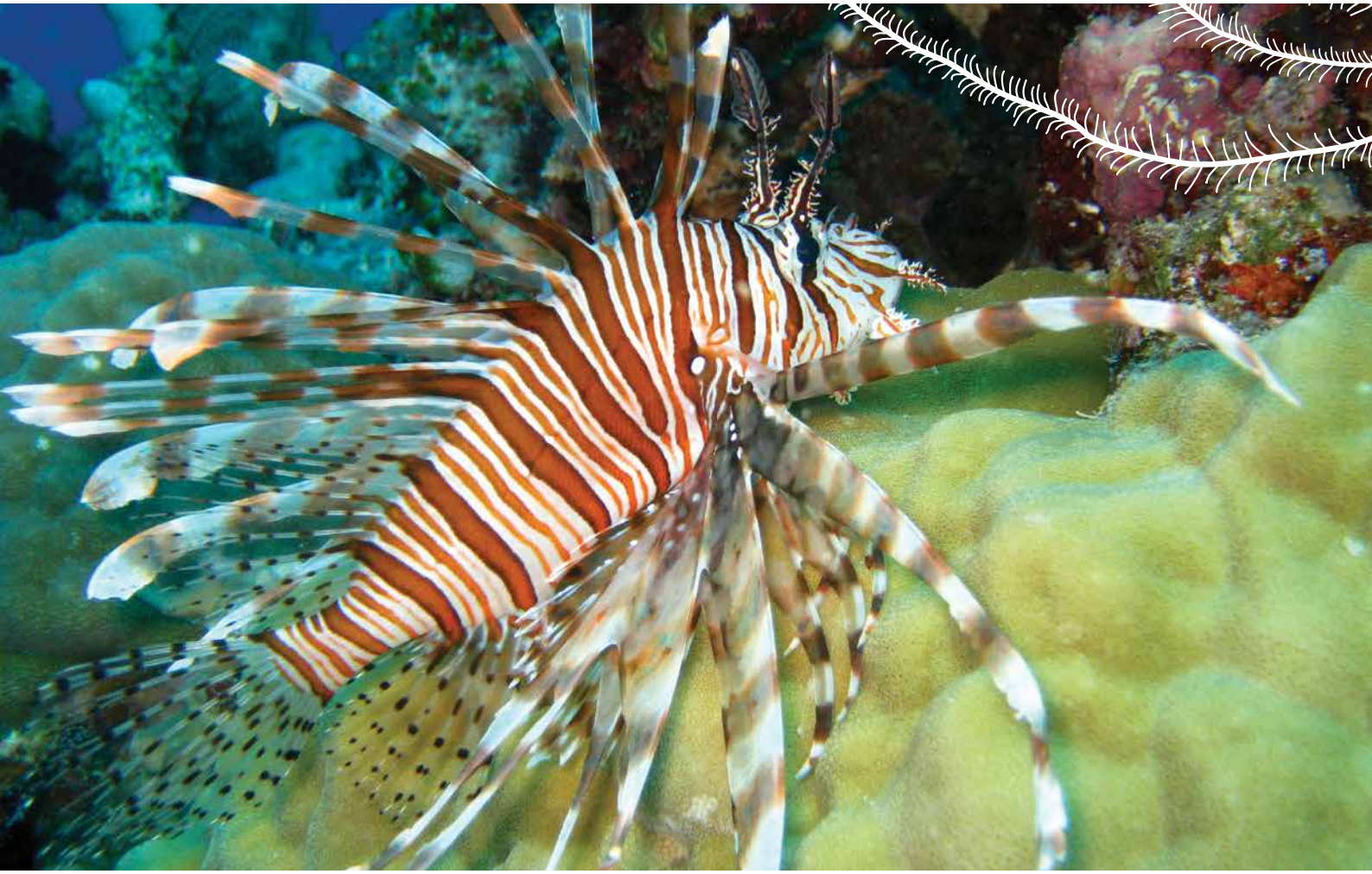
TEACH WILD



TeachWild Final Report

A three year synopsis of the Earthwatch-Shell-CSIRO national marine debris program

July 2011 to July 2014

EARTHWATCH INSTITUTE

CSIRO

"The collaboration with Earthwatch provides employees with first-hand experience of how we can, and must, work to minimise negative impact on the environment."

Dr. Steven de Bie,
Group Senior Adviser, Environment,
Royal Dutch Shell plc

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Final Report TeachWild

This document reports on the final activities and project outcomes conducted by Earthwatch Australia and principal partner CSIRO in delivering *TeachWild: a journey of marine discovery* a marine science research and education program.

Chris Gillies, Geraldine Davis & Michelle Joy

Earthwatch Australia

This document reports on activities between July 2011 and July 2013 of the agreement between Shell Australia and Earthwatch Australia to deliver *TeachWild*, a science based education program.

This report should be referenced as:
Gillies CL, Davis J, and Joy M (2014).
TeachWild Final Report: A three year synopsis of the Earthwatch-Shell-CSIRO national marine debris program, July 2011-July 2014.
A final Report to Shell Australia.

Acknowledgments

TeachWild is a joint initiative between Shell Australia, Earthwatch Australia and CSIRO. The TeachWild program team acknowledge and thank all program staff and scientists who have contributed to the design, content and delivery of the program from 2011 to 2014. We especially thank CSIRO scientists: Denise Hardesty, Chris Wilcox, TJ Lawson, Tonya van der Velde and Matt Lansdell; Former and Current Earthwatch staff: Andy Donnelly, Richard Gilmore, Rachel Maitland, Neil Hamilton, Lisa Dresher, Nonnie Kamau, Cassandra Nichols and David McInnes; researchers from the University of Western Australia: Nancy Longnecker, Jean Fletcher and Zarin Salter; University of Queensland researchers and staff from the North Stradbroke field expeditions: Kathy and Kevin Townsend, Qamar Schuyler, Hayley Jones and Lauren Roman; crew on board the CSIRO's RV Southern Surveyor; and, staff who contributed to the online TeachWild videos produced by Lush TV (James Lush and colleagues). Thank you to Jenny Odgers and Mike Seymour from Shell Australia who have contributed greatly to the success of TeachWild since its inception.

Finally, TeachWild could not have reached its great height without the passion and dedication of the many thousands of teachers, students and Shell staff who participated in the program. We are truly grateful for all their contributions to the science, education and sustainability outcomes produced as a result of participating in the TeachWild program.

Background, aims and objectives

World attention has recently been strongly drawn to the issue of marine debris (rubbish) through the discovery of the North Pacific Garbage Patch, where floating plastic debris is present in densities of over 350,000 pieces km^2, covering an area of approximately 1.7 million km^2. Within Australia, marine debris has been identified as one of three key threatening processes to marine habitats and wildlife by the Federal Government (Department of the Environment & Heritage 2003), especially to threatened and/or endangered species.

Despite the growing scale of debris in the marine environment, the impact of debris has, only in the last few years, received significant attention by scientists and the community. Marine debris affects wildlife through entanglement, ingestion and smothering and items of plastic or fishing origin are particularly harmful to wildlife due to their longevity in the marine environment (it's estimated a single plastic bottle may take up to 450 years to degrade). In Australia alone, 77 species of marine animals are known to have been affected by entanglement or ingestion of marine debris.

While there are a number of coordinated, voluntary events that conduct clean-up activities across a range of habitats (e.g. Clean Up Australia Day and World Clean Up Day), and which incidentally include marine habitats (especially beaches), a key issue remains that most general clean-up activities do not provide quantitative data to enable Australia to understand the threat and risks of marine debris on a national level.

In 2011, Shell Australia, Earthwatch and CSIRO initiated a partnership to address this issue and deliver the first comprehensive national risk assessment of marine debris for coastal Australia. TeachWild addresses four fundamental questions:

1. What are the sources, distribution, and ultimate fate of marine debris?
2. What is the exposure of marine wildlife to debris?
3. When wildlife is exposed to debris, what factors determine whether animals ingest, or are entangled by debris?
4. What is the effect of ingestion or entanglement on marine wildlife populations?

The program's activities focused on delivering:

1. A risk analysis completed for focal species across multiple taxa across the country
2. Increased science learning and uptake for individuals, schools, communities and industry across the country
3. Informed policy decisions based upon sound science
4. A priority list of 'at risk' species based upon distribution, encounter and impact of debris
5. Increased engagement with industries contributing to the marine debris issue (with potential solution-based approaches to resolving the issue)
6. Changes in behaviour resulting in decreased marine debris deposition across the country due to science learning at local scales

The program is an innovative partnership which brings together: students, teachers and shell staff from across Australia to assist CSIRO researchers and provides new opportunities for schools and community groups to engage in real scientific study.

The program uses several activities under the broader umbrella of 'citizen science' as a means to engage the wider community. These include:

- In-school workshops for teachers and students known as 'Scientist for a Day'
- Teacher and Shell staff professional development expeditions
- Volunteering days for Shell Australia staff and graduates
- Online webinars
- A dedicated website (**www.teachwild.org.au**)
- TeachWild event days
- National media releases

The program also delivers new lessons plans and activities for teachers which are linked to the Australian National Curriculum and are freely available on the website. Through these interactions, CSIRO scientists and Earthwatch staff are able to galvanise individuals, schools and the local community to undertake sustainable actions aimed at reducing the use of single-use plastics. This immense task is only achievable when the scientific, not-for-profit and corporate sectors partner together with mutual understanding and a single drive to address one of Australia's most critical environmental problems.

"That was the biggest thing for me: to get involved in some solid research and to have a connection with researchers, PhD students, Masters students and of course people like Denise who probably have a better understanding of marine debris than anyone else. I thought that was the best thing and I absolutely thrived on it and I wished I had the opportunity to do that more often. Essentially I think that's what kids miss out on."

Teacher
TeachWild Participant

"Great professional development – to be removed from your safety zone and be immersed in so much research and learning. Excellent staff and all were friendly, knowledgeable and committed."

Shell employee
TeachWild Participant

"My favourite part of the day was hearing about TeachWild, going to the beach and knowing that I'm helping the environment."

Student
TeachWild Participant

Summary

TeachWild has truly been an inspirational journey. Delivered through a landmark partnership between the corporate, NGO and the research sectors, TeachWild is a valuable demonstration of what can be achieved when the community work together to address one of Australia's most critical environmental issues. In just three short years, the TeachWild partnership has produced some remarkable achievements: **over 170 beaches** were surveyed around the coast of Australia (equating to a survey every 100 km) by CSIRO scientists and students to develop Australia's first national risk assessment for marine debris; **5700 students** have partnered with leading researchers to understand the causes and effects of marine debris and contributed to the solution; **160 teachers and Shell employees** have worked in the field alongside scientists conducting cutting edge research into the fate of plastics on our marine wildlife, and; a body of free education resources, materials and tools are continually being used by educators and government agencies across the country to engage students in the issue of marine debris.

The program's scientific and social outcomes have been **reported in eight peer-reviewed scientific papers,** received national media attention in over 150 articles (including primetime news stories and on the ABC's Catalyst program) and have revealed that the majority of coastal debris in Australia is from Australian sources and caused by consumer behaviour and illegal dumping. **Eighty per cent of all marine debris is plastic** (which can take 450 years to degrade) and that this debris has significant impacts on Australian wildlife. **Derelict fishing gear has entangled between 5,000 and 15,000 turtles** within the northern Gulf of Carpentaria region alone and globally, approximately one third of marine turtles and 40% of seabird species have likely ingested debris. The research demonstrated that **policies *can* reduce the problem and incentives *are* effective:** South Australia, which has a container deposit scheme, has one third as many beverage containers in its waste compared to all other states.

Yet perhaps the **most rewarding outcome of the program has been its influence on the individual teachers and students** participating in the program. TeachWild has improved the skills, motivation and understanding of many teachers on the issue of marine debris and has lifted their enthusiasm and capacity for teaching real-life sciences. Equally, thousands of students have been inspired to change their litter habits, reduce their use of single use plastic at home and in school, hold fund-raising events for marine research and are more motivated to engage in marine science.

This legacy is a testament to the individuals and partnerships involved in TeachWild. This report highlights the key achievements accomplished over three years (July 2011-July 2014) and supports more detailed program achievements and outcomes highlighted in the *CSIRO Final Report to Earthwatch Australia, UWA-TeachWild Final Evaluation Report and the TeachWild 2012-2013 Annual Activities Report.* Copies of these reports can be obtained from Earthwatch.

Not resting on these achievements, Earthwatch, CSIRO and the broader education community are working together to create a new, even more engaging TeachWild program for delivery in 2015-2020, TeachWild II. TeachWild II will emulate the success of the first three years of the program and build stronger partnerships to engage more of the Australian community in critical environmental issues of national importance.

Overview of TeachWild activities

Teacher Professional Development Fellowship Program - Earthwatch expeditions

Seven (4-7 day) teacher professional development expeditions ran over the course of July 2011-July 2014 in Queensland (North Stradbroke Island), Victoria (Philip Island), Western Australia (Rottnest Island) and on board CSIRO's research vessel the *Southern Surveyor* in the Indian Ocean. Participants (teachers and Shell employees) were able to work alongside CSIRO and University of Queensland researchers over several days, immersed in marine debris research and field sampling methodologies. Participants developed an understanding of sampling methods such as: seabird and turtle necropsies, spectrophotometry of plastics, surface trawl sampling, decay rates, plastic sampling, sorting and analysis and the expeditions provided a forum for teachers to discuss new lesson plans, teaching and engagement methods with their peers. Students were able to interact with teachers and scientists during the expeditions through live online feeds. These experiences demonstrably lifted the knowledge, enthusiasm and capacity of teachers to engage their students in marine sciences and the issue of marine debris.

A total of 79 teachers and Shell employees participated in field fellowship program experience. Their experiences were captured in detail in the TeachWild Evaluation Report produced by the University of Western Australia.

School-based workshops - Scientist for a Day

Over 5700 primary and secondary students participated in 60 School-based, Scientist for a Day workshops, almost double the original participation target of 3000. The workshops involved CSIRO researchers and Earthwatch staff joining teachers and students in classrooms to discuss marine debris, its impact on marine fauna, the importance of science and field methodologies and solutions to marine debris. Students and teachers would then join the CSIRO scientists and Earthwatch staff on a nearby beach where they would conduct surveys and classify debris. The teachers and students would later upload the survey data into the TeachWild database, discuss impact, solutions and personal sustainability. Some of the student outcomes and behavioural change associated with the Scientist for a Day workshops was captured in the TeachWild Evaluation Report produced by the University of Western Australia and the research results of the student surveys are reported in the CSIRO Final Report to Earthwatch Australia.

United Nations: World Oceans Day event

TeachWild held a United Nations 'World Oceans Day' event at Melbourne Aquarium on June 6th 2013 to celebrate the program's milestones and to release CSIRO's initial research findings.

The Director of United Nations Information Centre, Christopher Woodthorpe, was guest speaker at the event. Seventy guests attended, along with 15 school students. Presentations were made by the United Nations, Earthwatch, CSIRO and Shell. Marine debris art demonstrations were provided by students. Photos of entries in the art competition on the theme of marine debris were also submitted from schools around Australia. Schools also sent in film clips of their students' science questions which were then shown on the day and answered by CSIRO scientists. A video of the event, including: the science questions, art contributions and photos of the event, were posted on the TeachWild website for later use. The UN featured an article in recognition of the TeachWild event on the UN 'World Oceans Day' web page.

Shell Volunteering Days

Eighty one Shell employees participated in Earthwatch TeachWild events as part of Shell (employee) Volunteering Days. Four workshops were held in Queensland (Southport), Western Australia (Rottnest Island) and Victoria (Corio and Williamstown) which provided participants with an overview of marine debris and its impacts whilst also engaging staff in coastal debris surveys. The afternoon ended with group discussion directed towards changing (personal) behaviours and limiting the use of single-use plastic. The feedback from all workshops was exceedingly positive and participants left with a clearer understanding of the impact of marine debris in the environment particularly in their local area.

Webinars, online conferences

In addition to the school-based workshops, schools were invited to attend several online webinars during 2013-2014 hosted by Earthwatch staff and CSIRO scientists. During live feeds, students were able to ask scientists follow-up questions from their own TeachWild activities and CSIRO shared their research outcomes and discussed these with the teachers and students. Earthwatch and CSIRO scientists also hosted an online conference in 2014 including guest speakers and had over 650 students attending the event. TeachWild staff participated in events such as a school mentorship program (Youth Environment Conference) and the national, Kids Teaching Kids Conference in 2013. In total, 2296 students attended these events.

TeachWild footprint across Australia

The TeachWild program was able to complete Scientist for a Day (school-based) activities with 60 schools across each state and territory within Australia, including the ACT and Tasmania. Seven (4-7 day) professional development expeditions were completed as part of the Teacher Professional Development Fellowship Program in Queensland (North Stradbroke Island), Victoria (Philip Island), Western Australia (Rottnest Island) and on board CSIRO's research vessel the *Southern Surveyor* in the Indian Ocean. Four Shell corporate volunteering days were also completed in Queensland (Southport), Western Australia (Rottnest Island) and Victoria (Corio and Williamstown). Including additional outreach events such as the Kids Teaching Kids conference and webinars, there were over 80 individual events held across Australia as part of the TeachWild program.

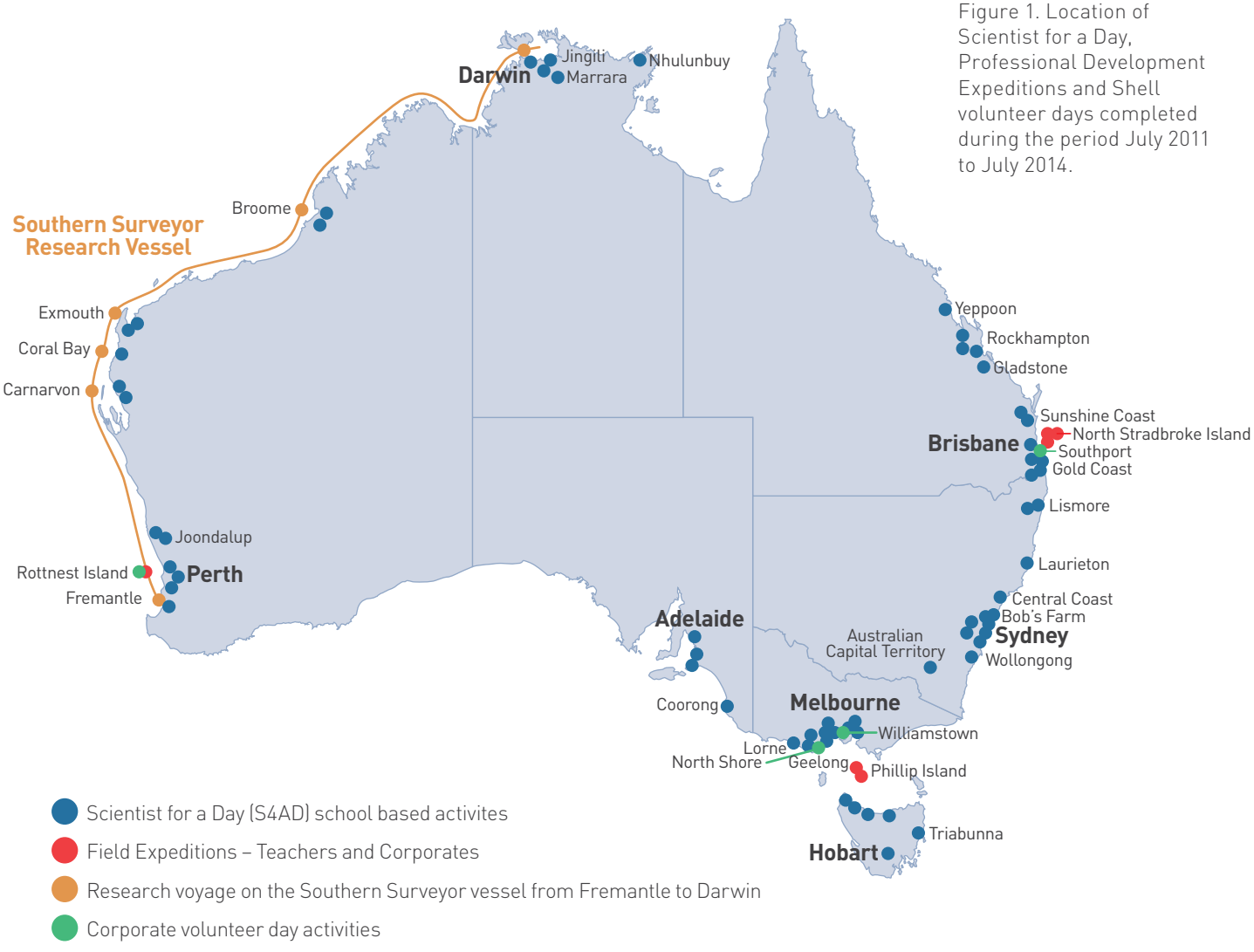


Figure 1. Location of Scientist for a Day, Professional Development Expeditions and Shell volunteer days completed during the period July 2011 to July 2014.

Key outreach achievements and learnings

Participation numbers (as of July 2014)

- 5718 students participated in the Scientist for a Day workshops
- 2296 students participated in other TeachWild activities including: online webinars, Kids Teaching Kids Conferences, sustainability clubs and Sustainability Victorian Resource Smart Schools Initiative
- Total of 8014 students participated in all TeachWild activities
- 160 teachers and Shell employees participated in field-based learning experiences
- 79 teachers and Shell employees fielded on expeditions to Rottnest Island, North Stradbroke Island, Phillip Island and on the CSIRO Southern Surveyor research vessel
- 81 Shell employees participated in Shell Volunteering Days
- Over 9,200 visits to TeachWild website

Education development

500,000 Australian teachers and students now have free access to:

- The National Marine Debris Database (developed by CSIRO **www.marine.csiro.au/apex/f?p=120:LOGIN:2976912159221**)
- The Marine Debris Resource kit which includes downloadable lesson plans for teachers and activities for students (available via TeachWild website – **www.teachwild.org.au**)
- Three Instructional videos on how to sample for marine debris (available via TeachWild website)
- Marine Debris fact sheets **www.csiro.au/Organisation-Structure/Flagships/Wealth-from-Oceans-Flagship/marine-debris.aspx**
- 45 expedition blogs completed by field participants (available via TeachWild website)
- Access to inspirational student stories (available via TeachWild website)
- Improved availability of TeachWild resources through permanent hosting of TeachWild resources on the Classroom Management System, Edmodo, which has over 34,000,000 registered users worldwide. (**www.edmodo.com/** – requires login)

Media coverage

Over the course of 2011-2014, TeachWild released over 20 local and national press releases, cumulating in over 150 TV, radio, print and online appearances including popular outlets such as:

TV

ABC 1 – *Behind the News*
ABC 1 – *Catalyst*
Channel 10 – *Scope TV feature*
ABC – *National News*
Prime7 – *Evening News*
Sky News – *Melbourne*

Radio

ABC Radio National – *Sunday Extra*
ABC National Radio – *Lifeline*
ABC National Radio – *Weekend Extra*
National Public Radio – *USA (international)*
SYN FM – *Panorama News and Current Affairs*
3AW – *NSW*
873 AM 2GB – *NSW*

Print

West Australian – WA
Newcastle Herald – NSW
Sunday Examiner – TAS
The Post (WA)
Australian Associated Press (AAP)
Herald Sun – VIC
The Hobart Mercury – TAS
The Sydney Morning Herald – NSW
The Age – VIC

Online

UWA Science Communication Seminar Series
CSIRO Blog
Healthy Waterways
News.com.au
TheAustralian.com.au
Brisbanetimes.com.au
Herald Sun
Sydney Morning Herald Sun
The Sydney News
ECOS Magazine
The Conversation
Yahoo! News Australia
CoolAustralia.org

Dr Chris Gillies (Director of Science) and Kevin Grunewald (Science Officer)

Awards

TeachWild was successfully awarded state winner in 'Best Litter Prevention Award' in Keep Australia Beautiful Victoria and was a finalist in two other categories.

The program has also been nominated in the 2014 National Banksia Awards under the 'Education category' and Earthwatch will enter submissions to a number of local and international awards in 2014/2015.

International exposure

TeachWild engaged with four international schools in India, United Arab Emirates and Indonesia, to share information, methodologies and discuss future collaboration. This work was in addition to the program's national objective yet illustrates the level of interest and exposure TeachWild is achieving amongst the international community.

"It is because of you and the TeachWild team that we now have a dedicated learning program of 1 hour a week, which includes sustainability and environmental issues. It is still being developed but eventually it will belong to the students and will not require my input to keep it going. Please pass on my thanks to the Team at TeachWild."

Teacher
TeachWild Participant

"It's easy for us not to be aware. And that's the beauty of TeachWild. It forces us to see the full impacts of plastic and our daily habits."

Teacher
TeachWild Participant

Program impact in participating school communities

TeachWild evaluation report

Earthwatch commissioned research from the University of Western Australia (UWA) to determine the extent to which TeachWild achieved its learning objectives and had an impact in school communities participating in the program. UWA researchers Professor Nancy Longnecker, Jean Fletcher and Zarin Salter conducted a series of evaluations focusing on experiences of teachers and students who participated in the Teacher Professional Development Fellowship Program or the Scientist for a Day Program. They also examined short and medium-term outcomes of participation.

The research addressed five key questions related to TeachWild education objectives:

- Do the aims of the TeachWild Program, as understood by CSIRO and UQ scientists and Earthwatch staff who deliver the program, match the experiences of participant teachers and students?
- Does participation in the TeachWild Program impact science teaching practices and innovation in curriculum delivery by teachers? If so, in what ways?
- Does the TeachWild Program impact students' knowledge, attitudes and behavioural intentions towards issues of ocean health?
- Does the TeachWild Program impact students' attitudes towards scientists and science careers?
- What impacts of the TeachWild Program can be observed within the school community relating to issues of ocean health and more broadly, environmental sustainability?

Key findings

The below key finding are extracted from the final UWA-TeachWild Evaluation Report. Copies of the final report can be request from Earthwatch.

Teacher (Professional Development) Fellowship Program:

1. All of the teachers enjoyed participating in the Fellowship Program and reported numerous benefits from attending the fellowship program.
2. The Fellowship Program inspired teachers to develop lessons and programs within their school, deliver TeachWild messages to local community groups, and actively advocate for colleagues and other teachers to participate in the program.
3. Teachers were confident enough with what they learned to modify the TeachWild Program if necessary to suit their circumstances.
4. Participation in the Fellowship Program inspired behavioural changes in school communities.
5. CSIRO scientists, Earthwatch staff, and participating teachers tended to focus on different attributes of the TeachWild Program.

Scientist for a Day Program:

1. Over 80% of students enjoyed the Scientist for a Day Program.
2. The program was delivered to a relevant audience.
3. Many students changed their behaviour following the Scientist for a Day Program.
4. Students increased their knowledge regarding the issue of marine debris.
5. Self-reported knowledge about the ocean increased in 18% of students.
6. Students gained an improved understanding of what marine debris was.
7. At least 50% of students gained a better understanding of the impacts of marine debris.
8. At least 20% of students increased their knowledge regarding marine debris in Australia.
9. Students overwhelmingly and consistently identified humans as the main source of marine debris.
10. Over 75% of students understood that human actions can affect the ocean.
11. Students related the TeachWild Program to lessons, projects and programs within their schools.
12. About 88% of participating students were generally interested in science.
13. Around 90% of students value the environment and similar numbers reported feeling a high level of environmental responsibility.

The UWA researchers concluded that the TeachWild Program was well targeted and enjoyed by almost all of its teacher and student participants with over 80% of participants saying they would participate in the program again. The program was able to increase knowledge and awareness about the issue of marine debris while also inspiring environmental behavioural change in students. Teachers not only integrated the program into their classroom lessons but expanded it across other disciplines or school-wide initiatives.

Key scientific achievements

During the course of the TeachWild program, lead CSIRO researchers Denise Hardesty and Chris Wilcox with CSIRO colleagues TJ Lawson, Matt Lansdell, Tonya van der Velde, David Milton, Margaret Miller and Genevieve Perkins, Earthwatch Staff Geraldine Davis and a team of local and international collaborators partnered with over 5700 students, teachers and Shell staff working as 'citizen scientists' to understand the patterns and sources of marine debris and assess the potential harm it poses to Australia's marine fauna.

The research objectives were addressed through four key research questions:

1. What are the sources, distribution, and ultimate fate of marine debris?
2. What is the exposure of marine wildlife to debris?
3. When wildlife is exposed to debris, what factors determine whether animals ingest or are entangled by debris?
4. What is the effect of ingestion or entanglement on marine wildlife populations?

The body of research conducted through the Scientist for a Day, Teacher Professional Development Fellowship Program, Shell Staff Volunteering Days, CSIRO independent debris surveys (170 completed across Australia) and CSIRO independent wildlife investigations has so far cumulated in over 10 local and international scientific conference presentation and seven published peer-reviewed scientific papers, with several more planed for publication in the near future.

Key scientific findings

The key scientific findings described below were extracted from the CSIRO Final Report to Earthwatch Australia:

Hardesty, BD, C Wilcox, TJ Lawson, M Lansdell and T van der Velde (2014). Understanding the effects of marine debris on wildlife. A Final report to Earthwatch Australia.

The final report (including all current published scientific papers) is available by request from Earthwatch or can be downloaded at: **http://www.csiro.au/marine-debris**

The majority of coastal debris in Australia is from Australian sources, not the high seas.

Debris is concentrated near urban centres.

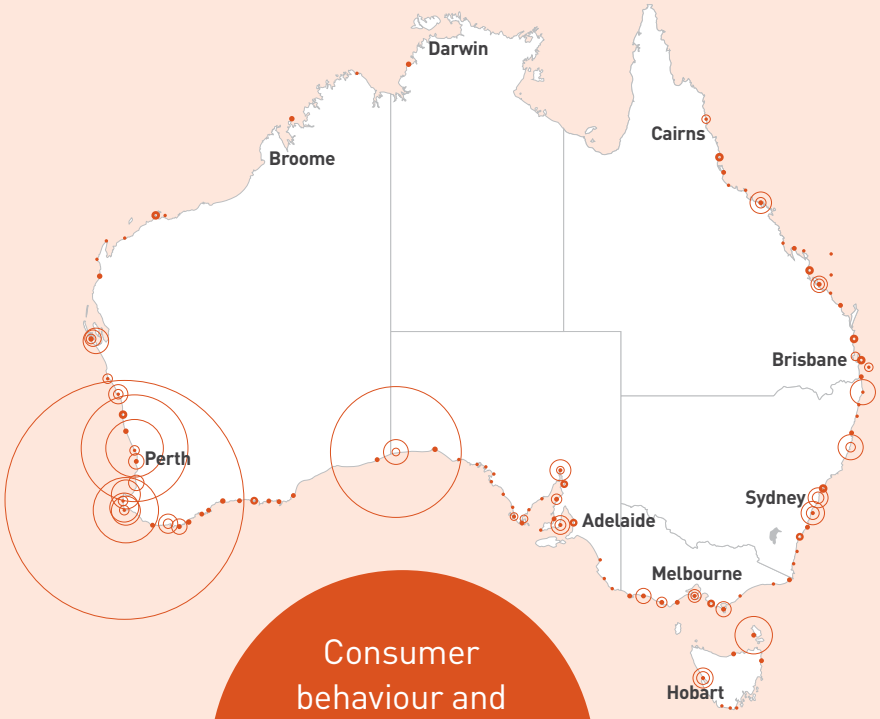


Figure 2 (right): Debris density along the coastline with circle sizes proportionate to debris density for each transect at a site. Map is uncorrected for population, beach type, substrate, or other covariates (Image courtesy of CSIRO)

Consumer behaviour and illegal dumping are primary causes of marine debris in Australia.

Debris has significant impacts on Australian wildlife. Derelict fishing gear has entangled between

5,000 – 15,000 turtles

within the northern Gulf of Carpentaria region alone.

Globally, approximately

one third

of marine turtles have likely ingested debris. Turtles ingest plastic debris that resembles their prey.

Policies can reduce the problem. Incentives are effective: **South Australia, which has a container deposit scheme, has one third as many beverage containers in its waste.**

Local initiatives are effective; prosecution of dumping significantly reduces marine debris along a council's coastline.

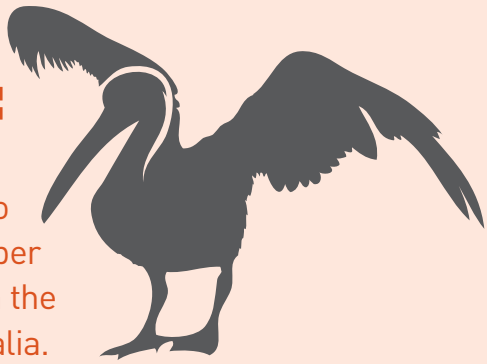
Individuals can make a difference!

Inspiring and educating the next generation is an excellent means of changing human behaviour.

Around the world,

nearly half

of all seabird species are likely to ingest debris. The greatest number of seabirds affected globally is in the Tasman Sea, southeast of Australia.



Key scientific achievements continued

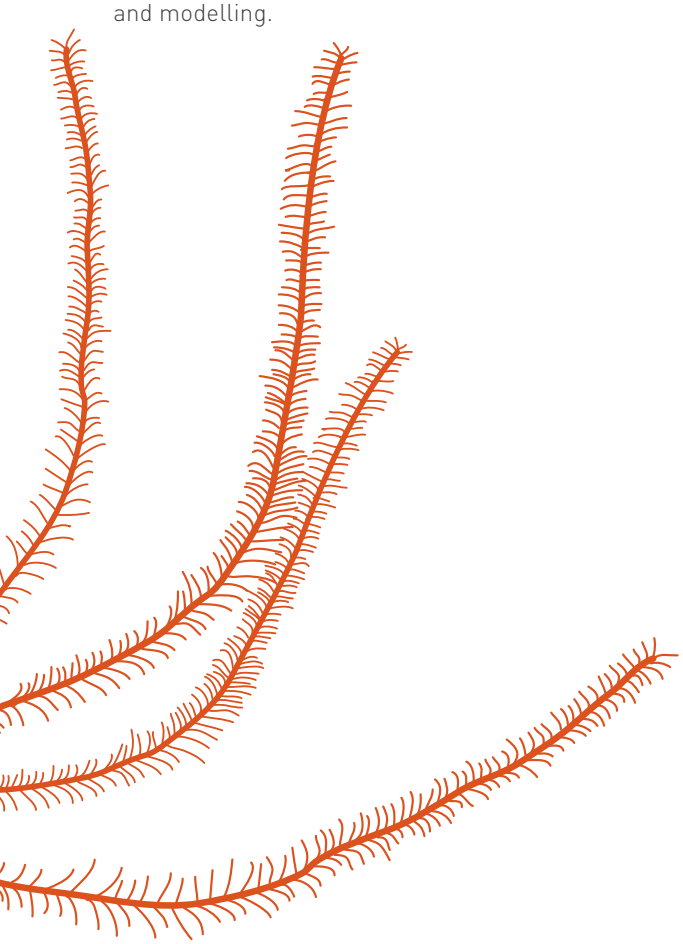
Type, source and quantity of debris

Within Australia, approximately three-quarters of the rubbish along the coast is plastic. Most is derived from nearby sources, with some likely to be from overseas. In coastal and offshore waters, most floating debris is plastic and the density of plastic ranges from a few thousand pieces of plastic per km^2 to more than 40,000 of pieces of plastic per km^2.

Debris is more highly concentrated around major cities, suggesting local source point pollution.

Threats to marine fauna

As the quantity of debris increases in the marine environment, so does the likelihood of impacts from debris to marine fauna. Plastic production rates are intensifying, and the volume of refuse humans release into marine systems is growing at an exponential rate. Litter impacts wildlife directly through entanglement and ingestion and indirectly through chemical affects. CSIRO researchers have documented rates of each of these mechanisms through dissections, literature reviews, chemical analyses and modelling.



Ingestion risk to marine turtles

CSIRO and UQ researchers found that the ingestion of anthropogenic debris by marine turtles has increased since plastic production began in the 1950s. Smaller, oceanic-stage turtles are more likely to ingest debris than coastal foragers, and carnivorous species are less likely to ingest debris than herbivores or gelatinovores. CSIRO and UQ findings indicate oceanic leatherback turtles and green turtles are at the greatest risk of both lethal and sub-lethal effects from ingested marine debris. Benthic phase turtles favour soft, clear plastic, supporting the hypothesis that marine turtles ingest debris because it resembles natural prey items such as jellyfish. Most items ingested by turtles are plastic and positively buoyant. CSIRO researchers estimated the risk of ingestion across turtle populations at the global scale, and identified regions, such as the north-eastern Indian Ocean, where risks appear to be particularly high.

Ingestion risk to seabirds

CSIRO researchers developed a new simple, minimally invasive way of quantifying plastics exposure in seabirds. It can be applied at individual, population and species levels and it has no observed detrimental impacts. CSIRO researchers also carried out a global risk analysis of seabirds and marine debris ingestion for nearly 200 species and found that 43% of seabirds and 65% of individuals within a species have plastic in their gut. CSIRO analyses predict that plastics ingestion in seabirds may reach 95% of all species by 2050, given the steady increase of plastics production. CSIRO researchers identified high risk regions for seabird impacts, finding a global hotspot in the Tasman Sea between Australia, New Zealand, and the Southern Ocean. In a species-specific study involving TeachWild participants, researchers found that 67% of short-tailed shearwaters *(Puffinus tenuirostris)* ingested litter. Juvenile birds were more likely to ingest debris than adult birds, and young birds ate more pieces of debris than adults. Birds ate everything from balloons to glow sticks, industrial plastic pellets, rubber, foam and string.

Entanglement risk to turtles and pinnipeds

Entanglement poses a significant risk to marine fauna. Seabirds, turtles, whales, dolphins, dugongs, fish, crabs and crocodiles and numerous other species are killed and maimed through entanglement. CSIRO researchers estimate that between 5,000 and 15,000 turtles have become ensnared by derelict fishing nets in the Gulf of Carpentaria region. For pinnipeds in Victoria, the majority of seal entanglements involved plastic twine or rope, and seals become entangled in green items more than in any other colour. In general, young seals are entangled in greater numbers than adults.

"When we went down to the beach we did find lots of [plastic] beads. [One of the grade six girls] was really surprised by this. So she started her own project. She got a jar and got the kids in the class to collect the beads any time they were at the beach. We have both a surf and bay beach and the kids all do water sports so they're there all the time. And the kids actually did it."

Teacher
TeachWild Participant

"I did things that I'd never done before and I did things that didn't think I could do, like cutting up a bird to learn the techniques without fainting or vomiting. So I came back thinking 'well if I can do that then there's lots of things I can do."

Teacher
TeachWild Participant

"I am an advocate for programs like this and spreading the word amongst the community about our cleanliness and the way we live our lives. We can chose more wisely and help stop the plastic pollution washing up on our shores."

Teacher
TeachWild Participant

"I remember that TJ was talking all about marine debris killing animals and how we should try to stop it because it's us that are mainly causing the problem. We went to the beach and did an emu walk to pick up rubbish. Then we did a data chart of the colour and type of rubbish. Then we watched a video and talk about what rubbish can last the longest."

Primary School Student (2 months post survey)
TeachWild Participant

Program legacy

The three year Shell Australia and CSIRO funded TeachWild program has profoundly influenced the lives of many of those who participated in the research, workshops and outreach events as teachers, students and Shell employees. The program has built a strong body of scientific knowledge which has already begun to influence national policy towards reducing litter. Teachers are more confident of engaging students in real-world science, thousands of students are now more likely to change their littering habits and 'do the right thing' and Shell employees are more aware of the impact of marine debris in the environment and how Shell is contributing to the solution.

Key legacy outcomes of the program include:

- A national marine debris risk assessment for coastal Australia for use by policy makers and planners
- TeachWild has been acknowledged in and contributed to the 5-year (2009-2014) statutory review of the *Threat abatement plan for the impacts of marine debris on vertebrate marine life* (Department of Environment).
- Seven scientific papers have been published describing how marine debris impacts Australia's marine fauna, including turtles, birds and pinnepeds (more to be released)
- One scientific paper has been published describing the social learning and outcomes of the teacher and student engagement (more to be released)
- New lesson plans and student activities linked to the national science curriculum (Marine Debris Tool Kit)
- Over 7,000 students, teachers and shell staff directly engaged in the issue of marine debris and are actively working to address the solutions
- TeachWild is now integrated into NSW National Parks and Wildlife 'Wilderquest' education program for primary schools
- TeachWild is now integrated into Sydney Institute of Marine Science education program
- TeachWild is now integrated into Sustainability Victoria's Resource Smart Schools (waste management) program
- TeachWild is featured as an 'environmental excellence' case study on the Government of Western Australia Department of Environmental Regulation website: **www.der.wa.gov.au/your-environment/50-environmental-excellence/126-teachwild-brings-real-science-into-the-classroom**
- The Ocean Project' North America has integrated a link on their website to the TeachWild Curriculum Kits in the category 'Promoting Cleaner Oceans' www.**worldoceansday.org/celebration-ideas/create-a-celebration/talking-with-kids/**
- Through the online videos, the TeachWild website and local, national and international media and program presence, an audience of over 1,000,000 people have been touched by the program
- TeachWild continues to be used by schools and teachers are engaging subsequent years

Financial acquittal

For years July 2011 to July 2014

	YEARS 1-3	
	TOTAL actual	TOTAL budget excluding in-kind
TOTAL DIRECT PROGRAM EXPENSES		
Research Grants and Field Costs	1,203,465	1,097,826
Communications and Outreach	150,664	200,000
Project Staffing	597,249	522,971
Information Technology	7,554	65,153
Project Evaluation and Reporting	90,000	90,000
Program Administration	358,563	383,303
TOTAL EXPENSES	**2,407,495**	**2,359,253**

What next?

TeachWild has in a relativity short time, changed the face of both environmental education and scientific research on marine debris. In the immediate future, the TeachWild website, CSIRO database and curriculum resource will remain available for public use and CSIRO scientists will continue to periodically analyse the data for new trends.

Not resting on the achievements of the first three years of TeachWild, Earthwatch staff, CSIRO scientists and the broader education community are currently working together to create a new, more engaging version of the program, TeachWild II.

TeachWild II will again push the boundaries of contemporary education practices by providing teachers and students with a framework in which to learn from and work with scientists, businesses and governments on original research, real business sustainability strategies and local government initiatives.

The program will engage participants in four environmental issues (themes) relevant to the broader Australian community:

- Waste (a continuation of TeachWild's original marine debris program)
- Freshwater sustainability and security
- Biodiversity loss
- Climate change

In order to link students to businesses and local governments, TeachWild II will run three concurrent programs for:

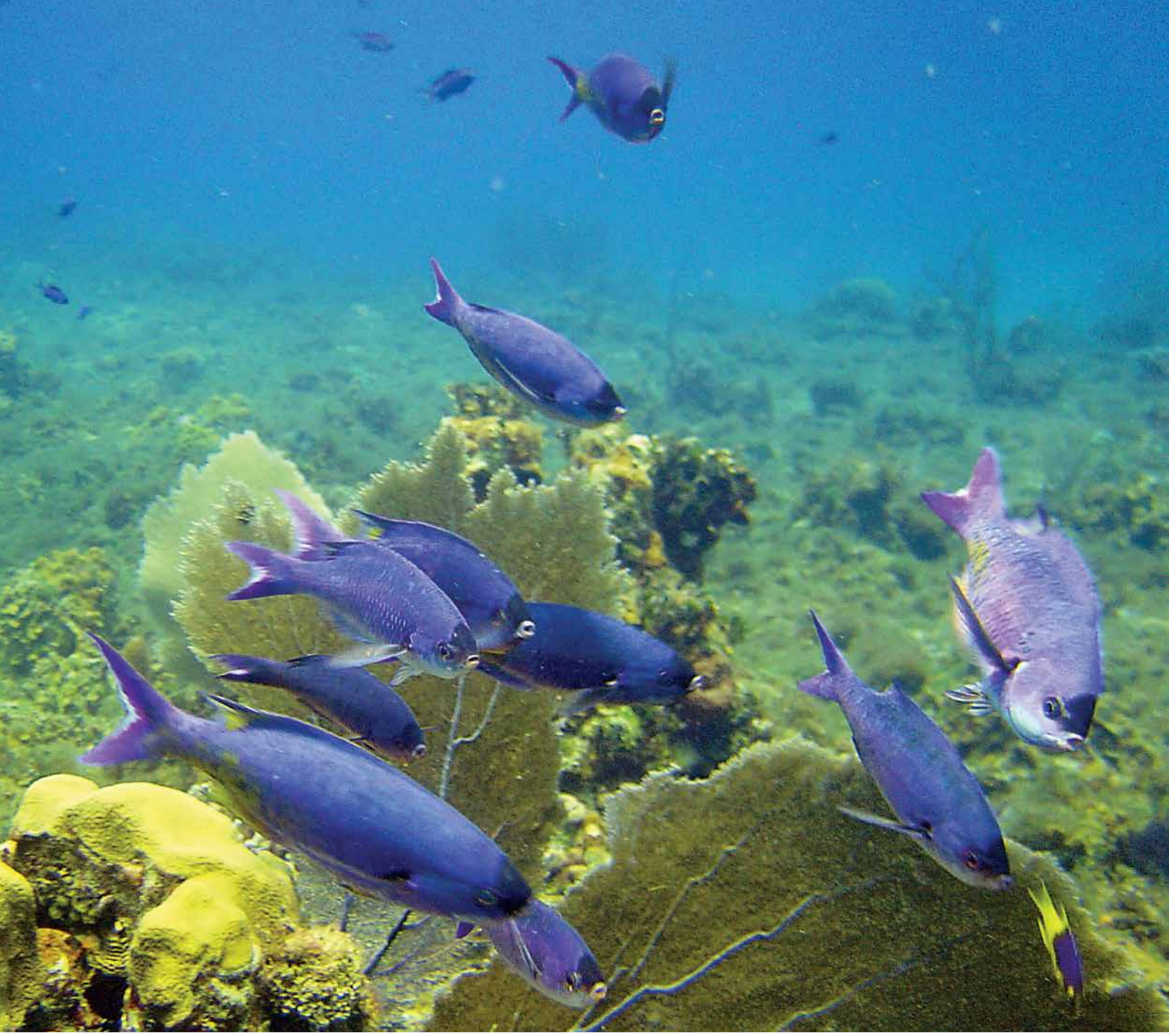
1. Schools year 6-10
2. Participating (sponsoring) corporate businesses and
3. Local governments.

In all three programs, the TeachWild philosophy will promote a collaborative, community approach to understanding the problems and working towards solutions for each environmental theme. These are focused on the objectives and actions each stakeholder must take to solve environmental problems.

TeachWild II is anticipated to start in mid-2015 and is seeking to run for a five year term. Copies of the TeachWild II proposal can be requested from Earthwatch.

"Professional learning via authentic project based learning – just how we want our students to be learning. Professional networking and sharing is invaluable and this program encourages sharing across all sectors – Government, Catholic and Independent schools."

Teacher
TeachWild Participant



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