



FUNDING AOTEAROA NEW ZEALAND'S COMMITMENT TO THE ROSS SEA REGION MARINE PROTECTED AREA

BIBLIOGRAPHIC REFERENCE

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**Antarctic
Science Platform**

Executive Summary

The Ross Sea Region Marine Protected Area (RSRMPA) is the world's largest high-seas marine protected area. It was established in 2017 by the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR) - the body established by international convention in 1982 with the objective of conserving Antarctic marine life. The RSRMPA was jointly proposed and designed by Aotearoa New Zealand and the United States of America and is set to run to 2052, at which time it can be continued by consensus with the CCAMLR.

A Research and Monitoring Plan (RMP) was developed to evaluate the RSRMPA, elements of which are being addressed by several nations. At present, Aotearoa New Zealand contributes substantially to MPA research and monitoring but, like other Antarctic nations, has not committed to long term investment. Aotearoa New Zealand has an opportunity to provide international leadership in this politically important area by committing to long term research and monitoring of the RSRMPA.

Action is urgent. Establishing the RSRMPA in a consensus-driven environment was difficult, taking four years of deliberations, and the RSRMPA will cease to exist if, at the end of its current life, consensus within the CCAMLR has not been reached that it is meeting its objectives and should continue. If the RSRMPA were to fail, establishment of other Antarctic protected areas (a key focus of Aotearoa New Zealand's commitment to Antarctica and mandated by CCAMLR) will become increasingly difficult.

This document aims to explore how Aotearoa New Zealand can best support our commitment to the RSRMPA. Here, we describe and summarise:

- the international context in which the MPA sits, its vulnerability to future challenges, and the importance of robust research and long-term monitoring that meets the specific needs of CCAMLR to pre-empt those challenges;
- existing research and monitoring of the RSRMPA by Aotearoa New Zealand, how this is achieved and funded, and the strengths and weakness of those existing pathways; and
- difficulties imposed by existing research funding mechanisms, including the short, and out-of-phase, funding cycles of different agencies and the different constraints imposed on research
- how Aotearoa New Zealand could respond to this opportunity by coordinating national research and monitoring, and enhancing international co-operation.

Our vision is for a long-term Ross Sea region MPA-mandated research investment to facilitate cost-effective research and monitoring. Such a programme will build capacity, attract international collaboration, and facilitate impactful science. We outline how such an investment might work, including logistical support, with an emphasis on remote sensing and autonomous data acquisition to advance research in the uniquely challenging environment of the RSRMPA. This will secure Aotearoa New Zealand's position as leader in Antarctic environmental management, and stimulate involvement in developing the next generation of researchers, research and environmental monitoring tools.

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This document has been developed by members of the Antarctic Science Platform and has canvassed input from organisations across Aotearoa New Zealand with an interest in the future of the Ross Sea region Marine Protected Area. The authors would like to thank all who were consulted in the formation of this report, and who contributed their time and expertise in providing input and feedback.

1. Scope

Through this document we aim to promote discussion across policy, research and funding organisations on how Aotearoa New Zealand can best support our commitment to the Ross Sea region Marine Protected Area (RSRMPA). We seek to raise issues that relate to science funding and logistics support, and to emphasise that many components of monitoring and research need to have a thirty-year perspective to match the MPA time span.

Aotearoa New Zealand, as a founding proponent of the RSRMPA and supporter of other Antarctic MPA proposals, has an internationally recognised obligation to ensure that MPA proposals are underpinned and validated with quality science. At present, no Antarctic nation has committed to long term research and monitoring programmes in the RSRMPA, and no single nation is likely to have the resources to do this alone. By taking a long-term approach, Aotearoa New Zealand has an opportunity to provide international leadership in this collaborative and politically-important area.

Chapters 2 and 3 introduce and explain the Ross Sea region MPA, and the RSRMPA Research and Monitoring Plan, respectively. Chapter 4 outlines how Aotearoa New Zealand has prioritised RSRMPA research into five themes, and shows how this research is being undertaken across four funded programmes. Chapter 5 explores the research and funding gaps and challenges, with Chapter 6 offering practical next steps to assure New Zealand's long-term commitment to RSRMPA research.

2. The Ross Sea Region Marine Protected Area

The RSRMPA is the world's largest high-seas marine protected area, with a total area of 2.09 million km², of which 80% is fully protected¹. Jointly proposed and designed by Aotearoa New Zealand and the United States, it was agreed by the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) in October 2016 and came into effect on 1 December 2017¹. Other than the smaller South Orkney Islands Southern Shelf Marine Protected Area (94,000 km²), which came into force in 2010, the RSRMPA is the only Antarctic MPA established to date.

The RSRMPA was designed around a suite of specific objectives: conservation of biodiversity, ecological structure, and ecosystem dynamics and function throughout the Ross Sea region; protection of ecosystem processes, core distributions of species, vulnerable habitats, and areas of importance to the life cycles of toothfish, seals and penguins. It had an initial 35 year duration, after which it could be renewed by consensus of members.

The establishment of CCAMLR MPAs is also intended to provide opportunities for research (including monitoring), to provide reference areas for studying and separating the impacts of environmental change and fishing¹, and opportunities to understand ecosystem impacts of climate change, separate from those of fishing. The establishment of zones within the MPA (Figure 1) provides a mechanism for establishing spatially explicit management regimes to achieve protection and scientific objectives, while still allowing some fishing to occur in specific areas within MPAs.

To these ends, the RSRMPA is comprised of three zones (Figure 1) with differing management rules. The General Protection Zone (GPZ) occupies the majority of the area, where all commercial fishing is prohibited. It is designed to provide representative protection of different habitats and bioregions, to mitigate or eliminate a number of specifically identified potential ecosystem threats from fishing, and to support existing and future scientific research and monitoring. The Special Research Zone (SRZ) and the Krill Research Zone (KRZ) allow limited fisheries, Krill (KRZ and SRZ) and toothfish (SRZ), designated as one third of the fishing allowed outside of the MPA. The Research Zones are designed to serve as a scientific reference area to increase scientific understanding about the ecosystem effects of external

¹ [Conservation Measure 91-05 \(2016\)](#)

forces like fishing and climate change, and continue to inform the science-based management of the Ross Sea toothfish fishery.

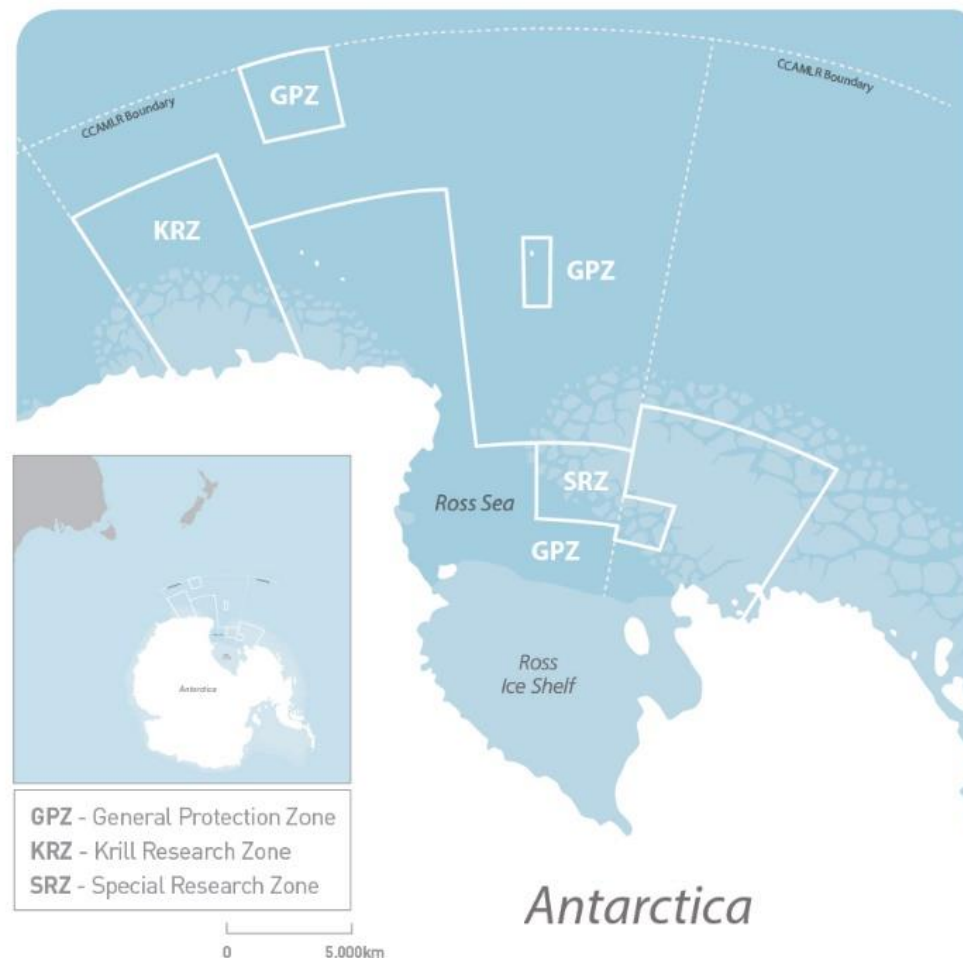


Figure 1. The Ross Sea Region Marine Protected Area is comprised of three zones with differing management rules.

3. The RSRMPA Research and Monitoring Plan

In designating the RSRMPA, and to inform critical review points, CCAMLR required further scientific study to:

1. ensure the objectives of the MPA are being achieved,
2. ensure the objectives remain relevant across different areas of the Ross Sea region, and
3. to determine if design changes are required to achieve any of the objectives.

Progress in achieving objectives of the MPA are to be reported to CCAMLR every five years (completed in 2022) and reviewed for effectiveness every ten years, with the first such review due in 2027.

Required research is guided by a Research and Monitoring Plan² (RMP), first presented to the CCAMLR Scientific Committee in October 2017. The RMP provides a framework for the research needed to

² A. Dunn, M. Vacchi and G. Watters. [The Ross Sea region Marine Protected Area Research and Monitoring Plan](#). SC-CAMLR-XXXVI/20.

measure the effectiveness of the MPA in protecting the ecosystem. It identifies research topics, and describes the process for CCAMLR members to collaborate and report on research.

The RMP requires that research undertaken is open and transparent, with underlying research data available to all members. CCAMLR hosts a repository for MPA-related research activities³. Baseline data are publicly available on the site. More detailed access to the research held by the CCAMLR Secretariat are available through discussion with the Scientific Committee Representative for the member hosting the work. In recent years, the primary contributing nations to MPA-related research database have been Aotearoa New Zealand, Italy, Korea and the United States of America.

Aotearoa New Zealand, as a proponent of the RSRMPA has a responsibility to support the RMP. This responsibility was recently reinforced by the Aotearoa New Zealand Government's Antarctic and Southern Ocean Research Directions and Priorities 2021-2030⁴. Aotearoa New Zealand's priorities that guide engagement with CCAMLR are well articulated in this document and include the paramountcy of science and the need for support of MPAs.

Research priorities within the Research and Monitoring Plan

CCAMLR's highest priority for information about performance of the RSRMPA is information that will assist in making decisions about how and where to manage fishing. Eleven objectives are described in the RMP, grouped in three key topics: threat mitigation, conservation of representative ecosystems and deconvolution of the impacts of changing climate and fishing.

Threat Mitigation

These objectives aim to prevent negative impacts on ecosystems as a result of fishing, in accordance with the requirements of the CAMLR convention (Article II⁵). To do this, CCAMLR needs to understand key ecological relationships and distinguish between the effects of fishing and environmental factors, particularly those related to climate change over decadal timeframes.

The RMP has particular focal interests in the top predators potentially interacting with toothfish; ecological roles of silverfish; Antarctic toothfish life cycle and movement; impacts on associated fish species (by-catch, predation relief, food availability) and the ecological role of krill.

Representativeness

These objectives aim to ensure the MPA protects an adequate and representative proportion of the marine habitats, species and ecosystems in the region. The RMP indicates that the focus of work to meet these objectives should be in areas where baseline information is lacking, in particular the regions where habitats are poorly described (e.g., the northern seamounts, noting that much of this area is outside the RSRMPA).

Scientific Reference Areas

The goal of these objectives is, through the SRZ and the KRZ, to establish areas to compare marine ecosystems with difference levels of fishing pressure to compare the effects of different levels of fishing in different habitats and to promote investigation of krill and toothfish life cycles, both inside and outside the MPA.

There is also potential to define other regions of interest for experimental comparison. For example, smaller areas within the GPZ could be established for directed comparison with areas outside the MPA, or within the SRZ or KRZ to compare ecosystem effects of fishing or climate change.

³ www.cmir.ccamlr.org

⁴ MFAT. 2021. [Aotearoa New Zealand Antarctic and Southern Ocean Research Directions and Priorities 2021–2030](#).

⁵ www.ccamlr.org/en/organisation/camlr-convention-text

Indicators for Assessment of the RSRMPA

Two categories of indicators will be used to assess the RSRMPA: indicators of scientific effort and progress, and indicators that describe ecosystem outcomes and services. Some indicators have already been identified and others will be relevant to projects that have yet to be undertaken.

Indicators of effort relate to the numbers of research and monitoring topics that have been addressed, grouped by location and specific objectives, the number of datasets shared with CCAMLR membership and the impact of research.

Indicators of ecosystem outcomes and services specifically mentioned within the RMP are:

- Numbers of nesting pairs of Adélie and emperor penguins
- Numbers of Weddell seals and Type C killer whales
- Biomasses of Antarctic and crystal krill, Antarctic silverfish and Antarctic toothfish
- Densities of benthic communities containing taxa that comprise vulnerable marine ecosystems
- Total catches by zone within the RSRMPA of Antarctic krill and toothfish.

Each of these requires long term data collection to facilitate robust indicators and, while Aotearoa New Zealand currently collect data on some of these, each dataset is subject to uncertain future funding.

4. Aotearoa New Zealand's RSRMPA-relevant research

RSRMPA-relevant research priorities

Aotearoa New Zealand collates RSRMPA research into five themes:

1. targets of fisheries,
2. top predators,
3. fisheries-dependent species and food webs,
4. benthic habitats,
5. the physical environment and how this may change.

These priorities have been selected based on CCAMLR's RSRMPA Research and Monitoring Plan, and Aotearoa New Zealand's strategic interests in the Ross Sea region, and current areas of expertise and infrastructure in marine research.

Together these priorities are directed to understand the impacts of fisheries, how to measure them, and, in particular, how to separate fishing effects from the impacts of other processes, particularly climate change. This is important as the draw-down of the total stock of Antarctic toothfish is expected to have been fished down towards 50% remaining in the near future (currently 70-80%) and ecosystem impacts of fish removal are more likely to become evident, even if the effects of fishing activities do not.

1. Targets of fisheries

Research into the biology of harvested species and the impacts of fishing within and outside the MPA boundaries, to include:

- a. Improved understanding of toothfish biology, stock structure, growth rates population dynamics, and trophic relationships.
- b. The importance of particular areas as nurseries for toothfish, or other key dependent or related species, such as silverfish and macrourids.
- c. Trends in abundance, distribution and ecology of krill.

2. Top predators

Research on top predators to develop indicators of ecosystem change, ideally with the ability to separate climate change and fishery effects, including:

- a. Abundance, distribution, diet, and reproductive performance of marine mammals, toothfish, seabirds and their prey.
- b. Identifying what to monitor, how, and for how long (methods development).
- c. Development of spatially and temporally resolved ecosystem models to synthesise monitoring programme data, biological data, and create testable hypotheses of future dynamics.

3. Fishery-dependent species and food webs

To better understand the fish communities and food webs associated with toothfish and krill, specifically:

- a. Historic, current, and future drivers and changes to productivity in the region.
- b. Direct ecosystem effects of fishing on toothfish prey (e.g. bottom fish communities), toothfish competitors (e.g. Adélie penguins) and the potential indirect effects that fishing may have on taxa such as silverfish that compete with toothfish prey species.
- c. Changes to the distributions, population dynamics, or ecology of species as a result of climate change.

4. Benthic habitats

Improved understanding of the ecological roles of benthic species, particularly habitat-forming benthic invertebrates (vulnerable marine ecosystems), and the effects of fishing on those ecosystems, focussing on:

- a. Distribution and biodiversity of habitat-forming benthic invertebrates.
- b. Methods to monitor and evaluate the effects of fishing on benthic habitats.
- c. Changes or potential changes to benthic productivity, for example through acidification or changing climate-dependent variables.

5. The physical environment and how this may change

Understanding how drivers of ecosystem productivity varies spatially, and particularly how this might change with climate change:

- a. Monitoring, modelling, and predicting changes in ocean productivity throughout the Ross Sea region.
- b. Modelling and predicting changes in sea ice dynamics and ice sheet dynamics and consequent impacts on productivity and any associated species, including the benthos.
- c. Development of coupled ocean-atmosphere models to describe the oceanographic setting, ocean biochemistry, bottom water formation, and transport of nutrients at relevant spatial scales.

RSRMPA-relevant NZ research programmes

At the date of writing, there are four main programmes of research relevant to the Ross Sea region MPA Research Management Plan, through a range of funding mechanisms (Figures 2 and 3). The scope and focus of each programme is summarised below. Table 1 maps the contributions of the various research efforts to Aotearoa New Zealand's priority goals for research and monitoring in the Ross Sea region MPA.

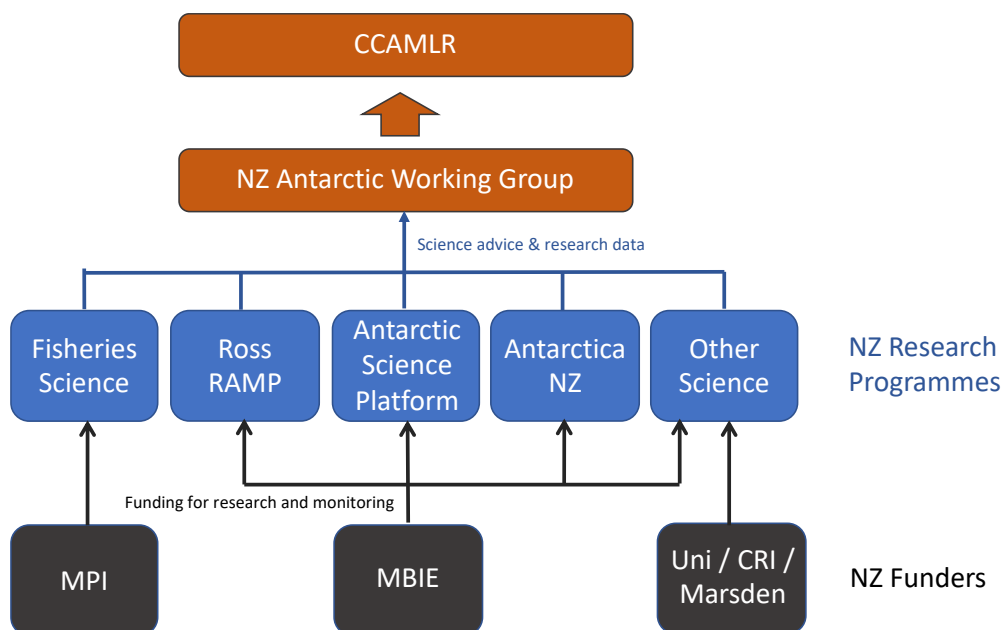


Figure 2. Basic structure underlying Aotearoa New Zealand research relevant to the Ross Sea region MPA, and how it is delivered to the CCAMLR scientific committee.

	2018	2020	2022	2024	2026	2028	2030	2032	→	2052
RSRMPA			▲		▲			▲	▲	▲
Fisheries Science	... ongoing		4 years		renewable		???		???	
RossRAMP		5 years	+1				???			
Antarctic Science Platform			7 years			renewable			???	
Antarctica NZ	... since 1983					renewable			???	
Other Science	variable		1-3 years				???			

Figure 3: Differing timeframes and certainty for currently funded research programmes supporting RSRMPA-relevant research and monitoring. There is an expectation of renewed and ongoing funding for the fisheries science, Antarctic Science Platform and Antarctica NZ's Adelie penguin data, but no certainty for Ross Ramp nor 'other' science. RSRMPA review points (orange triangles) are also noted.

Fisheries Science

Funder: Ministry for Primary Industries (MPI)

Fund: Fisheries Research

Funding duration: four-year contract.

Catch and effort fishery data are collected and monitored by vessels reporting directly to CCAMLR, and through logbook data submitted by vessels through flag states to CCAMLR. Aotearoa New Zealand then requests data from all flag states in the Ross Sea from CCAMLR to conduct analyses, such as stock assessments.

Contracting for Aotearoa New Zealand's work in this programme currently is through MPI to NIWA through 4-year contracts (with annual work planning) to provide analytical support on CPUE (catch per unit effort) and a raft of other topics (Table 1). MPI contracts a fishing vessel to undertake research fishing targeting pre-recruit populations within the MPA, as they traverse the shelf zone on route to spawning areas in the north, designed to provide early-warning monitoring of the future of the fishery.

It is expected that MPI will continue to provide this scientific support to protect their leadership role and strategic interests in the Ross Sea, and to this end considerable effort went in to continue the dataset through the COVID disruptions. There is, however, no statutory amount that MPI must contract out for this work and the amount varies through time. There is also a tension in this funding insofar that science to support fishery management is normally supported by industry. The high cost of research in Antarctica, and the small size of the fishery, mean that the normal funding model cannot be used and a disproportional amount of MPI research funds need to be directed towards the toothfish fishery.

Ross RAMP

Funder: Ministry for Business, Innovation & Employment (MBIE)

Fund: Endeavour Fund

Funding duration: five-year contract; current contract 2017-2022 (+ 1-year extension to 2023).

Ross RAMP is a \$11.4M, five-year multidisciplinary programme (recently extended by one year), and is led by NIWA. This research is specifically targeted at understanding the effectiveness of the RSRMPA. It addresses most of the major research priorities (Table 1), and a number of other topics discussed in the Research and Monitoring Plan.

Principle research components of Ross RAMP are:

- physical and chemical environment and oceanography
- establishing "bio-regions" (representative areas)
- phytoplankton, oceanic primary production, and energy flow through the microbial system
- keystone species (including krill, silverfish, lanternfish and zooplankton)
- krill predators (Adélie and emperor penguins)
- Antarctic toothfish predators (Weddell seals and sperm whales)
- Antarctic toothfish biology (the target of the Ross Sea long line fishery)
- deep-sea fish species that are the prey of Antarctic toothfish (rattails and icefish especially)
- bycatch species (skates)
- vulnerable benthic ecosystems (habitat-forming benthic invertebrates)

Ross RAMP is funded through the contestable Endeavour Fund process, run by MBIE. Long term data acquisition is not an expectation within this funding mechanism. For this reason, Ross RAMP focusses on establishing ecosystem baselines, developing methodologies to measure long term change, and development of model approaches to evaluate the effects of the MPA.

Endeavour research programmes are not designed for renewal at the end of their five-year lifespan, and are currently positioned in the "competitive, investigator/mission-led" quadrant of the MBIE funding matrix⁶. This means future funding through this funding mechanism is highly uncertain.

⁶ MBIE. [Endeavor Fund Investment Plan 2022-2024](#)

Antarctic Science Platform

Funder: Ministry for Business, Innovation & Employment (MBIE)

Fund: Strategic Science Investment Fund

Funding duration: seven-year contract; current contract 2018-2025

The Antarctic Science Platform (ASP) is a seven-year, \$49 million programme that largely supports research to understand how the Ross Sea region will respond to anticipated climate warming, and the impacts that this may have on Antarctic and global systems. Marine ecosystem research within the ASP, by focusing on climate change impacts, provides baseline information essential to the separation of responses to changing environment and fisheries. The ASP came into being after Ross RAMP, and was specifically developed to allow the two programmes to be complementary, with strong connections, including shared researchers.

The ASP is funded by MBIE through the Strategic Science Investment Fund⁷, nominally in seven-year blocks, with an expectation of renewal. SSIF sit in the “negotiated” part of the MBIE funding matrix⁶. This funding model allows the ASP to take a medium-term-perspective, and includes the establishment of medium-term monitoring sites and data collection, but still lacks any mandate for long term surveillance-based research specifically focused on the RSRMPA.

Antarctica New Zealand

Funder: Ministry for Business, Innovation & Employment (MBIE)

Fund: Nationally Significant Databases

Funding duration: five-year contract; current contract 2022-2027

Antarctica New Zealand is contracted by MBIE, through the Nationally Significant Database programme⁸, to undertake annual censuses of Adélie penguins on Ross Island, and five-yearly census on other parts of the Victoria Land coast. This dataset dates back to 1983 and represents one of the longest ecological records from Antarctica. Funding is normally renewed on ten year cycles, though the current contract is for five years with renewal anticipated. While excellent, this dataset small, and its long term aspirations relates only census data, with no other demographic data collected that could enable attribution of change.

Other Science

Smaller programmes (1-3 year duration) relevant to, or aligned with, achieving Aotearoa New Zealand’s priority goals for research and monitoring in the Ross Sea region MPA are or potentially could be undertaken within universities and Crown Research Institutes (CRI). These currently range in scale from student research projects to collaborative \$1M projects. This other funded science, though often high quality and relevant, is not well suited to long term monitoring goals and may not always be directly focused on the previously mentioned objectives.

⁷ MBIE. [Strategic Science Investment Fund](#)

⁸ MBIE. [Nationally Significant Databases and Collections](#)

Table 1. Contributions of four major research efforts to achieving Aotearoa New Zealand's priority goals for research and monitoring in the Ross Sea region MPA.

Priority Research Theme			Ross RAMP	Antarctic Science Platform	Fisheries Science	Antarctica NZ
Targets of fisheries	Toothfish Biology	Stocks				
		Growth				
		Trophic relationships				
	Nursery areas	Toothfish				
		Macrourids				
		Silverfish				
	Krill Abundance and distribution					
Top predators	Abundance and distribution					
	Diet					
	Reproduction					
	Ecosystem models					
Fishery-dependent species and food webs	Historic, current and future drivers of productivity					
	Ecosystem effects of fishing on toothfish prey					
	Indirect effects on toothfish prey or competitors					
	Effects of climate change					
Benthos	Distribution and biodiversity of benthic habitat-forming invertebrates					
	Methods to monitor effects of fishing on benthic habitats					
	Effects of climate change					
Physical Environment	Monitoring, modelling and predicting changes in ocean productivity					
	Monitoring, modelling and predicting changes in sea ice dynamics					
	Monitoring, modelling and predicting changes in ocean dynamics					

5. Gaps & Challenges

What emerges from this summary is a picture of a substantial volume of existing national research relevant to the RSRMPA, accomplished by several programmes, each supported over different funding cycles, by different funding agencies, with different mandates and philosophies around renewal and required outcomes. This does not facilitate a coordinated strategy to addresses the key, high priority issues surrounding the MPA. Furthermore, the absence of continuing support for most of these programmes shows no commitment to research and monitoring across the life of the RSRMPA, nor direct targeting of the RMP objectives.

Despite this lack of high-level strategic planning, coordination at the research provider level ensures that overlap of research within Aotearoa New Zealand is largely prevented. While Table 1 might

suggest some duplication of effort, this would be an error. Firstly, care has been taken to ensure that work in, for example ASP and Ross RAMP are complementary and address issues from different angles. Secondly, many of the research tasks are so enormous and expensive that only by coordinating activities can they begin to be addressed.

What is missing from the above analysis of research providers are Aotearoa New Zealand's existing and potential international colleagues. For example, the Korean Oceanographic and Polar Research Institute (KOPRI), a Korean government-funded logistics and science organisation, boasts ongoing research and monitoring into physical oceanography, krill biomass and distribution, silverfish ecology and penguin population dynamics in Northern Victoria Land as part of its contribution towards the RSRMPA. The Italian National Programme for Antarctic Research (PNRA) also has a commitment to be at the forefront of protecting, monitoring and studying the Ross Sea MPA and have a network of oceanographic moorings and ARGO float programmes across the Ross Sea, lead the world in silverfish research and undertake a wide range of ecosystem analyses that are relevant to the RSRMPA. Consultation with relevant international colleagues confirms that in neither international case are these research initiatives long-term funded, instead they are researcher-led and supported through competitive, fixed-term grants. The last is particularly true of US NSF-funded research, that adheres strongly to a philosophy of bottom-up research funding.

The potential value of a coordinated, collaborative international research is difficult to realise when no nation's RSRMPA research has long-term funding security. Variability and uncertainty in contract renewability, start time and duration makes it particularly onerous when attempting to engage with international partners to facilitate a collaborative, coherent approach to the RSRMPA.

Coordinating and resourcing science in support of the RSRMPA

We highlight the following issues with the existing arrangements in coordination and resourcing of science in support of the RSRMPA:

1. *Aotearoa New Zealand cannot currently target long term research to support its aspirations in the RSRMPA*

Long term observations require long term funding. CCAMLR metrics for evaluation of the RSRMPA require that monitoring that provides long term, consistent data, across a range of variables at relevant time and spatial scales to allow evaluation of effectiveness. This requires a core set of observations to be supported through long-term, renewable funding mechanisms, which Aotearoa New Zealand, and indeed the international Antarctic community, is currently lacking. We note potential overlap with discussions currently underway around a coordinated environmental assessment for the Ross Sea region, led by Antarctica New Zealand.

Attracting international cooperation requires commitment. The scale of the challenge in the Ross Sea region is so enormous that only through research collaboration can ambitious goals be achieved. A core research program that has long term horizons, is linked to MFAT and MPI, and specifically addresses targets of highest priority to CCAMLR, has the greatest chance of succeeding in attracting international cooperation.

Addressing big questions requires scaling observations across hundreds of kilometres and annual cycles. One of the key challenges being taken up by environmental science is that of scaling. We have become adept at collecting high quality point-in-space, moment-in-time data, but to address big questions, mechanisms are needed to scale observations across hundreds of kilometres and annual cycles. In few places is this more important, and more difficult, than in the Ross Sea. Effective monitoring will require development of new autonomous technologies as well as scalable modelling frameworks that incorporate the complexity of the extant system as well as future projections. Already this is beginning to happen within the ASP and Ross RAMP, and with our international collaborators, and will inevitably form part of new research proposals designed to support RSRMPA.

Early adoption and assimilation of such tools into research programmes is essential, but requires immediate and consistent funding to upkeep.

2. Aotearoa New Zealand lacks sufficient logistics infrastructure to support many requirements of MPA-related research

Access to ice-capable marine vessels. In addition to secure science funding, access to the RSRMPA is logistically challenging. At present, the ability of Antarctica New Zealand to support marine research is limited. Most marine research is currently either undertaken using commercial fishing vessels (mostly MPI-funded) or with the NIWA vessel R.V. *Tangaroa*. Biannual access to Antarctic waters in this vessel is directly supported by MBIE, but is highly competitive, and her age is such that a replacement will be required within 10 years. Without a suitable ice-strengthened vessel, Aotearoa New Zealand RSRMPA research will be severely constrained. Enhanced collaboration with the fishing fleet, and with other national programmes, particularly the Italian program whose vessel often operates out of Lyttelton, would enhance this capability, and the newly commissioned and ice-strengthened HMNZS *Aotearoa* may offer another option for some types of research.

Recommendations

From the above analysis we suggest that barriers to effective research and monitoring of the RSRMPA by Aotearoa New Zealand stem from a lack of an entity that has a mandate to address long term issues around the core research components for the MPA. While the ASP has some ability to plan long term, its mandate is for climate-related research, and it does not have the capacity to broaden this to more specifically fishery related work or any other challenges highlighted by CCAMLR in the future.

We make the following recommendations:

(i) Invest in a long-term, large-scale research programme targeting RSRMPA research priorities. The existence of a programme mandated to undertake core research towards the high priority targets of the RMP offers potential for leveraging benefits to short term, task-specific research. In the same way that the Antarctic Science Platform has core projects and spin-out projects, a core RSRMPA programme would act as a catalyst for higher-risk, higher-impact research. Our vision is that a long-term Ross Sea region MPA-mandated research programme will act as a crucible for Aotearoa New Zealand's visionary technology sector, supported by universities, to become world leaders in remote, unattended data acquisition. The potential market for such equipment, developed and proven in the most challenging of environments, is enormous.

(ii) Establish an entity with a clear mandate to target collaborative data acquisition, storage and management, and that can come to international negotiations with the ability to offer long term stability. Experience shows that such an entity would best not be linked to a single research provider, but should be negotiated and provider-neutral. This model is much more attractive in such a context than one with a strictly limited time frame. Longer term security would allow Aotearoa New Zealand to offer leadership to potential partners within the Ross Sea, particularly with collaborators in the US, Korea, Italy and China.

(iii) Strategically invest in access to ice capable vessels and/or next autonomous data collection. Entities are needed to lead and coordinate a national approach to support for national research assets and to facilitate evolution and deployment of new technologies. The ongoing review of strategic science funding in Aotearoa New Zealand will include the future strategy for management of research assets, but to support the RSRMPA consideration of the needs for certain access to an ice-strengthened research vessel is essential. A "Technology Hub" to target the development of emerging autonomous approaches to data and sample collection year round, across broad spatial scales would be relevant not only to RSRMPA research but across the entire Aotearoa New Zealand marine research landscape.

Fit-for-purpose research funding mechanisms

Now is the time to establish a more fit-for-purpose research funding mechanism for the Ross Sea region Marine Protected Area. Currently, interest across the international community in RSRMPA issues is acute, and there are numerous pressing national reasons for consideration of how best to pursue the benefits of establishing the world's best Antarctic MPA assessment program. We summarise these below.

1. *In 2022, the first five yearly review of the RSRMPA was delivered.* Aotearoa New Zealand was able to point to a body of research that addresses many of the wide range of issues raised in the Research and Monitoring Plan. A demonstrable plan for Aotearoa New Zealand to continue this research is necessary, and currently does not exist.
2. *Aotearoa New Zealand's flagship RSRMPA programme, the MBIE-funded Ross RAMP, will end in June 2023.* This is an Endeavour Fund programme, which is by definition time-limited and focused on delivering outcomes at its termination. A new proposal will likely be submitted, but if this is another Endeavour Research Programme it will have the same structural constraints and will be in the openly contestable, and uncertain, funding arena.
3. *MPI funding is allocated on an annual basis, and analysis of data and samples is currently unable to keep pace with collection.* MPI contracts NIWA to undertake research to monitor fished stocks and bycatch species within key parts of the Ross Sea. This provides critical information on juvenile toothfish recruitment via the MPA and a range of other metrics. At present, funding to support this research is marginal and a substantial backlog of samples exists. Investment in developing an analytical pipeline is already overdue and the challenge increases by the year.
4. *ASP is beginning to set goals for the next seven year contract.* The ASP's mid-term review, undertaken in July-August-2022, examined the successes and challenges of the first tranche of SSIF funding. This Platform is starting to indicate how the programme may move into its next 7-year tranche of funding. This represents an opportunity to adjust MPA-relevant settings.
5. *Aotearoa New Zealand has reiterated its commitment to MPA-related research.* The Aotearoa New Zealand Antarctic and Southern Ocean Science Directions and Priorities 2021–2030 has been adopted and indicates a significantly increased focus on marine science, particularly that relating to the MPA. Related is the commissioning of HMNZS *Aotearoa*, which is anticipated to make biannual voyages to McMurdo Sound and potentially represents a platform for some forms of observational science.
6. *The national environmental research landscape is changing.* The Te Ara Paerangi Future Pathways discussion document released in late 2021 by MBIE⁹, asks searching questions around the best way for Aotearoa New Zealand to develop a modern, future-focussed research system. Given the potential changes that may ensue from this review, it is timely to look at how the requirements of a long-term perspective on the Ross Sea environment could be accommodated. A recent review of the Aotearoa New Zealand environmental research landscape highlights the ASP as potentially reflecting the future shape of SSIF platforms¹⁰ insofar as it was negotiated, is science-based and provider neutral. The ASP could grow into an example of how a more persistent core research programme into the Ross Sea region MPA

⁹ MBIE. 2021. [Te Ara Paerangi, Future Pathways Green Paper](#)

¹⁰ Parliamentary Commissioner for the Environment. 2020. [A review of the funding and prioritisation of environmental research in New Zealand.](#)

can be developed that will coordinate all providers to bring relevant skills and capability to the intended outcomes. The ASP's submission¹¹ to the Te Ara Paerangi consultation process addressed this possibility and explored the advantages and disadvantages of this model.

7. *Time is passing.* Research and monitoring into the RSRMPA needs to be designed to accommodate the MPA's 35-year time frame, five years of which have already passed. With the major Aotearoa New Zealand programmes currently supporting research into this MPA coming to direction-setting moments, it is timely to consider whether and how a core programme of research into the Ross Sea region MPA can be coordinated over a suitable time frame. Such a core programme needs to meet the national need to deliver defensible research that will allow a robust evaluation of the values of the MPA over the first 35 years of its existence to a potentially wary international community. The Ross Sea region MPA is unique amongst Antarctic Treaty Consultative Meeting (ATCM) environmental agreements in that it is designed to terminate, unless there is consensus on renewing, unlike previous agreements (such as the hold on mineral exploitation) that are designed to be extended unless there is consensus that they should terminate.
8. *Geopolitics are becoming less favourable for consensus decision making.* Chinese and Russian delegations have recently been seen as obstructionist within Antarctic environmental management forums (CCAMLR, ATCM and the Committee for Environmental Protection (CEP)). Geopolitics is likely to strengthen this trend if the isolation of China and Russia intensifies. Brooks et al., (2020, 2021)¹² describe the importance of politics as well as science agreement in getting the Ross Sea region MPA over the line in 2016, when both China and Russia were in settings where agreeing the MPA was politically expedient. In contrast, Sylvester and Brooks (2020)¹³ note the intransigence within China and Russia has stalled progress on the first component of the Western Antarctic Peninsula MPA (proposed by Chile and Argentina and known as Domain 1 Marine Protected Area - D1MPA¹⁴). Objections raised by the Chinese and Russian delegations around the D1MPA were summarised as “validity of the reference area design with respect to its intended use to study the effects of climate change; and the ability of the MPA to provide protection against threats, as well as the existence and analysis of threats in the Domain” (Sylvester and Brooks, 2020)¹⁴. China and Russia also requested more evidence that the MPA could decrease the risks of krill fishing having a negative impact on the ecosystem (Scott, 2019)¹⁵. If this will be the ongoing situation, it is even more important to develop a robust research and monitoring effort that is well connected to our international partners.

Designing a model for RSRMPA-relevant research and monitoring

We have argued that discussion be entered into as to how Aotearoa New Zealand can most effectively support long term, focused and effective research and on monitoring. This recognises that the RSRMPA is an important strategic issue for Aotearoa New Zealand, that no jurisdiction has a statutory responsibility for it, and that there are currently no national or international bodies mandated to ensure its evaluation over its planned 35-year duration.

¹¹ ASP. 2022. [Antarctic Science Platform Submission on Te Ara Paerangi Future Pathways Green Paper](#).

¹² Brooks, C. M., Crowder, L. B., Österblom, H., & Strong, A. L. (2020). Reaching consensus for conserving the global commons: The case of the Ross Sea, Antarctica. *Conservation Letters*, 13(1), e12676

Brooks, C. M., Bloom, E., Kavanagh, A., Nocito, E. S., Watters, G. M., & Weller, J. (2021). The Ross Sea, Antarctica: A highly protected MPA in international waters. *Marine Policy*, 134, 104795.

¹³ Sylvester, Z. T., Brooks, C. M. (2020). Protecting Antarctica through co-production of actionable science: Lessons from the CCAMLR marine protected area process. *Marine Policy*, 111, 103720.

¹⁴ cmir.ccamlr.org/node/30

¹⁵ Karen N. Scott, K.N. 2019. Area-based Protection Beyond National Jurisdiction: Opportunities and Obstacles” *Asia-Pacific Journal of Ocean Law and Policy* 158 – 180

The RSRMPA falls into a complex space domestically and internationally, amongst Aotearoa New Zealand's Ministries of Foreign Affairs and Trade (MFAT - international agreements), Primary Industries (MPI - fishing) and Business, Innovation and Employment (MBIE - research funding). The Antarctic Science Platform (SSIF funded by MBIE) functions well in a similar space, with steering group representation across Ministries, and we suggest that a sister research platform could be an effective funding model. The research platform approach has the benefits of avoiding institutional capture, but would require a neutral host organisation. As with the ASP, funding could be in seven-year (or longer) tranches, with contract renewal ongoing unless there was a failure to deliver. The existing Antarctic Science Platform has a current mandated focus of the effects of a Paris Agreement-level climate change on the Ross Sea. There is potential overlap with the suggested new programme, and an argument could also be made that expanding the mandate, and funding, of the existing Antarctic Science Platform could be a cost-effective option, by reducing the management overhead and optimising synergies amongst researchers. This would require that research areas and functions more directly related to fishing/stock reduction effects would need to be designed into the Impact Statements.

A new, or expanded, Antarctic research platform could, in consultation with stakeholders (particularly the Antarctic Working Group that directly advises the national CCAMLR negotiation team), develop an initial seven to ten year research plan to identify key research questions to be addressed, time bases for ongoing observational studies, and develop international linkages to leverage wider research coverage. Linking the funding cycle to the 10-yearly reviews of the RSRMPA could be useful.

While the new research platform would directly fund ongoing science related to the core goals, a critical role would be to provide short term support on a competitive basis to projects that seek to support RSRMPA science, either by developing new techniques, technologies or to address specific, high value but time-defined questions.

With long term strategic continuity supported within a "platform" style research initiative, shorter, focused research programmes would be well placed to support its long-term aspirations by addressing short-term questions, developing new research and data acquisition approaches, and continuing to enhance the values of the RSRMPA.

6. Summary

This document acts to inform a pathway for future Aotearoa New Zealand funding of MPA aligned research. The key messages are:

1. Aotearoa New Zealand, as a founding proponent of the RSRMPA and supporter of other Antarctic MPA proposals, has an obligation to ensure that MPA proposals and monitoring are underpinned and validated with quality science.
2. A substantial volume of existing national research is relevant to the RSRMPA, and is accomplished via several funded programmes. However, each is supported over different funding cycles, by different funding agencies, with different mandates and philosophies around renewal and required outcomes.
3. This variability and uncertainty undermines Aotearoa New Zealand's ability to build capacity, facilitate impactful science, attract international collaboration, and fulfil international commitments.
4. A coordinated strategy and commitment to long-term investment is needed to address the key, high priority issues surrounding the Ross Sea region MPA.
5. There are opportunities for national and international leadership and collaboration, which delivers significant positive impacts for the protection of Antarctic environments.

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