

2016 Finalists
Stockholm Junior
Water Prize

20
1997-2016

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The Stockholm Junior Water Prize

Each year, the Stockholm Junior Water Prize congregates 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 for their outstanding work.

This year we are proud to host the 20th annual competition and welcome the winners of national competitions from 29 countries: Argentina, Australia, Bangladesh, Belarus, Canada, Chile, China, Cyprus, Finland, France, Germany, Hungary, Israel, Italy, Japan, Latvia, Mexico, Nigeria, Norway, Russian Federation, Singapore, South Africa, Spain, 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 finalists a place to compete for this international honor.

All the finalists are invited to Stockholm for the special opportunity to meet with present leaders of the global water community and to make life-long friendships with likeminded from around the world who share the passion for water and science.

This visit includes the chance to receive the international prize from H.R.H. Prince Carl Philip of Sweden during an exciting award ceremony which will be held this year on Tuesday 30 August at the Grand Hôtel in Stockholm.

World Water Week participants have the opportunity to meet this next generation of water leaders by visiting their poster exhibition.

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.

All members of the jury has extensive experience and represents a wide range of disciplines from natural to social sciences in order to ensure all projects are equally reviewed and judged.

The 2016 International Jury Members

- Dr Fredrik Moberg (Chair), Sweden
- Dr Jo Burgess, South Africa
- Ms Belinda Abraham, Canada
- Ms Danka Thalmeinerova, Sweden
- Prof Yoshihisa Shimizu, Japan
- Mr Johan Bratthäll, Sweden
- Prof Krishna R. Pagilla, USA

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 with environmental, scientific, social and/or technological importance.

The aim of the competition is to increase awareness, interest and knowledge of water and the environment.

The international winner will receive a USD 15,000 award and a prize sculpture, the winner's school receives USD 5,000

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 founding global sponsor.

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2015 Stockholm Junior Water Prize
finalists

Photo: Jonas Berg

Cover Photo: Jonas Berg

Design by: Elin Ingblom, SIWI.

Printing by Molind. The printing process has been certified according to the Nordic Swan label for environmental quality. For electronic versions of this and other SIWI publications, visit www.siwi.org.



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Argentina

Usage of eggshell to remove iron from water

Florencia Franzoni

The objective of this investigation was to evaluate the removal of iron through a filter made out of eggshell to decrease the concentration of this mineral in groundwater. Iron concentrations were measured with a colorimetric test.

The investigation concludes that the use of this filter medium was effective, achieving an average iron removal of 83 per cent. Filter residues can be used in agriculture as a natural fertilizer.

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The effect of surface area of *Elodea canadensis* on the assimilation of nitrate in effluent

Mohamed Jakaria

Excessive levels of nitrate in effluent discharged from wastewater treatment plants leads to environmental issues such as eutrophication. This study investigates the efficiency of *Elodea canadensis* in assimilating nitrate in effluent as an alternative tertiary wastewater treatment method. The results showed *Elodea canadensis* as an effective nitrate assimilator having significant reduction in nitrate levels over 48 hours. It was concluded that further research involving other micronutrients is needed to make significant claims about an alternative method to tertiary wastewater treatment.

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Bangladesh

Purification of drinking water using coconut shell-based activated carbon (PDWCAC)

Bakhtiar Zaman Bhuiyan

In Bangladesh there is a crisis concerning safe drinking water as pond, river and lake water is often contaminated. Microorganisms present in water cause diarrhoea, typhoid, rotavirus, *Vibrio cholera*, and species of *Shigella*. Coconut shell-based activated carbon is effective for removing microbial pathogens and also chemical impurities. A copper coil

filtration system is used to reduce the levels of bacteria in the water through a “oligodynamic effect.” Copper ion breaks down the bacterial fungi, algae and harmful microbes due to its toxic effects on living cells.

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Belarus

**Baltic salmon spawning in the rivers
of Belarus: what is the reality?**
Dzianis Marach

Despite not having direct access to the Baltic Sea, Belarus does experience problems in its environment. One of these is the lack of spawning places for anadromous salmon fishes ie- sea trout and atlantic salmon. Nowadays, a few spawning places exist on some rivers in Belarus. They are small tributaries of the Vilia river and have vulnerable ecosystems. The author of the project made long-term and complex investigations of this region in order to reveal the ecological situation on these rivers. The region is poorly researched and some hydrobiological data is newly obtained for the rivers.

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Canada

**Impact of an oil spill and emergency
response on thick-billed
Murre Feathers**
Caitlyn Pratt

Oil spills and emergency response can involve use of dispersants. These substances affect the feather micro-structure/mass of Thick-billed Murres (*Uria lomvia*), a North Atlantic seabird. In particular, its survival if its insulating feathers are compromised. An oil spill environment was mimicked by exposing feathers to seawater and seawater with oil, oil with dispersant and dispersant and determining a feather amalgamation index. Results showed dispersants harmed feather waterproofing adding to the discussion of dispersant use, alternative mitigation tactics and changing dispersant use regulations.

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Chile

Fogs catchers of Atacama, care and preservation of regional flora and fauna
Brittany Paredes and Paula Dvorquez

While drinking water is in increasingly short supply on a global scale, significant sources remain untapped. These include the camanchaca, a thick, highly dynamic, notably moisture-laden fog common across northern Chile. Harvesting water from airborne moisture is a long-standing technique that could prove valuable in easing the water shortages currently

affecting both human and animal populations across the arid spans of northern Chile.



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China

Test and popularization of ultrasonic algae removing system in reservoirs in Foshan

Zeming Zhang, Zhongpei Luo and Shiyong He

This project was the the development of an environmentally friendly ultrasonic algae removal system, consisting of intelligent controlling software, UAV, patrolling boat and buoy-type ultrasonic algae removal device. The system is fully-automatic in monitoring algae distribution to remove excessive algae in time. Satisfying results have been achieved during testing, which can effectively remove cyanobacteria and Chlorophyta, and inhibit the growth of algae. At present, the device has already been applied to Foshan Dongfeng Reservoir.

Finland

Effect of the Baltic Sea Water to the Germination and Growth of Different Type of Plant Seeds

Liina Yliheikkilä

In this project I used seeds of typical trees from Finnish nature and seeds of common garden plants. The seeds were planted every week and the last seeds after they had been in the sea water for three weeks. The planting was also done without affecting the seeds to the sea water, so comparison to normal conditions was possible. Tomato and radish seeds were

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Cyprus

Alternative ballast water treatment for sustainable transportation

Alexandra Christofi, Thaleia Sofokleous and Maria Charalambous

In this project, we propose the use of silver nitrate embedded on alumina for treating water ballast in ships. Ballast water is used in ships when they have no cargo in order to provide them balance, and once they load the cargo they discard it in the sea. This ballast water however contains various microorganisms which pollute sea water. We investigated the effectiveness of killing E.coli bacteria using the catalyst we created. The results were significant especially given the catalyst is effective and cheap.

able to germinate after exposed to the sea water, but salad seeds were not. However, it is difficult to conclude the ability of the typical tree seeds to germinate, because their germination in normal conditions was poor.

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France

The dead water phenomenon

Harmand Thomas, Delorme Louis and Herve Titwan

Global warming could open maritime ways through the pole in summer. But, a curious phenomenon occurs when the ice melts. Ships are sometimes retained by a mysterious force. Where does it come from? In a tank, in which we release two layers of water, one salted and the other "pure" and coloured, a little boat is pulled by a traction system with a constant strength. A high amplitude wave was formed on the two liquid layers interface. The boat velocity oscillated in synchronism with the interfacial wave. A wave is formed on the interface with such amplitude that the boat's movements can be impacted.

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Odour removal of wastewater by using ferrous scrap

Johannes Harald Hammer

In my research work I try to find out how I can remove the hydrogen sulphide in wastewater by using an electrochemical reaction of ferrous scrap, because hydrogen sulphide causes some problems in the sewer tunnel. Due to its characteristic smell of rotten eggs it generates complaints and it also determines corrosion of concrete. The aim of my research was to investigate if it is possible to lower the hydrogen sulphide content in wastewater simply by using ferrous scrap and the power of a solar panel, and if it is possible to ascertain the optimum value of the needed power.

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Hungary

What can we gain by using greywater?

David Kovacs and Akos Ivan Szucs

This project statistically verifies what economic and water savings are possible in schools and households by reusing rainwater and greywater from hand-washing. Furthermore, this research presents both the inhibiting factors and the problems of greywater usage, while it also explores the possible reasons why young people waste water at school.

The research is additionally aided by a short film which raises awareness on environmental protection for high-school students.



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Israel

Harnessing biomimicry for reducing biofouling in irrigation systems by micro-topographic structures

Lipaz Harodi

Drip irrigation systems save water but microorganisms settlements on the devices' walls cause clogging. Today's solutions for biofouling use harmful chemicals. This work suggests a sustainable technical solution, based on a micro-topographic structure mimicking shark skin, that enhances water turbulence which prevents biofouling. Using 3D modeling and printing we have manufactured surfaces which mimic this structure toward developing pipes and drippers for irrigation system. Controlled and systematic experiments using plates proved biofouling reduction both under water flow and in still water.

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Italy

Boiling water reveals its secrets Gianluca Pasquini and Erica Melelli

The aim of this research is to distinguish different ways of warming water up to boiling point and maintaining it at that point for four minutes by means of Infra-red Spectroscopy. We take into account two vibrations of the water molecule: the symmetric stretching and the bending of the OH group. Three systems of warming are used: microwave oven; electrical heater; Bunsen burner. The average wave number of the two OH vibrations and their variances are calculated and used to plot suitable graphs that allow us to highlight the differences.

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Development of inexpensive and novel real-time biomonitoring system using alternative organisms

Naoki Hamada, Kyuya Matsumoto and Kaname Harada

The pollution of water by chemical substances can harm humans and affect ecosystems. We aimed to develop a low cost, yet high accurate, automatic bio-monitoring system to ensure drinking water. We created an innovative toxicity monitoring system using three kinds of bio-monitoring at the same time. It enables us to detect harmful

influences given by chemical substances more comprehensively. It is expected that costs of toxic materials test will be reduced substantially because our system is very small and monitored by computers.

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Experimental application of phytoremediation terraces in water purification from heavy metal ions

Haralds Baunis, Irina Česnokova

The aim: investigate the suitability of the many-leaved lupine, coriander and garden parsley for their application in phytoremediation terraces to remove heavy metal ions. Plants were grown on a scaled model of a phytoremediation terrace and watered using a solution containing zinc, nickel, lead and copper ions. After 30 days, plant and water samples were collected and analysed using a flame atomic absorption spectrometer. Results indicated a nearly absolute decrease in concentration of heavy metal ions in water samples, while the plant samples exhibited signs of accumulation of heavy metal ions.

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Mexico

Reclaim water integral system of wetlands and tertiary treatment for a sustainable vision

**Gabriel David Alejandro Trujillo,
Eunice Yaneli Masegosa Gaona and
Carlos Castellanos Dominguez**

Water scarcity and pollution is an internationally growing problem. The aim of this project is to mitigate this through a pilot plant that combine an artificial wetland, electrocoagulation process and a purification system to promote the use of reclaim water for small agricultural activities and school uses (such as bathroom discharges and cleansing). The results show that the use of this scheme warrants the removal of organic matter, faecal coliforms, oils, grease and nutrients. Nevertheless, it is necessary to perform more exhaustive and specific tests to confirm the results obtained in this research.

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Water Education for Schools and Communities in Lagos Project

Adeleke Victor Ademola and Idris Omogbolahan Musa

The broad aim of the Water Education for Schools and Communities in Lagos Project is to promote better understanding of water as a key social, economic and environmental resource and to facilitate a new water-use ethic in Nigeria. It is about the community's sense of duty – the obligation members have to each other,

to the use of water itself and to future generations.

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**What is so special about Pollevann?
Susanne Havsberg and Mathilde
Glende Klausen**

Pollevann is a proglacial, meromictic lake in Ås Municipality, formed as a result of the isostatic uplift after the last ice age. It is a vulnerable wetland area which became a nature reserve in October 1992. By measuring the pH value, conductivity, colour of the water, visibility, smell and temperature we have seen how the water quality is affected by the lake previously being a part of the ocean. The results showed how the water is separated into different layers with saltwater at the bottom and how the lake is affected by its history.

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**Dishwashing detergent: How much is enough? Conserve water; reduce chemical waste and save money
Orion Lee Young Xun, Rasheed Muhammad and Muhamad Raimi Rosian**

Surfactants are known to be harmful to the environment but its usage cannot be totally eliminated. This project determines the minimum effective concentration of surfactants that exhibits required detergency effect, reducing surfactants used. Dishwashing detergent was used as the study model. Dishwashing detergents at critical micelle concentrations (CMC)

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**A study of bacteriologic status of water
reservoirs in Morozovsky district
Tatiana Sheremetova and
Ivan Sheremetov**

The influence of bacterial contamination of 37 water bodies on development of cattle breeding in the district was studied. Seasonal changes of selected indicators – total bacterial count, coli-titer, Coli-index were analyzed on the basis of 5-year study of 4,218 water samples. Bacteriological analysis of water and biologic samples revealed the disease pathogen. Then we developed and implemented schemes of vaccination of cattle, which helped protect the animals from pathogenic microorganisms and preserve breeding stock. Proposed schemes were later implemented in the five farms before grazing season.

levels were found to exhibit excellent degreasing effect. Finally, an education card was devised to educate consumers on appropriate amounts of detergent required, thereby conserving water, reducing wastewater and saving money.

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Saving water drop by drop

Driaan Lou Kemp

My project focuses on collecting clean water which is wasted when turning on the shower and waiting for the water to heat up to the desired temperature. Experiments were conducted in my home over a number of days to determine the amount of water that is wasted when the shower is on while waiting for it to heat up. This led to the development of a device/model that allows the cold water to be diverted to a container and only allow water to flow out of the shower head when it is at, or above, the desired temperature. The saved diverted cold water in the container could then be used to wash the dishes, water the plants or even as drinking water as it is already treated water, thereby saving the consumption of water.

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Reclaimed water, a further step

Pep Pou Coll

The objective is to improve the water's sustainability in the city of Figueras by regenerating and reusing residual water in the environment and the urban areas. The lack of water is a serious worldwide problem. The availability of water depends on various factors, such as nature, technological factors, climate change or an increase of the population among others. I realised that "Figueras's conca" is suffering a water shortage and the water treatment plant in Figueras is carrying water that directly affects the ecological state of water.

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Vattholmsskärens nature reserve

Eric Marcus

This thesis is about trying to create Sweden's first freshwater reserve. The reserve covers three rocky islands in the middle of lake Siljan. My research has shown that these three islands play an important role for fishes, birds and for outdoor life. The islands give a maritime feeling and is a place for maritime birds to nest. My study has also shown that the site plays an important roll for the

reproduction of fish. Since my project was finished, several steps have been taken by Leksands municipality to create the reserve. The formal decision will be taken by politicians in August.



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Natural innovative water retention Mimicry Bromeliad (*Aechmea aculeatosepala*)

Sureeporn Triphetprapa, Thidarat
Phianchat and Kanjana Komkla

The natural innovative water retention mimicry of the Bromeliaceae was investigated to examine the efficacy of the natural water collection by plants, specially in terms of the shape of the plants that can collect and capture the water. The finding indicated that *Aechmea aculeatosepala* constitutes crucial multiple parts to retain water. We adopted to model the mimic water retention device. In the real application, the unit is installed on the rubber tree. It found that soil moisture when the device is installed represents 17.65 per cent greater than that non-installation, and is 57.50 per cent more productive.

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A novel approach to flood control Mariia Krokis

A fundamentally new method of combat-
ing floods has been invented, deepening
river beds in places with small sloped
bottom and by installing controllable rifts
in deep places. By setting the parameters
of rifts opening and closing, one can, in
a wide range, maintain a stable level of
water regardless the atmospheric precipi-
tations. The offered method, which was
experimentally tested at several working
models of river beds, has shown high ef-

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Turkey

The use of silkworm cocoon waste as an alternative sorbent for removal of oil from water

Gizem Agtas, Gizem Baykal

Removal of oil which is spread in the
sea by tankers or water treatment plants
is the aim of this project. Comparative
experiments are done between silkworm
cocoon waste and chicken feathers. It is
shown that silkworm cocoon waste has
higher absorption capacity. As a result,
a practical and environmentally friendly
product has been assumed and designed.
This product consists of silkworm cocoon
waste, which is cut in half, attached to a
fishing line which is attached to a propel-
ler in one end and swivel in the other.
It is projected to be integrated to sea
vehicles in order to increase absorption.

iciency in all proportions of depth
and width and slopes of the bottom.
The funds will pay-off already for a few
strong showers.

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United Kingdom

FLOW: A system that repurposes grey water in the home

Anna Morris, Jenny Rodgers

On average, 150 Litres of water are used per person per day in the UK, and bathing, showering and toilet use account for a large proportion of this total use. FLOW is intended to repurpose shower or bath water to reuse as toilet water. As toilet water is not required to be chemically clean, but should be clear, a Light Dependent Resistor (LDR) is used to detect its clarity. Clear water is allowed straight through into the tank and dirty water is diverted by a solenoid valve into normal waste. The system could be adjusted for different users to choose the clarity of their toilet water.

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USA

Experimental studies in developing safe sanitation solutions

Nishita Sinha

2.4 billion worldwide lack access to safe in-home toilets. In countries like India open defecation leads to the spread of germs and waterborne diseases. An inexpensive option is the Sulabh International 2-pit Composting toilet. Though this toilet effectively turns solid waste into fertilizer, I showed that liquid waste that seeps into soil, and eventually drinking water sources, is ripe with germs. I used natural additives and varying electric fields to create a cheap, sustainable solution that minimizes water contamination. I also raised funds for toilet installation and encouraged education.

Perry Alagappan from the United States received the 2015 Stockholm Junior Water Prize for inventing a filter through which toxic heavy metals from electronic waste can be removed from water.



2015 Stockholm Junior Water Prize Winner

"I am surprised, but so honoured, to win this award. I want to launch my study as open source technology that others can use and build upon in their research. This way, I think we can solve really big issues," said Perry after having received the award.

The Jury was impressed by Perry's passion and long-term commitment to the research and its practical application.

"This project addresses a critical water issue with broad implications for the whole world. Through its sound science and sustainable technology, the solution is scalable from household to industrial scale for a broad range of applications," said the Jury in its citation.

Stockholm Junior Water Prize Winners, 1997-2015

- 2015** | Perry Alagappan, USA
“Novel renewable filter for heavy metal removal”
- 2014** | Hayley Todesco, Canada
“Waste to water: Biodegrading naphthenic acids using novel sand filters”
- 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 polysterene”
- 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”



**OUR WATER,
OUR CLIMATE,
LET'S TAKE
ACTION.**

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