



# **FINALISTS 2014**

## **STOCKHOLM JUNIOR WATER PRIZE**

**ARGENTINA • AUSTRALIA • BELARUS • CANADA • CHILE • CHINA • CYPRUS • FRANCE • GERMANY  
HUNGARY • ISRAEL • ITALY • JAPAN • LATVIA • MEXICO • THE NETHERLANDS • NORWAY • POLAND  
REPUBLIC OF KOREA • RUSSIAN FEDERATION • SINGAPORE • SOUTH AFRICA • SRI LANKA • SWEDEN  
THAILAND • TURKEY • UKRAINE • UNITED KINGDOM • UNITED STATES**

# 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 competition, and have been selected as winners from thousands of entries.**

This year we are proud to host the 18th annual competition and welcome the winners of national competitions from 29 countries: *Argentina, Australia, Belarus, Canada, Chile, China, Cyprus, France, Germany, Hungary, Israel, Italy, Japan, Latvia, Mexico, The Netherlands, Norway, Poland, 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. 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 2014 finalists a place in competing for this international honour. All the finalists were invited to Stockholm for the special opportunity to meet with present leaders of the global water community and to make life-long friendships with inter-

national 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 award ceremony which will be held this year on Wednesday September 3 at the Grand Hôtel in Stockholm.

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

## 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 three rounds of interviews. The jury members are appointed by Stockholm International Water Institute Board.

### THE 2014 INTERNATIONAL JURY MEMBERS

- DR. FREDRIK MOBERG, (CHAIR), SWEDEN
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- MS DANKA THALMEINEROVA, SWEDEN,
- MR. MICHAEL FIELDS, USA and
- MS. CAJSA LARSSON (SIWI, SECRETARY), 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 and/or technological importance. The aim of the competition is to increase awareness,

interest and knowledge of water and the environment. As of this year the board of SIWI has decided to increase the prize sum to the winners and also to institute a new prize. The international winner will from now on receive a USD 15,000 award and a prize sculpture, the winner's school

receives USD 5,000 (new category) and the winner of the Diploma of Excellence USD 3,000. H.R.H. Crown Princess Victoria of Sweden is the Patron of the Stockholm Junior Water Prize and Xylem Inc. is the global sponsor.

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ARGENTINA

**Electrophotocatalysis, a Proposal for our Rivers •**

Ezequiel Alberto Solis, Julian Alexis Zuñiga and Ramon Daniel Eduardo Gramajo

The objective of the work is to provide solutions to diminish the polluting agents in intubated streams in uncontrolled discharges of the river “Río de la Plata” (Buenos Aires). With proposals of application of redox processes of remediation, through electrochemical means, helped by the reactivation with photoactive catalysts with ultraviolet radiation, it was tested with real effluents in prototypes constructed with the technological requirements to perform the treatment and the evaluated results made it feasible an alternative towards the solution of the problem.

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AUSTRALIA

**Finding the Optimal Reclamation Point of Phosphate in a Waste Water Treatment Facility •** Lewis Nitschinsk

Phosphorus sustainability is becoming a serious agricultural and environmental problem. The aim of the investigation was to find a simple and feasible way to recover and reuse phosphate precipitated from wastewater. Water was collected from various locations of a local wastewater treatment facility and each sample analysed to deduce the optimal reclamation point of phosphate.

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BELARUS

**Nitrate Contamination of Drinking Water in Belarus (On the Example of Osipovichi District) •** Pavel Tatur and Alena Shevchuk

The project presents the long-term investigation (2009-2013) of nitrates and nitrites content of decentralised sources (wells) of drinking water on example of one district of the Republic of Belarus. The research part was accompanied by a huge work with removing potential sources of water contamination in selected households by reconstruction of outdoor toilets and repairing the wells. Besides it was proved experimentally that the usage of wastes from reconstructed toilets has advance benefit on private agriculturing practice.

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### Waste to Water: Biodegrading Naphthenic Acids using Novel Sand Filters • Hayley Todesco

Effectiveness of slow sand filters (SSF) newly applied as biofilm bioreactors (BB) to biodegrade toxic naphthenic acids (NA) in oil sands tailings ponds was studied using indigenous bacterial isolates in a bench scale SSFBB versus planktonic batch culture bioreactors (PBCB). Planktonic microbial growth, biofilm development and NA reductions determined effectiveness of bioreactors. SSFBB reduced total NA concentrations faster than the PBCB. Cost-effective, sustainable SSFBB could detoxify NA in tailings water preventing more pollution of ground/surface water resources in the oil sands region.

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### Deception Island Bacteria Capable of Producing Fluorescent Nanoparticles: A Biotechnology Alternative • Estrella Calderon and Reynalda Zarate

The project involved isolating and characterising Deception Island bacteria capable of metabolising cadmium (Cd) and selenium (Se) in aqueous solution and synthesise fluorescent nanoparticles (QDs), thus providing an innovative water remediation option.

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### Novel Robot Fish – A Biomimetic Underwater Detector • Mingwei Zou and Yunling Hu

The newly developed bionic fish effectively improves original shortages of biological detection device and the project brought about a variety of innovative designs to the underwater detector. For example: the moving style in bionic fish only leads to faint noise, originally-created bionic whale tail fin makes rapid ups and downs possible by the swing of the fin, the mechanism of 'smooth amplification of linkage system' adopted from the horizontal tailing wagging of swordfish eliminated the shortages of the loud noise from crank linkage system and the huge energy consumption from rhombus folding structure and generated functions of horisontal and vertical wagging with remote control.

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CYPRUS

**A Novel Advanced Treatment Process for the Removal of Xenobiotics from Wastewater •**

Silvia Vitturini, Athanasios Phedonos and Zoi Konstantopoulou

The main idea of our project was to discover the impact of pharmaceuticals on the aquatic environment and their adverse effects on microorganisms. The test substances were paracetamol and caffeine which according to our questionnaires are the most commercialised pharmaceuticals. We applied the advanced chemical oxidation process Solar photocatalysis on a laboratory and pilot scale. The result showed that these technologies can remove substances by measuring the dissolved organic carbon.

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**Sensitivity through Educating of Water and Energy Treatment •** Pierre-André Crépon, Paul-Vinh Lê and Sohaïb Ouzineb

Our project is a model of a communicating pedagogical wastewater plant named Sensitization and Educating of Water and Energy Treatment or SEWET. It reproduces all the steps of water purification in a functional scale model which deals with this water-energy duality. We wanted to broadcast our system to raise awareness on energy issues in the wastewater treatment, so we decided to reach the widest possible student audience of different ages, from 9 to 20 years old, different nationalities particularly in Europe and different disciplines.

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FRANCE

### Biodegradation of Polyethylene • Finn Sombrutzki and Robin Hertel

This study deals to the subject of the biodegradation of polyethylene in sea water. The work was done with four microorganism species, two bacteria and two fungi species. In a preliminary test the four microorganism species were cultivated in an atmosphere of diesel respectively benzene in order to get them used to the hydrophobic and complex structure of the polyethylene. The scanning electron microscope was to furnish proof optically. In the course of the experiments the focus was put on *Alcanivorax borkumensis*.

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### Our Water is Our Future • Claudia Li, Livia Mayer and Nikolett Sebestyén

Have you ever wondered about the quality of the water you drink on a daily basis? We have. We examined different parameters of tap water in our region to compare them with the labels of the liquids in the shops. You'd better know that the restrictions for tap water are the strictest. We asked more than 550 students in seven European countries about their drinking habits. According to the responses, they are aware of the quantity and the quality of water they should drink, but they are unlikely to consume it sufficiently. So we should pay attention to water from now on. Because we are what we drink.

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### A Method of Enriching Desalinated Water with Vital Sea Water Minerals • Rashbil Izrailov and Shachar Rachmnpour Davar

World water scarcity has led to the development of desalination facilities. Desalinated water, especially its lack of magnesium mineral which is vital for the function of many systems in our body, is a major threat to the human health and to the agriculture. Studies show that only in Israel it leads to death of 150 people annually. Our project shows that the dialysis filter can transfer minerals from sea water via a diffusion process, thus enriching water quality, solving the lack of magnesium problem. The system we developed enriches water quality through a simple inexpensive process.

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**Arsenic in Cage** • Federico Ferrari, Domenico Pisana and Luca Isoletta

The purpose of our work is to develop a new method to remove arsenic from water. The presence of arsenic limits the use of water resources. Our method provides a high removal in a short time with affordable cost and without a specific chemical knowledge. The arsenic is removed, thanks to the action of a metal cage formed by copper, iron and galvanized iron that reacts with the arsenic in the water, forming a precipitate, without generating microbial and chemical contamination. This method can be a viable alternative to traditional removing methods for the simplicity of action.

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**Water-Jet: A Novel Technique for Water Purification**  
Tatsumasa Takei, Yuri Kirita and Kiichi Sugimoto

The Japanese delegation found an interesting phenomenon; a water-jet projected from underwater drags the surrounding water to be discharged out of a tank. The mechanism of this phenomenon was formulated using hydrodynamic approaches. Using the water-jet, several experiments were conducted to remove pollutants: oil, floating litter, duckweed, and sawdust from the water surface. These results suggest the applicability of this cost-efficient and eco-friendly technique to remove crude oil, floating litter, and algal bloom in the ocean and eutrophicated ponds/lakes all over the world.

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**The Amount of Manganese (II) in Drinking Water, Its Interaction with Cooking of Potato** • Loreta Rutkovska and Eliza Madara Treija

The work reveals a very topical and global issue, affecting a lot of people using potatoes and potato products in their diets because in the present research it was found that during the boiling of potatoes a part of manganese (II) content from potatoes transfers to the water. The goal of the project: To investigate the amount of manganese (II) in water samples collected from various districts of Riga. Also interaction with potatoes boiled in it or the changes in the amount of manganese in water before and after boiling of the potatoes.

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### Extremophile Organisms for Improving Water Quality: A Binational Problem • Adolfo Alejandro Romero Ángeles and Mauricio Alberto Romero Ángeles

In this project, we studied the polluted water from two important lakes by the Mexico-USA border: Lake Salton Sea and Mexicali's Lagoon. We analysed the reaction of extremophile microorganisms to pollution in order to evaluate its possible usage as bio-indicators for water quality. We found that the resistance properties of tardigrades to polluted environments make them excellent candidates to this use.

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### CAD Spotter – The Optical Watersensor • Eva Maquelin and Hannah Spaander

China is suffering from a serious drinking water shortage, since a lot of the (ground) water is polluted by heavy metals among others. In this project we will give these people a way to test the water they drink and the water they use for agriculture. The optical water sensor indicates whether or not the water contains Cadmium(II) ions, which are carcinogenic. The sensor absorbs the Cd(II) ions from the water which causes the colour to change. The sensor is small and easy to use and make, so that also people without education or knowledge about the subject can use this sensor.

**NATIONAL ORGANISER • NETHERLANDS WATER PARTNERSHIP, WETSUS**

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### Cumulo-Nimbus: Discovering Polar Jet Streams Over Norway using High Altitude Balloons • Christopher Gundersen and Jonathan Harbakk

Our focus has been on the polar jet streams over Norway using audio signals from two high altitude missions to 33 kilometers. We looked for the “core” of the strongest signals and inferred these cores where the center of the jet stream “cylinder” where winds were at their maximum velocity. We discovered seasonal variation in the jet streams over Norway. In addition we discovered the application of false color to the high altitude images made it easier for us to determine the types and patterns of clouds – especially Cumulo-Nimbus clouds, which are responsible for precipitation.

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**The Analysis of Youth's Preferences and further Research on Polish Bottled Water** • Dorota Szymała, Zuzanna Konieczna and Beata Urbanek

The investigation included several stages: questionnaire, laboratory research and advertising campaign. The brands chosen for further analysis were the most popular among Polish youth. The questionnaire together with the sensory analysis showed the relation between the taste and popularity of water. The changes in the pH of water after opening the bottle and the SEM photos helped to draw conclusions about the optimal storage conditions. The amount of water remaining in the bottle after its emptying was calculated and a solution for the problem – pouring water into a PP bottle was suggested.

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**A Novel Draw Solute of Forward Osmosis for Water Purification** • Subin Jeon, Jinsol Shim and Soyoung Yun

Forward osmosis (FO) is an aspiring technology in the field of water purification. One of the most important components of this process is the draw solute, which creates a driving force (osmotic pressure). In this project, polyethylene imine (PEI) was applied as a novel draw solute. For better recovery of the draw solute, PEI was combined with magnetic nanoparticles (MNPs). PEI-MNPs complex may be applicable to FO process for water purification, especially enzyme enrichment.

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### Hydrological and Hydrodynamic Factors Affecting Distribution of *Mytilus* Genus Molluscs in White Sea • Pavel Safonov

The White Sea is inhabited by two mussels species: *Mytilus edulis* and *Mytilus trossulus*. Presence of *Mytilus trossulus* at mariculture plantations isn't desirable. Factors affecting distribution of the two species are poorly studied. I took samples from the ground and fucoids at Kandalaksha Bay with different values of salinity and tidal activity. Shown that proportion of *M.trossulus* at apex areas is higher than at tidal areas. Share of *M.trossulus* is on fucoids is higher than that on the ground. Salinity had no significant effect. Mariculture shouldn't be placed in apex waters and near large fucoids clusters.

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### Nanofied RHS Using Nanotechnology to Purify Water Harvested from the Roof • Dipuo Rebecca Nthane, Nthabiseng Motona and Tebogo Makana Mamabolo

This Nano enabled RHS focuses on treatment of rain water harvested from the roof which proves unsafe for human consumption. Nanotechnology has been used to remove microbial and chemical contaminant from roof-harvested rain water. Physical, chemical and microbiological test were done to determine the contaminants present and to evaluate the efficacy of nano treatment system. The results showed that the system could filter out physical, chemical and microbiological contaminants to satisfactorily safe levels for human consumption. However, further studies to determine the toxicity of nanosystem are to be carried out for safety. The project sets out to improve the quality of life in rural and urban settings of South Africa and the world over.

**NATIONAL ORGANISER • DEPARTMENT OF WATER AFFAIRS**

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### Use of Durian Waste in Multi-purpose Filter for Water Purification • Bryan Cheng Yee Lim, Wei Heng Tan and Ruobing Han

Countries in South East Asia are faced with water pollution caused by heavy metal ions and microorganisms. Durian (*Durio zibethinus*) is an exotic fruit native to South East Asian countries but its waste is under-utilized. In this study, a novel multi-purpose filter was constructed using durian husk and rind, activated carbon coated with silver nanoparticles synthesised from durian rind extract and sand. Results show that the filter is able to remove more than 90% of metal ions and *E.coli*. This filter has great potential to be used in South East Asian countries to purify water.

**NATIONAL ORGANISER • LIEN FOUNDATION AND Ngee ANN POLYTECHNIC**

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SRI LANKA

**New Technique to Minimise the Impact on Stream Fish with Modified High Velocities** • Kavya Rasanjalee Habarakada Liyanage, Thisaru Aparna Hettiarachchi and Tharindu Madhawa Premathilake

Construction of mini-hydropower stations along the stream network of Sri Lanka has created an intolerable pressure on aquatic organisms which has ultimately resulted in diminishing of vital aquatic organisms from this unique environment. Effect of stream flow velocity variations on stream fish was studied with respect to their occurrence in different modified environments. Laboratory experiment shows that fish cannot tolerate high velocities such as 10 cm/s. We propose that slow flow pockets with aquatic vegetation are applied when streams are modified for various development activities.

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THAILAND

**Transforming Wastewater from Raw Rubber Sheets Production to GBC Plastic** • Orawan Thasanabenjakul, Pannawat Peanjad and Natthanicha Jairungsri

The production process of rubber sheet from Para tree involves using acid as rubber coagulant and approximately 20 litres of wastewater per kilogramme of coagulated latex is left over. This wastewater has an acidic property with BOD and COD which is unsuitable to discharge into the environment. It is found that such wastewater is in favor of synthesis of gelatinous bacterial cellulose (GBC). The obtained GBC exhibits properties similar to petroleum-based plastic which process dramatically lower the BOD and COD and the by-product as a rubber coagulant can reduce the amount of wastewater by 95.15 per cent.

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**SPONSORS** • TTW PUBLIC COMPANY LIMITED

SWEDEN

**The Local Environment's Impact on the Morphology of Zostera Marina Plants** • Ana Latorre and Frida Hellström

This study investigated how the morphology of *Zostera marina* plants differ in regards to their leaf lengths and root lengths between two different sides of the island Saltö. The physical factors which have an impact on this morphology were limited to winds, waves and sea bottom toughness. In the exposed site, wind and water movements were greater while the sea bottom was also tougher in comparison to the protected site. There was a statistically significant difference between the leaf lengths of each site but not between their root lengths. Studies such as these are crucial for replantation.

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TURKEY

**Removal of Cr (III) Ion with Alkali Blue 6B Attached P(Hema) Nanopolymer** • Helin Vardar and Sude Acı

The aim of this study is to develop an affinity system ensuring high adsorption with the contribution of nano dimension, being highly efficient to use for removal of Cr (III) in waste water and that has high re-usability. For this purpose, we employed dye affinity system to remove Cr (III) and a supporting material to Cr (III) could be removed directly not requiring activation process was synthesised and used for removal of Cr (III). In this study, results of studies of removal of Cr (III) and Cr (III) suppressed nanopolymer characterisation were summarised.

**NATIONAL ORGANISER** • GENERAL DIRECTORATE OF STATE HYDRAULIC WORKS (DSI)

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### Wave-Powered Desalination Plant • Mykhailo Lytovchenko

The main problem of islands and coastal areas is lack of electricity and fresh water. Traditional diesel generators pollute the environment. Wind turbines and solar panels do not solve the problem either. Mykhailo Lytovchenko from Ukraine has invented a technology, created and tested the device prototype, which produces fresh water and electricity simultaneously. The invented technology needs only sea waves as a driving force. The technology is highly advantageous due to short period of investments return, helps to improve level of human life and promotes economic and social development.

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### Toxicity Testing of Chemicals used to Treat Sea Lice Infestations • Annabel Macklin

We assessed a potential chemical solution to sea lice infestation (by *Lepeophtheirus salmonis* (LS)) in the Atlantic salmon industry. The effect of Emamectin benzoate and Product X on LS and a benign copepod species (*Amphiascus tenuiremis* (AT)) was studied in an ecotoxicology bioassay. The study used copepod nauplii in microwell plates with a bath solution of the chemical and daily observation. Results showed that AT were less susceptible to both chemicals and that both chemicals are effective anti-sea lice treatments.

**NATIONAL ORGANISER • CHARTERED INSTITUTION OF WATER AND ENVIRONMENTAL MANAGEMENT (CIWEM)**

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### A Novel Photocatalytic Pervious Composite for Degrading Organics and Inactivating Bacteria in Wastewater • Deepika Kurup

The goal of this research was to integrate enhanced photocatalysis with filtration, to develop a safe, cost-effective, sustainable and ecofriendly technique for wastewater purification. A novel silver doped photocatalytic pervious composite was synthesized using uniformly graded sand, Portland cement, titanium dioxide and silver nitrate. Photodegradation studies of the organic indicator dye methylene blue were conducted using UV-Vis spectroscopy. Bacterial inactivation studies with the photocatalytic pervious composite showed 100% inactivation of coliform bacteria 15 minutes after filtration.

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# 2013 STOCKHOLM JUNIOR WATER PRIZE WINNER



Photos: Cecilia Östhammar, Exray

Naomi Estay and Omayra Toro, Chile, receiving the 2013 Stockholm Junior Water Prize from H.R.H. Crown Princess Victoria.

The 2013 Diploma of Excellence was awarded to Yairi Vigder and Noam Arye Nassi from Israel.

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# STOCKHOLM JUNIOR WATER PRIZE WINNERS

- 2013** | Naomi Estay & Omayra Toro, Chile  
"Psychiobacter: Antarctic Co-operation on Bioremediation of Oil-Contaminated Waters"
- 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 Polyesterene"
- 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, Dalía 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"

# 2013 STOCKHOLM JUNIOR WATER PRIZE CONTESTANTS





Photo: Cecilia Östberg, Exray

## Do you want to be part of the Stockholm Junior Water Prize?

If you are interested in leading a national competition in your country or would like to learn more about sponsorship opportunities for the Stockholm Junior Water Prize, please contact [cajsa.larsson@siwi.org](mailto:cajsa.larsson@siwi.org).

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