OOS [redacted]

From: Crisp, Jo
Sent: Thursday, 30 November 2023 1:33 PM
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Cc: Bannister, Raymond; Rush, Bec; Robbins, Rachel
Subject: FOR FEEDBACK Conservation Action Plan for the Maugean Skate
Attachments: DRAFT_Maugean Skate Conservation Action Plan_29 Nov 23 for Recovery Team.docx

Dear colleagues

As we communicated in our Recovery Team meetings I am pleased to provide the Draft Conservation Action Plan for the Maugean Skate. The draft CAP sets out the objectives and actions designed to support recovery of the Maugean skate and is based on the workshops and decision-making sessions that you have all been involved in. The document is intended to complement and not duplicate existing conservation planning documents. The Tasmanian Minister for Environment has made a commitment to release the CAP before Christmas 2023.

I would appreciate it if you would review and provide feedback on the plan to ensure that it is up-to-date and appropriately represents our collective actions by close of business on Monday 11 December 2023.

The document is still a draft and has several sections that are still being worked on. As such, I would appreciate it if you wouldn't forward the document on outside of the Recovery Team membership.

Kind regards

Jo

Tasmanian Government

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Delivering a sustainable Tasmania

In recognition of the deep history and culture of this island, I acknowledge and pay my respects to all Tasmanian Aboriginal people; the past and present custodians of the land.

Conservation Action Plan for the Maugean Skate

Department of Natural Resources and Environment Tasmania

Tasmanian Government

Contents

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Front cover: Maugean skate Jane Rucker/IMAS

In recognition of the deep history and culture of these islands, we acknowledge all Tasmanian Aboriginal people as the continuing Custodians of this Land and Sea Country and pay our respect to elders past and present.

Acknowledgement

The Department of Natural Resources and Environment Tasmania (NRE Tas) acknowledges the significant contribution of scientists and information custodians, industry representatives, conservation groups, Tasmanian Aboriginal people, local community members and representatives of all levels of government in working to recover the Maugean skate. The Department would especially like to acknowledge and thank members of the national Recovery Team for their advice and assistance in the development of this Conservation Action Plan. Recovery Team membership is detailed in Appendix 1.

Acronyms

ABS	Australian Bureau of Statistics
ARIS	Adaptive Resolution Imaging Sonar
CAP	Conservation Action Plan
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DO	Dissolved Oxygen
EPA	Environment Protection Authority
IMAS	Institute for Marine and Antarctic Studies
LiDAR	Light Detection and Ranging
NRE Tas	Department of Natural Resources and Environment Tasmania
PVA	Population Viability Analysis
RMPS	Resource Management and Planning System of Tasmania
TPDNO	Total Permissible Dissolved Nitrogen Output
TSPA	*Threatened Species Protection Act 1995*
ZAA	Zoo and Aquarium Association (Australasia)

Introduction

The Maugean skate (*Zearaja maugeana*) is a cartilaginous fish in the skate (Rajidae) family. Its genus, Zearaja, comprises a small group of skates recognised for having a long snout with a quadrangular disc, dark-edged ventral pores, and claspers with extremely spatulate distal lobes (Last and Gledhill, 2007). The genus consists of only three species, the New Zealand rough skate (*Zearaja nasuta*) found in New Zealand, the yellownose skate (*Zearaja chilensis*) found in Chile, and the Maugean skate (*Zearaja maugeana*) found in Australia.

Endemic to Tasmania, the Maugean skate is listed as endangered under both Tasmania's *Threatened Species Protection Act 1995* (TSPA) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. The species has also been included as a priority threatened species under the National Threatened Species Action Plan (2022-2032). It is the only species of skate in the world known to mostly inhabit brackish waters (Treloar *et al*., 2017).

The Maugean skate has been recorded in two isolated estuaries in southwestern Tasmania, Macquarie Harbour and Bathurst Harbour. Surveys indicate that the species is now likely extinct in Bathurst Harbour and Macquarie Harbour is considered to hold the sole remaining viable population (Moreno *et al*. 2022).

Species information, including description, population trends and distribution, can be found in the Tasmanian Government's Maugean Skate Listing Statement released in 2022 (NRE Tas, 2022). As such ecological and species information will not be duplicated in detail in this document.

Conservation Action Plan purpose

This Conservation Action Plan (CAP) builds on work of Tasmanian and Australian Government threatened species experts and scientific advisors. In 2022 the Tasmanian Government's Maugean Skate Listing Statement was released. In September 2023, the Australian Government's Department of Climate Change, Energy, the Environment and Water (DCCEEW) issued a Conservation Advice statement on advice from their Threatened Species Scientific Committee. Both documents set a foundation for urgent conservations actions and research ahead of the release of this CAP.

The CAP sets out the objectives and actions designed to support recovery of the Maugean skate and complements existing conservation planning documents for the species mentioned above. The CAP is intended to fulfil the general intent of a Recovery Plan, while requiring a shorter timeframe to develop and having the capacity to be flexible, adaptive and responsive as new information becomes available.

The CAP provides a coordinated approach to identifying resources to implement priority activities, critical research and management actions.

The CAP has been prepared by the Department of Natural Resources and Environment Tasmania (NRE Tas), with input from the national Recovery Team, published scientific data and associated local, national and international experts to support the Secretary in performing functions under section 7 of the TSPA. Implementation of the CAP will take place with reference to relevant legislation, including the objectives of the Resource Management and Planning System of Tasmania (RMPS).

The overarching purpose of the CAP is to outline interventions to minimise the extinction risk of the Maugean skate and maximise the probability of recovery for the species in the wild. This purpose will be achieved through five objectives.

Conservation Action Plan objectives

The five objectives are designed to give effect to the CAP purpose and establish the framework for conservation action and for tracking of the impacts and effectiveness of the plan.

Objective 1: Ensure that healthy habitat in Macquarie Harbour is available to meet Maugean skate physiological requirements

Continue to monitor, maintain and as necessary improve environmental conditions in Macquarie Harbour, to provide viable habitat for a self-sustaining population of Maugean skate.

Objective 2: Establish additional Maugean skate subpopulations for future re-introduction

Act immediately to minimise the extinction risk for the skate by establishing and maintaining a captive breeding population *ex situ*, and investigate opportunities to reintroduce skate or establish new populations in areas of suitable wild Tasmanian habitat.

Objective 3: Implement strategies to reduce threats to the Maugean skate population

Mitigate and manage the potential impacts caused by other threats such as climate change/marine heatwaves, aquaculture, historical mining activities, hydro-electrical generation, fishing and in particular gillnetting and depredation of Maugean skate individuals by other species.

Objective 4: Actively engage key stakeholders and the community in Maugean skate conservation recovery actions

Work closely with stakeholders to identify opportunities for direct engagement in conservation actions with a particular focus on sharing learnings and promoting community understanding of, participation in, and benefits from, Maugean skate conservation actions.

Objective 5: Maintain and strengthen the knowledge base for skate recovery

Coordinate the data gathering and knowledge sharing efforts of research organisations, government agencies, environmental groups and the community to ensure that data related to skate recovery is properly curated and widely accessible. This will require broadening the evidence base for conservation decision-making, including understanding of the benefits and impacts of management actions on the skate population, habitat quality, local industries and harbour users, traditional owners and the broader community. As well as understanding of long term climate change impacts on the skate population.

Conservation Action Plan development

The need for considered management action to recover the Maugean skate has brought together a diverse range of stakeholders. Recovery actions for the Maugean skate have been determined after analysing existing research, data and knowledge provided by organisations and individuals. Between August 2022 and July 2023 a series of workshops coordinated by NRE Tas and the Australian Government's Department of Climate Change, Energy, the Environment and Water (DCCEEW) analysed current science and knowledge on the environment within Macquarie Harbour and the biology, population and resource needs of the Maugean skate to consider threats and potential mitigation actions for the species.

These workshops included individuals with a significant interest, or relevant technical expertise, in Maugean skate ecology, conservation planning and the environment, social and economic values of Macquarie Harbour and included local community representatives with an interest in skate recovery.

Conservation management actions identified during the workshops were evaluated through an externally-led Structured Decision-Making process (SDMP) which assessed the benefits, impacts and levels of certainty associated with actions, in relation to key objectives. The results of the SDMP were then used to identify and prioritise actions identified in the 'Conservation Actions' section below.

Technical working groups under the National Recovery Team for the Maugean Skate (the Recovery Team) have consolidated and refined actions. The groups have drawn on learnings from local, national and international remediation, conservation and recovery projects and sought to identify relevant and practical approaches to apply science with the safety of the skate and the health of Macquarie Harbour front and centre in decision-making.

The CAP also draws on existing conservation planning documents and published research including, as mentioned above, the NRE Tas Maugean skate Listing Statement (published in July 2022) and DCCEEW Conservation Advice (published September 2023). However, there is no intention to duplicate in full the content of these documents.

Action Plan review and timeframe

This CAP seeks to establish a coordinated approach to skate recovery for the next three years (2024-2026). Actions will be reviewed by the Recovery Team annually or when new information becomes available. Estimated timelines associated with conservation actions are presented in the 'Conservation Actions' section below.

Criteria for success

The CAP will be deemed successful if, within three years, the following have been achieved:

- Threats to the health of Macquarie Harbour and specifically to Maugean Skate populations are better understood, managed and, where feasible, reduced.
- *An Ex situ* captive breeding populations has been established, and there is:
    - a plan for reintroduction of these individuals back to Macquarie Harbour developed; and
    - research and planning to inform the feasibility of release of the species in other locations has been completed.
- Understanding of the species' ecology and response to anthropogenic impacts has increased.
- The Maugean skate population is being adequately monitored using standardised methods, and the population has not decreased from baseline data as a result of recovery actions.
- There is increased understanding of the importance of skate and active participation by key stakeholders, traditional owners and the public in recovery efforts and monitoring.

Distribution and habitat

Maugean skate are found in brackish waters with individuals showing a preference for shallow channels between 5 and 15 metres in depth (Bell *et al.* 2016). Waters preferred by the species generally have relatively stable temperatures (12–15 °C) and salinity (18–27 ppt), and naturally low-moderate dissolved oxygen concentrations (30–80% dissolved oxygen) (Bell *et al.* 2016; Morash *et al.* 2020). The species is more active at night using a broader range of waters to forage. Egg capsules have been detected across a wide range of depths (2.5–30 m).

The species has been recorded in only two estuaries in west and south-western Tasmania. These are Bathurst Harbour in the South-West National Park and Tasmania Wilderness World Heritage Area (TWWHA), and Macquarie Harbour on the West Coast, adjacent to the township of Strahan, part of which is also located inside the TWWHA. Only four records of the species have been confirmed from Bathurst Harbour, with the last record from this location occurring in 1992. Although there are anecdotal reports, no specimens have been recorded from marine waters outside these two harbours, although it is notable that there has also been relatively little historical marine ecosystem survey work undertaken in this region of Tasmania.

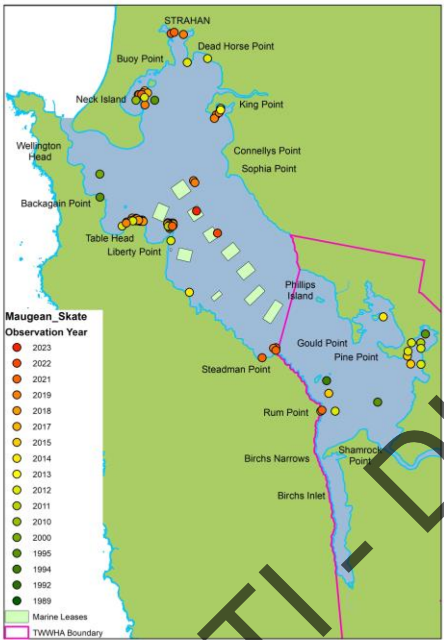

Figure 1: Map of Macquarie Harbour with locations of Maugean skate observations as recorded in the Natural Values Atlas

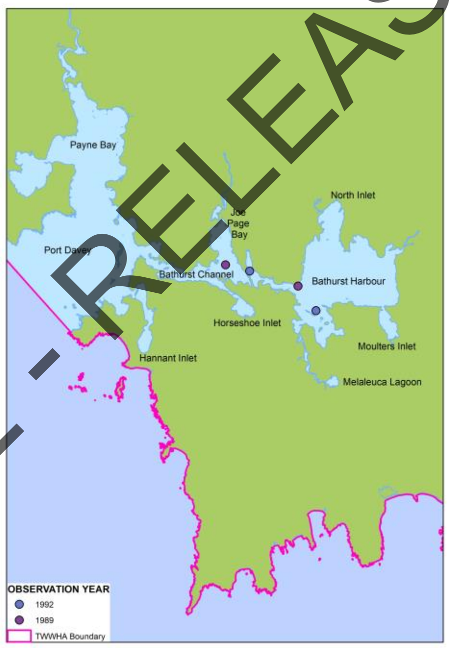

Figure 2: Map of Bathurst Harbour with locations of Maugean skate observations as recorded in the Natural Values Atlas

Macquarie Harbour

Macquarie Harbour is a large estuarine system of approximately 276 km², with complex hydrodynamics and variable environmental conditions. The harbour has a deep central basin with a shallow, narrow entrance. Freshwater in-flows are highly variable and enter the harbour from two major catchments, the Gordon River and the King River.

The Macquarie Harbour aquatic ecosystem is highly stratified, with a freshwater top layer, brackish mid-layer and deep waters which are close to marine salinity (EPA 2017). In combination, these features mean that there is limited exchange of the deeper harbour waters with the ocean, which leads to naturally low levels of oxygen in harbour depths and mid-layers (Wild-Allen *et al*. 2020). While natural oxygen levels in the harbour have historically been highly variable, monitoring data indicates that anthropogenic uses of the harbour, including aquaculture and hydro-electric power generation, also influence dissolved oxygen (DO) concentrations. Monitoring data indicates that around 2009, DO concentrations underwent a significant decline. While some signs of improvement have been observed in recent years, DO concentrations remain well below 2009 levels (Ross *et al*. 2021).

Figure 3 shows DO levels at various depths recorded in Macquarie Harbour from 1993 through to 2023. Of note is that while the surface oxygen levels (0 - 5 meters) remain relatively constant due to wind and wave churning, the lower levels of the water column show declining oxygen levels from 2009 reaching very low levels in 2014.

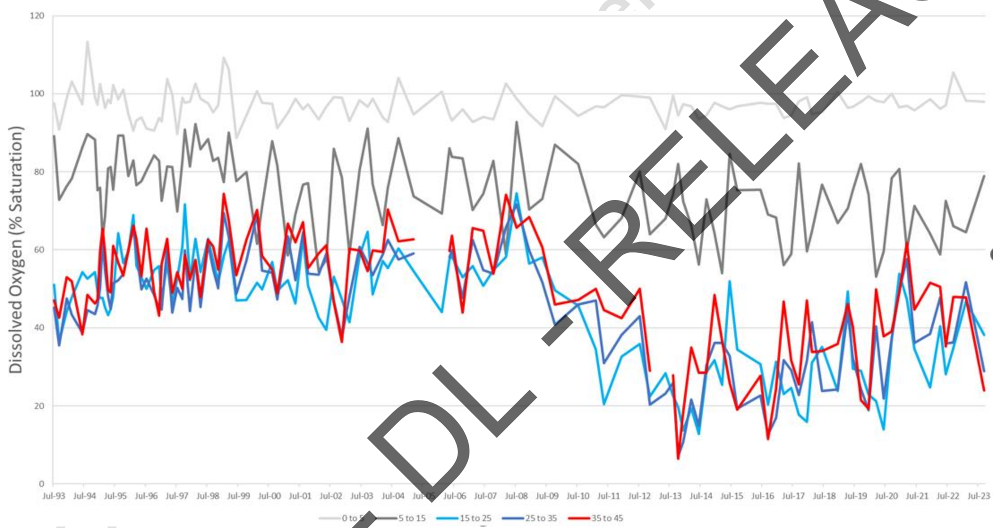

Figure 3: Dissolved oxygen levels at various depths in the water column from 1993 to 2023 (source EPA).

In fjord-like estuaries, such as Macquarie Harbour, DO levels and distribution are complex, variable and driven by the combined effects of river flow, tidal exchange, oceanic deep-water renewal, wind, organic loading, and microbial processing in the sediments and water column (Edwards and Edelsten 1977; Maxey *et al.* 2020; Maxey *et al.* 2022). Figure 4 provides a conceptual model of the deep-water renewal process occurring in Macquarie Harbour.

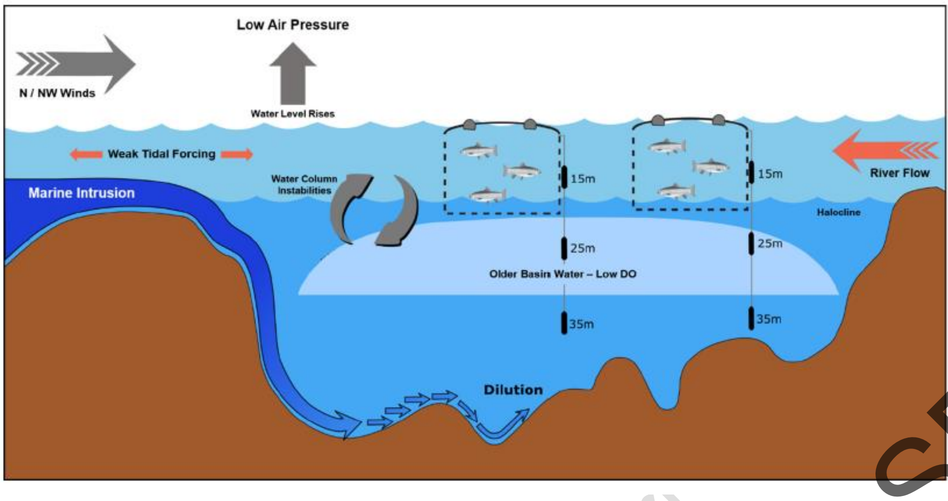

Figure 4: Conceptual model highlighting the drivers of deep-water renewal in Macquarie Harbour Hartstein *et al.* (2019) from IMAS

Climate change is likely to be causing higher water temperatures to occur, directly impacting the water quality in Macquarie Harbour by reducing DO levels. The mean temperature of Macquarie Harbour's bottom waters increased by approximately 1.5 – 2 °C from 1993 to 2020 (Ross *et al.* 2021).

Bathurst Harbour

Bathurst Harbour is a large, shallow (maximum depth of 10 m), fully mixed estuary. The Bathurst Channel that connects the harbour to Port Davey is permanently stratified and up to 50 m deep (Last and Gledhill 2007). DO levels in Bathurst Harbour are naturally higher than in Macquarie Harbour (Moreno *et al.* 2022). No hydroelectric power generation or upstream mining currently occurs in tributaries entering Bathurst Harbour, and no aquaculture operations occur in the area. In addition, the area has been subjected to very limited historical and modern recreational and commercial fishing pressure.

Little is known about the population that once existed in Bathurst Harbour. The species has not been recorded in the harbour since 1992 and is thought now to be extinct at this location, despite very low levels of anthropogenic impact. Conversely, Macquarie Harbour has been subject to a variety of anthropogenic impacts over the past century. This has led to some uncertainty regarding the full suite of threatening processes impacting population decline; and hence the need for an adaptive management framework which is responsive to new information as it is collected and analysed.

Gillnet and other surveys have been used in Bathurst Harbour, but only four Maugean skate were ever caught in this location. A recent Environmental DNA survey of the harbour undertaken in 2022 by IMAS detected a presence of skate environmental DNA. It is possible that Bathurst Harbour and other similar estuaries in the TWWHA may prove to be suitable locations for re-introduction of captive bred individuals.

Population

The Institute for Marine and Antarctic Studies (IMAS) at the University of Tasmania currently monitors the species in Macquarie Harbour in quarterly surveys using monofilament gillnets. Survey efforts using this technique have been ongoing since 2012, although the methods used have varied over this time, partly to reduce the risk of skate mortality (noting that this monitoring work requires a permit under the *Threatened Species Protection Act 1995* and *Living Marine Resources Management Act 1995*).

Environmental DNA, remote operated vehicles, tow cameras, dive transects, and baited remote underwater video have also been used to survey the population in both Macquarie Harbour and Bathurst Harbour. However, there are considerable logistic and resourcing considerations that currently limit the feasibility of applying these techniques in routine monitoring (Moreno and Semmens 2023).

Non-invasive survey methods using Light Detection and Ranging (LiDAR) and Adaptive Resolution Imaging Sonar (ARIS) technologies have been investigated, and have potential advantages over gillnet surveys (e.g. lower risk of impacts to skate, increased efficiency and accuracy).

In 2016, the Macquarie Harbour subpopulation was estimated to be 3,200 individuals (Bell *et al.* 2016). However, recent research estimates that a decline in relative abundance of the species in Macquarie Harbour of up to 47% occurred between 2014 and 2021 (Moreno and Semmens 2023).

A Population Viability Analysis (PVA) has recently been undertaken for the species (Grant *et al.* 2023). The PVA estimated a best-case scenario of a population decline of 89% by 2041 and worst-case scenario of > 99% decline, including extinction probabilities of greater that 25% by 2041.

Uses and Impacts on Macquarie Harbour

The conditions in Macquarie Harbour have changed markedly since the 1800s, influenced by activities in and around the estuary including mining, dredging, forestry, hydro-electricity generation, marine farming operations, and the effects of climate change (Moreno and Semmens 2023). Figure 5 provides a summary of key historical and contemporary harbour uses and activities, together with notable climatic and other events that may have impacted the skate population within Macquarie Harbour.

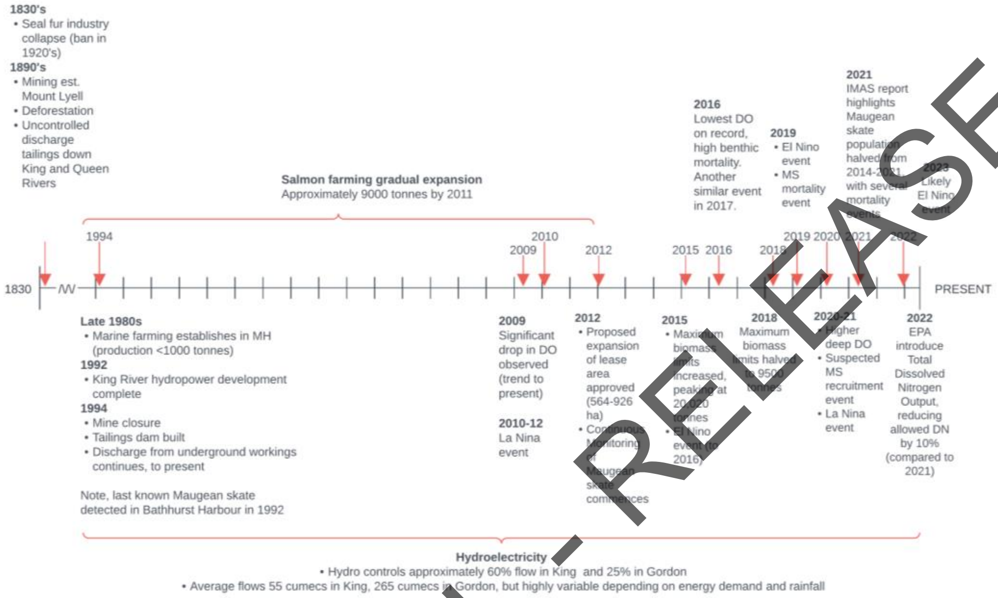

Figure 5: Macquarie Harbour and Maugean skate timeline

Commented [CJ1]: Draft timeline to be edited and graphically designed.

Aquaculture

Insert graph showing production and value over time

Aquaculture began in Macquarie Harbour in the late 1980s. From 2005, the industry expanded, reaching a standing biomass peak of over 20,000 tonnes in 2014-15. Environmental monitoring has showed a decrease in harbour water quality, including reductions in DO concentrations (Ross and Macleod 2017). As a result of a significant decline in seabed ecosystem health in 2016, the standing biomass limit for the harbour was progressively lowered by the EPA, culminating in a standing biomass cap of 9,500 tonnes in 2018 (EPA 2022).

In 2022, the EPA began regulating salmonid production in Macquarie Harbour through a cap on dissolved nitrogen outputs in place of standing biomass caps. A nitrogen cap provides better control over feed inputs, which are more closely related to overall environmental impact. The resulting Total Permissible Dissolved Nitrogen Output (TPDNO) of 500.1 tonnes represents a reduction of dissolved nitrogen output of approximately 60% compared to 2014-15 peak levels (EPA 2022). The Statement of Reasons for the 2022 TPDNO determination is available on the EPA website.

Feed provided to farmed fish increases nutrients available in the water column. Nutrients are then taken up through the primary production cycle, which causes a reduction in DO. Under normal circumstances DO is recharged though atmospheric, hydrodynamic and biogeochemical processes. However, the time taken for these processes to take effect and the extent and nature of impact is dependent on a number of variables. Any change to aquaculture operations or stocking rates needs to take into account considerations including animal welfare, production cycles, biosecurity considerations and operational logistical constraints.

The EPA has developed draft dissolved oxygen targets for Macquarie Harbour as a guideline for remediation work. These targets use data from 1993-2009 to define preferred oxygen conditions in surface, mid, and bottom waters, across three different regions of the harbour.

Commented [CJ2]: Draft or finalised - to be reviewed when released

Hydro-electricity generation

The major freshwater inputs into the harbour, the Gordon and King Rivers, are both used for hydro-electric power generation. Release of water from the Gordon Power Station in particular has been identified as having an impact on DO concentrations in the harbour, largely because river in-flows influence the degree to which high DO oceanic waters enter the system. Low river flows typically facilitate entry of oceanic water into the harbour, however, the relationship between river in-flows and entry of oceanic water, and the resulting effects on DO, are complex, timescale dependent, and also influenced by other factors, including weather events and tides (Wild-Allen *et al.* 2020; Ross *et al.* 2021).

Operation of the Gordon Power Station is dependent on multiple factors, some of which are difficult to predict, including inflows to other catchments across the state used for generation of hydro-electricity and the National Electricity Market. The operation of the Gordon Power Station in itself does not cause low DO water to enter the harbour, as water released from the turbines is re-oxygenated shortly after discharge, due to high flow velocities and turbulence in the middle Gordon River (Locher 2001).

Mining

The Mount Lyell copper mine was established in the 1890s in the King River catchment (Stauber *et al.* 1996). Run-off from historical mining activities has led to reduced water quality and high levels of heavy metal contamination within the sediments (Koehnken 1996). Current mine operation includes containment of mill tailings in a tailings dam, and active management of acid mine drainage from the site. While the flow of heavy metal pollutants into Macquarie Harbour has decreased substantially over time, input of heavy metals into the harbour continues at a reduced rate in association with weather events and water run-off.

The EPA monitors heavy metal concentrations in the harbour, results of which indicate a gradual decrease in historic levels of some heavy metals, including copper, over time.

Fishing

Both recreational and commercial gillnetting occur in Macquarie Harbour, and recreational line-fishing also occurs. Changes to rules and fisher education programs have occurred over recent years and, in November 2022, NRE Tas implemented interim measures to reduce the likelihood of incidental bycatch of Maugean skate from fishing activities. These interim measures were formalised through statutory rules in effect from 1 November 2023. NRE Tas has prohibited take of any species of skate in Macquarie Harbour, including those caught by line-fishers.

For recreational gillnetters, measures included additional spatial closures in important areas of skate habitat, a two-hour maximum soak time for gillnets, and a prohibition on overnight netting to reduce risks to skate of depredation by parasitic sea-lice, crabs and other species.

Commercial gillnetting in the harbour is limited to two licence holders. Commercial gillnetters are subject to the same area closures as those for recreational gillnetters. Commercial gillnetters are permitted to set nets overnight, but under the measures introduced, are subject to a seasonal closure at times of the year (late Spring to mid-Autumn), when Maugean skate are considered most at risk from fishing activities.

The NRE Tas *Recreational Sea Fishing Strategy 2021-2030* outlines a transition away from recreational gillnetting by 2030 across the state.

A range of educational materials about the Maugean skate have been produced, including information signage at the Strahan boat ramp, information included in the annual State Government *Recreational Sea Fishing Guide*, and through education and awareness activities delivered by the local Natural Resource Management organisation.

Cultural and community significance

Approximately one third of the area of Macquarie Harbour is located within the boundary of the Tasmanian Wilderness World Heritage Area (TWWHA).

Add natural, cultural and TWWHA values

Add socio-economic significance

Direct Threats to Maugean Skate

Table 1: Priority known and potential threats for the Maugean skate, based on available evidence. Interactions occur between the major threats and may lead to cumulative impacts to the skate.

Threat	Description	Evidence	Impact
Reduced water quality in Macquarie Harbour	Macquarie Harbour is naturally low in DO and has also been impacted by historical and ongoing anthropogenic activities, including expansion of aquaculture and changes in river flows due to generation of hydro-electricity and leachate from mining operations (Ross *et al.* 2021). Water temperature and salinity also affect skate habitat use and physiology, including through the reduced solubility of oxygen in water as temperature increases (Moreno *et al.* 2020; see Climate Change below). Environmental monitoring shows that DO levels in middle and bottom waters underwent a significant decline beginning around 2009 and, notwithstanding a trend showing gradual improvement since 2017, remain low. Deep water oxygen recharge events in Macquarie Harbour driven by atmospheric conditions, low freshwater flows and strong north-westerly winds have been reduced due to hydroelectric operations.	Moreno *et al.* (2020) observed mortality of skate individuals attributed to low DO concentrations and warm water temperatures. Deep water renewal events bring oxygen-rich water over the sill into the basin, replenishing deep water oxygen levels (MHDOWG 2014; Hartstein *et al.* 2019; Ross *et al.* 2020). The magnitude of oceanic deep water renewal events are highly correlated with freshwater river flows (MHDOWG 2014; Maxey *et al.* 2022).	Known. Reduced DO in Macquarie Harbour is a significant threat to the Maugean skate. While the species has high tolerance to changes in DO concentrations, salinity and temperature, changing environmental conditions (particularly over relatively short timeframes) can cause behavioural responses, physiological stress, and can result in mortality of adult skate. Changes to water quality also have the potential to reduce survival rates for skate eggs and juveniles (Moreno *et al.* 2020).

Climate change and the occurrence of extreme weather events	Climate change and the occurrence of extreme weather events directly influence water quality in Macquarie Harbour, including through higher water temperatures causing reduced DO levels, changes to freshwater flows into the harbour, and extreme weather events leading to inversion of the harbour water column and changes to DO levels at the skate's preferred depth (Moreno *et al.* 2020) of between 5 and 15 metres.	The mean temperature of Macquarie Harbour's bottom waters has increased by approximately 1.5 – 2 °C from 1993 to 2020 (Ross *et al.* 2021). Another significant heatwave event is predicted for the 23/24 summer (CSIRO 2023). Climate change predictions for the west coast of Tasmania suggest that there will be greater and more intense rainfall in the winter and lower rainfall in summer after 2050 (Grose *et al.* 2010).	Higher water temperatures reduce oxygen solubility, and climate change is likely to contribute to other changes to water quality in Macquarie Harbour given the influence climate and weather events have on environmental conditions in the harbour (e.g. through influence on river in-flows). Increased temperatures may also impact skate directly through behavioural changes, physiological stress or reproductive impacts.
Incidental bycatch from fishing activities in Macquarie Harbour	Both recreational and commercial gillnetting occur in Macquarie Harbour. Maugean skate ecology and feeding behaviour may exacerbate the risk of incidental capture by gillnets in some circumstances, because Maugean skate are more likely to utilise shallow areas where gillnetting occurs in response to physiological stress, and also appear to be more active at night when many gillnets are set (Moreno *et al.* 2020). Recreational line-fishing also occurs in Macquarie Harbour and presents a potential threat to Maugean skate due to the potential for post-release mortality. However, this fishing method is considered to present a lower relative risk to the species, because it is a less effective method of capture than gillnets, and considered less likely to expose skate to depredation.	The Maugean skate is particularly susceptible to capture in gillnets, with mortality associated with long soak times and related depredation by whitespotted dog-fish, crabs and sea lice (Lyle *et al.* 2014; see 'predation and depredation' below).	Known. While mortality of Maugean skate caught in gillnets has been observed (Lyle *et al.* 2014), current catch rates and post-release survival rates for Maugean skate in Macquarie Harbour are not known. Gillnetting measures (see 'Fishing' section) are expected to reduce the likelihood of skate mortality from fisher interactions. However, the potential for gillnetting activities to impact the skate population remains.

Predation and depredation	'Predation' is used here to refer to events relating to free-ranging Maugean skate or their eggs, while 'depredation' refers to predator-prey interactions which occur as a result of a Maugean skate being immobilised or injured (e.g. when caught in a gillnet).	Depredation by parasitic sea-lice, crabs and whitespotted dogfish is a known cause of mortality for Maugean skate caught in gillnets (Lyle *et al.* 2014). There is no evidence to suggest that sea-lice have an impact on free-ranging skate individuals or their eggs. Seals are present in Macquarie Harbour and predation and/or depredation of Maugean skate is possible, however, no confirmed instances have been observed. There is also potential for crabs to predate on Maugean skate eggs (Moreno *et al.* 2020).	Uncertain. There is currently no evidence to suggest that predation is having a significant impact on the Maugean skate population. The impact of depredation is also uncertain, given that current catch rates and post-release survival rates for Maugean skate caught by fishers in Macquarie Harbour are not known.
Heavy metals pollution	Historical mining activities in the King River catchment have led to elevated levels of heavy metals in Macquarie Harbour (Koehnken 1996). There is potential for heavy metals to cause mortality of skate adults, juveniles or eggs, or to decrease reproductive success (NRE Tas 2022).	While there is no direct evidence on the threat presented by heavy metals to Maugean skate, heavy metal pollution has been implicated in decreased reproductive success of other elasmobranchs (Tiktak *et al.* 2020).	Uncertain
Genetic diversity and stochastic (random) risk	Species with limited genetic diversity have reduced capacity to adapt to changing ecological conditions. Species with small populations and limited geographic distributions and/or number of subpopulations are at increased risk of extinction due to stochastic events.	The Maugean skate is identified as at increased risk of extinction due to low genetic diversity, a small population size and as now only known to occur in one location (Weltz *et al.* 2018)	Uncertain. Any impact is likely to be amplified if the population continues to decline.

Priority Conservation Actions

This section outlines priority conservation actions identified during the conservation planning process.

The presented list of actions is derived from the full suite of potential actions identified during the series of workshops described in the 'Introduction'. The conservation planning process was not always able to achieve consensus amongst participants on the priority conservation actions. Consequently, NRE Tas has included priority conservation actions based on:

- immediate conservation interventions that are needed to prevent the extinction of the species
- population size and trends for the species which indicate that every skate individual is important in increasing the probability of recovery
- accepting that some economic and social impacts may be unavoidable if extinction of the species is to be prevented. However, consistent with the objectives of the resource management and planning system of Tasmania, the priority conservation actions aim to minimise such impacts where possible.

Descriptions of indicative costs and priority ratings are included in Tables 2 and 3 respectively. Priority Conservation Actions are detailed in Table 4.

Table 2. Indicative costs for conservation actions

Costs are estimated over a five-year period, recognising that some costs will be incurred on an ongoing, per annum basis, while others will be one-off costs (e.g. capital costs).

Indicative costs	
Low	< $200,000
Medium	$200,000 – $2,000,000
High	> $2,000,000

Table 3. Action priority/timeframe ratings

The priority and timeframe for conservation actions is summarised as current, (in recognition of the significant work program underway), as well as short, and medium to long-term.

Priority / timeframe ratings	
Current	Action is currently in progress or imminent
Short-term	Action begins within 1 year of CAP publication
Medium to Long-term	Action begins between1-5 years from CAP publication

Table 4. Priority Conservation Actions

Action	Timeframe	Involved groups	Cost	Status
Objective 1: Ensure that healthy habitat in Macquarie Harbour is available to meet Maugean skate physiological requirements **Threats addressed: climate change, aquaculture and reduced freshwater flows**				
New or varied Marine Farming Development Plans and Environmental licence conditions incorporate the Environmental Standards for Finfish farming and adaptively consider: • oxygen demand monitoring. • reduction of oxygen demand over time. • shorter licence timeframes to enable adaptive review and adjustment conditions.	Current	State Government (EPA, NRE Tas)	Low (implementation) Potentially High (socio-economic depending on conditions).	In progress
Investigate and trial artificial injection of oxygen into Macquarie Harbour to effectively increase supply of dissolved oxygen. Steps include: • international scan of technology options. • planning and approval of pilot study. • implementation of pilot study, including monitoring and assessment of effectiveness in increasing DO concentrations and any adverse impacts.	Current	Salmon industry, Institute for Marine and Antarctic Studies (IMAS), State Government including EPA (permitting, DO optimal levels), Australian Government, Local Government, FRDC	Low (investigate options) High (implementation)	In progress
Investigate and implement options to reduce, offset or supplement oxygen levels in Macquarie Harbour, which may include injection and mixture of buoyant water into Macquarie Harbour depths, ongoing injection of oxygen using or adapting method trialled in pilot study, and engineer options to increase the capacity of marine water to enter the harbour. Selection of options will take into account: • results of oxygen injection pilot study. • identification and mitigation of potential environmental impacts (including exploring transition to renewable energy sources).	Short-term	State Government, Australian Government, Local Government, EPA, Salmon industry, IMAS, FRDC	High	Further investigation planned by Recovery Team, implementation dependent on results of investigation and from pilot study described above.

Action	Timeframe	Involved groups	Cost	Status
• approvals. • cost benefit analysis of options. • analysis of expected benefits to Maugean skate recovery.				
Assess and model the role of hydropower-generated flows in the DO dynamics of Macquarie Harbour and investigate options for adjusting hydro-electric water flows in Gordon and King Rivers to facilitate entry of high DO marine water into the harbour (i.e. oceanic recharge), including assessment of any opportunistic changes to river flows in late 2023 and early 2024.	Current (investigation of options)	Hydro Tasmania, State Government, CSIRO,	Low (investigation of options)	In progress (investigation of options)
Develop and implement options for adjusting hydro-electric water flows in Gordon and King Rivers to facilitate entry of high DO marine water into the harbour (i.e. oceanic recharge). Requires an assessment of risks to other threatened species at other operational sites and integration with other harbour uses.	Medium to long term (implementation of options)	Hydro Tasmania, State Government, CSIRO	Cost of implementing options not yet known. Further assessment required in relation to impacts on power generation.	To be assessed
Develop an integrated spatial model of habitat dynamics in Macquarie Harbour to better understand the available habitat for Skate and their prey availability under various seasonal conditions and particularly in periods of environmental stress (e.g. marine heatwaves).	Medium	Hydro Tasmania, State Government, CSIRO, IMAS	Medium	To be assessed

Action	Timeframe	Involved groups	Cost	Status
Objective 2: Establish additional Maugean skate subpopulations for future re-introduction **Threats addressed: Genetic diversity and stochastic (random) risk**				
Initiate captive breeding trial utilising existing IMAS facilities, including: • securing relevant permits and approvals. • collection of eggs from Macquarie Harbour with the intent to rear in captivity. • removal of a small number of adult skate individuals from Macquarie Harbour to establish an insurance population. • temporary holding of females to support collection of eggs. • development of accompanying husbandry, welfare and biosecurity protocols and procedures.	Current	IMAS, Zoo and Aquarium Association (ZAA), Tasmanian Aboriginal people, Cradle Coast Natural Resource Management (CC-NRM), State Government, Australian Government, Local Government	Medium	In progress
Establish additional, self-sustaining captive breeding sub-populations in Tasmania, including investigation of the feasibility of breeding and holding facilities in Strahan or other locations.	Short-term	IMAS, ZAA, Tasmanian Aboriginal people, CC-NRM, State Government, Australian Government, Local Government	High	Planned
Re-introduce captive bred Maugean skate individuals into Macquarie Harbour, dependent on need to augment sub-population and presence of suitable habitat.	Medium to Long-term	IMAS, ZAA, Tasmanian Aboriginal people, CC-NRM, State Government, Australian Government, Local Government	To be assessed	To be assessed
Investigate opportunities to establish new Maugean Skate sub-populations in the wild, by translocating captive bred individuals to areas of suitable habitat (e.g. Bathurst Harbour, New River Lagoon), including in areas with the potential to act as refuges from the impacts of climate change and extreme weather events. May include habitat suitability assessments and investigation into historical status of Bathurst Harbour sub-population.	Medium to Long-term	IMAS, ZAA, Tasmanian Aboriginal people, CC-NRM, State Government, Australian Government, Local Government	To be assessed	To be assessed

Action	Timeframe	Involved groups	Cost	Status
Objective 3: Implement strategies to reduce threats to the Maugean skate population **Threats addressed: Incidental bycatch from fishing activities, depredation and predation, and heavy metals pollution**				
Introduce new fishing restrictions through the *Living Marine Resources Management Act 1995*	Current	State Government	Low	In Progress
Increase awareness of best practice catch handling and release for recreational line-fishers to optimise post-release survival from incidental bycatch.	Short-term	State Government, Local Government, West Coast community groups	Low	Planned
Bring forward the planned ban on recreational gillnetting in Macquarie Harbour to 2024 to reduce the potential for skate mortality due to depredation.	Short-term	State Government, Local Government, West Coast community groups	Low	To be assessed
Prohibit commercial gillnetting in Macquarie Harbour from 2024 to reduce potential for skate mortality due to depredation.	Short-term	State Government, Local Government, West Coast community groups	Low	To be assessed
Support increased Tasmanian Police and NRE Tas Fishery Officer presence on the harbour to monitor compliance.	Current	State Government	Low	In Progress
Implement Marine Finfish Environmental and Technical Standards to protect and maintain environmental values and the ecological character of Macquarie Harbour including water quality investigative trigger values and monitoring of sensitive habitats as part of the broadscale monitoring program. Environmental Standards for Tasmanian Marine Finfish Farming 2023 link	Current	EPA	Medium	In progress
Mitigate impact of heavy metals already occurring in the harbour as a legacy of historical mining activities, by avoiding disturbance of the benthic sediments.	Current	State Government, Local Government, EPA	Low	In progress

Action	Timeframe	Involved groups	Cost	Status
Manage ongoing releases of heavy metal pollutants occurring as a legacy of historical mining activities, to minimise the amount of heavy metals entering the harbour and the potential for remobilisation of currently stable tailings waste.	Medium to Long-term	State Government (Mineral Resources Tasmania, EPA), Local Government	Medium to High	To be assessed

Action	Timeframe	Involved groups	Cost	Status
Objective 4: Actively engage key stakeholders and the community in Maugean skate conservation recovery actions **Threats addressed: Lack of knowledge and awareness**				
Establish a dedicated Maugean Skate recovery action webpage that serves as the principal online focus for sharing and reporting progress on recovery activities and as a gateway to related pages maintained by other partner organisations e.g. NRE Tas, IMAS, FRDC, Cradle Coast NRM)	Short-term	NRE Tas, Cradle Coast NRM etc	Low	Planned
Impacts and benefits to the west coast community from conservation actions are investigated including engagement of social science expertise in conservation planning.	Short-term	IMAS, west coast community groups, State Government, Local Government, Australian Government	Medium	In progress
Collaborate with and engage Tasmanian Aboriginal people in recovery actions, including but not limited to: • removal of Maugean skate individuals or eggs from Macquarie Harbour for captive breeding program. • potential translocation of captive bred individuals to areas of suitable habitat. • Public education about the cultural value(s) of skate and the Macquarie Harbour ecosystem. • opportunities for on-country conservation planning.	Current	Tasmanian Aboriginal people, State Government, Local Government, Australian Government, research institutions	Low	In progress

Action	Timeframe	Involved groups	Cost	Status
Recognise Tasmanian Aboriginal cultural knowledge and the significance of Maugean skate and related species and collaborate on activities to maintain and share such knowledge, where appropriate.	Short-term	Tasmanian Aboriginal community, State Government, Local Government, Australian Government, research institutions	Low	Planned
Maintain and expand community involvement in the species recovery program including citizen science (e..g skate monitoring app below), co-design and knowledge sharing, information sessions and education resources.	Current	Cradle Coast NRM, IMAS, west coast community groups, State Government, Local Government, Australian Government	Medium	In progress
Encourage the use of existing apps that will enable harbour users to report both skate presence and related environmental information that will assist to better understand skate behaviour and distribution.	Short term	Tasmanian Aboriginal community, community members, fishers, State Government, Local Government, Australian Government, Cradle Coast NRM, research institutions	Low	Planned

Action	Timeframe	Involved groups	Cost	Status
Objective 5: Maintain and strengthen the knowledge base for skate recovery				
Continue to monitor the current population status of the skate (abundance, trends, and age structure) using quarterly gillnet surveys, and/or other monitoring techniques, to provide the evidence base to make conservation planning decisions and assess the effectiveness of implemented conservation actions.	Current	IMAS	Medium	In progress
Continue to investigate additional population monitoring methods such as Adaptive Resolution Imaging Sonar (ARIS) and close-kin mark recapture population analysis.	Current	IMAS, CSIRO	Medium	In progress
Continue environmental monitoring in Macquarie Harbour and investigate opportunities to consolidate and optimise monitoring effort, including: • identification of duplication. • location, quality and diversity of sensors. • ensuring data is fit for purpose and relevant to future decision-making. • continued monitoring and regulation of processes not currently considered to significantly contribute to reduced water quality (e.g. Tas Water sewerage inputs, minor marine heatwaves or seasonal weather variations, etc).	Short-term	State Government, EPA, IMAS, CSIRO, Hydro Tasmania, Salmon industry	Low	Planned
Undertake quarterly monitoring of physio-chemical, nutrient and heavy metal data at 15 additional sites throughout Macquarie Harbour, including: • comparison of data to long term datasets for sites monitored since 2013 (oxygen logger) and 1993 (quarterly water sampling). • provision of monitoring coverage for a longitudinal section along the deepest part of Macquarie Harbour.	Current	EPA, CSIRO	Medium	In progress

Action	Timeframe	Involved groups	Cost	Status
• deployment of additional logger instrumentation within the TWWHA. • investigation of areas on the western side of the harbour for deployment of three additional sets of data logging equipment.				
Re-initiate Oxygen Process Modelling for Macquarie Harbour, and incorporate additional modelling to predict: • assessment of habitat suitability and impacts to suitability by changes in DO. • prediction of DO dynamics under contrasting hydro-electric flow management and various marine heatwave scenarios. • catchment in-flows, including timing preferences for predicted dam releases. • impacts of climate change and prolonged marine heatwaves.	Current	CSIRO, State Government, Hydro Tasmania, BOM	Medium	In progress
Improve understanding of Maugean skate physiology and environmental thresholds and preferences within Macquarie Harbour, including: • determining the effect of different environmental characteristics, such as DO, temperature, salinity across all life stages of the species. • determining how reproductive success, egg survival and recruitment are being affected by environmental pressures.	Short-term	IMAS, CSIRO	Low	In progress
Improve understanding of ecological preferences, including: • distribution and abundance of preferred prey species in Macquarie Harbour and prey dynamics under various environmental conditions. • impacts of changing environmental conditions and reduced water quality on prey.	Current	IMAS	Low	In progress
Collate, independently review, and update scientific data as new information or technologies become available, including the option of incorporating Artificial Intelligence (to optimise data gathering, model recovery scenarios, etc).	Medium term	State Government, IMAS, CSIRO	Low	Planned

Action	Timeframe	Involved groups	Cost	Status
Conduct an annual Maugean Skate Science Seminar in Strahan (with video access) to provide updates on the results of scientific studies undertaken on Maugean Skate.	Short term	IMAS, Cradle Coast NRM	Low	Planned
Consider establishing and maintaining a Maugean Skate science page that enables public access to relevant data and publications in one location.	Short term	IMAS, FRDC, CSIRO, Cradle Coast NRM	Low	In design

Reporting

The National Recovery Team for the Maugean skate has oversight of skate recovery outcomes and organises, implements, reviews and reports on the success of the CAP. The Recovery Team liaises with governance and working groups delivering the various funded priority actions.

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Appendix 1: National Recovery Team for the Maugean Skate

As an advisory body, the national Maugean Skate Recovery Team provides advice on recovery actions to a range of stakeholders, including the Australian and Tasmanian Governments. One of the roles of the Recovery Team is to recommend and coordinate activities which facilitate implementation of the CAP and the Australian Government's Conservation Advice for the species. It provides a representative, collaborative and transparent framework for coordinated conservation management of the species.

Participant	**Organisation**	**Purpose**
Colin Simpfendorfer	Australian Government Threatened Species Scientific Committee	Representative of Australian Government Threatened Species Scientific Committee
Leonardo Guida	Australian Marine Conservation Society	Representative of environmental-NGO sector
Clint Mayes	Copper Mines Tasmania	Representative of mining industry
Iona Flett	Cradle Coast Natural Resource Management	Representative of local NRM organisation
Karen Wild-Allen	CSIRO	Technical specialist on Macquarie Harbour environmental dynamics
Toby Patterson	CSIRO	Technical specialist on elasmobranchs
Lesley Gidding-Reeve (Vice-chair)	DCCEEW (Marine Species Conservation Section)	Representative of the Australian Government agency accountable for species
Alyssa Giffin	DCCEEW (Marine Species Conservation Section)	Representative of the Australian Government agency accountable for species
Darryl Cook	EPA (Salmon Environmental Regulation Division)	Representative of independent environmental regulator
Bec Sheldon	Hydro Tasmania	Representative of hydro-electric energy producer
Jayson Semmens	IMAS	Technical specialist on the species
David Moreno	IMAS	Technical specialist on the species
Jeff Ross	IMAS	Technical specialist on Macquarie Harbour
Maree Fudge	IMAS	Engagement and social science specialist
Jo Crisp (Chair)	NRE Tas (Environment)	Representative of Tasmanian Government agency accountable for threatened species
Tom Duncan (Coordinator)	NRE Tas (Environment)	Representative of State Government Agency accountable for threatened species

Davina Gregory-Dunsmuir	NRE Tas (Environment)	Representative of State Government Agency accountable for threatened species
Jarrod Edwards	NRE Tas (Marine Resources)	Aboriginal Cultural Fisheries
Sven Frijlink	NRE Tas (Marine Resources)	Representative of State Government Agency accountable for aquaculture and fisheries
Matt Barrenger	Salmon Tas	Representative of aquaculture industry, with operations in Macquarie Harbour
Harriet Brinkhoff	Strahan Community Aquaculture Forum	Representative of West Coast community
David Midson	West Coast Council	Representative of Local Government
Laura Simmons	Zoo and Aquarium Association (ZAA), SEA LIFE ANZ	Technical specialist on ex-situ conservation techniques

Tasmanian Government

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Department of Natural Resources and Environment

Environment, Heritage and Lands Division

Project Management Framework

INITIATE | GATE 1 | PLAN | GATE 2 | EXECUTE | GATE 3 | CLOSE | GATE 4 | BUSINESS AS USUAL

Project Initiation Document
Maugean Skate Conservation Planning

SECTION 1: PROJECT DETAILS	
Project Name:	Maugean Skate Conservation Planning
Project ID:	TBA
Objectives:	To implement and support a coordinated conservation planning framework for the endangered Maugean Skate to address the immediate, medium and long term actions to address the risk of extinction of the species including: • Evaluation of opportunities to reduce fishing-related instances of skate mortality • Identification of any opportunities for short-term mitigation and long-term remediation of environmental conditions in Macquarie Harbour • Identification of other potential threatening processes, and *in situ* and *ex situ* management actions, for skate • Identification of critical knowledge gaps and research needs to support conservation management • Development of a Conservation Action Plan (CAP) from project working group outputs, and initiation of a Recovery Team (or a recovery team substitute) to oversee CAP implementation. • Communication, engagement and consultation with relevant stakeholders who may be impacted by, or interested in, project activities.
Background:	The Maugean Skate is endangered under Tasmania's *Threatened Species Protection Act 1995* (TSPA) and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBCA), and is listed in the top one hundred priority threatened species under the Australian Government's Threatened Species Strategy Action Plan 2022-2032. Recent results from research and monitoring campaigns led by the Institute of Marine and Antarctic Studies (IMAS) raise concerns about the status of the species. Known threats include habitat degradation and loss, particularly declines in dissolved oxygen levels, and mortality associated with fishing activities, particularly gill-netting. Other potential threats have been posited but require confirmation, including predation (seals, crabs and parasitic sea-lice), reduced sediment health and historic mining runoff, increased pollution linked to altered river flows from hydroelectric production, increased nutrient loadings from salmonid aquaculture operations, genetic in-breeding and climate change. Addressing these threats requires initiation of a range of actions and liaison with multiple stakeholders across government and the general community, including: • Community education and awareness • Regulatory changes to address fishing related mortality • Potential opportunities to improve environmental conditions in Macquarie Harbour by changing current industry practices (hydro-electric flows, aquaculture and other remediation activities)

	• Coordination and prioritisation of research and management strategies with relevance to skate conservation planning Given the urgent need to address the risk of extinction for the species, some project activities have been expedited prior to project initiation and formation of the Steering Committee. These include: • Development of the Listing Statement • Evaluation of management options to reduce fishing-related mortality • Submission to the CEO of the EPA to reduce aquaculture biomass limits • Engagement of Hydro Tas and other stakeholders in early discussions to share existing knowledge and to identify priority knowledge gaps		
Relationship to Agency or Divisional strategic priorities and Corporate Plan:	The project supports the Department's strategic priority four: Protect and strengthen Tasmania's cultural and natural values, by aiming to support recovery of a listed taxon.		
Project Classification:	Operational		
Reasons for project classification:	Project involves the execution of standard functional operations		
Approved Business Case:	**Yes** ☐ **No** ☒	**If No, why:**	Not needed
Initiate Date:	**Plan Date:**	**Execute Date:**	**Close Date:**
15/10/2022	15/11/2022	15/12/2022	15/06/2023
SECTION 2: PROJECT DEFINITION			
Project Scope:	**The project scope includes initiation of multiple actions to develop planning frameworks and policy settings to support Maugean Skate recovery, as outlined below.** Note that a conceptual summary of project processes and outputs is included in Appendix A. **<u>Evaluate and implement options to reduce fishing-related mortality</u>** Including: • Evaluate potential legal instruments under the TSPA and *Living Marine Resources Management Act 1995* (LMRMA), including requests for legal advice from the Office of the Solicitor-General (OSG). • Liaise with scientific experts to identify management options that are likely to be effective in reducing skate mortality, and assess options in the context of potential stakeholder impacts. • Develop communications and consultation plan to guide interactions with gill-netters and recreational line fishers in Macquarie Harbour. • Implement identified management options under appropriate legal instruments. **<u>Initiation of working groups to explore opportunities to address threats to the Maugean Skate</u>**		

	Working groups will be focussed on three thematic areas, as follows: (1) opportunities to mitigate and remediate environmental conditions (including dissolved oxygen and pollution) in Macquarie Harbour through management of aquaculture and hydro-electric flows; (2) impact of predation on skate; and (3) investigation of *ex situ* management options to aid skate recovery. Activities will include: • Convening working groups with relevant scientific experts and relevant Government agencies. • Facilitating workshops to identify research gaps and priorities, resourcing opportunities, and potential management strategies. **Development of a Conservation Action Plan** Development of the CAP will identify and prioritise areas of research and *in situ* and *ex situ* management strategies for both the short- and long- term recovery of the species, and will include: • Outputs from working groups • Incorporation of additional sources where relevant (e.g. Maugean Skate Listing Statement) **Formation of a Recovery Team (or recovery team substitute) to oversee the implementation of the CAP** Including identifying relevant stakeholders and developing appropriate governance structures and frameworks (e.g. Terms of Reference)
Outcomes:	Recovery outcomes A Maugean Skate conservation planning framework that identifies coordinated research and management actions to support recovery of the species. Key stakeholders are aware of, and engaged with, project activities. Knowledge gaps and research and resourcing opportunities are identified and prioritised. Social and economic impacts of potential management options are considered and incorporated into decision-making frameworks.
Outputs:	Maugean Skate Listing Statement (COMPLETE) Conservation Action Plan Briefings to relevant Ministers and NRE Tas Executive Prospectus identifying research and funding opportunities Project communications (e.g. letters to stakeholders, media releases, updates to fishing guides) Cost/benefit analyses and decision-making frameworks for implementation of management options, (e.g. changes to hydro-electric flows or aquaculture industry), where appropriate
Exclusions:	Undertaking any research programs that may be relevant to conservation planning Community education and awareness activities undertaken as part of Cradle Coast Authority's Commonwealth funded project focussing on the skate Activities associated with ongoing administration and support of Recovery Team (or recovery team substitute)

Related projects:	Review of the Environmental Strategic Business Unit (ESBU) Translocation Policy (to evaluate *ex situ* management options) Review and amendment of the LMRMA *Fisheries (Scalefish) Rules 2015*
SECTION 3: CHANGE MANAGEMENT	

Key stakeholders:	**Change readiness:**
Minister for Environment and Climate Change	Strong interest and readiness for change
NRE Tas Executive	Strong interest and readiness for change
Other NRE Tas Strategic Business Units	Strong interest and readiness for change
Environment Protection Authority (EPA)	Strong interest and readiness for change
Cradle Coast Authority	Strong interest and readiness for change
Research institutions	Strong interest and readiness for change
Hydro Tasmania	Strong interest, some readiness for change in the context of operational and business limitations
Aquaculture industry	Strong interest, may be resistant to change
Recreational and commercial gill-netters in Macquarie Harbour	Strong interest, some likely to be resistant to change

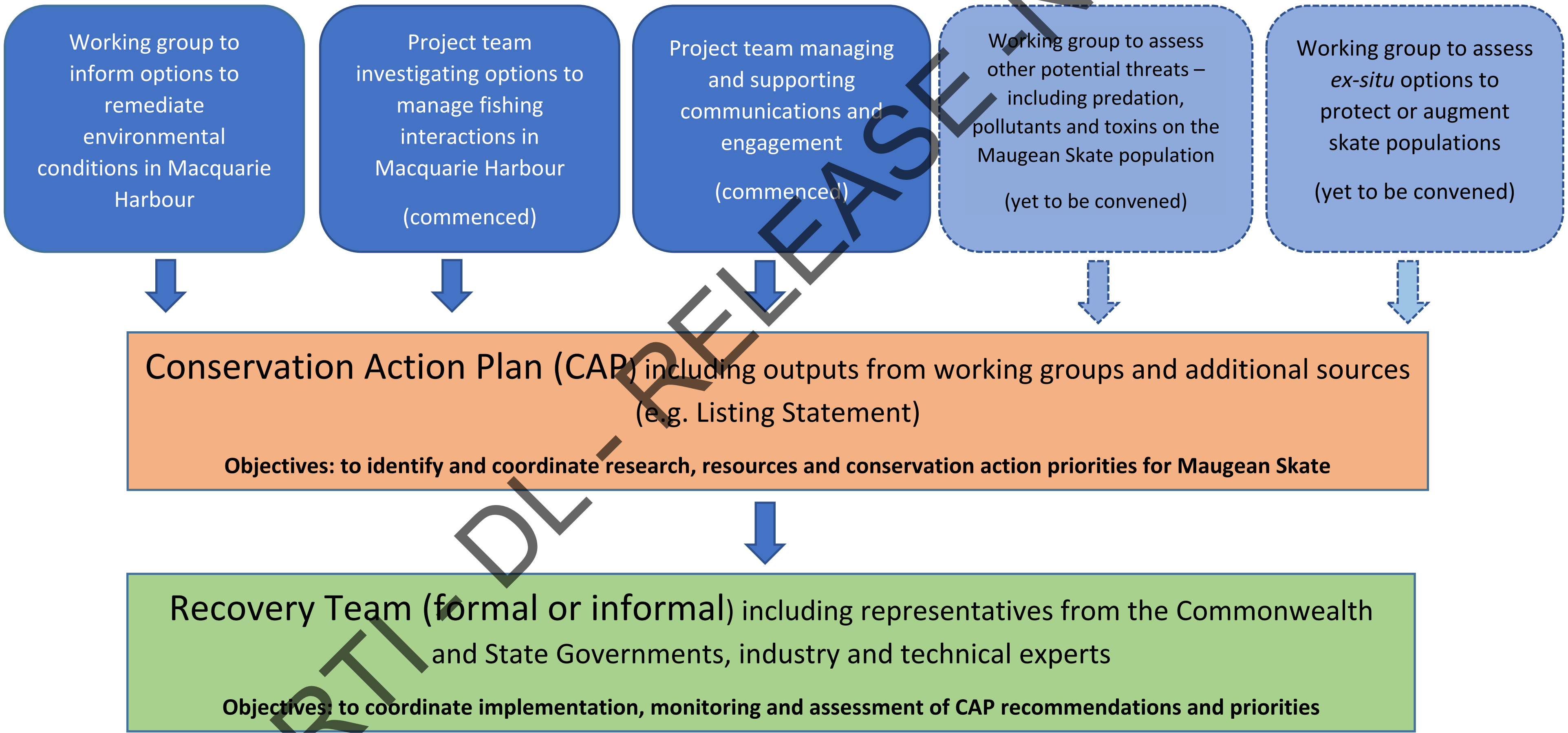
SECTION 4: GOVERNANCE	
Project Sponsor:	Jo Crisp, General Manager, Environment Strategic Business Unit
Business Owner:	Rachael Alderman, Branch Manager Threatened Species and Conservation Programs
Project Manager:	Tom Duncan, Project Manager Threatened Species
Steering Committee members:	Jo Crisp, General Manager, Environment Strategic Business Unit Ian Dutton, General Manager Marine Resources Strategic Business Unit Darryl Cook, Director Finfish Compliance, Environmental Protection Authority
Reference / Working Group members:	A graphical representation of project contributors and working groups is included in Appendix 1
Other (please specify)	Critical Species Oversight Committee (CSOC) – NRE Tas committee to resolve resourcing or other issues unable to be resolved by the project Steering Committee
SECTION 5: PROJECT RISK	
Constraints:	Available resources of the Threatened Species Section

	Availability of relevant stakeholders to participate in workshops and to implement management options Knowledge gaps and scientific uncertainty impeding the capacity to identify appropriate management strategies Economic and social context of potential management options		
Assumptions:	Assumed support of other NRE Tas Strategic Business Units (e.g. Marine Resources) in supporting or driving relevant management options (e.g. implementing identified regulatory changes to fishing rules) Assumed support and availability of relevant scientific experts for working groups		
Risks:	Stakeholders are unaware of, or disengaged with, project activities. Mitigation is to use Communications Plan to guide awareness and engagement activities. Stakeholders reject or disagree with proposed management options. Mitigation is to appropriately consult and communicate potential management options. Lack of staff continuity. Mitigation is to avoid key person dependencies and to maintain project documentation.		
SECTION 6: ACKNOWLEDGEMENT and APPROVAL (GATE 1)			
Business Owner	**Rachael Alderman**	RAlderman	**17/10/2022**
Project Sponsor (Gate 1 Approver)	**Jo Crisp**		**18/12/2022**

Tasmanian Government

Appendix 1

Maugean Skate conservation planning: Contributors, processes, and outputs



Project Classification Matrix

PROJECT RISK CRITERIA	PROJECT TYPE: Strategic	Divisional	Operational
Strategic Priority	Will achieve high priority initiatives in Corporate Plan	Will achieve priority initiatives in Corporate Plan	Standard functional operations
	☐	☐	☒
Significance	Cross-sectoral; major sensitivities	Single sector; sensitive	No strategic implications of not proceeding
	☐	☐	☒
Impacted stakeholders	Cross-Divisional stakeholder impacts; outcomes cross-sectoral	Stakeholder impacts across multiple branches; single sector outcomes	Operational outcomes impact a single team or branch
	☐	☐	☒
Timeframe	Deadline is fixed or very short, no program flexibility	Deadlines may be variable or extended	Project can be reprioritised
	☐	☐	☒
Scope Definition	Scope/objectives potentially ambiguous or transient; complex deliverables	Clear objectives, defined scope and deliverables	Repeatable; generic scope and deliverables
	☐	☒	☐
Contractors / Consultants	Competitive procurement of contractors/consultants (RFT or RFQ)*	Procurement of single contractor/consultant (RFQ)	Internal resources only
	☐	☐	☒
Interdependent and related projects	High risk inter-dependencies and inter-related projects	Some major inter-dependencies or inter-related projects	No major inter-dependencies or related projects
	☐	☐	☒
Change Impact	Significant atypical changes to approach or practices	Medium to large scale changes to approach or practices	Limited or regular changes to practices
	☐	☐	☒

[redacted]

From: Matt Barrenger [redacted]
Sent: Monday, 11 December 2023 2:04 PM
To: Crisp, Jo; lesley.gidding-reeve; Gregory-Dunsmuir, Davina; Duncan, Tom; Cook, Darryl W; David Midson; Wild-Allen, Karen (Environment, Hobart; Jeff Ross; Jayson Semmens; Edwards, Jarrod; David Moreno; Leo Guida; Bec Sheldon; Frijlink, Sven; Maree Fudge; colin.simpfendorfer@[redacted]; Patterson, Toby (Environment, Hobart; harrietbrinkhoff@[redacted]; Iona Flett; laura.simmons; Clint Mayes
Cc: Bannister, Raymond; Rush, Bec; Robbins, Rachel
Subject: RE: FOR FEEDBACK Conservation Action Plan for the Maugean Skate - closing 11 Dec 23
Attachments: DRAFT_Maugean Skate Conservation Action Plan_29 Nov 23 for Recovery _STas Review.docx

HI Jo,

Thanks for sending this (and reminders) through.
Attached with a couple of comments from my review.

Regards,
Matt.

From: Crisp, Jo <Jo.Crisp@nre.tas.gov.au>
Sent: Sunday, December 10, 2023 5:41 PM
To: lesley.gidding-reeve <lesley.gidding-reeve@dcceew.gov.au>; Gregory-Dunsmuir, Davina <Davina.Gregory-Dunsmuir@nre.tas.gov.au>; Duncan, Tom <Tom.Duncan@nre.tas.gov.au>; Cook, Darryl W <Darryl.Cook@epa.tas.gov.au>; Matt Barrenger [redacted]; gm <gm@westcoast.tas.gov.au>; Wild-Allen, Karen (Environment, Hobart <[redacted]>; Jeff Ross <Jeff.Ross@utas.edu.au>; Jayson Semmens <jayson.semmens@utas.edu.au>; Edwards, Jarrod <Jarrod.Edwards@nre.tas.gov.au>; David Moreno

<david.moreno@utas.edu.au>; Leo Guida [redacted]; Bec Sheldon <Bec.Sheldon@hydro.com.au>; Frijlink, Sven <Sven.Frijlink@nre.tas.gov.au>; Maree Fudge <maree.fudge@utas.edu.au>; colin.simpfendorfer@[redacted]; Patterson, Toby (Environment, Hobart <[redacted]>; harrietbrinkhoff@[redacted]; Iona Flett [redacted]; laura.simmons [redacted]; clint.mayes [redacted]
Cc: Bannister, Raymond <Raymond.Bannister@epa.tas.gov.au>; Rush, Bec <Bec.Rush@dcceew.gov.au>; Robbins, Rachel <Rachel.Robbins@dcceew.gov.au>
Subject: FW: FOR FEEDBACK Conservation Action Plan for the Maugean Skate - closing 11 Dec 23

Dear colleagues

Thank you to the many of you who have already provided comments on the draft Maugean Skate Conservation Action Plan. Your feedback is much appreciated. For those of you who are still intending to provide a response, I note the cut-off date is close of business Monday 11 December 2023 which will enable the Plan to be finalised and released before the end of the year.

Kind regards

Jo

From: Crisp, Jo <Jo.Crisp@nre.tas.gov.au>
Sent: Thursday, November 30, 2023 1:33 PM

Duplicate

[redacted]

Conservation Action Plan for the Maugean Skate

Department of Natural Resources and Environment Tasmania

Tasmanian Government

Uses and Impacts on Macquarie Harbour

The conditions in Macquarie Harbour have changed markedly since the 1800s, influenced by activities in and around the estuary including mining, dredging, forestry, hydro-electricity generation, marine farming operations, and the effects of climate change (Moreno and Semmens 2023). Figure 5 provides a summary of key historical and contemporary harbour uses and activities, together with notable climatic and other events that may have impacted the skate population within Macquarie Harbour.

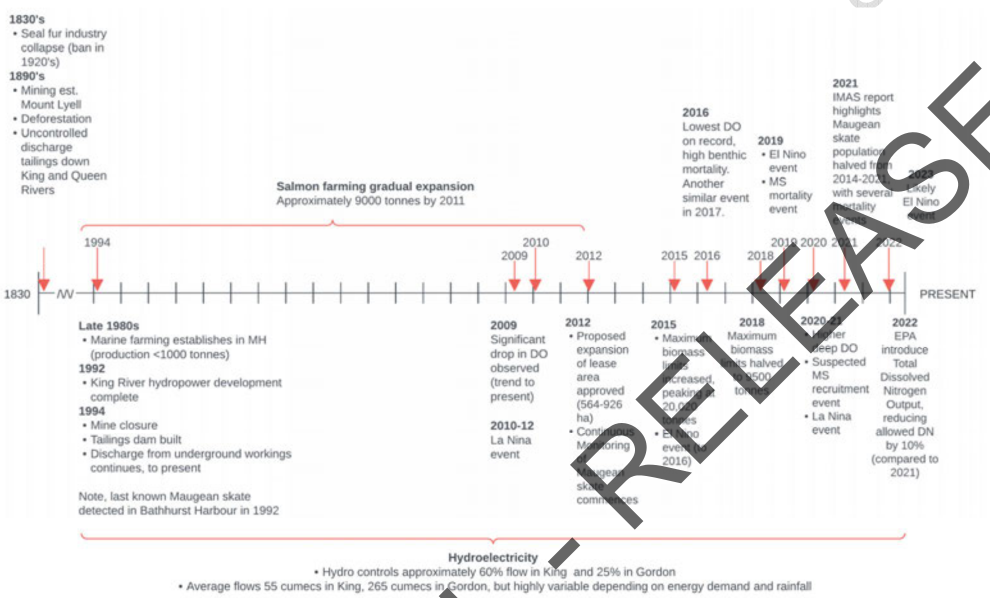


Figure 5: Macquarie Harbour and Maugean skate timeline

Aquaculture

Insert graph showing production and value over time

Aquaculture began in Macquarie Harbour in the late 1980s. From 2005, the industry expanded, reaching a standing biomass peak of over 20,000 tonnes in 2014-15. Environmental monitoring has showed a decrease in harbour water quality, including reductions in DO concentrations (Ross and Macleod 2017). As a result of a significant decline in seabed ecosystem health in 2016, the standing biomass limit for the harbour was progressively lowered by the EPA from early 2017, culminating in a standing biomass cap of 9,500 tonnes in 2018 (EPA 2022).

In 2022, the EPA began regulating salmonid production in Macquarie Harbour through a cap on dissolved nitrogen outputs in place of standing biomass caps. A nitrogen cap provides better control over feed

OOS

[redacted]

Commented [MB11R9]: Also worth noting here (it is stated below in the fishing section) that commercial fishing has occurred in the Harbour. This was known for a sheltered shark fishing area in the past when ocean conditions were not suitable.

Climate change and the occurrence of extreme weather events	Climate change and the occurrence of extreme weather events directly influence water quality in Macquarie Harbour, including through higher water temperatures causing reduced DO levels, changes to freshwater flows into the harbour, and extreme weather events leading to inversion of the harbour water column and changes to DO levels at the skate's preferred depth (Moreno *et al.* 2020) of between 5 and 15 metres.	The mean temperature of Macquarie Harbour's bottom waters has increased by approximately 1.5 – 2 °C from 1993 to 2020 (Ross *et al.* 2021). Another significant heatwave event is predicted for the 23/24 summer (CSIRO 2023). Climate change predictions for the west coast of Tasmania suggest that there will be greater and more intense rainfall in the winter and lower rainfall in summer after 2050 (Grose *et al.* 2010).	Higher water temperatures reduce oxygen solubility, and climate change is likely to contribute to other changes to water quality in Macquarie Harbour given the influence climate and weather events have on environmental conditions in the harbour (e.g. through influence on river in-flows). Increased temperatures may also impact skate directly through behavioural changes, physiological stress or reproductive impacts.
Incidental bycatch from fishing activities in Macquarie Harbour	Both recreational and commercial gillnetting occur in Macquarie Harbour. Maugean skate ecology and feeding behaviour may exacerbate the risk of incidental capture by gillnets in some circumstances, because Maugean skate are more likely to utilise shallow areas where gillnetting occurs in response to physiological stress, and also appear to be more active at night when many gillnets are set (Moreno *et al.* 2020). Recreational line-fishing also occurs in Macquarie Harbour and presents a potential threat to Maugean skate due to the potential for post-release mortality. However, this fishing method is considered to present a lower relative risk to the species, because it is a less effective method of capture than gillnets, and considered less likely to expose skate to depredation.	The Maugean skate is particularly susceptible to capture in gillnets, with mortality associated with long soak times and related depredation by whitespotted dog-fish, crabs and sea lice (Lyle *et al.* 2014; see 'predation and depredation' below).	Known. While mortality of Maugean skate caught in gillnets has been observed (Lyle *et al.* 2014), current catch rates and post-release survival rates for Maugean skate in Macquarie Harbour are not known. Gillnetting measures (see 'Fishing' section) are expected to reduce the likelihood of skate mortality from fisher interactions. However, the potential for gillnetting activities to impact the skate population remains.

OOS

Commented [MB17]: Is there evidence that Dog fish predate on skate in gill nets? I have not heard this before.

OOS

[redacted]

From: Crisp, Jo
Sent: Tuesday, 12 December 2023 9:54 AM
To: 'Matt Barrenger'
Subject: RE: FOR FEEDBACK Conservation Action Plan for the Maugean Skate

Thanks Matt. Appreciate your feedback.

Cheers

Jo

Tasmanian Government

Jo Crisp | General Manager Environment
Environment
Department of Natural Resources and Environment Tasmania
GPO Box 44, Hobart 7001
Lands Building, Level 5, 134 Macquarie Street, Hobart 7000
M: +61 (0) [redacted]
E: Jo.Crisp@nre.tas.gov.au
W: www.nre.tas.gov.au

Delivering a **sustainable Tasmania**

In recognition of the deep history and culture of this island, I acknowledge and pay my respects to all Tasmanian Aboriginal people; the past and present custodians of the land.

From: Matt Barrenger [redacted]
Sent: Tuesday, December 12, 2023 9:25 AM
To: Crisp, Jo <Jo.Crisp@nre.tas.gov.au>
Subject: RE: FOR FEEDBACK Conservation Action Plan for the Maugean Skate

HI Jo,

I meant to mention that my version was to follow on from the one that Toby sent through.
I think one or two may have come in between these but that was the one I worked off.

Also, I did mean to include these broader comments in the body of my email but understand I may have missed the cut off time:

1. Pg.7. Objective 1 is to provide a 'healthy' habitat. That is very hard to define. Suggest changing to 'viable' habitat which is used in the description below.

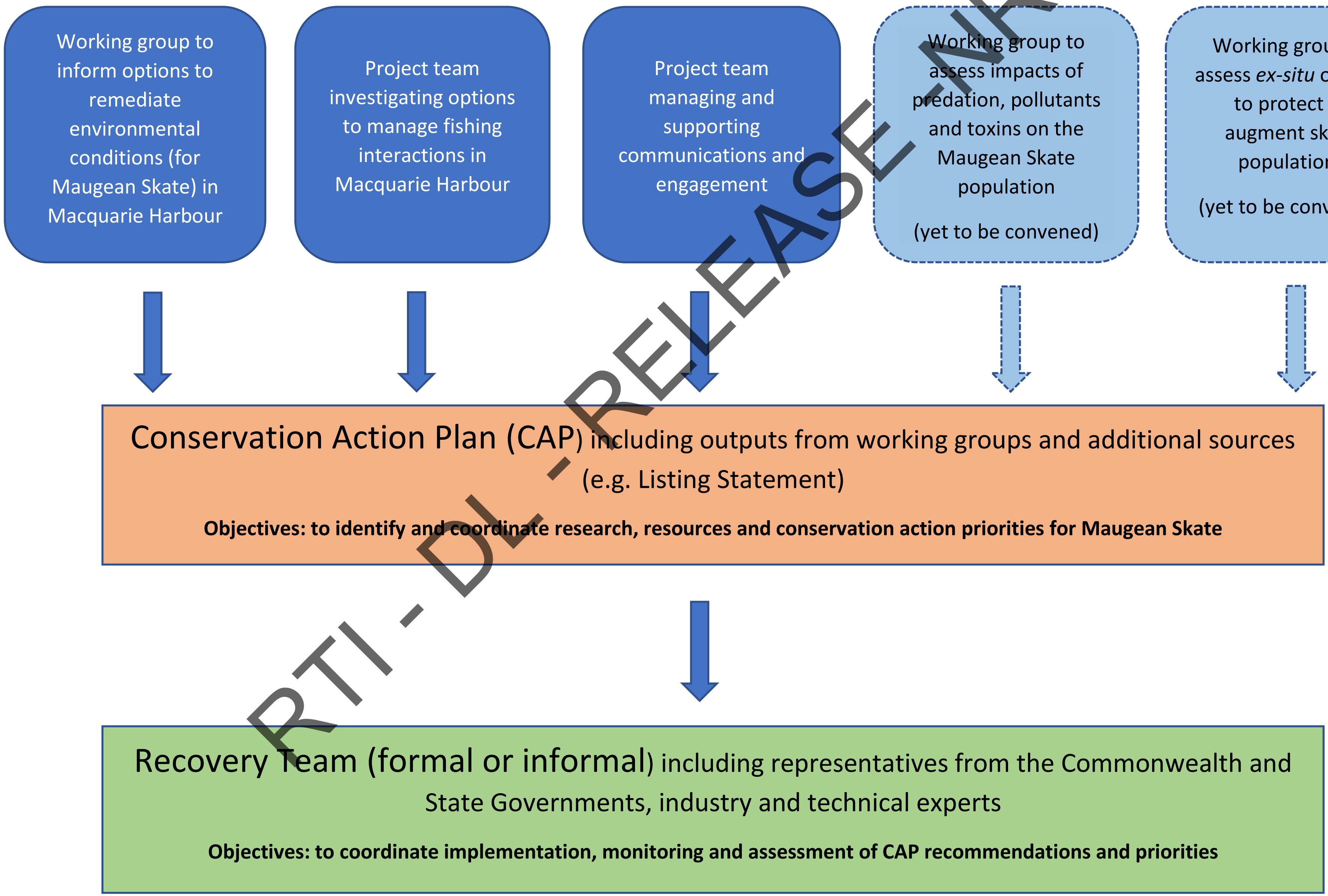
2. Pg. 8 "The Maugean skate population is being adequately monitored using standardised methods, and the population has not decreased from baseline data as a result of recovery actions." What is the baseline data? Is that at time of implementation of the CAP?
3. Pg. 13 "From 2005, the industry expanded, reaching a standing biomass peak of over 20,000 tonnes in 2014-15". The industry never got close to this peak. This was the limit. But if the production graph is inserted that should clarify that, but still suggest this is reworded.
4. Pg. 14 – Impacts, the sections on Mining and Hydro is very light on and the level of detail is not really proportionate with their potential impacts on the harbour.

Regards,
Matt

OOS

[redacted]

Appendix 2: Maugean Skate conservation planning: Contributors, processes, and outputs



Key activities: Maugean Skate Conservation Planning

7/12/2023

Completed activity	
Incomplete activity	

August – December 2023		
Activity	**Completion/activity date**	**Assumption/comment**
Draft template	25th August	Template to serve as initial discussion document between Davina and Tom
Draft text	4th - 27th September	
Steering Committee feedback and update draft	27th September	Feedback on initial draft received at Steering Committee meeting
Send updated draft to Steering Committee for internal review	28th September	Updated draft sent to Steering Committee. Subsequent consultation with additional business units (EPA, Marine Resources)
Feedback from NRE Tas and EPA incorporated	30th November	
Send draft to Recovery Team for comment	30th November	
Submit Draft CAP to Cabinet	7th December	
Send finalised timeline text to Design team	11th December	
Deadline for feedback from Recovery Team	11th December	

Consider feedback from Recovery Team and add remaining sections	13th December	Two days to consider comments, but can begin considering comments before 11th December deadline if received before then. Some considerations likely to require input from Davina Gregory-Dunsmuir and Jo Crisp. Items to be added to CAP: • Add additional graph showing aquaculture production and value over time • Add natural, cultural and TWWHA values text • Add socio-economic significance text • Edit timeline and request graphic design **Risks**: • Capacity to consider feedback in this time frame will depend on volume and complexity of feedback and date received by project team. • Remaining sections dependent on capacity of responsible people to complete work
Workflow CAP for approvals	14th December	**Assumption**: Approvers able to review within short timeframe. Proposed approval chain: Jo Crisp, Louise Wilson, Diedre Wilson, Jason Jacobi
Complete approvals	18th December	
Publication on NRE Tas Maugean Skate webpage	21st December	

Appendix 1: Timeline for development of Conservation Action Plan

Task	Week commencing																		
	14 Aug	21 Aug	28 Aug	4 Sep	11 Sep	18 Sep	25 Sep	2 Oct	9 Oct	16 Oct	23 Oct	30 Oct	6 Nov	13 Nov	20 Nov	27 Nov	4 Dec	11 Dec	18 Dec
Draft template																			
Draft text																			
Send draft to SC																			
Internal review government																			
Seek feedback from Recovery Team																			
Consider feedback from Recovery Team																			
Deadline for submission to Cabinet																			
Cabinet meeting																			
Final formatting and publication																			