



Sunscreen and bay marine life

A citizen science project by RMIT and the Port Phillip EcoCentre

We are all now familiar with the fact that sunscreen is important in helping to protect our skin from sun damage. But what is the sunscreen we are dousing ourselves with doing to the environment?

For some years now, scientists have known that particular active chemicals in some sunscreens have a toxic effect on corals and their development. One of these chemicals is Oxybenzone (aka Benzophenone-3, or BP-3). Oxybenzone causes coral to bleach, damages its DNA and disrupts coral development by deforming and killing juvenile coral. This chemical is the active component in over 3,500 sunscreen products, as it blocks ultraviolet rays.

In popular tourist areas where tropical coral reefs are present, researchers have detected levels of Oxybenzone as much as 12 times the concentration needed to have a detrimental effect on corals. As researchers estimate that between 6,000 and 14,000 tonnes of sunscreen lotion are affecting coral reefs each year, this is a serious issue for coral reefs world-wide.

Another development is the use of nanoparticles in sunscreens. Although sunscreens containing 'normal' zinc oxide (ZnO) and titanium oxide (TiO₂) are safe for the environment, nano-sized molecules of ZnO and TiO₂ could have a toxic effect on some wildlife. As the nanotechnology industry is a booming new frontier, we need to make sure we know about the effects of nanoparticles in the environment.

To date, the effects of sunscreen chemicals on organisms in temperate waters such as Port Phillip Bay are still unknown. The bay may not have the number of coral species that the tropics have, but it sure has a lot of other very special marine life: 80% of species are endemic to Port Phillip Bay, meaning that you will not find them anywhere else in the world but here.

RMIT and the EcoCentre have therefore teamed up to research effects of sunscreen on marine life in the bay.

So what are we testing, exactly?

To understand the potential impacts of sunscreen on wildlife, we will test if it has an effect on the phytoplankton and algae communities in the bay. Phytoplankton is a group of various plant-based microorganisms (mostly diatoms and dinoflagellates) which form the basis of the food chain for all bay species, together with algae. Algae and phytoplankton function much like plants, turning the sun's rays into

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biomass accessible to other life forms through photosynthesis. They are the food source of many larger marine organisms, including jellyfish, whales, shrimp and fish larvae. Since they are the very building blocks of ecosystem health, it is important that we find out if sunscreen has any effect on their populations.

How are we testing this?

With your help – the citizen scientists - we will take sea water samples at 3 of the most popular beaches of Port Phillip Bay: St Kilda, Elwood and Rye. This summer, we will select seven sampling days, which will depend on the weather conditions: of course we want to take water samples when as many sunscreen-wearing people as possible are in the water at the same time, to get measurable concentrations of sunscreen in our samples. This means that we will sample on warm, sunny days during the school summer holidays, between Christmas and New Year and on weekends.

Each sampling day consists of taking a series of water samples every 4 hours around the following time points: 6 am, 10 am, 2 pm, 6 pm and 10 pm. We will therefore likely need a morning crew and afternoon/evening crew of volunteers.

We will also be recording the environmental conditions on that day, like water temperature, wave action, how many people are present in the water at the time the samples are taken, weather conditions, etc.

What happens to the samples?

The samples are marked and stored in an esky and go to the lab at RMIT within 24 hours of sampling, where the team of scientists will run a series of tests on them. They will measure the concentrations of sunscreen nanoparticles and sunscreen chemicals in the sample, and measure the levels of phytoplankton and microalgae present. They will also look at how quickly the concentration of sunscreen disperses in the water, until it is diluted to the point of no effect.

When and how will we know the outcome of the research?

It is important we gather together a comprehensive data base to understand what is going on. This research project will take 3 years. We will be taking samples on 7 days during each summer, and on 5 days during each winter (as the control group). In June 2020, the results will be in. This will be in the form of one or more research papers that will contribute to the growing body of international scientific knowledge about sunscreen and its effects on the environment.

And who knows where the results may lead? More environmentally friendly sunscreens? Bans or limits on the use of certain chemicals or metal nanoparticles? We don't know yet.

All volunteers will be kept up to date about new developments via the project's [facebook page](#), a dedicated blog, and a [project newsletter](#). And at some stage, we hope to invite you into the lab to see what happens to the samples there.

What is expected of the citizen scientists?

We cannot do this project without the citizen scientists: you!

We need people who love the bay and its creatures, to take the samples. We will of course provide training on exactly how to do this. It's not hard to learn at all, and it's a great learning opportunity for kids too.

We need reliable volunteers, who are available for a minimum of half a day of sample taking (in the am or pm), preferably over several sampling days. Even better if you can stay the whole day! You don't have to stick around in between, just make sure you're back in time to take the next sample. Groups are welcome.

We also need a few keen people who are willing to lead the sampling on days that no EcoCentre person can be present. We are looking for volunteers willing to sample in Elwood, St Kilda and Rye. You are welcome to help with more than one sampling location, of course!

Finally, we are doing some social science alongside our citizen science to help us understand how you find the process and to explore the learning involved. To help with this we may ask to interview you briefly about your experience. There is no pressure to participate in this but we hope you will agree to the chat.

Training & insurance

Training sessions will be organised in St Kilda, Elwood and Rye with the scientists from RMIT and the EcoCentre. It is strongly advised that volunteers attend a training session, to ensure the scientific rigor of the data collection.

Following a safety induction and signing in, volunteers and volunteer activities for this project are insured under the EcoCentre's Volunteer & Public Liability Insurance.

FAQ and myth-busting

Is wearing sunscreen in Port Phillip Bay bad for our wildlife?

We don't know yet if sunscreen is harmful to marine organisms living in temperate waters. As a matter of fact, we don't yet know anything about the effects of sunscreen on wildlife in Port Phillip Bay. Trying to answer this question is the goal of this research.

Is wearing sunscreen with nanoparticles bad for people?

No.

In August 2016, the Therapeutic Goods Administration of the Department of Health published a review of all known research on the safety of titanium dioxide and zinc oxide nanoparticles in sunscreen. The conclusion was that the nanoparticles in sunscreen do not penetrate the skin and are therefore safe to use.

It is important to understand that we are NOT saying that people should stop wearing sunscreen. Approximately 2 in 3 Australians are diagnosed with skin cancer before they are 70 years old and 75,000 people were diagnosed last year. Wearing sunscreen is an important way to prevent skin cancer. We are merely trying to understand more about sunscreen's effect on phytoplankton and microalgae in temperate waters. This research may or may not lead to changes in the ingredients of sunscreen, but it's just too early to tell. This really is cutting-edge science!

Are all nanoparticles bad for the environment?

No.

The nano-technology industry is an exciting and promising new field of research. It was discovered that nanoparticles of known substances behave very differently (due to their smaller size) than the same particles of micro size. This has both advantages and disadvantages. Examples of disadvantages are that some nanoparticles are a similar size to DNA and other molecules that are responsible for important functions within the cells of a living organism. They can be extremely chemically reactive with these molecules and have an active changing effect on DNA. This is a serious issue for corals for example, and the reason why this requires more research. This is not to say that all nanoparticles do this, but there is not enough research yet to be conclusive on when nanoparticles are 100% safe.

The high reactivity of nanoparticles is, ironically, also their great advantage for advances in soil remediation and pollution events. For example, some nanoparticles are extremely reactive with pollutants in soil and water that are otherwise not accessible to clean up. By reacting with these pollutants, nanoparticles can neutralise the chemicals' toxic effects in the environment.

Are you getting paid by the sunscreen industry to do this research?

No.

On 21 November 2016, Minister for Industry, Innovation and Science, the Hon Greg Hunt announced the opening of the [Citizen Science Grants](#) element of the Inspiring Australia – Science Engagement Programme. This project is one of multiple projects awarded this grant.

RMIT University is an independent education and research organisation and is not getting any funding from industry for this research project.

The Port Phillip EcoCentre is an independent, community-led not for profit organisation and is likewise not receiving any financial benefits from industry for this project.