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# FINALISTS 2013

# STOCKHOLM JUNIOR WATER PRIZE

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STOCKHÖLM  
JUNIOR  
WATER PRIZE

# THE STOCKHOLM JUNIOR WATER PRIZE

**Each year, the Stockholm Junior Water Prize international competition brings together young scientists and innovators from around the world who have created new solutions to the planet's growing water challenges. Each of the finalists represented in Stockholm are the champions of their national competitions, and have been selected as winners from thousands of entries.**

This year we are very proud to host the 18th annual competition and welcome the winners of national competitions from 29 countries: *Argentina, Australia, Belarus, Belgium, Canada, Chile, China, Cyprus, Finland, France, Germany, Hungary, Israel, Japan, Latvia, Mexico, The Netherlands, Norway, Republic of Korea, Russian Federation, Singapore, South Africa, Sri Lanka, Sweden, Thailand, Turkey, Ukraine, United Kingdom and United States.*

The Stockholm Junior Water Prize competition proves that brilliant young minds can find inspiration in unlikely places.

Ingenious teams from the world over have shown how to clean water and protect marine environments with substances ranging from oysters to eggshells. They see opportunity and hope where others find challenges and have developed cost-efficient and immediate solutions, applicable the world over. In this catalogue, you can learn more about the innovative research and inventions that earned each of the 2013 finalists a place in competing for this international honour.

All the finalists were invited to Stockholm for the special opportunity of meeting and with present leaders of the global water

community and making life-long friendships with international compatriots who share a passion for water and science. This visit includes the chance to receive the international prize from H.R.H. Crown Princess Victoria of Sweden, during an exciting ceremony, which will be held this year on Wednesday September 4.

World Water Week participants have the opportunity to meet this next generation of water leaders at this year's conference by visiting their booths in Hall B.

## THE INTERNATIONAL JURY

The competitions International Jury includes experts within the field of water who, appoint the winner of the international final by committee consensus. The decision is based on the finalists written report, a short presentation of their display material and a round of interviews. The jury members are appointed by Stockholm International Water Institute Board.

### THE 2013 INTERNATIONAL JURY MEMBERS

DR. FREDRIK MOBERG, (CHAIR), SWEDEN; DR. JOHAN GROEN, USA; MS. CHARLOTTE DE FRAITURE, NETHERLANDS; MS. EILEEN O'NEILL, USA; DR. PIET LENS, NETHERLANDS; MS. SUSANA SANDOZ, CANADA; DANKA THALMEINEROVA, SWEDEN AND MS. CAJSA LARSSON (SECRETARY), SIWI, SWEDEN.

### About the Stockholm Junior Water Prize competition

The competition is open to young people between the age of 15 and 20 who have conducted water-related projects at local, regional, national or global levels on topics of environmental, scientific,

social or technological importance. The international winner receives a USD 5,000 award and a prize sculpture. As a result of the competitions, thousands of young people around the world become

interested in water. H.R.H. Crown Princess Victoria of Sweden is the Patron of the Stockholm Junior Water Prize. Xylem is the global sponsor of the Stockholm Junior Water Prize.

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## ARGENTINA

### Technological advances for the Treatment of Industrial Effluents

*By Ezequiel Solis & Julian Zuñiga*

The Argentinian delegation proposes a breakthrough in the use of photo-active catalysts irradiated with ultraviolet light. In combination with oxygen from the air, catalysts can be used to treat industrial effluents carrying organic and inorganic pollution, inducing the oxidation of the organic loads and the reduction of the inorganic of metal ions. The scheme proposed was tested with a prototype, simulating industrial effluents, and achieved mineralisation of organic substances as well as reduction of metal ions.

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## AUSTRALIA

### Facing the Reality of Ground-water Salinity

*By Declan Fahey*

Undertaken in Tasmania, Australia's most southern state, the delegation from Australia set out to model the effects of salinisation on soil from water movement in potato crops. This was utilised by an examination of water movement in potato cells due to variations in salt concentration in extra-cellular fluids. From such a model, one could infer the likelihood of successful large-scale crop production in Tasmanian soils in areas affected by groundwater salinity, and by extension, in salinity-prone areas across the globe.

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## BELARUS

### Sorption Properties of Alginic Acids Originated from Laminaria and Its Usage in Water Treatment

*By Sviatlana Kazlova*

In order to treat contaminated waters naturally, the delegation from Belarus set out to establish the sorption properties of natural materials, such as alginic acids. Alginic acids were collected from the Laminaria thalli and tested for quality. The Belarusian delegation found that alginic acids have very good sorption capacities. Furthermore, an additional beneficial quality of alginic acids was found; due to its excellent sorption qualities, the acids can also be used as antiseptic combines, for example in adhesive plasters.

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## BELGIUM

### Water, Source of Life, Can it be a Source of Energy?

*By Alexis Pierson & Loïc Preud'homme*

The Belgian delegation has created an ecological, economical and sustainable battery that runs on water. The battery is based on the oxidation-reduction process and constitutes an alternative to currently used batteries that are a major source of pollution, significantly reducing their environmental impact. The reaction takes place between a metal electrode, made out of zinc or magnesium, and water. The electrode releases electrons which induces an electric current that supplies energy to the electric circuit of the device.

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## CANADA

### **Eggshells: Simple, Practical, Cost Efficient Remedy to Address Cadmium Pollution**

*By Hannah Landry*

In many countries around the world, the levels of Cadmium (Cd) pollution have increased to hazardous levels. The goal of the Canadian delegation was to discover a low cost, practical, viable water filtration system working to remove Cd from water in developing nations. The study examined the efficiency of eggshells from six breeds of chickens in their ability to remove Cd from drinking and waste water. Results proved the capacity of eggshells to remove Cd from water and determined the Hungarian Yellow to be the most efficient.

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## CHILE

### **Psychobacter: Antarctic Co-operation on Bioremediation of Oil-Contaminated Waters**

*By Naomi Estay & Omayra Toro*

The delegation from Chile have identified Antarctic psychophiles that are capable of metabolising phenanthrene (a polycyclic aromatic hydrocarbon, PAH) as the sole source of carbon for use in bioremediation of contaminated waters in extreme low-temperature zones. The research conducted by the Chilean delegation yielded twelve bacterial strains capable of degrading phenanthrene.

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## CHINA

### **Development and Test of Robot for Prevention and Control of Water Bloom**

*By Qian Dashi, Li Chang & Feng Yikai*

Blue algae water bloom proposes a serious environmental hazard and creates the need for eutrophication prevention and treatment of water. The robot developed by the Chinese delegation is designed to control water bloom. The robot adopts solar energy as an auxiliary power, uses new water pressure filters and possesses several innovative functions, including anti-blockage. This creative innovation can automatically work in waters, removing floating algae and preventing its burst in large areas.

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## CYPRUS

### **Creating a Sustainable Desalination System Through Renewable Energy Generation Using Brine as an Energy Storage Medium**

*By Antonis Antoniadis*

Desalination is from its nature a very energy-dependent process. The delegation from Cyprus, aiming to curb the large energy demand for this activity, has devised a new model that fits right into the desalination system. This brand new, innovative model provides renewable energy and uses it to create electricity. In addition, this method allows for the use of solar energy in daylight as well as at night.

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## FINLAND

### **Determining The Viability of Struvite Precipitation as an Alternative Method for Phosphate Ion Removal from Wastewater**

*By Filip Soich*

The aim of the Finnish delegation was to quantitatively determine, under laboratory conditions, whether dissolved phosphate could be removed from water and thus recovered through the precipitation of struvite. The practical component showed that there was over 99 per cent decrease in remaining phosphate levels in the solution. The benefits as well as the difficulties of precipitating struvite to remove phosphate from wastewater were also qualitatively discussed throughout the work.

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## FRANCE

### **Tip Tap Top: Water Saves, Save Water!**

*By Robin Menelot, Olivier Arconte & Lucas Baraize*

How many children waste water while washing their hands every day around the world? Too many! Kids, do you always wash your hands as you are told? Not always... The delegation from France and Tip Tap Top teaches this task in a new and amusing way, reducing water waste by up to 70 per cent while increasing sanitation and hygiene. Through a jolly jingle, Tip Tap Top guides children and shows them how fun it can be to wash their hands. Last but not least, the device is totally autonomous! Water saves, save water.

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## GERMANY

### **Detector for Finding the Optimum Washing-Performance of Washing Machines Based on Impedance-Spectroscopy**

*By Dana Tran & Wolfgang Köbele*

In the washing machines of today, washing powder is added manually, and often, too much is added. This not only leads to a higher consumption of washing powder, but also to a higher consumption of water when rinsing. This presents an environmental issue in a time where preservation of water is more important than ever. The full washing power of a machine is only achieved around about the critical micelle formation concentration (CMC). The delegation from Germany aimed to find the optimum washing powder-concentration by applying the Impedance-Spectroscopy to the washing solution.

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## HUNGARY

### **The Importance of the Szinva-Stream – Biological and Chemical-Physical Examinations**

*By Péter Polák, Jr, Dézi Kakas & János Béri*

The Hungarian delegation presents a small part of a research project that began in 2010. The Hungarian students have investigated the water quality of their local stream, the Szinva, whose water is used by the city for the production of drinking water as well as for industrial purposes. The delegation from Hungary has made measures with credible devices and methods in order to present feedback to the local authorities. The delegation is hoping that the results generated can assist in the improvement of the water quality and preserve their biggest treasure – the Szinva.

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## ISRAEL

### **Ever Green: Smart Irrigation in the Palm of Your Hand**

*By Yeari Vigder & Noam Arye Nassi*

The project presented by the Israeli delegation proposes a cheap and easy way to use a remote sensing system for farmers in developing countries. This inspiring innovation provides a plug-in and a smartphone application that delivers an immediate field condition feedback that allows for water saving. The plug-in sensors are mounted on a moving platform that takes snapshots of the crops and calculates the field's "Water Index", indicating what areas need more or less water. The delegation from Israel has constructed a working prototype by using a small helicopter, a tablet and sensor units. This prototype has been tested on real fields.

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## JAPAN

### **A Challenge to Reduce Seabed Litter in the Seto Inland Sea by Two Activities Gathering and Education**

*By Yua Yamaguchi, Ayumi Inoue & Shiho Tsukiji*

It is estimated that over 13,000 tonnes of garbage is piled up at the bottom of the Seto Inland Sea. The Japanese students have tackled this problem in two ways. First, they have removed garbage from the sea bed through the use of large trawling fishing nets attached to fishing boats. Furthermore, the Japanese delegation has strived to educate the public about the damage caused to the Seto Inland Sea through garbage waste. By taking these two steps, the Japanese delegation hopes to significantly reduce the garbage located at the bottom of the Seto Inland Sea.

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## LATVIA

### **Wastewater Purification From Phosphates Using Various Materials**

*By Arturs Janis Petersons & Rolands Capars*

The Latvian delegation has aimed to determine the ability of various materials, such as dolomite, red brick, travertine and gravel, to sorb phosphate ions. The delegation used prepared phosphorus containing solutions as well as wastewater samples from washing machines in order to investigate the different sorb abilities. Final results showed that travertine was the most effective material to sorb phosphates, with the ability to sorb about 95 per cent of phosphates from wastewater. However, other materials appeared to sorb phosphates as well and were found able to sorb phosphate ions below the permitted concentration in wastewaters.

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## MEXICO

### **Extraction and Purification of Cactus Mucilage and Its Effect as Coagulant-Flocculant to Produce Drinking Water for the Inhabitants of Rural Areas**

*By Clarissa Camargo Tapia, Doryan Brenda Laura Callejas López & Julisa Guadalupe Lugo Pacheco*

The project presented by the delegation from Mexico was performed in a Mexican rural area using a local and biodegradable product known as mucilage (cactus fibre). The Mexican delegation tested three different water sources recharged by wastewater containing TC, FC, Na; As, F, Pb and TDS, which all exceeded the Mexican regulation. For each water source, 200, 300, 400 and 500 mg/L mucilage powder were applied. In addition, a control dose of Al (SO<sub>4</sub>)<sub>3</sub> was added. Results showed that all parameters measured were similar in both cases, therefore safe drinking water might be obtained.

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## THE NETHERLANDS

### Green Cities

*By Kimberly Schoenmaker &  
Lotte Hoes*

The delegation from the Netherlands shows how it is possible to design an apartment building with a green roof as efficiently and inexpensively as possible. This building would be especially built for the purpose of water storage in cities. The Dutch students touch upon the issues of mass calculation, types of soil and the possibilities of green roofs. This project also discusses the main issue of how green cities can help city management in their fight against rising water consumption.

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## NORWAY

### **The Impact of De-Icing Road Salt on Surface Water – Focusing on the Drinking Water Supply Gjersjøen**

*By Hanne Minken Farestveit, Johannes Nyland Tandberg & Anna Grønning*

The use of de-icing road salts to improve winter road conditions is linked to an increasing salinity in nearby lakes. This increase in salinity can lead to changes in density gradients, stratification as well as circulation patterns, resulting in oxygen depletion. The Norwegian delegation has investigated the current situation as well as the long-term development of the lake Gjersjøen. The lake's salinity is increasing, but the circulation is not yet affected. The Norwegian project presents several recommendations to prevent a further negative development.

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## REPUBLIC OF KOREA

### **Producing Reusable Photocatalyst and Its Application**

*By Seohee Kim & Isabella Kim*

Photo catalysts, especially the  $TiO_2$ , present a promising way of decomposing pollutants. However, there is one major issue preventing this method from being adopted in reality; photo catalysts are too small to be separated from a solution. Therefore, the delegation from the Republic of Korea has developed a new type of photo catalyst that is produced by synthesising  $TiO_2$  with  $Fe_3O_4$ . This innovative type of photo catalyst can be separated from a solution through the use of a magnet. The new photo catalyst has been investigated for both properties and application.

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## RUSSIAN FEDERATION

### **Geophysical Methods of Ground Water Monitoring**

*By Vadim Tereletsy*

The delegation from the Russian Federation has conducted a geophysical survey of an area around a well to assess the risks of potential infiltration of oil products from a new gas station into the drinking water. The assessment was conducted from a novel method of joint interpretation of results using electric tomography and electric charge measurements. The direction of laminar groundwater flow was established by a sanitary-topographic survey of the geological structure of the area. Results showed that the gas station could not be the source of well water pollution. A computer analysis of field measurements detected other potential sources of well water pollution, which originated in the communal sector.

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## SINGAPORE

### Use Of Recycled Clam Shells In Water Purification

*By Yinn Jaye Ong, Kang Le Yeo & Wei Jin Gong*

Water polluted by heavy metal ions poses significant health risks. The delegation from Singapore has set out to compare the effectiveness of the lala clam, blood cockle and mussel shells in removing heavy metal ions under different pH levels. An easy-to-construct, cheap and eco-friendly filter capable of removing close to 100 per cent of metal ions was constructed using the more effective lala and blood cockle clam shells, low-cost charcoal, recycled bottles and sand. This filter can be used by those in poverty-stricken areas to obtain clean, potable water.

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## SOUTH AFRICA

### Evolution of Water Access and Usage

*By Ayanda Tsitsa*

The South African project addresses the issue of water waste by introducing a paddle system that will recycle water wasted through dripping. The system will reduce dripping water wastage, promote efficiency and minimise the risk of waterborne diseases generated in water pools created around taps where water is dripping. This new innovation consists of a tap, paddle, underground filter tank and a reservoir. The filter and the reservoir address the issue of dripping water by recollecting, purifying and reusing the water. This innovation could become very useful in rural and informal settlements where the effects of drip water waste are evident.

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## SRI LANKA

### Optimizing Soil Moisture for Higher Yield Using Solar Evaporation with Minimum Water

*By Navaretnarajah Kishoth,  
Shanthalingam Hisbanth &  
Nadarajah Viththiyakaran*

As of today, the methodologies used for watering crops in agriculture are driven by manually set times, irrespective of the individual plants' needs. However, in a time where water conservation is crucial, a better approach would be to use water crops based on the individual needs of the plants rather than on a set frequency. Thus, the Sri Lankan delegation introduces a novel methodology suggesting to water crops depending on ambient soil and temperature conditions. By applying this method to modern agriculture, farmers will be able to not only conserve water. This method further proposes an opportunity to use sea water for watering crops.

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## SWEDEN

### An Investigation of Harmful Substances in Ordinary Garden Hoses by XRF Spectrometer Analysis

*By Emil Johansson*

The Swedish project has investigated the existence of environmentally harmful substances in ordinary garden hoses. The analysis of the hoses reveals that the inner PVC plastic contains substantial amounts of lead, antimony and barium. The highest amount of lead found in the PVC plastic was 1,251 ppm. Concentrations of lead over 100 ppm were found in four out of six of the hoses tested. Previously conducted studies have found that lead has neurotoxic properties that affect cognitive abilities. Low concentrations of lead in the blood of children have been linked to reduced IQ levels. In addition, both antimony and barium compounds can be poisonous to humans. The project highlights the potential health risks related to the presence of lead, barium and antimony in garden hoses. Essential in the risk evaluation is the chemical constellation in which the substances are found.

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## THAILAND

### **A Novel Bioabsorption Instrument for Removal of Heavy Metals from Wastewater**

*By Cattliya Laohapotjanart,  
Thanwarat Jantiwatkun &  
Patnarin Kattiyasuwong*

The delegation from Thailand has aimed to investigate the heavy metal removal capabilities of natural absorbents to discover a cleaner, safer, more cost efficient and feasible alternative to wastewater treatment. The bio absorbents chosen were sawdust, coconut fibre and rice husk as they are in abundance and otherwise wasted by products. Results showed that the studied bio absorbents were extremely effective, up to 98 per cent, in the removal of copper, lead and cadmium ions.

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## TURKEY

### **Common Structures, Common Solutions – from Water Scales to Water Towers**

*By Günnur Tekşen*

In the Ottoman Empire, water distribution towers were used to decrease the pressure of water flowing from higher altitudes, as well as to share that water. However, these structures are not under protection in Turkey today although the information about these designs is considered a guiding element for the use of old technologies in the construction of new projects. Because of this, the Turkish delegation advises that the properties of these structures are to be taught in the physics, history and architectural departments of universities.

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## UKRAINE

### **Autonomous Device that Prevents Fish Smothering**

*By Zenoviya Shvayka*

Fish smothering is a great ecological problem in ponds, rivers and lakes, and is caused by oxygen scarcity during freezing-over periods. Ice holes have been a previous solution to this problem. However, once mechanically drilled, the ice holes require systematic renovation. These known solutions are both dangerous and energy consuming or require special chemicals. The device developed by the Ukrainian delegation utilises wind energy to create vertical water flow in the ice holes, thus preventing its freezing and providing good aeration to overcome oxygen deficiency in the water.

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## UNITED KINGDOM

### **Measuring the Hydrodynamic Load on Wave Energy Structures**

*By Astrid Blee, Elena Stronach & Leah Edwards*

Alstom are involved in the development of a device to generate electrical power from ocean waves. This innovation, created by the delegation from the United Kingdom, concerns small scale measurement of the forces on a wave device. This provides fundamental information requested by the designers of the device, who are working towards a full scale prototype, due to enter sea trials at Costa Head, Scotland, in 2014.

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## UNITED STATES OF AMERICA

### **Sulfidation as a Novel Method to Reduce Toxicity of Silver Nanoparticle Pollution**

*By Anirudh Jain*

Explosive growth in the use of silver nanoparticles in consumer products is increasing their concentration in wastewater. If the nanoparticles are released untreated after wastewater treatment, they can adversely impact benign microorganisms in our ecosystem. The study conducted by the delegation from the United States of America investigated sulfidation as a viable treatment method for reducing the toxicity of silver nanoparticles. It established that exposure to sulfides effectively reduced the biotoxicity of silver nanoparticles by altering their properties.

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# 2012 STOCKHOLM JUNIOR WATER PRIZE WINNER



Photo: Cecilia Östhammar, Exray

Luigi Marshall Cham, Jun Yong Nicholas Lim and Tian Ting Carrie-Anne Ng, Singapore, receiving the 2012 Stockholm Junior Water Prize from H.R.H. Crown Princess Victoria.

The 2012 Diploma of Excellence was awarded to Alonso Alvarez and Daniel Barrientos from Chile.

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**Xylem congratulates all participants in the 2013 International Stockholm Junior Water Prize competition!**

# STOCKHOLM JUNIOR WATER PRIZE WINNERS

- 2012** | Luigi Marshall Cham, Jun Yong Nicholas Lim and Tian Ting Carrie-Anne Ng, Singapore  
"Investigation of the Use of Sodium-Activated Bentonite Clay in the Removal and Recovery of Non-Ionic Surfactants from Wastewater"
- 2011** | Alison Bick, USA  
"Development and Evaluation of a Microfluidic Co-Flow Device to Determine Water Quality"
- 2010** | Alexandre Allard and Danny Luong, Canada  
"Research on Biodegradation of the Plastic Polystyrene"
- 2009** | Ceren Burçak Dag, Turkey  
"A Solution to Energy-Based Water Contamination: Rain as an Alternative Environmentally Friendly Energy Source"
- 2008** | Joyce Chai, USA  
"Modelling the Toxic Effects of Silver Nanoparticles Under Varying Environmental Conditions"
- 2007** | Adriana Alcántara Ruiz, Dalia Graciela Díaz Gómez and Carlos Hernández Mejía, Mexico  
"Elimination of Pb(II) From Water Via Bio-Adsorption Using Eggshells"
- 2006** | Wang Hao, Xiao Yi and Weng Jie, China  
"Application Research and Practice of a Comprehensive Technology for Restoring Urban River Channels Ecologically"
- 2005** | Pontso Moletsane, Motebele Moshodi and Sechaba Ramabenyane, South Africa  
"Nocturnal Hydro Minimiser"

- 2004** | Tsutomu Kawahira, Daisuke Sunakawa and Kaori Yamaguti, Japan  
"The Organic Fertilizer – an Alternative to Commercial Fertilizers"
- 2003** | Claire Reid, South Africa  
"Water Wise Reel Gardening"
- 2002** | Katherine Holt, USA  
"Cleaning the Chesapeake Bay with Oysters"
- 2001** | Magnus Isacson, Johan Nilvebrant and Rasmus Öman, Sweden  
"Removal of Metal Ions from Leachate"
- 2000** | Ashley Mulroy, USA  
"Correlating Residual Antibiotic Contamination in Public Water to the Drug Resistance of *Escherichia Coli*"
- 1999** | Rosa Lozano, Elisabeth Pozo and Rocío Ruiz, Spain  
"Echinoderms as Biological Indicators of Water Quality in the Alborán Sea Coast"
- 1998** | Robert Franke, Germany  
"The Aquakat – a Solar-Driven Reactor for the Decontamination of Industrial Wastewater"
- 1997** | Stephen Tinnin, USA  
"Changes in Development, Sperm Activity and Reproduction Across a 105 Exposure Range in *Lytechinus Variegatus* Gametes Exposed to Pesticides in Marine Media"



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