constipation. They also investigated the relationship between advertisement and consumption of bottled water, as well as the environmental impact from Italian consumption of bottled water. In order to harness and give added value to local water resources while reducing the consumption of bottled water, they suggested a regional database that subdivides the springs according to their properties be created. This would allow anyone to find the best type of water for treating their particular condition and the location of the springs. The local water sources should be promoted as healthy and free.

JAPAN

### Giant Salamander's Preservation Saves the Aquatic Environment – Genetic Analysis for Successful Achievement of the Releasing Project

*By Minami Kiuchi, Masato Nitta and Masahiro Otao*

Despite historic and continued efforts to protect them, the Giant Salamander – a symbol of Japanese nature and culture – remains an endangered species. The Japanese group decided to contribute to the preservation of the salamanders and their habitat by increasing both their own and the overall understanding of the amphibian. Their analysis of the mitochondrial and nuclear genes of the Giant Salamander demonstrated that genetic variation is extremely poor between

JAPAN

populations of the salamander in different areas. They also found that the populations are genetically divided into two distinct groups, west and east, although the differences are tiny. The west group, furthermore, has three smaller different sub-groups. They are convinced that the results would be useful for a careful hatch-and-release programme to help avoid gene disturbance. In a novel approach to spread awareness of the importance of the gene composition, Minami Kiuchi, Masato Nitta and Masahiro Otao transformed the genetic code of the salamander into a musical score. They hope that by hearing this melody, people will appreciate the wonder of life and the importance of saving the aquatic environment.

LATVIA

### Water Enriched with Coral Calcium

*By Arita Kreslina and Linda Viksne*

The Latvian project evaluated the efficiency of an alternative method of raising the quality of water and human living standards. They gathered data on coral calcium and the prime minerals it provides (calcium, magnesium and iron), which they analysed through practical experiments in order to determine both physiochemical and biological parameters of the enriched water. The complexometric and spectrophotometric analysis proved that coral calcium enriches water. The pH examination showed that coral calcium raises the solution's pH and the microbiological analysis confirmed that the enriched water contained fewer bacteria than normal drinking water. They detected a great difference when comparing the forms of frozen crystals. They concluded that enriching water with coral calcium does improve water quality and affects its physiochemical and biological parameters. In addition, using the enriched water on a regular basis can help the human body to raise its immunities to fight the negative influence of the surrounding environment because it lessens the chance of experiencing the shortage of water and such significant minerals as calcium, magnesium and others.

MEXICO

### Macroalgae – An Alternative for Treating Wastewater from Shrimp Farms in Sinaloa, México

*By José Humberto Ramírez Leyva*

Shrimp farming is a primary economic activity along the coasts of Mexico. However, the release of nutrient-rich wastewater has very negative effects on the farms' surrounding environment, especially the wetlands, which have been completely or partially destroyed. As a result, their ecological carrying capacity has dramatically decreased.

José Humberto Ramírez Leyva proposes an alternative to reduce the large quantities of nitrogen and phosphorus present in the wastewater. Complimentary cultivation of macro algae, which use the nutrients to grow, would decrease pollution and open up alternative income sources for the farmer. The macro algae can, for example, be used for oil extraction, food, or biomass production. The finalist built two ponds, one of which simulated a shrimp farm, with white *Litopenaeus vannamei* shrimps. In the other pond he introduced the seaweed *Ulva lactuca* and reused the shrimp water with its high nutrient content. In this second pond he detected a significantly reduced amount of nitrogen and phosphorus in the wastewater. Introducing this method in conventional shrimp farming could decrease the environmental damage on the coastal wetlands.

**El Oro Azul – The Blue Gold***By Frédérique Baas, Fons Mentink and Michiel Roelofs*

The Dutch project uses the new and advanced technology of electro-spraying in order to desalinate seawater for agricultural purposes on dry farmlands, where alternative water is scarce. Electro-spraying is used for various applications, such as medicine specified for lung patients or pesticide spraying. In this project the seawater is diverted through small nozzles through which an electric charge is applied to positively charge saltwater particles. Through gravity, electric forces and repulsion, the droplet at the edge of the nozzle is diverted into a mist of extremely fine, charged particles. Most of this mist evaporates, leaving a mixture of positively charged salt water particles and neutral vapour. The vapour is separated from the salt water particles by a second electrical field that attracts the water particles. It is then transported out of the chamber where it condenses and can be collected. When 1,500 consecutive electro-spraying components are used, the harvesting capacity is up to 125,000 litres per hour. The estimated cost per litre is low (USD 0,15 for 1000 litres) and the return on investment is estimated at 5 percent profit per year.

**Simple Approach to Safe Water Accessibility and Affordability as a Source for Fish Farming***By Maryam Cam, Okugbene Ejiroghene and Hope Izevbige Iyobosa*

Accessing safe water in rural communities in the Niger-delta region is not easy. Most of the water stems from rivers and streams which are also used for cleaning and other human activities. A community effort is important to preserve and protect accessible drinking water in order to ensure that it is kept affordable and safe. The Nigerian project seeks to address this problem by creating a safe source of water and contribute to an extra source of income for the local communities. The new source of income introduced comes from the local fish farming project. The drinking water is channelled from a stream to a reservoir where it is filtered, heated, purified and redirected to the community as safe drinking water. Children play a very vital role in water collection and are more exposed to water borne diseases. This is because they often go directly to untreated streams and take the water before it has passed the treatment channel. The group, who are part of the Young Water Action Gender Team, have campaigned and advocated that youth should be involved in water decisions.

**Lake Storeid – Nature Reserve in a Cultural Landscape***By Morten Bergheim, Tore Halse and Aleksander Knædal*

Morten Bergheim, Tore Halse and Aleksander Knædal have collected and analysed a large quantity of information about Storeid Lake, located in a nature reserve in northern Norway. The purpose of their research was to obtain information to project future management of the Lake and its traditional surrounding landscape. Ultimately, this information will serve and be available to the local community.

The group took several factors into account to make its projections: the lake's history (including its eutrophication), current water quality, the species living in and around the nature reserve, the use of the area, and the strain on the area

posed by tourism and construction. Then they projected possible futures over 50 year timescales where various scenarios were shown as possible results of different management choices. They detected a reduction in water levels and found that plant growth along the edges would decrease the lake's size and change the beaches dramatically. They propose that these changes can be mitigated by grazing animals, logging and a complete stop of nutrient leakage. The group are planning to contribute their information to the local plans that are being revised and inform the community on the state of the lake.

**Restoration of Water Reservoirs Using Latent Phases of Aquatic Organisms***By Alexey Shinkarev*

Creating sustainable biological communities is needed to restore polluted water reservoirs and construct artificial water bodies. Alexey Shinkarev examined well-known properties of zooplankton organisms (such as ascysts, spores, ehippiums, etc.) to withstand adverse weather conditions through hibernation. He developed a method for the restoration and reproduction of aquatic biodiversity. His method has been tested in two small man-made reservoirs and in a small but highly polluted river of Bulak near the city of Kazan. The introduction of latent phases of aquatic organisms increased the biodiversity of zooplankton in the river by 7 times and its biomass increased by 149 times. Self-purification properties, measured by hydro-chemical indicators of water pollution, increased. The project proved that latent phases of hydrobionts can be stored for long periods of time (using low-temperature stratification techniques) and then reactivated before introduction in water reservoirs. The proposed solution is ecologically safe, low-cost, and labour-saving. This makes it widely applicable for environmental restoration and rehabilitation of water reservoirs.

**Design and Optimisation of a Portable Low-cost Distillation Modular Unit***By Rajarshi Roy, Shao Yang Koh and Chengxu Wang*

The occurrence of natural disasters in Asia like the tsunami in Indonesia (Aceh) in 2004, Cyclone Nargis in Myanmar in 2008 and more recently the earthquake in China (Sichuan) further highlights the need to provide safe drinking water for areas where fresh water supply is contaminated or even cut off from the survivors of the disasters.

The objective of the Singaporean project was to design an innovative new system that utilises thermal distillation and scale it to a level for use by a low-income household or for disaster relief efforts. The main considerations are portability, cost and ease of maintenance. The design comprises three key modules for evaporation, condensation and collection. The unit was described and the preliminary performance of the prototype's evaporation and condensation unit was discussed. In essence, the processes of thermal distillation were observed to take place in the prototype but require further intensive optimisation to yield enough water for storage. This study gives insight into an innovative and alternate method of desalination which is economical and possibly effective under optimal temperature climate.

SLOVAKIA

### Negative Impact of River Regulation on Oxbow Ecosystems

By Oliver Rovný

Natural ecosystems in central Europe have been heavily impacted over the past century. Riverine wetlands are among the most threatened ecosystems due to their dependence on specific water dynamics. Regulation of rivers effects the dynamic equilibrium of their sediment deposits in the rivers and as a consequence, natural degradation and disappearance of old oxbows are no longer compensated by the creation of new ones. Oxbows are U-shaped river or lake bodies and their degradation is accelerating. Oliver Rovný studied how different ecological factors resulting from river regulation in the Moraca River in Slovakia threaten the aquatic character of various types of oxbows. The research analysed three important ecological factors responsible for successive oxbow destruction: vegetation dynamics, fine sediments and water dynamics. The results showed that significant water dynamics of oxbows close to rivers inhibit their succession and that decreasing water levels in the long run is a decisive factor to the oxbow's disappearance. Furthermore he found that there is a specific phase in oxbows terrestriification when the aggradation and erosion processes reach a dynamic equilibrium.

SOUTH AFRICA

### Aquatic Life vs. Pollution – Does Man Pose a Threat?

By Raksha Gosai

South Africa lies on one of the busiest shipping routes in the world. Oil pollution is a huge threat to the health of ecosystems in and surrounding the coast. Oil is not only spilled in the disasters that make the news. Little attention is drawn to the hundreds of millions of gallons of oil that end up in the ocean each year. In her project, Raksha Gosai investigates how varying pollutants of different concentrations harm aquatic life. In order to find out the effects, Raksha Gosai exposed *Daphnia Pulex* (a type of "water flea" sensitive to poor water conditions and involved in many of the food chains necessary to sustain fish) to investigate the effects of oil, petrol, chlorine, detergent, sunlight, dishwashing liquid, pesticides and antifreeze. The results showed that the pollutants did indeed have a negative effect on the *Daphnia Pulex*. The highest concentrations of pollutants were the most lethal to the Daphnia. The information gained from this experiment will help biologists and the public to learn and become more aware on both the general and specific ways that pollution harms regional and global environments.

SPAIN

### System to Generate Electricity Taking Advantage of the Tides

By Alicia Gonzalez Piñedo

Tides are caused by the gravitational pull from the moon and sun combined with the rotation of the earth. Potentially, the tides could provide great amounts of energy to be used by humans. Especially since the tides are a reliable and unlimited source of energy and act independent of other factors. In her study, Alicia Gonzalez Piñedo aimed to use the tides to generate electricity that has a minimal impact on the environment. The project was designed to make use of the force of tidal water to move generators that produce energy. At the same time the system was constructed to store air displaced by the water in deposits which could be used later to produce energy. Finally, the system generated a vacuum in those deposits which also could be used to produce more energy. The system created by Alicia Gonzalez Piñedo is capable of generating 144 Kilowatt hours of electricity per month per cubic metre of water. This means that the system requires only 20,43 cubic metres of water per house in order to supply electricity efficiently. This is very effective compared to other methods to generate power from the tidal water.

SRI LANKA

### Firewood Hearth Distiller for Safe Drinking Water for Vulnerable Rural Population

By R.D. Dasun Thakshala Siriwardana, Sandun Gayath Sameera Dissanayaka and A. Sujith Madushan Silva

Approximately 3 out of 20 million people in Sri Lanka lack safe drinking water. Only 31 percent of people have access to pipe borne water supplies and only 10 percent have access to hand pump tube wells. Health authorities propose that communities and individuals boil water, but many have difficulties to get firewood to do so. The Sri Lankan team improved an existing combustion stove called "Anagi Unduna." Combustion stoves lose 73 percent of the heat used while cooking. The Sri Lankan team took the initiative to look to use this energy to provide distilled water. A prototype was developed and has been experimented with three samples collected from three different areas representing the dry zone of the country. Thereafter the results for the waste energy utilisation and water purification in three samples were compared. Using the firewood hearth distiller, fluoride, nitrate and salinity concentrations could be removed by 99 percent from drinking water.



SWEDEN

### Restoring the Natural Cycle of Nutrients

*By Anna Rengstedt*

Nutrients such as nitrogen and phosphorus are dependent on a cycle between human and nature. However, human intervention has created a non-recycling system where the nutrients are lost to watercourses. The abundant supplement of artificial fertiliser and the treatment of wastewater are some of the reasons for this loss. In order to balance the cycle, the nutrients should be returned to the ground from which they originate. In sewage, urine possesses the majority of the nutrients. By separating the urine before it is mixed with other components, it is possible to return the nutrients for use in agriculture. Furthermore, urine-diversion systems can improve sanitation conditions in developing countries. Anna Rengstedt studied the nutrient cycle and urine separation. In addition, she performed a small-scale experiment with the purpose of investigating how urine performs as a fertiliser compared to artificial fertilisers. She concluded that urine can be an effective substitute for fertiliser. The extent to which urine will be productively used will largely depend on our attitude towards urine separation and its usage as a fertiliser.

TURKEY

### Obtaining Drinkable Water from Rivers, Seas and Lakes in Events of Disasters Using a New Type of Solar Panel Distiller and UVC

*By Berk Özdemir*

Obtaining safe drinking water can be very difficult for people in areas that are struck by natural disasters. In many dry regions of the world, clean water is always a scarce resource. In these areas and across the world, wastewater can also pose a serious threat to human health. Available methods to clean water, such as boiling, chlorine treatment, reverse osmosis, solar energy, etc., are expensive. Berk Özdemir therefore developed a method to clean water using a solar panel and Ultraviolet A beams that are both inexpensive and environmentally friendly. After surveying different methods of cleaning water, Berk Özdemir developed a solar panel from cheap, easily available materials. The solar panel heats and evaporates wastewater. The clean water then condenses on glass and runs into a collection cup. A solar charged UV lamp integrated into the system produces UV-light, which is able to eliminate bacteria and micro-organisms. The final product is clean drinking water. The system is capable of producing microbiologically and chemically clean water in accordance to the established standards in Turkey.

UKRAINE

### Obtaining Potable Water with the Help of Sun and Air

*By Timur Fatkullin, Ganna Shevchenko and Zarema Umerova*

The Ukrainian project proposes two methods that utilise solar power to produce clean drinking water. Both methods obtain potable water by condensing air moisture that has been heated by the sun by placing water on either crushed stone heaps or between a closed space above a surface of sea water. The first method relies on the sun to heat the stones (it is only possible on sunny days). At night, the sea breeze brings moisture to the mounds of crushed stones. The larger the differences in temperatures there are between night and day, the greater the capacity is to condense water. Constructing the stone heaps is inexpensive

UKRAINE

and has no negative influences on an environment since it is a natural condensing mechanism. The second method involves heating a thin layer of water to high temperature with solar rays. The water vapour saturates the air layer in a closed space above the water surface and the moisture from the air is channelled through a water tank by a system of air channels where it cools and condenses. The water obtained through these methods could be used in a variety of places, such as at farms, houses, "green oases" or on camping grounds.

USA

### Modelling the Toxic Effects of Silver Nanoparticles under Varying Environmental Conditions

*By Joyce Chai*

Silver nanoparticles (NP) abundance in the nanotechnology consumer market has made "nanosilver" a major concern in the scientific community. The investigation attempts to model and quantify the toxicity of nanosilver under varying environmental conditions. It measures the reliability of a nanosilver consumer product. In Phase I and II of the investigation, a novel, high-throughput bacterial toxicity assay was developed to quantify the toxicity of nanosilver. Most importantly, Phase III of this investigation repudiated the assertion that silver NP are more reliable and less environmentally hazardous. The study demonstrated three essential concepts. First, the bacterial toxicity assay technique is a reliable, reproducible approximation of the potential toxicities of silver NP. Second, silver NP induce significantly higher toxic effects, including overwhelming cell death and cell inactivity, than silver ions do in the environment and water sources. Finally, the practical application of the toxicity assay substantiates the known efficacy of silver NP, but questions the reliability of using nanosilver consumer products. This investigation took steps toward understanding and quantifying the potential environmental consequences and risks of using NP.

VIETNAM

### Moment Filter for Household

*By An Dinh Tran Vu*

The aim of An Dinh Tran Vu's project was to find a safe way to collect and discharge household wastewater. Even simple water treatment technologies, such as a filter of activated carbon, can contribute significantly to protecting water sources in Vietnam. His research improved common household manholes, which block solid waste to avoid obstacles in the drainage pipe but do not include any wastewater treatment. Therefore, thousands of chemicals are discharged into the water environment causing serious water pollution and risk infecting humans and other organisms. An Dinh Tran Vu's experiment was implemented over nine days and obtained good results. An average filter's efficiency was 70-85 percent, and the odour of detergent, oil, grease and toxic chemicals was not detected. Analyses of the filtered waste water by his moment filter satisfied Vietnamese wastewater discharge standards.

The filter is inexpensive and easy to apply in every region of Vietnam, which makes wide-spread application quite feasible. The filter is also able to capture and clean rainwater to increase the water source for domestic water supply for agriculture both in Vietnam and internationally.



Stockholm Junior Water Prize Finalists, 2007.

## Stockholm Junior Water Prize Winners

### 2007

Adriana Alcántara Ruiz, Dalia Graciela Díaz Gómez and Carlos Hernández Mejía, Mexico, were awarded the Prize for a project that developed a novel approach to adsorb lead in industrial wastewater using eggshells, an abundant and inexpensive bio-residual.

### 2006

In 2006, Wang Hao, Xiao Yi and Weng Jie, China, won the Prize for their originality and ingenuity in their use of low-cost, ecologically friendly technology to restore a polluted urban river channel.

### 2005

In 2005, Pontso Moletsane, Motebele Moshodi and Sechaba Ramabenyane, South Africa, won the Prize for their revolutionary solution to minimise the need for water in small-scale irrigation. They developed a low-current electric soil humidity sensor which uses light detection to control water pipe valves and improve irrigation efficiency.

### 2004

Tsutomu Kawahira, Daisuke Sunakawa and Kaori Yamaguti, Japan, won the Prize for the development and application of an environmentally friendly organic fertiliser for the Miyako Island. The method is applicable to many places around the world.

### 2003

Claire Reid, South Africa, won the Prize for an innovative, practical, easily applicable technique for planting and successfully germinating seeds in water-scarce areas to improve rural and peri-urban livelihoods.

### 2002

Katherine Holt, USA, won the Prize for research that looked at how foreign species could be introduced to benefit the Chesapeake

Bay while preserving the bay's native oyster species and meeting national environmental goals.

### 2001

Magnus Isacson, Johan Nilvebrant and Rasmus Öman, Sweden, won the Prize for their innovative and relevant research on the use of natural materials to remove metals in leachate from landfills.

### 2000

Ashley Mulroy, USA, won the Prize for a contemporary project that investigated how inefficient wastewater treatment processes can lead not only to antibiotic contamination in American waterways, but also to progressive resistance among harmful bacteria to those same antibiotics that once controlled them.

### 1999

Rosa Lozano, Elisabeth Pozo and Rocío Ruiz, Spain, won the Prize for an innovative project that used sea urchins, starfish and sea cucumbers to measure the effectiveness of an EU beach protection programme on Spain's western Mediterranean coast.

### 1998

Robert Franke, Germany, won the Prize for his design of the Aquakat, a solar-powered, flow-through reactor for the treatment of industrial wastewater.

### 1997

Stephen Tinnin, USA, became the first international Stockholm Junior Water Prize winner for research that investigated the correlation between the reproductive rate of sea urchins and water pollution.



# ITT

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**Nigeria:** African Initiative for Environment Sustainable Network, Alele Company Ltd., Young Water, Gender Action Team (YWGAT) Joint Fund, Gender and Water Alliance

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