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RESEARCH ARTICLE

Inundation, Extinction and Lacustrine Lives

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Abstract

In 1972, Lake Pedder in south-west Tasmania was submerged under 15 metres of water as a result of the Tasmanian State Government's Middle Gordon Hydro-electric Power Scheme. The lake was subsumed into a much larger artificial impoundment formed by three rockfill dams, making it the largest freshwater lake in Australia. The Tasmanian government transferred the name Lake Pedder to the new impoundment. Three species endemic to the original Lake Pedder were recorded as extinct as a consequence of the lake's flooding. The Lake Pedder planarian, a species of carnivorous flatworm, the Lake Pedder earthworm, and the Pedder galaxias, a small freshwater fish, disappeared from the lake area after the inundation of this unique habitat, the site of a number of ecologically valuable faunal communities. The divergent fates of these animals, their status as lost species and their significance as creatures both meaningful and meaning-making, marks out an extinction matrix suggesting that the absence of specific animals and specific experiences and ways of life matter more than others, that specific deaths can be more readily incorporated into stories of loss and restoration, and that the perceived malleability of habitats invariably involves death inscribed as sacrifice or justifiable casualties. This paper seeks to retrieve some of the perspectives and experiences forgotten or written over in the lake's stories of flooding and redemption.

Keywords

extinction; conservation, Lake Pedder; Lake Pedder planarian; Lake Pedder earthworm; Pedder galaxias

In 1972 Lake Pedder in south-west Tasmania was submerged under 15 metres of water as a result of the Tasmanian State Government's Middle Gordon Hydro-electric Power Scheme.

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The lake was subsumed into a much larger artificial impoundment formed by three rockfill dams, making it the largest freshwater lake in Australia. Three species endemic to the original lake, the Lake Pedder planarian, the Lake Pedder earthworm, and the Pedder galaxias, were recorded as extinct as a consequence of the flooding. These official determinations, however, remain open to both contestation and reiteration. While extinction is typically enunciated as a scientific and historical occurrence, it is practiced culturally: extinction is experienced, resisted, measured, performed, and narrated in a variety of ways. The meanings of particular species extinctions are deferred to specific spaces and times that, in their social and cultural dimensions, determine the ethical significance of each extinction event. An important challenge for extinction studies is to explicate the specific ways threatened communities of biological and cultural diversity are experienced and narrated. Lake Pedder, a site of debate as to its status as a lake and as part of Tasmania's natural heritage, holds together a multiplicity of contested understandings and experiences of extinction. This paper argues that the social and cultural meanings emerging during and after the lake's flooding have combined and coalesced in a way that has either mitigated or forgotten the disappearance of endemic animals and their perspectives and experiences in the name of civic progress, the restoration of nature, and human redemption.

Before the flood

Prior to 1972 Lake Pedder was a natural glacial lake, relatively shallow in depth and small in area. It was believed to have formed about 10,000 years ago, during the last Ice Age, and regarded as the only significant example of a glacial outwash impoundment in Australia.¹ The lake lay in a valley of the Serpentine River, sheltered by the mountains of the Frankland Range. It was surrounded by swamps, button grass sedgeland, and peat plains which left the waters of the lake tea-coloured and slightly acidic. It is estimated that about 4,000 years ago the swamps and wooded plains of the Lake Pedder area began to be visited by platypus, echidna, eastern quolls, wombats, Bennett's wallabies, ringtail possums and marsupial mice. While the lake and its surrounding area, which was situated in what is now recognised as the Tasmanian Wilderness World Heritage Area, have not been recorded or narrated as specific Aboriginal cultural or kinship country, the presence of wallabies and other food species drew Tasmanian Aboriginal people on hunting expeditions up to the middle of the nineteenth century when British colonists violently displaced them.²

Limnologists considered Lake Pedder to be of special significance due to its location, the extensive inland quartz beach near the Maria Creek entrance on the lake's eastern edge, the distinctive community of aquatic and semi-aquatic animals and plants inhabiting it, and the high level of endemism amongst them.³ The psammon, or biotic community living at the lake's edge, was described as representing 'a unique faunal association', unlike any other inland lake psammon (Dyne 1991).⁴ The nekton, or community of free-swimming aquatic organisms in the lake, were also distinctive and included endemic fish and insect species.⁵ While the lake occupied an isolated location within Tasmania's south-western wilderness, it was visited by bushwalkers, naturalists and artists, with visitors commenting on the lake's tranquil beauty, in particular the contrast between the amber-brown water and the pinkish-white eastern beach, and the lunette, or lacustrine dune formed by the lake's internal current and wave action, which backed the beach.

A planarian lost in time

Lake Pedder planarians are freshwater flatworms, carnivorous night-feeding invertebrates endemic to the Lake Pedder area.⁶ Like other aquatic planarians, they are social and active animals, swimming freely with an undulating motion along the lake's surface, and feeding on protozoans, tiny snails and small worms. Aquatic planarians have been identified as important bioindicators of freshwater environmental quality, as they are sensitive to a number of toxins at very low levels and undergo bioaccumulation.⁷ Lake Pedder planarians formed part of the active-swimming aquatic community of the original lake, along with small fish, crustaceans and aquatic insects.

They were introduced to the scientific world as a new species *Romankenkius pedderensis*, within a new genus *Romankenkius*, in a paper by Ian R. Ball in 1974. Ball described the species from specimens collected by the limnologist and marine scientist Ian A. E. Bayly in 1972 beneath stones in Lake Pedder, prior to the lake's flooding. The description was limited to taxonomy, anatomy, and speculations regarding phylogeny. Ball, however, acknowledged the lack of scientific information available regarding freshwater planarians in Australia:

It is clear that the austral relationships of freshwater triclads are exceedingly complex and difficult to unravel. More sophisticated classificatory and biogeographical hypotheses than those already available can be expected only when we know much more concerning the planarian faunas of the Gondwanian continents, and the kind of taxonomic work needed is that which will lead to real knowledge of the species concerned and not merely to their diagnosis and naming.⁸

In 1986 the Lake Pedder planarian was recorded as regionally extinct in the 1986 IUCN Red List, nominally as a result of an assessment by the World Conservation Monitoring Centre. Subsequent listings repeated this status until 1996 when the Lake Pedder planarian was formally classified as extinct.⁹ However, there appears to be no published literature between the initial assessment and the eventual listing as extinct, an absence noted by Forteath and Osborn, who were also unable to find evidence of a specific search for the planarian since Bayly in 1972.¹⁰

Somewhat surprisingly, then, an article was published in 2006 surveying and assessing the classification and distribution of freshwater planarians in Australia, in which an examination was undertaken of slide-mounted specimens of *Romankenkius pedderensis* recently collected by David Hay from Lake Pedder at a site near Serpentine Dam.¹¹ No mention was made of the planarian's status, other than noting that they had been found at the type locality of Lake Pedder.

Forteath and Osborn confirmed that Lake Pedder planarians were still present in the impoundment in their 2012 paper, commenting that previous statements of conservation status displayed confusion around the term 'extinction'. They suggest that the planarians received insufficient taxonomic treatment, collections, and observations to confirm their identity and distribution with any degree of certainty.¹² While Forteath and Osborn were unable to find Lake Pedder planarians along the shorelines of the new impoundment, a subsequent concentrated search of the original lake's shoreline led to them trapping and killing more than 40 specimens, which were subsequently slide-mounted and examined to ascertain the planarians' identity.

Combined, all the ... histological and morphological features confirm that, at April 2010, a population of R. pedderensis still existed in the expanded Lake Pedder some 38 years after Lake Pedder was expanded massively.¹³

These findings suggest that the continuity of Lake Pedder planarians and their way of life has relied on a choice to remain and endure within the specific site that had sustained them for thousands of years. However, the fact that they did not appear to have extended their range but rather to have remained confined to the vestiges of their original habitat suggests that the new impoundment poses a number of possible threats to them, including its greatly increased depth, its faster flowing currents, the increased disturbance of its substrata, and increased competition and predation from new arrivals. While a scientific consensus exists as to the need for more detailed research into the lives of Lake Pedder planarians and how they have responded to their inundated habitat, their conservation status remains in limbo, their IUCN classification as regionally extinct deferred, awaiting updating.

A most singular worm

[T]he plight of the Lake Pedder earthworm (Hypolimnus pedderensis) and the Lake Pedder planarian (Romankenius pedderensis) was probably the first attempt to use invertebrates of conservation significance to stop a major development for conservation reasons. At that time the Australian community was not ready to embrace the idea of the need to conserve invertebrates. The important consequence from Lake Pedder is that it stimulated a group of limnologists to undertake research on freshwater invertebrates that included a strong habitat protection focus.¹⁴

The Lake Pedder earthworm was a segmented, semi-aquatic, megadrile earthworm that lived, and was probably restricted to, the white quartzite beach at the Maria Creek entrance to Lake Pedder. Like most earthworms, *Hypolimnus pedderensis* was hermaphroditic. The sandy beach-like habitat on the banks of Lake Pedder was important to them. They burrowed constantly through the soil, searching for food, and secreting their eggs within it after mating. They fed on microbes or algae on sand particles, or on organic matter amongst the sand.¹⁵

The activity of Lake Pedder earthworms, in conjunction with other local earthworms, had a considerable effect on the banks of the lake. The sand particles and organic matter consumed by the earthworms were deposited on the surface of the ground, in the form of castings. As the castings and the burrows were exposed to the air, the soil was aerated, improving both its drainage and water holding capacity. Surface and sub-surface soils were mixed together. The soil was effectively cultivated by being ground up in the worm's gizzard. The fragments of vegetation pulled underground during the earthworms' burrowing, along with the worms' excretory wastes, introduced organic matter and nutrients into the soil of the lake's banks.¹⁶

Lake Pedder earthworms had a number of features distinguishing it from other megadrile earthworms, including the absence of dorsal pores on the anterior and posterior segments, a characteristic viewed as wholly consistent with their existence at the edge of the lake. The confinement of dorsal pores to the mid-body also suggested that the species was a local derivative that had adapted specifically to the semi-aquatic conditions of Lake Pedder's eastern beach.¹⁷ An important taxonomic feature of these earthworms is that they had multiple oesophageal gizzards occurring on their fifth, sixth, and seventh segments, a unique feature in Australian native earthworms.¹⁸ They formed part of the biotic community that inhabited the moist, sandy habitat on the lake's eastern beach. Along with ciliates, algae, rotifers, gastrotrichs,

isopods, and other worms, the earthworms' way of life was forged in the emergent and damp sand at the edge of the lake.

The Lake Pedder earthworms' specialised habitat was inundated as part of the flooding of the lake in 1972. Dyne argues that it is extremely unlikely that the species could have survived the loss of that environment.¹⁹ Unable to breathe while fully submerged, all earthworms on the beach would have drowned. The isolation of this habitat from other lakes with similar characteristics indicates that they had no other location for refuge when the Lake was flooded. Lake Pedder earthworms could not swim independently, relying on the damp sand for their sustenance, shelter, movement, interactions and meanings. A survey in 1996 was undertaken to investigate the status of the Lake Pedder earthworm, but direct sampling of the general area where the previous specimen was found failed to find further specimens, leading to the conclusion that the earthworms were probably extinct as a result of the inundation of their original and unique habitat.²⁰

Knowledge about Lake Pedder earthworms and the lives they led is based on a single specimen found by the limnologist Dr Peter Tyler in 1971. The specimen is 50 mm in length and 1.6 mm in diameter and has 129 body segments. The head and back have faint brown colouring and the clitellum (the smooth, short section of skin that secretes cocoons) is pinkish and buff.²¹ It was found in sandy, waterlogged sediment among interstitial fauna on the beach of the original Lake Pedder. The preserved specimen is stored within the Tasmanian Museum and Art Gallery's zoological collections. The connections between this specimen and the lives of Lake Pedder earthworms are obscured and restricted. While the specimen offers itself for morphological and taxonomic analysis, its singular, clinical presence does not point to the intimate connection between Lake Pedder earthworms and the soil that sustained them and which they in turn helped to sustain. It does not indicate their relationships, both direct and indirect, with other animals, and with plants and organic matter.

Scientific knowledge about Australian native earthworms in general is limited, with much of it being extrapolated from previous knowledge of European and introduced earthworm species. Changes in soil and vegetation as a result of European settlement have led to the disappearance of native earthworms from many of their historical habitats, before substantial knowledge of their lives, their relationships with other animals with whom they shared their habitat, and of their ecological importance could be acquired and understood.²²

The inundation and extirpation of Lake Pedder earthworms is obscured by the relative invisibility of their lives inasmuch as their habitat and community was both isolated and physically hidden, and obscured discursively by both their classification as invertebrates and by a lack of human/scientific knowledge of them, with what little knowledge that existed written over by pre-existing knowledge of European earthworms. In arguing for a broader and more open sense of environmental ethics, Mick Smith considers soil communities and the challenges they present to humans in terms of concern and care.

What can we say about those beings that pass us by unnoticed, that appear only fleetingly if at all in our lives, that are invisible to the naked eye, or even those whose existence (like so many unremarked species) we are not even aware of? What could it possibly mean for such beings to 'disappear' from the world in the sense of becoming extinct when they don't appear (to be/as) significant?²³

In considering the appearance and disappearance of beings that come to our attention or awareness, Smith argues for a way of responding ethically to them that goes beyond a functional or instrumental understanding of their lives and perspectives. The very fact that

earthworms and other beings remain largely hidden from view is important and significant, drawing our attention to the infinite potentialities of the Earth and of more than human life.²⁴ Lake Pedder earthworms' lives and deaths matter regardless of their function as environmental agents and cultivators of the soil, and irrespective of any direct relationship with humans. They challenge us to respond to them ethically without the need for explication. Their appearance and disappearance leads us to sense and consider the other earthworms, microbes, algae and other interstitial fauna inhabiting the quartzite beach with whom Lake Pedder earthworms related and responded to in the course of their lives, and to reflect on the likely possibility that many other groups of living things disappeared during the flooding of the lake.

A lack of scientific knowledge of and interest in lacustrine invertebrates prior to the announcement of the lake's inundation was a major obstacle in assessing the risks of such a course of action. Other than very general taxonomic and anatomic details, these Lake Pedder inhabitants, their biotic relationships, life histories, and changes over time and space were largely unknown. A biological survey was conducted in 1967, focusing on mammals and vascular, or higher, plant species. The survey found platypus, echidna, eastern quolls, wombats, Bennett's wallabies, ringtail possums and two species of antechinus, as well as evidence of Tasmanian devil activity in the area.²⁵ No surveys had been undertaken and no literature had been published that focused on invertebrates and lower plants such as bryophytes, lichens, fungi and algae. As a result, whole biotic communities were ignored and largely forgotten as naturalists attempted to salvage and gather knowledge of life in and around the original lake in the face of its imminent disappearance.

A galaxias far away

Pedder galaxias are small, scaleless, freshwater fish growing to between 75mm and 160mm in length. Their bodies are slender and have a gold iridescence on their back and sides. They were once endemic to Lake Pedder, Lake Maria and the immediate surrounding area, preferring to swim near the shaded edges of the lake and streams. They shared this restricted habitat with the only other species of fish in the area, swamp galaxias, a related species that was both smaller in size and in number within the lake.²⁶

Pedder galaxias are non-migratory, shy and considered to have a low fecundity.²⁷ They spawned in spring, and in relation to other freshwater fish laid large eggs, had a long development period before hatching, and then had rapid larval development. They fed on aquatic and terrestrial insects, and aquatic crustaceans.²⁸ The fish lived adfluvially, with juveniles staying in nursery shoals close to the lake's margins, and adult galaxias frequenting the meandering streams flowing slowly into the lake.

The flooding of Lake Pedder in 1972 led to a dramatic change in habitat for Pedder galaxias. Initially, like a number of other animals in the new impoundment's littoral zone, their numbers increased. Peter Lake argues that this initial increase in aquatic faunal numbers after inundation is a well-documented phenomenon, one that may be due to increased organic detritus as a result of the lake bed and surrounding terrestrial areas being disturbed.²⁹ Drowned vegetation and peat soils contributed to the transformation of the galaxias' environment from one of low productivity to one that was nutrient-rich and more complex, with an increase in aquatic invertebrates and the occurrence of algal blooms.³⁰

However, as well as transforming the lacustrine habitat, the new impoundment also covered and inundated the Huon River catchment area, where brown trout had been introduced and lived alongside the native climbing galaxias.³¹ Both these fish were markedly larger and more

aggressive than the Pedder and swamp galaxias, with the brown trout adopting the smaller galaxias species as their principal prey, and the climbing galaxias becoming a competitor for food in the impoundment. The trout and climbing galaxias flourished in the new environment, with trout in particular reaching extremely large sizes and weights. The new impoundment was envisaged as a lucrative tourist attraction for local and international visitors, and reports of the increased abundance and size of brown trout attracted recreational fishers. Late in 1972, 350,000 brown trout fry, sourced from the Salmon Ponds hatchery, were released into the impoundment to bolster trout stocks³². It was generally accepted that predation on Pedder galaxias was the most important contributor to the increased size of brown trout, with some trout anglers using live galaxias as bait. This predation also meant that climbing galaxias had diminished competition for food.

By 1978 Pedder galaxias numbers had begun to decline noticeably, and swamp galaxias had disappeared from the impoundment, although they were still present in streams on the margins of the impoundment. After 1980, however, Pedder galaxias could no longer be found in surveys of the impoundment conducted by the Tasmanian Inland Fisheries Commission, and were only rarely seen in the inflowing tributaries.³³ Recreational anglers had also reported the absence of galaxias, troubled by the threat to the trouts' food supply, as trophy-size brown trout were becoming harder to find in the new impoundment.³⁴ By 1990 fears for the survival of Pedder galaxias had become widespread. Once the most numerous fish in Lake Pedder, their population was estimated at less than 200. While swamp galaxias were still present in other locations, it was reported in 1995 that the remaining Pedder galaxias could only be found in the most shaded, slow-flowing, meandering sections of two small streams draining into Bonnet Bay on the eastern side of the lake, with their imminent demise becoming a more widespread and concrete concern.

Because of its restricted distribution and the very low numbers of individuals remaining (apparently lower than 100 individuals), this species must now be considered as the most endangered vertebrate in Tasmania and perhaps as the freshwater fish species in the gravest danger of extinction in Australia.³⁵

A long-term recovery plan, funded by the Commonwealth government and led by the Inland Fisheries Commission, commenced in 1991. Captive breeding and artificial fertilization breeding trials met with very limited success, largely due to the very limited knowledge available regarding the galaxias' reproductive behaviour and breeding biology. The decision was made to translocate the few Pedder galaxias still present in the Bonnet Bay streams to a new habitat. Lake Oberon, a glacial lake in the Western Arthurs Range, was chosen due to the absence of other fish, its abundant invertebrate community, its slow, inflowing streams and its similarity to the original Lake Pedder in terms of size, depth, and water chemistry.³⁶ Electrofishing, whereby fish are caught by being attracted to a submerged, positively charged electrode, was employed to capture 31 galaxias in the Bonnet Bay streams for release in Lake Oberon in late 1991 and early 1992. Three more fish were released in 1997, when regular surveying of the lake commenced. The surveys indicated a steadily increasing galaxias population in Lake Oberon. In 2001, a second translocation commenced, with Pedder galaxias from Lake Oberon moved to the Strathgordon water supply dam. In total, 353 fish were transferred from Lake Oberon to the Strathgordon water supply dam in five translocations between 2001 and 2007. Surveys conducted in the first few years did not indicate a rise in the galaxias population, and it was strongly indicated that the dam did not possess a sufficiently suitable environment for spawning. In 2007, in order to maintain a littoral zone where water

quality and erosion could be controlled and where galaxias eggs could be deposited and sheltered, rocks were placed in specific areas near the edges of the dam. Surveys conducted between 2008 and 2012 showed increasing numbers of galaxias.³⁷

By this time Pedder galaxias were widely recognised as extinct in their original habitat. No specimen had been collected in the Pedder impoundment since 1996. This articulation of extinction raises questions as to what the Lake Oberon and Strathgordon Dam populations of Pedder galaxias constitute, and what exactly has been saved. While both populations were borne of acts of translocation, an undertaking that invariably leads to the deaths of some fish in the process of catching, transporting and releasing them in the new body of water, they are promoted in public and scientific debates as evidence of a successful attempt to save a species. There appears to be little likelihood of Pedder galaxias returning to Lake Pedder, as brown trout and climbing galaxias have successfully colonised the impoundment, making it impossible for them to re-establish themselves in their original habitat.³⁸ This dilemma is compounded by the status of brown trout as a species that is closely associated with sport angling and with aspirational leisure and recreation activities. Brown trout were introduced to Tasmanian rivers in 1864 and are now considered to be traditional and desirable constituents of Tasmanian inland waterways, and an important species in terms of tourism.

'Returning' Pedder galaxias to the lake could only be achieved by another act of translocation, with its attendant risks. The Oberon and Strathgordon populations are no longer connected to Lake Pedder in either of its manifestations. The knowledge gained by Pedder galaxias in the Bonnet Bay streams and in Lake Oberon does not correspond to the *in situ* knowledge and experiences possessed by Pedder galaxias who lived in the habitat to which they were endemic, and who forged complex and varying relationships with the other animals and plants with whom they shared their lives. Matthew Chrulew examines the biopolitics of endangered species preservation, pointing out the paradox of undertaking activities aimed at giving life while simultaneously producing damage and death.³⁹ He argues that these activities constitute a management regime that, while focusing on genetics and on population statistics, ignores the significance of learned behaviours and knowledges, and the way in which captivity has a deleterious effect on subjects' capacity to survive out of captivity. Translocated populations, for example, while appearing to realise the saving of a species, beg the question of the purpose of their being saved. The Oberon and Strathgordon populations of Pedder galaxias, then, may be considered as fish in limbo, 'a wounded life severed from the connectivities of emplaced kin and habitat, from the traditions of behaviour learned and adapted within such forms of life across innumerable generations'.⁴⁰ These populations, cut off in time and space from the memories of previous generations' lives in Lake Pedder, from the living creatures with whom they interacted, and the knowledge of how to survive and thrive in this embodied world, are doomed to a dependency on a version of protection manifested by the absence of other fish.

Inundation

In August 1967 the Tasmanian State Parliament approved a bill providing expenditure for a major hydro-electric project on the Gordon River in southwest Tasmania. A report by the Tasmanian Hydro-Electric Commission had been tabled three months earlier, citing an unprecedented demand for supply of power and the economic cost-benefit imperatives for extending the hydro-electric scheme in Tasmania. The report recommended the construction of a dam on the Gordon River with subsidiary dams to be constructed on the Serpentine and Huon Rivers in order to allow for water to be stored and diverted into Lake Gordon, the new

artificial reservoir created by the Gordon River dam.⁴¹ No specific mention of Lake Pedder was made in this report, but once the project was announced and it became clear that the lake would be subsumed for the purpose of additional storage, a public furor broke out. Since 1955, Lake Pedder and its surrounding area had been afforded official protection as a National Park. However, as part of the new project, this protection was revoked. Anger centred not only on the proposed destruction of an iconic constituent of Tasmania's natural heritage, but also on the lack of transparency shown by the State government in planning the project.

The Lake Pedder Action Committee was formed in 1971, with branches in each Australian state, in order to carry out a national campaign to draw attention to the project and save the lake. The federal government and UNESCO both lobbied the Tasmanian government to reconsider the project. In the face of a Labor-Liberal consensus in Tasmania regarding the hydro-electric scheme, the LPAC established a new political party, the United Tasmania Group, to contest the 1972 State election and provide a political voice for those opposing the Lake's flooding.⁴² Despite these concerted efforts, the Middle Gordon Hydro-electric Power Scheme received parliamentary approval. In 1972, after the construction of three rockfill dams on the Huon and Serpentine Rivers, the surrounding land began to be inundated, forming a much larger impoundment. The process took two years to reach a conclusion, with Lake Pedder, the buttongrass moorland surrounding it, and the forested Serpentine river valley all being flooded.⁴³ While the original lake had a surface area of approximately nine square kilometres, the new impoundment covered just over 240 square kilometres, and was sixteen metres deeper than the original lake.

Lake Pedder's inundation was not experienced by its denizens as a tumultuous deluge nor a sudden coup de grace. The two years it took for the lake to be flooded effected a gradual erosion of the lake and stream banks, and of the life within and surrounding this habitat. How the lake's inhabitants experienced this cumulative engulfing and unravelling of their homeland, lives and relationships would have differed markedly. The disturbance of the lake's substrate would have created a more turbulent and muddy environment for Lake Pedder planarians, hampering movement and communication and making it more difficult to catch prey. Infill water from the rivers and dams may have introduced new pathogens into the lake, in turn possibly causing an increased loss of planarians in a relatively short period of time that may have taken many years from which to recover. Observations have shown that, in contrast to the planarians, Pedder galaxias experienced an increase in food supply as a result of the disturbance, thriving in the short term before the erosion of critical spawning habitats and the encroachment of brown trout and climbing galaxias threatened their numbers and way of life. For Lake Pedder earthworms, inundation would have meant a gradual, desperate attempt to flee the encroaching water, and eventually the lake's tides, striving to reach the steadily eroding beach. Their attempts would have been in vain. Lake Pedder's isolation meant that there was no other location to seek refuge in the face of the water's relentless progress. The beach's submersion sealed the fate of the Lake Pedder earthworm, along with an unknown number of other members of their biotic community, animals never known or remembered by humans.

Following the inundation of the lake, the Hydro-Electric Commission announced that the new impoundment would be named 'Lake Pedder', despite the fact that it did not resemble the original lake in size, appearance or ecology. Ostensibly, the use of this name acknowledged the lake that had been flooded but not forgotten. The decision was met with cynicism and outrage by conservationists and those who had opposed the inundation. In practice, the naming of the impoundment worked to erase the geographical and historical fact of the original lake, and at the same time to write over the violence enacted to produce the impoundment,

and the lives of the animals killed in the process. Lake Pedder had been transformed from natural environment to built environment, and as such different regimes of significance were employed in attracting visitors to the space. Rather than a space for bushwalkers and those interested in nature and wilderness, the new Lake Pedder was promoted as valuable Tasmanian infrastructure, the product of Tasmanian labour, as well as an attraction for tourists, families and recreational anglers. Brown trout became the most important nonhuman animal in this reconfigured space, with galaxias relegated to the role of prey or bait.

Violence and representation

In considering ethical ways of responding to biodiversity loss, Kathryn Yusoff interrogates the relationship between violence, care and the making of biotic communities. She asks the question, 'What are the ways in which biodiversity loss is called into being through aesthetic representational practices to shape modes of attention, disclosure and ethical considerations?'⁴⁴ She contends that conservation bodies foreground practices of care, attention and the valuing of the *bios* at the expense of the historical violence involved in making particular beings the subject of conservation. The risks and harm involved in conservation practices are thus often concealed in the representation of conservation efforts. Yusoff argues that the distancing of violence in its many forms allows one not to be implicated in it, rather than making explicit 'the invisible ties that bind us to violence as a primary mode of engaging'.⁴⁵

Representation, for Yusoff, is always already present in encounters between human and nonhuman beings, be they archived encounters evidenced by, for example, zoological or botanical collections, seed banks or frozen zoos, or 'live' encounters ostended by zoos, wildlife reserves and discovery areas like wetlands. Such encounters embody a politics of how subjects come to be represented; indeed they confirm that the primary function of representation is to transform objects into subjects.

The Hydro-Electric Commission, which underwent a restructuring in 1998 and a name change to Hydro Tasmania, now promotes itself as an organisation committed to protecting threatened species, celebrating the Lake Oberon and Strathgordon translocations of Pedder galaxias as successful conservation activities.⁴⁶ Its website does not acknowledge that the inundation of Lake Pedder led to the loss of countless lacustrine lives and to the critical endangerment and extinction of endemic species. Lake Pedder earthworms are not mentioned. The Hydro Tasmania website does, however, celebrate the discovery of new species within other lakes in the hydro-electric scheme: 'We manage waters that provide essential habitat for threatened species. We protect those species and manage the environment for future generations'.⁴⁷ Given that Hydro Tasmania employs research scientists and funds research documenting the progress of fish and crustacean populations in waters under its administration, seeking to reposition itself as a champion of endemic species, it bears an ethical responsibility to acknowledge the species that it has harmed in the course of its activities.

The representation of Lake Pedder as an icon and metonym of Tasmania's southwestern wilderness was utilised extensively in public actions opposing the lake's inundation. The aesthetic experience provided for human visitors by the original lake, its stark colours, tranquility, and isolation became the principal image in the fight against the Tasmanian government and the Hydro-Electric Commission.⁴⁸ Combining this image with that of the lake's vulnerable endemic species, for whom it held other, more complex meanings, constituted an aesthetic-ethical practice that prepared both the lake and its inhabitants as suitable subjects for biological study. Even with the widespread admission that very little was known about

their lives, the promise was established that a scientific methodology held the key to future knowledge.

The preserved specimen of the Lake Pedder earthworm and the prepared and mounted slides of Lake Pedder planarians provide salient evidence of the role of violence and death in representation:

*The represented non-human subject is a thing caught between two worlds; as a life held in a space in which it cannot be held. In giving subjectivity, we take sovereignty. The thing is not as it would be on its own terms.*⁴⁹

Such a description also provokes a reconsideration of the Pedder galaxias populations contained in Lake Oberon and the Strathgordon storage dam. In each of these three cases specifically designated nonhuman animals are subjected to the sovereignty of biological science. The official announcement that the lake would be imminently inundated is the event that triggered their appearance within the sphere of both scientific and political debate. All three were first articulated as endemic species within the context of several desperate biological investigations of the lake, in the face of a survey and report to parliament by representatives of the Tasmanian Museum and Art Gallery and the Queen Victoria Museum and Art Gallery, and the subsequent pronouncement by the Hydro-Electric Commission that ‘no intimations of the likely loss of unique species have been received as a result of these investigations’.⁵⁰ Thus, Lake Pedder planarians, Lake Pedder earthworms, and Pedder galaxias were all made social and biological subjects under the shadow of Lake Pedder’s flooding, and already had dependence and demise inscribed in their appearance as officially enunciated species. The violence involved in their subjection and representation was concealed and subsumed in identifying the violence effected in the destruction of their habitat.

Sacrifice

*In July 1972, Lake Pedder disappeared under the rising waters of the Middle Gordon hydro-electric scheme that took two years to fill. Its loss illustrated the triumph of human rights, utilitarianism and economism over earth rights, preservation and ecological aesthetics. But Pedder’s loss was not for nothing. It also marked the emergence of ecological consciousness and public attempts around the country to assert ecological ‘intangibles’ against market values.*⁵¹

Lake Pedder constitutes a contested time as well as a contested space. While this paper has discussed the time and space of the lake as a cultural and political environment in which extinction was experienced, enunciated and responded to, Lake Pedder also functions as a historic sign, with the decision by the Tasmanian government to flood the lake being credited as leading to the formation of the world’s first environmental movement and Green political party, the United Tasmanian Group. Lake Pedder marks a schism between governmental and scientific authority and celebrates a time where biological scientists joined with other protestors in voicing opposition to the Middle Gordon Hydro-electric Power Scheme. Political and community lobbying to drain and restore the original lake has existed in some form since its inundation, with the establishment of the Lake Pedder Restoration Committee in 1992 and the 1995 House of Representatives Standing Committee on Environment, Recreation and the Arts’ *Inquiry into the proposal to drain and restore Lake Pedder* highlighting the issue in public fora. The moves to restore the lake, however, are a response to the actions of the Tasmanian government and the Hydro-Electric Commission rather than a response to extinction and habitat destruction. The loss of the aesthetic experience felt by human visitors

writes over the complex, entangled experiences of inundation and devastation experienced by all others in official historical records. Restoring the lake means remembering and re-placing the geomorphological entity recognisable as Lake Pedder while sacrificing and forgetting the biotic communities that the lake sustained.

Hugo Reinert connects the notions of sacrifice and violence, considering the contexts in which the loss or destruction of an offering is effected in the name of a desired benefit.⁵² He contends that when something precious is violently destroyed, questions of hopes, losses and the concealment of violence are begged, and calls for sacrifices to be critically examined ‘in the full weight of their strangeness’. Like Yusoff, Reinert challenges us to acknowledge our connection to and inheritance of this violence. Is the offering ours to give? Can we construe the willingness of the subject/victim? Will the sacrifice work? Was the offered species of least concern or worth? Was the sacrifice for a higher cause?⁵³ Given the lack of knowledge about Lake Pedder earthworms, Lake Pedder planarians and Pedder galaxias, their lack of visibility and their concealed connections with human lives, these questions lead us to reflect on the extent to which such sacrifices are actually felt. For the Tasmanian State Government and the Hydro-Electric Commission, the question of sacrifice hardly represents an issue. In choosing to ignore, dismiss or discount evidence of the threatened species in the area and their social, cultural and biological significance, these entities can be construed as denying the very fact of loss or sacrifice. However, for the coalition of scientific and environmental groups seeking to build an ecological future by restoring the lake to its perceived state prior to inundation, Lake Pedder earthworms, Lake Pedder planarians and Pedder galaxias constitute a more salient offering, especially as their imminent extinctions were utilised in efforts to resist the lake’s flooding. Restoration means moving past the extinction of the earthworms, the extirpation of the galaxias from their historical home and the threats to the survival of the planarians. Doing so, however, neither severs nor absolves us from the violence we have inherited. While the translocated populations of galaxias might be seen as preserving the biological presence and genetic matter of these fish, their lacustrine connections with humans and other living things are nonetheless relinquished for a perceived higher cause.

In the flooding of Lake Pedder we can see a variety of extinction practices apposed: the ignoring and downplaying of biological research and environmental reports in favour of civic progress; the limiting of the scope of historical biological surveys to vertebrate populations, and subsequent surveys to the taxonomy and anatomy of endemic species while ignoring life histories, behaviours and biotic relationships; the separating of humans from nonhuman animals in order to foreground human proclivities; contesting and conflating versions of the lake as space; contesting and conflating understandings of extinction, species and biodiversity; conserving through extraction and translocation; and separating acts of conservation and restoration from attendant acts of violence. Both inundation and restoration carry with them the trace of the violence inherited in effecting these activities. We are all implicated when we represent our actions as serving a greater good. But what is sacrificed in these practices are real lives and ways of life, nonhuman others who lived and interacted on the lake’s quartzite beach, on the margins of the lake, and swam within the lake: lives, relationships, experiences, and possibilities that had existed for thousands of years and that were ongoing, vital and unique.

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