The Royal Society OF VICTORIA
Promoting science since 1854

Discussion paper — Financing the Future of the Platypus

Author: Mr Gordon Noble MRSV

The Royal Society OF VICTORIA
Promoting science since 1854

Contents

Summary

The Platypus: a Sentinel of Biodiversity Loss

There is no greater example of the threats facing Australia's biodiversity than the listing in 2021 by the Victorian Government of the platypus as a threatened species. Unless urgent actions are taken, the anticipated changes to Australia's climate means that, here in Victoria, we face the genuine prospect that our very own platypus may only be encountered in the zoos of the future.

The future of the platypus is in our hands. There is the potential to take actions today that can provide the regular water flow and stable environment that are critical for the platypus to breed and thrive. There are great examples of innovation, including Melbourne Water's partnership with Yarra Valley Council that is focusing on developing new sources of water for platypus through smart technology. The challenge is that the existing efforts need to be urgently scaled to support the platypus.

Why the Royal Society of Victoria?

The platypus itself has deep links to the history of the Royal Society of Victoria (RSV). During Sir Joseph Banks period of presidency of the RSV's progenitor, The Royal Society of London for Improving Natural Knowledge, he received a platypus specimen which he initially took to be a hoax. In a momentary peace between Britain and France in 1802, Banks sent the specimen to French Zoologist, Étienne Geoffroy de Saint-Hilaire, at the Muséum d'Histoire Naturelle in Paris who first identified it as belonging to the family of monotremes. Napoleon himself examined the specimen.

Charles-Alexandre LESUEUR, French 1778-1846
Platypus (Ornithorynque) (1802-04)
watercolour, pencil, 24.0 x 38.0 cm, Muséum d'Histoire Naturelle, Le Havre (inv. 80033)
Photo: Alain Havard

In the mid to late 19th century, the Royal Society of Victoria advocated for, and supported the science behind, the development of Melbourne's water, storm water and sewerage system, which has had a profound impact in

disrupting the platypus' natural habitat - particularly through the transformation of natural waterways into drains which transport water quickly away from Melbourne's urban areas into Port Phillip Bay. Given our contribution to its predicament, we owe it to the platypus to do everything we can to secure its future.

Convening a Natural Capital Financing Working Group

The *Financing the Future of the Platypus Discussion Paper* proposes the establishment of a RSV Natural Capital Financing Working Group which would provide a mechanism to develop innovations to finance biodiversity at scale.

Ideas that are floated in the discussion paper that would be considered in detail by the RSV Natural Capital Financing Working Group include:

- Develop commercial market opportunities for recycled water that can support biodiversity outcomes.
- Develop an advocacy strategy to promote RSV's work on "saving the platypus".
- Develop mechanisms to fund necessary investments to protect, preserve and regenerate platypus habitat from financial markets through the issuance of bonds that could colloquially be called Platypus Bonds. These bonds, which would be issued by water corporations as well as government and corporates, would align to Sustainability Bond Principles of the International Capital Markets Association (ICMA) and would be marketed internationally.
- Develop strategies to support citizen science that can provide independent sources of data.
- Recognising the historic links that the Royal Society of London has in respect to the platypus, invite a representative from the Society to join and financially contribute to the Natural Capital Financing Working Group.

Whilst the Working Group would initially focus on the platypus its work would have broad implications in terms of financing biodiversity, both here in Australia and globally. The Working Group would provide a structured means to bring science and finance together and, subject to future resources would be underpinned by strong governance principles including public release of minutes of meetings. It is proposed that the RSV Natural Capital Financing Working Group would:

- Invite a broad cross section of stakeholders to participate. A key focus would be on creating ongoing conversations between scientists and stakeholders including local government, financial institutions and corporations.
- Specifically target financial institutions and corporations to participate and fund the Working Group.
- Operate in a transparent manner with reports to the RSV Executive and participation of RSV Executive and Council.

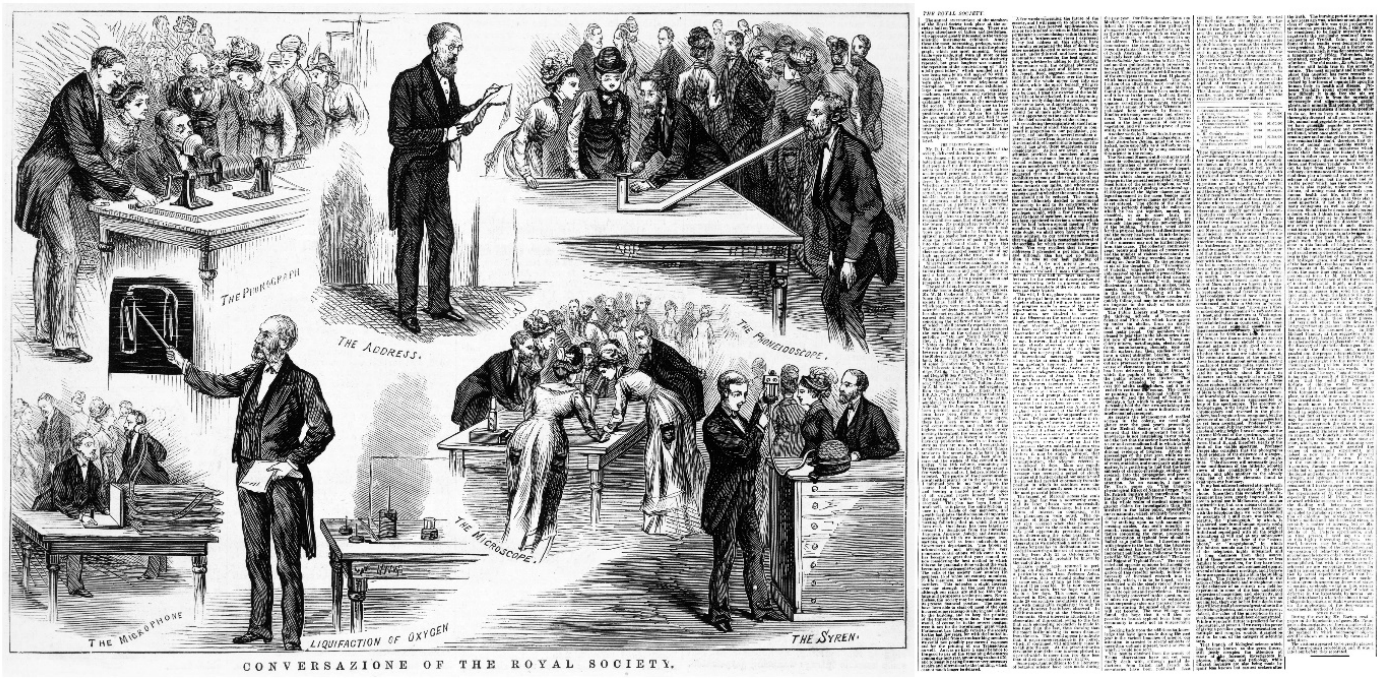
About the RSV

Victoria's Old Bones

The history of the Royal Society of Victoria is in many ways the history of Victoria.

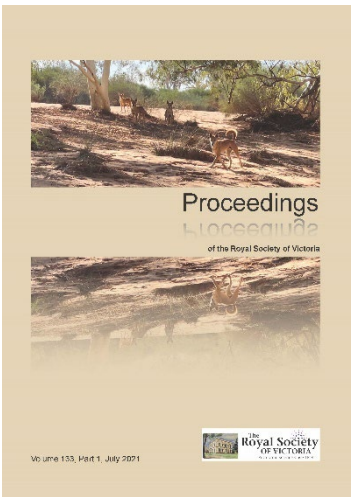
The RSV was established in 1854 as an organisation concerned with the advancement of science for the public good. It organised the Burke and Wills Expedition of 1860; managed the inaugural scientific program of the National Museum of Natural History (now, Museums Victoria); advocated for science teaching and Victoria's first university degree in science; hosted the Bureau of Meteorology's first station to monitor Melbourne's weather and collect data over 107 years (now at Olympic Park); inaugurated consideration of Australia's exploration of Antarctica and campaigned for the setting-aside of Wilson's Promontory as a National Park.

Less well known is the role that RSV played in brokering the development of the water supply, stormwater and sewerage infrastructure that played a critical role in making Melbourne one of the most liveable cities in the world.



Wood engraving published in *The Illustrated Australian News*, depicting a public demonstration of new technology at the Royal Society of Victoria (Melbourne, Australia) during its annual "conversazione" on 8 August, 1878. This represents one of the world's first public demonstrations of the phonograph, invented by Thomas Edison in 1877. The technology is here demonstrated by the Society's Honorary Secretary, Alexander Sutherland MA (top left), a talented schoolmaster and the lead champion of Victoria's first Science Degree (BSc) at the University of Melbourne. The Society's annual address was given by Robert Ellery MCRS, the Society's longest-serving President (top centre), reproduced in the article to the left published in the *Argus* newspaper on 9 August, 1878.
Sources: State Library of Victoria, National Library of Australia

The RSV's patron since inception has been the Governor of Victoria. We have been open to membership to people from all walks of life since inception and are today act as the Victorian community sector's lead proponent for evidence-based decision making, science translation and community scientific literacy. We publish Victoria's longest running regional science journal, the *Proceedings of the Royal Society of Victoria*, online and open access with CSIRO Publishing.



The Society's heritage-listed buildings are located within the precinct of the United Nations Educational, Scientific and Cultural Organisation (UNESCO) World Heritage Environs Area of the Royal Exhibition Building and Carlton Gardens. They are the oldest buildings in the precinct, designed by colonial architect Joseph Reed, completed first in 1859 with further works in 1869 and 1953. Whilst the Society has built and thus owns its buildings, the land on which they sit is subject to a Crown Grant, formalised in 1880 and further subject to the *Royal Society Land Act 1915* (Vic).

Richly Networked, Poorly Funded

The Victorian Society is a member of an international network of sister Societies across the Commonwealth of Nations, established in the nineteenth century on the model of the world's oldest and must august scientific institution, the Royal Society of London for Improving Natural Knowledge. Unlike our London progenitor (and our other Australian, British, Canadian and New Zealand counterparts), we are not funded by a significant endowment from the Crown and must deliver our programs based on our capacity to raise funds through subscriptions, service provision, venue hire and small grants.

We are a neutral, unaligned voice for science in Victoria and value this independence. Despite this critical freedom, we always strive to be collaborative rather than adversarial, working for evidence-based solutions to be of service to the interests of our state, its people, and its environment.

Our **civic mission** is focused on community, industry and government engagement with and pragmatic use of scientific knowledge.

Our **membership** is not exclusive to professional scientists; we also welcome educators, students, lawyers, librarians, politicians, historians, architects, entrepreneurs, technologists, industrialists and anyone with a passion for extending their understanding of the way the world around and within us works.

Our **Fellows** are high-achieving individuals who have made, and continue to make, significant contributions to their fields of inquiry and the public appreciation of science more generally.

The platypus is under threat

In 2021, for the first time in its 4 million year history, the platypus was officially listed as vulnerable in the state of Victoria.[1] [2]

Along with the echidna, platypus are monotremes, mammals that lay eggs rather than bearing live young. They are entirely dependent on aquatic ecosystems. The species occurs in a variety of water bodies including rivers, creeks, lakes, as well as human-made dams and reservoirs where there is reliable surface water.

Platypus rely on reliable surface water to breed. They are seasonal breeders, with courtship and mating generally occurring in early spring, and independent juveniles emerging from burrows in late summer. The breeding season is typically from August to the end of November. The female platypus lays 1-3 eggs each year and will suckle the young for 3-4 months prior to them emerging from their nest and weaning in late summer.

If conditions are not essentially consistent, then the platypus will not breed every season. The key to the survival of the platypus is reliable water levels in our creeks and streams. In addition to ongoing land use changes which impact platypus habitat, the major challenge that climate change poses for the platypus is the variability of rainfall, from extreme downpours causing 'surge' conditions in waterways to extended droughts eliminating the water supply.

Climate change presents an existential threat to the species

According to the Australian Government's latest *State of the Climate 2020* report,[3] Australia's climate has already warmed by over 1 °C since 1960. The warmest year on record was 2019, with the seven years from 2013 to 2019 all ranking in the nine warmest years. It is, however, the shifting weather patterns that threaten the platypus. The evidence demonstrates that the southeast of the continent is drying out whilst northern Australia has been wetter across all seasons.

When rain does come, we are seeing an increase in the intensity of heavy rainfall events. Australia's Bureau of Meteorology State of the Climate 2020 report states:

> *"As the climate warms, heavy rainfall events are expected to continue to become more intense. A warmer atmosphere can hold more water vapour than a cooler atmosphere, and this relationship alone can increase moisture in the atmosphere by 7 per cent per degree of global warming. This can cause an increased likelihood of heavy rainfall events. Increased atmospheric moisture can also provide more energy for some processes that generate extreme rainfall events, which further increases the likelihood of heavy rainfall due to global warming".*[4]

If the planet experiences 1.5°C of global warming, then we can expect temperatures over landmass to be higher than over water. There is the potential for temperatures on a hot summer's day across southeast Australia to range between 40-50°C. High temperatures themselves represent a threat for some species. Flying foxes, for instance, are unable to survive when temperatures exceeded 42°C. It is estimated that 23,000 died in two days of extreme heat in Queensland in 2014.[5] For the platypus, high temperatures result in high rates of evapotranspiration, which reduces water in creeks, rivers and lakes.

It is, however, not just higher temperatures that pose a threat to the platypus. Increased incidents of flash flooding, which we can expect in a 1.5°C world, has the potential to washout platypus nesting burrows.

The threat to the platypus will not take place at some distant date in the future. It is today. It is possible that at any time in the next years we can envisage a spring flash flood followed by a string of 45°C+ days.

In this environment the platypus will not breed.

Impact of land-use changes

Whilst climate change presents an existential threat to the platypus, the actions of humans have also impacted the species. In the years following Napoleon's viewing of the platypus, a European settlement grew on the banks of the Yarra River in Port Phillip Bay which began to encroach on an ecosystem that had sustained the local Kulin Nation for thousands of years. Melbourne's creeks and wetlands provided a rich food bowl for the Wurundjeri and Bunurong peoples of the Kulin Nation. *Kooyang*, in late summer, was known as the season of eels. The seasonal rainfalls also sustained the local platypus population, which was able to move along creek beds, billabongs and wetlands to breed.

As Melbourne grew, the town's waste was tipped directly into the Yarra River. It was the gold rush of the 1850's that made this practice unsustainable. As population swelled, Melbourne's sewerage coupled with waste from slaughterhouses was pouring straight into the River. By the 1880's, Melbourne was commonly referred to as "Smellbourne."

An 1892 map of Melbourne's sewers. Most of the infrastructure remains in place. *Source: Melbourne Water*

Melbourne's geography meant that heavy rainfalls over winter and spring flowed down a myriad of creeks and streams into wetlands, which the Europeans disparaged as "swamps." The Royal Society of Victoria played a sustained role in advocating for Melbourne's sewerage, storm water and water interventions, convening the Colony of Victoria's engineering and scientific expertise in support of strategic infrastructure investment. In 1873 the Victorian Government responded to the smell and disease, which had become rampant, by holding a Royal Commission on Low Lying Lands. This led to the establishment in 1891 of the Melbourne and Metropolitan Board Of Works.

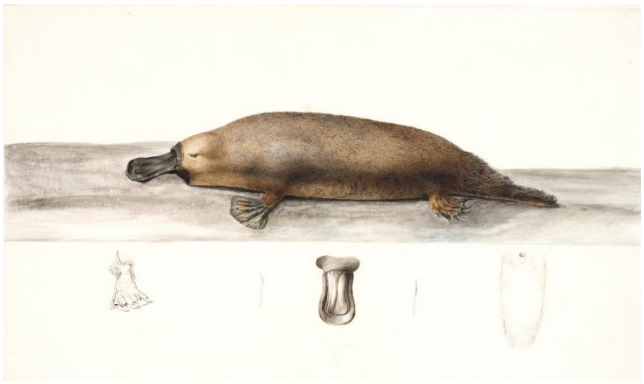
A remarkable undertaking: building a vast sewer and stormwater network by hand and steam-power. *Source: Melbourne Water*

The MMBW built dams to capture Melbourne's variable rainfall and piped sewerage to be treated in the (then) distant town of Werribee. The MMBW also began the process of ridding Melbourne of its swamps by turning the permeable soils beneath creeks and streams into hard-surfaced drainage channels, which transported water as quickly as possible to Port Phillip Bay. The result was, unsurprisingly, that the platypus retreated to the upper reaches of the Yarra and Melbourne's sprawling suburbs.

Whilst the Smellbourne era is now long behind us, the legacy of these water infrastructure investments, including the creeks transformed into drainage channels, remains.

The plight of the platypus is of national and international concern

The first research into the platypus was facilitated by botanist Sir Joseph Banks, who accompanied Lieutenant James Cook, captain of HMB Endeavour, on the expedition of the Australian continent claiming the eastern portion of the Australian continent for the British Crown in 1770. [6] At first Banks believed that the platypus must be a hoax. When he did receive a specimen, in a momentary peace between Britain and France in 1802, he sent it to French Zoologist, Étienne Geoffroy de Saint-Hilaire, at the Muséum d'Histoire Naturelle in Paris who identified it as belonging to the family of monotremes. Napoleon himself examined the specimen. Charles-Alexandre Lesueur, artist on Nicolas Baudin's expedition to Australia, sketched the platypus in Botany Bay.[7]

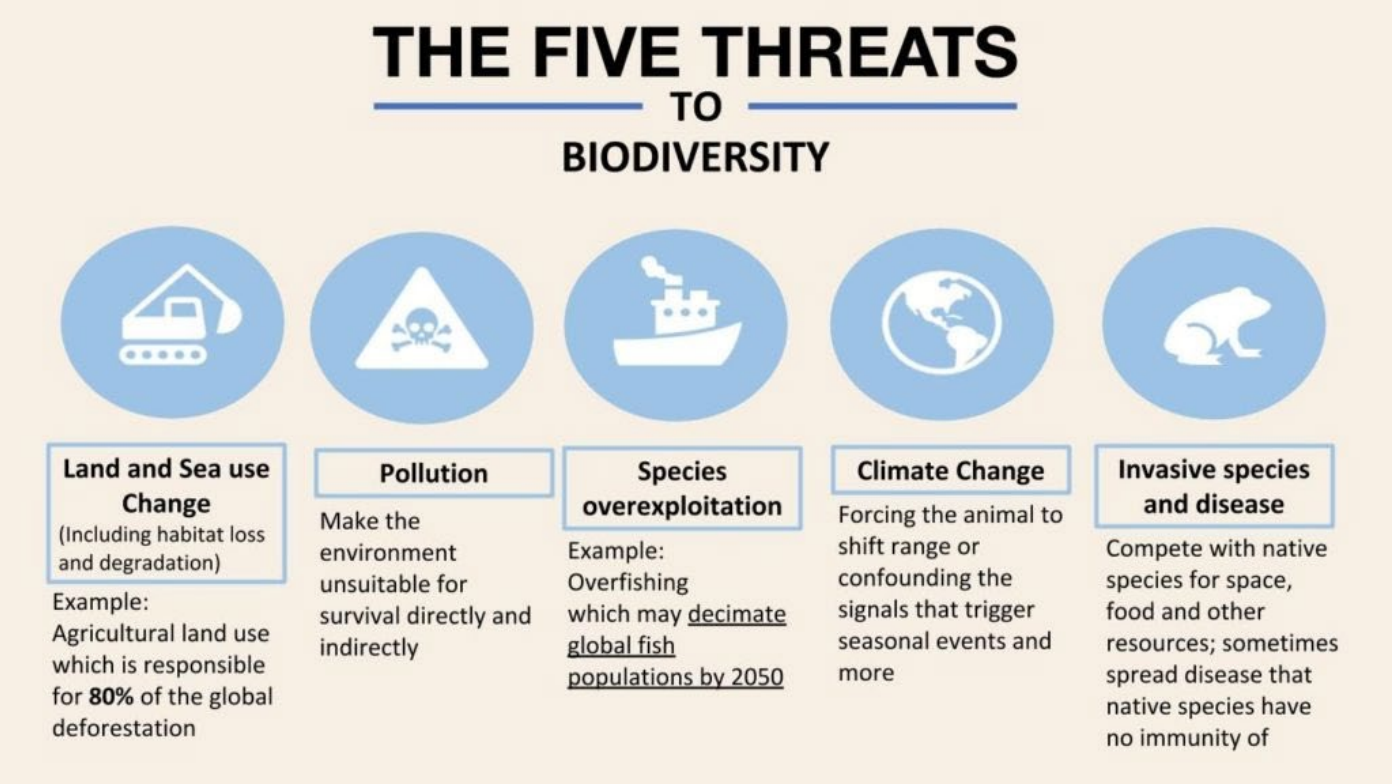


We know that the platypus is not alone in being threatened due to the impacts of climate change. It is estimated that 6,300 of known species of amphibians, 12 percent of 9,865 bird species, 21 percent of all fish species, 30 percent of invertebrate species and half the globe's 5,491 known mammals are currently under threat.[8] The iconic koala has now joined the unhappy list of endangered species. **We are clearly not doing enough to halt the loss of our biodiversity**, much less restore depleted numbers to healthy population sizes with adequate genetic diversity to combat disease and adapt to rapidly changing environmental conditions.

A Compounding Crisis

We are, in fact, ramping up the damage. According to the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) - based on the UN IPCC model of providing international science-based assessments - nature and its vital contributions to people, which together embody biodiversity and ecosystem functions and services, are deteriorating worldwide.[9] IPBES makes clear the impact of human activities that are threatening more species with global extinction now than ever before.

The 2019 IPBES global assessment states "an average of around 25 per cent of species in assessed animal and plant groups are threatened, suggesting that around 1 million species already face extinction, many within decades, unless action is taken to reduce the intensity of drivers of biodiversity loss. Without such action, there will be a further acceleration in the global rate of species extinction, which is already at least tens to hundreds of times higher than it has averaged over the past 10 million years".[10]



Source: Earth.Org

Climate Change 2021: The Physical Science Basis

As ecosystems struggle to deal with ongoing human actions, such as land clearing for development and agriculture, climate change is posing an existential threat for many species. The International Panel on Climate Change's most recent assessment, *Climate Change 2021: The Physical Science Basis,*[11] states that 'for every additional increment of global warming, changes in extremes continue to become larger'.

An area of particular focus for biodiversity and ecosystem services is how climate change impact rainfall patterns. According to the IPCC:

> *"every additional 0.5°C of global warming causes clearly discernible increases in the intensity and frequency of hot extremes, including heatwaves (very likely), and heavy precipitation (high confidence), as well as agricultural and ecological droughts in some regions (high confidence). Increases in frequency and intensity of hydrological droughts become larger with increasing global warming in some regions (medium confidence). There will be an increasing occurrence of some extreme events unprecedented in the observational record*

with additional global warming, even at 1.5°C of global warming. Projected percentage changes in frequency are higher for rarer events (high confidence).”

The IPCC argue that

“It is very likely that heavy precipitation events will intensify and become more frequent in most regions with additional global warming. At the global scale, extreme daily precipitation events are projected to intensify by about 7% for each 1°C of global warming (high confidence). The proportion of intense tropical cyclones (categories 4-5) and peak wind speeds of the most intense tropical cyclones are projected to increase at the global scale with increasing global warming (high confidence).”

Natural capital economics

Over the last 190 years since Melbourne was settled things have come circle. There is an emerging understanding that it is possible to have an urban settlement and have a vibrant ecosystem at the same time. An age-old challenge however remains. And that is how to finance investment that can regenerate habitat whilst investing at scale to address the variability of rainfall which promises to get worse as the impacts of climate change take a grip. Globally the finance sector is increasingly focusing on the importance of biodiversity and ecosystems. There are two developments of note: the Taskforce on Nature-related Financial Disclosures, and the Dasgupta Review.

The Taskforce on Nature-related Financial Disclosure (TNFD), a risk management and disclosure framework for organisations, is currently under development. TNFD received a considerable boost in 2021 and 2022 with the G20's Sustainable Finance Working Group (SFWG) officially endorsing it in its Sustainable Finance Roadmap.

The G20 SFWG, which is co-chaired by China and the United States, has outlined a series of actions that will be driven through International Organisations (IOs). It is expected that TNFD will test and revise a framework in 2022 and consult stakeholders and launch the framework in 2023. The work of TNFD will be supported by other IOs including the Network for Greening the Financial System (NGFS), United Nations Environment Programme Finance Initiative (UNEP FI), OECD and the Coalition of Finance Ministers for Climate Action (CFMCA) who will focus on research on how nature-related financial risks manifest, how biodiversity loss transmits to financial risks and the impact of biodiversity risks in financial markets. TNFD may be particularly important for bond markets. Governments themselves, as well as municipal authorities owned and controlled by governments, rely on bond markets to raise capital to meet needs. If governments take a lead in disclosing nature-related risks through their own bond market dealings this would have a major impact on driving acceptance of nature-related financial risks into financial market practices.

The United Kingdom's Dasgupta Review,[12] published in February 2021, represents a critical step forward in momentum. The Report's core argument is that the economics of biodiversity is the economics of the entire biosphere which, using the language of finance, in turn becomes a study in portfolio management. The importance of the Dasgupta Review is that it formally brings biodiversity into the language of economics.

Partha Dasgupta argues that nature is more than a mere economic good. "Nature nurtures and nourishes us, so we will think of assets as durable entities that not only have use value but may also have intrinsic worth. Whether as farmers or fishers, foresters or miners, households or companies, governments or communities, we manage the assets to which we have access, in line with our motivations as best as we can. But the best each of us is able to achieve with our portfolios may nevertheless result in a massive collective failure to manage the global portfolio of all our assets."[13]

Whilst disclosure is a foundation for action, it is not action itself. This is why bringing biodiversity formally into the economics profession, as the Dasgupta Review does, is important in terms of financing.

Using finance models to support biodiversity

Understanding aspects of biodiversity from the perspective of supply and demand opens up the opportunity to establish financing models. In respect to the platypus, we know that the variability of rainfall, which is expected to increase as a result of climate change, can result in a massive shift from excess of supply (flood) to excess of demand (drought).

In the Australian context, water as a commodity has four broad stakeholders who all use water for different purposes.

Households principally use water for cleaning and drinking but also water gardens and fill swimming pools.

Businesses use water for a range of industrial applications which vary in their demands.

Farmers use water for agriculture and animal husbandry.

Water for **biodiversity** includes rainfall that sustains plants, feeds streams, creeks, rivers, and lakes and flows into marine environments.

When there is an excess of supply of water (flood) the focus is how to limit the damage on property and get rid of it quickly and efficiently. This can involve building infrastructure such as drains which transmit water quickly away from urban environments. When there is an excess of demand for water (drought) this is where different problems arise. Of the four water stakeholders (households, business, farming and biodiversity) it is biodiversity which has the least ability to speak for itself when supply for water is scarce.

The platypus is the poster child for water scarcity and variability because it relies on reliable water for its very survival. The reality of climate change is that there is increased likelihood that there will be times of water scarcity and times of intense rainfall events. Both events pose threats to the platypus. Whilst financial systems cannot alter when and where it rains, there is the potential to reduce conflict amongst stakeholders who have competing interests, and more specifically to guarantee the supply of water for biodiversity through new investment models.

The Victorian Desalination Plant at Wonthaggi was completed in 2012. It can produce 410 megalitres of water per day.

Today we take for granted that we can turn on a tap and clean, drinkable water flows. As urban populations have grown, we have secured water by building dams and increasingly through investment in desalinisation plants which convert brackish and saline water into potable water. It is estimated that there are over 15,000 desalinisation plants worldwide.[14] Whilst the focus has been on securing water for domestic, industrial and agricultural needs, we have however not secured water for biodiversity.

Without these investments, it will be biodiversity that bears the brunt of the variability of water supply resulting from a changing climate. Examples of this are already occurring. In southeast of Australia during December 2018 and January 2019, three significant fish kill events occurred in the Darling River near Menindee. Up to one million fish died, with Murray cod, silver perch, golden perch and bony herring the main species affected.[15] The lack of water allocations for biodiversity exposed biodiversity to risks with blue green algae thriving which, when it dies decomposes oxygen levels below critical levels leading to the death of fish.[16]

The future is in our hands

There is hope for the platypus. Melbourne Water, the government owned utility which is responsible for managing Melbourne's water catchments, is working with a wide range of stakeholders to deliver 'daylighting' projects which involve bringing the flow of waterways out of underground concrete pipes and replacing with an open, flowing channel that more closely resembles the original shape and form of creeks.[17]

The projects also involve construction of new habitats for threatened fish species as well as focusing on pollution prevention and managing uncontrolled sewage spills.

An exciting innovation is that Melbourne Water, together with Yarra Ranges Council and South East Water, are developing a smart rainwater tank using 'Tank Talk' flow control technology that enables water to be released remotely to the creek network. The flow of water into creeks at critical times aims to support stream health which can support platypus breeding.[18]

Daylighting Dandenong Creek. Source: Melbourne Water

Financing Biodiversity Conservation and Recovery

In the face of anticipated changes to climate a significant question is:

How can we unlock a flow of finance at scale to make investments that are specifically focused on supporting biodiversity?

To take forward discussion on the development of innovative models to finance natural capital, it is proposed that the Royal Society of Victoria host a **Natural Capital Financing Network** (NCFN). The NCFN would provide a structured means to bring science and finance together and would be underpinned by strong governance principles including public release of minutes of meetings.

It is proposed that the RSV Natural Capital Financing Working Group would:

- Invite a broad cross section of stakeholders to participate. A key focus would be on creating ongoing conversations between scientists and stakeholders including local government, financial institutions and corporations.
- Specifically target financial institutions and corporations to participate and fund the Working Group.
- Operate in a transparent manner with reports to the RSV Executive and participation of RSV Executive and Council.

Ideas that would be considered in detail by the RSV Natural Capital Financing Working Group include:

Commercial Market Opportunities

Develop commercial market opportunities for recycled water that can support biodiversity outcomes.

Upgrade Melbourne Water's Western Water Treatment Plant to Class A recycled water and construct a pipeline that would transport water to the source of the Lerderderg River to improve stream flow and support platypus recovery.

Advocacy Strategy

Develop an advocacy strategy to promote RSV's work on "saving the platypus".

Reform water markets with objective of increasing allocation of water to waterways including the Avoca River, Bass River, Wimmera River and Mackenzie River where the platypus have historically been found.

Financing

Develop models to fund necessary investments to protect, preserve and regenerate platypus habitat from financial markets through the issuance of bonds that could colloquially be called Platypus Bonds. Bonds could be issued by water corporations as well as government and corporates, would align to Sustainability Bond Principles of the International Capital Markets Association (ICMA) and would be marketed internationally.

Partnerships

Develop distributed smart water systems in the southeast of Melbourne to support flow of water to waterways flowing from the Dandenong Ranges.

Citizen Science

Develop strategies to support citizen science that can provide independent sources of data.

International

Recognising the historic links that the Royal Society of London has in respect to the platypus, invite a representative from the Society to join and financially contribute to the Natural Capital Financing Working Group.

Conclusion

This discussion paper briefly outlines the threats facing the platypus, which in 2021 was officially listed as vulnerable in the state of Victoria.

RSV has a proud history of supporting critical initiatives at critical times. RSV's legacy includes its advocacy for Wilson's Prom. Today's challenge is how to build upon RSV's long-term focus on the environment and nature-based systems by developing and advocating for innovative financing models that can secure the future of one of Australia's most iconic species, the platypus.

The benefit of establishing a Natural Capital Financing Working Group will not just be to enable the platypus to survive the threats of climate change but offers the opportunity to open up a flow of finance that can support biodiversity globally.

Endnotes

[1] https://www.premier.vic.gov.au/protecting-our-iconic-platypus

[2] NOMINATION NO. 884 TAXON ID 5136, FLORA AND FAUNA GUARANTEE - SCIENTIFIC ADVISORY COMMITTEE PRELIMINARY RECOMMENDATION ON A NOMINATION FOR LISTING, Ornithorhynchus anatinus Shaw 1799 – Platypus, https://www.environment.vic.gov.au/__data/assets/pdf_file/0030/484086/01-Platypus-PRR-FinalSign-1.pdf

[3] Australian Government, bureau of Meteorology, State of the Climate 2020

[4] Australian Government, bureau of Meteorology, State of the Climate 2020 http://www.bom.gov.au/state-of-the-climate/australias-changing-climate.shtml

[5] https://www.bbc.com/news/world-australia-46859000

[6] First Nations Australians have lived in Australia for over 60,000 years. https://aiatsis.gov.au/explore/australias-first-peoples

[7] https://www.ngv.vic.gov.au/napoleon-and-the-platypus/

[8] https://www.biologicaldiversity.org/programs/biodiversity/elements_of_biodiversity/extinction_crisis/

[9] IPBES (2019), Global assessment report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, Brondízio, E. S.,

Settele, J., Díaz, S., Ngo, H. T. (eds). IPBES secretariat, Bonn, Germany. 1144 pages. ISBN: 978-3-947851-20-1

[10] IPBES (2019), Global assessment report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, Brondízio, E. S.,

Settele, J., Díaz, S., Ngo, H. T. (eds). IPBES secretariat, Bonn, Germany. 1144 pages. ISBN: 978-3-947851-20-1

[11] IPCC, 2021: Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis.

Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu and B. Zhou (eds.)]. Cambridge University Press. In Press

[12] Dasgupta, P. (2021), The Economics of Biodiversity: The Dasgupta Review. (London: HM Treasury)

[13] Dasgupta, P. (2021), The Economics of Biodiversity: The Dasgupta Review. (London: HM Treasury)

[14] https://www.water.vic.gov.au/water-grid-and-markets/desalination/desalination-background/desalination-history

[15] Australian Sustainable Finance Initiative, Australian Sustainable Finance Roadmap, 2020

[16] https://www.mdba.gov.au/issues-facing-basin/fish-deaths/fish-deaths-lower-darling

[17] https://livinglinks.com.au/daylighting-of-dandenong-creek-complete/

[18] https://www.melbournewater.com.au/water-data-and-education/news/smart-water-tank-improve-platypus-breeding-odds