ATLAS OF COASTAL MARINE HABITAT

REPUBLIC OF VANUATU

MINISTERO DELL'AMBIENTE
E DELLA SICUREZZA ENERGETICA

ENEA
ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES,
ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

REPUBLIC OF VANUATU

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Index

Foreword 4

1. Planning the Atlas 5
- 1.1 Collection of the best available satellite images in 2018-2019 of Republic of Vanuatu 5
- 1.2 Satellite imagery procedure for the Atlas of Marine Coastal Habitats 5
  - 1.2.1 Pre-processing 5
  - 1.2.2 Resampling bands and layer stacks 6
  - 1.2.3 Image classificaton 6
    - 1.2.3.1 Supervised classification: Mangrove forests detection 6
    - 1.2.3.2 Unsupervised classification: Corals and Seagrasses detection 7
    - 1.2.3.3 Photo-interpretation 8

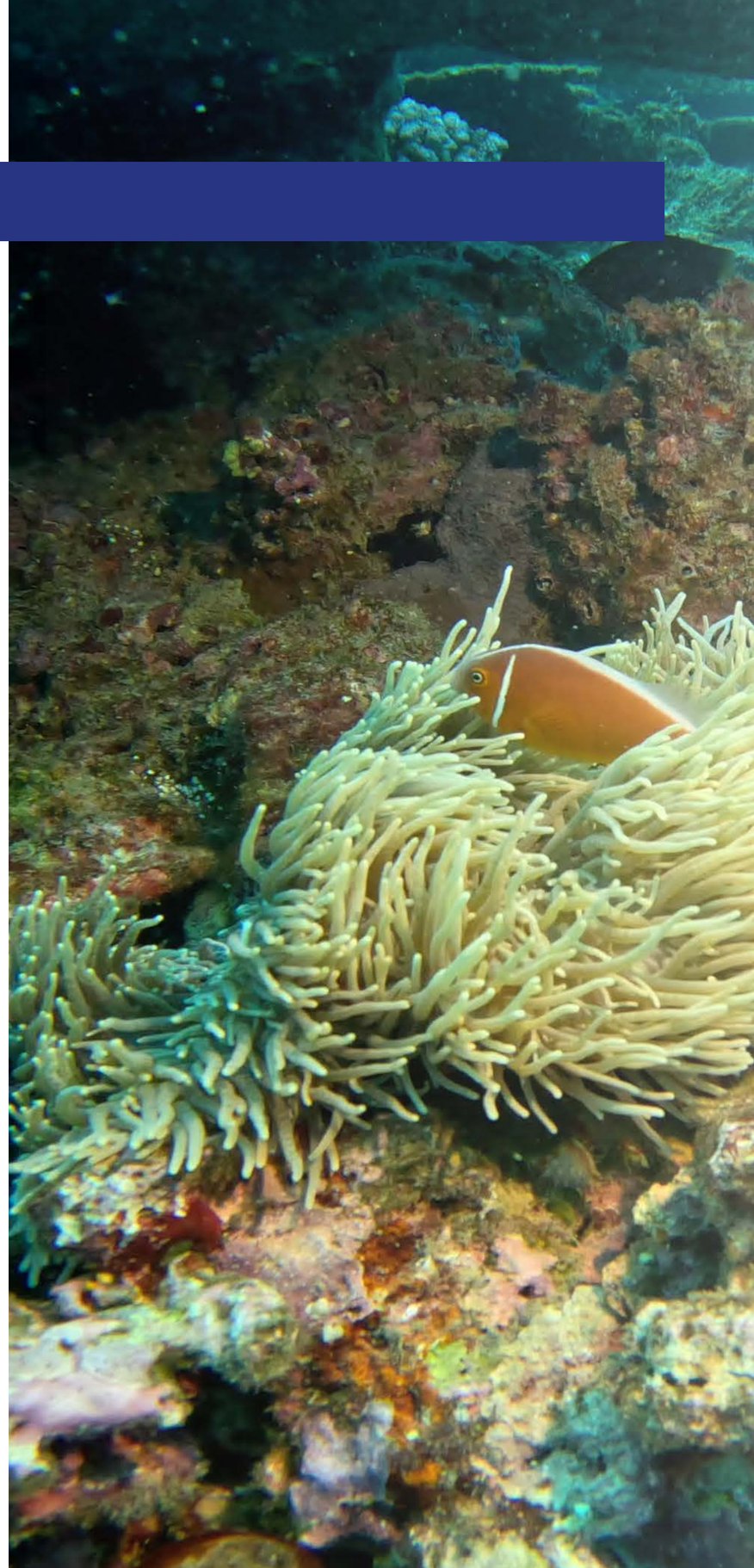
2. Habitat Mapping 9
- 2.1 The Ecological Quality Index (EQI) 12
- 2.2 Assessment of Marine Coastal Habitats 12

Cited References 12

Reading guide to the Atlas 12

Foreword

The project “A national marine spatial plan for Vanuatu – including a network of marine protected areas”, agreed between the Italian Ministry of Environment and Energy Security (MASE) and the Maritime and Oceanic Affairs Division of the Ministry of Foreign Affairs of the Republic of Vanuatu (MAEV), had the objective to support the realization of a Marine Spatial Plan with the development of a National network of Marine Protected Areas.
The project involved ENEA (Italian National Agency for New Technologies, Energy and Sustainable Economic Development) as technical partner, responsible for the “WP2 – Habitat Mapping: identification and quantification of the marine habitat changes and the vulnerability of coral reef ecosystems and associated coastal habitats”.
ENEA worked on the interpretation of satellite images in order to obtain a digital cartography of the coastal marine environment of the Republic of Vanuatu, a base for the creation of a Marine Spatial Plan and the identification of a national network of possible Marine Protected Areas (MPAs). ENEA aimed to realize the Atlas of Vanuatu Archipelago at scale ranging from 1:100.000 to 1:50.000. The Atlas is based on recent, free, satellite images analysed and interpreted through dedicated software and ancillary data. The Atlas reports the habitat classification referred to corals, seagrasses and mangroves of the Vanuatu Archipelago.
The ability to remotely map, measure and monitor the health and status of coral reef systems and associated coastal environments has gained remarkable advances thanks to the application of Earth Observation System (EOS). It represents a valuable habitat management tool to quantify damage and habitat vulnerability in areas of high natural and economic value, particularly in times of climate changes. In this framework, ENEA commits its expertise applied to the marine environment of Vanuatu Republic for shallow-water benthic habitat mapping.



1 Planning the Atlas

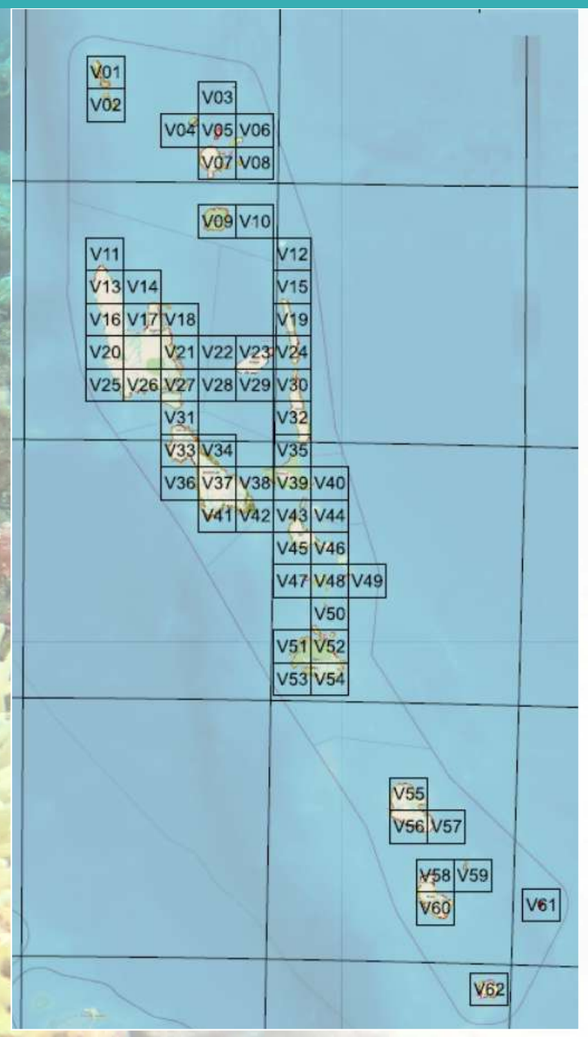


Fig. 1. The index map of the Atlas of Marine Coastal Habitats of Republic of Vanuatu. Tables are progressively numbered from North to South, from V01 to V62.

Based on updated knowledge gathered from dataset, maps and atlas available for Vanuatu archipelago, ENEA planned the Atlas of Coastal Marine Habitats of Republic of Vanuatu with the following objectives:

- Focus on the most sensitive biological communities to climate change, as corals, seagrasses and mangroves.
- Implement information on benthic habitat mapping through the analysis of the most recent satellite images available from 2018 to 2019 for the whole Vanuatu archipelago.
- Define an Ecological Quality Index (EQI) for each identified habitat as a tool to help future planning of Marine Protected Areas and coastal management.

Digital maps provided by the Atlas will be open and available to Vanuatu stakeholders (scientists or administrative personnel), as well as the database associated to the Atlas accessible through open-source QGIS software (www.qgis.org). Information stored in the Atlas could be modified, updated, and implemented, for example for associated species related to each habitat record. Moreover, maps on marine and terrestrial habitats could be updated and uploaded on GIS, thus offering an efficient tool for coastal planning.

1.1 Collection of the best available satellite images in 2018-2019 of Republic of Vanuatu

The analysis of satellite repositories available for Vanuatu Archipelago was carried out on the web portal of ESA-COPERNICUS project (https://scihub.copernicus.eu/dhus/#/home). Recent data available for the period from the 1st of January 2018 to the 1st of December 2019 showed a great number of satellite images available for the Sentinel-2 repositories. Due to the problem that in the tropics the cloud cover is observed frequently on islands, the examination was restricted to images with a cloud cover < 10 %. Sentinel-2 images were preferred for the greater resolution in comparison to Landsat 8 images.
On Sentinel-2 images a further analysis was conducted on each available image, covering hundreds of km2 to be sure to have the best, most recent and free of clouds view for each island/groups of islands. This activity allowed to cover all Vanuatu archipelago and to prepare the 62 tables of the Atlas, shown here (Fig. 1).

1.2 Satellite imagery procedure for the Atlas of Marine Coastal Habitats

Sentinel-2 products are available to users in SENTINEL-SAFE (Standard Archive Format for Europe) format, including image data in JPEG2000 format, quality indicators, auxiliary data and metadata https://sentinel.esa.int/web/sentinel/user-guides/SENTINEL-2-msi/data-formats). The SAFE format has been designed to act as a common format for archiving and conveying data within ESA Earth Observation archiving facilities.

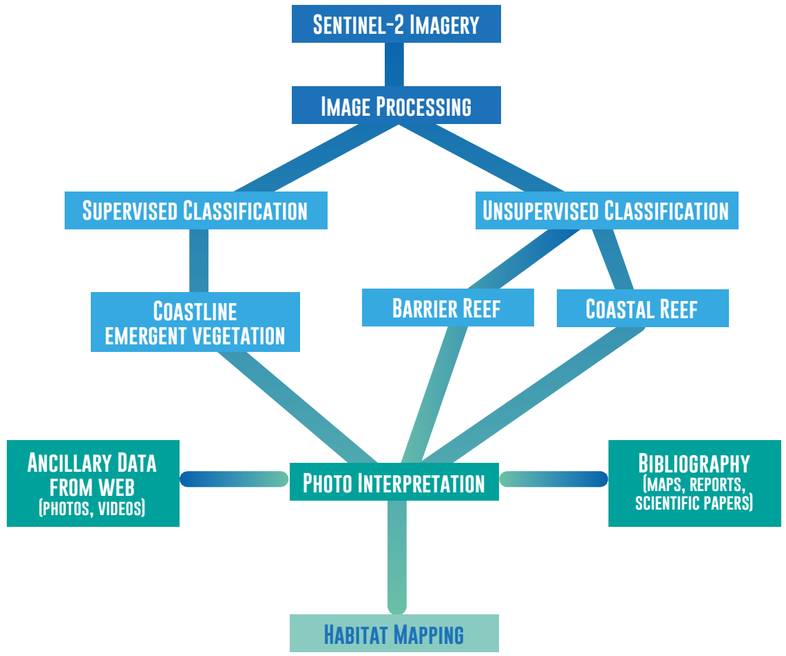


Fig. 2. Workflow diagram illustrating the steps followed for the habitat mapping classification (from Immordino et al., 2019, modified).

1.2.1 Pre-processing

The pre-processing steps include image radiometric, atmospheric and geometric correction (Purkis et al., 2004), sun glint correction (Kay et al., 2009; Hedley et al., 2018), application of depth invariant bands and correction for air water interface (Mumby et al., 1998; Zoffoli et al., 2014). All these pre-processing techniques become challenging to apply consistently at large scales. Further, there is an upper limit to what can be achieved: the mixed composition of reefs at sub-metre scales and spectral and structural diversity of the benthos introduces fundamental uncertainties in the relationship between benthic cover and above water reflectance. The environmental context of the reef influences the accuracy of the classification, with deeper, more turbid areas creating higher uncertainties for benthic mapping (Hedley et al., 2012). When using habitat maps for management activities such as marine spatial planning, these limitations should be taken into account by including explicit information on the accuracy of the features into the planning process (Tulloch et al., 2013). In figure 2, a general scheme of the adopted workflow on satellite images is shown.

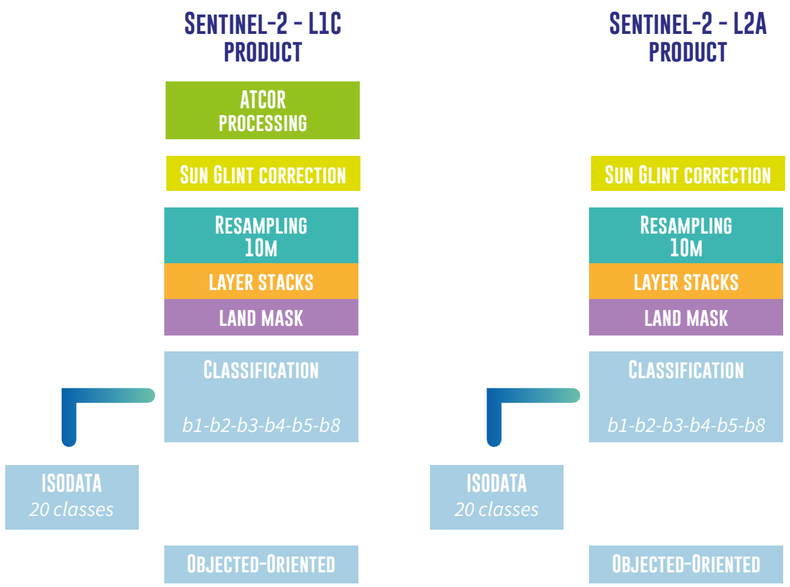


Fig. 3. Sentinel-2 data products: processing steps.

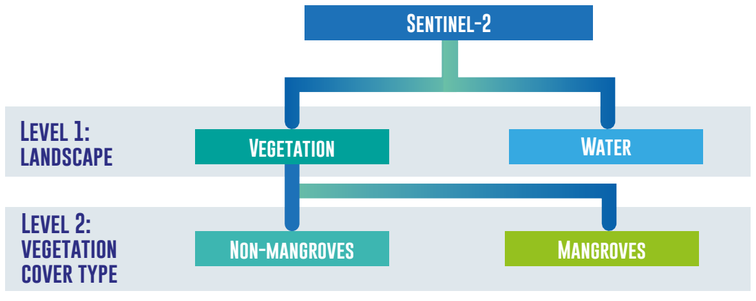


Fig. 4. Image object hierarchy for mangrove feature classifications (Wang et al, 2018, modified).

1.2.2 Resampling bands and layer stacks

When an image is created through remotely sensed data, it needs to undergo some form of validation procedure using observational and/or sampling techniques; failure to do so will reduce the confidence in the final product. Nearest neighbour is a resampling method used in this work from 20m to 10m images pixel size and thus increasing the geometric resolution of the bands. The approach assigns a value to each "corrected" pixel from the nearest "uncorrected" pixel; the advantages of nearest neighbour include simplicity and the ability to preserve original values in the unaltered scene. The re-sampled SENTINEL-2 bands were subsequently subjected to the Layer Stacking procedure obtaining a file that contained only the visible and IR bands (fig. 3).

1.2.3 Image classification

Benthic habitats can generally be categorized according to either hierarchical geomorphological or ecological classification schemes (Mumby and Harborne, 1999; Andréfouët 2011). Digital processing includes image classification or segmentation based on spectral characteristics (i.e., digital number, radiance, or reflectance) and, in some cases, texture. Spectral processing discriminates features based solely on multispectral signatures, while texture approaches also incorporate spatial variability of the multispectral signatures. Unsupervised classification analyses images without user input, and then the different segments are assigned to a given benthic category, or class, according to expert knowledge of the user. In supervised classification, ground- truth for each class (i.e., user supplied input) is used to train the classification scheme and identify these classes throughout the image. Classification using texture considers spatial patterns as function of spectral variation within a particular area.

For all objectives to be addressed with remote sensing imagery, the environmental conditions at the moment of image capture are limiting factors: water depth, water clarity. Remote Sensing studies apply automatic *Unsupervised* and *Supervised Classifications* that allow the extraction of geo-information layers and the production of thematic maps.

Unsupervised and Supervised classification can be performed with any number of different remote-sensing or GIS-derived inputs. Commonly, spectral bands from satellite, band ratios or vegetation indices, and topographic data (e.g., elevation, slope, aspect) are used as inputs in these classifications. Two separate approaches were used in the Atlas for the habitat mapping classification: the supervised classification was used to map littoral mangrove forests; the unsupervised classification was used to classify underwater classes related to coral platform.

1.2.3.1 Supervised classification: Mangrove forests detection

Emergent vegetation habitat composed primarily of mangrove generally found in areas sheltered from high-energy waves. This habitat type is usually found in the shoreline/intertidal or reef flat zone.

Following partially the approach applied by Wang et al. (2018), to map mangrove extent, a two-level hierarchical structure based on the spatial structure of a mangrove ecosystem and geographic object-based image analysis is applied and modified. So, the mangrove determination in the Archipelago of Vanuatu was divided into two levels, namely landscape and vegetation cover type (Fig. 4).

The object-based image analysis approach was used to implement the hierarchy of Level 1 and 2.

For this purpose, Trimble eCognition® software was used. Creating an object-based classification mainly consists of two steps: image segmentation and object classification. Table 1 shows the algorithm ("rule set") and classification processes developed for the archipelago of the Republic of Vanuatu, where some spectral indices are selected and combined.

Tab. 1. Mangrove feature classifications based on Sentinel-2 imagery (Wang et al. 2018, mod). Seg is an abbreviation for segmentation.

Level		Sentinel-2 image (13 bands)
Level 1	Water	Chessboard Seg: 1 MNDWI > 0 FDI < 0 Brightness < 1250
	Vegetation	WFI > 0.7
Level 2	Mangroves	Multiresolution Seg: 64 300 < Band 11 (SWIR1) < 660
	Non-mangroves	Not "mangroves"

In Tab. 1, MNDWI represents the Modified Normalized Difference Water Index:

1) MNDWI = (Band 3 – Band 11) / (Band 3 + Band 11) = (Green − SWIR1)/(Green + SWIR1)

FDI represents the Forest Discrimination Index:

2) FDI = Band 8 – (Band 4 + Band 3) = NIR − (Red +Green)

and WFI represents the Wetland Forest Index

3) WFI = (Band 8 – Band 4) / Band 12 = (NIR − Red)/SWIR2

The first level was used to discriminate vegetation and non-vegetation and produced a mask of vegetation. A chessboard segmentation with an object size of one pixel was applied in order to preserve the pixel value of coarse or moderate resolution images. Following segmentation, the objects with the Modified Normalized Difference Water Index MNDWI (1) higher than zero and the Forest Discrimination Index FDI (2) less than zero were classified as water. Moreover, due to some of mudflat overlapping with water and the brightness of the mudflat being greater than water, the brightness was used as supplement to exclude these mudflats (Brightness < 1250). The second level was used to separate mangrove from non-mangrove within the vegetation mask, and Wang et al., (2018) applied the Mangrove Discrimination Index 2 (MDI2) index:

MDI2 = (Band 8 – Band 12)/Band 12 = (NIR − SWIR2)/SWIR2

Developing an efficient algorithm for mapping mangroves requires an understanding of the spectral, physical, and spatial distribution characteristic of the mangroves. There is no universal rule-set for different imagery and sites. By applying the MDI2 index in the few islands of the Vanuatu archipelago where the presence of mangroves is confirmed by the bibliography,

it has been observed that in this context, the use of the MDI2 index overestimates the extension of the mangroves. For this reason, it was preferred to apply a selection of the values of Band 11 (SWIR1). In particular, the definition of the spectral value range of Band 11 (SWIR1, tab. 2, level 2) must be calibrated for each Sentinel-2 image.

1.2.3.2 Unsupervised classification: Corals and Seagrasses detection

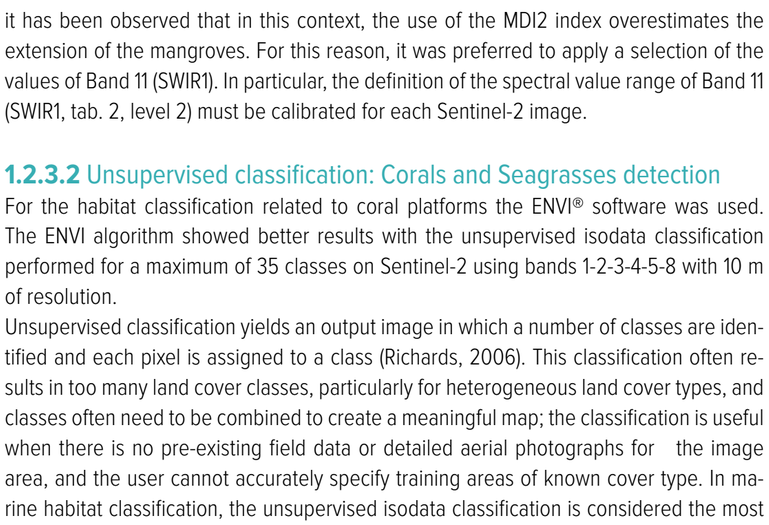
For the habitat classification related to coral platforms the ENVI® software was used. The ENVI algorithm showed better results with the unsupervised isodata classification performed for a maximum of 35 classes on Sentinel-2 using bands 1-2-3-4-5-8 with 10 m of resolution.

Unsupervised classification yields an output image in which a number of classes are identified and each pixel is assigned to a class (Richards, 2006). This classification often results in too many land cover classes, particularly for heterogeneous land cover types, and classes often need to be combined to create a meaningful map; the classification is useful when there is no pre-existing field data or detailed aerial photographs for the image area, and the user cannot accurately specify training areas of known cover type. In marine habitat classification, the unsupervised isodata classification is considered the most appropriate approach not supported by sea-truth validation (Mumby, 2000).

The spectral signatures of the reef cover were extracted from Sentinel-2 image as reported in Immordino et al. (2019) to show the spectral separability among them (Fig. 5).

To check the reliability of atmospheric corrections and subsequent classification of the Sentinel-2 image, the ROI of the coverage classes present in the coral environment was extracted.

Immordino et al. (2019) showed as the image interpretation procedure for habitat classification was based on two main components: the geomorphologic description of the seabed and the biological relevance of the associations living in the zone. According to this approach, we considered the geomorphologic description of the seabed and the biological relevance of the associations living in the two main zones of the coral reefs: the Barrier Reef and the Coastal Reef (Tab. 2).



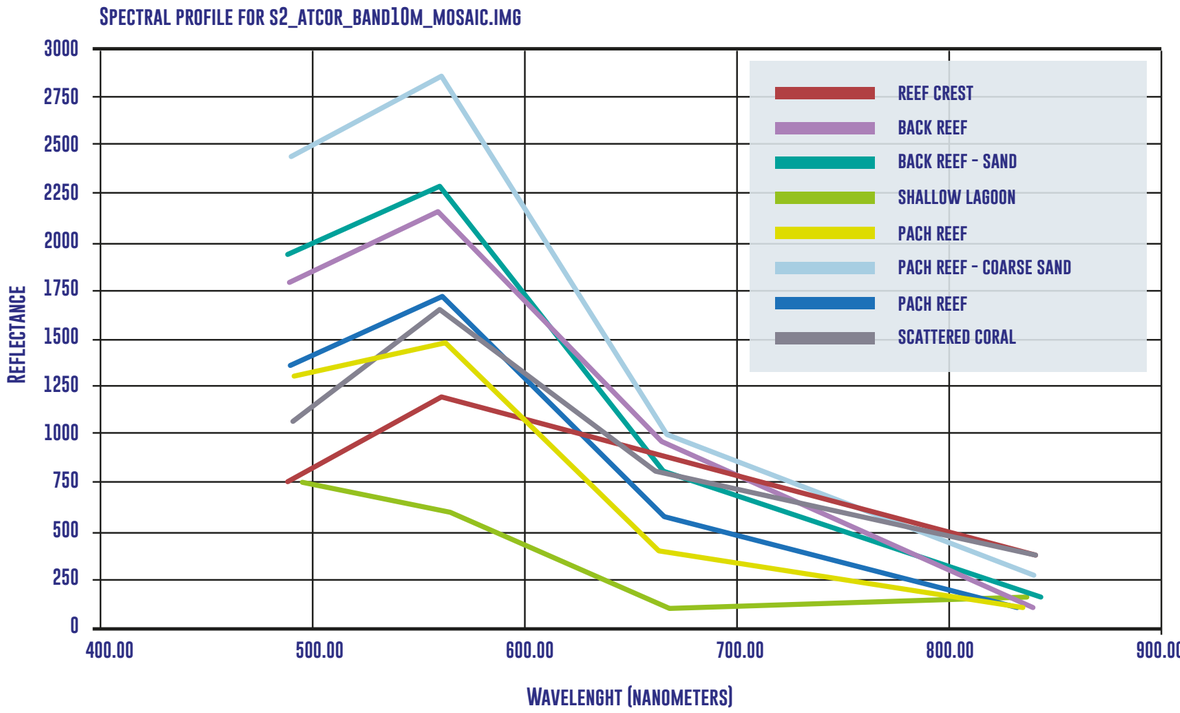


Fig. 5. Spectral signature of reef coverage (Barrier Reef zone, site 1) in Erdas software (from Immordino et al, 2019, modified).

Tab. 2. Geomorphological description and biological relevance of the main classes/subclasses used for the Vanuatu habitat mapping with Sentinel-2 imagery (from Immordino et al., 2019, modified).

Zone	Habitat Classes	Habitat Subclasses	Geomorphological Description	Biological Relevance
Barrier Reef	Bank/shelf and Forereef	coral, coralline algae	underwater coral cliff	dense coral, high biodiversity, coral reservoir
	Reef crest	coral, coralline algae	windward coral platform shelf edge, algae ridge	dense coral, high biodiversity
	Back reef	scattered coral, flesh algae	coral platform, and channels	medium to scarce coral density
	Patch reef	coral/coralline algae	coral knob, aggregate coral	medium coral density, coral reservoir
	Lagoon	sand coral knoll, massive coral	sand, rubbles, coral	medium to dense coral density, coral reservoir
Coastal Reef	Reef crest	coral, coralline algae	seaward coastal coral platform, shelf edge	high coral density, high biodiversity, coral reservoir
	Reef flat	coral, flesh algae, seagrasses	coral platform	high coral density, high biodiversity, coral reservoir
	Uncolonized	outward limit of mangrove area	sand/ mud	nursery area for fish, shrimps, etc.
	Emergent vegetation	Mangrove	intertidal/sand/mud	high primary productivity area

1.2.3.3 Photo-interpretation

One of the most important feature of satellite imagery is the ability to observe the Earth's surface synoptically by observing the mutual relationships between structures and objects in the portion of territory acquired by the satellite sensor, ranging from local to regional.

By observing and interpreting the shape of objects on the image, it is possible to carry out a process of identification and knowledge of the territory. Satellite imagery allows, through specific acquisition methods, to observe the territory in three dimensions for a series of surveys in the field of geomorphology, topography and environmental studies. In multispectral satellite images the presence of bands embracing different regions of the electromagnetic spectrum allows the observation of the Earth's surface with various colour syntheses in natural and false colours (Fig. 6). From the latter, much information can be obtained about the properties of the objects on the Earth's surface: the nature of the rocks and soils, the density and state of the vegetation.

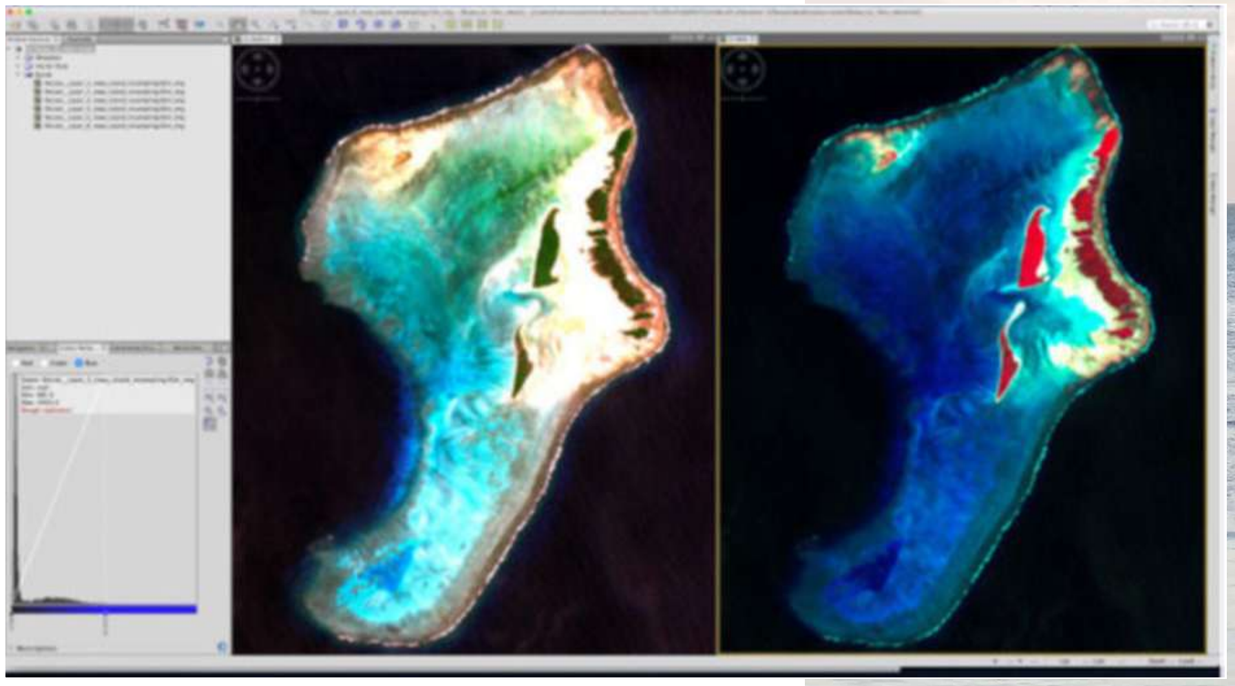


Fig. 6. Rowa Island (Republic of Vanuatu): natural colors (left) and false colors (right) composite. The presence of bands that embrace different regions of the electromagnetic spectrum allows the observation of the Earth's surface with various RGB color synthesis (ESA - Sentinel-2 image).

2 Habitat Mapping

The coastal benthic classification was based on two main components: the geomorphologic characteristics of the zone and the biological associations living in the zone. Benthic classification has been adapted to the objectives of the Atlas; in particular we gave more emphasis to biological habitats that refer to corals, seagrasses and mangroves. With the aim to identify priority habitats useful for further analysis on the environment health status, we referred mainly to NOAA Shallow-Water Benthic Habitats Manual (NOAA, 2005) and to the Millennium Coral Reef Mapping project. The submerged habitats of corals and seagrasses were identified taking into consideration the actual depth limit of the satellite images, normally within 20-30 m depth, and the actual spectral and resolution limit of the Sentinel-2 satellites. Deeper areas, as the deep lagoons or the offshore zones around banks and forereef, should be investigated with other methodologies (transects, Multibeam, Side Scan Sonar). These deep areas are of relevant ecological importance as species of coral inhabiting these zones could be a reservoir of larvae for the shallower reefs impacted by climate changes.

In the two main morphological zones of the reef islands, the barrier reef and the coastal reef, eleven main biological habitat classes were identified (Fig. 7 and Tab. 3). Further five classes, with no or scarce biological relevance, were identified during habitat classification and reported in the Atlas: Mud (MU), Sand (S), Littoral Sand or beaches (LS), Beach Rocks and No Reefs (NR). We decided to maintain these classes for their relationships with biological ones and for their natural value for the Marine Protected Areas. For example, sand cover may vary in season and year, seagrasses may colonise new sand bars or disappear under them. The same is true for Mud zones (MU). These areas, in front of mangrove forests, are in equilibrium with these last ones and they are important transition zones, creating a link among littoral and offshore areas. Littoral Sand (LS) and Beach Rocks are of relevant interest from a geomorphological point of view. The No Reef (NR) class is associated with rocky, basaltic reefs of volcanic island, boulder beaches, with no value from the biological point of view.

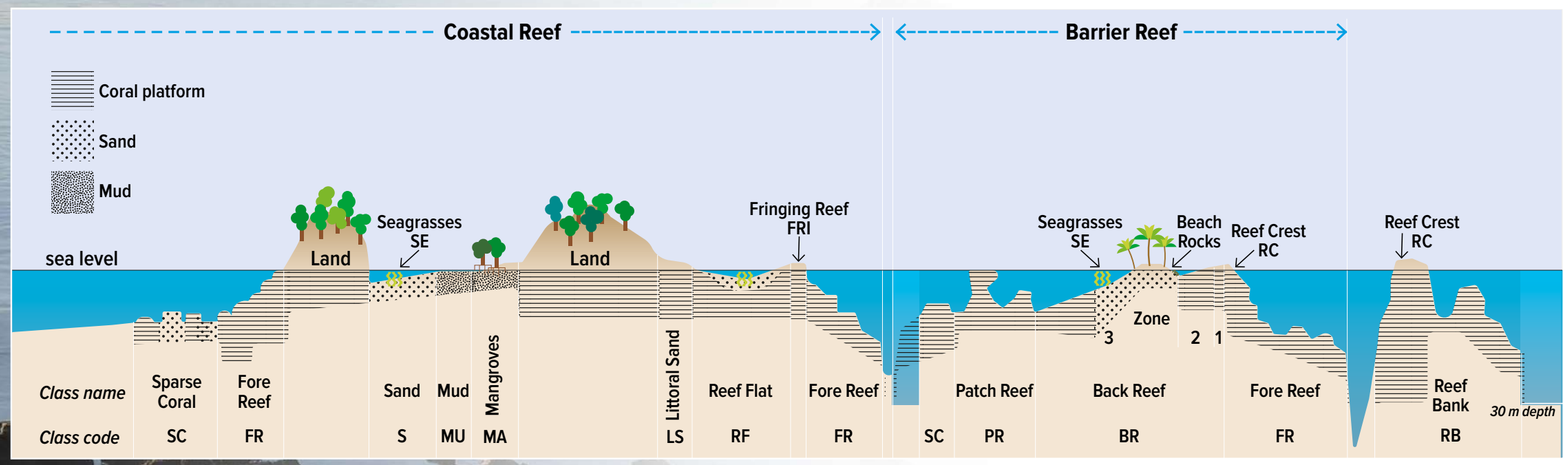
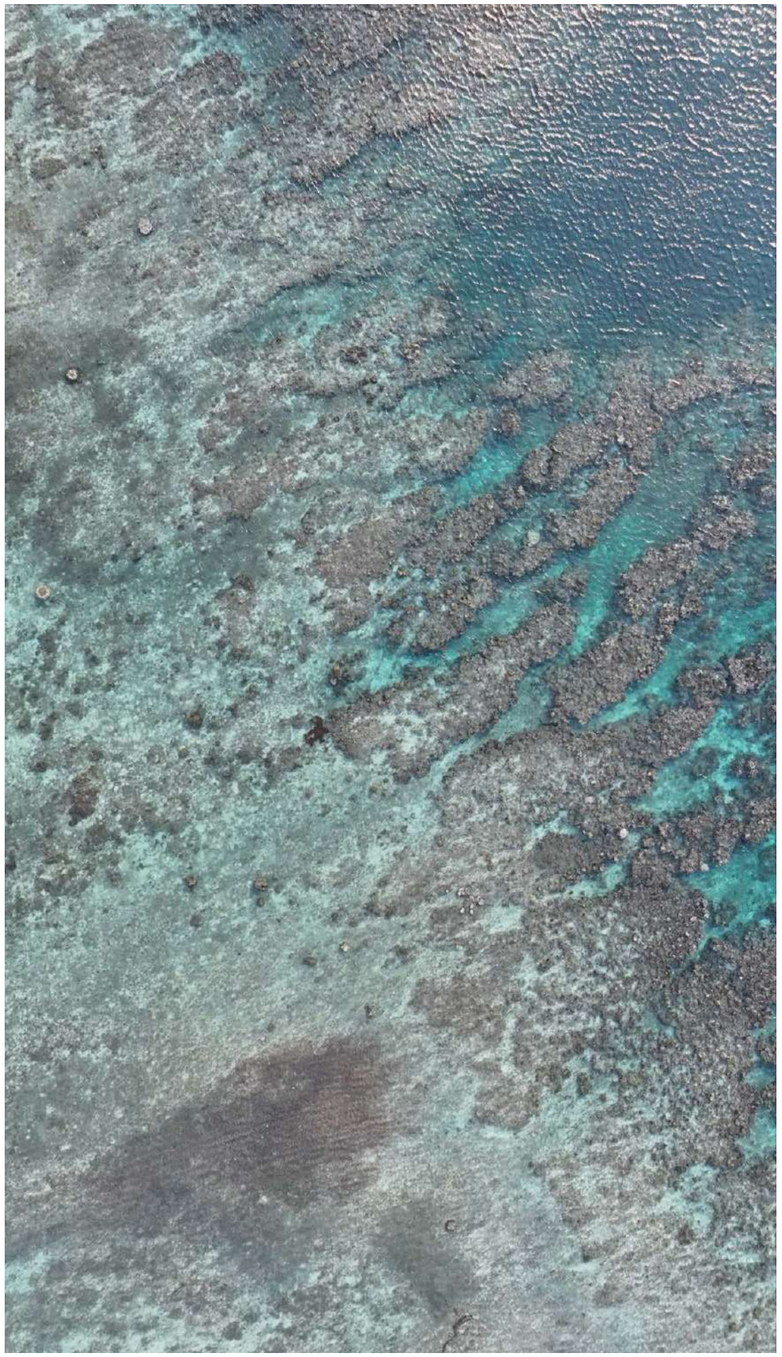


Fig. 7. Zonation of the marine shallow-water habitat classes identified and included in the Atlas of Tonga Archipelago.



2.1 The Ecological Quality Index (EQI)

Defining an Ecological Quality Index (EQI) associated with the presence of the identified habitats is a fundamental tool to help scientists and stakeholders to plan Marine Protected Areas and to manage coastal areas.
For this reason, an Ecological Quality Index (EQI), based on the ecological relevance of each habitat identified, has been elaborated.
Given the resolution scale of the satellite images (20 m) and the consequent representation scale, limited to 1: 50,000, the EQI was evaluated as the mean of a 3-level scores/colours (1= low value/Green, 2= medium value/Yellow, 3= high value/Red). These scores / colours are assigned (Tab. 3) to the six following parameters:

1. nursery ground,
2. connectivity,
3. species reservoir,
4. fish attraction,
5. biodiversity,
6. primary production.

The EQI was integrated in the database associated to the QGIS software, giving the possibility to identify on the maps the area of interest, the associated habitats and to quantify its ecological relevance.

Tab. 3. Main Classes/Subclasses used for the Vanuatu habitat mapping. Habitat Classes, with their code, and sub-zones used for shallow-water benthic habitat of Vanuatu islands. The Ecological Quality Index (EQI) was calculated as the mean of the scores of six ecological parameters (nursery ground, connectivity, species reservoir, fish attraction, biodiversity, primary production).

BIOLOGICAL HABITAT CLASSES	ABBREVIATION	SUB ZONES	GEOMORPHOLOGICAL SETTING	Biological value (1= low , 2 = Medium , 3 = High)						ECOLOGICAL QUALITY INDEX (EQI)
				NURSERY GROUND	CONNECTIVITY	SPECIES RESERVOIR	FISH ATTRACTION	BIODIVERSITY	PRIMARY PRODUCTION	
SPARSE CORAL	CS		Sparse colonies on sand and gravel bottoms	1	2	2	2	2	0	2
REEF BANK	RB		Offshore sparse banks and shoals in the open ocean	3	3	3	3	3	0	3
PATCH REEF	PR		Coral Pinnacles and broken reef, may reach the surface with a reef crest (RC)	2	3	3	3	3	0	3
FORE REEF	FR		Coral cliffs and continuous, dense coral beds and bank shelves outward fringing reef and barrier reef. It include spur and grooves	2	3	3	3	3	0	3
REEF CREST	RC		Outward edge of barrier reef, coral and coralline algae exposed to wave actionto and air at low tide	2	3	3	3	3	3	3
BACK REEF	BR	1	Coral and coralline algae. Just behind reef crest.	2	3	3	3	3	3	3
		2	Scattered corals and flesh algae on coral platform behind the BR zone 1	1	1	1	1	1	1	1
		3	Scattered coral on coral platform with moderate slope with sand and gravel. Between the BR zone 2 and internal lagoon and sand bar.	1	1	2	1	1	0	2
FRINGING REEF	FRI		Coral on the edge of RF. Exposed to air at low tide and to wave action.	2	2	2	3	3	1	2
REEF FLAT	RF		Coral platform among the FRI and the coast rare, sparse coral, sand patches, and algae	1	1	1	1	1	1	1
SEAGRASSES	SE	1= High Density	Dense plant cover on sand patches on barrier reef (BR 1 and BR 2) and on RF	3	3	3	3	3	3	3
		2=Low density	Plant patches variable in space and time on sand bars in lagoons and on RF	2	2	1	2	2	2	2
ALGAE	AL		Large patches of algae may be present on sandy and rocky bottoms of the Barrier Reef and Coastal Reef	1	1	1	2	1	3	2
MANGROVE	MA		Terrestrial plant forest implanted along coastline where rivers are present	3	3	3	3	3	3	3
MUD	MU		Mud fringe in front of mangrove water limit	2	1	1	1	0	0	1
SAND	S		Sand bottoms, sand bars	0	0	0	0	0	0	0
LITTORAL SAND	LS		Beaches	0	0	0	0	0	0	0
NON REEF	NR		Rocky, basaltic reefs of volcanic island, boulder beaches	0	0	0	0	0	0	0

2.2 Assessment of Marine Coastal Habitats

The comparison of the occurrence of the habitats of biological importance among the Vanuatu provinces showed like, among the 11 habitats of biological and ecological importance Forereef, Reef Flat and Fringing reef habitats are dominant and present in all provinces (Fig. 8). Tafea, Shefa and Malampa provinces show high percentages of Fore reef, Reef flat and Fringing reef habitats and Malampa province has the highest percentage of Mangroves habitat. Furthermore, with the use of the digital cartography of coastal marine habitats (shapefile), it is possible to evaluate the presence of habitats for each island of the archipelago.

The comparison of the EQI is shown here for all Vanuatu provinces (Fig. 9).

The assessment of habitats of biological importance for the whole Vanuatu archipelago showed like Forereef, Reef flat and Fringing reef are the habitats with the highest bottom cover with values from about 30.000 to 7.000 hectares respectively (Fig. 10), contributing to the total highest values of EQI of about 51 %.

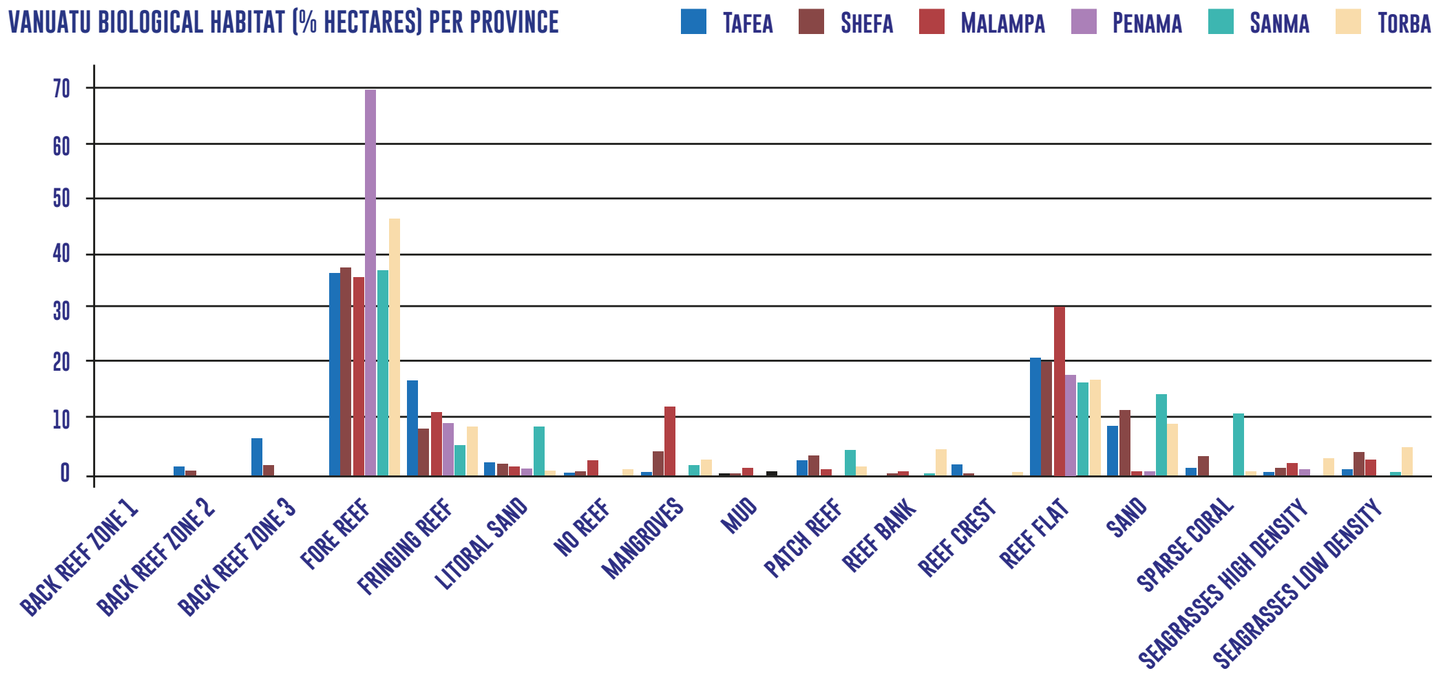


Fig. 8. Habitat percentage occurrence of the habitats of biological importance in each of the Vanuatu provinces.

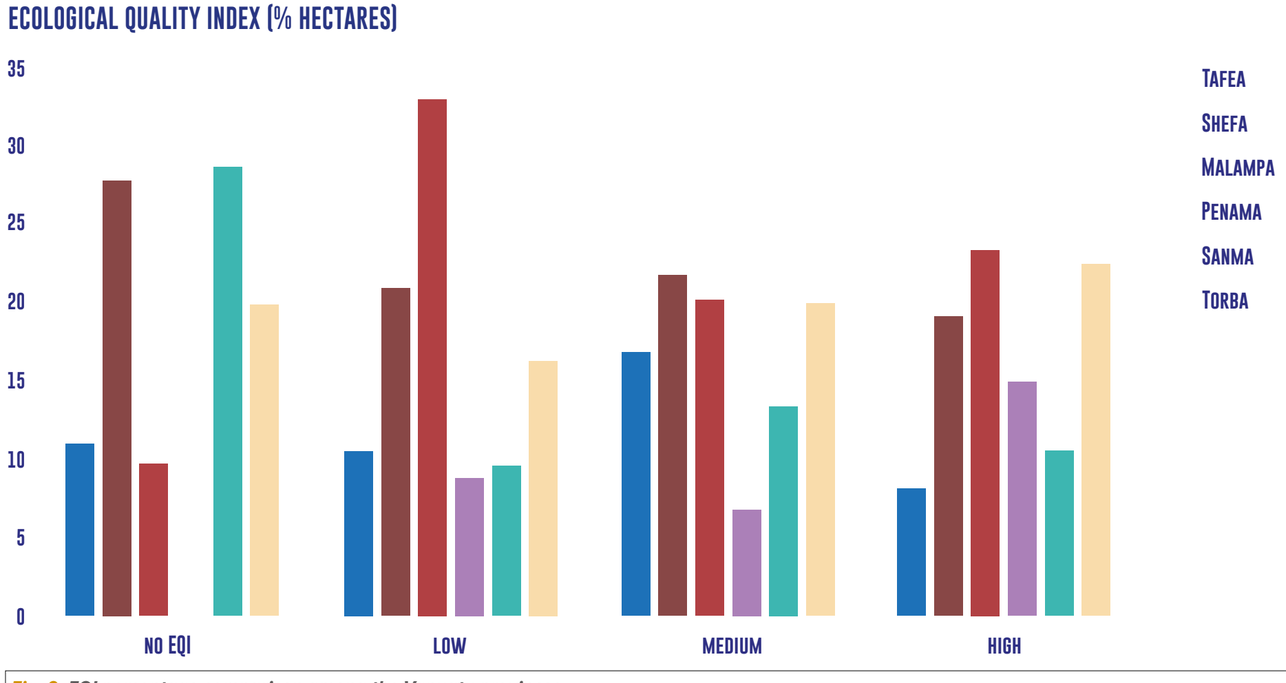


Fig. 9. EQI percentage comparison among the Vanuatu provinces.

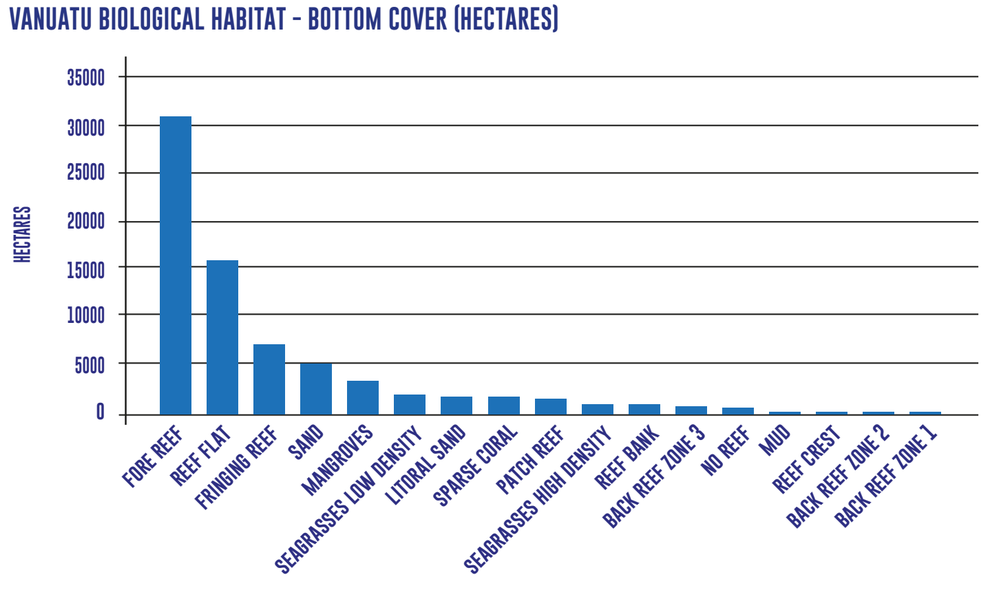


Fig. 10. Cover in hectares of the coastal marine habitats of Vanuatu archipelago.

Reading guide to the Atlas

The following Atlas reports 62 tables referring to the habitat classification of corals, seagrasses and mangroves of the Vanuatu archipelago. The Atlas is based on the photointerpretation of recent (2018-2019) Sentinel-2 satellite images. The satellite images have the limit of being obscured by clouds, to have different degrees of illumination and they cannot show clearly the limits of some habitats in case of presence of turbid water or rough sea. To solve these problems in some cases it was necessary to use two photos of the same area taken at different times.
Recognition of habitats were done on the basis of the radiometric characteristics of images and on the analysis of ancillary data obtained from photos and videos available on the web. In tropical seas, the satellite images cannot 'see' beyond 15-20 meters in depth, hence and the depth limits of some coral habitat as the Fore reef and Reef Bank can be underestimated.

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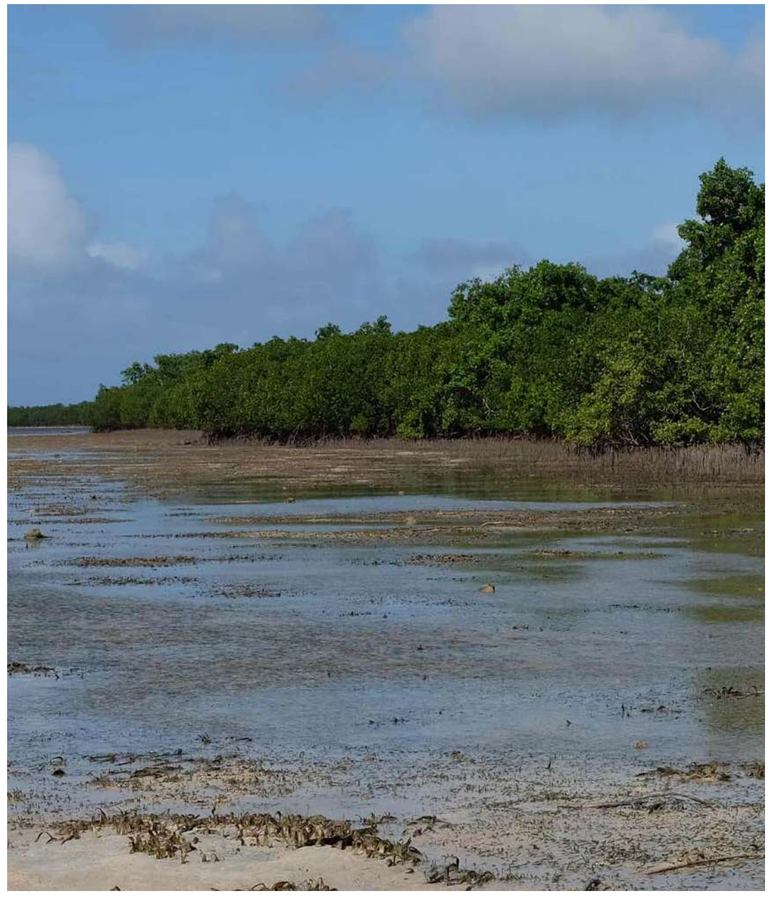

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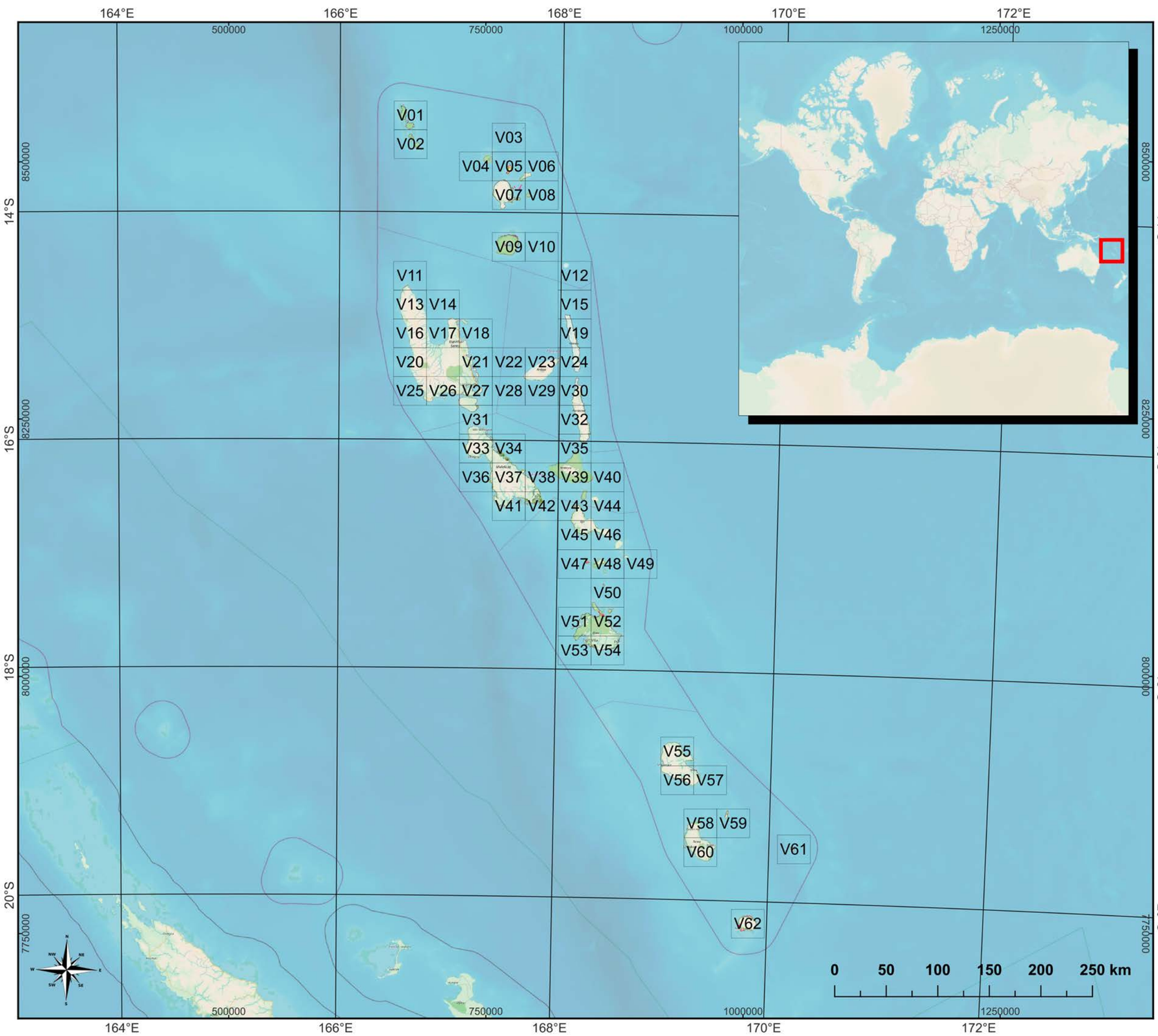

OVERVIEW - 62 TABLES

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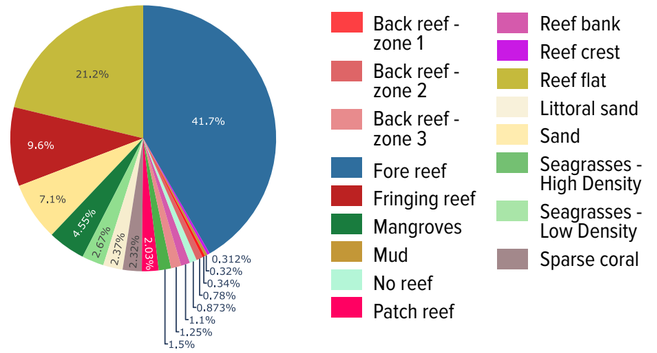
MARINE HABITATS



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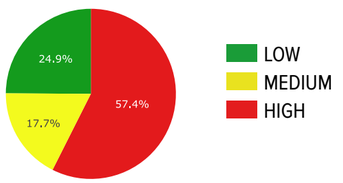

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Geographic Coordinate system: WGS84 - EPSG:4326

Basemap: OpenStreetMap from OSM Foundation (year 2022)

Bathymetry: GEBCO General Bathymetric Chart of the Oceans (year 2021)

Remote Sensing Images: Sentinel-2 (years 2018-2019)

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MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

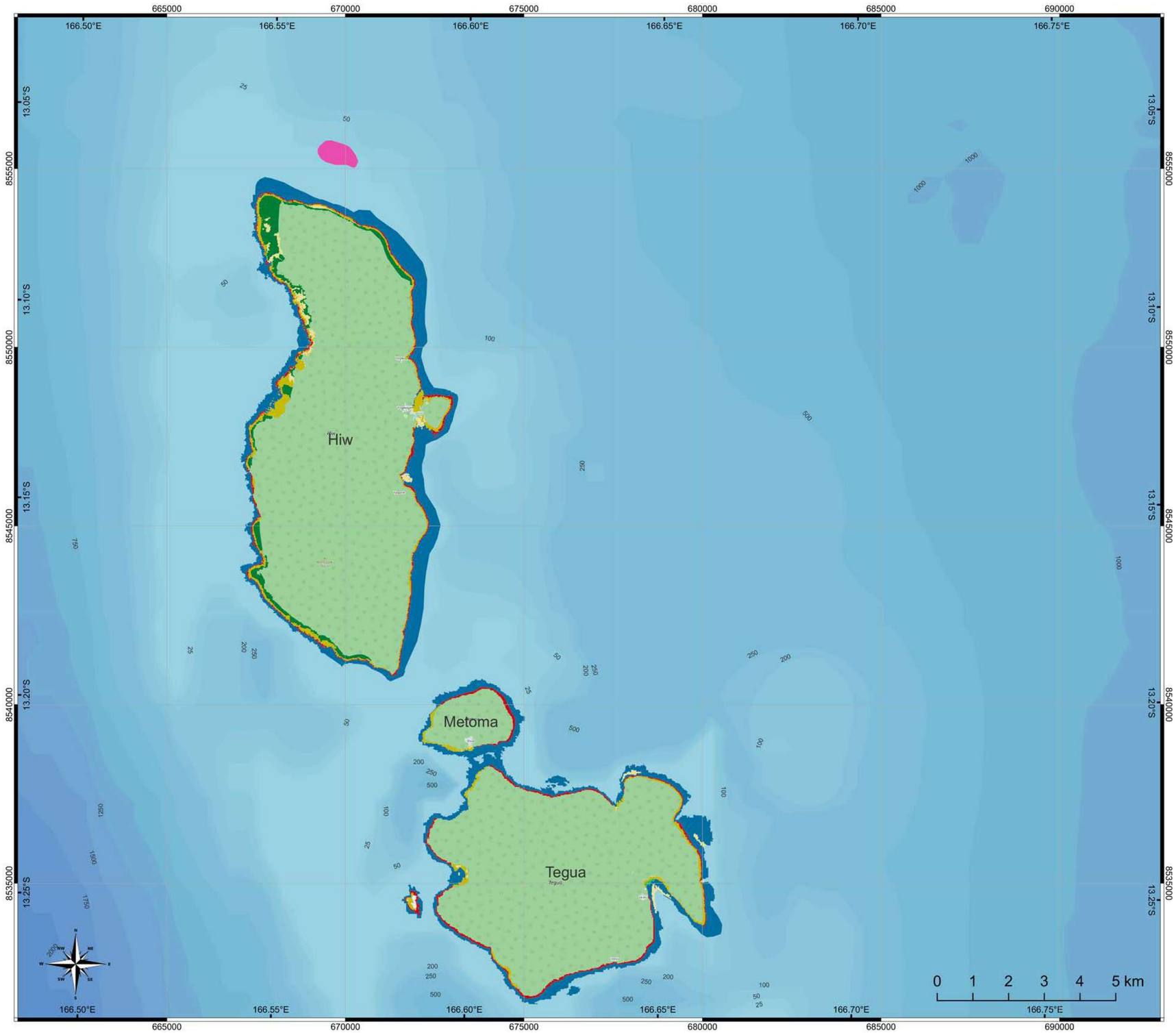

TABLE 1 OF 62 - V01
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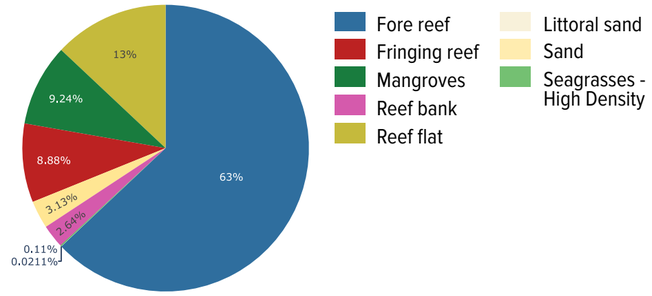

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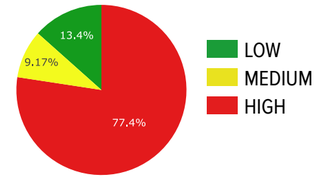

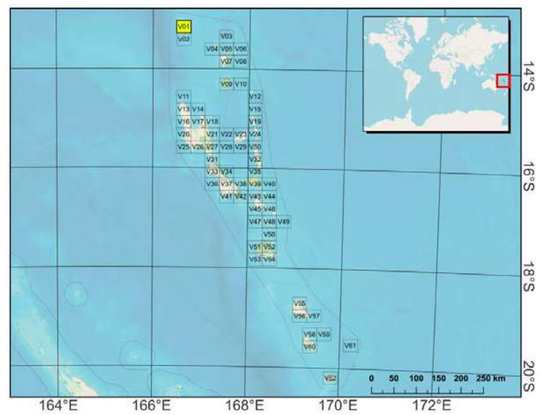

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Bathymetry: GEBCO General Bathymetric Chart of the Oceans (year 2021)
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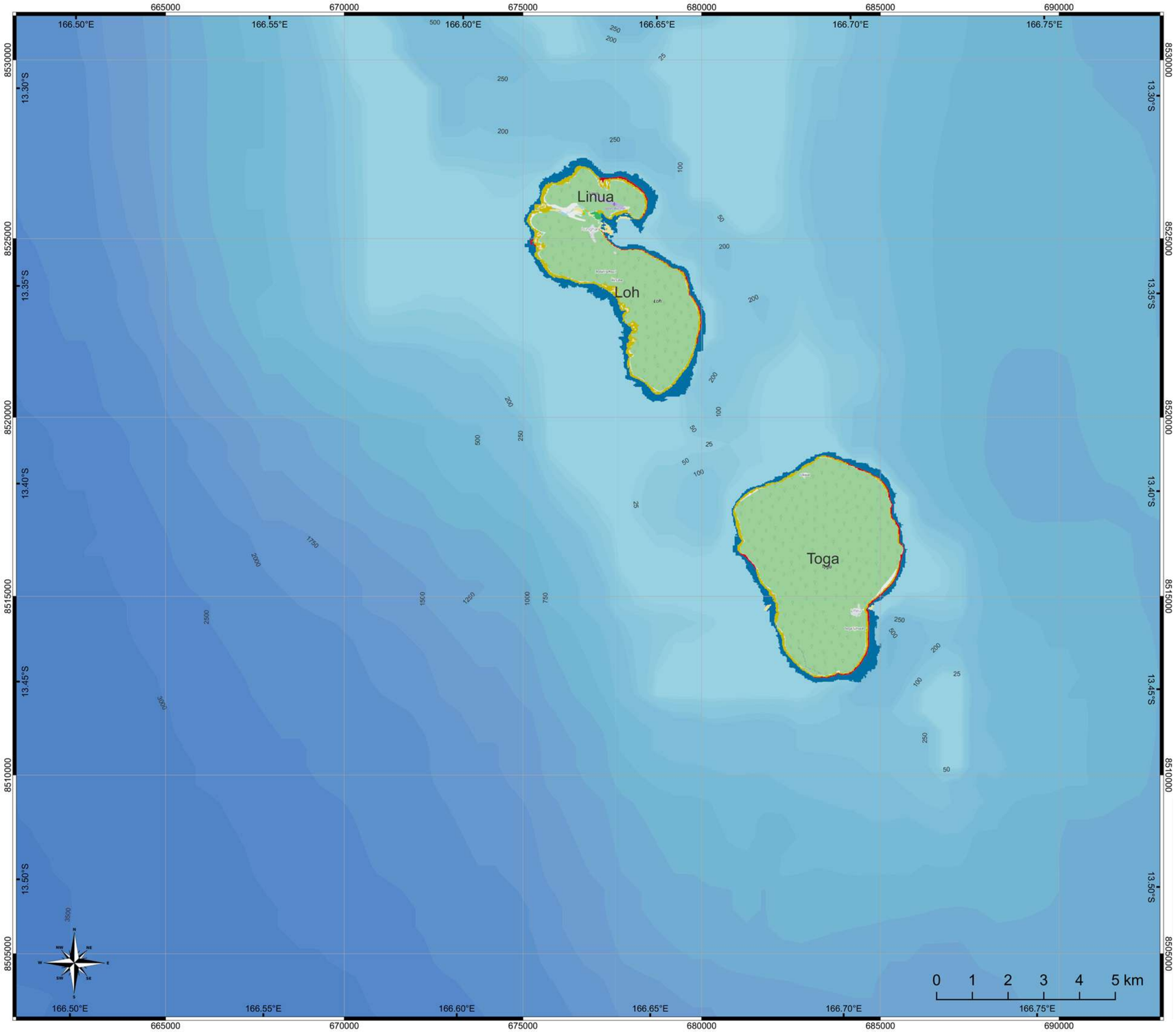
MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA



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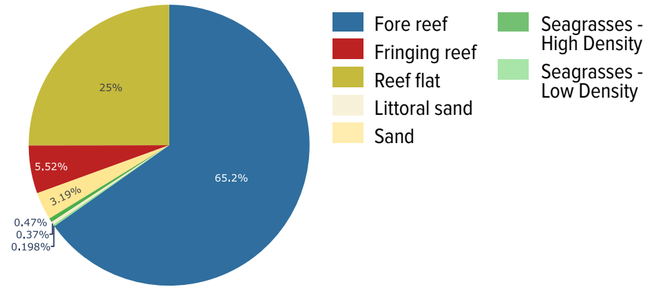

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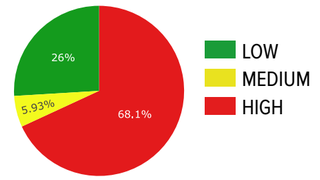

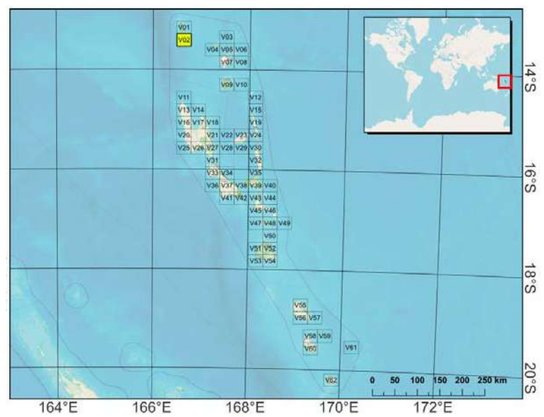

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Remote Sensing Image: Sentinel-2 (years 2018-2019)

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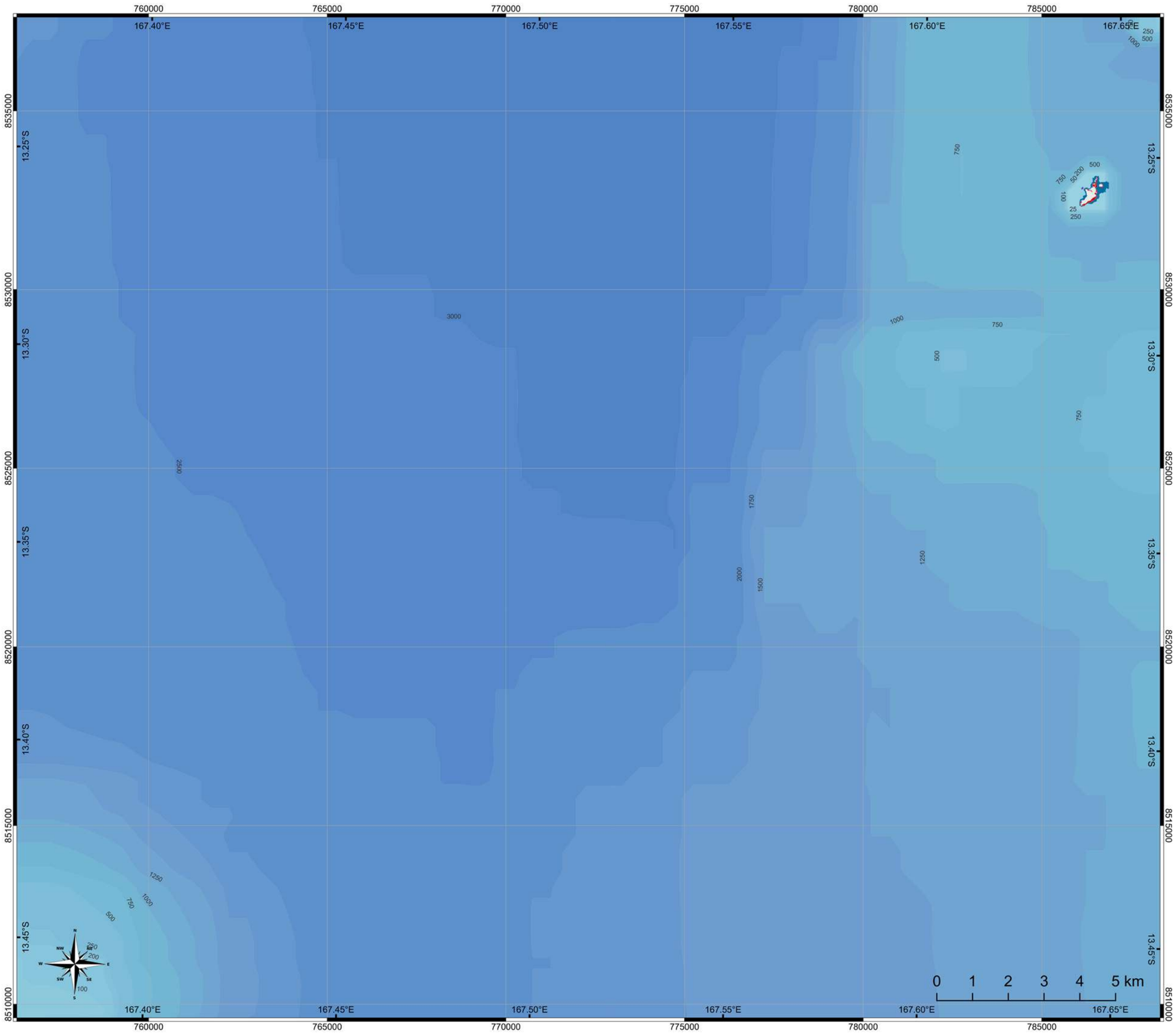
MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA



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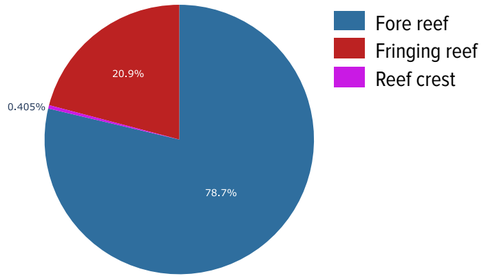

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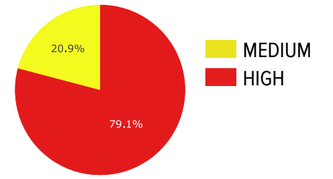

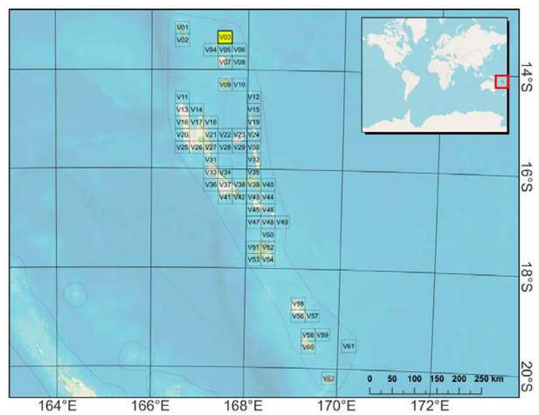

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Remote Sensing Image: Sentinel-2 (years 2018-2019)

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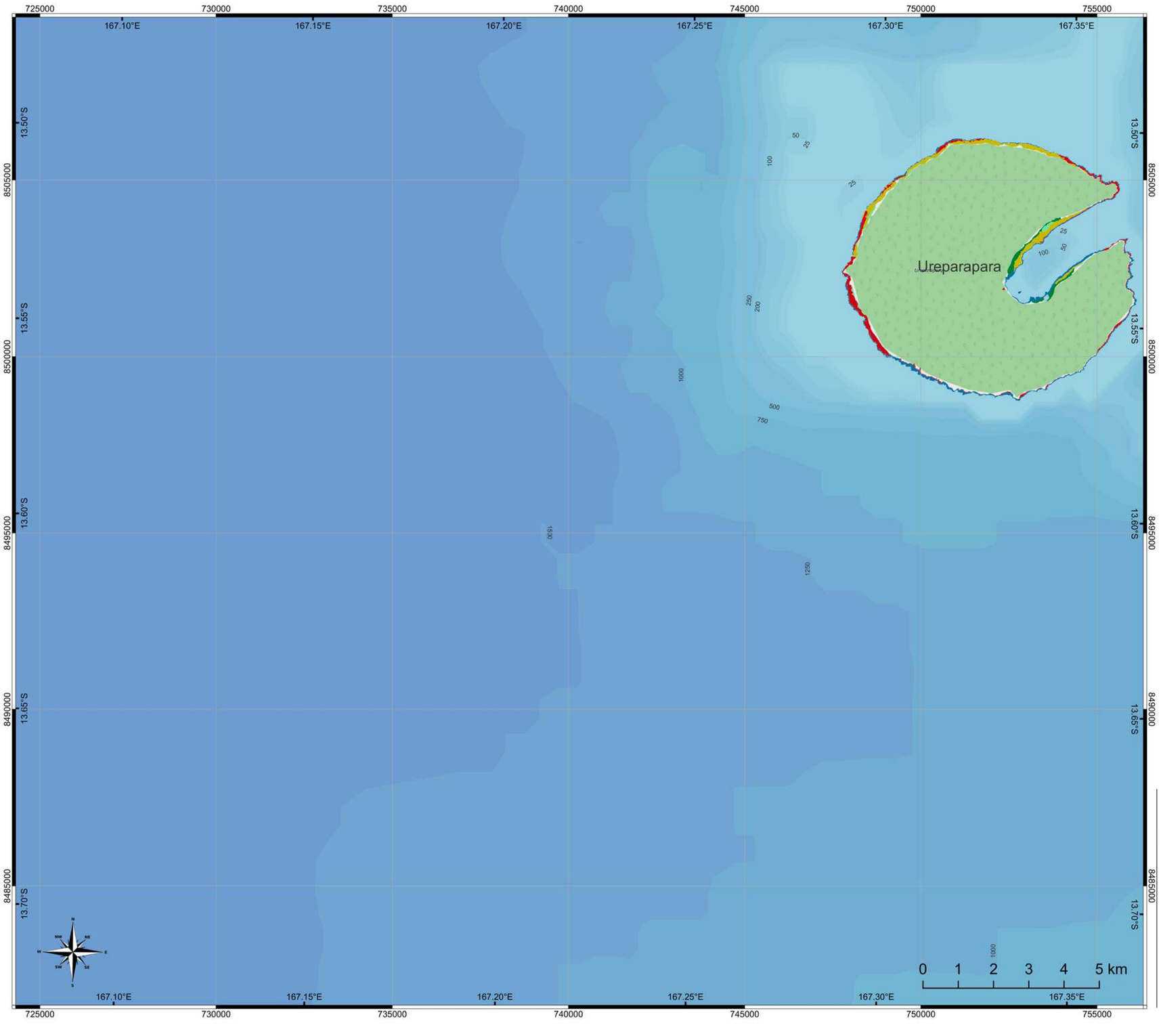
MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA



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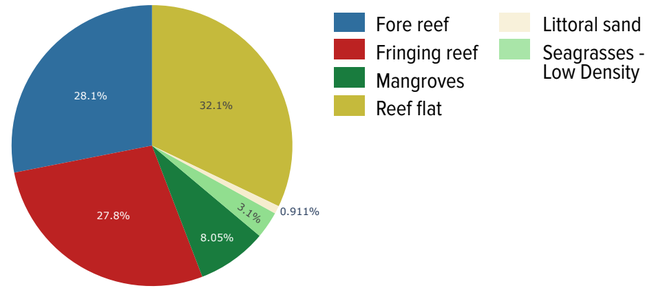

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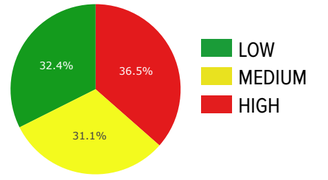

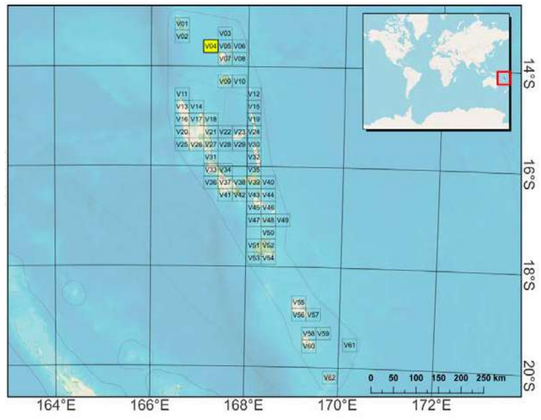

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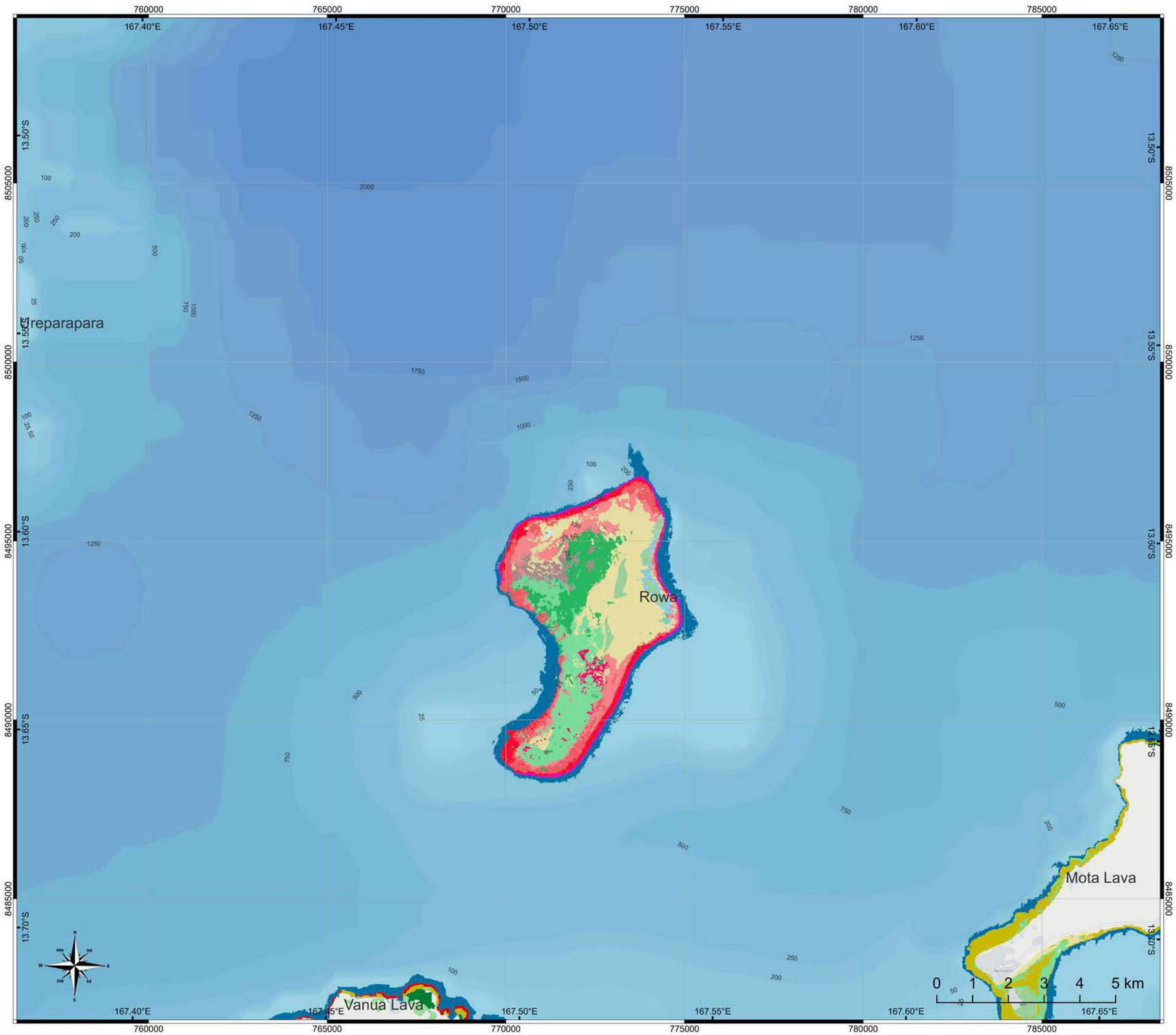
MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA



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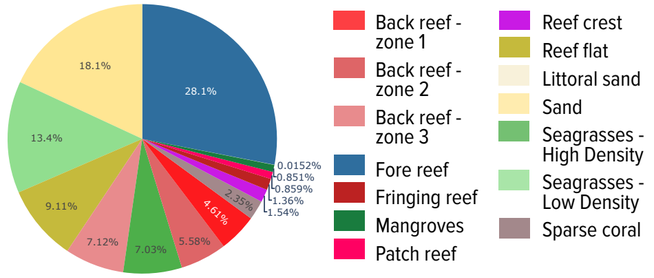

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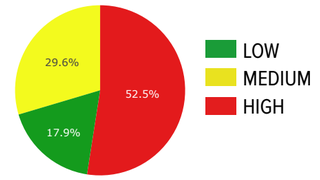

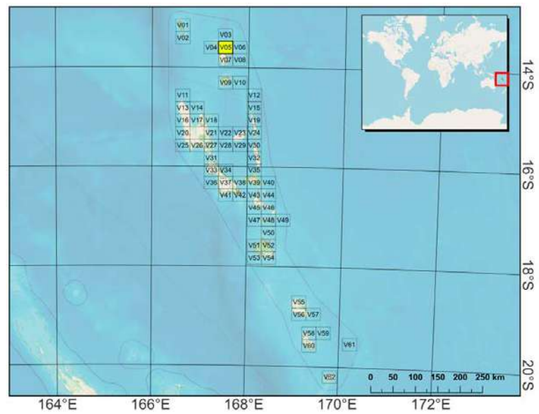

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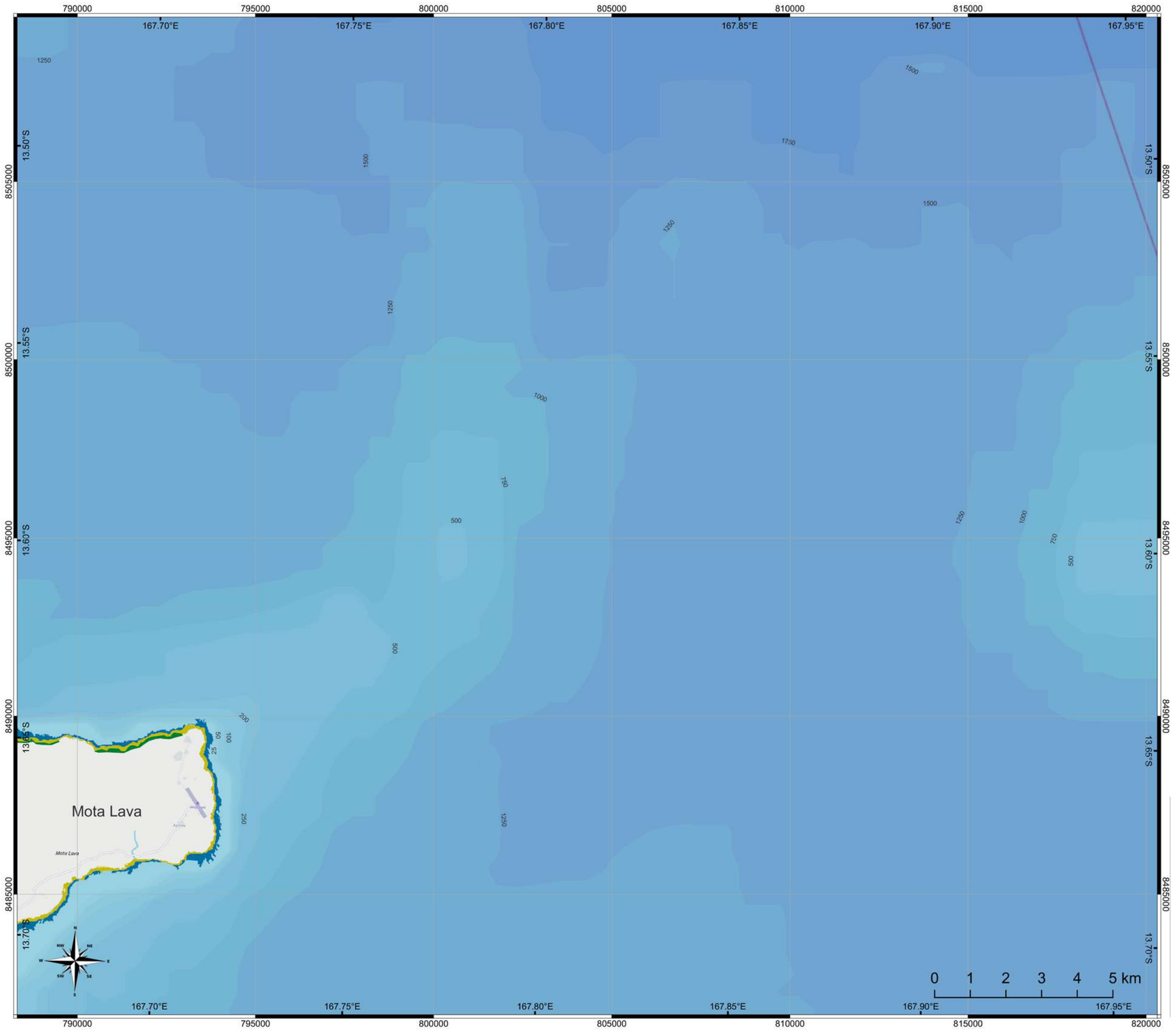

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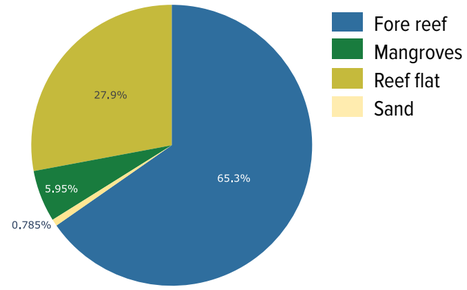

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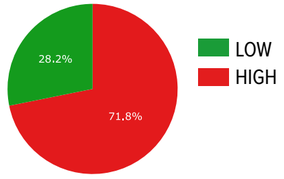

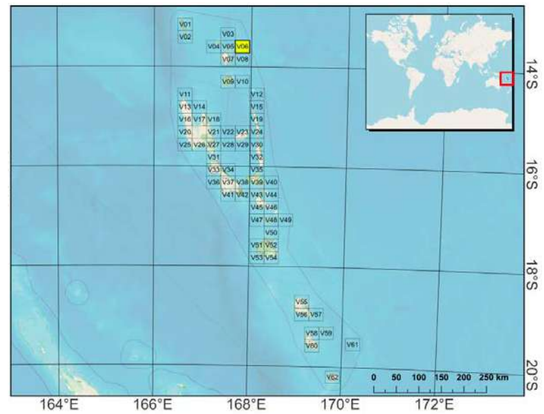

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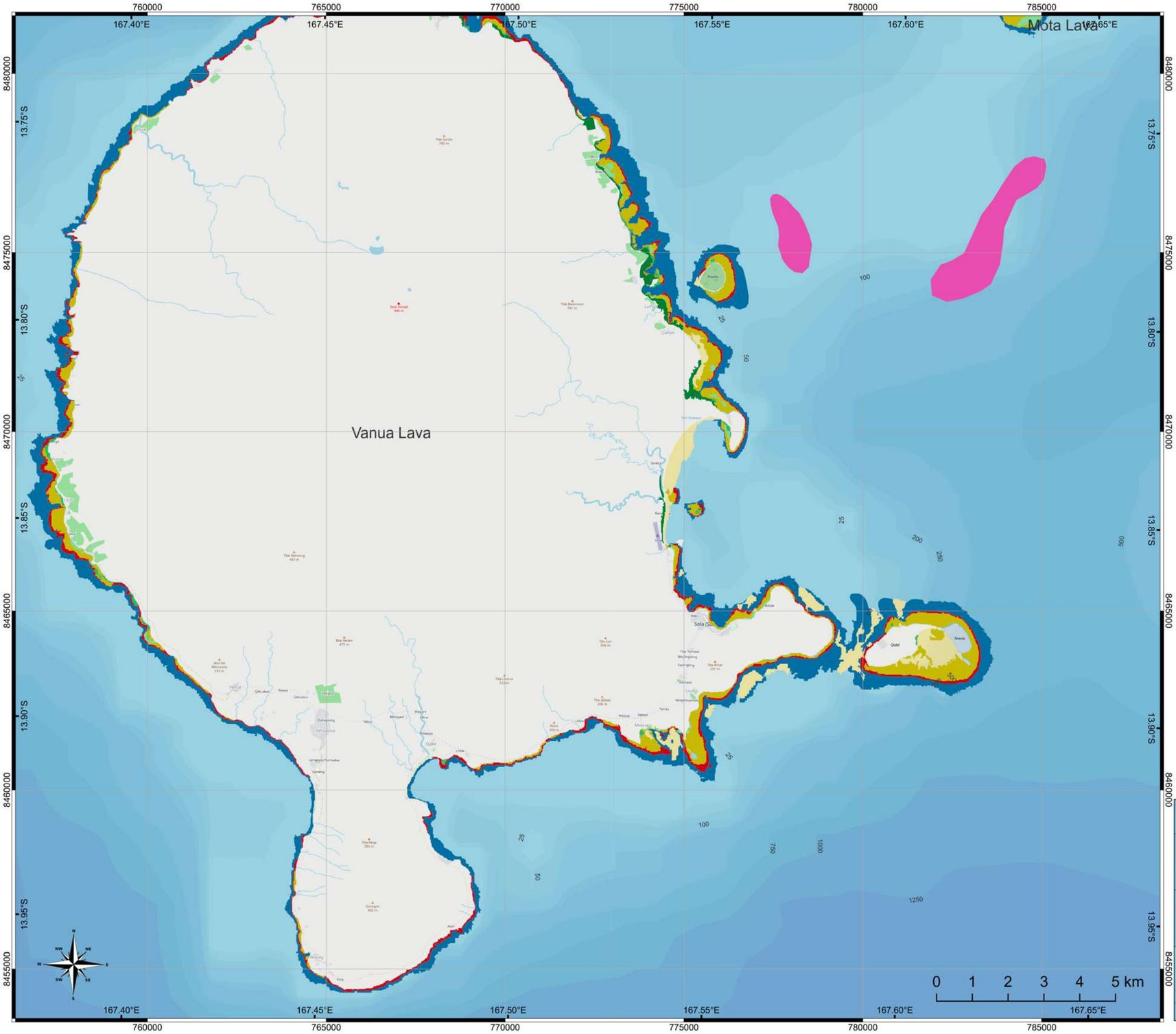
MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA



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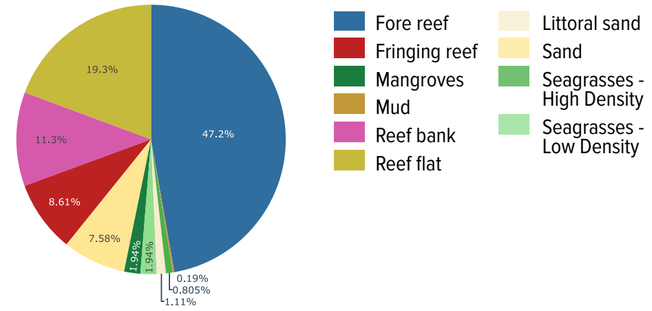

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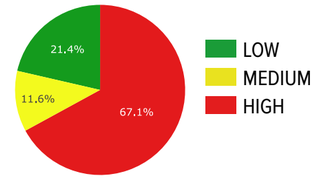

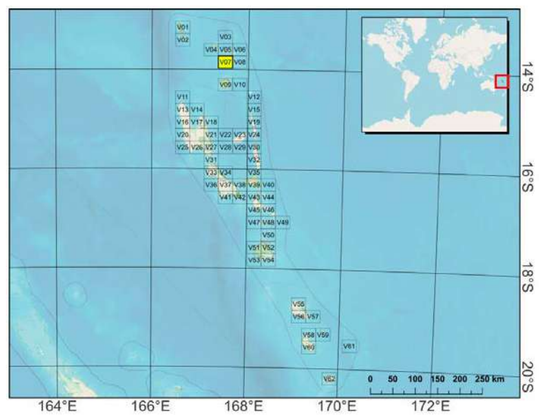

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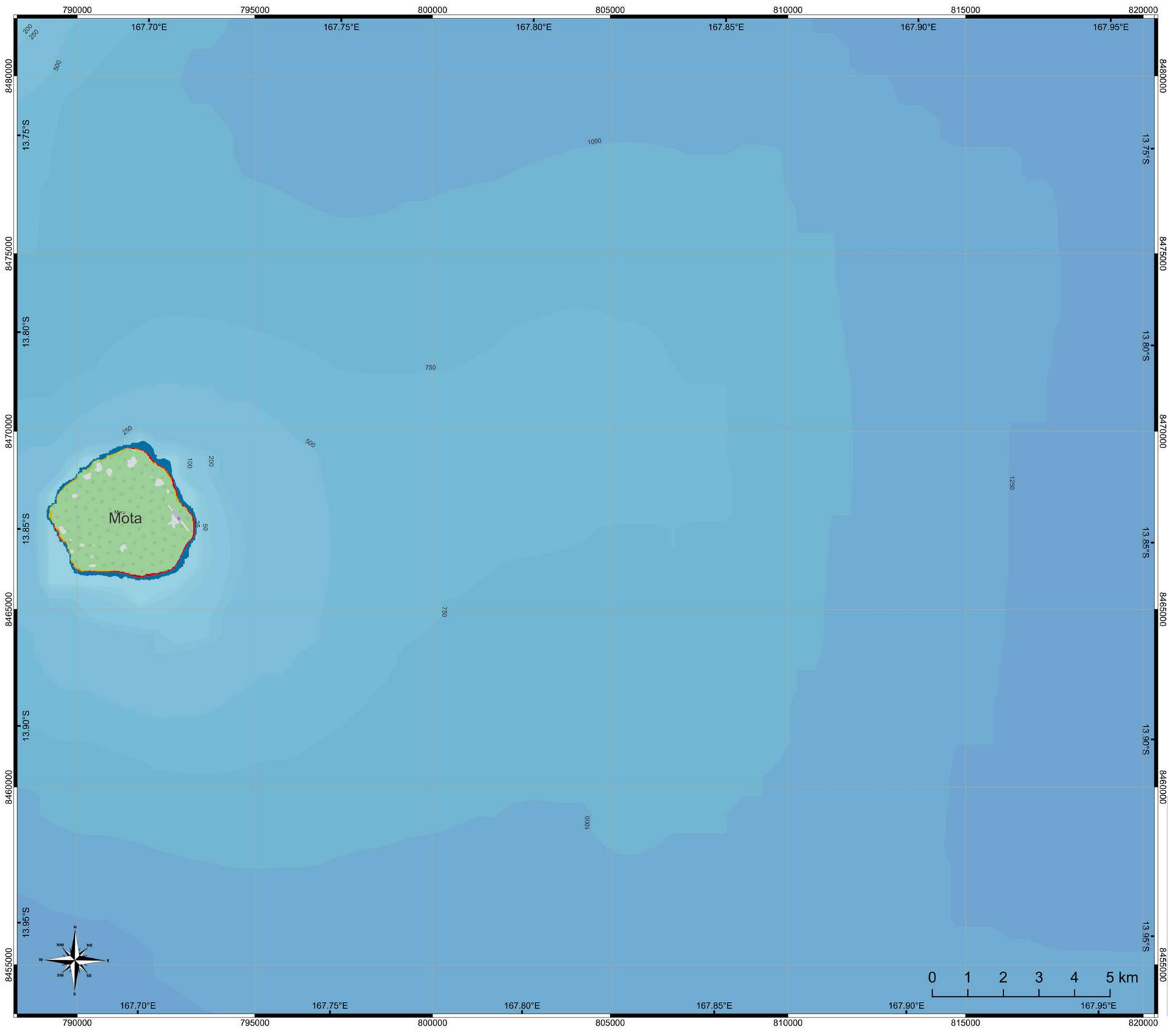
MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA



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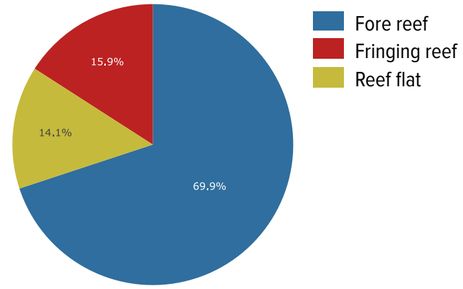

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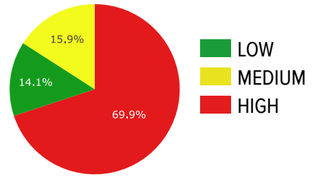

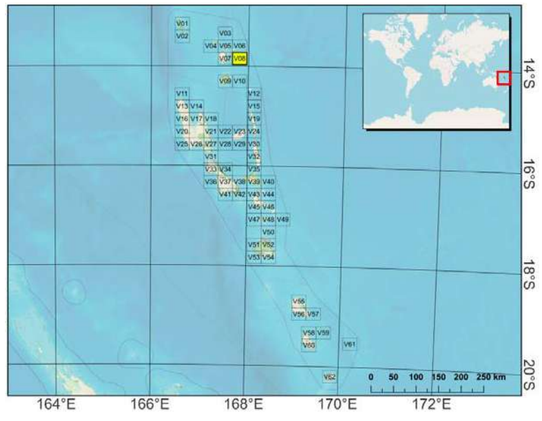

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Remote Sensing Image: Sentinel-2 (years 2018-2019)

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MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

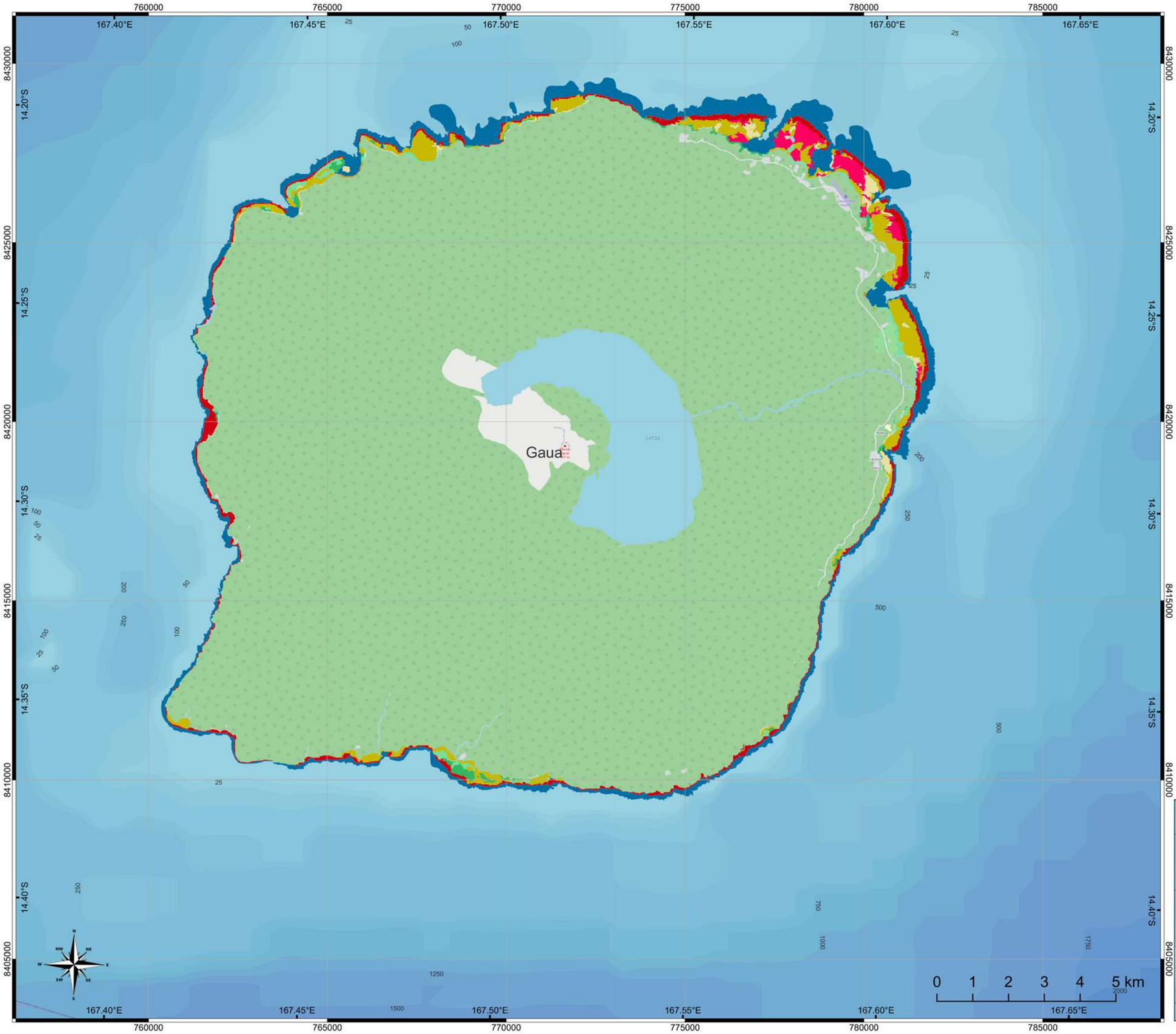

TABLE 9 OF 62 - V09
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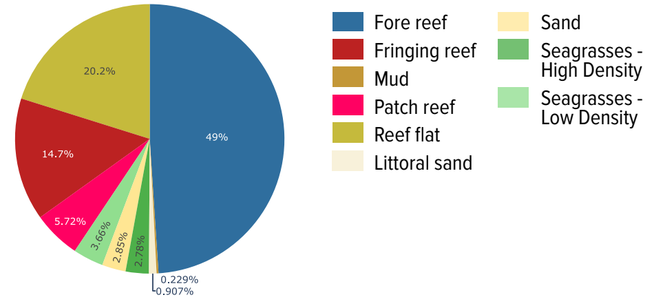
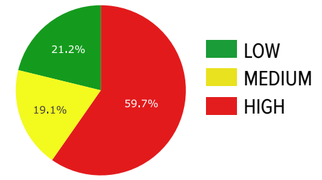
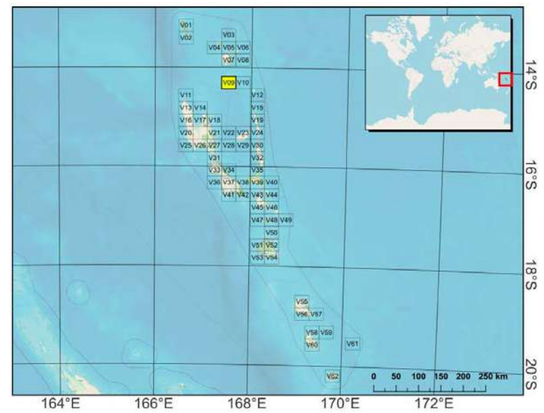
MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
Bathymetry: GEBCO General Bathymetric Chart of the Oceans (year 2021)
Remote Sensing Image: Sentinel-2 (years 2018-2019)

ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

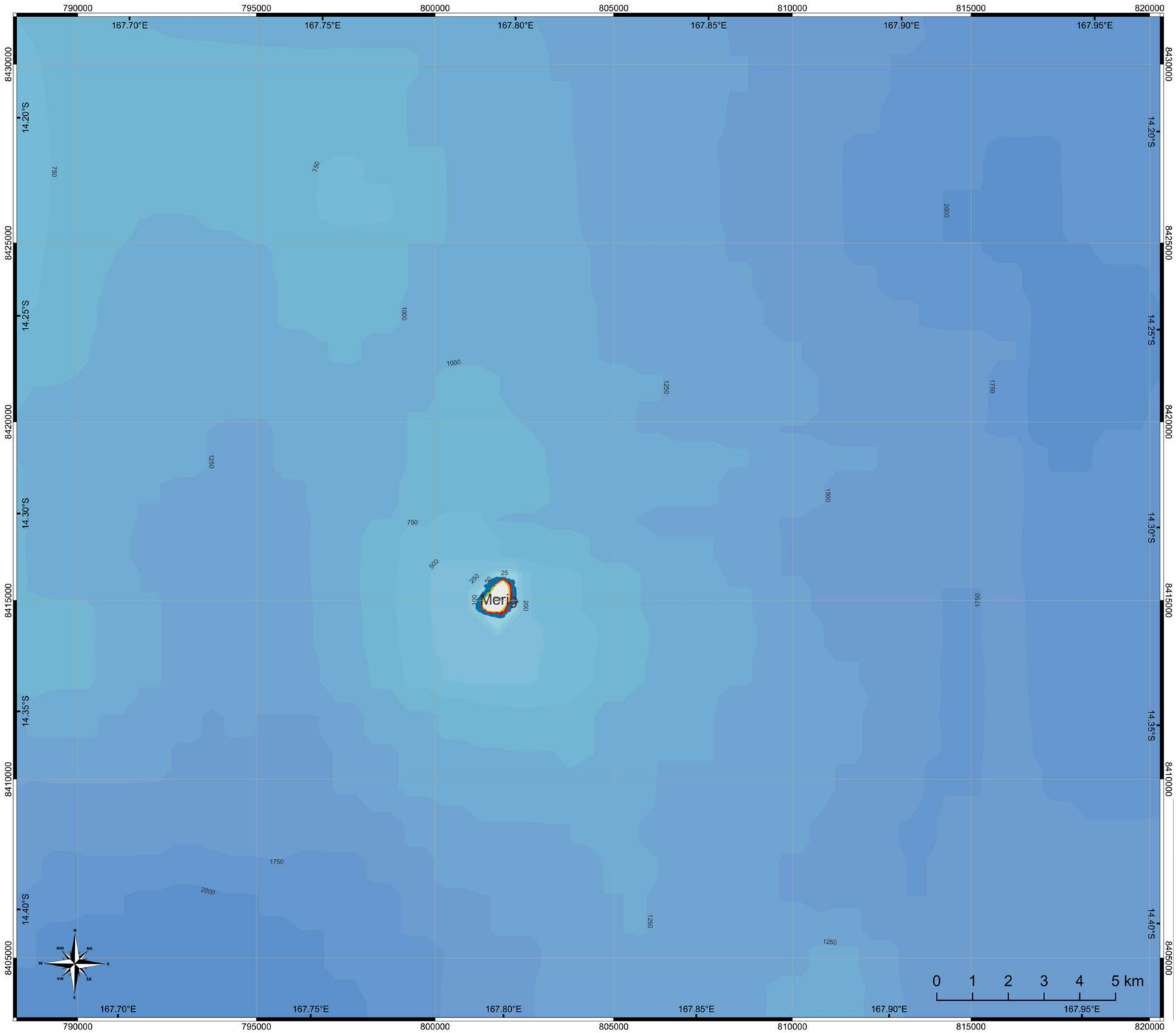
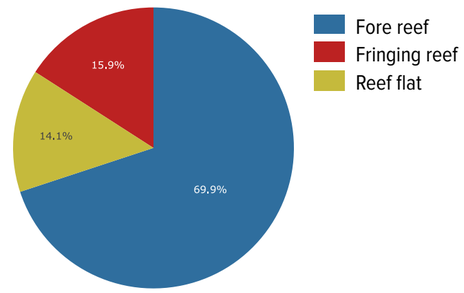


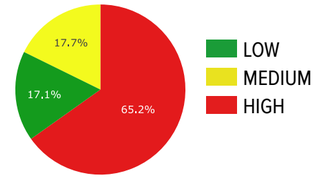
TABLE 10 OF 62 - V10

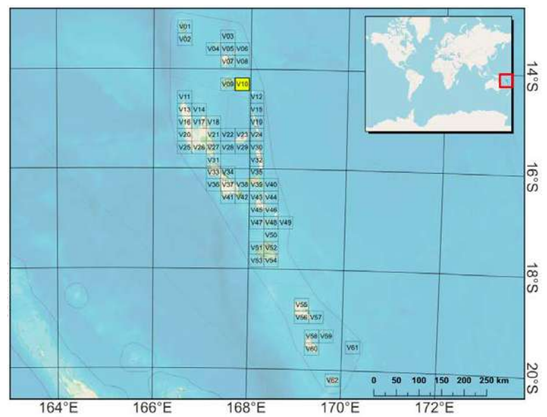
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
Bathymetry: GEBCO General Bathymetric Chart of the Oceans (year 2021)
Remote Sensing Image: Sentinel-2 (years 2018-2019)

ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

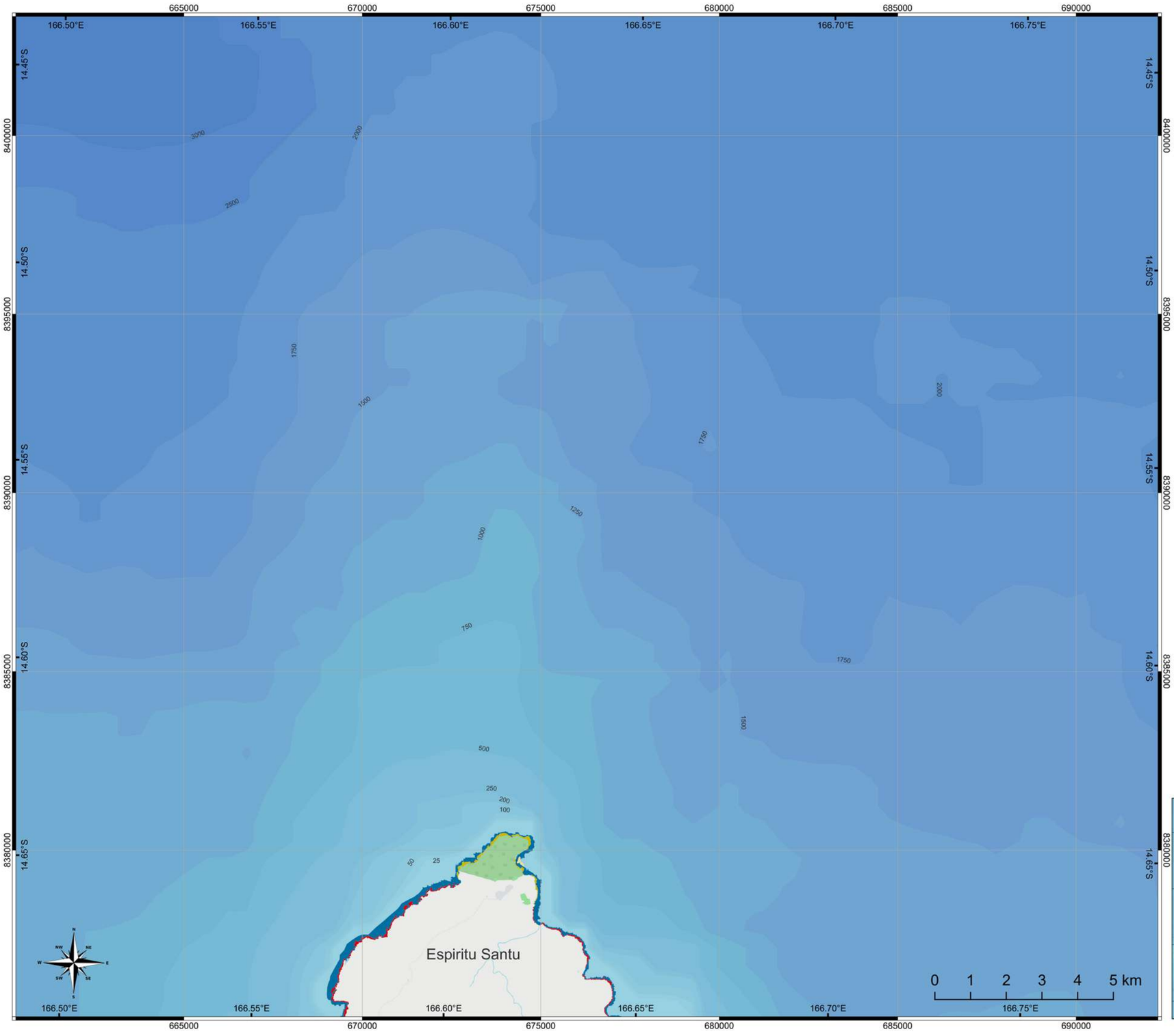
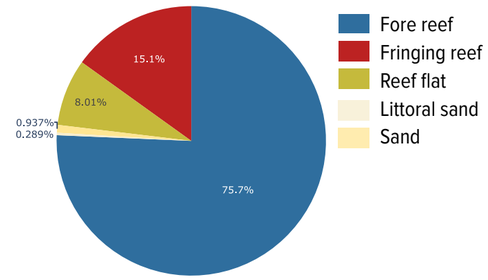


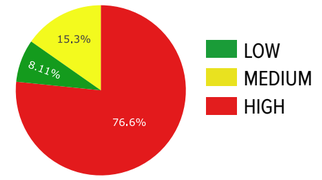
TABLE 11 OF 62 - V11

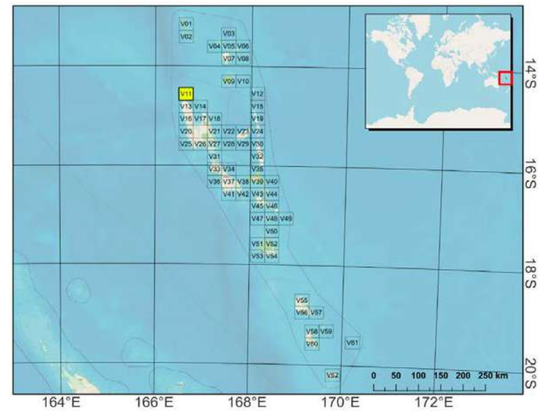
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
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ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

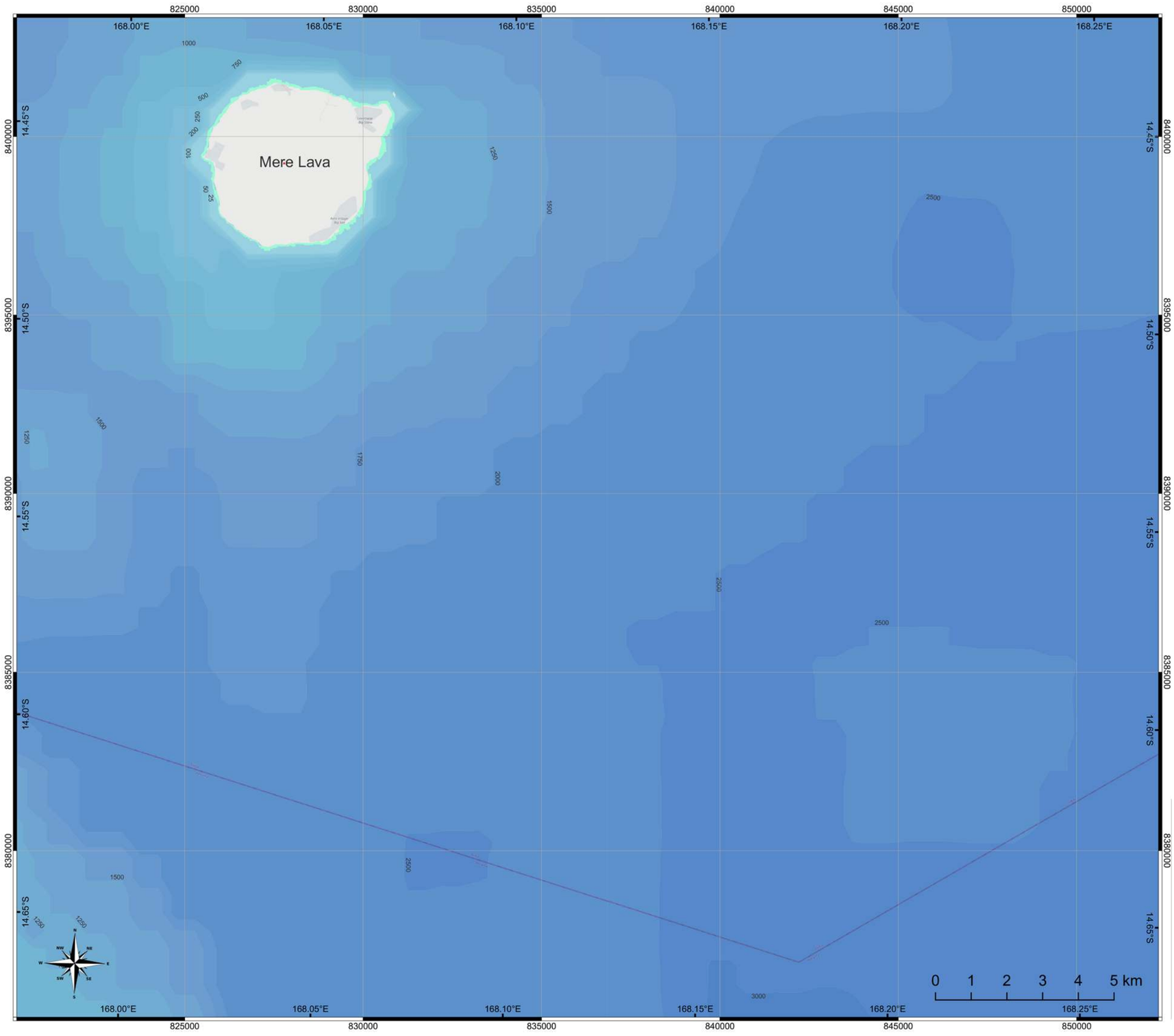
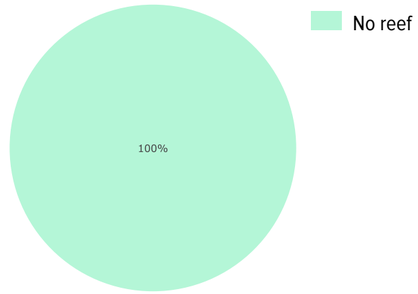
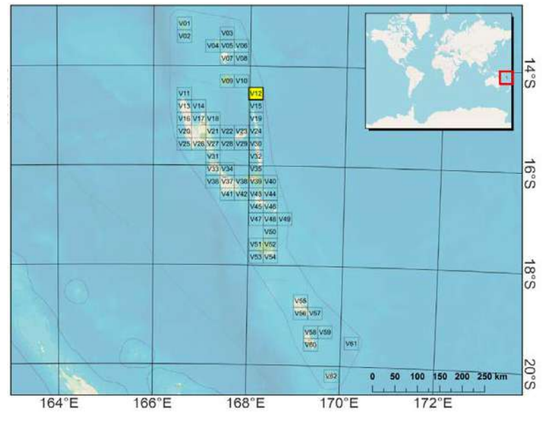


TABLE 12 OF 62 - V12
SCALE 1:100,000

MARINE HABITATS





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
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ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

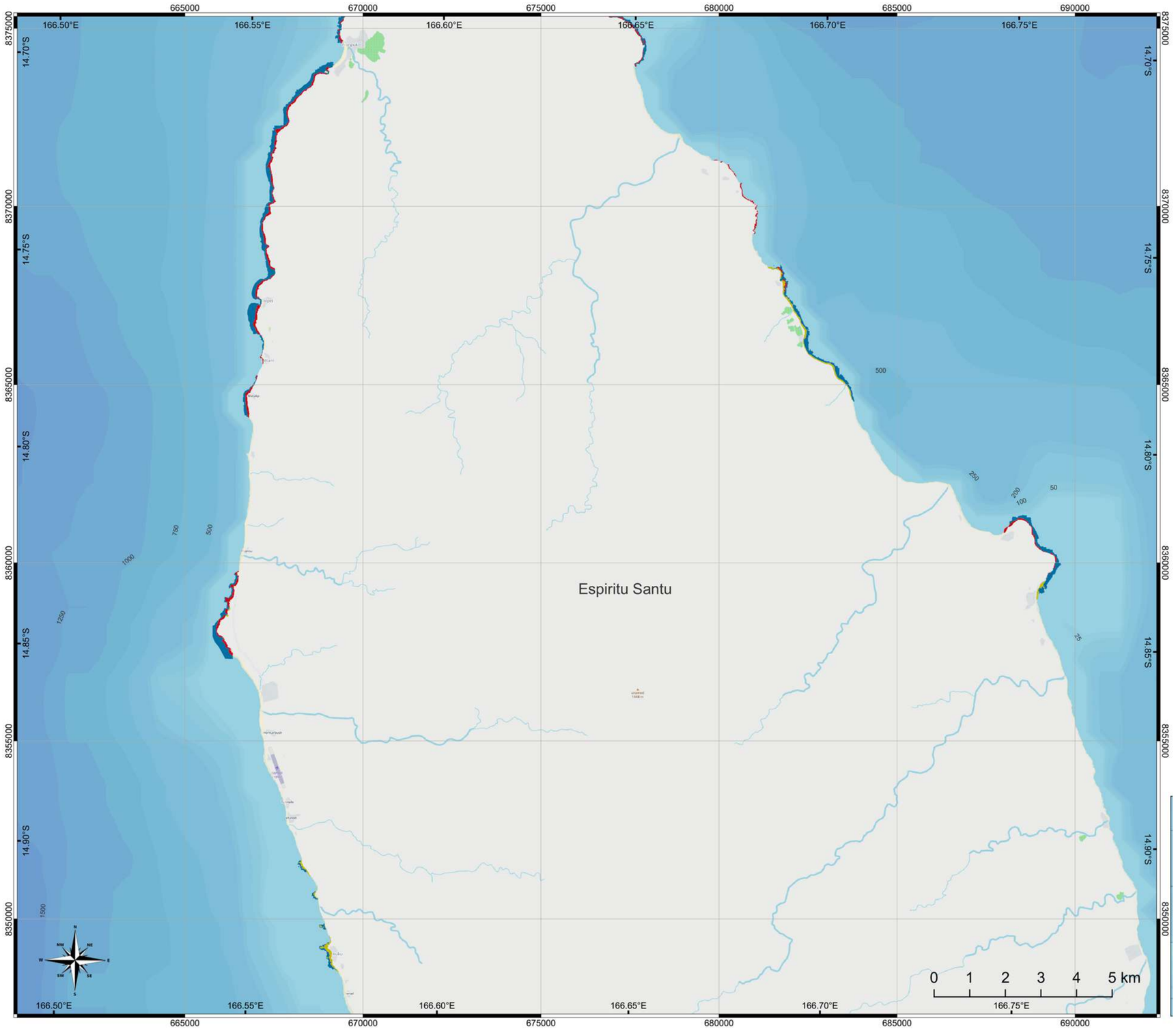
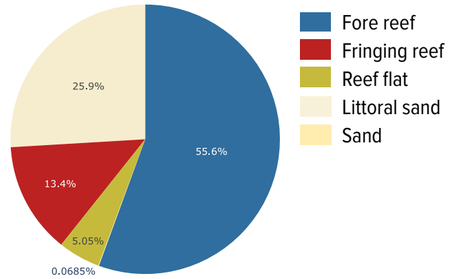


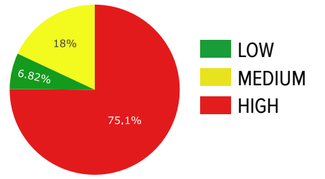
TABLE 13 OF 62 - V13

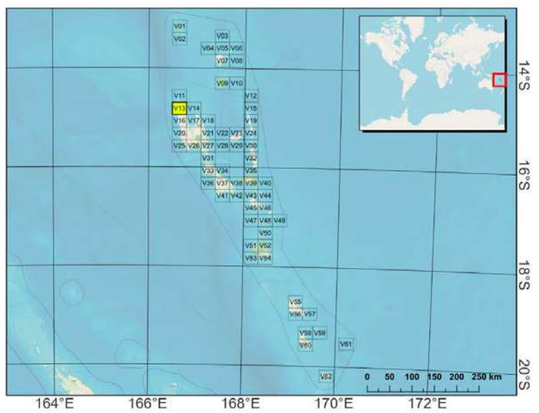
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
Bathymetry: GEBCO General Bathymetric Chart of the Oceans (year 2021)
Remote Sensing Image: Sentinel-2 (years 2018-2019)

ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

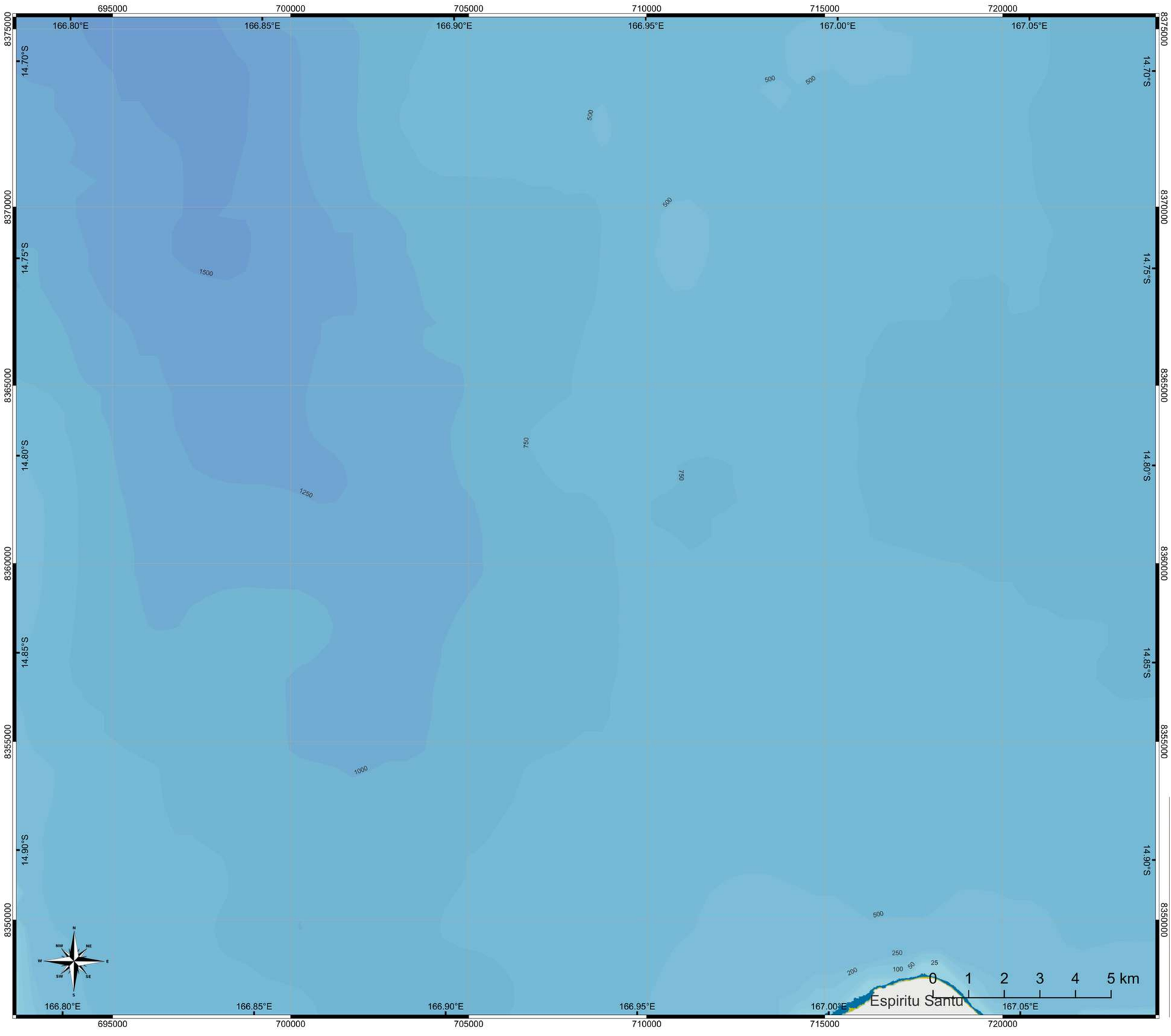
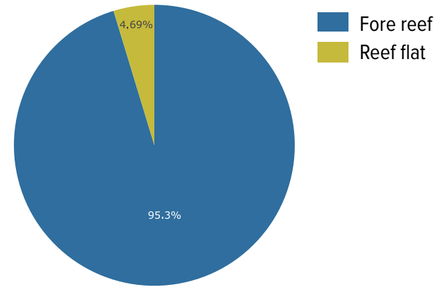


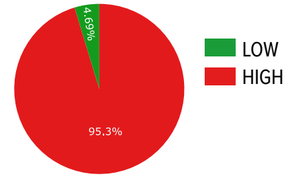
TABLE 14 OF 62 - V14

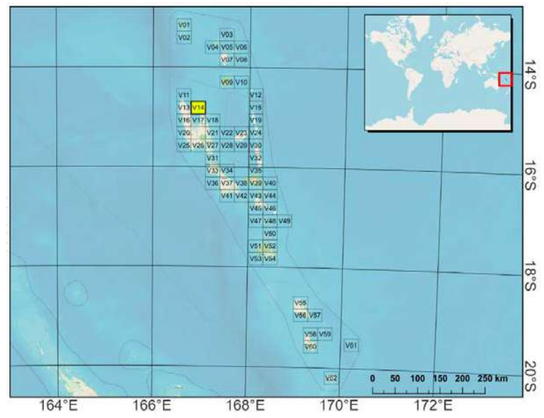
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Geographic Coordinate system: WGS84 - EPSG:4326
Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Basemap: OpenStreetMap from OSM Foundation (year 2022)
Bathymetry: GEBCO General Bathymetric Chart of the Oceans (year 2021)
Remote Sensing Image: Sentinel-2 (years 2018-2019)

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ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

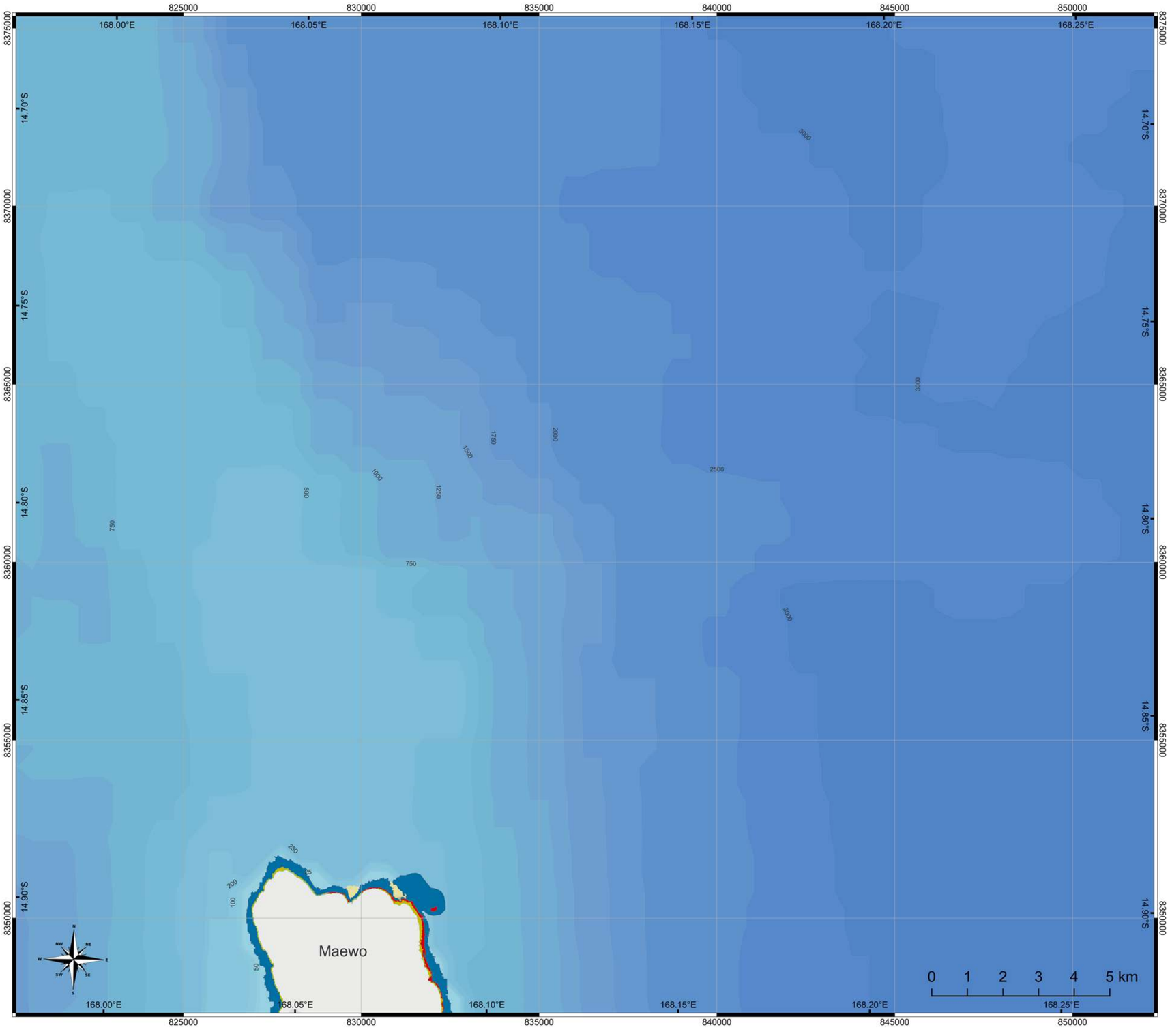
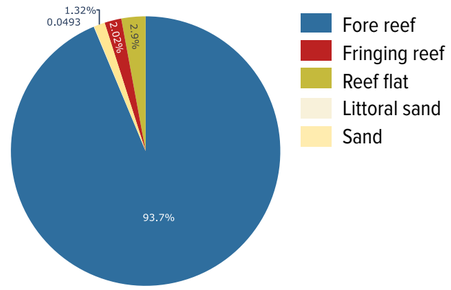
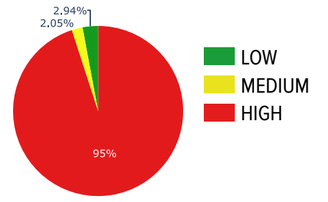


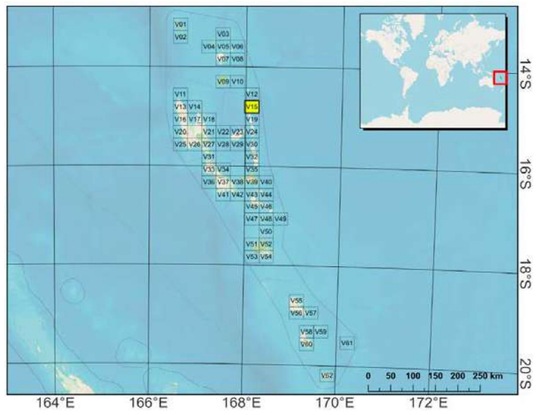
TABLE 15 OF 62 - V15
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
Bathymetry: GEBCO General Bathymetric Chart of the Oceans (year 2021)
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ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

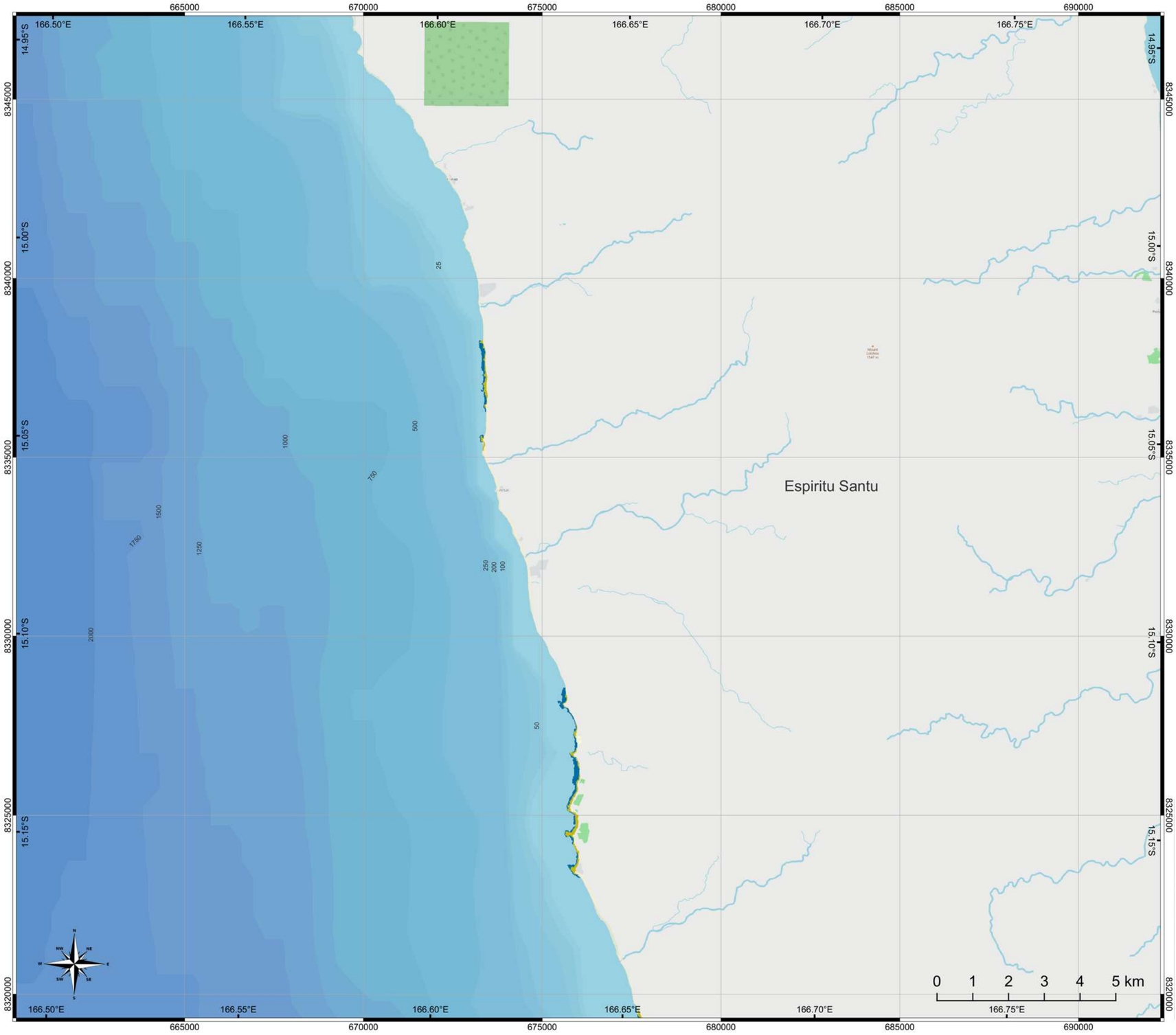
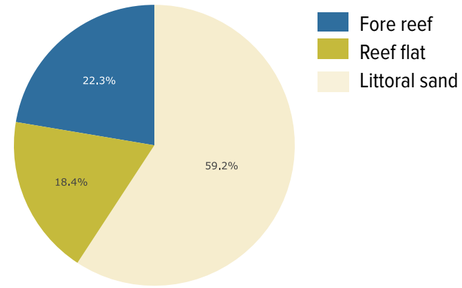


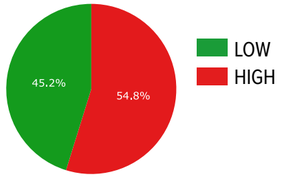
TABLE 16 OF 62 - V16

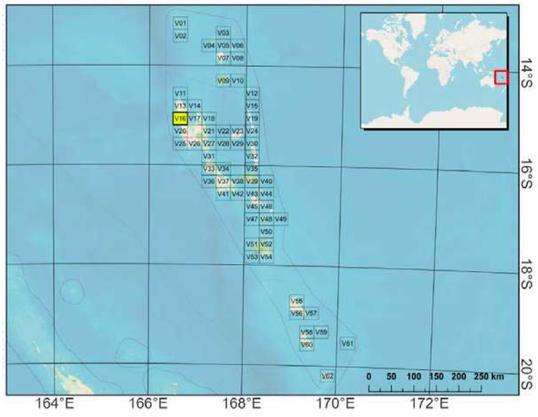
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Geographic Coordinate system: WGS84 - EPSG:4326
Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Basemap: OpenStreetMap from OSM Foundation (year 2022)
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ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

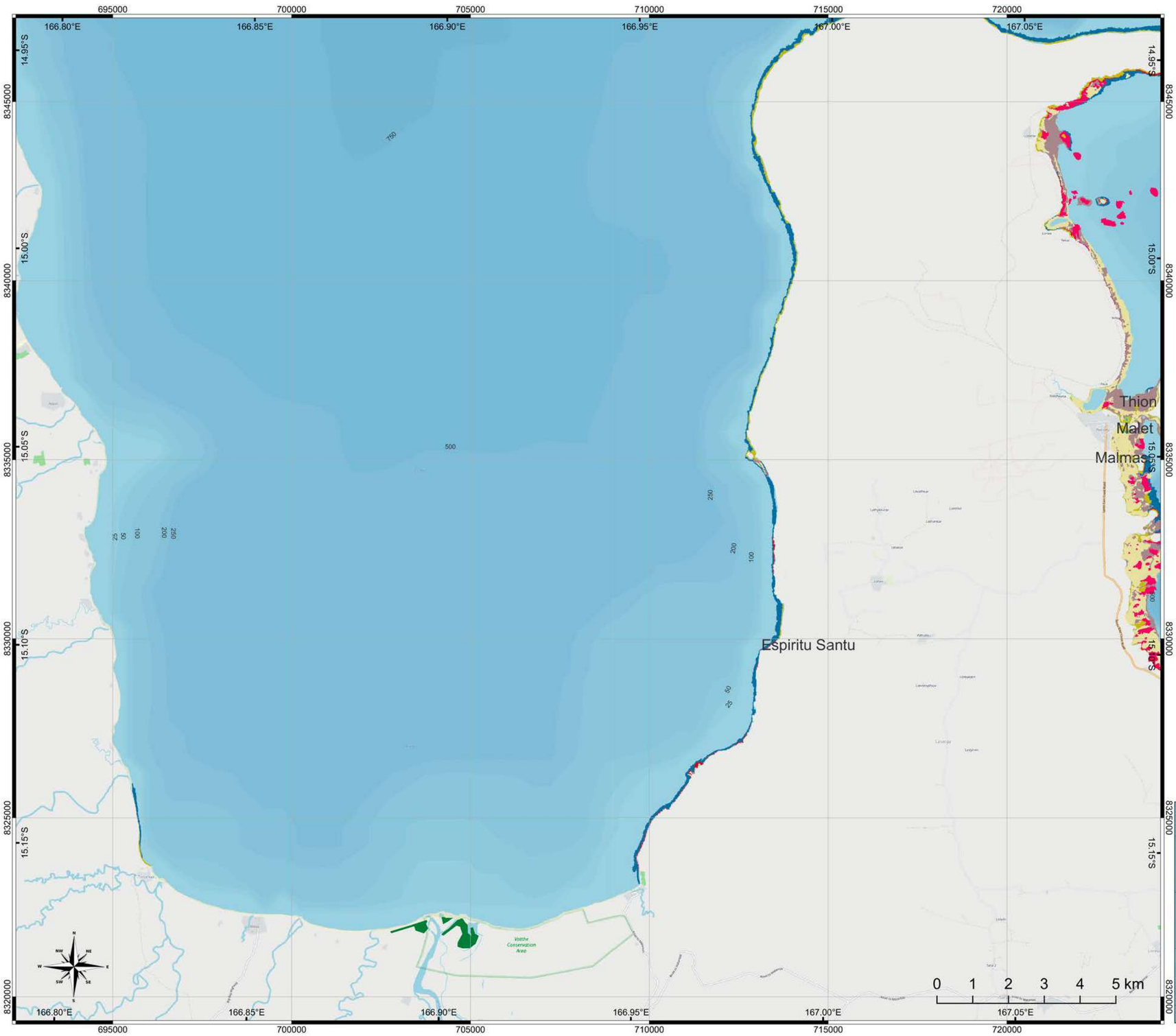
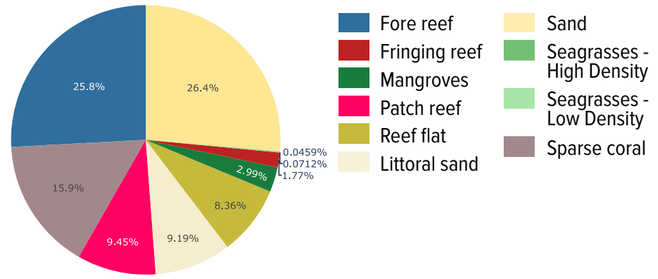


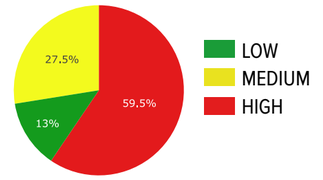
TABLE 17 OF 62 - V17

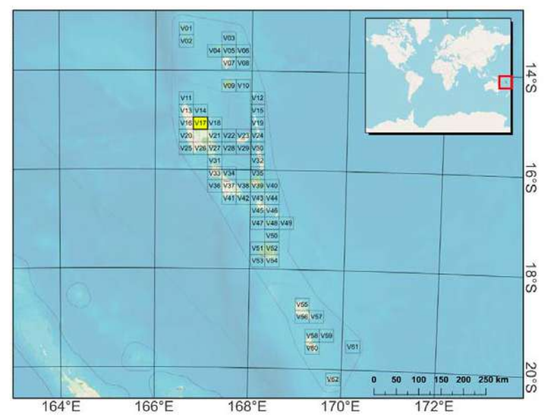
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
Bathymetry: GEBCO General Bathymetric Chart of the Oceans (year 2021)
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ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

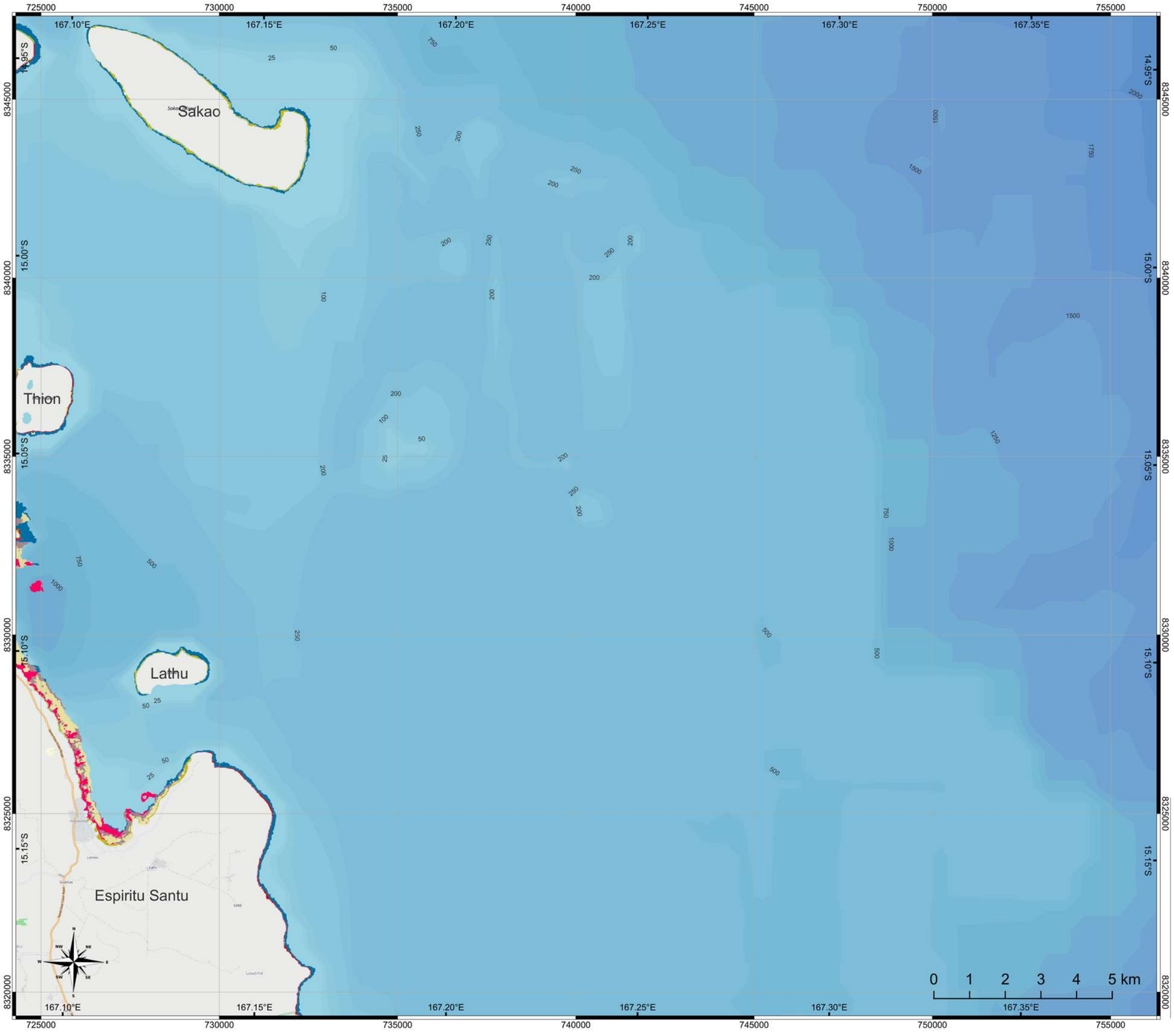
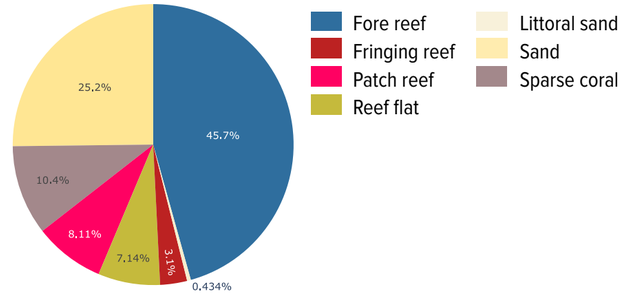


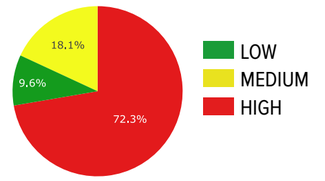
TABLE 18 OF 62 - V18

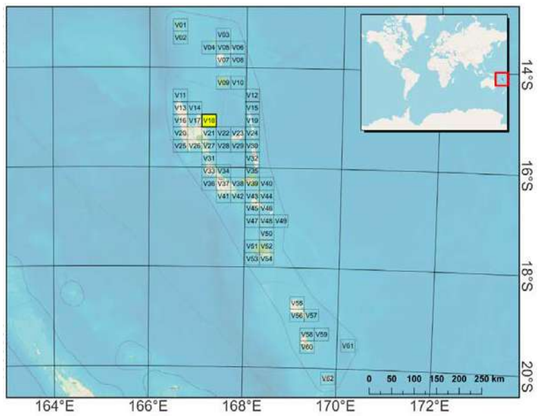
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





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Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
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ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

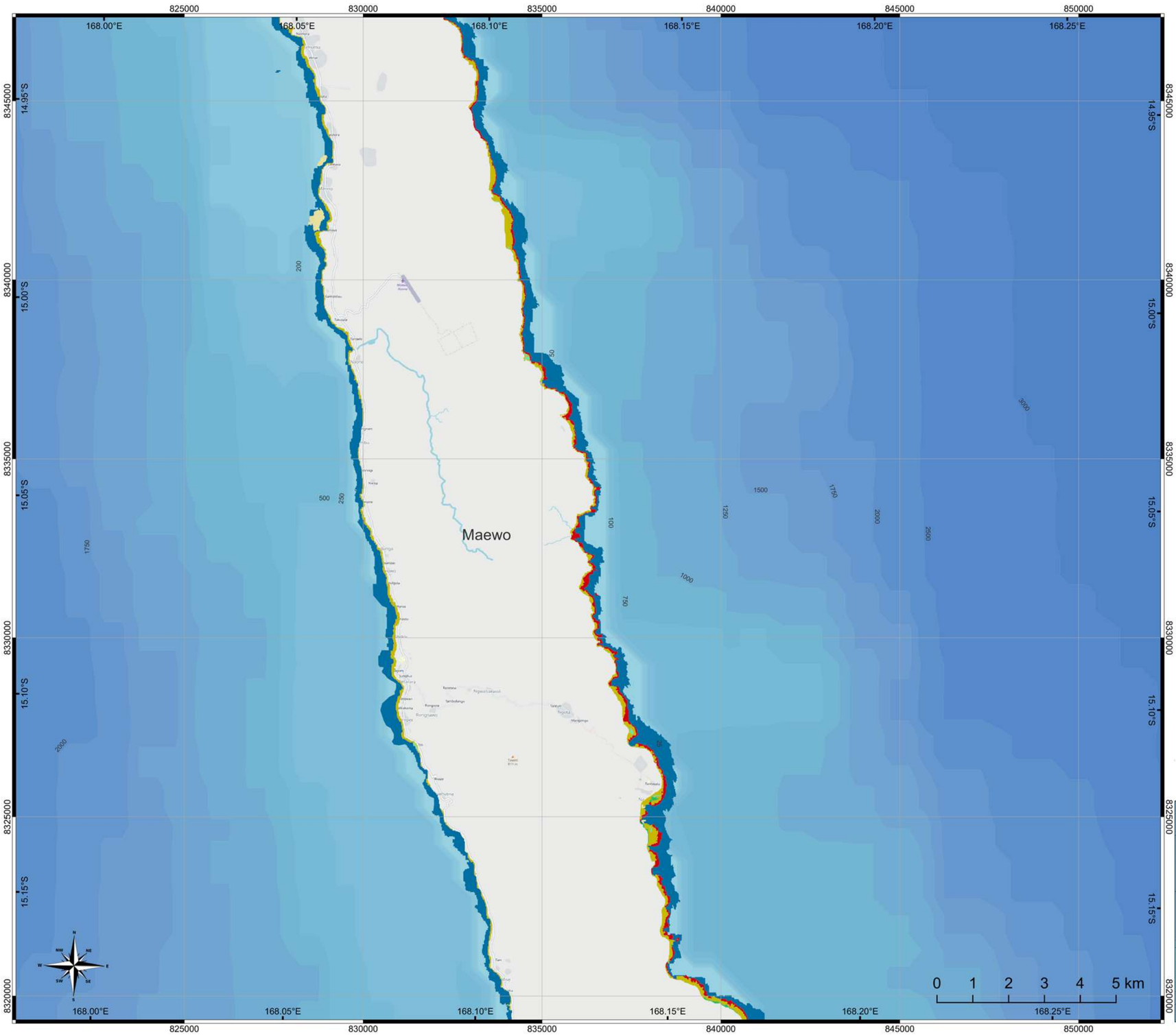
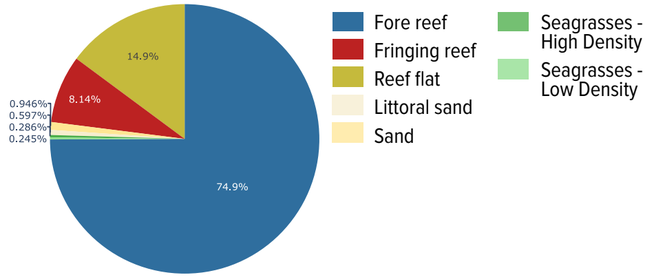


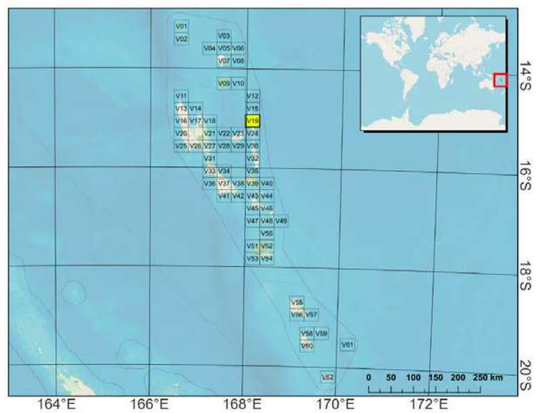
TABLE 19 OF 62 - V19

SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX



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Basemap: OpenStreetMap from OSM Foundation (year 2022)
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ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

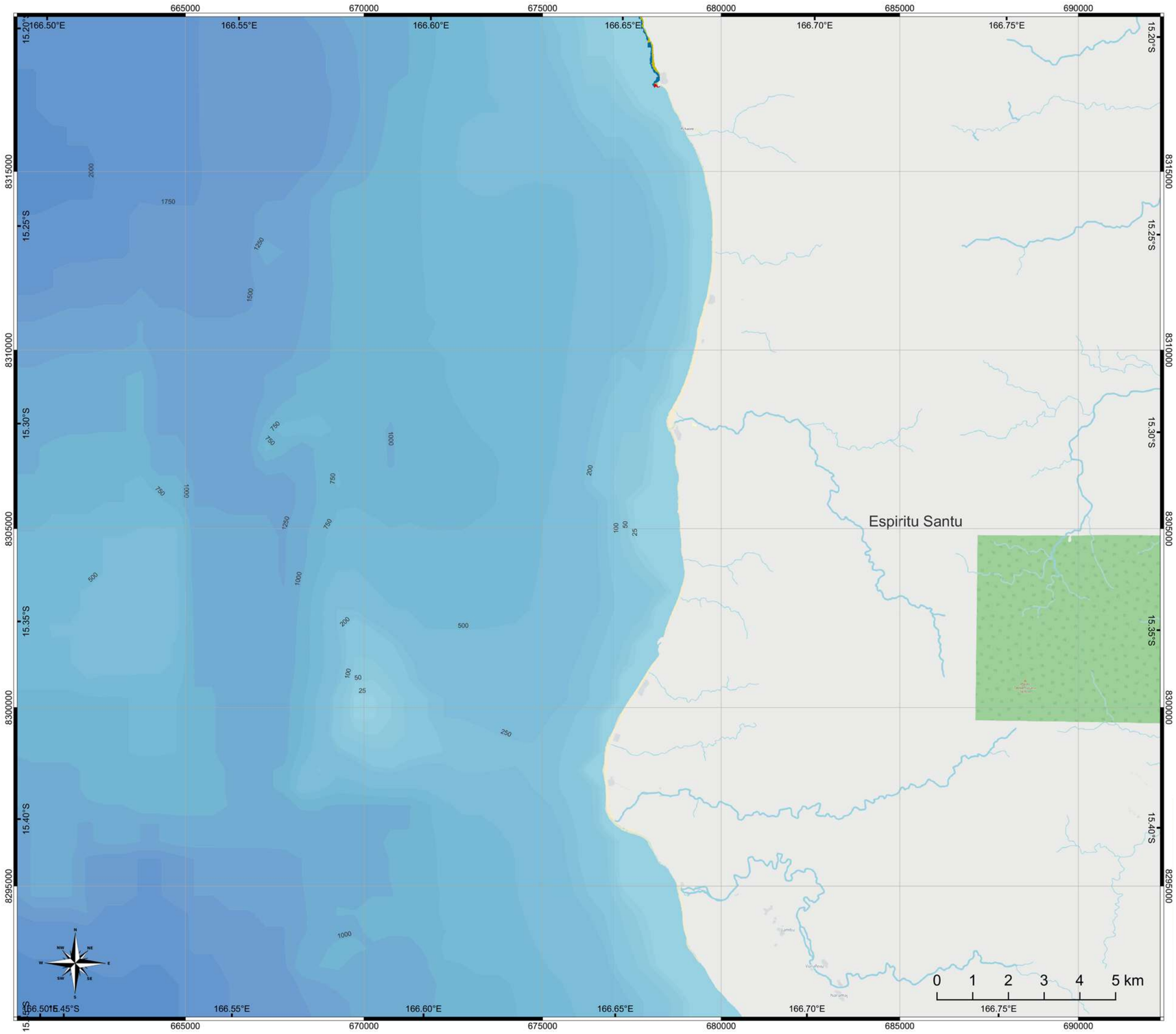
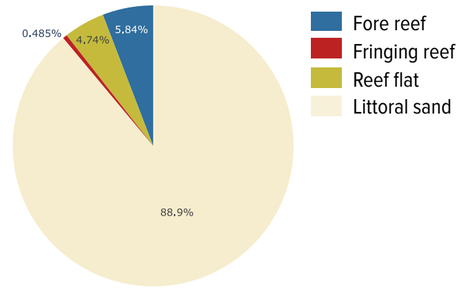


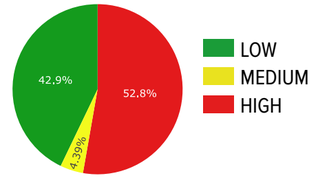
TABLE 20 OF 62 - V20

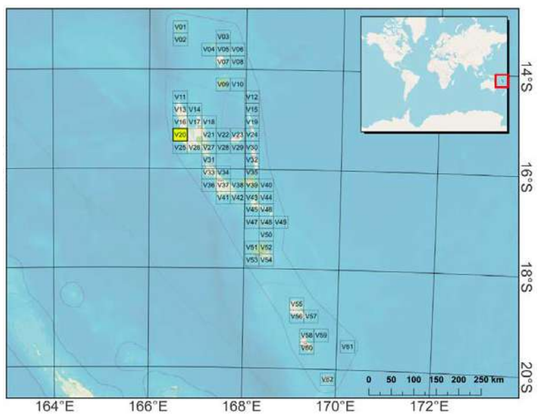
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
Bathymetry: GEBCO General Bathymetric Chart of the Oceans (year 2021)
Remote Sensing Image: Sentinel-2 (years 2018-2019)

ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

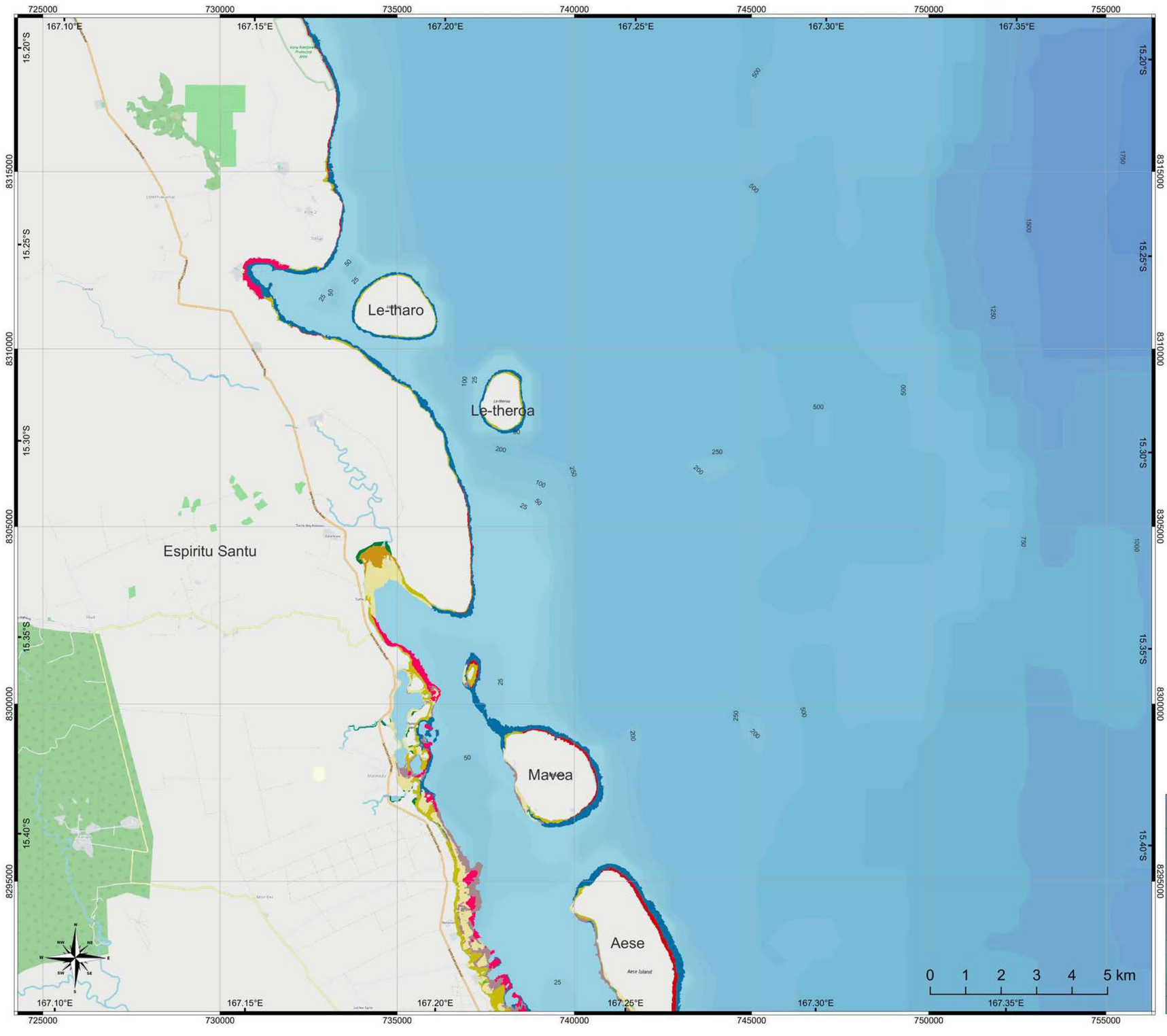
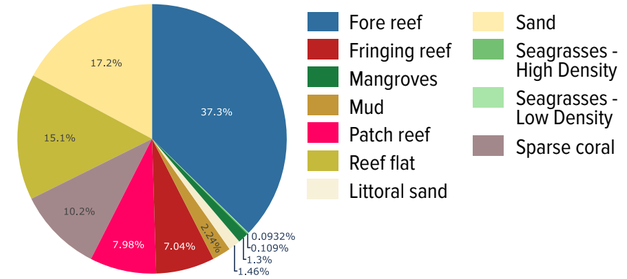


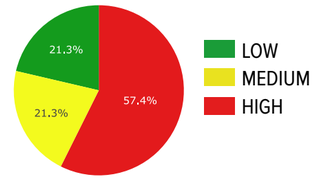
TABLE 21 OF 62 - V21

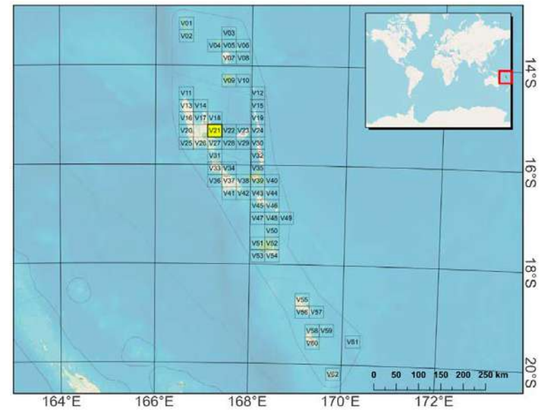
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
Bathymetry: GEBCO General Bathymetric Chart of the Oceans (year 2021)
Remote Sensing Image: Sentinel-2 (years 2018-2019)

ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

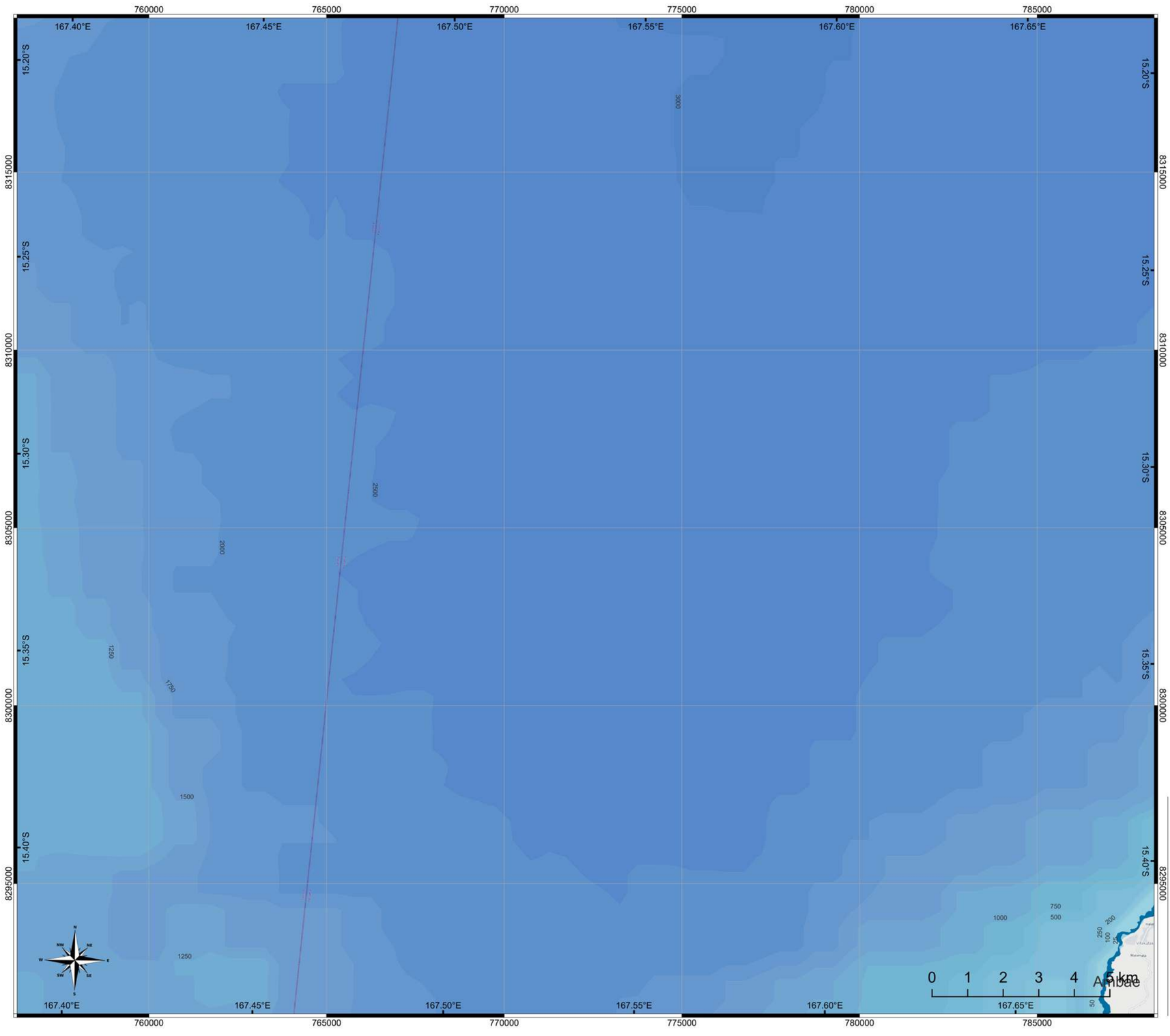


TABLE 22 OF 62 - V22

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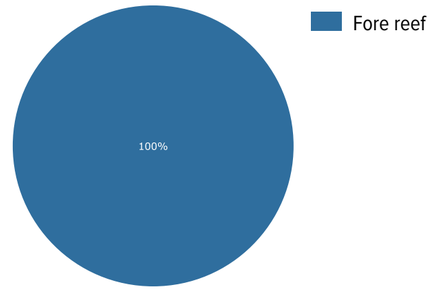
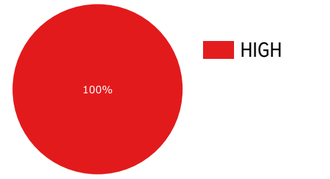
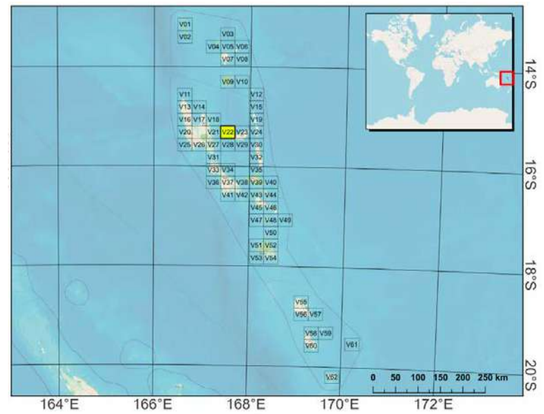


ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
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ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

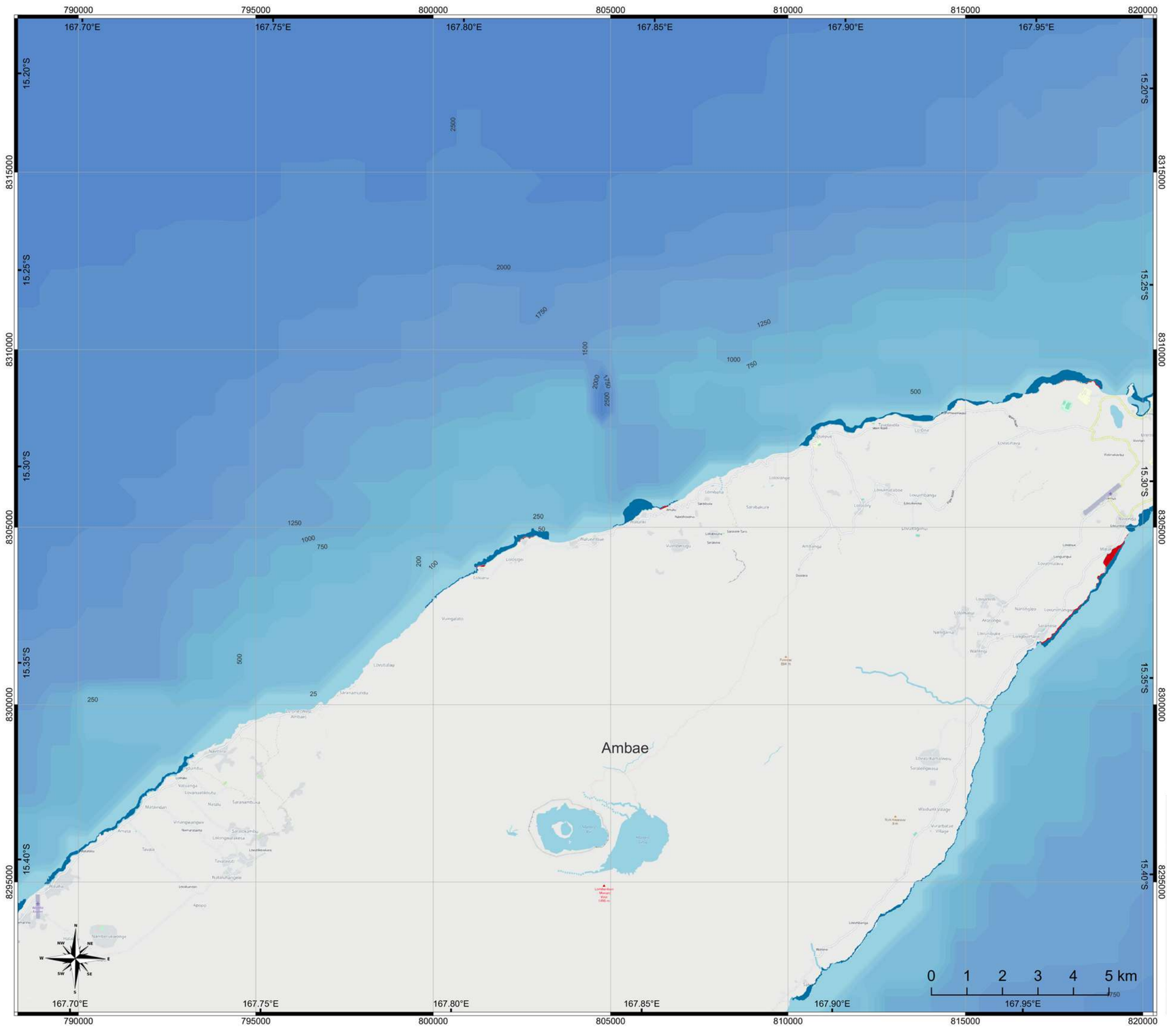
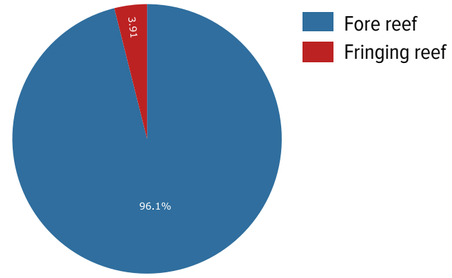
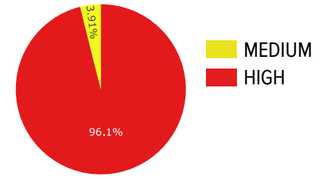


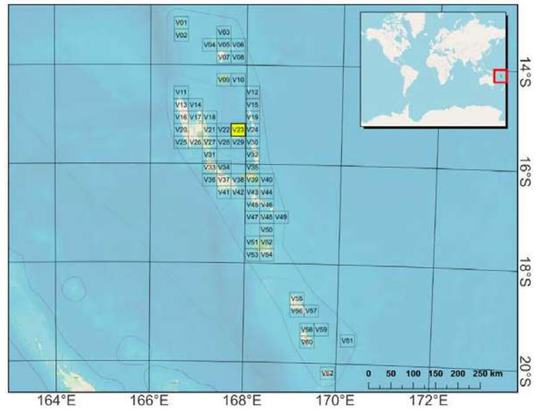
TABLE 23 OF 62 - V23
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
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ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

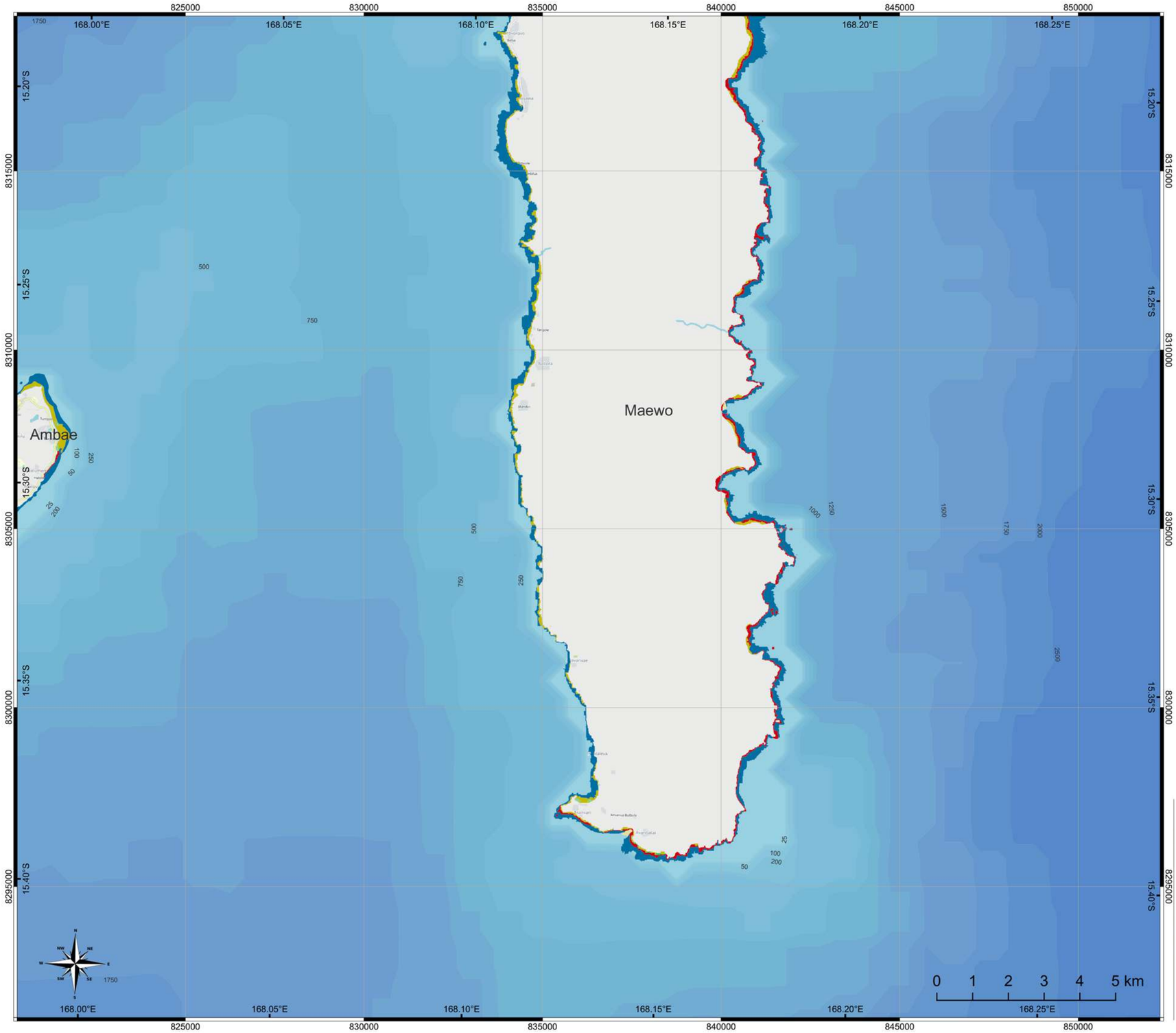
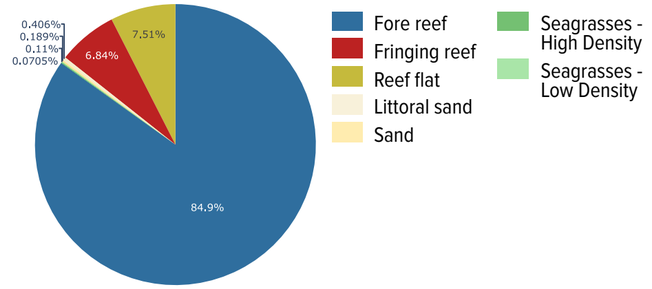


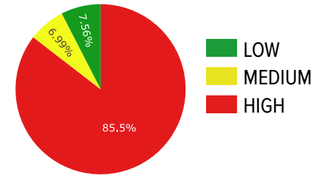
TABLE 24 OF 62 - V24

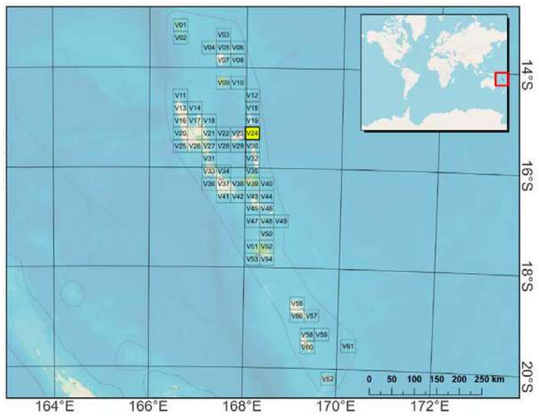
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
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ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

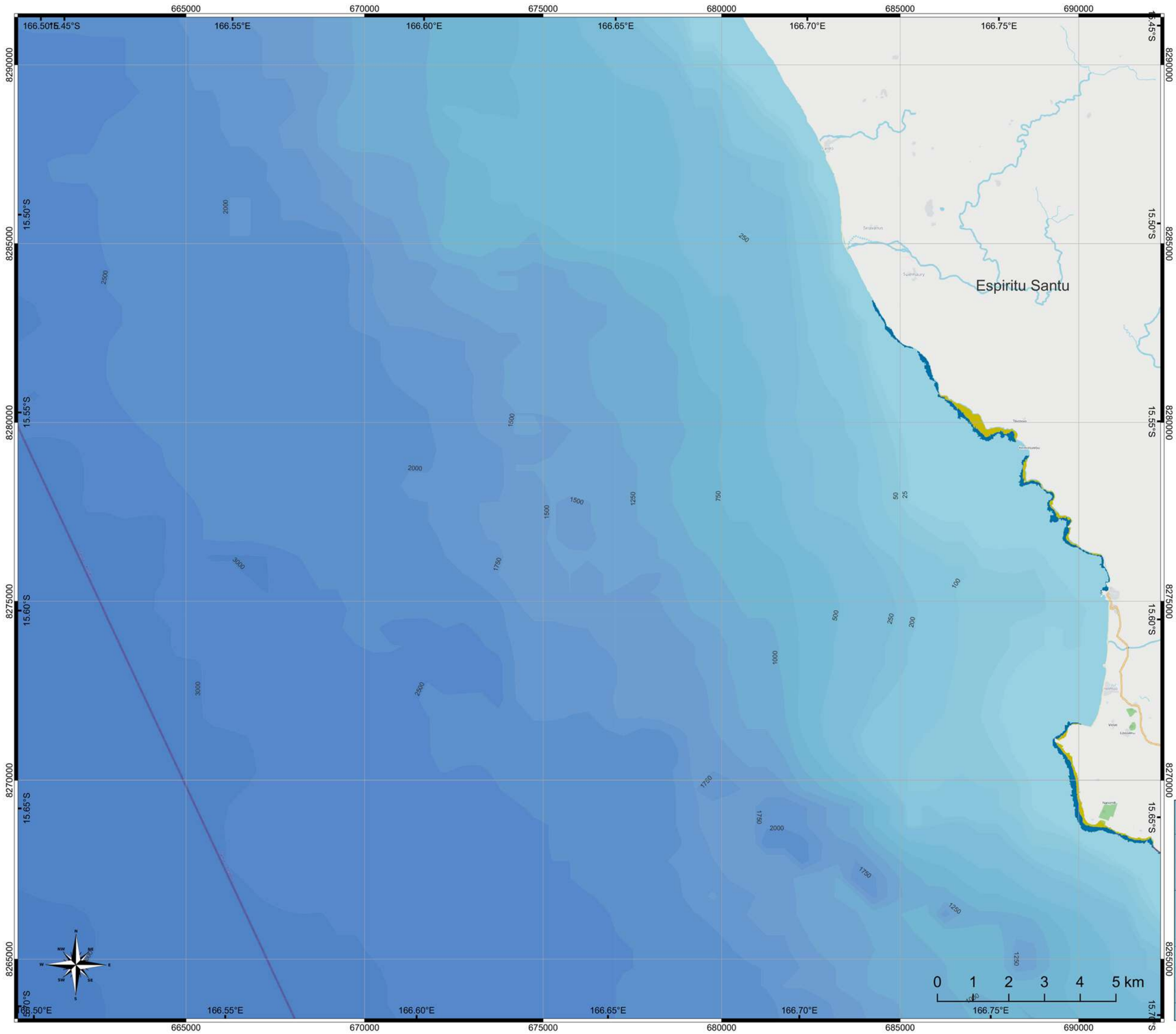

TABLE 25 OF 62 - V25

SCALE 1:100,000

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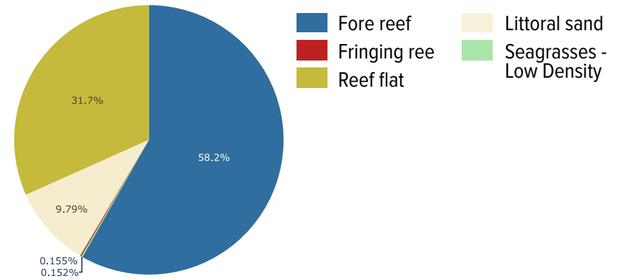
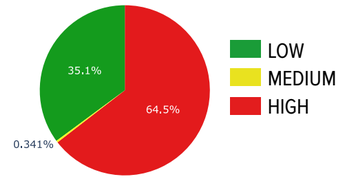
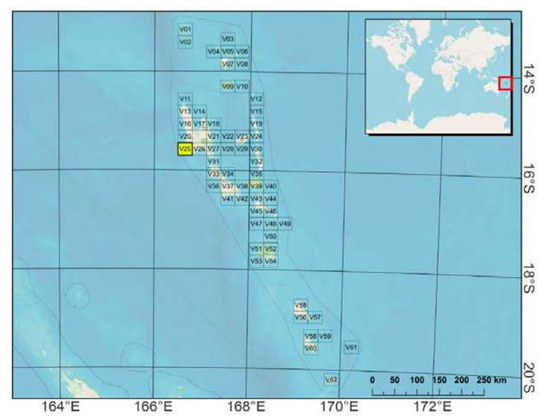


ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
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ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

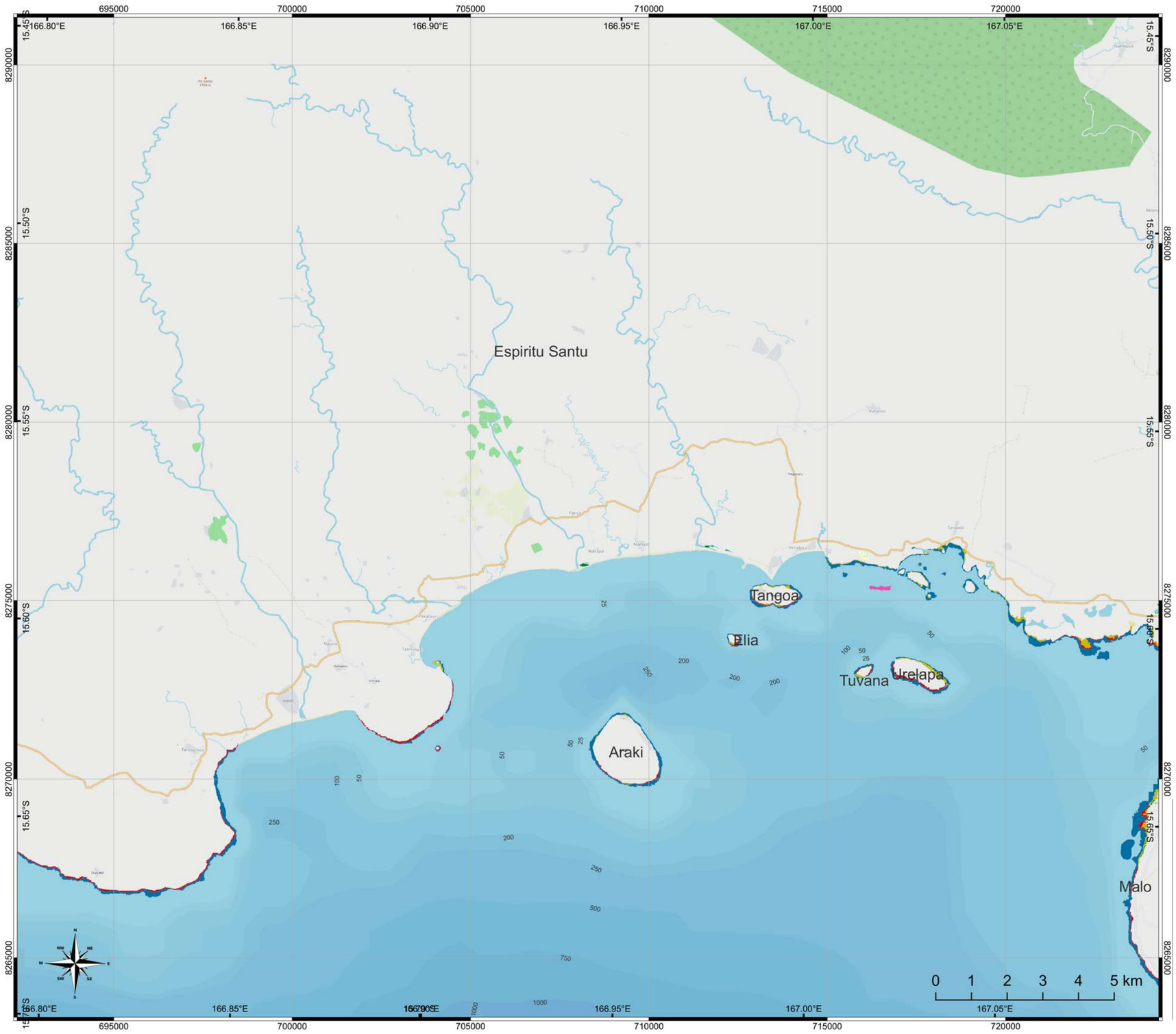

TABLE 26 OF 62 - V26

SCALE 1:100,000

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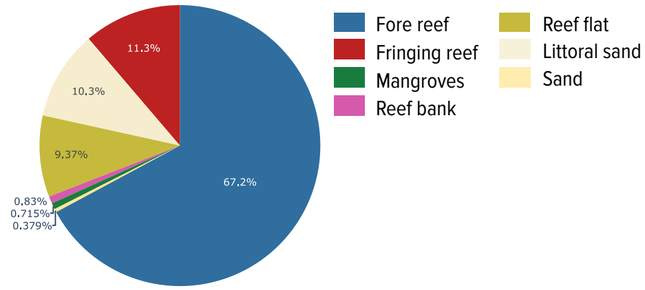
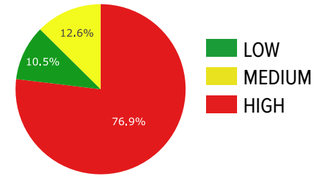
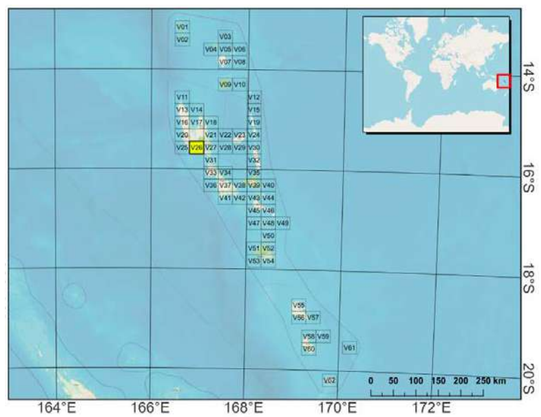


ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
Bathymetry: GEBCO General Bathymetric Chart of the Oceans (year 2021)
Remote Sensing Image: Sentinel-2 (years 2018-2019)

ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

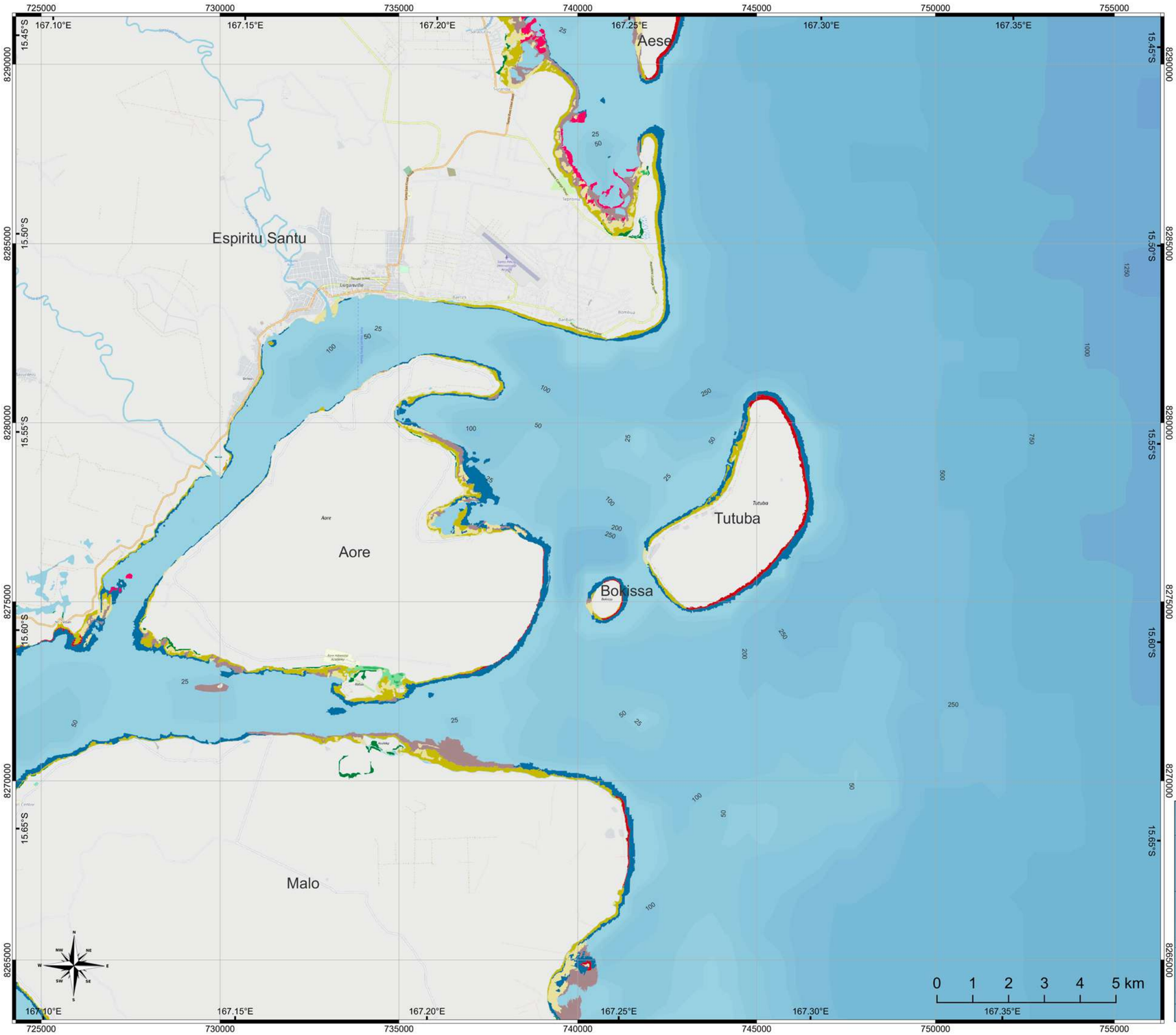
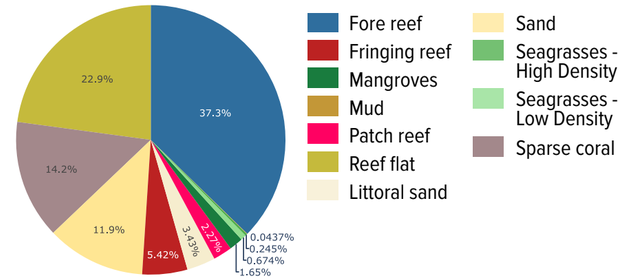


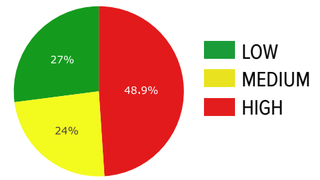
TABLE 27 OF 62 - V27

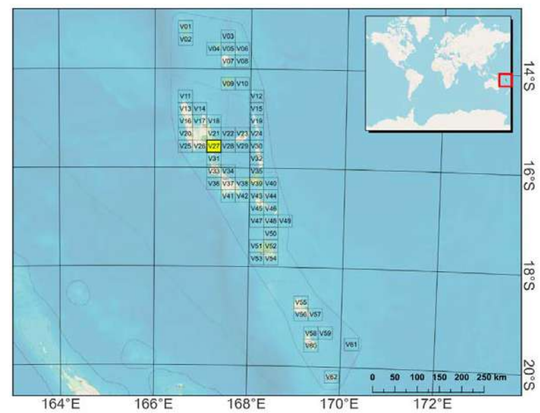
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
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ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

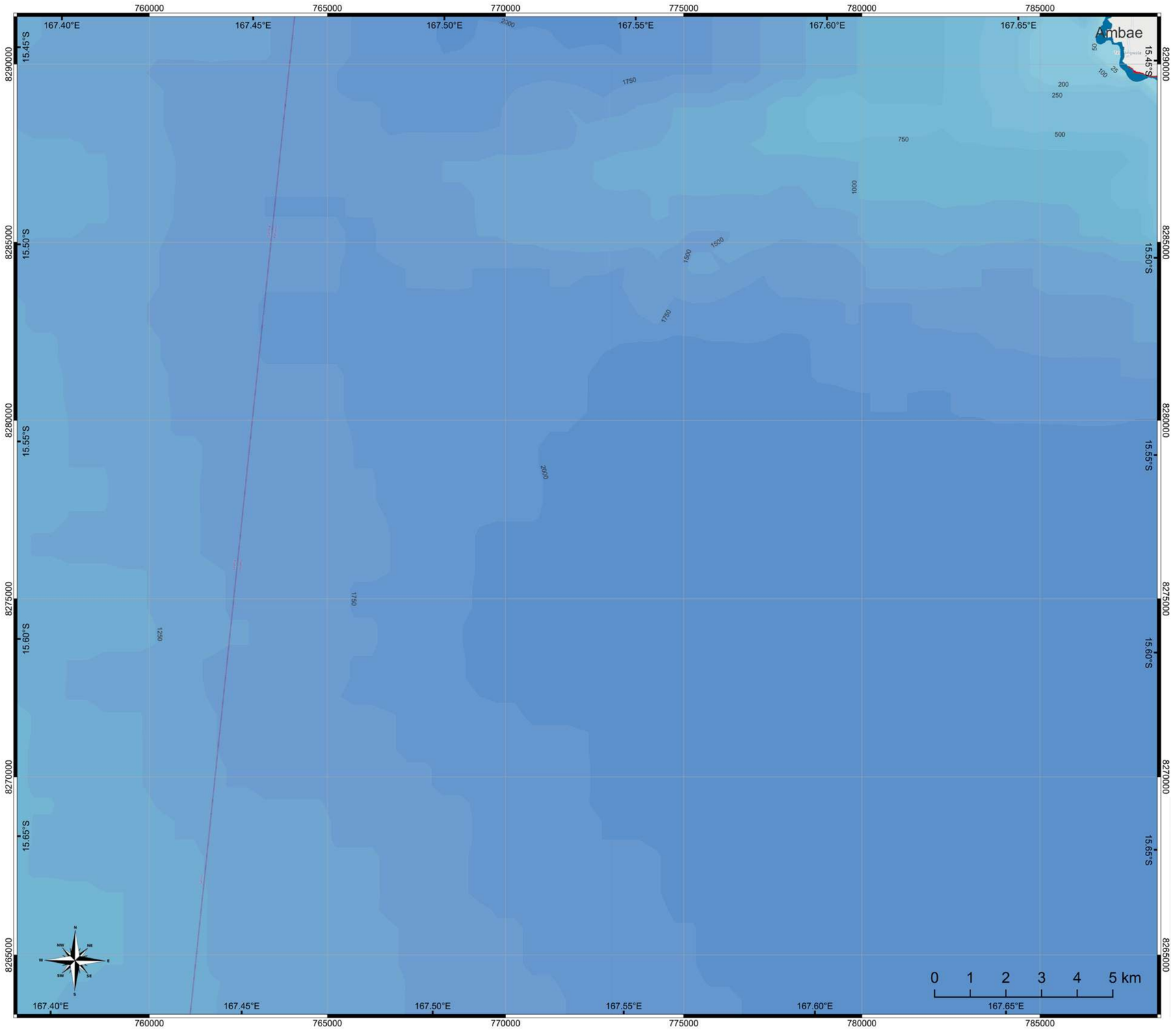
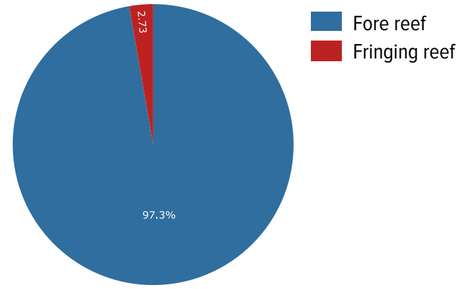


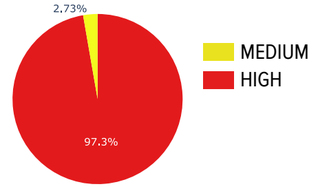
TABLE 28 OF 62 - V28

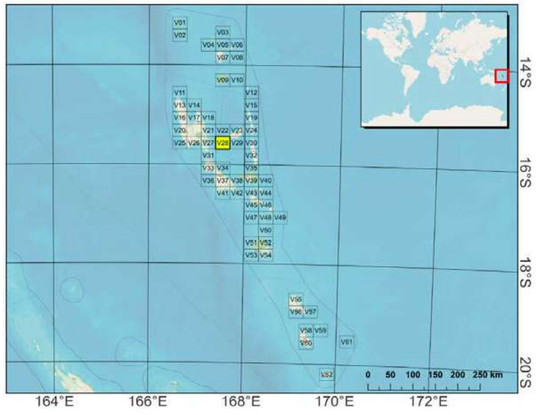
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
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ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

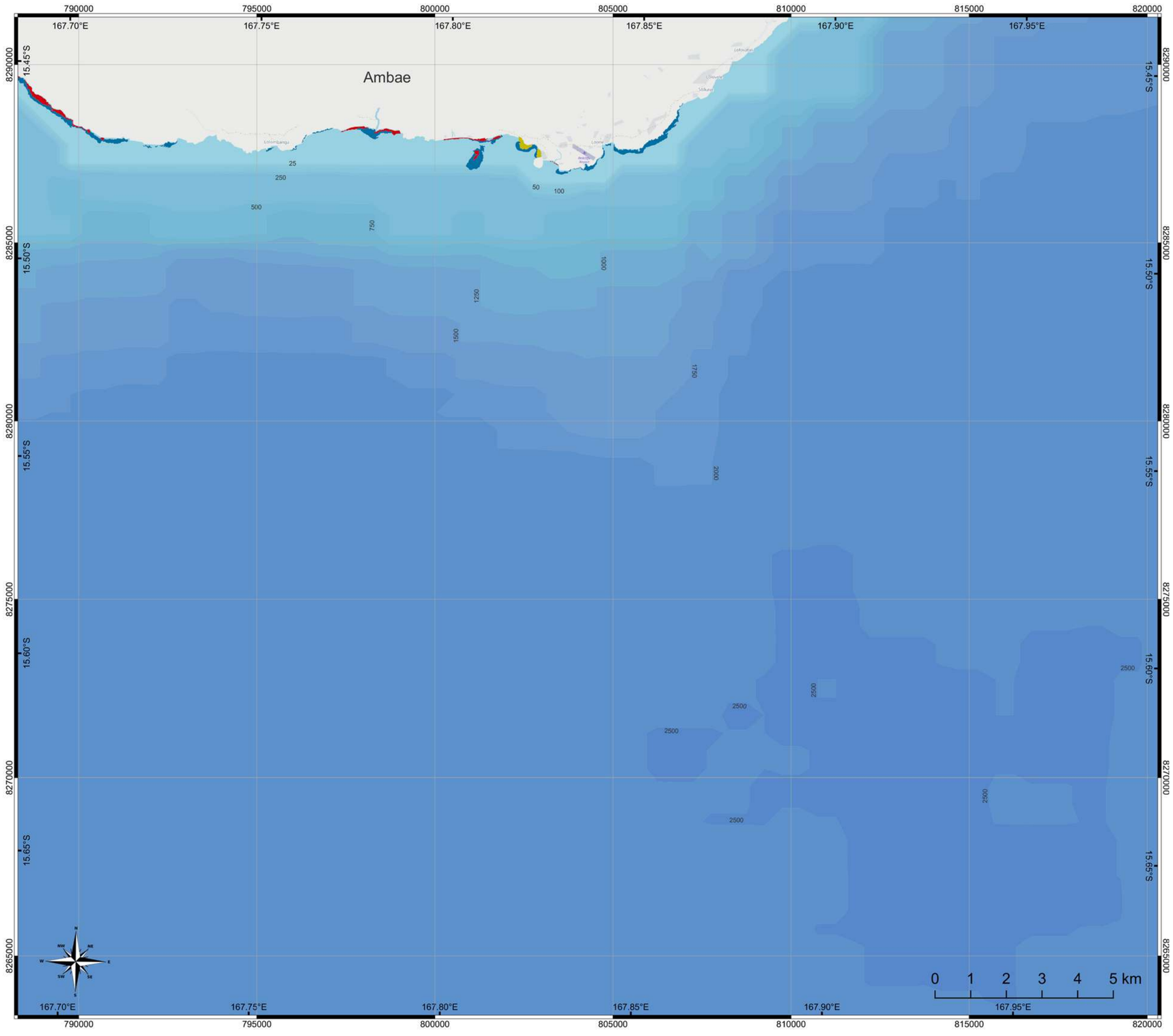
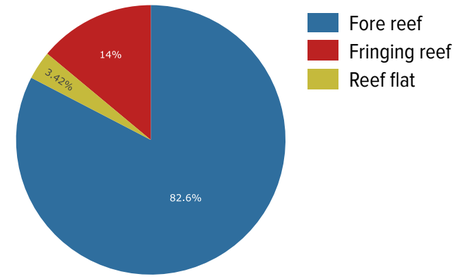
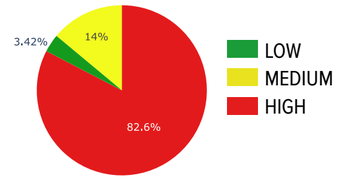


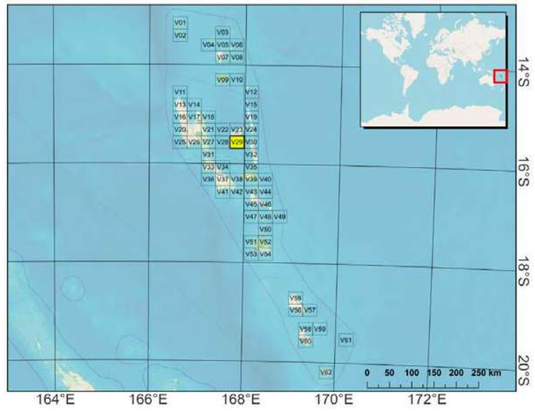
TABLE 29 OF 62 - V29
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
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ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

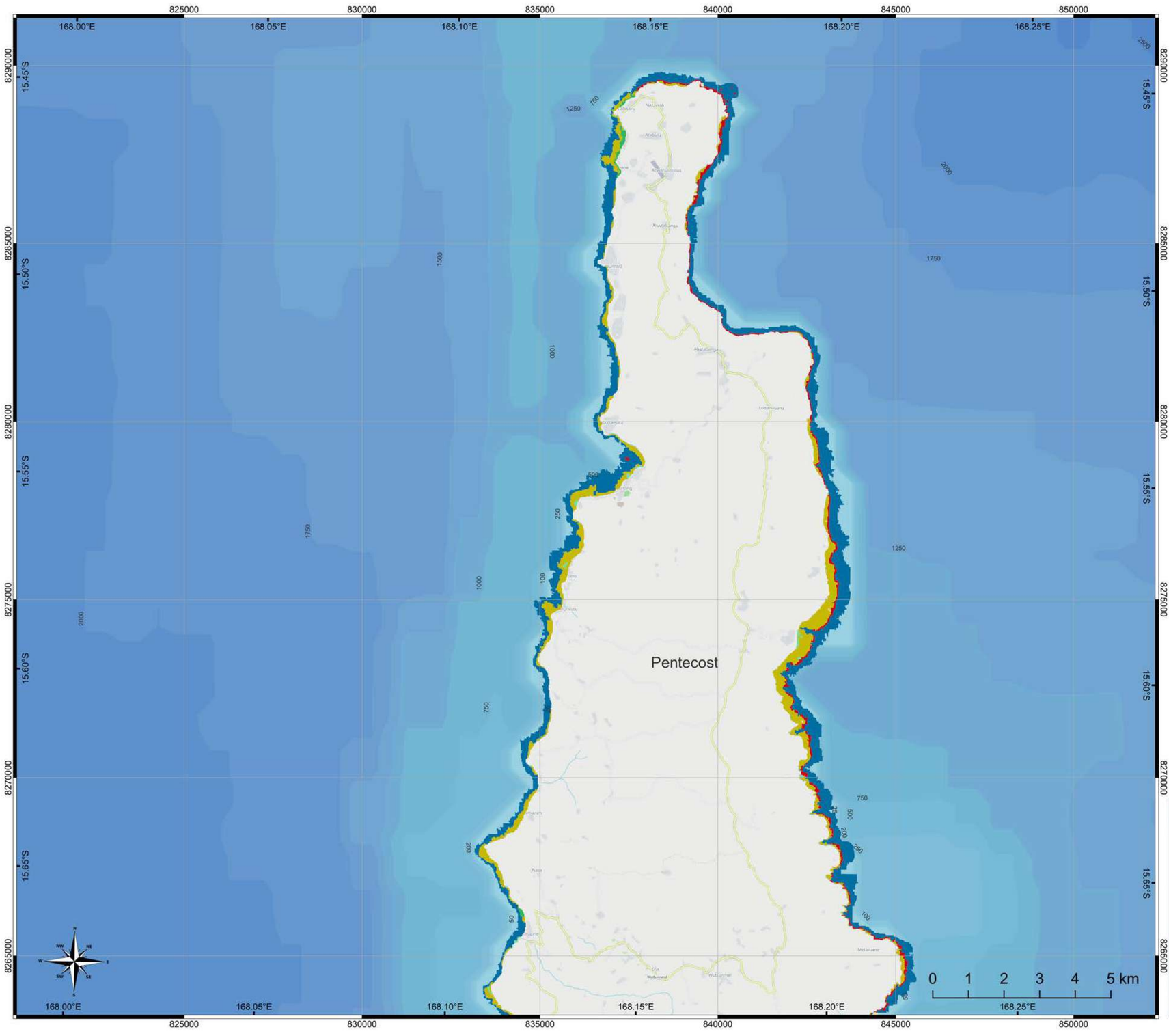
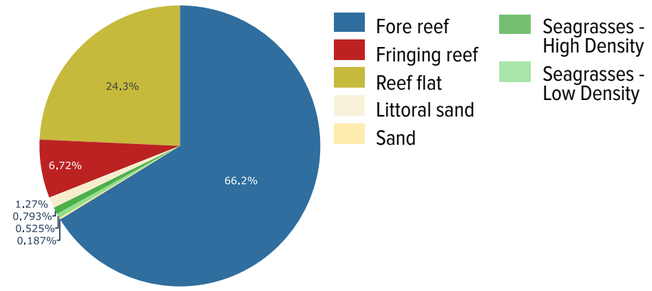


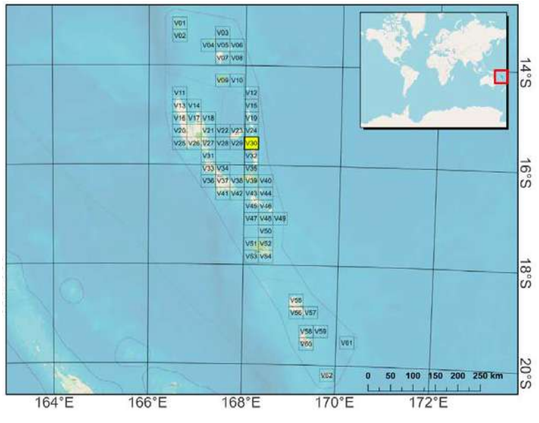
TABLE 30 OF 62 - V30

SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX



Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
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Basemap: OpenStreetMap from OSM Foundation (year 2022)
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ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

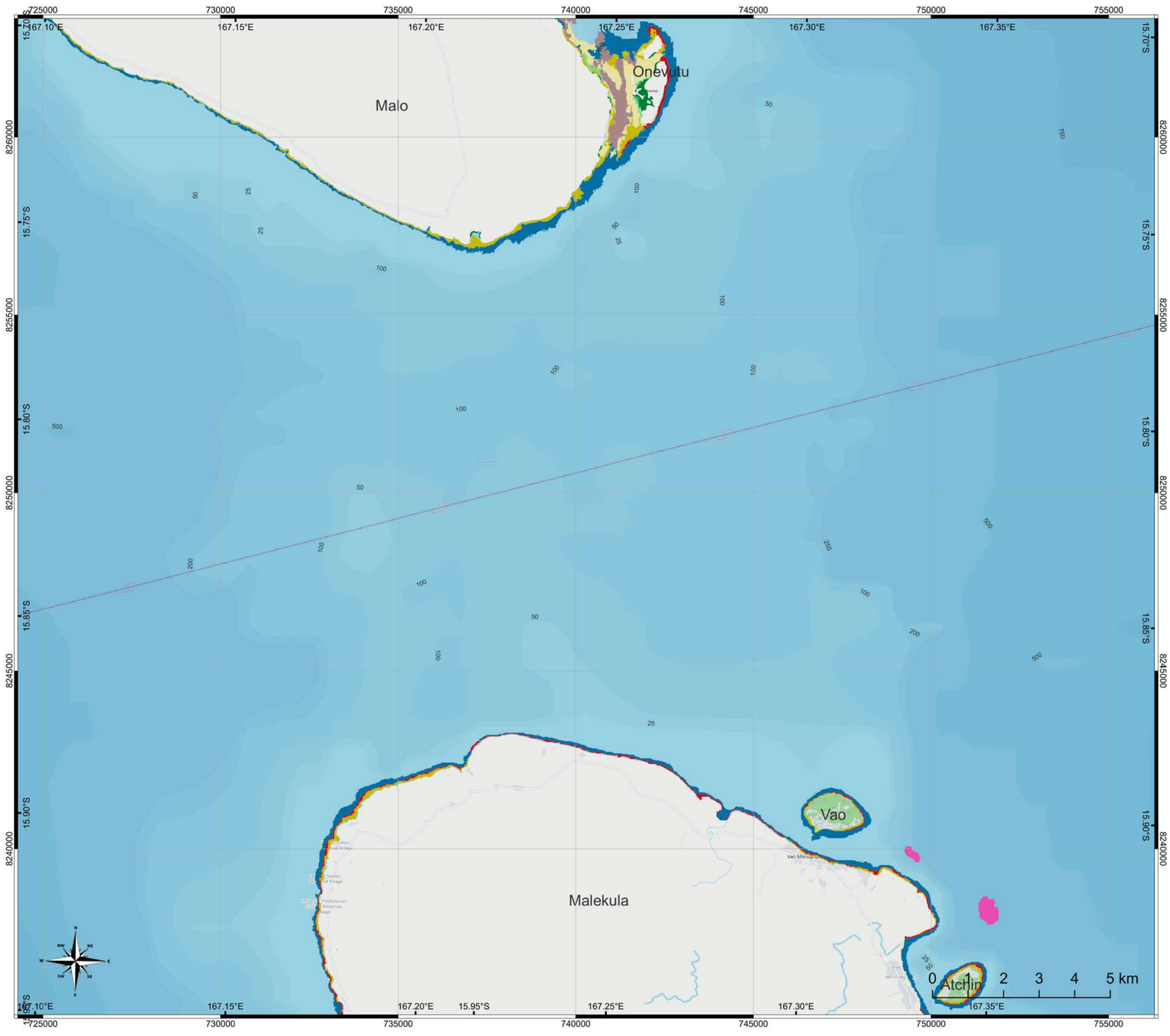
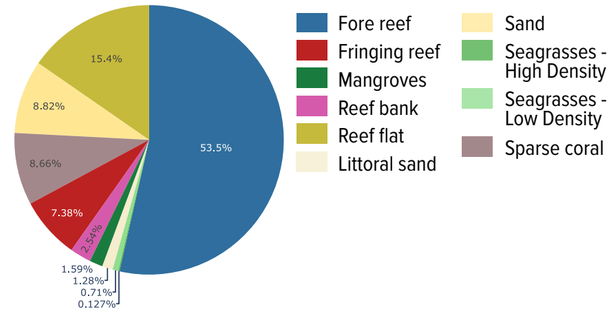


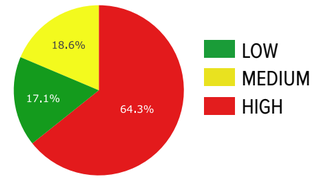
TABLE 31 OF 62 - V31

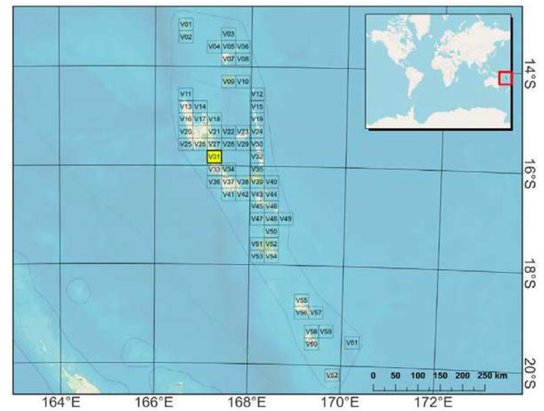
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
Bathymetry: GEBCO General Bathymetric Chart of the Oceans (year 2021)
Remote Sensing Image: Sentinel-2 (years 2018-2019)

ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

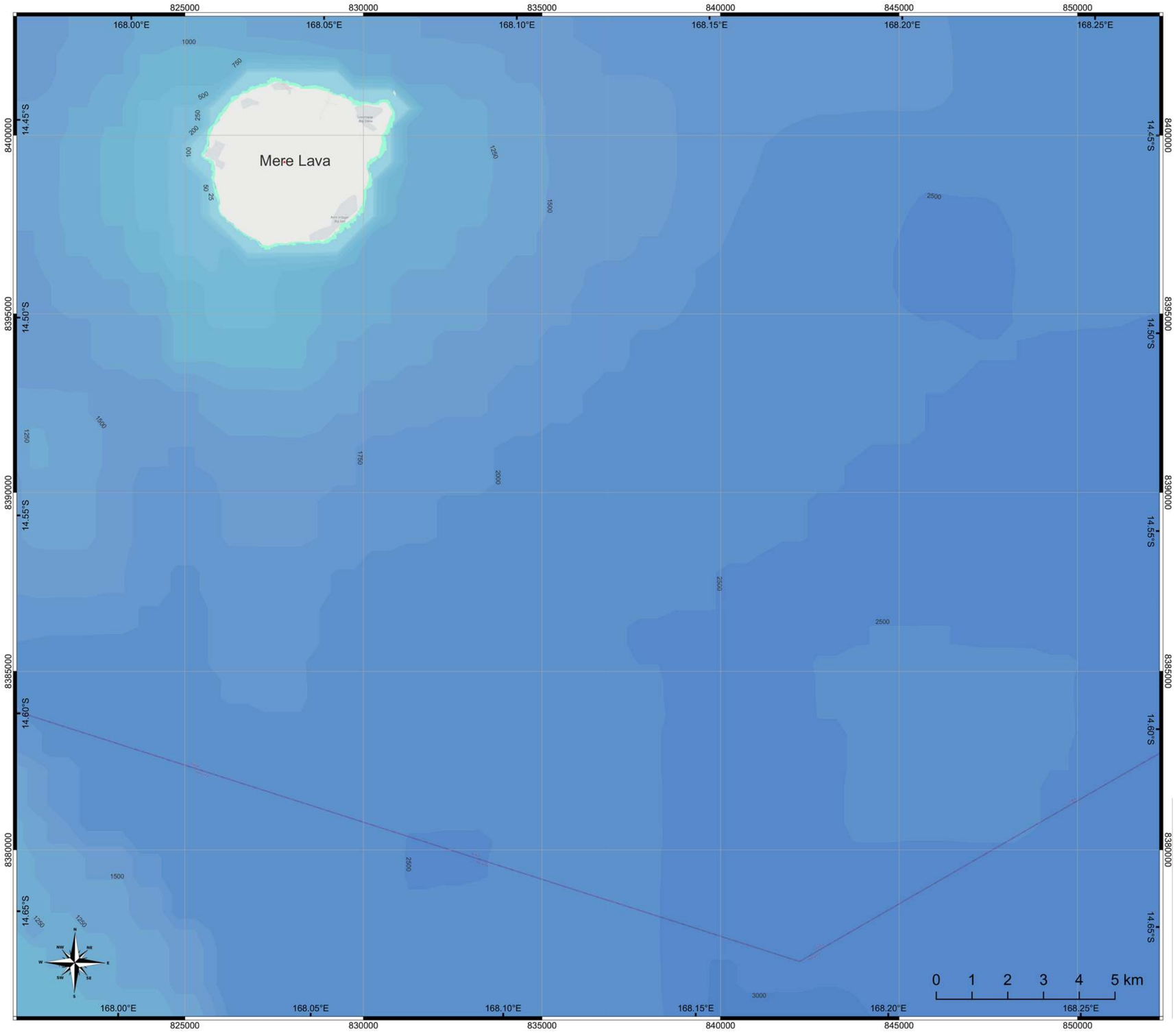
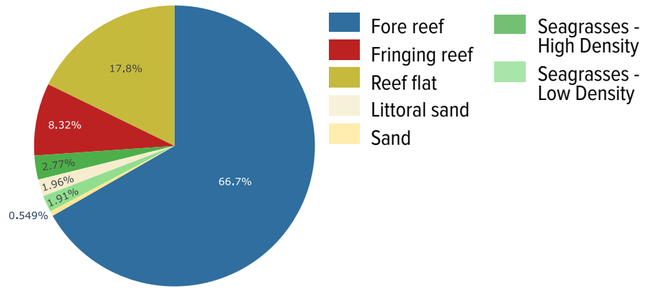


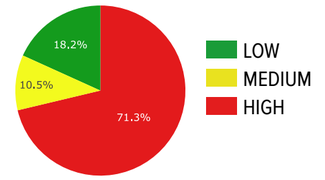
TABLE 32 OF 62 - V32

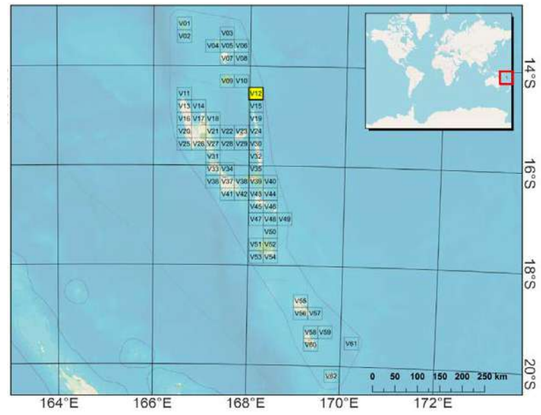
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
Bathymetry: GEBCO General Bathymetric Chart of the Oceans (year 2021)
Remote Sensing Image: Sentinel-2 (years 2018-2019)

ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

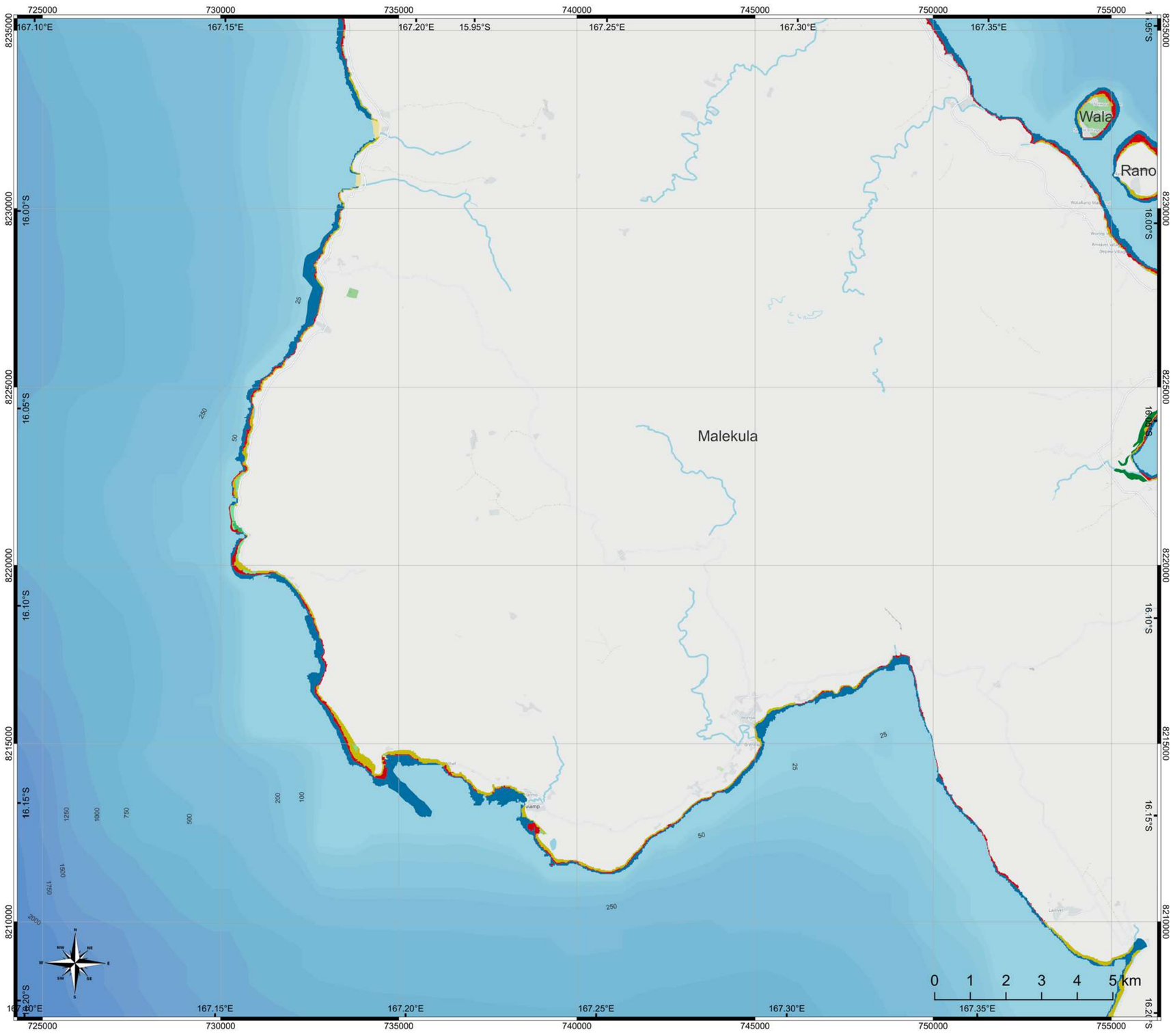
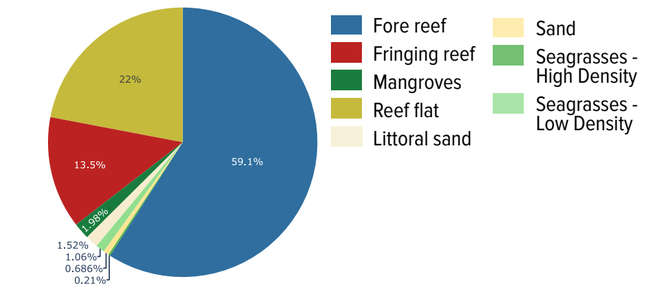


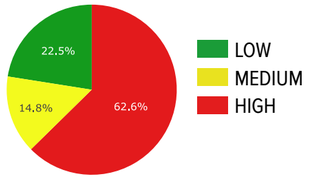
TABLE 33 OF 62 - V33

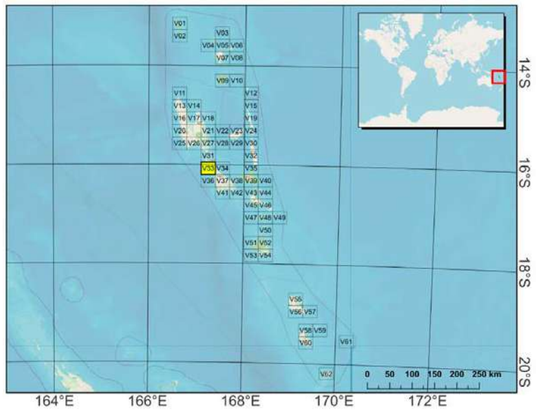
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
Bathymetry: GEBCO General Bathymetric Chart of the Oceans (year 2021)
Remote Sensing Image: Sentinel-2 (years 2018-2019)

ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

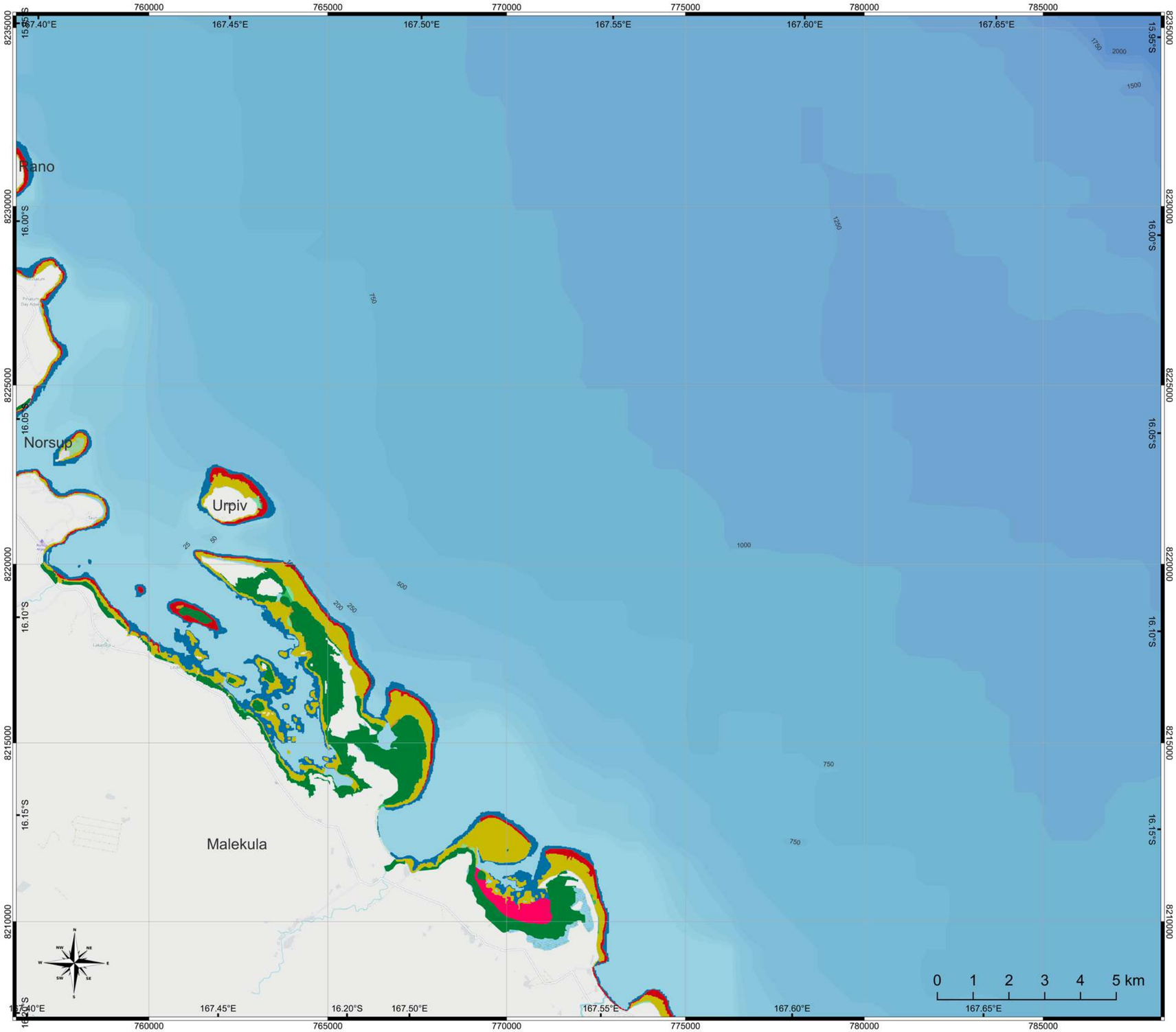
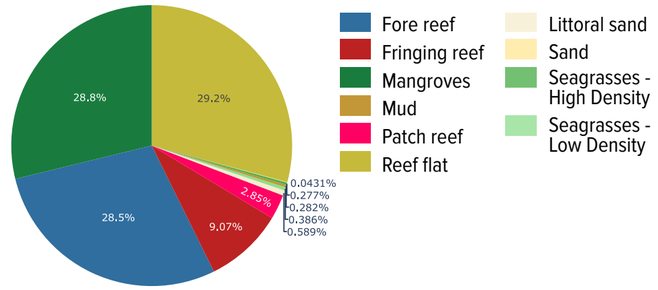


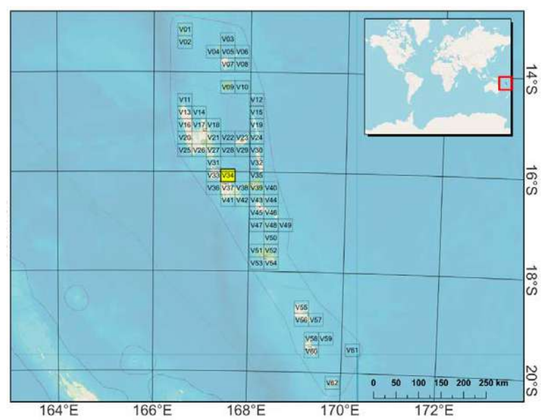
TABLE 34 OF 62 - V34

SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX



Geographic Coordinate system: WGS84 - EPSG:4326
Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Basemap: OpenStreetMap from OSM Foundation (year 2022)
Bathymetry: GEBCO General Bathymetric Chart of the Oceans (year 2021)
Remote Sensing Image: Sentinel-2 (years 2018-2019)

ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

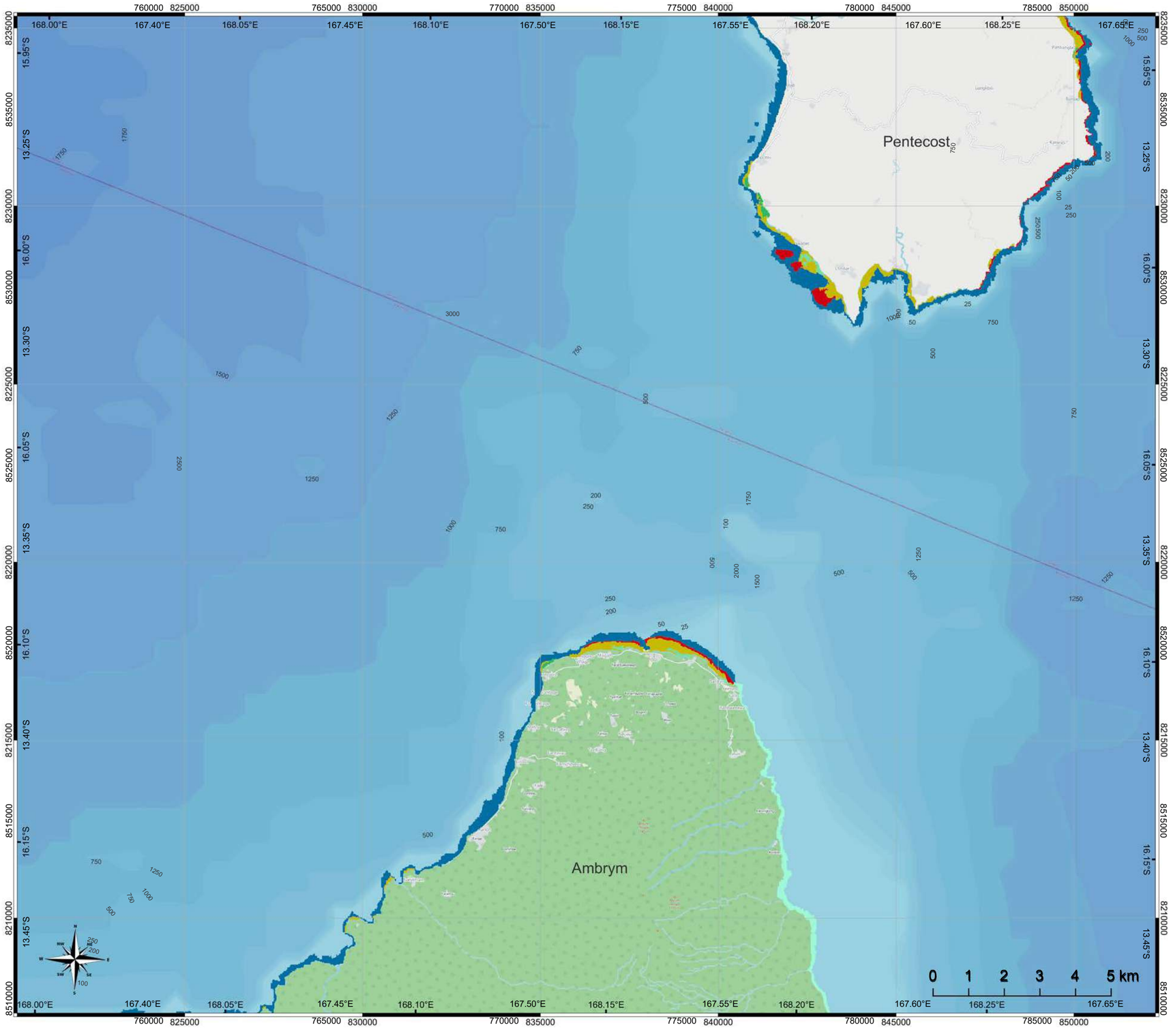
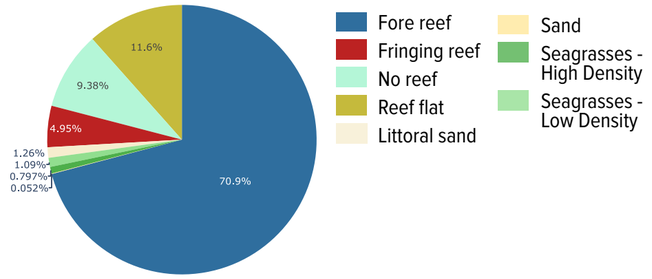


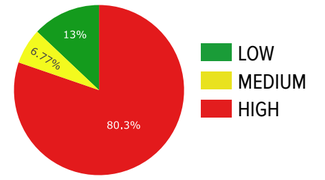
TABLE 35 OF 62 - V35

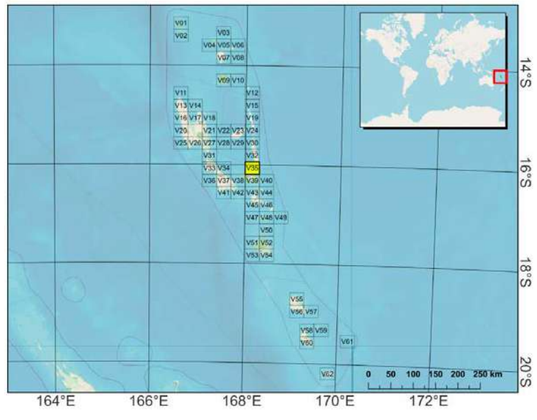
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
Bathymetry: GEBCO General Bathymetric Chart of the Oceans (year 2021)
Remote Sensing Image: Sentinel-2 (years 2018-2019)

ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

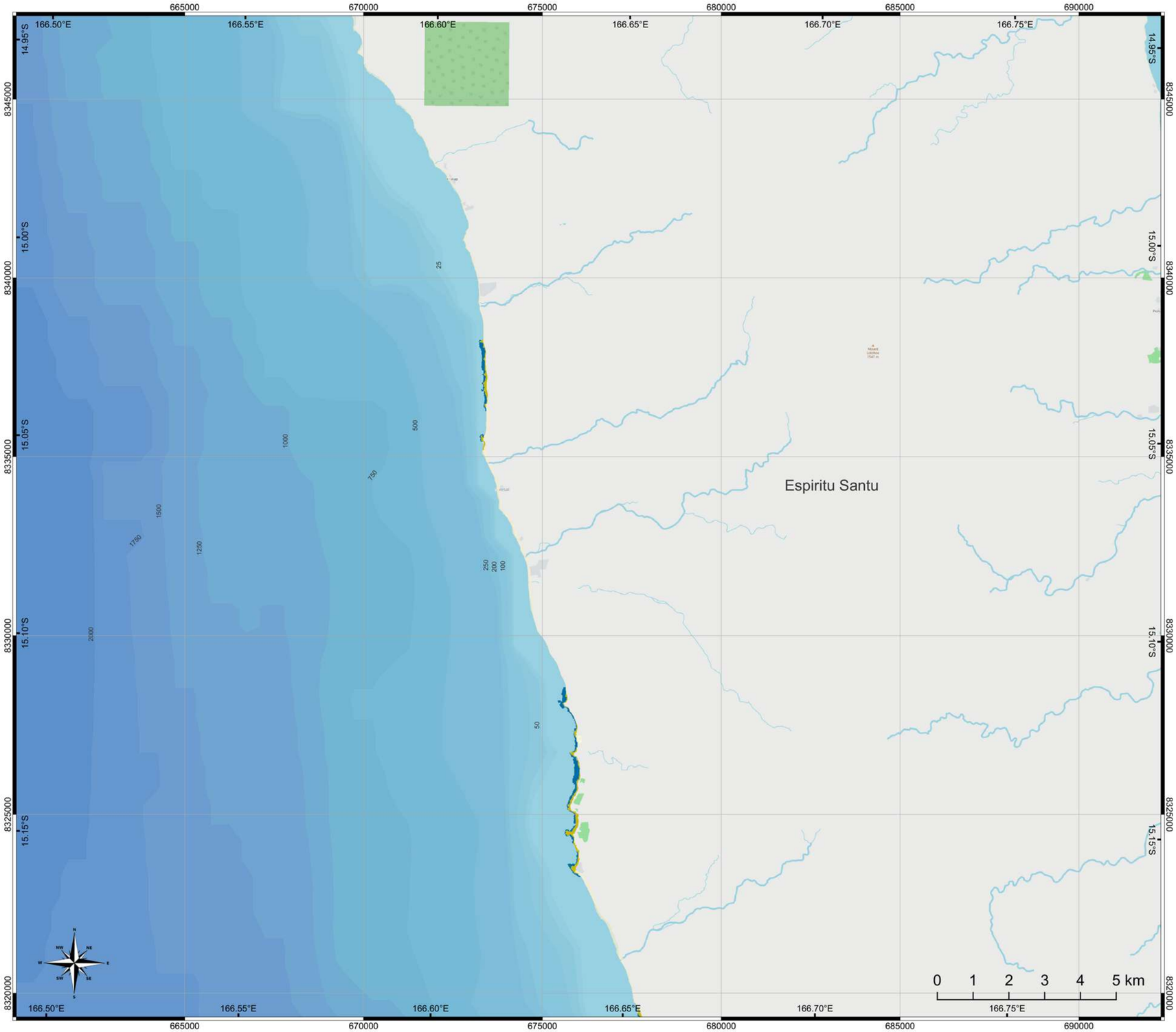
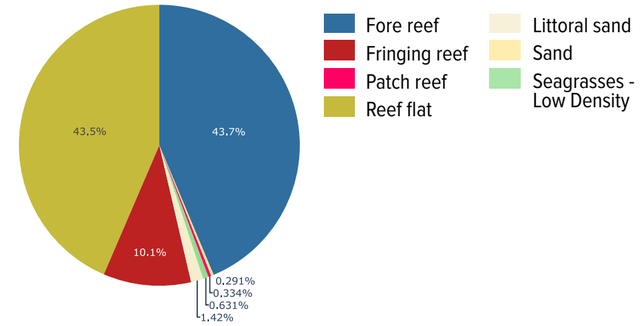


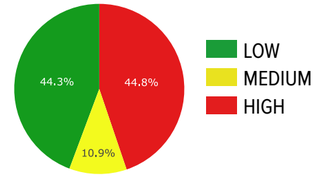
TABLE 36 OF 62 - V36

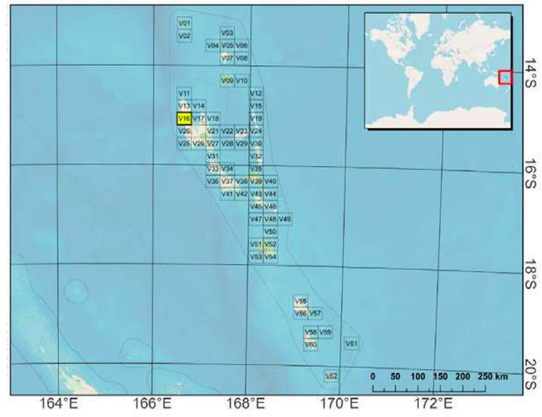
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Geographic Coordinate system: WGS84 - EPSG:4326
Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Basemap: OpenStreetMap from OSM Foundation (year 2022)
Bathymetry: GEBCO General Bathymetric Chart of the Oceans (year 2021)
Remote Sensing Image: Sentinel-2 (years 2018-2019)

ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

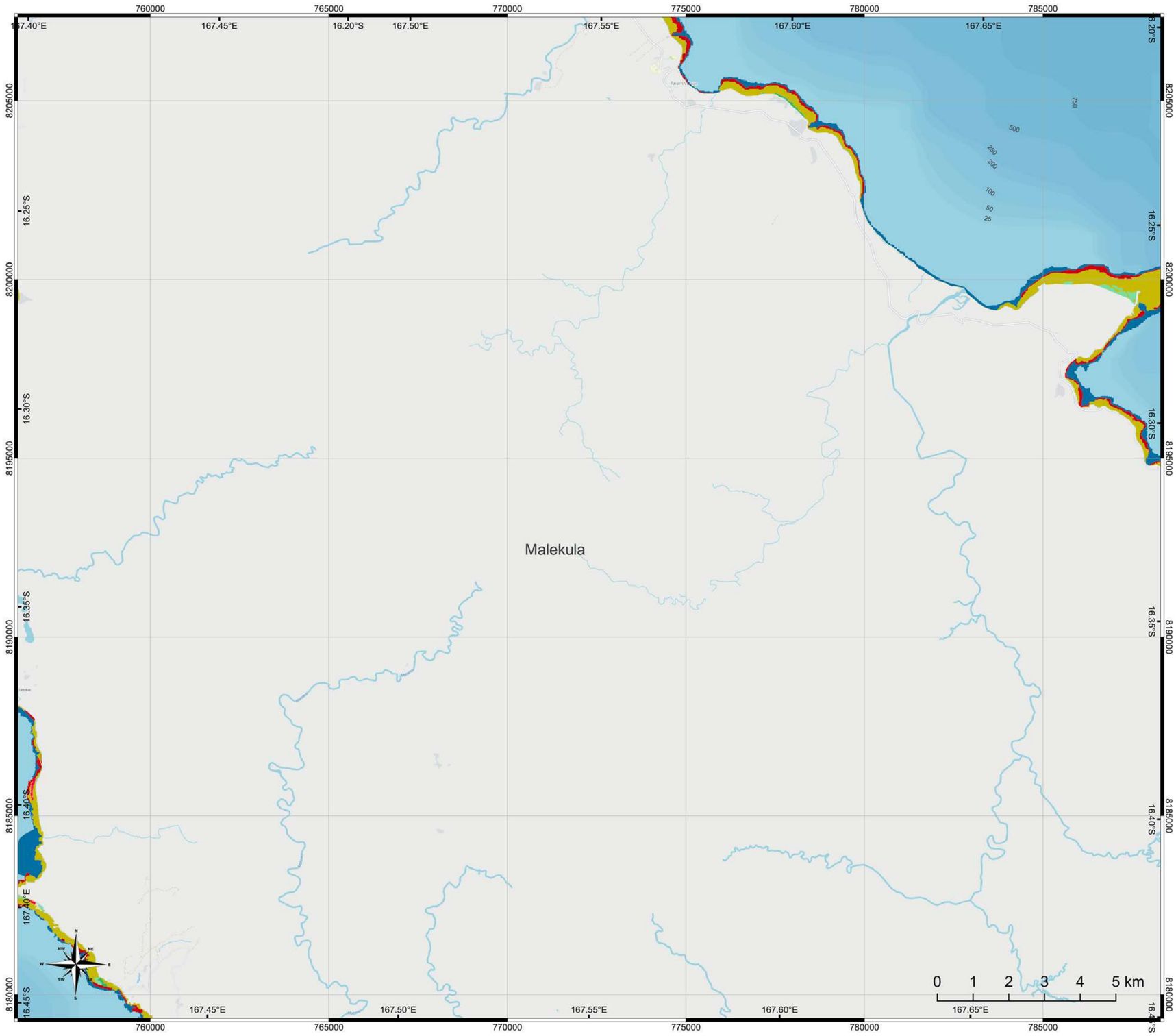
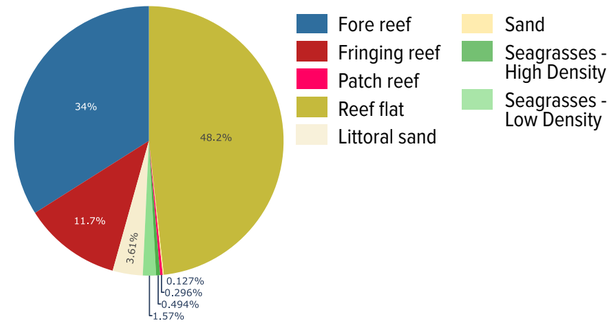


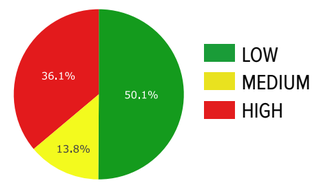
TABLE 37 OF 62 - V37

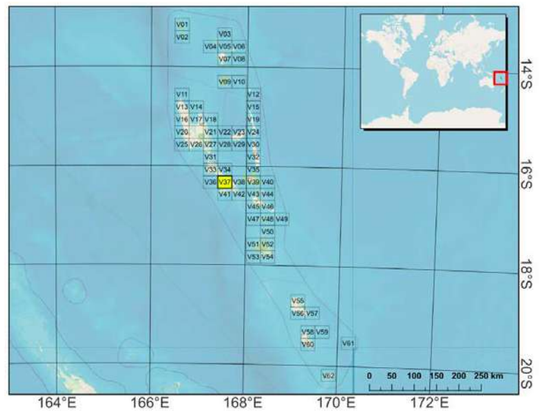
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
Bathymetry: GEBCO General Bathymetric Chart of the Oceans (year 2021)
Remote Sensing Image: Sentinel-2 (years 2018-2019)

ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

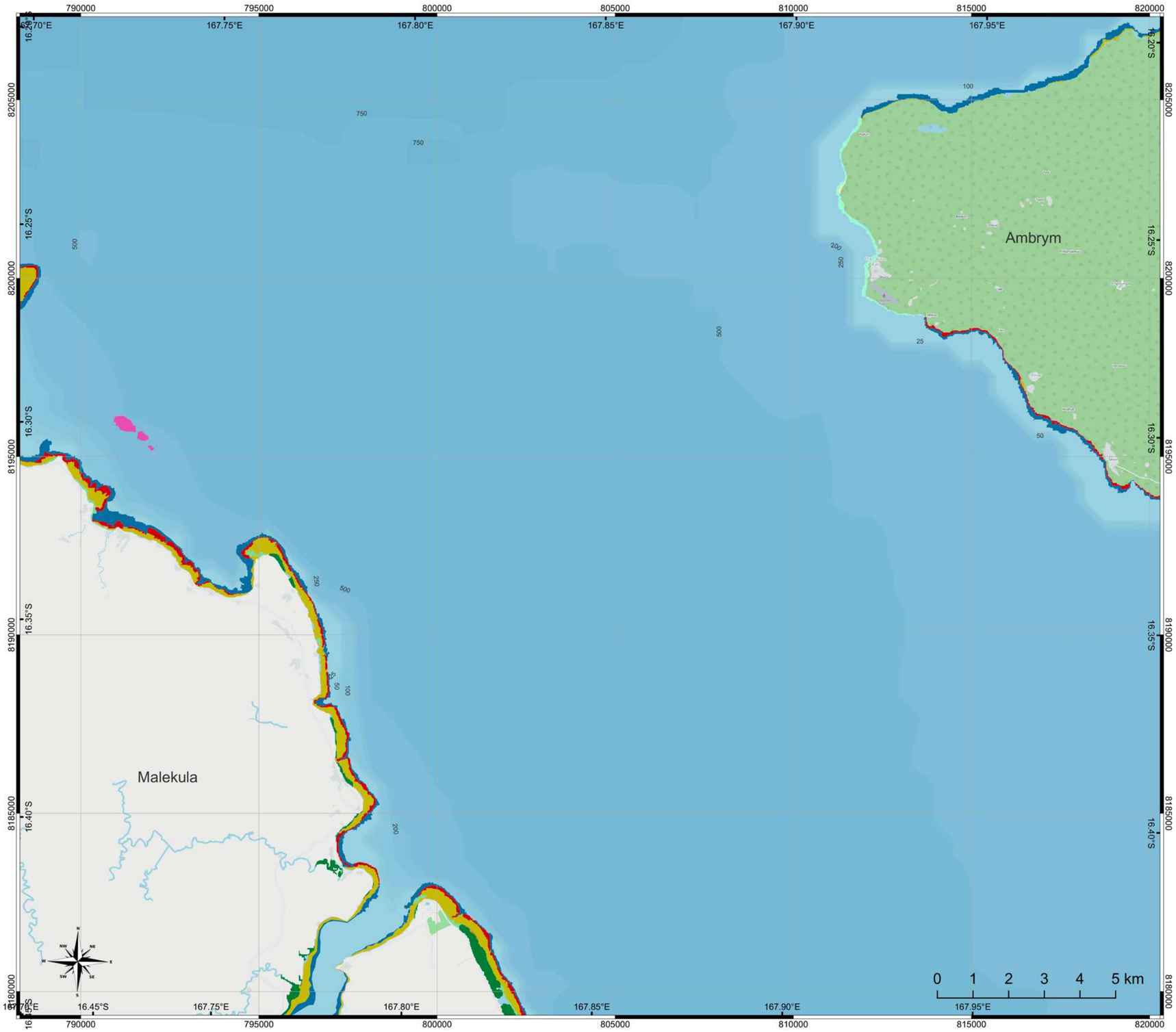
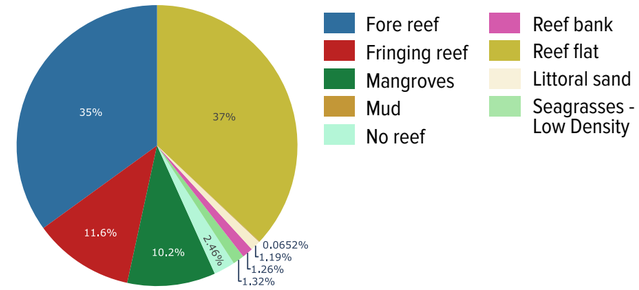


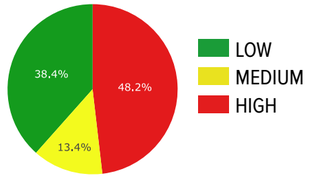
TABLE 38 OF 62 - V38

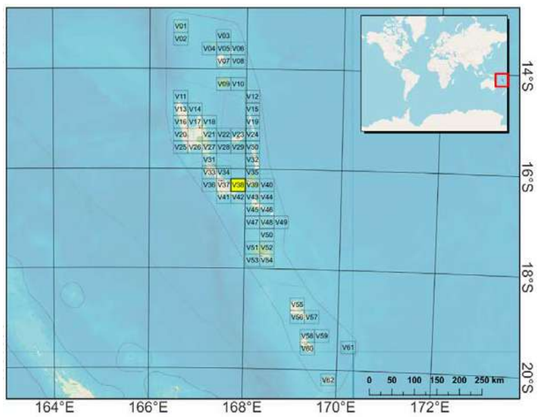
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
Bathymetry: GEBCO General Bathymetric Chart of the Oceans (year 2021)
Remote Sensing Image: Sentinel-2 (years 2018-2019)

ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

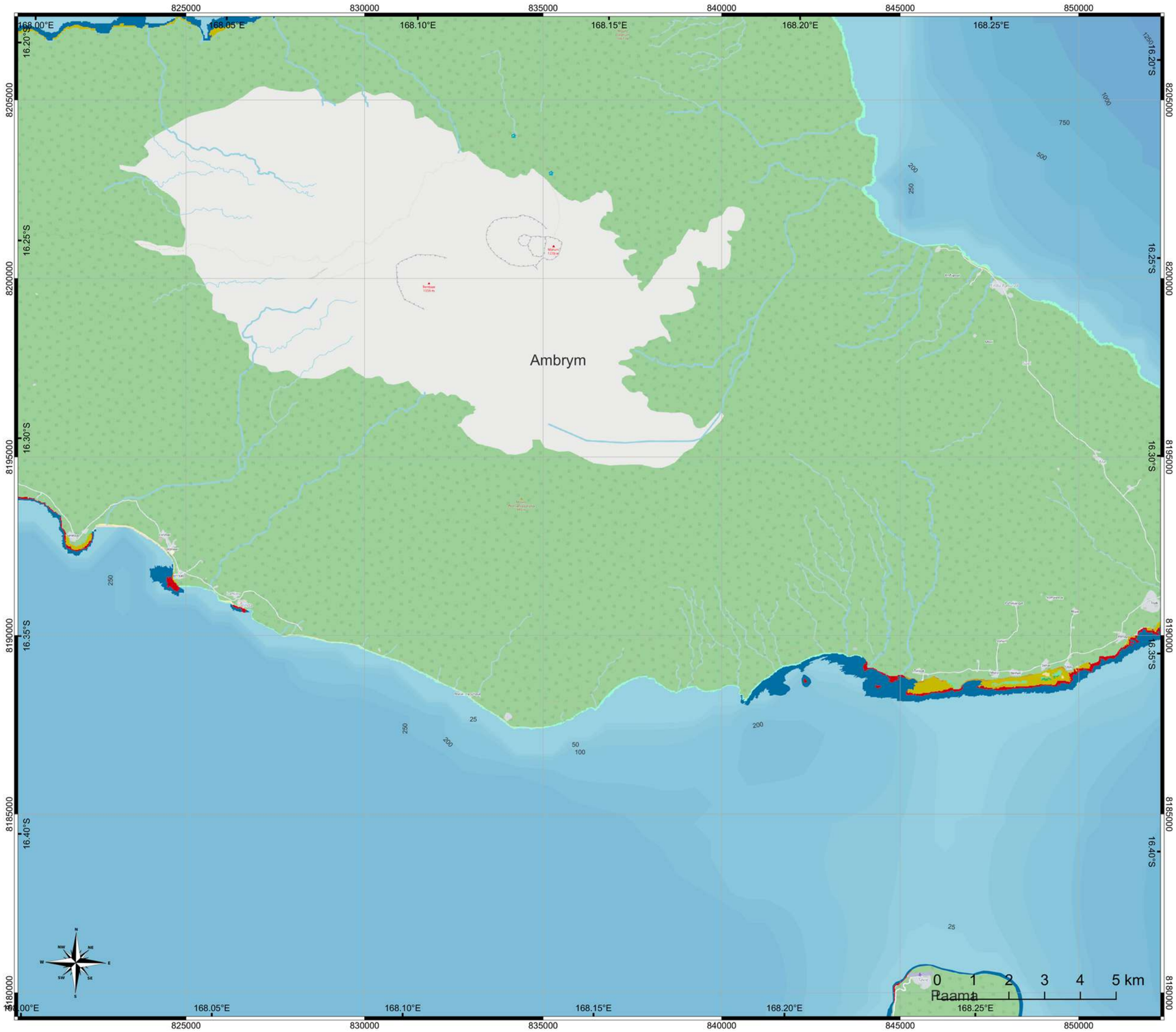
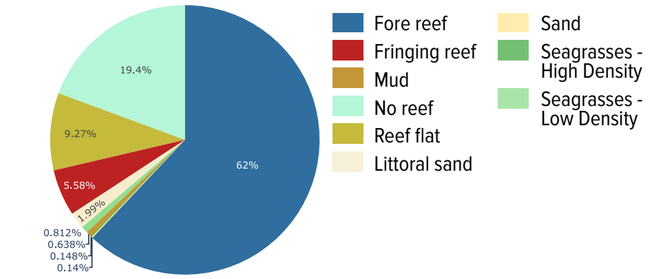


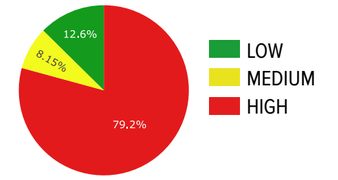
TABLE 39 OF 62 - V39

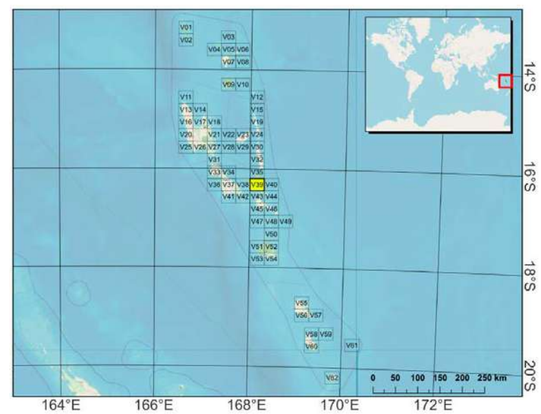
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
Bathymetry: GEBCO General Bathymetric Chart of the Oceans (year 2021)
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ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

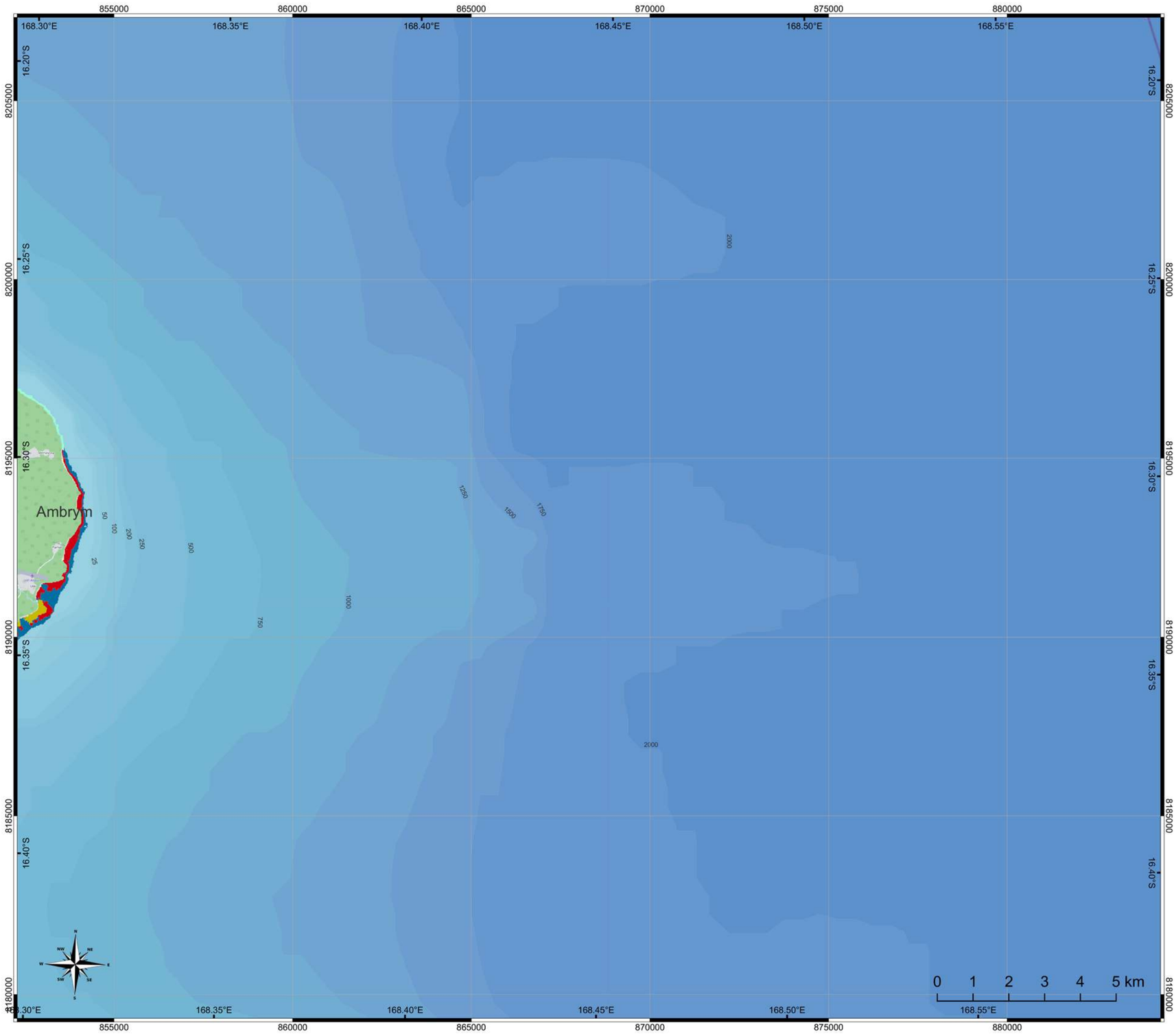
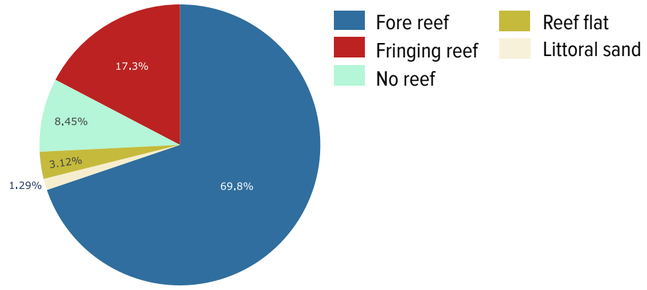


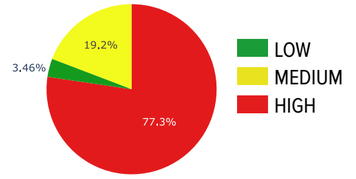
TABLE 40 OF 62 - V40

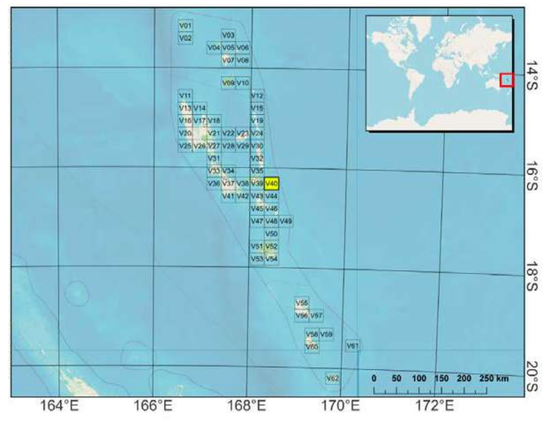
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
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ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

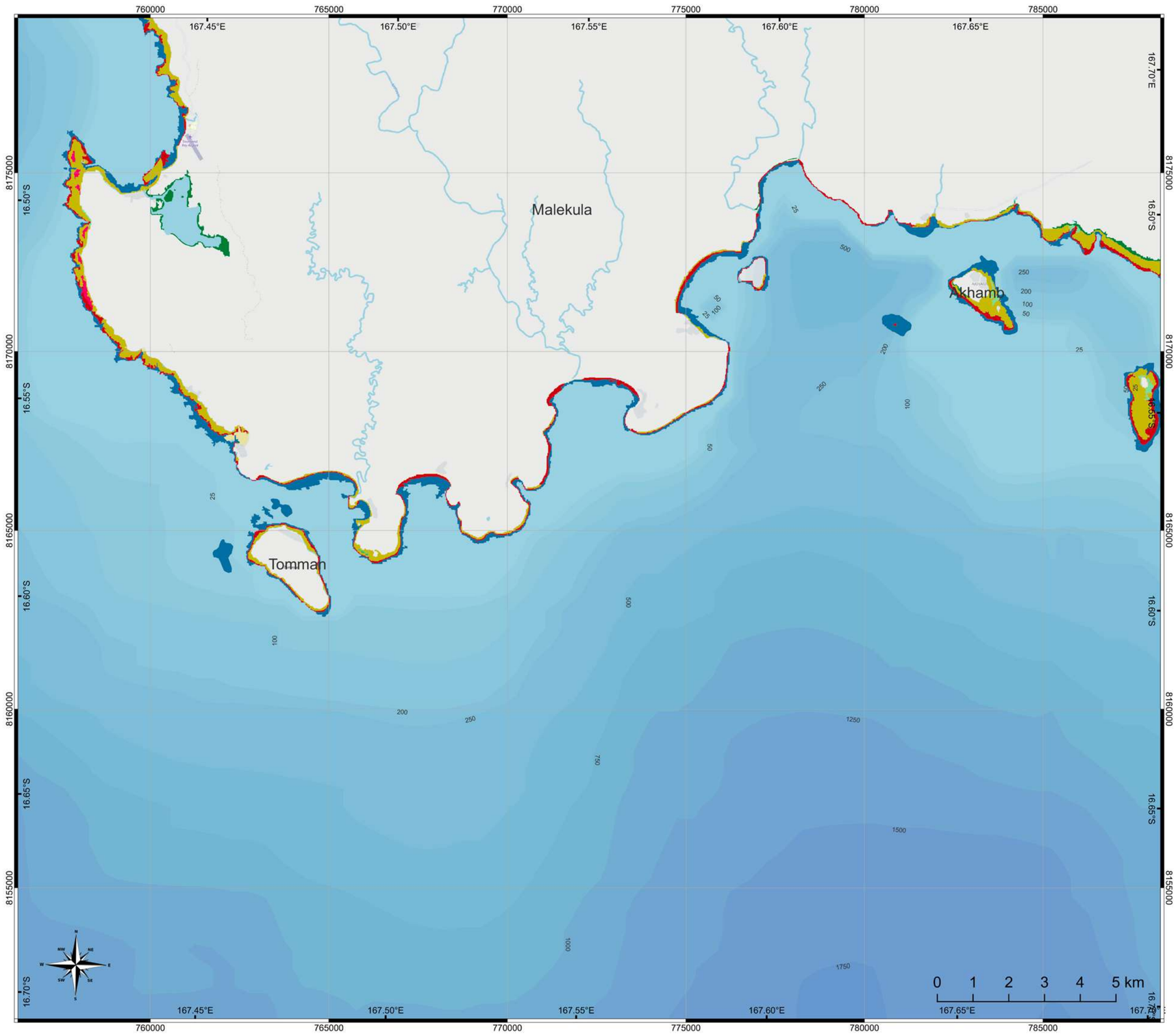
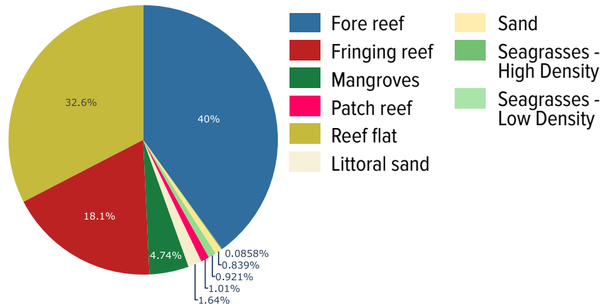
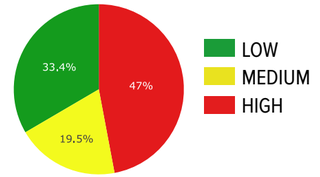


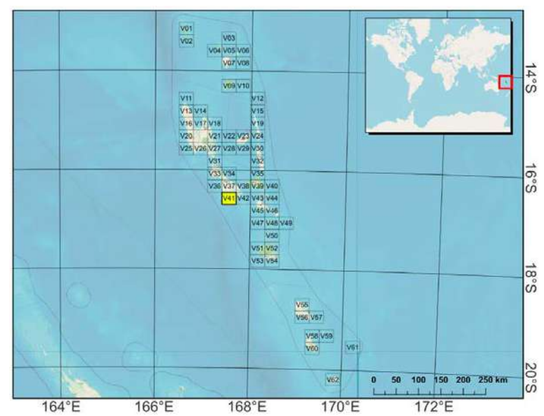
TABLE 41 OF 62 - V41
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
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ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

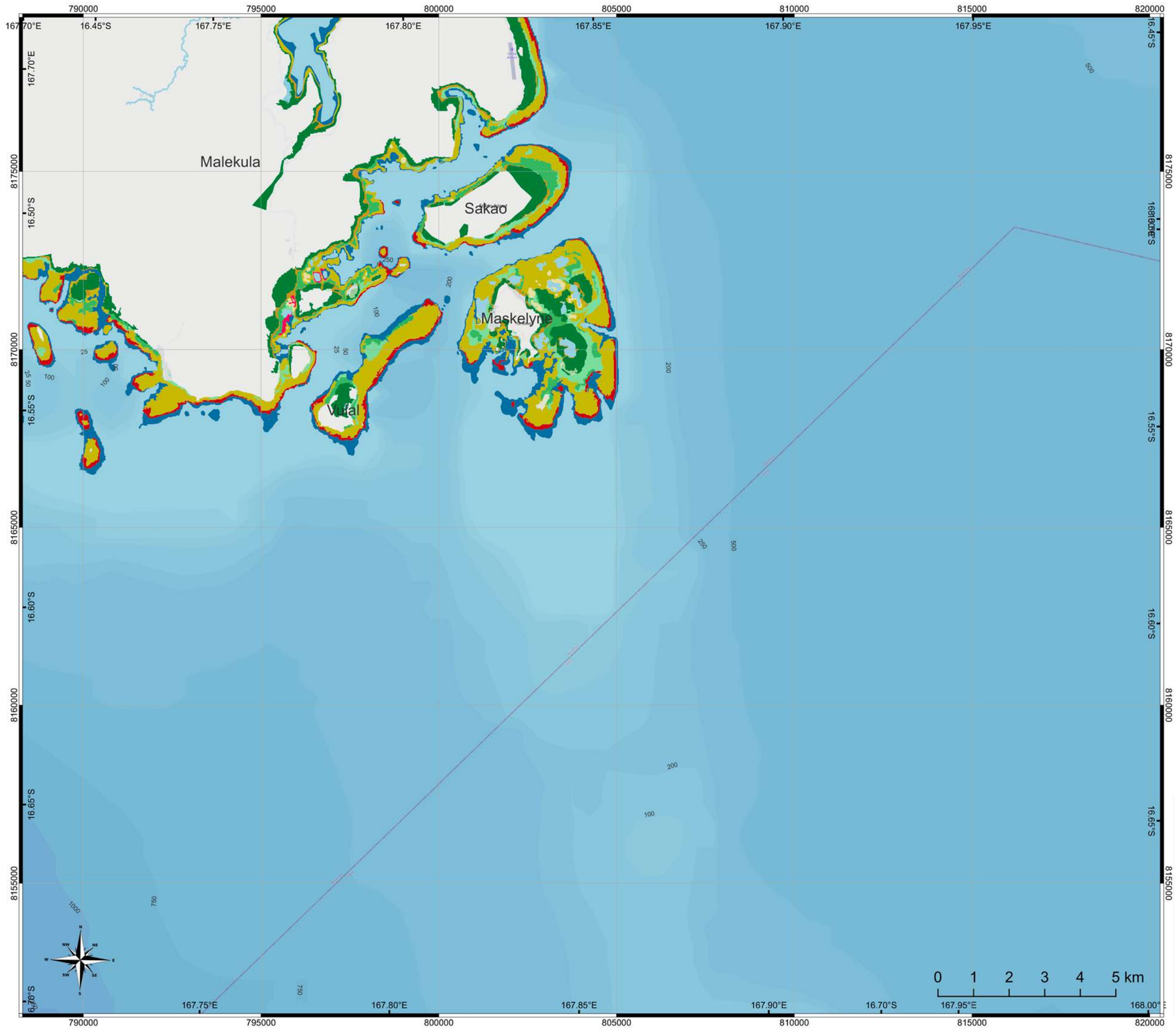
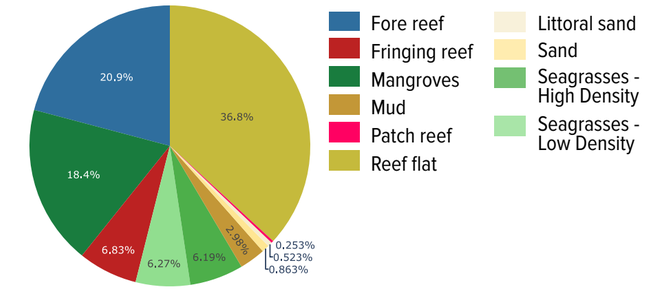


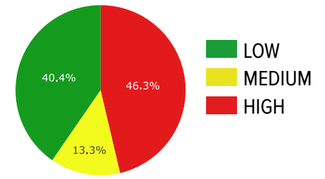
TABLE 42 OF 62 - V42

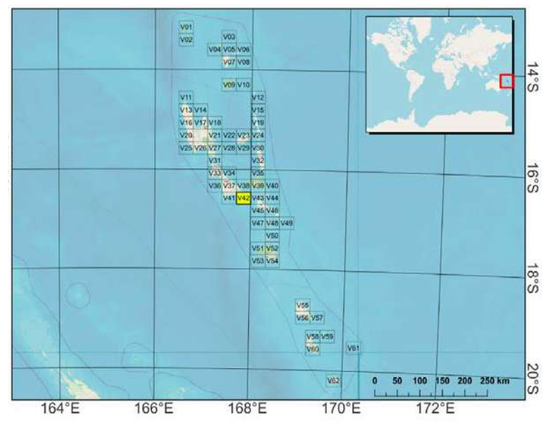
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
Bathymetry: GEBCO General Bathymetric Chart of the Oceans (year 2021)
Remote Sensing Image: Sentinel-2 (years 2018-2019)

ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

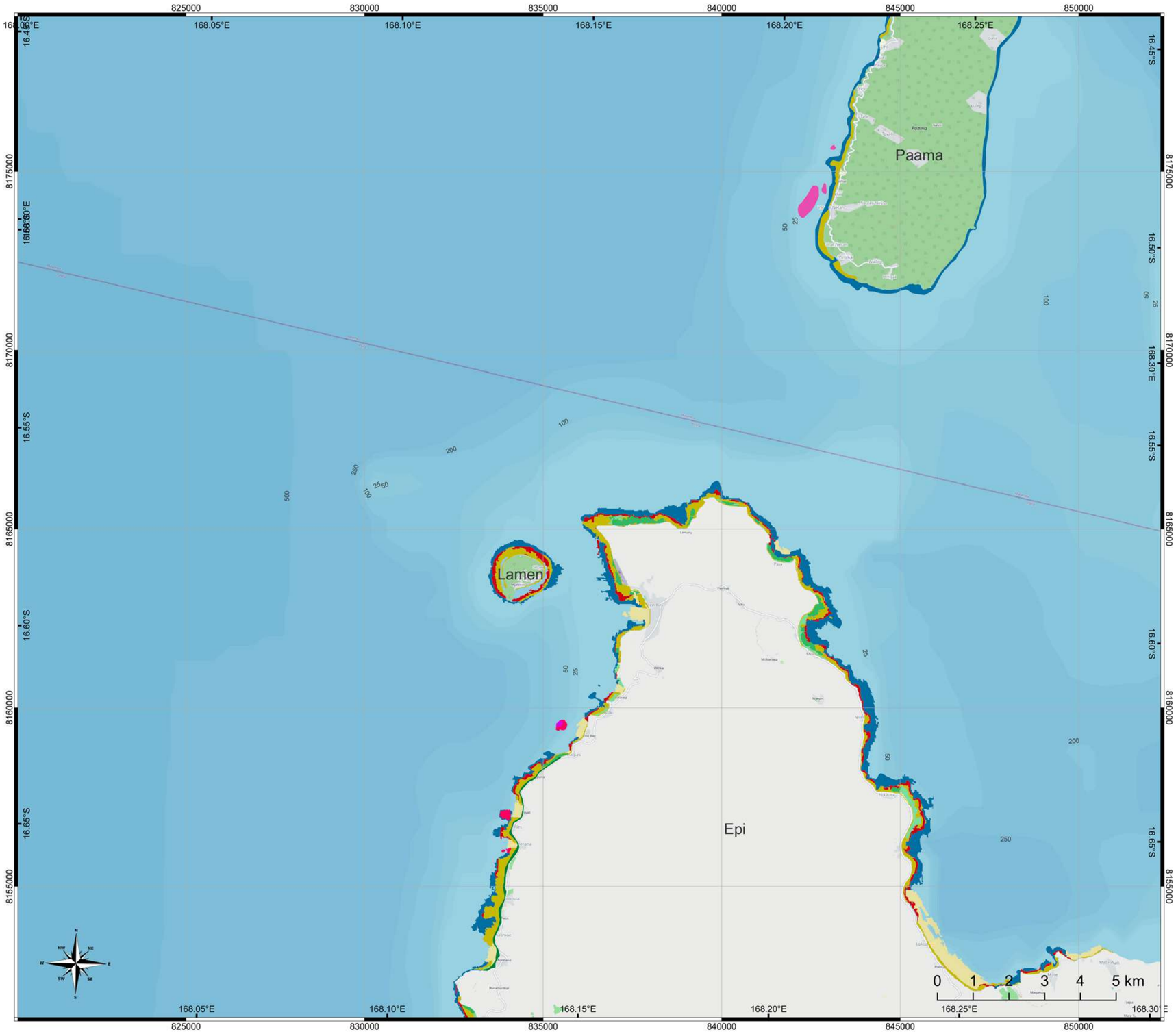
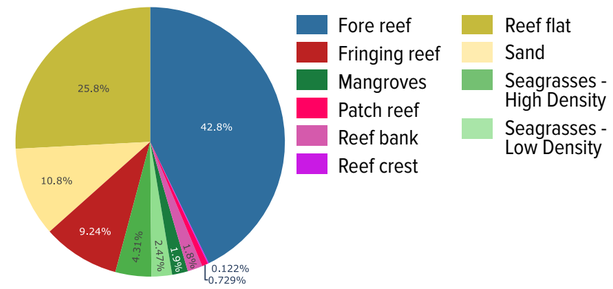


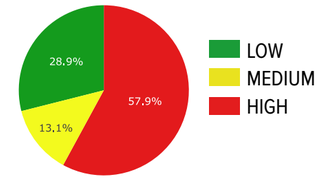
TABLE 43 OF 62 - V43

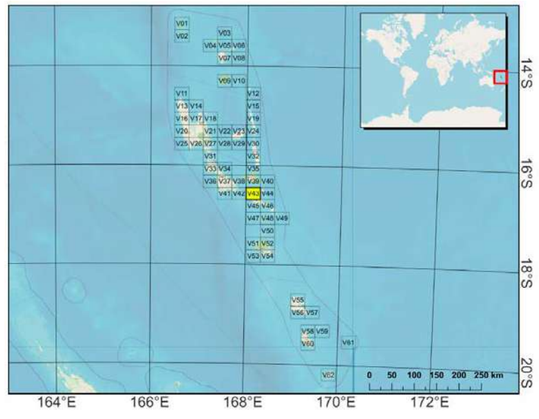
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
Bathymetry: GEBCO General Bathymetric Chart of the Oceans (year 2021)
Remote Sensing Image: Sentinel-2 (years 2018-2019)

ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

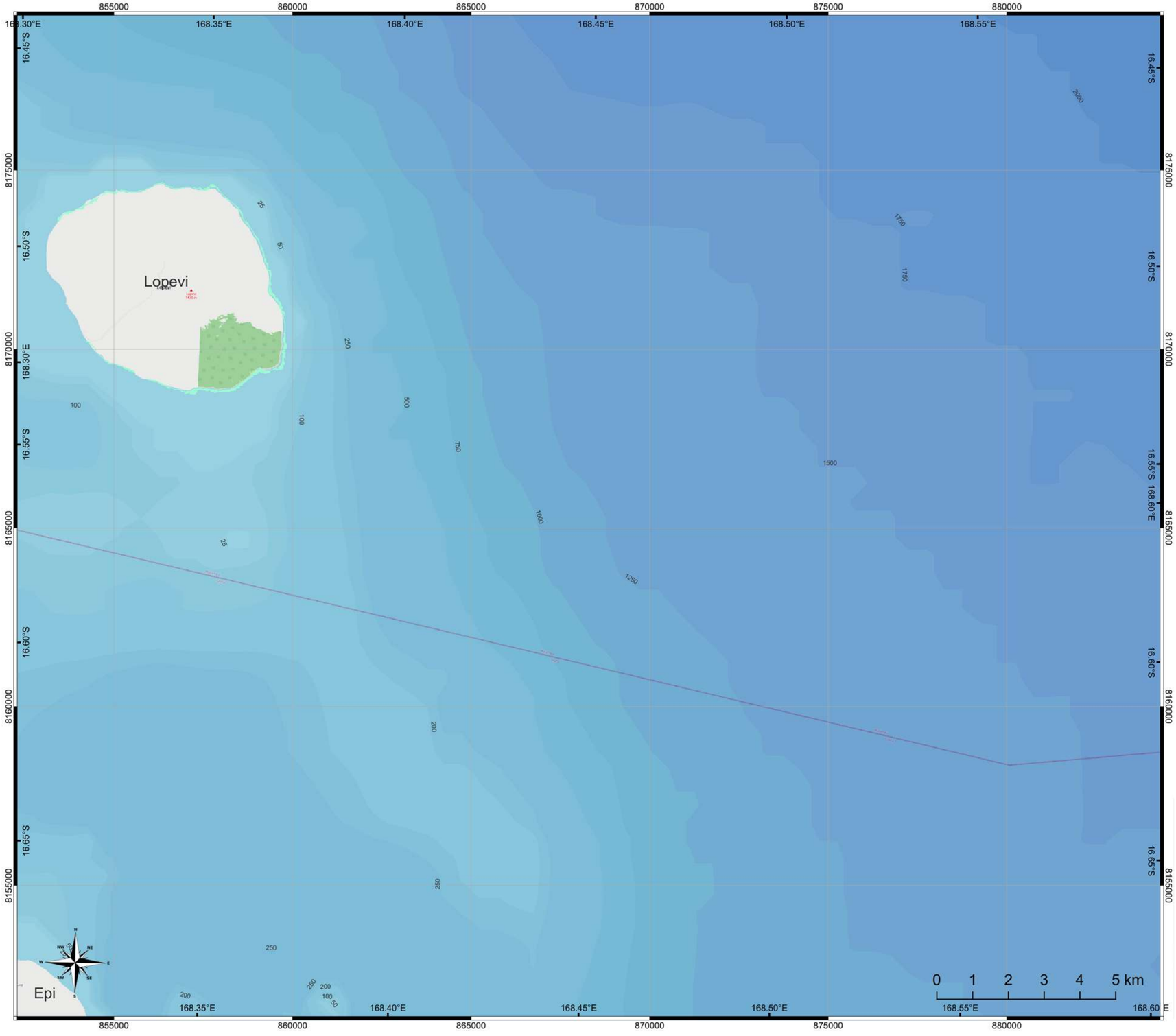
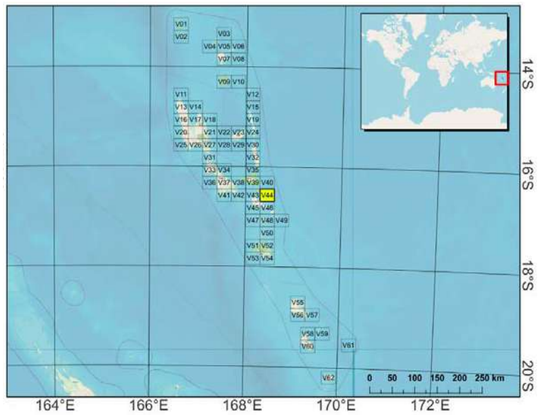


TABLE 44 OF 62 - V44

SCALE 1:100,000

MARINE HABITATS



Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
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ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

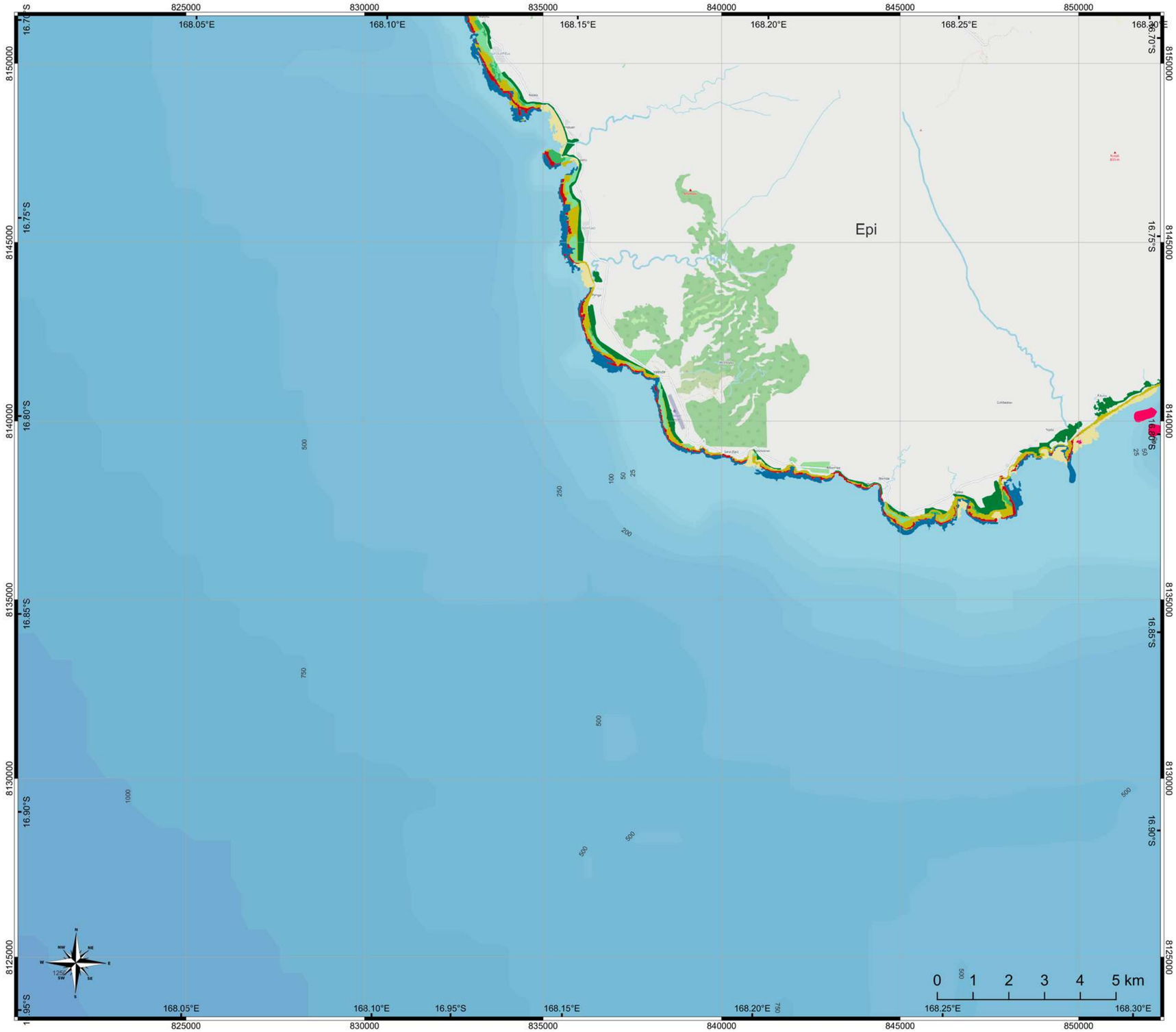
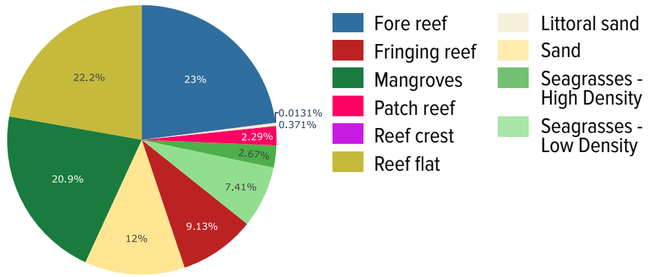


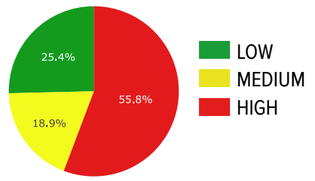
TABLE 45 OF 62 - V45

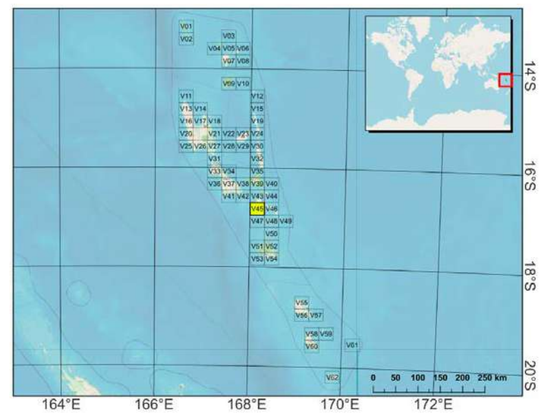
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
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MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

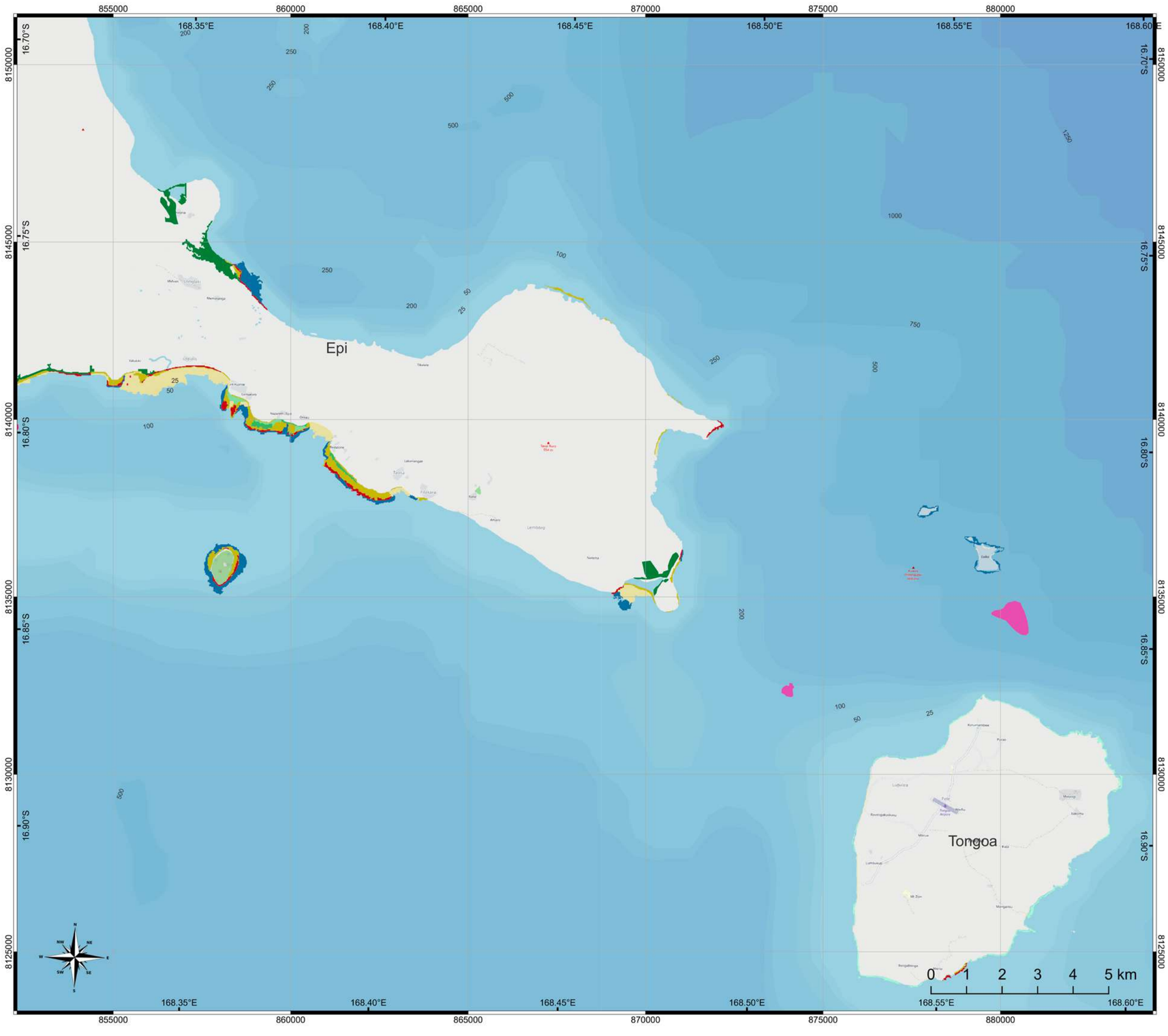
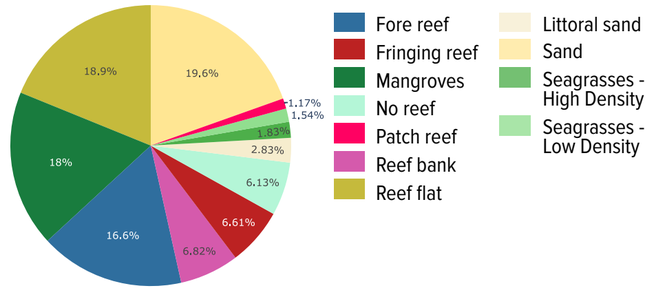


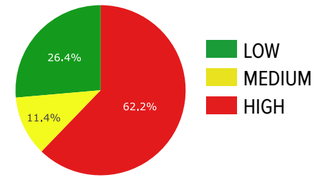
TABLE 46 OF 62 - V46

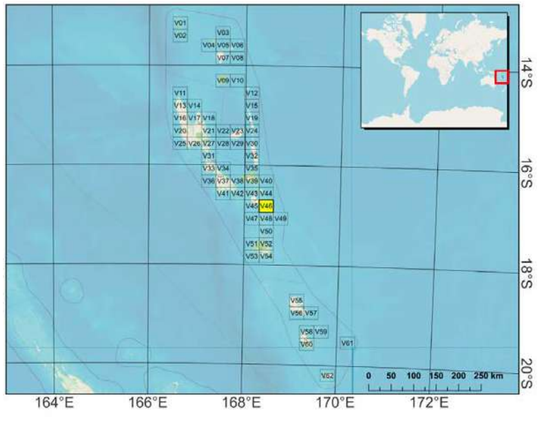
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
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ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

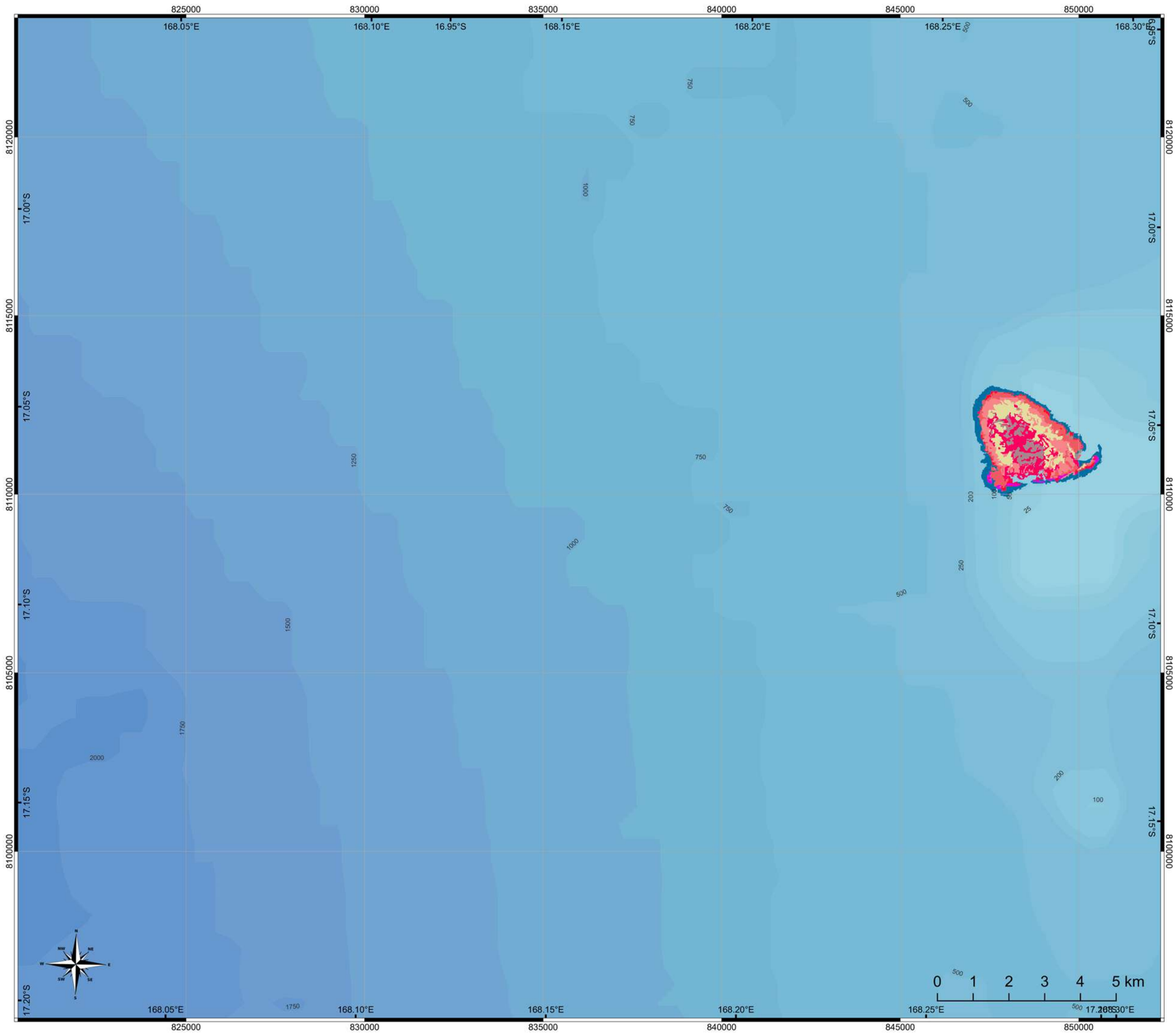
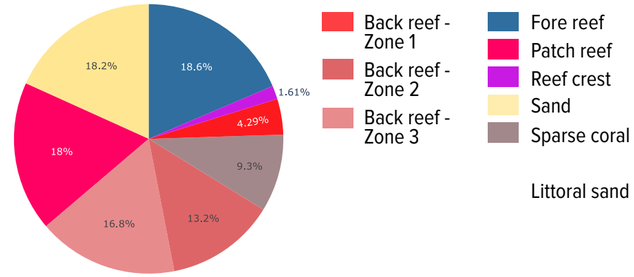


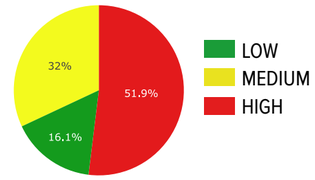
TABLE 47 OF 62 - V47

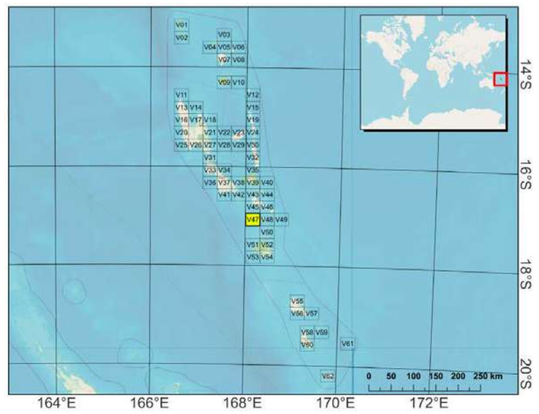
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
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ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

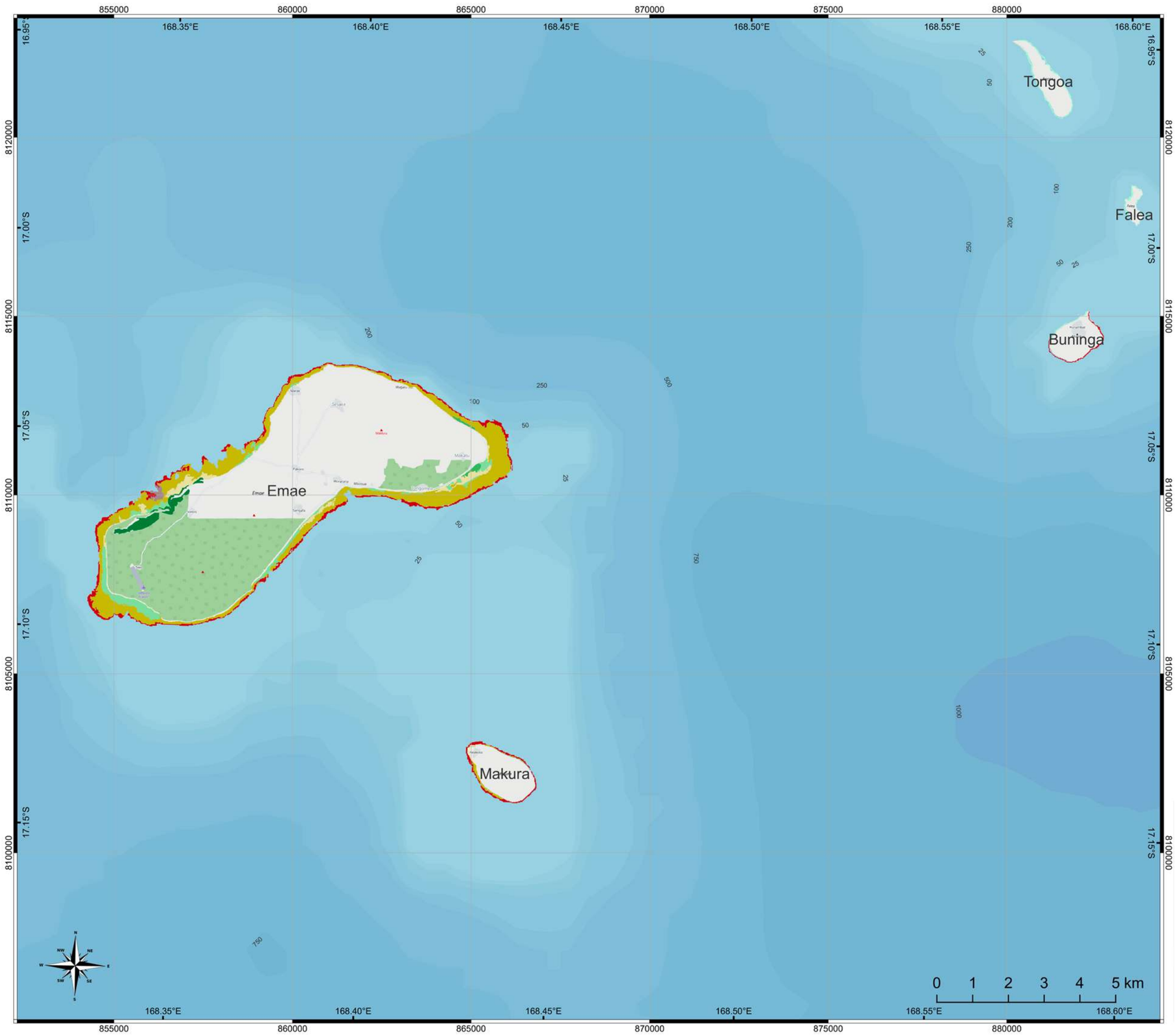
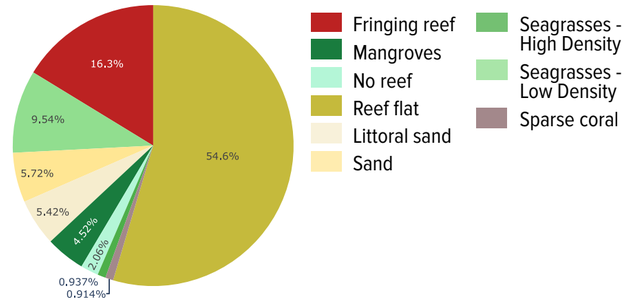


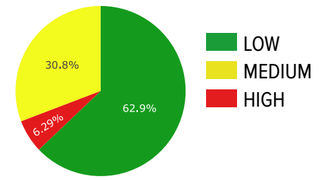
TABLE 48 OF 62 - V48

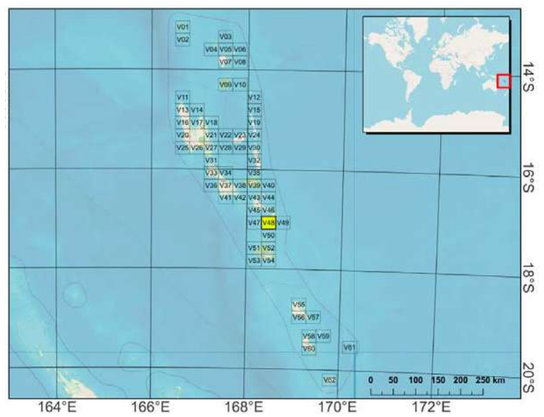
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
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ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

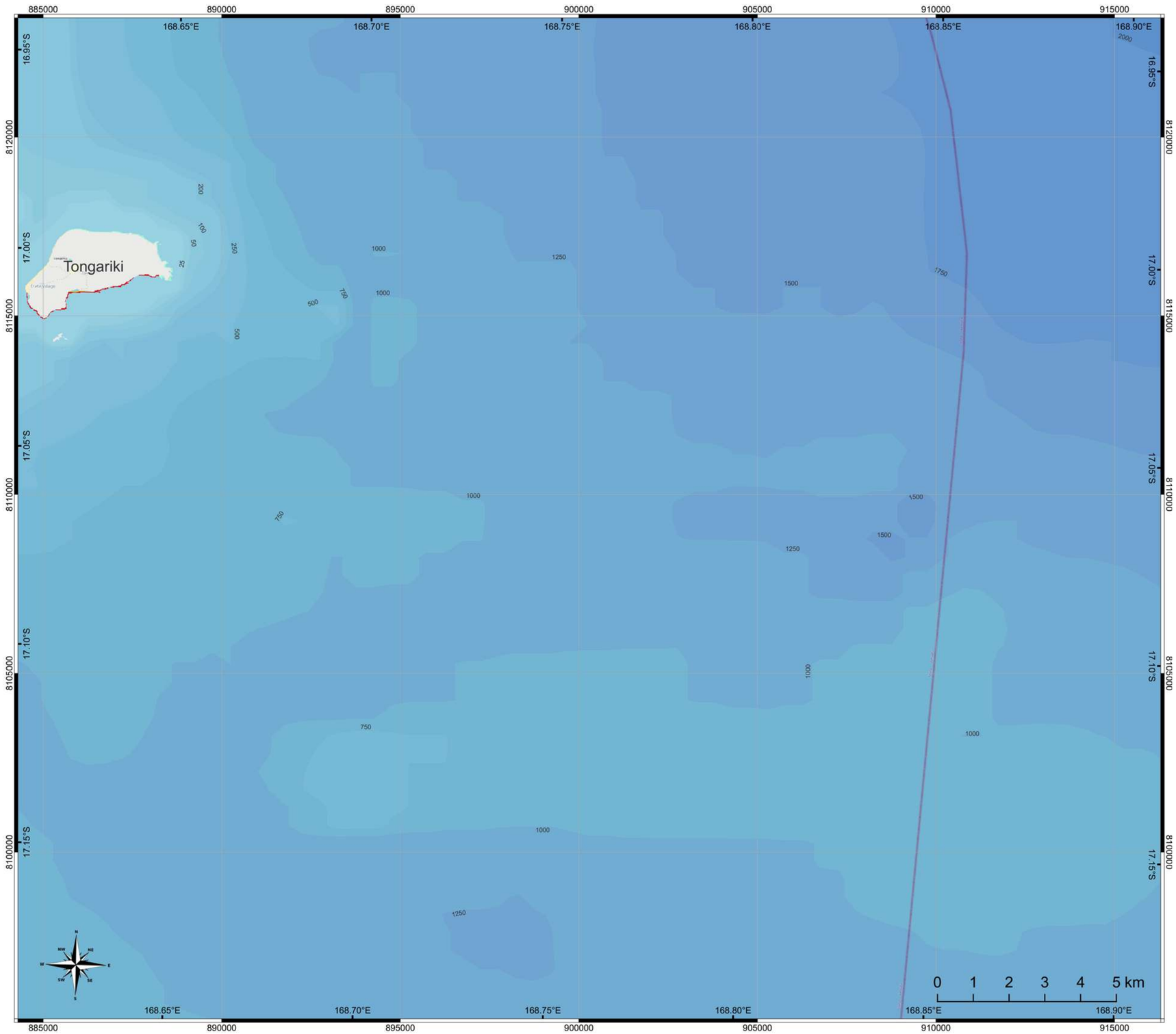
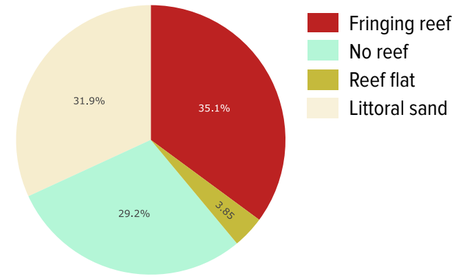


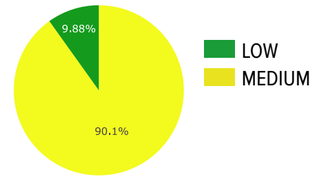
TABLE 49 OF 62 - V49

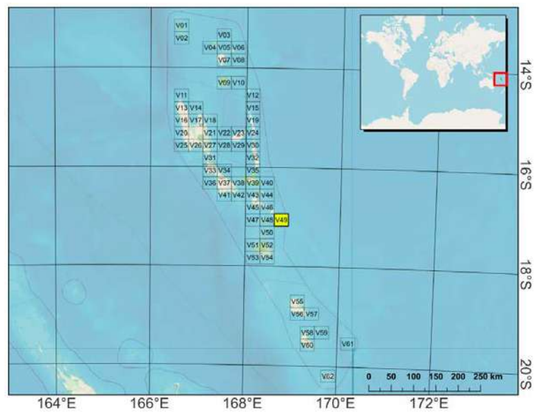
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
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ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

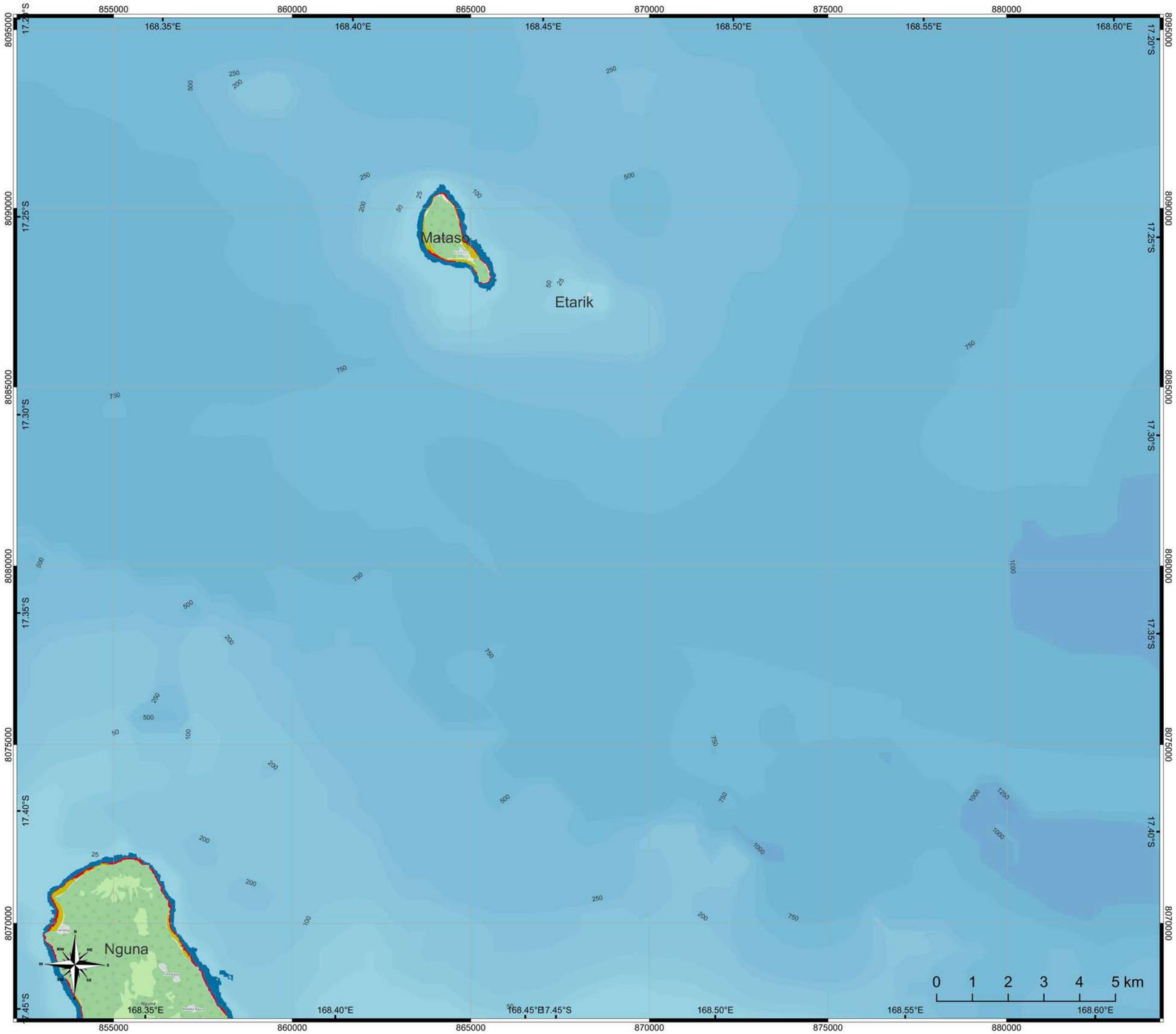
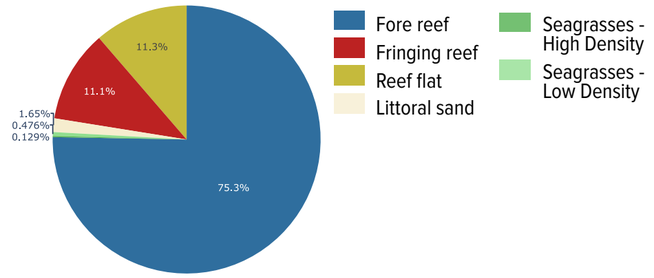


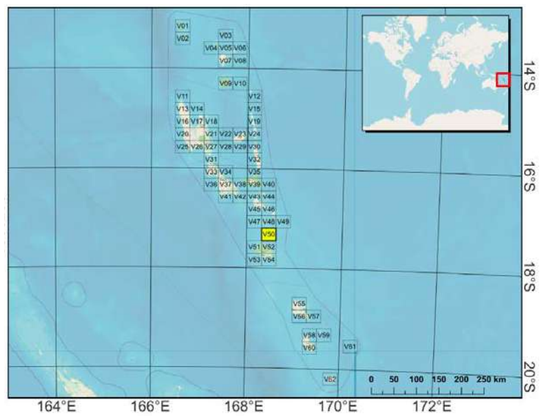
TABLE 50 OF 62 - V50

SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX



Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
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ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

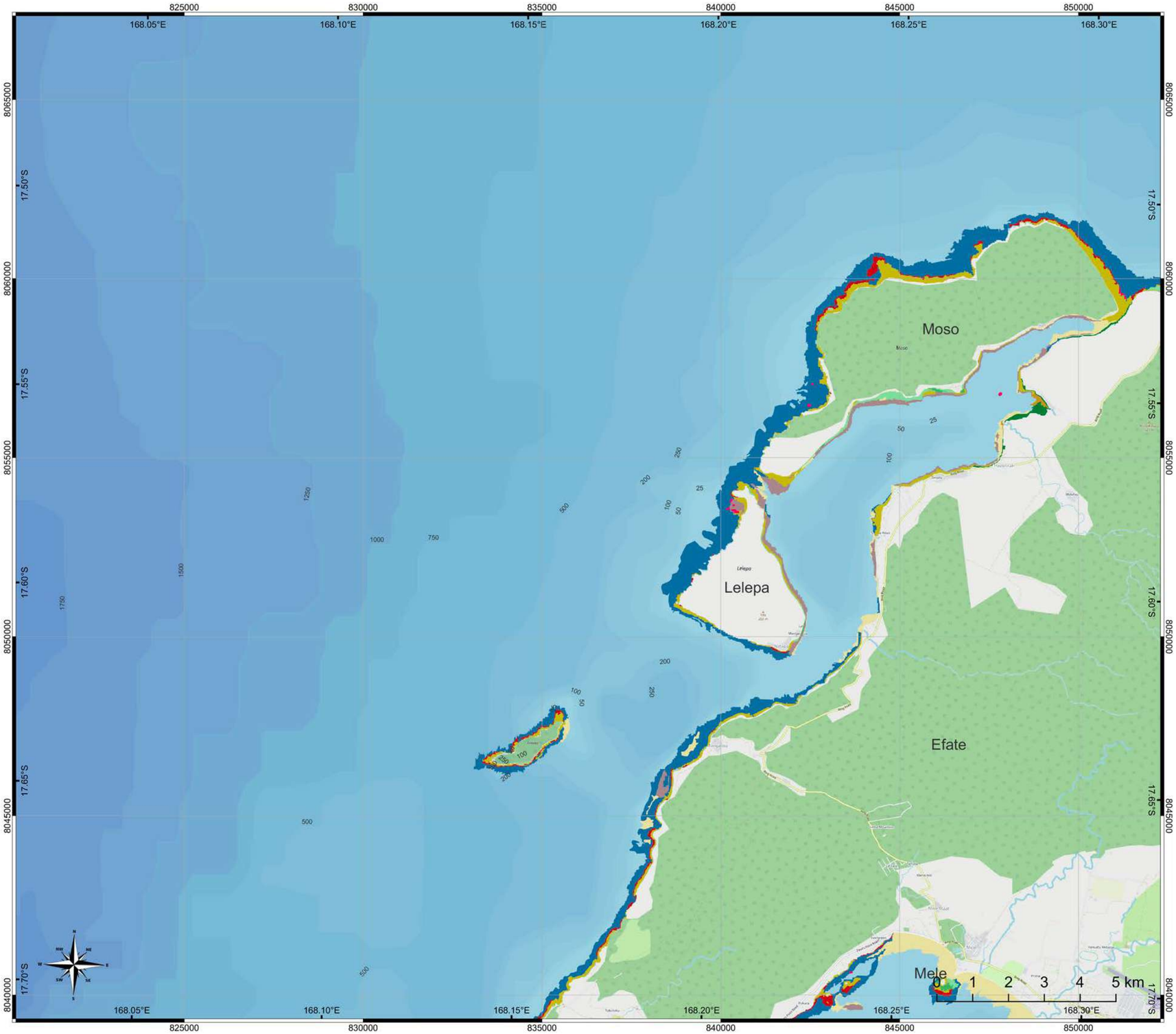
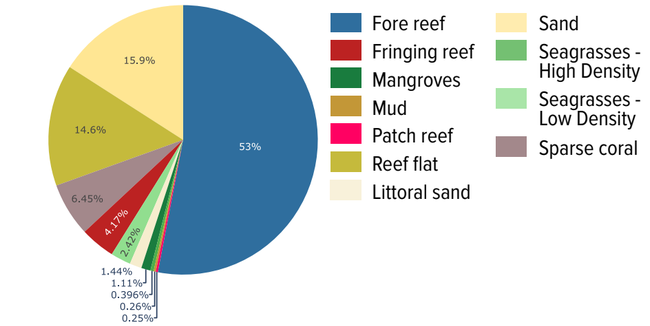


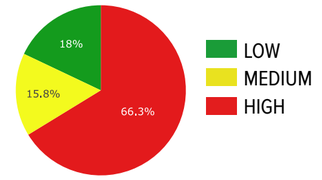
TABLE 51 OF 62 - V51

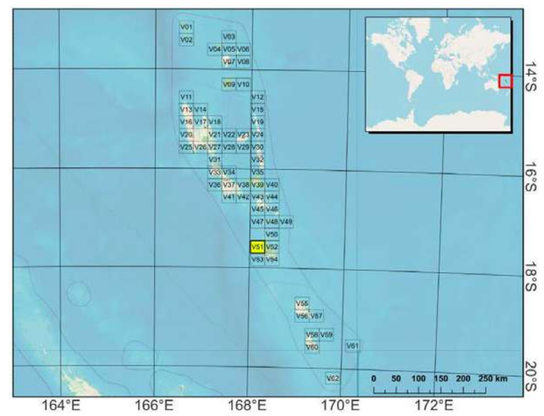
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
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ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

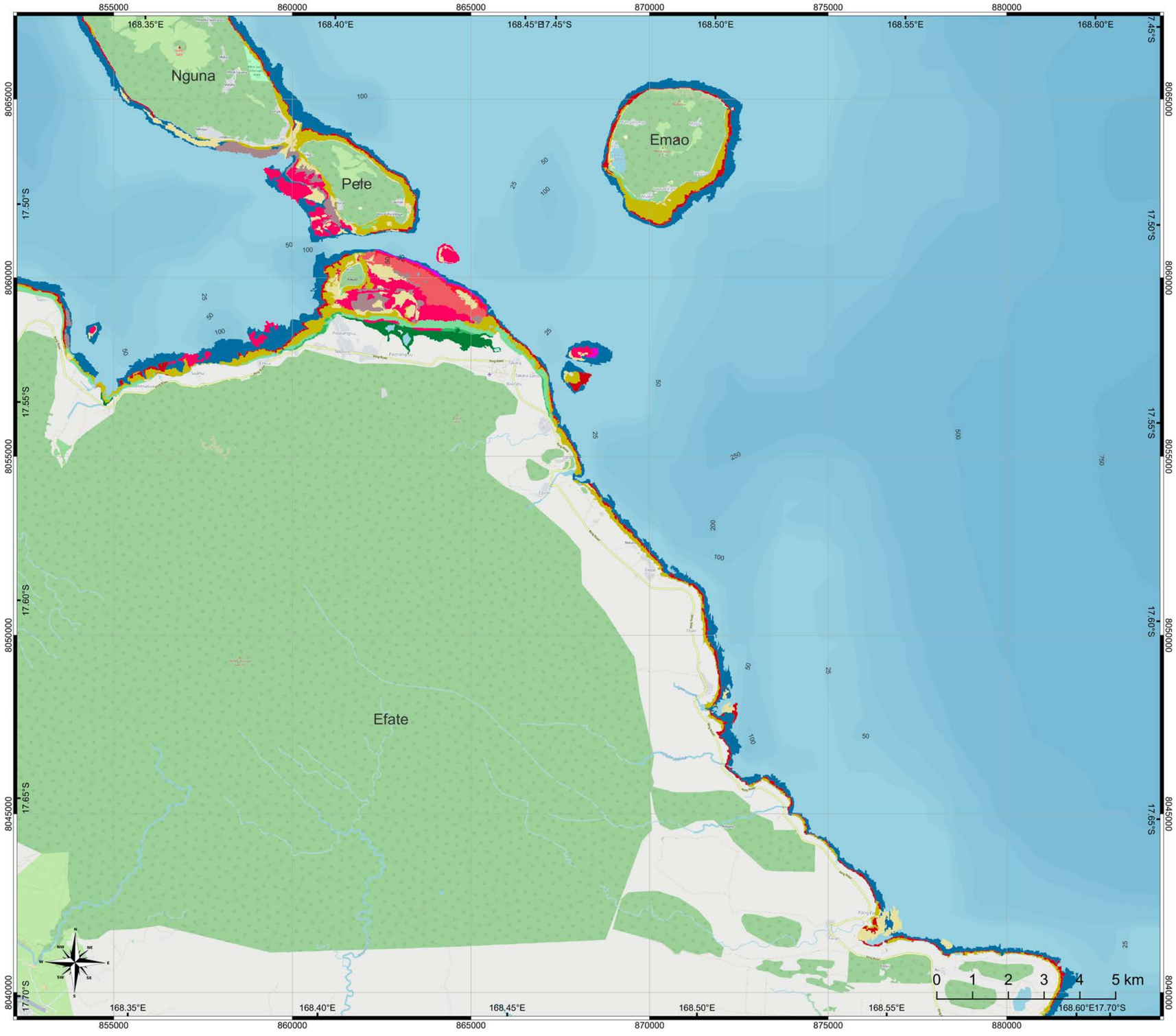
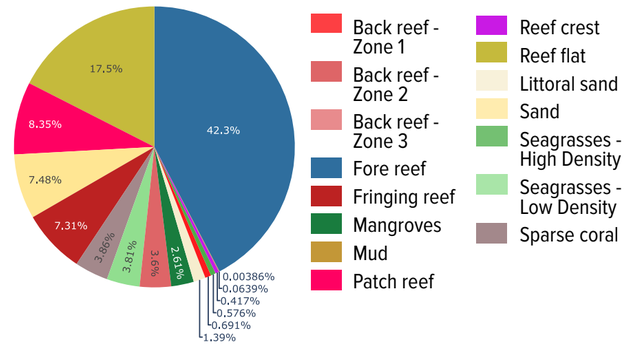


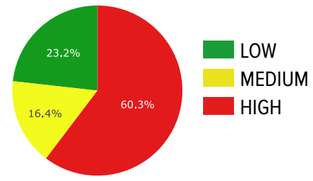
TABLE 52 OF 62 - V52

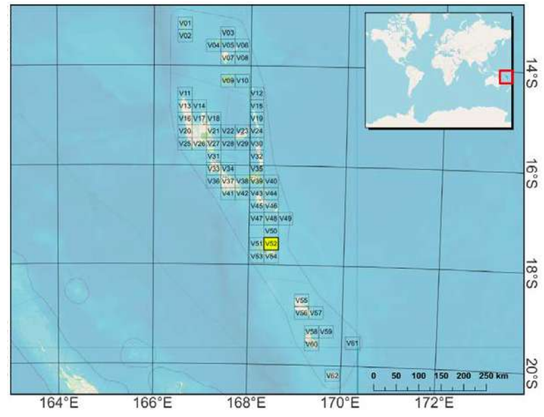
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





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ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

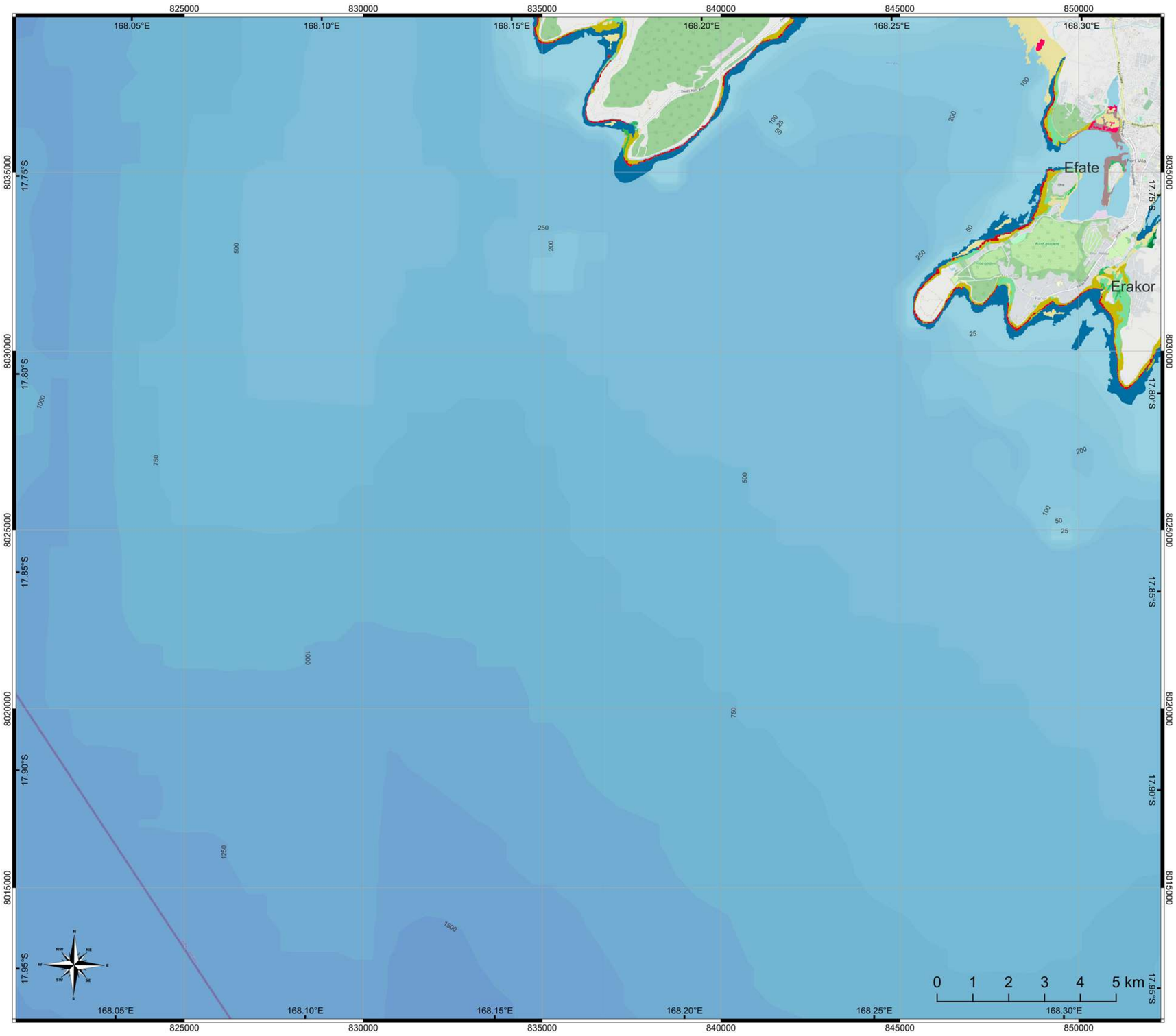
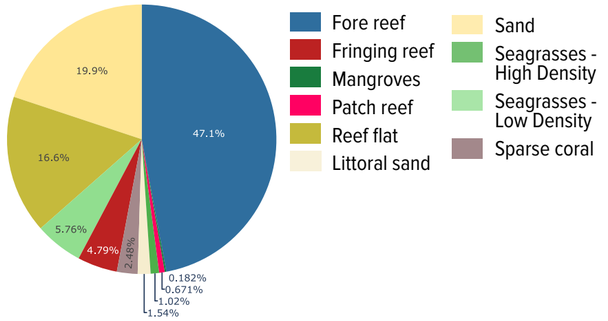


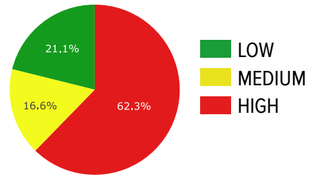
TABLE 53 OF 62 - V53

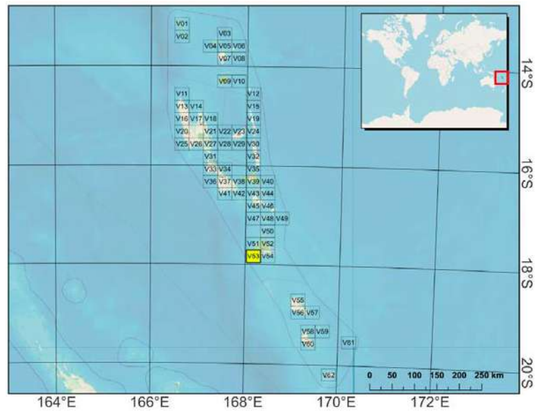
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
Bathymetry: GEBCO General Bathymetric Chart of the Oceans (year 2021)
Remote Sensing Image: Sentinel-2 (years 2018-2019)

ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

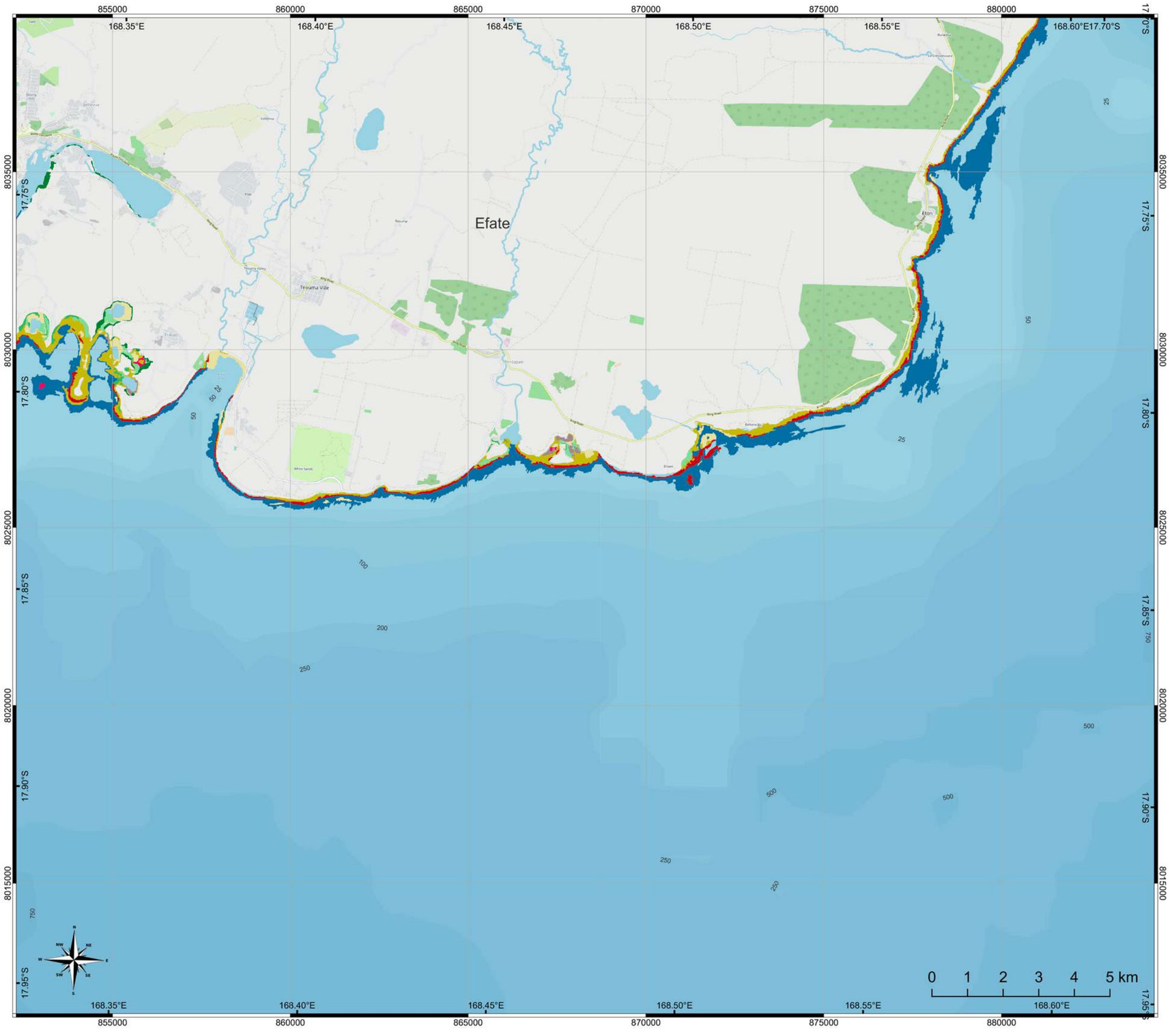
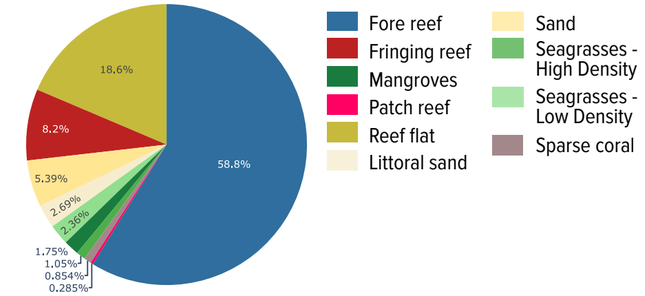


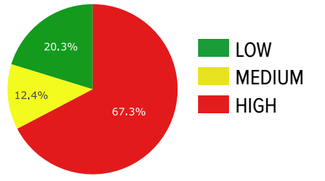
TABLE 54 OF 62 - V54

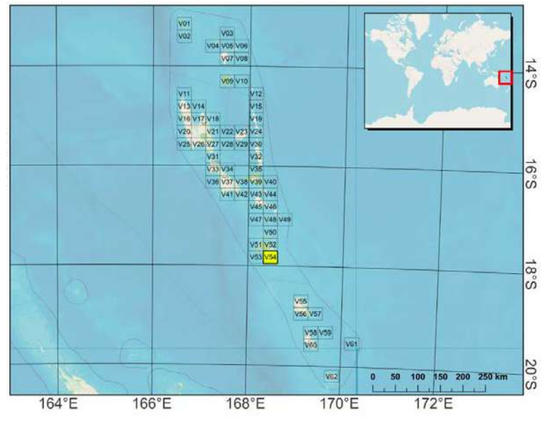
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Geographic Coordinate system: WGS84 - EPSG:4326
Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Basemap: OpenStreetMap from OSM Foundation (year 2022)
Bathymetry: GEBCO General Bathymetric Chart of the Oceans (year 2021)
Remote Sensing Image: Sentinel-2 (years 2018-2019)

ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

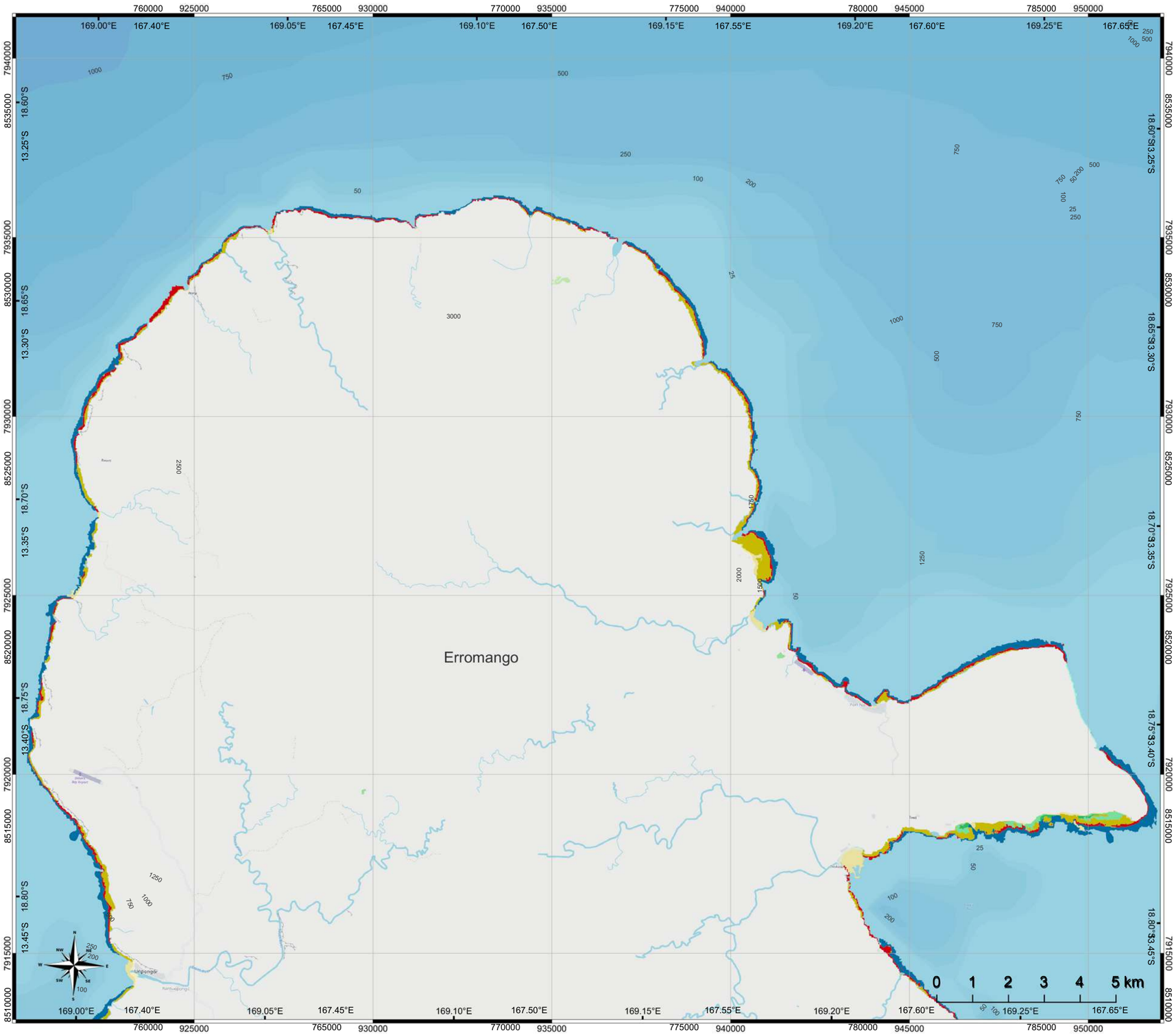
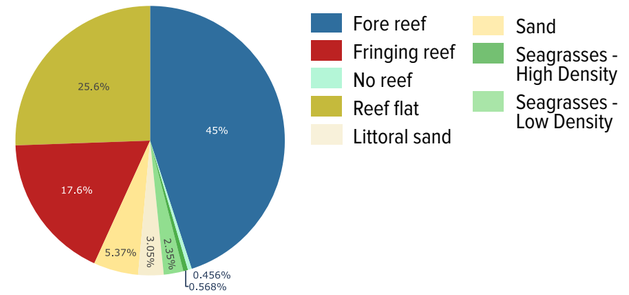


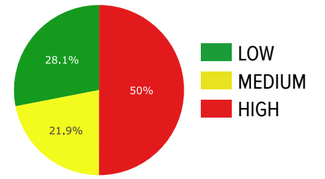
TABLE 55 OF 62 - V55

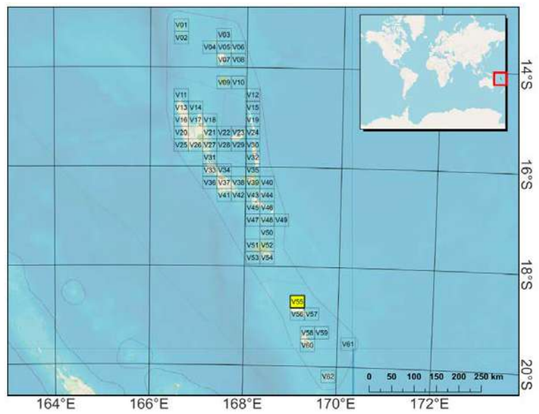
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
Bathymetry: GEBCO General Bathymetric Chart of the Oceans (year 2021)
Remote Sensing Image: Sentinel-2 (years 2018-2019)

ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

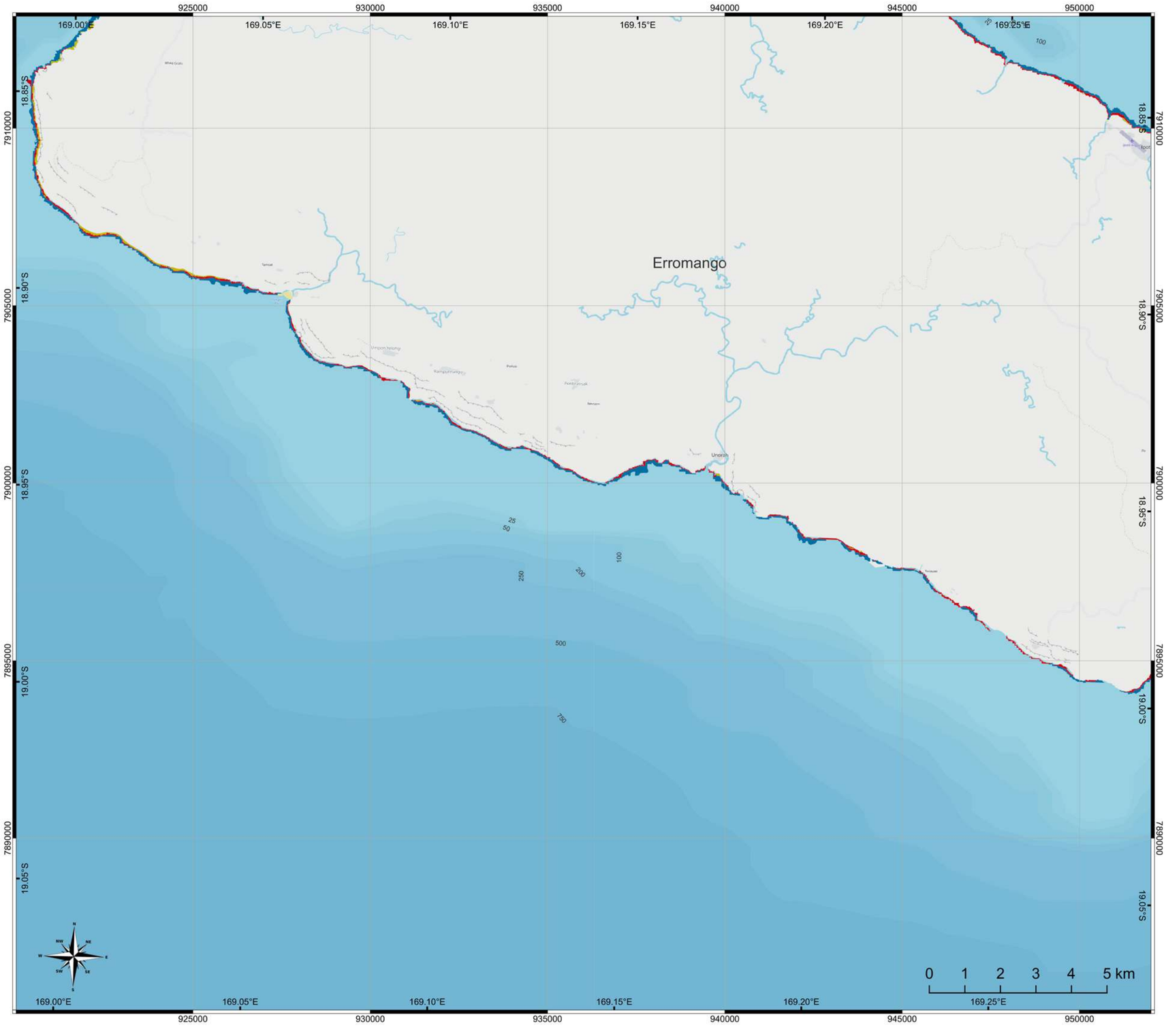
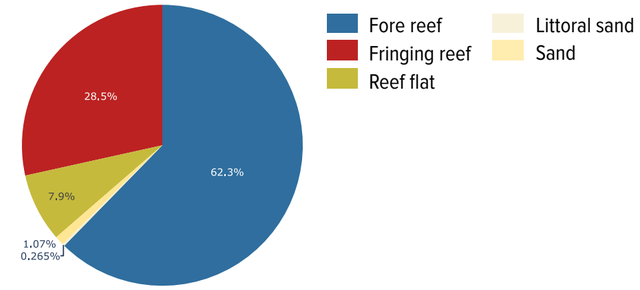


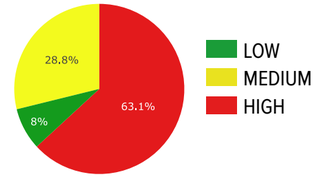
TABLE 56 OF 62 - V56

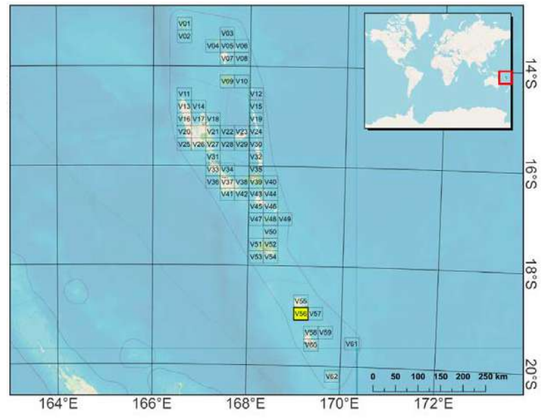
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Geographic Coordinate system: WGS84 - EPSG:4326
Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Basemap: OpenStreetMap from OSM Foundation (year 2022)
Bathymetry: GEBCO General Bathymetric Chart of the Oceans (year 2021)
Remote Sensing Image: Sentinel-2 (years 2018-2019)

ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

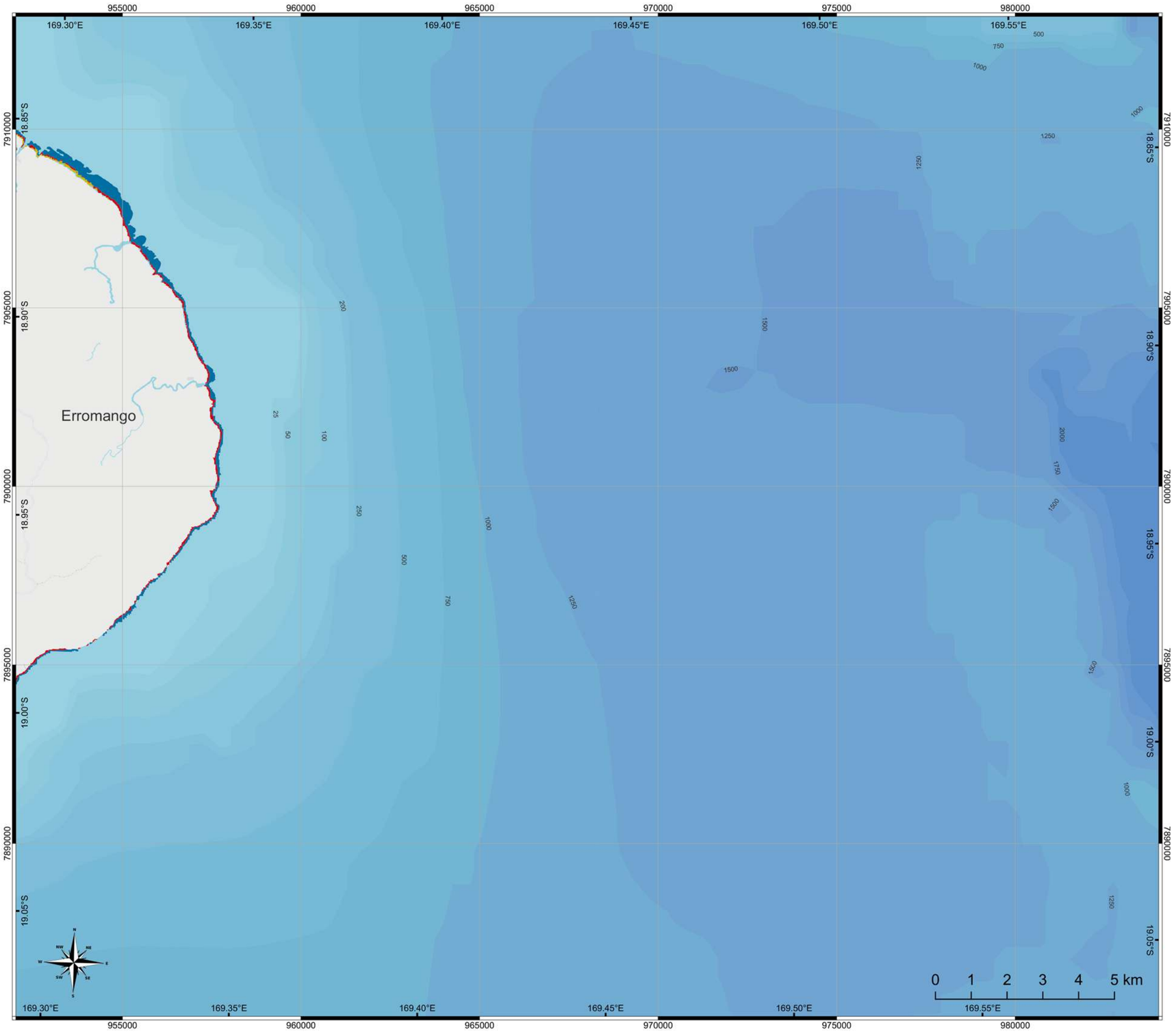
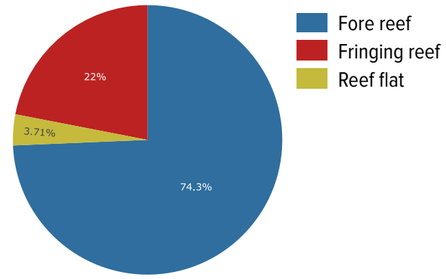


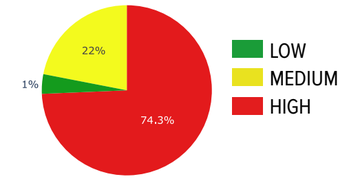
TABLE 57 OF 62 - V57

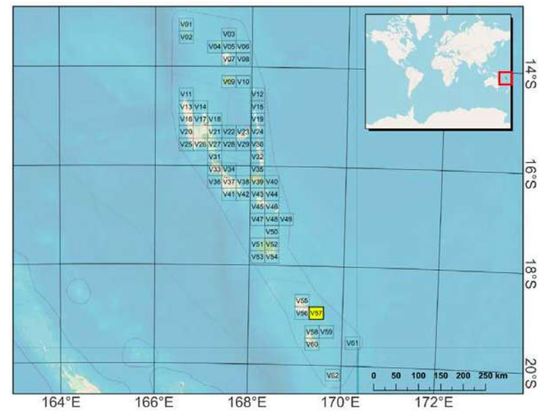
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
Bathymetry: GEBCO General Bathymetric Chart of the Oceans (year 2021)
Remote Sensing Image: Sentinel-2 (years 2018-2019)

ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

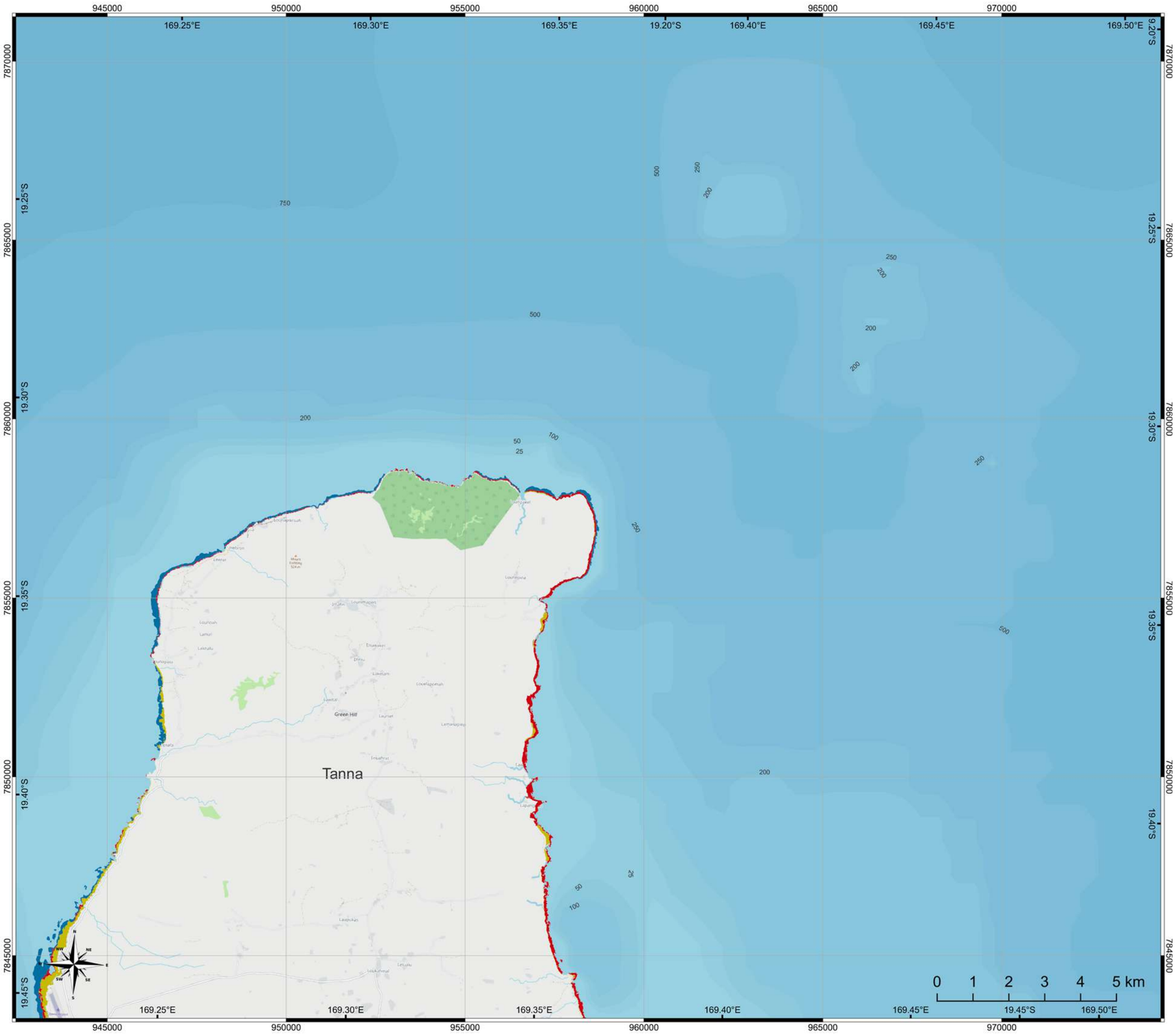
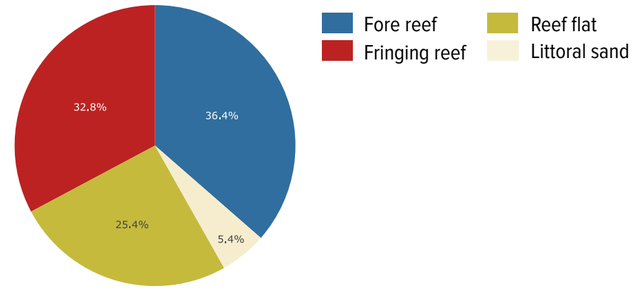


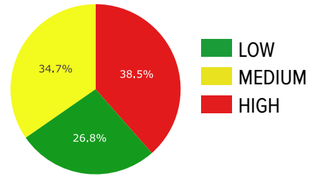
TABLE 58 OF 62 - V58

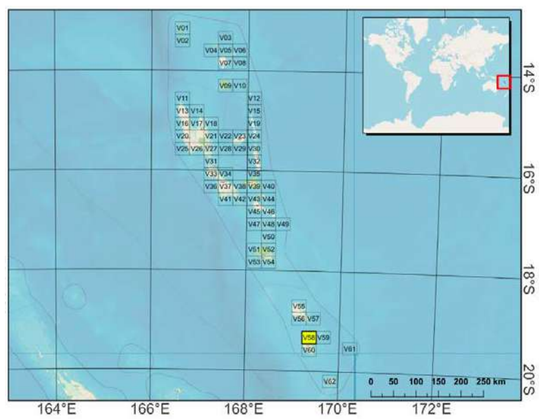
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
Bathymetry: GEBCO General Bathymetric Chart of the Oceans (year 2021)
Remote Sensing Image: Sentinel-2 (years 2018-2019)

ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

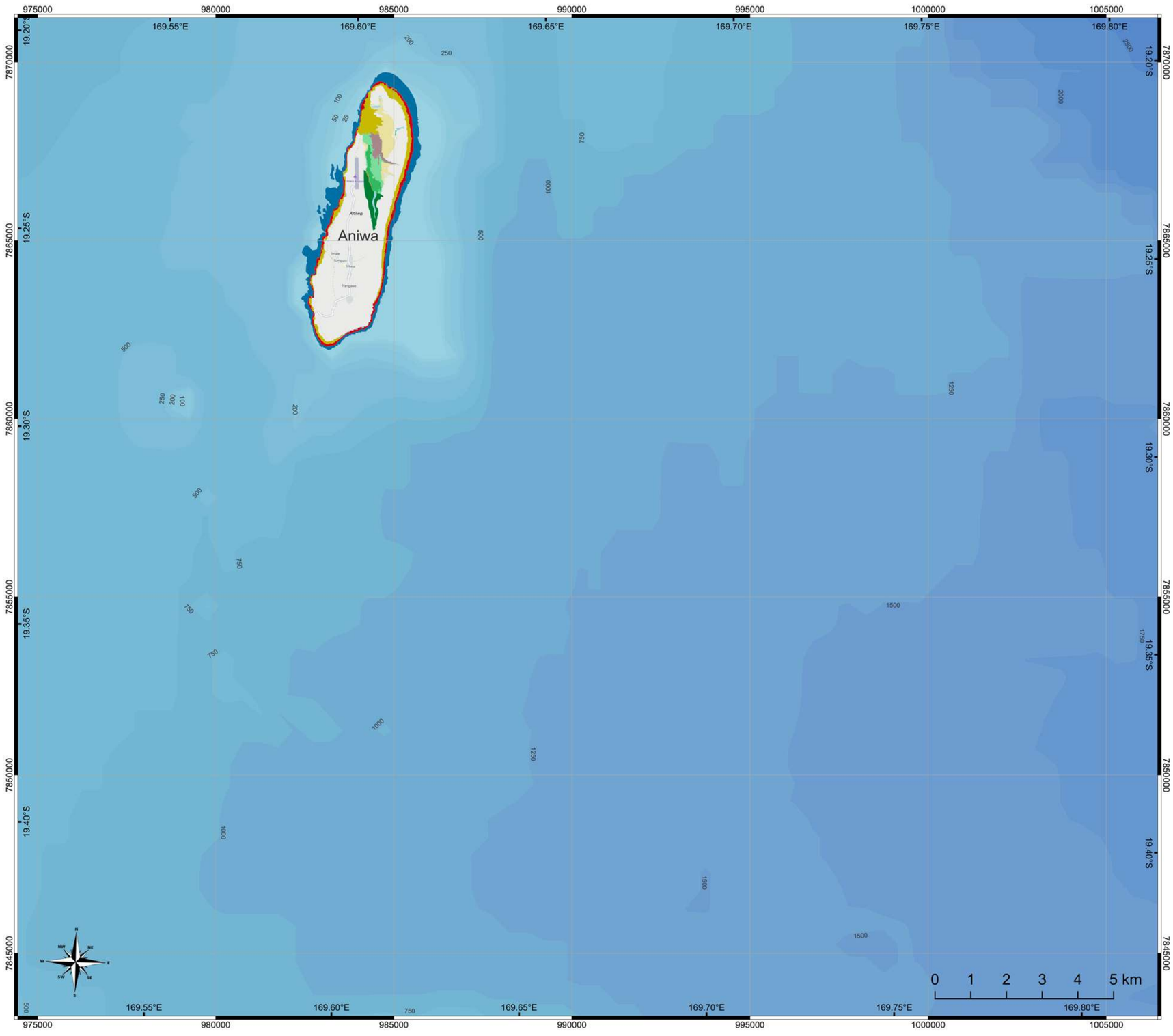
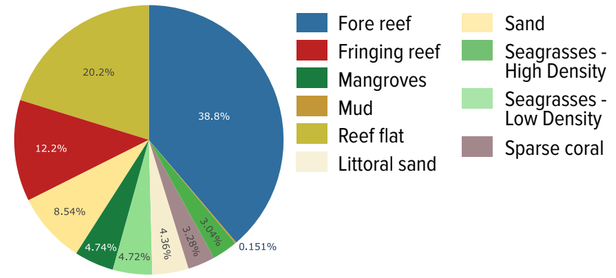


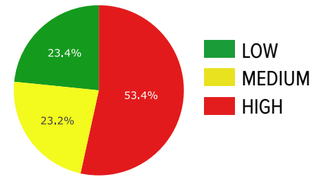
TABLE 59 OF 62 - V59

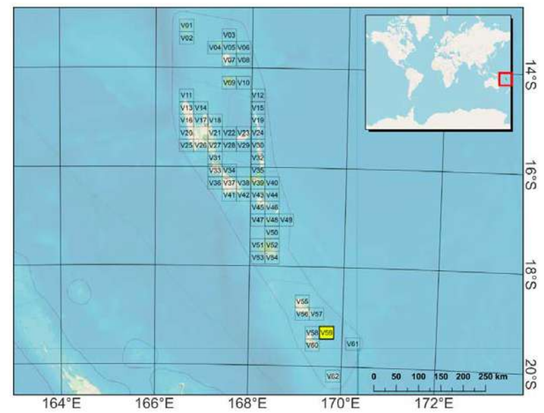
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
Bathymetry: GEBCO General Bathymetric Chart of the Oceans (year 2021)
Remote Sensing Image: Sentinel-2 (years 2018-2019)

ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

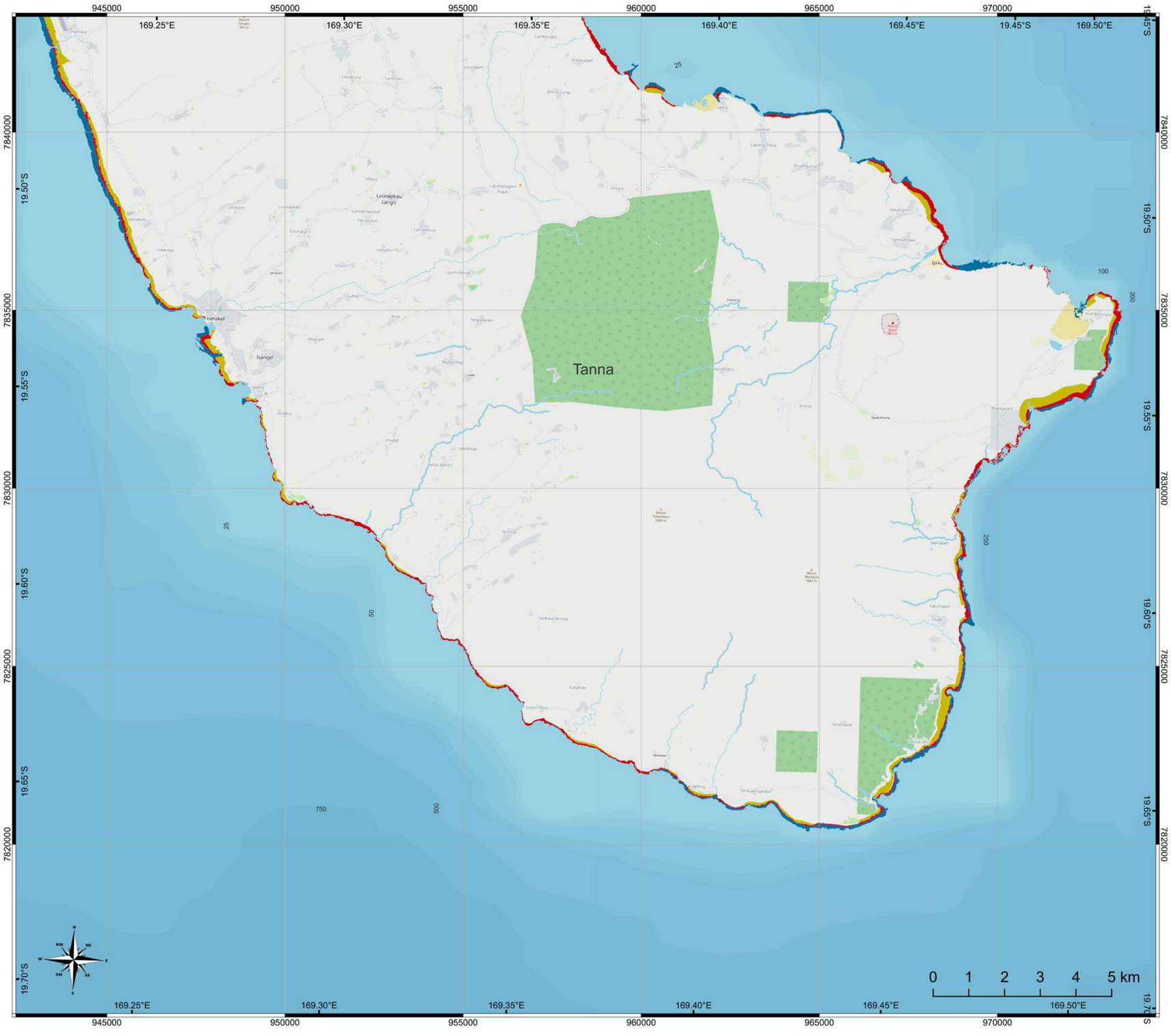
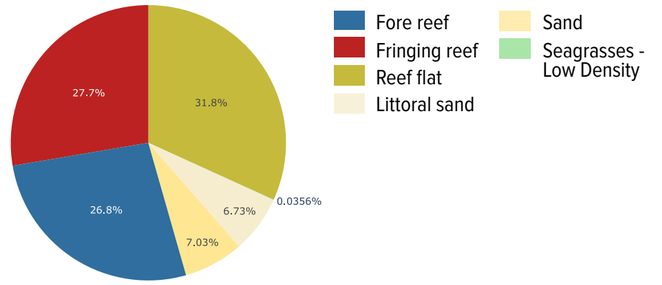


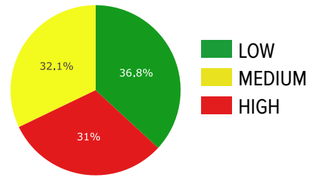
TABLE 60 OF 62 - V60

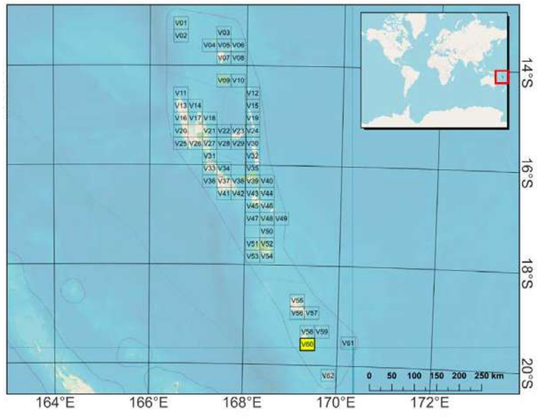
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
Bathymetry: GEBCO General Bathymetric Chart of the Oceans (year 2021)
Remote Sensing Image: Sentinel-2 (years 2018-2019)

ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

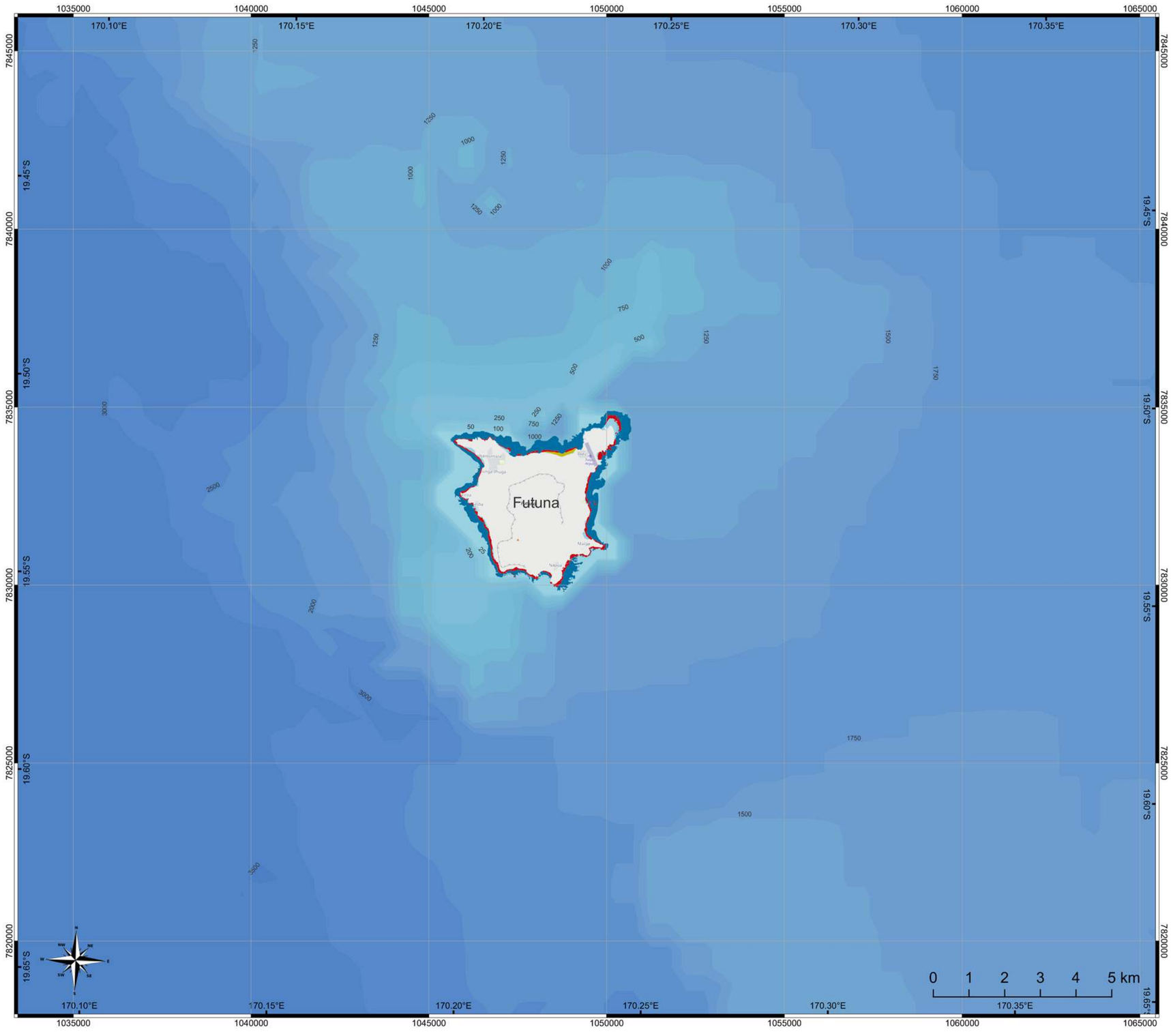
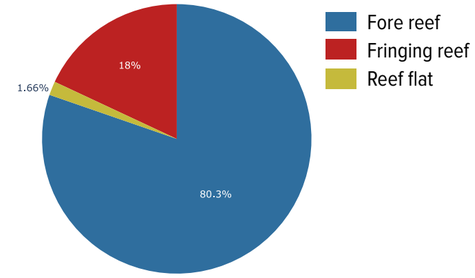


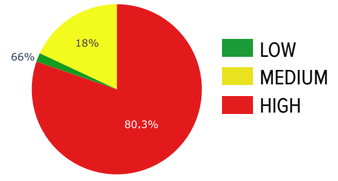
TABLE 61 OF 62 - V61

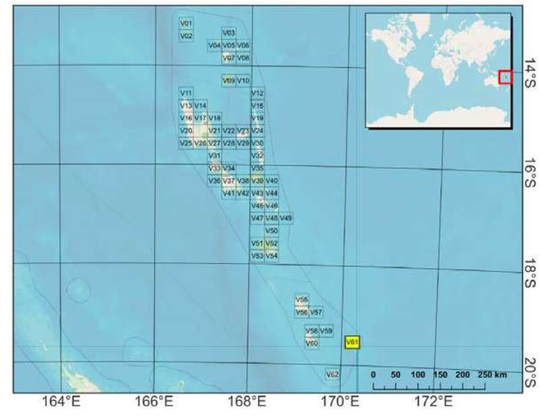
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
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ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

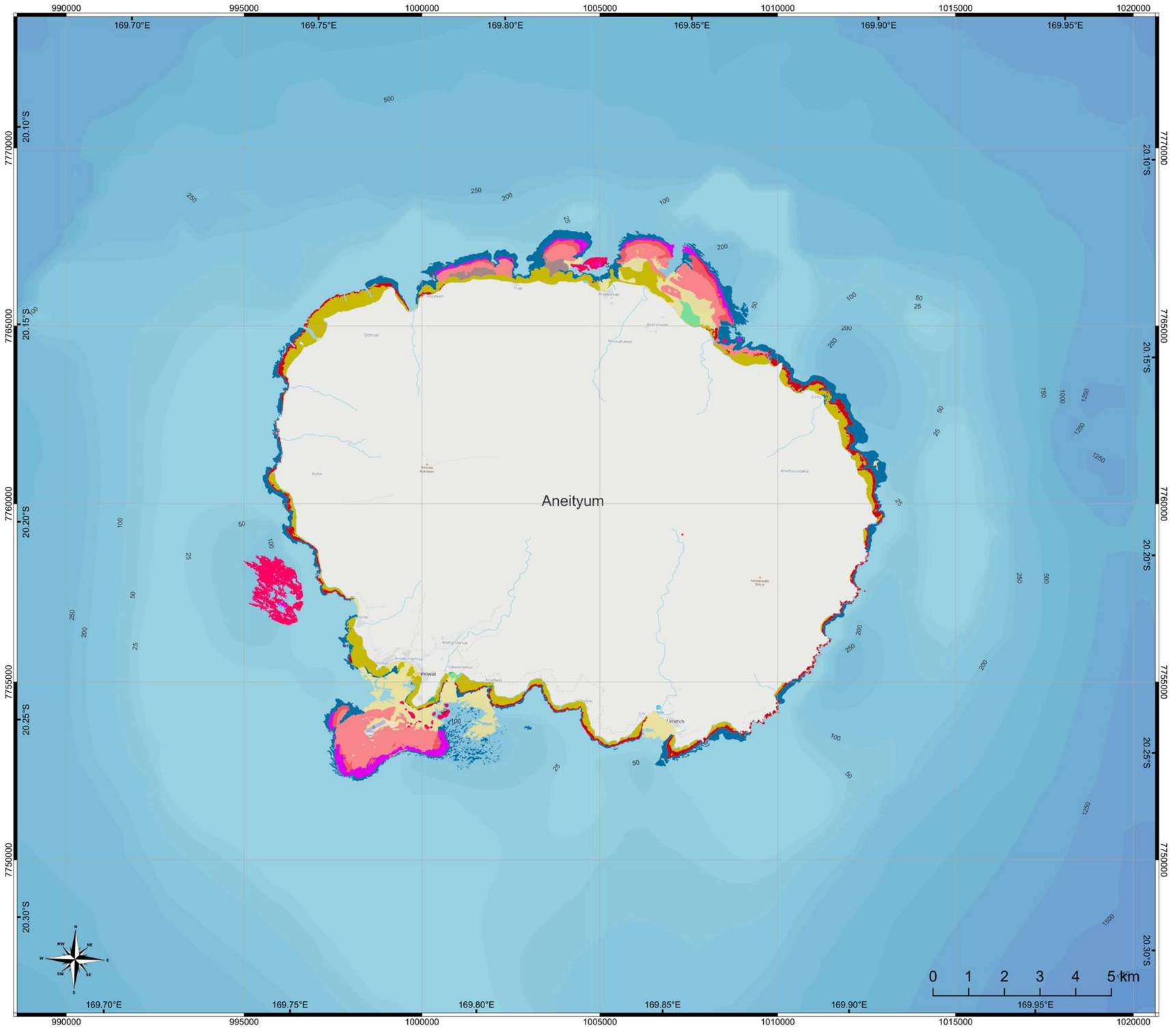
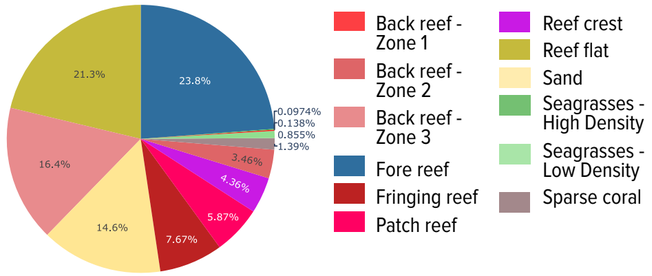


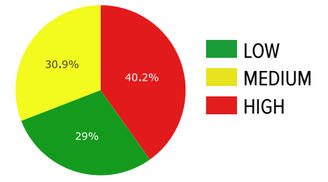
TABLE 62 OF 62 - V62

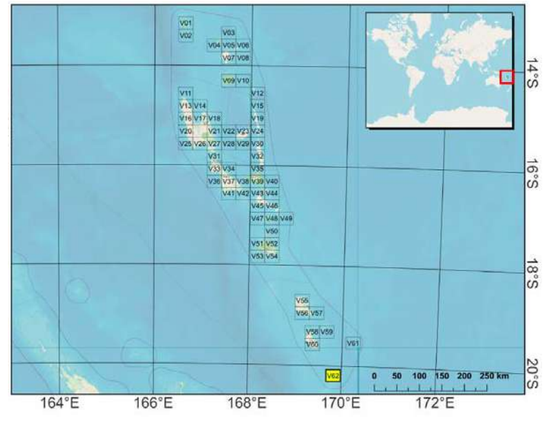
SCALE 1:100,000

MARINE HABITATS



ECOLOGICAL QUALITY INDEX





Projected Coordinate system: WGS84 UTM Zone 58S - EPSG:32758
Geographic Coordinate system: WGS84 - EPSG:4326
Basemap: OpenStreetMap from OSM Foundation (year 2022)
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REPUBLIC OF VANUATU

MINISTERO DELL'AMBIENTE
E DELLA SICUREZZA ENERGETICA

ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES,
ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT