A review of the activities conducted by Italy in support of the established CCAMLR Ross Sea Region Marine Protected Area (RSRMPA)

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**Information Paper submitted by Italy**

***Abstract***

The approved Resolution 5 *Establishment of the Ross Sea Region Marine Protected Area* (ATCM XL - 2017) recommended that Parties identify opportunities to conduct and support relevant research and monitoring activities that support the objectives and the forthcoming Research and Monitoring Plan of the RSRMPA, in particular through international collaborations. In this paper, an overview on the science developed by Italy in support of the RSRMPA is presented, in addition to the work done in the past on ASPAs including a marine component (ASPA 161, ASPA 165, ASPA 173, Inexpressible Island ASPA proposal).

Italy’s aim is to promote knowledge of Italian activities and of the ongoing international collaborations thus helping harmonization of research initiatives in the Ross Sea Area. The available research infrastructures are also presented.

***1. Introduction***

Since 1985, vessel-based as well as land-based marine researches have been developed in the Western Ross Sea under the umbrella of the Italian National Antarctic Program (PNRA), especially in Terra Nova Bay where the Italian ‘Mario Zucchelli Station’ (MZS, formerly ‘Terra Nova Bay Station’) is located. A general overview of the activities was presented in the frame of the first CCAMLR MPA Workshop (2011, Brest, France) (CCAMLR WS-MPA-11/14). In 2017, after the agreement by CCAMLR of the Ross Sea Region MPA (RSRMPA), an update on the PNRA supported scientific activities relevant for evaluating the performance of the RSRMPA was provided (CCAMLR WS-RMP-17/10) during the CCAMLR Ross Sea region MPA Research and Monitoring Plan Workshop (2017, Rome, Italy).

During the last five years, the PNRA has put in efforts over research and monitoring in the RSRMPA. In addition to the activities conducted in the frame of the Italian Marine Observatory in the Ross Sea (MORSea,*http://morsea.uniparthenope.it*) available since 1994, and to the hydrographic activities conducted for over 30 years in collaboration with the Italian Hydrographic Institute (IP 48 - ATCM XLII), new research projects in the region have been supported. Recently, the available research infrastructures were updated and a platform for marine research, the research vessel Laura Bassi, is now available.

***2. Scientific Projects***

In 2016, Italy was leading research in the Ross Sea in the frame of 27 PNRA supported projects addressing a wide range of topics associated to the RSR-MPA, including among others the physical, biological and ecological changes in habitats and communities related to climate change, sea-ice variations, and changes of the ocean circulation; biodiversity mapping; distribution of spawning and nursery areas for the Antarctic silverfish, distributions and movements of Antarctic toothfish, and monitoring of the Adélie penguin.

Two years later a new call for proposal was launched by the PNRA, that allocated a specific financial support to scientific activities focusing on the priorities identified in the CCAMLR CM 91-05 Annex C, researches pursuant to the specific objectives of the RSRMPA, and monitoring to evaluate the extent to which these objectives are being achieved. Fifteen new research projects were selected, four vessel-based projects implemented on the RV Laura Bassi, and 11 coastal land-based activities at Terra Nova Bay, relying on the logistic support from the Italian Mario Zucchelli Station.

Evaluation of new proposals for researches in the Ross Sea is currently in progress, and novel scientific activities are foreseen to start by the end of this year.

A summary of the completed and new projects is given in Table 1. Graphic representation by specific objective number of the RSRMPA (CM 91-05, paragraph 3) is shown in Figure 1.

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| --- | --- |
| **PNRA Code** | **Project Title** |
| PNRA14\_00053 | Biological and ecological information on the Antarctic toothfish, *Dissostichus mawsoni*, in the Ross Sea (Dismas) |
| PNRA16\_00069 | Geochemical signals in Antarctic Biogenic Carbonates for Paleoceanographic Reconstructions (GRACEFUL) |
| PNRA16\_00103 | PRokaryote Interactions with Antarctic phytodetritus: a Micro- to macroscale voyage from the surface to the deep Ocean (PRIAMO) |
| PNRA16\_00239 | Plankton biodiversity and functioning of the Ross Sea ecosystems in a changing Southern Ocean (P-ROSE) |
| PNRA16\_00289 | BEnthic biodiversity and ecosystem functioning of the Deep ROss SEa in a changing Southern Ocean (BEDROSE) |
| PNRA14\_00048 | Marine food webs at Terra Nova Bay under varying sea-ice extension: stable isotopes of C and N for the identification of trophic links underlying biodiversity organization and heavy metals bioconcentration |
| PNRA14\_00070 | Marine Observatory in the Ross Sea (MORSea) |
| PNRA16\_00004 | PenguinERA: Ecology, Reproduction and Adaptation of a climate change sentinel. |
| PNRA16\_00011 | IceClimaLizers: Antarctic biomineralizers as proxies of climate change: in situ monitoring and transplantation experiments |
| PNRA16\_00020 | Antarctic Porifera: Hot-spots for Prokaryotic diversity and biotechnological Potentialities - P3 |
| PNRA16\_00031 | Surface-Atmosphere Mass and Energy Exchanges at a Coastal Antarctic site (SAMEECA) |
| PNRA16\_00052 | Ice Sheet and Sea Ice Ultrawideband Microwave Airborne eXperiment (ISSIUMAX) |
| PNRA16\_00055 | TephRochronology and mArker events for the CorrElation of natural archives in the Ross Sea, Antarctica (TRACERS) |
| PNRA16\_00065 | Correlation between biogenic aerosol and primary production in the Ross Sea (BioAPRoS) |
| PNRA16\_00099 | How key components of the coastal Antarctic food web respond to global change: an “omic” approach |
| PNRA16\_00105 | Microbial colonization of benthic environments in Antarctica: responses of abundance, diversity and microbial activity and larval settlement to natural or anthropogenic disturbances and search for secondary metabolites (ANT-Biofilm) |
| PNRA16\_00120 | Terra Nova Bay barCODing and mEtabarcoding of Antarctic organisms from marine and limno-terrestrial environments (TNB-CODE) |
| PNRA16\_00173 | Diversity and Evolution of marine Microbial assemblages associated with Benthic Antarctic (DEMBAI) |
| PNRA16\_00196 | Multiplatform Observations and Modelling in a sector of the Antarctic circumpolar current (MOMA) |
| PNRA16\_00198 | Pieces In pLace for a research and mOnitoring program Targeting the two key fish  species of the establishing Ross Sea MPA (PILOT) |
| PNRA16\_00207 | CDW Effects on glaciaL mElting and on Bulk of Fe in the Western Ross sea (CELEBeR) |
| PNRA16\_00226 | Journey to the cold and back : comparative genomics and transcriptomics in Antarctic and sub-Antarctic notothenioids |
| PNRA16\_00246 | Future Antarctic microbial communities: predicting the impact of global climate changes on aquatic microbial communities through guided evolution and multi-omics integration |
| PNRA16\_00274 | Trophic and symbiotic relationships among bacteria, macrobenthos and meiobenthos in Antarctic environments. |
| PNRA16\_00279 | Unravelling ecological, immunological and evolutionary aspects of the host-parasite interaction: the case of the anisakid nematodes and their Antarctic fish hosts |
| PNRA16\_00291 | Sea-ice dynamics and variations of food webs and pollutants transfer at Terra Nova Bay (Ross Sea): a study based on multiple stable isotopes (C, N) and heavy metals in sympagic algae, plankton, nekton and birds. |
| PNRA16\_00294 | Vulnerability to climate change and anthropogenic pressure in key Antarctic species: modulation of antioxidant defences, detoxification pathways and lipid metabolism |
| PNRA18\_00276 | Pelagic ecosystem monitoring of the key species of Middle. Trophic Level in the Ross Sea Marine Protected Area |
| PNRA18\_00154 | Acoustic monitoring of the Ross Sea |
| PNRA18\_00259 | Processes controlling the presence and distribution of pollutants in Ross Sea Area |
| PNRA18\_00258 | Effects of the East current on the variability of salinity in the Ross Sea |
| PNRA18\_00263 | Programme for the monitoring of benthos in the Ross Sea: novel non destructive approaches based on machine-learning for the analysis of benthos |
| PNRA18\_00137 | Research and monitoring in the Ross Sea based on robotic technologies (RESTORE) |
| PNRA18\_00097 | Emerging contaminants in the Ross sea: new challenges and potential threats in a changing world |
| PNRA18\_00078 | Monitoring the biodiversity of the Ross Sea by environmental DNA; barcoding, and metabarcoding |
| PNRA18\_00016 | Monitoring *Dissostichus mawsoni* in sea-ice COVered areas of the Ross SEa Region MPA by low-impact technologies (DisCOVERy) |
| PNRA18\_00101 | Diversity and functioning of the microbial trophic net in relation to the ice melting processes in the Ross Sea coastal ecosystems |
| PNRA18\_00216 | Emerging contaminants in the Ross Sea: distribution, sources, and ecotoxicological risks |
| PNRA18\_00041 | Study of Bacteria resistant to Antibiotics and heavy Metals (water, sediment and *Trematomus bernacchii*) and detection of Heavy metals (SBAM) |
| PNRA18\_00295 | Role of the variations of the sea-ice coverage on structure of the trophic nets and key species of the Ross Sea in the frame of climate change |
| PNRA18\_00133 | Antarctica as a global pollution sensor: aquatic and terrestrial organisms as bio-indicators and meta-analysis of pollutant trends (AntaGPS) |
| PNRA18\_00361 | Impact of the MZS on the natural capital, beta diversity, macro-benthonic communities connectivity and zonation of the ASPA 161 - Ross Sea |

**Table 1** - Summary of Italian research projects in the Ross Sea region (since 2016)

**Gráfico, Gráfico circular

Descripción generada automáticamente**

**Figure 1** - Summary of PNRA projects in the RSRMPA by specific objective (CM 91-05, paragraph 3).

***3. Scientific Results***

A census of the recent (2016-today) Italian scientific production related to the Oceanography, Biology and Ecology of the Ross Sea reported 103 publications (Source: Scopus; export date: 7 May 2021; Search criteria: “Ross Sea” in “Title, Abstract, Key words” + “Italy” in “Affiliation Country” + “>2015” in “date range”). Records were manually checked, and publications purely related to paleo-records or other research fields not-relevant for the present IP (51 publications in total) were manually excluded from the list.

Among the 103 selected publications, 95 (92.2%) were primary Research articles, 3 (2.9%) were Reviews, 3 (2.9%) were Conference papers, and 2 (1.9%) were Editorials. This indicates that the recent Italian scientific production was strongly devoted to the generation of new data for the Ross Sea Region. With reference to research topics relevant for the research and management of the Ross Sea Region MPA, 27 publications (26.2%) were primarily related to “Climate change and oceanography”, 27 (26.2%) to “Ecosystem structure and functioning, including food webs”, 19 (18.4%) to “Biodiversity”, 13 (12.6%) to “Pollution”, 8 (7.8%) to “Pelagic prey species” (Krill and the Antarctic silverfish), 7 (6.8%) to “Top predators”, and 5 (4.8%) to the “Antarctic toothfish” (please consider that in few cases a given publication was assigned to more than one topic). Published researches were related to the sea ice, pelagic and benthic compartments, as well as to the physical and ecological interconnections among compartments.

Notably, Authors affiliated to Institutions belonging to foreign Countries/Territories were included in 41 publications (39.8%), indicating that the research activity in the Ross Sea Region was a strong catalyzer of scientific international collaborations in recent years. Specifically, 98 Institutions belonging to 22 foreign Countries/Territories were represented. Among the most represented: New Zealand (in 16 publications), United Sates (15), United Kingdom (11), Australia (6), Germany (5), Canada (4), South Korea (4), China (3), France (3), Norway (3), and Spain (3). With reference to the different research topics, “Climate change and oceanography” and “Ecosystem structure and functioning, including food webs”, resulted in highest number of publications characterized by international collaborations (12 and 9 publications, respectively), followed by “Biodiversity” (8), “Pelagic prey species” (5), “Antarctic toothfish” (4), “Top predators” (3) and “Pollution” (3).

***4. Available infrastructures***

Research conducted on the topics indicated in Table 1 can rely on the support of both Mario Zucchelli Station and the Research Vessel Laura Bassi, purchased in 2019 by the Italian OGS Institute being equipped with scientific instrumentation (see <https://www.eurofleets.eu/vessel/rv-laura-bassi/>). A web site developed by ENEA allows visualizing the tracks of the RV Italica and RV Laura Bassi as well as the sampling points of the different research projects conducted since 2015: https://myway.enea.it/Myway\_all/Welcome.action?request\_locale=en (from 2015 to 2020) and https://myway.enea.it/MAH\_36/Welcome.action?request\_locale=en (2020-2021).

At MZS modernization works are under way and the revamping of laboratories ended in the last Antarctic summer campaign. New laboratories are now available in addition to a new aquarium.

In a 80m2 area, the new aquarium is equipped has 24 m3 of total water capacity and will allow rearing of collected marine organisms.

The following tanks are available:

- n. 7 water tanks (200x90xH80 cm)

- n.18 water tanks (100x40xH50 cm)

- n. 8 water tanks (50x50xH50 cm)

- n.1 circular tank (300 cm diameter, H 110 cm)

The facility offers the possibility to regulate water temperature and dissolved gases separately and for specific groups of tanks.

***5. Conclusive remarks***

Since the establishment of the RSR MPA, the Italian scientific activities have been improved: 42 Italy led research projects are ongoing, and novel projects are soon to be launched. Such an effort has led to significant advancements in a range of topics of interest for the RSRMPA, and strongly catalysed scientific international collaborations, as testified by over a hundred publications in international peer reviewed scientific journals. The provided overview is intended as a contribution to foster international collaborations and to harmonize researches in the Ross Sea, in agreement with the Resolution 5 /ATCM XL – 2017).