Gas Pipeline Interconnection

Malta-Italy Project

REPORT

ENVIRONMENTAL AND BIODIVERSITY BASELINE

Co-financed by the European Union
Connecting Europe Facility

GAS PIPELINE INTERCONNECTION MALTA-ITALY

POST SURVEY ASSESSMENT

Produced by : Lighthouse S.p.A. - Bologna - Italy

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1.1.0 Definitions

CLIENT: Maltese Ministry for Energy and Water Management

CONTRACTOR: LIGHTHOUSE S.p.A.

1.2.0 Abbreviations

m b.s.l.	Metres Below Sea Level
AA-EQS	Environmental Quality Standard–Annual Average
ARPA	Agenzia Regionale Protezione Ambiente
BC	Box Core
BH	Borehole
CD	Chart Datum
CMEMS	Copernicus Marine Environment Monitoring Service
CNR	National Research Council
CPT	Cone Penetration Test
CSD	Continental Shelf Department
CTD	Conductivity, Temperature, Depth
DPR	Daily Progress Report
DXF/dxf	AutoCAD Drawing Exchange Format
EIA	Environmental Impact Assessment
EPC	Engineering, Procurement and Construction
EPSG	European Petroleum Survey Group
EQS	Environmental Quality Standard
ERA	Environmental and Resoruces Authority
ESIA	Environmental and Social Impact Assessment Survey
FEED	Front End Engineering Design
GC	Gravity Cores (Piston Cores)
GS	Grab Sample
GIS	Geographic Information System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GWF	Work Form(s)
GWI	Work Instruction(s)
GWP	Work Procedure(s)
HDD	Horizontal Directional Drilling
HSE	Health, Safety and Environment
ICPC	International Cable Protection Committee
ICRAM	Istituto Centrale Ricerca Applicata al Mare
IDP	Identifier of Project
IHO	International Hydrographic Organisation
IMCA	International Marine Contractors Association
INS	Inertial Navigation System
ISPRA	Istituto Superiore per la Protezione e la Ricerca Ambientale
IUCN	International Union for Conservation of Nature
KP	Kilometre Post

LAT	Lowest Astronomical Tide
LGH	Lighthouse Spa
LoD	Limit of Detection
m	Metre
MATTM	Ministero dell'Ambiente Tutela Territorio e Mare
MAC-EQS	Environmental Quality Standard–Maximum Allowable Concentration
MAG	Magnetometer
MBES	Multi Beam Echo Sounder
MEDITS	International bottom trawl survey in the Mediterranean
MEPA	Malta Environment and Planning Authority
MOM	Minute of Meeting
NBSAPs	National Biodiversity and Action Plans
nm	Nautical mile
NU	North-Up
PC	Party Chief
PAM	Passive Acoustic Monitoring
PEP	Project Execution Plan
PMRS	Preliminary Marine Route Survey
PMB	Project Management Board
PPE	Personnel Protective Equipment
PSA	Post Survey Assessment
QA/ QC	Quality Assurance/ Quality Control
R/V	Research Vessel
ROV	Remote Operating Vehicle
RMS	Reconnaissance Marine Survey
RPL	Route Position List
SBP	Sub Bottom Profiler
SCI	Sites of Community Importance
SCPT	Seismic Cone Penetration Test
SdM	Soprintendenza del Mare
SIMOPS	Simultaneous Operations
SIN	Sites of National Interest (Siti Di Interesse Nazionale)
SOW/SoW	Scope of Work
SPA	Special Protection Areas
Squa - MA	Environmental Quality Standard–Annual Average
Squa - CMA	Environmental Quality Standard–Maximum Allowable Concentration
SSS	Side Scan Sonar
T.B.D.	To Be Determined
TORs	Terms of Reference
TP	Tangent Point
TVG	Time Varied Gain
USBL	Ultra Short Base Line
UTM	Universal Transverse Mercator
UXO	Unexploded Ordnance
VAS (SEA)	Strategic Environmental Assessment
VIA (EIA)	Environmental Impact Assessment
WCMP	Water Catchment Management Plan
w.d.	Water Depth
WS	Water Sample
WWF	World Wide Fund for Nature

2.0.0 GENERAL CONSIDERATIONS

The company **Lighthouse S.p.A** of Bologna – was entrusted by **Maltese Ministry for Energy and Water Management** to perform a reconnaissance geophysical investigation in the Sicily Strait area, located between Italy and Malta (Figure 2.1).

The objectives of the project were as follows:

- **Work Package 1**: execution of the Preliminary Reconnaissance Marine Survey (PRMS) on the offshore pipeline routing corridor;
- **Work Package 2**: execution of Post Survey Assessment (PSA).

This document is part of the **Post Survey Assessment**.

The results of the PSA are organized into eight (8) separate reports. This report focuses on the environmental and biodiversity framework of the area of interest.

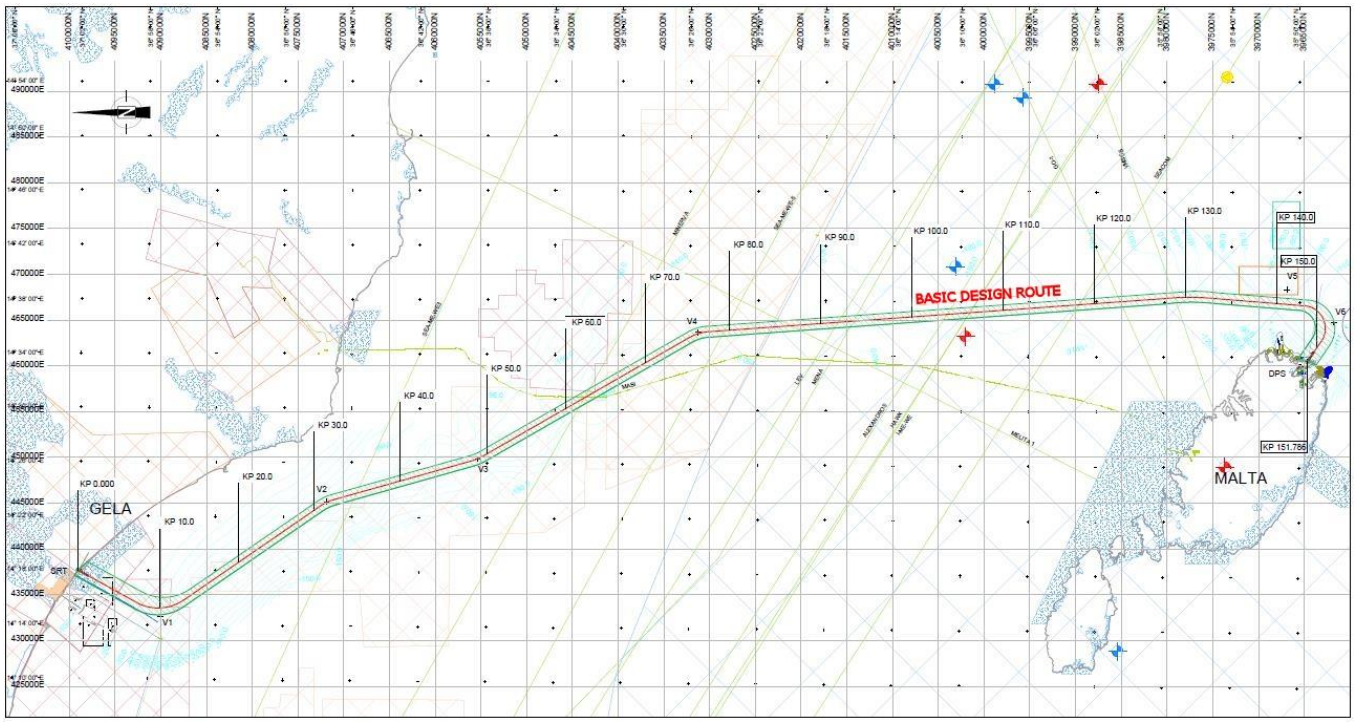


Figure 2.1 - Overview of reconnaissance survey route

2.1.0 Introduction

The Environmental and Biodiversity Baseline Report is based on information gathered from published scientific papers, desktop studies carried out in the landing areas and data collected during the geophysical, geotechnical, environmental and ROV surveys. The scope of this document is to provide a comprehensive picture of the environmental and the biodiversity framework of the area potentially interested by the construction of the Malta-Italy gas pipeline, with focus on the identification of sensible biodiversity features, protected species and environmental quality.

The **basic design route** was provided by the Client representative onboard R/V Odin Finder at the beginning of the marine survey (see GWF66 - PIPELINE LAYING THEORETICAL ROUTE of the report "MEW001_GEOPHY_FINAL_REPORT_REV02.doc") hereafter referred to as the "**route**", while the route provided by the Client on the base of the PMRS study is named as "**FEED route**". The images included in this report show the basic design route in black (unless otherwise stated in the images) and the FEED route in red.

2.2.0 Survey Geodetic System

The work was conducted, processed and reduced using the following geodetic parameters (Table 2.1).

Table 2.1 – Geodetic data and projection parameters

GEODETIC PARAMETERS	
Datum	World Geodetic System 1984 (WGS84)
Reference Ellipsoid	World Geodetic System 1984 (WGS84)
Semi-major Axis (a)	6 378 137.000m
Semi-minor Axis (b)	6 356 752.314m
Inverse Flattening (1/f)	298.2572236
First eccentricity squared (e2)	6.69437999014x10−3
PROJECTION PARAMETERS	
Projection method	UTM 33N
Latitude Origin	0
Central Meridian (CM)	15°E
False East	500000m
False North	0m
Scale factor	0.9996
Units	metres

3.0.0 BIODIVERSITY AND SENSITIVE HABITATS REGULATIONS

As per regional legislation, in accordance with EU and national legislation, the analysis of any project interference with the environmental system have to consider the following legislations, given also that both Malta and Gela include areas which are part of the Natura 2000 network. Most legislations and conventions are aimed to protect and supervise local biodiversity.

The following laws and regulations have been taken into account whilst defining the methodologies associated with the sampling and laboratory analyses, as well as aiding the assessment associated with the visual inspections of the biodiversity presented within this report.

It is to be noted that the results obtained during the PMRS campaign have been compared, whenever possible, with the Environmental Quality Standards presented herein. This is summarised in conclusions, section 7.0.0.

3.1.0 EU legislation

I. Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (Habitat Directive):

The aim of this Directive is to contribute to ensure bio-diversity in the European Union by the conservation of:

- Natural habitats, and
- Wild fauna and flora species.

It sets up the 'Natura 2000' network, the largest ecological network in the world. Natura 2000 comprises special areas of conservation designated by EU countries under this directive. Natura 2000 also includes the special protection areas classified under the Birds Directive (Directive 2009/147/EC).

In "Annex I", natural habitat types are indicated; their conservation requires the designation of special areas of conservation. In particular, our survey areas could be included in the following habitats: **1110** Sandbanks which are slightly covered by sea water all the time; **1120** * *Posidonia* beds (*Posidonion oceanicae*). The sign '*' indicates priority habitat types.

For the list of marine protected fauna, check the "Annex II" of the Habitat Directive full text (J).

II. Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds:

This Directive is related to the conservation of all species of naturally occurring birds in the wild state in the European territory of the Member States to which the Treaty applies. It covers the protection, management and control of these species and lays down rules for their exploitation.

A large number of species of wild birds naturally occurring in the European territory of the Member States are declining in number, very rapidly in some cases. This decline represents a serious threat to the conservation of the natural environment, particularly because of the biological balances threatened thereby.

Measures have to be set in place to preserve, maintain, or re-establish a sufficient diversity and area of habitats for all bird species. These measures mainly involve:

- the creation of protected areas,

- the upkeep and management of habitats inside and outside the protected areas,
- the re-establishment of destroyed biotopes*, and the creation of new ones

With respect to the whole wild bird's species list, check the "Annex I", "Annex II" and "Annex III" of the Directive 2009/147/EC full text (K).

These include species that are:

- in danger of extinction,
- vulnerable to habitat change,
- in small numbers or restricted local distribution, or
- in need of particular attention because of the specific nature of their habitat.

EU countries have to create special protection areas (SPAs) for threatened species and migratory birds, with conditions favorable to their survival, situated in the birds' natural area of distribution (i.e. where they naturally occur). Particular attention is paid to wetlands. The SPAs form part of the Natura 2000 network of protected ecological sites.

It's possible to find the species list referred to in Article 4 of Directive 2009/147/EC and in Annex II of Directive 92/43/EEC and site evaluation for them in Natura 2000 website (I) both for Gela (Site: ITA050012; Sitename: Torre Manfria, Biviere e Piana di Gela) and Malta (Site: MT0000107, Sitename: Żona fil-Baħar fil-Grigal; Site: MT0000108, Sitename: Żona fil-Baħar fil-Lvant; Site: MT0000111, Sitename: Żona fil-Baħar fil-Lbiċ).

III. Council Directive 97/62/EC of 27 October 1997 adapting to technical and scientific progress Directive 92.43/EC on the conservation of natural habitats and of wild fauna and flora;

IV. Commission Implementing Decision (EU) 2016/2328 of 9 December 2016 adopting a tenth update of the list of sites of Community importance for the Mediterranean biogeographical region (notified under document C (2016) 8142);

V. Directive 2008/105/EC of the European Parliament and of the Council of 16 December 2008 on environmental quality standards in the field of water policy:

This Directive outlines environmental quality standards (EQS) for priority substances and certain other pollutants as provided for in Article 16 of Directive 2000/60/EC, with the aim of achieving good surface water chemical status and in accordance with the provisions and objectives of Article 4 of that Directive.

The EQSs in Directive 2008/105/EC are limits on the concentration of the priority substances and 8 other pollutants in water (or biota*), i.e. thresholds which have not to be exceeded if a good chemical status is to be met. There are 2 types of water standard:

- a threshold for the average concentration of the substance concerned calculated from measurements over a 1-year period. The purpose of this standard is to ensure protection against long-term exposure to pollutants in the aquatic environment;
- a maximum allowable concentration of the substance concerned, i.e. the maximum for any single measurement. The purpose of this standard is to ensure protection against short-term exposure, i.e. pollution peaks.

The EQSs are different for:

- inland surface waters (rivers and lakes);

- other surface waters (transitional, coastal and territorial waters).

EU countries have to ensure compliance with the EQSs. They must also take measures to ensure that the concentrations of substances that tend to accumulate in sediment and/or biota do not increase significantly.

In "Annex I" PART A (L), a table of Environmental quality standards for priority substance and certain other pollutants is reported, with the name of the substance with the unit, the related annual average and the maximum allowable concentration.

Member States may, when assessing the monitoring results against the relevant EQS, take into account:

a) natural background concentrations for metals and their compounds where such concentrations prevent compliance with the relevant EQS;
b) hardness, pH, dissolved organic carbon or other water quality parameters that affect the bioavailability of metals, the bioavailable concentrations being determined using appropriate bioavailability modelling.

VI. The EU Water Framework Directive, WFD (2000/60/EC):

This Directive sets out rules to halt deterioration in the status of European Union (EU) water bodies and achieve 'good status' for Europe's rivers, lakes and groundwater by 2015.

Specifically, this includes:

- protecting all forms of water (surface, ground, inland and transitional);
- restoring the ecosystems in and around these bodies of water;
- reducing pollution in water bodies;
- guaranteeing sustainable water usage by individuals and businesses.

The legislation places clear responsibilities on national authorities. They have to:

- identify the individual river basins on their territory — that is, the surrounding land areas that drain into particular river systems;
- designate authorities to manage these basins in line with the EU rules;
- analyse the features of each river basin, including the impact of human activity and an economic assessment of water use;
- monitor the status of the water in each basin;
- register protected areas, such as those used for drinking water, which require special attention;
- produce and implement 'river-basin management plans' to prevent deterioration of surface water, protect and enhance groundwater and preserve protected areas;
- ensure the cost of water services is recovered so that the resources are used efficiently and polluters pay;
- provide public information and consultation on their river-basin management plans.

VII. Directive 2013/39/EU of the European Parliament and of the Council of 12 August 2013 amending Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy Text with EEA relevance;

This Directive provides amendments of Directive 2000/60/EC and Directive 2008/105/EC (RR).

VIII. Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive):

The Marine Strategy Framework Directive (N), MSFD, (2008/56/EC):

- It establishes a common approach and objectives for the prevention, protection and conservation of the marine environment against damaging human activities.
- It requires European Union (EU) countries to develop strategies to achieve 'good environmental status'* by 2020. The strategies, which span over 6-year cycles, need to include measures that protect the marine ecosystem and that ensure economic activities linked to the marine environment are sustainable.
- It emphasises the need for EU countries to cooperate with their neighbours in the marine regions (North-East Atlantic, Baltic, Mediterranean and Black Sea), namely when devising and implementing their marine strategies. The use of existing regional governance structures, such as Regional Sea Conventions, is therefore an important element to be considered by EU countries.
- It recognises the importance of spatial protection measures for the marine environment, thereby contributing to the creation of a global network of marine protected.

"ANNEX III" (N) shows an Indicative list of characteristics, pressure and impacts referred to in Article 8 (Assessment), 9 (Determination of good environmental status), 10 (Establishment of environmental targets), 11 (Monitoring programmes) and 24 (Technical adaptations).

- EU countries, as part of their marine strategies, must assess the environmental status of their marine waters and the impact of human activities (including a socioeconomic analysis). They must establish what is 'good environmental status' for their marine waters and set environmental targets. They have to develop monitoring programmes and prepare programmes of measures.
- EU countries' evaluations of their waters help improve the knowledge of Europe's marine waters. This is also supported by programmes such as Marine knowledge or Copernicus.
- Europe's seas are divided into four marine regions: the Baltic Sea, the North-East Atlantic, the Mediterranean and the Black Sea. Countries working in the same marine regions are required to coordinate their actions.
- Monitoring programmes are drawn up to measure and evaluate progress in reaching the objectives. If certain objectives are not met, EU countries must explain why and can, if necessary, apply certain exceptions.
- The directive contains a set of qualitative 'descriptors' for EU countries to consider when devising their strategies to achieve good environmental status of their waters. These include:

  - maintaining biodiversity;

  - engaging in sustainable fishing;

- safeguarding the seabed; and

- keeping marine litter and contaminants in check.

Member States shall also take into account the indicative lists of elements set out in Table 1 of Annex III and, in particular, physical and chemical features, habitat types, biological features and hydro-morphology. Moreover they shall consider the pressures or impacts of human activities in each marine region or subregion, having regard to the indicative lists set out in Table 2 of Annex III.

The directive builds on existing EU legislation and covers specific elements of the marine environment not addressed in other policies, such as the Water Framework Directive, the Habitats and Birds Directives.

IX. Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment:

The Directive aims to ensure a high level of environmental protection and that environmental considerations are taken into account when preparing, adopting and implementing plans and programmes.

It promotes sustainable development by ensuring that environmental assessment is carried out of certain plans and programmes likely to have significant effects on the environment.

The public plans and programmes covered by the Strategic Environmental Assessment (SEA) Directive are subject to an environmental assessment during their preparation and before their adoption.

This directive applies to the public plans and programmes (as well as their amendments) which have been prepared and/or adopted by a competent authority and which are subject to legislative, regulatory and administrative rules:

- plans and programmes which are prepared for specific sectors (agriculture, forestry, fisheries, energy, industry, transport, waste management, water management, telecommunications, tourism, town and country planning and land use) and which set the framework for development consent of projects under the Environmental Impact Assessment (EIA) Directive;
- plans and programmes for which an assessment is required under Articles 6 and 7 of the 'Habitats' Directive;
- plans and programmes which set the framework for future development consent of projects other than those under the EIA Directive (not limited to the sectors listed above) and which EU countries have identified as likely to have significant environmental effects. EU countries can determine this either through case-by-case examination or by specifying types of plans and programmes or by combining both approaches.

The directive sets out a procedure and a number of steps to be followed when assessing a plan or programme to which it applies. These steps include:

- scoping;
- preparing the environmental report;
- public consultation and participation;
- decision-making;

- monitoring.

The directive also refers to a screening procedure:

- plans and programmes different from those listed in Article 3 (2), but which set out the scheme for future development consent of projects, as well as
- plans and programmes: which determine the use of small areas at local level and minor modifications to plans and programmes, but only if they are likely to have significant environmental effects.

EU countries' margin for discretion is limited by the significance criteria in Annex II, when it comes to screening certain plans and programmes. It is also restricted by the overall objective of the directive — which is to ensure a high degree of environmental protection.

Plans and programmes the sole purpose of which is to serve national defence or civil emergency, and financial or budget plans and programmes are not covered by this directive.

A specific set of rules applies to the early stages of decision-making when plans and programmes are being developed, i.e. when:

- preparing a report on the likely significant effects on the environment;
- informing and consulting the public and the environmental authorities;
- conducting transboundary consultations with potentially affected EU countries;
- identifying measures to address and monitor significant environmental impacts.

The environmental report must contain, among other information, the following:

- the contents of the plan or programme and its main objectives and links to other relevant plans and programmes;
- the existing environmental situation and its likely development if the plan or programme is not implemented;
- any existing environmental problems which are relevant to the plan or programme, specifically those relating to zones in the Natura 2000 network;
- the measures envisaged to prevent, reduce and offset any significant adverse effects on the environment;
- a description of how the assessment was carried out;
- the envisaged monitoring measures;
- a non-technical summary of the above information.

The draft plan or programme and the environmental report must be made available to the authorities responsible for environmental issues and to the public. The authorities and the public must have the opportunity to express their views on the draft plan or programme at an early stage and in sufficient time before it is adopted or submitted to the legislative procedure.

The EU country responsible for preparing the plan or programme is required to send a copy of it, together with a copy of the environmental report, to other EU countries:

- where it considers that the plan or programme is liable to have environmental effects on the territory of those other EU countries;

- at the request of those other EU countries.

The environmental report, the opinions expressed by the relevant authorities and the public and the results of any transboundary consultations must be taken into account by the competent authority during the preparation of the plan or programme and before it is adopted.

When a plan or programme is adopted, the EU country responsible must inform all parties concerned which have been consulted and make available to them:

- the plan or programme as adopted;
- a statement summarising how environmental considerations have been integrated and the environmental impact report;
- the opinions and the results of consultations;
- the reasons for choosing the plan or programme as adopted;
- the monitoring measures undertaken.

The environmental assessment carried out under the SEA Directive does not remove the obligation to conduct the assessment required under the EIA Directive, or to meet any other EU legal requirements.

EU countries may provide for coordinated or joint procedures in order to avoid duplication of environmental assessment in respect of plans and programmes for which the obligation to carry out assessments arises simultaneously from this directive and from other EU legislation.

From 21 July 2006 and every 7 years after this date, the European Commission will continue to submit reports on the application of the directive to the European Parliament and the Council.

X. Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment Text with EEA relevance:

Known as the EIA Directive, the directive aims to ensure:

- a high level of environmental protection;
- environmental considerations are integrated into the preparation and authorization of projects.

This Directive shall apply to the assessment of the environmental effects of those public and private projects which are likely to have significant effects on the environment.

Directive 2011/92/EU defines the environmental impact assessment (EIA) process which ensures that projects likely to have significant effects on the environment are made subject to an assessment, prior to their authorisation.

Amending legislation (Directive 2014/52/EU) was adopted in 2014. In line with the drive for smarter regulation.

The main amendments are:

- EU countries can simplify their different environmental assessment procedures.
- Timeframes are introduced for the different stages of environmental assessments.
- The screening procedure, determining whether an EIA is required, is simplified.

- Decisions must be duly motivated in the light of the updated screening criteria.
- EIA reports are to be made more understandable for the public, especially as regards assessments of the current state of the environment and alternatives to the project in question.
- The quality and the content of the reports is improved. Competent authorities also need to prove their objectivity to avoid conflicts of interest.
- The grounds for development consent decisions* must be clear and more transparent for the public.
- If projects do entail significant adverse effects on the environment, developers are obliged to avoid, prevent or reduce those effects. These projects must be monitored.

The EIA process operates as follows:

- the project developer may request the competent authority to specify what should be covered by the EIA information to be provided (scoping stage);
- the developer must provide information on the environmental impact (in the form of an EIA report drafted in accordance with Annex IV of the directive);
- the environmental authorities and the public, as well as local and regional authorities (as well as any EU countries that are affected) must be informed and consulted;
- the competent authority decides taking into consideration the results of consultations; this decision also includes a reasoned conclusion on the significant effects of the project;
- the authority informs the public of its decision;
- the public can challenge the decision before the courts.

Projects referred to in Article 4 (1) are listed in ANNEX 1 which includes Pipelines with a diameter of more than 800 mm and a length of more than 40 km:

a) for the transport of gas, oil, chemicals;

b) for the transport of carbon dioxide (CO_2) streams for the purposes of geological storage, including associated booster stations.

With respect to Location of Projects: the environmental sensitivity of geographical areas likely to be affected by projects must be considered, having regard, in particular, to:

i) wetlands;

ii) coastal zones;

iii) mountain and forest areas;

iv) nature reserves and parks;

v) areas classified or protected under Member States' legislation; special protection areas designated by Member States pursuant to Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (1) and to Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (2);

vi) areas in which the environmental quality standards laid down in Union legislation have already been exceeded;

vii) densely populated areas;

viii) landscapes of historical, cultural or archaeological significance.

Authorities have to decide within a reasonable time whether to approve the project or not. They must make available to the public, as well as to environmental, local and regional bodies, the content of a positive decision, including the main reasons for their approval and any environmental or other conditions they attach. If they refuse development consent, they should explain why.

EU countries may lay down more stringent conditions and fix penalties for any infringements.

XI. Council Regulation (EC) No 1967/2006 of 21 December 2006 concerning management measures for the sustainable exploitation of fishery resources in the Mediterranean Sea, amending Regulation:

This Regulation shall apply to the conservation, management and exploitation of living aquatic resources and to marketing of fishery products caught in the Mediterranean Sea (O).

The CHAPTER II is dedicated to "Protected species (Article 3) and habitats (Article 4)".

In "Article 4" protected habitats are mentioned:

1) Fishing with trawl nets, dredges, purse seines, boat seines, shore seines or similar nets above seagrass beds of, in particular, *Posidonia oceanica* or other marine phanerogams shall be prohibited.

2) Fishing with trawl nets, dredges, shore seines or similar nets above coralligenous habitats and mäerl beds shall be prohibited.

5) By way of derogation from the paragraph 1, subparagraph 1, fishing by vessels of less than or equal to 12 metres overall length and engine power of less than or equal to 85 kW with bottom towed nets traditionally undertaken on *Posidonia* beds may be authorised by the Commission in accordance with the procedure provided in Article 30(2) of Regulation (EC) No 2371/2002 provided that:

(i) The fishing activities concerned are regulated by a management plan provided for under Article 19 of this Regulation.

(ii) The fishing activities concerned affect not more than 33 % of the area covered by seagrass beds of *Posidonia oceanica* within the area covered by the management plan.

(iii) The fishing activities concerned affect not more than 10 % of seagrass beds in the territorial waters of the Member State concerned.

XII. Regulation (EU) No 347/2013 of the European Parliament and of the Council of 17 April 2013 on guidelines for trans-European energy infrastructure and repealing Decision No 1364/2006/EC and amending Regulations (EC) No 713/2009, (EC) No 714/2009 and (EC) No 715/2009 Text with EEA relevance:

This Regulation (HH) lays down guidelines for the timely development and interoperability of priority corridors and areas of trans-European energy infrastructure set out in Annex I ('energy infrastructure priority corridors and areas').

In April 2013, the EU guidelines for the development of European energy infrastructure were approved.

One of the priorities of the Europe 2020 strategy is sustainable growth to be achieved by promoting a more resource-efficient, more sustainable and more competitive economy. That strategy put energy infrastructure at the forefront of this effort by underlining the need to urgently upgrade Europe's networks, interconnecting them at the continental level, in particular to integrate renewable energy sources.

The essential background to this is that EU Member States agreed in 2011 that:

- Europe's energy infrastructure needs to be modernized and expanded;
- networks across borders need to be interconnected;
- there is a need to provide for alternative supply or transit routes;
- there is a need for alternative sources of energy, including renewables;
- no EU country should remain isolated from the European gas and electricity networks after 2015 or see its energy security jeopardized by lack of the appropriate connections.

The guidelines established 12 regional groups for trans-European energy infrastructure (TEN-E), which selected projects.

In October 2013, the Commission adopted a list of 248 key energy infrastructure projects (projects of common interest), which will benefit from faster and more efficient permit granting procedures and improved regulatory treatment.

The projects may also have access to financial support from the Connecting Europe Facility(CEF), under which almost EUR 6 billion has been allocated to TEN-E up to 2020.

For a project to be included in the list, it has to:

- have significant benefits for at least two EU Member States ;
- contribute to market integration and further competition;
- enhance security of supply;
- reduce CO2emissions.

A new EU list will be established every 2 years.

The guidelines state that projects of common interest should be implemented as quickly as possible and closely monitored and evaluated, while keeping the administrative burden for project promoters to a minimum.

It adds that the Commission should nominate European coordinators for projects facing particular difficulties.

XIII. Bern Convention 1979: Convention on the Conservation of European Wildlife and Natural Habitats.

The aims of this Convention are to conserve wild flora and fauna and their natural habitats, especially those species and habitats whose conservation requires the co-operation of several States, and to promote such co-operation (P).

Particular emphasis is given to endangered and vulnerable species, including endangered and vulnerable migratory species. The following ANNEXES are related to:

- Annex I: Strictly protected flora species

- Annex II: Strictly protected fauna species
- Annex III: Protected fauna species
- Annex IV: Prohibited means and methods of killing, capture and other forms of exploitation

For the complete list of species check the convention full text of the (P).

XIV. SPA/BD Protocol: Protocol concerning specially protected areas and biological diversity in the Mediterranean (Barcelona, 1995), for implementing the 1992 Convention on Biological Diversity, as regards the in situ sustainable management of coastal and marine biodiversity:

By means of enhanced international cooperation to protect and improve the state of the natural and cultural heritage of the Mediterranean through the establishment of specially protected areas and the protection and conservation of threatened species, and to restore the health and integrity of ecosystems. The parties to the Protocol are to cooperate directly or through international organizations for the conservation and sustainable use of biodiversity, identify its components and adopt sectoral programs (Q).

"Article 8" is dedicated to the Establishment of the list of specially protected areas of Mediterranean importance (SPAMI list).

Moreover, PART III of the Protocol, is referred to the Protection and conservation of species. In particular a complete list of endangered or threatened species is listed in Annex II (Q).

3.2.0 Regional and National regulations

3.2.1 Maltese Waters

The EU biodiversity strategy aims to halt the loss of biodiversity in the EU by 2020. It requires full implementation of the Birds and Habitats Directives to achieve favorable conservation status of protected species and habitats. It also requires that the agricultural and forest sectors help maintain and improve biodiversity.

Today the management of freshwater and marine waters, including fisheries in the Maltese Islands is significantly governed by EU (European Union) law. These (along with others) are reviewed below with the aim of setting the background for the subsequent assessment of fresh and marine waters.

- Below a list of Malta environmental legislations and action plans:

The main piece of legislation that tackles the environment in Malta is the Environment Protection Act (Chapter 549 of the Laws of Malta - V). Prior to the demerger of MEPA, the relevant piece of legislation was Chapter 504, the Environment and Development Planning Act, however the latter has since been repealed.

The main aim of Cap. 549 is to protect, preserve and improve the environment, and ensure that the well-being of the environment is maintained. Through this Act, the Minister responsible for the environment is given the power to publish regulations which will fall under the Act – these are referred to as Subsidiary Legislation (SL).

I. S.L. 549.04 - Environment Protection (Preventive And Remedial Measures) Regulations (1994):

This subsidiary legislation indicates all duties that Director, and Minister have in relation to Environment protection and regulations. In particular the Director being the official as delegated

in terms of the Act to be responsible for the protection of the environment, and delegated for the control, direction and management of the Department for the Protection of the Environment.

It's important to note that "Director" has the power, carrying identification attestations signed by the Minister, to inspect any place in Malta, or any vehicle, ship, platform, airplane or other craft existing therein, or any such vehicle, vessel or aircraft belonging to Malta outside the territorial waters of Malta, in order to ascertain the levels of protection of the environment as well as to investigate suspected violations of the provisions of the Act or of regulations made thereunder, or codes of practice issued under the Act, and to secure proof of any such violation (U).

II. S.L. 549.10 - Pollution Caused By Certain Aquatic Dangerous Substances Discharged Into The Aquatic Environment Regulations (2004):

This regulation shall apply to: Inland surface water, territorial waters, internal coastal waters and ground water.

The competent authority shall take the necessary measures to eliminate pollution of the waters by the dangerous substances in the families and groups of substances in List I of the Annex (W).

It should be take into account that any person who discharges into the waters referred to in regulation any substances within List I shall require prior authorization by the competent authority. Furthermore, the competent authority shall lay down the limit values which the emission standards may not exceed for the various dangerous substances included in the families and groups of substances within List I.

List I contains certain individual substances which belong to the following families and groups of substances, selected mainly on the basis of their toxicity, persistence and bioaccumulation, with the exception of those which are biologically harmless or which are rapidly converted into substances which are biologically harmless:

1. organ-halogen compounds and substances which may form such compounds in the aquatic environment;

2. organophosphorus compounds;

3. organotin compounds;

4. substances in respect of which it has been proved that they possess carcinogenic properties in or via the aquatic environment;

5. mercury and its compounds;

6. cadmium and its compounds;

7. persistent mineral oils and hydrocarbons of petroleum origin;

8. persistent synthetic substances which may float, remain in suspension or sink and which may interfere with any use of the waters.

List II contains:

a) the following metalloids and metals and their compounds:

Table 3.1 - Metalloids and metals list

1. zinc	6. selenium	11. tin	16. vanadium
2.copper	7. arsenic	12. barium	17. cobalt

3. nickel	8. antimony	13. beryllium	18. thallium
4. chromium	9. molybdenum	14. boron	19. tellurium
5. lead	10. titanium	15. uranium	20. silver

b) biocides and their derivatives not appearing in List I;

c) substances which have a deleterious effect on the taste and, or smell of the products for human consumption derived from the aquatic environment, and compounds liable to give rise to such substances in water;

d) Toxic or persistent organic compounds of silicon, and substances which may give rise to such compounds in water, excluding those which are biologically harmless or are rapidly converted in water into harmless substances;

e) Inorganic compounds of phosphorus and elemental phosphorus;

f) Non persistent mineral oils and hydrocarbons of petroleum origin;

g) Cyanides, fluorides;

h) Substances which have an adverse effect on the oxygen balance, particularly: ammonia and nitrites.

III. S.L. 549.13 - Limit Values And Quality Objectives For Mercury Discharges By Sectors Other Than The Chlor-Alkali Electrolysis Industry Regulations (2002):

The competent authority (Department for Environment Protection), draw up specific programmes for mercury discharges by multiple sources which are not industrial plants and for which the emission standards laid down in regulation 3 cannot be applied in practice. Furthermore, the purpose of these programmes shall be to avoid or eliminate pollution. The competent authority shall in these programmes include the most appropriate measures and techniques for the replacement, retention and recycling of mercury (X).

The limit values are inserted in ANNEX at the end of the SL 549.13:

Table 3.2 – Mercury limit values

Industrial sector[1]	Limit value which shall be complied with		Unit of measurement
	on the date of entry into force of these regulations	three years after the entry into force of these regulations	
1. Chemical industries using mercury catalysts:	3	2	
(a) in the production of vinyl chloride	0,1 0,2	0,05 0,1	mg/l effluent vinyl chloride production capacity
(b) in other processes	0,1 10	0,05 5	mg/l effluent g/kg mercury processed
2. Manufacture of mercury catalysts used in the production of vinyl chloride	0,1 0,1	0,05 0,7	mg/l effluent g/kg mercury processed
3. Manufacture of organic and non-organic mercury compounds (except for products referred to in point 2)	0,1 0,1	0,05 0,05	mg/l effluent g/kg mercury processed
4. Manufacture of primary batteries containing mercury	0,1 0,05	0,05 0,03	mg/l effluent g/kg mercury processed
5. Non-ferrous metal industry[2]			
5.1 Mercury recovery plants	0,1	0,05	mg/l effluent
5.2 Extraction and refining of non-ferrous metals	0,1	0,05	mg/l effluent
6. Plants for the treatment of toxic wastes containing mercury	0,1	0,05	mg/l effluent

IV. S.L. 549.17 - Limit Values And Quality Objectives For Discharges Of Certain Dangerous Substances Into The Aquatic Environment Regulations (2002):

As the Subsidiary Legislation 549.13, the competent authority shall be responsible for monitoring the aquatic environment affected by discharges from industrial establishments and by other sources of significant discharges. Furthermore, in the case of discharges affecting the territorial waters of Malta and of other States the competent authority concerned shall cooperate with the competent authorities of Malta and other States, with a view to harmonizing monitoring procedures.

The Annexes under heading A of the S.L. makes a list of the limit values, the time limits for compliance therewith and the procedures for monitoring discharges (Y).

In accordance with regulation 7 (3) of the Pollution Caused by Certain Dangerous Substances Discharged into the Aquatic Environment Regulations, the competent authority shall, for each quality objective chosen and applied, report to the Commission on:

a) the points of discharge and the means of dispersal;

b) the area in which the quality objective is applied;

c) the location of sampling points;

d) the frequency of sampling;

e) the methods of sampling and measurement;

f) the results obtained.

- In ANNEX II there are specific provisions relating to:

1) carbon tetrachloride
2) DDT
3) Pentachlorophenol
4) aldrin, dieldrin, endrin and isodrin
5) hexachlorobenzene
6) hexachlorobutadiene
7) chloroform
8) 1,2-dichloroethane (EDC)
9) trichloroethylene (TRI)
10) perchoroethylene (PER)
11) trichlorobenzene (TCB).

The numbering of the substances listed in this Annex corresponds to the list of 129 substances contained in the communication from the Commission to the Council of 22 June 1982(1).

V. S.L. 549.35 - Marine Mammals Protection Regulations (2003):

The specie of marine mammal listed in the Schedule at the end of Z are declared to be protected marine mammal species for the purpose of article 54(2)(*m*)(ii) of the Act and shows in table below:

Table 3.3 – Marine mammal list

SCHEDULE

PROTECTED MARINE MAMMALS

Scientific name	Maltese name	English name
CETACEA		
Balaenoptera acutorostrata	Balena Żgħira; Balenottera Żgħira, Balena ta' Geddumha Ppuntat	Minke Whale
Balaeonoptera borealis	Balenottera tan-Nofsinhar	Sei Whale
Balaenoptera physalus	Balena Kbira; Balenottera Kbira, Baliena Mbaċċa	Fin Whale; Finback Whale
Delphinus delphis	Denfil Komuni	Common Dolphin
Eubalaena glacialis	Baliena tat-Tramuntana	Northern Right Whale
Globicephala melas (=Globicephala meleana)	Balena Sewda	Long-Finned Pilot Whale
Grampus griseus	Denfil Griż; Denfil ta' Risso; Monka tal-Punent	Risso's Dolphin
Kogia simus	Balena ta' Mnehirha Ċatt	Dwarf Sperm Whale
Megaptera novaeangliae	Balena tal-Ħwienah Kbar	Humpback Whale
Mesoplodon densirostris	Balena ta' Blainville	Blainville's Beaked Whale
Orcinus orca	Orka	Killer Whale
Phocoena phocoena	Denfil Iswed	Common Porpoise; Harbour Propoise
Physeter macrocephalus (=Physeter catodon)	Gabdoll	Sperm Whale
Pseudorca crassidens	Psewdorka	False Killer Whale
Sousa chinensis	Denfil tal-Baħar l-Aħmar	Indo-Pacific Humpback Dolphin
Stenella coeruleoalba	Stenella	Striped Dolphin
Steno bredanensis	Denfil tat-Tikki	Rough-Toothed Dolphin
Tursiops truncates	Denfil Geddumu Qasir	Bottlenose Dolphin
Ziphius cavirostris	Balena ta' Kuvjer	Cuvier's Beaked Whale
PINNIPEDIA		
Monachus monachus	Bumerin; Monka, Foka Monka	Mediterreanean Monk Seal

VI. S.L. 549.42 - Conservation Of Wild Birds Regulations (2006):

The bird species referred to in Schedule I of AA, shall be the subject of special conservation measures concerning their habitat including in particular the designation of special protection areas.

For the purposes of sub-regulation (1), account shall be taken of:

a) species in danger of extinction;

a) species vulnerable to specific changes in their habitat;

b) species considered rare because of small populations or restricted local distribution;

c) other species requiring particular attention for reasons of the specific nature of their habitat.

Similar measures shall also be established for regularly occurring migratory species not listed in Schedule I, as regards their breeding, moulting and wintering areas and staging posts along their migration routes, bearing in mind their need for protection in the geographical sea and land area of Malta.

The Ornis Committee shall make recommendations to the Minister on the adoption of measures under this regulation in accordance with the provisions of regulation 10(6)(*i*).

Moreover, in this S.L. and per our survey purpose, there is a list of Bird Sanctuaries locations. One of these site is near to Delimara and includes the surroundings of the Salt Marsh at il-Ballut, Marsaxlokk, with the site plan attached AA.

VII. S.L. 549.44 - Flora, Fauna And Natural Habitats Protection Regulations (2006):

The aim of these regulations is to contribute towards ensuring biodiversity in the territory of the Member States of the European Community through the conservation of natural habitat sand of wild fauna and flora in the Maltese Islands.

These regulations provide the provisions required for the implementation in Malta of:
(a) Council Directive 92/43/EEC of 21 May 1992 on the Conservation of Natural Habitats and of Wild Fauna and Flora

a) 2009/147/EC of 30 November 2009 on the Conservation of Wild Birds

a) the Convention on Biological Diversity (II)

b) the Convention on the Conservation of European Wildlife and Natural Habitats (JJ)

c) the Convention on the Conservation of Migratory Species of wild Animals (KK)

d) the Protocol for Specially Protected Areas and Biological Diversity in the Mediterranean of the Barcelona Convention (LL).

Without prejudice to the provisions of the Conservation of Wild Birds Regulations, no person shall carry out in any site within a SAC or SPA, any operation or activity, unless the operation or activity is carried out, or caused or permitted to be carried out, by the owner or occupier of the site and one of them has given the competent authority written notice of a proposal to carry out the operation or activity, specifying its nature and the site on which it is proposed to carry it out and such proposal has been approved by the competent authority (BB).

The competent authority shall notify the applicant of its consent or otherwise for the carrying out of such operation or activity. A consent granted by the competent authority under this regulation may contain such conditions and other provisions it deems fit and appropriate to impose. The competent authority may furthermore regulate such an operation or activity in a management agreement validly entered into in accordance with the provisions of regulation 15.

Where the competent authority gives such consent under this regulation, it shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted.

VIII. S.L. 549.61 - Strategic Environmental Assessment Regulations (2010):

The objective of these regulations is to provide for a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans and programmes with a view to promoting sustainable development, by ensuring that, in accordance with these regulations, a strategic environmental assessment is carried out of certain plans and programmes which are likely to have significant effects on the environment.

These regulations transpose the provisions of Directive 2001/42/EC of the European Parliament and of the Council on the assessment of the effects of certain plans and programmes on the environment (FF).

A strategic environmental assessment shall be carried out for plans and programmes which are prepared for agriculture, forestry, fisheries, energy, industry including mining, transport, regional development, waste management, water management, telecommunications, tourism, town and

country planning or land use, and which set the framework for future development consent for projects listed in Annex I and any other project listed in Annex II that require an environmental impact assessment under national legislation. In particular, for our purpose, "large-diameter oil and gas pipelines" programs must be considered. As per Article 6, each Party shall establish arrangements for the determination of the relevant information to be included in the environmental report, prior consultation with environmental and health authorities (FF).

Furthermore for each programmes and plans to strategic environmental assessment, each Party shall ensure that an environmental report is prepared.

IX. S.L. 549.62 - Marine Policy Framework Regulations (2011):

The scope of these regulations is to establish a framework within which Malta shall take the necessary measures to achieve or maintain good environmental status in the marine environment by the year 2020 at the latest and to transpose the provisions of Directive 2008/56/EC of the European Parliament and of the Council.

In SCHEDULE II a list of ecosystem elements, anthropogenic pressures and human activities relevant to the marine waters is reported. In the table below an indicative list relevant parameters and characteristics for species, habitats and ecosystems is given, reflecting parameters affected by the anthropogenic pressures of Table 2 of this Schedule and of relevance to criteria laid down in accordance with Article 9(3) of Directive 2008/56/EC.

Table 3.4 - Ecosystem elements list

Theme	Ecosystem elements	Possible parameters and characteristics (Note 1)	Relevant qualitative descriptors laid down in Schedule I (Notes 2 and 3)
Species	Species groups (Note 4) of marine birds, mammals, reptiles, fish and cephalopods of the marine region or subregion	Spatial and temporal variation per species or population: — distribution, abundance and/ or biomass — size, age and sex structure — fecundity, survival and mortality/injury rates — behaviour including movement and migration — habitat for the species (extent, suitability) Species composition of the group	(1); (3)
Habitats	Broad habitat types of the water column (pelagic) and seabed (benthic) (Note 5), or other habitat types, including their associated biological communities throughout the marine region or subregion	Per habitat type: — habitat distribution and extent (and volume, if appropriate) — species composition, abundance and/or biomass (spatial and temporal variation) — size and age structure of species (if appropriate) — physical, hydrological and chemical characteristics Additionally for pelagic habitats: — chlorophyll a concentration — plankton bloom frequencies and spatial extent	(1); (6)

Ecosystems, including food webs	Ecosystem structure, functions and processes, comprising: — physical and hydrological characteristics — chemical characteristics — biological characteristics — functions and processes	Spatial and temporal variation in: — temperature and ice — hydrology (wave and current regimes; upwelling, mixing, residence time, freshwater input; sea level) — bathymetry — turbidity (silt/sediment loads), transparency, sound — seabed substrate and morphology — salinity, nutrients (N, P), organic carbon, dissolved gases (pCO_2, O_2) and pH — links between habitats and species of marine birds, mammals, reptiles, fish and cephalopods — pelagic-benthic community structure — productivity	(1); (4)

In SCHEDULE II (Table 2) it's possible to have a look about all the anthropogenic pressures, uses and the human activities in or affecting the marine environment. Assessments of pressures should address their levels in the marine environment and, if appropriate, the rates of input (from land-based or atmospheric sources) to the marine environment.

All monitoring programmes and each programmes of measurement are indicated in SCHEDULE IV and SCHEDULE V which can be consulted in the full text of the present subsidiary legislation GG.

X. S.L. 549.100 - Water Policy Framework Regulations (2015):

The purpose of these regulations is to establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater and to transpose the provisions of Directive 2000/60/EC of the European Parliament and of the Council, described in paragraph above.

XI. L.N. 345 of 2015 - Water Policy Framework Regulations

These Regulations lay down a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater. These provisions are adopted pursuant to Directive 2000/60/EC of the European Parliament and of the Council, and they provide for the implementation in Malta and Gozo of Environmental Quality Standards (EQS) for priority substances and certain other pollutants, with the aim of achieving good surface water chemical status.

Table 1 (PART A - ENVIRONMENTAL QUALITY STANDARDS (EQS)) shows a list of EQS with the maximum allowable concentration for Priority Substances and Certain Other Pollutants.

XII. S.L. 549.46 - Environmental Impact Assessment Regulations (2017):

These regulations transpose and implement the provisions of:

a) Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment (codification), as amended by Directive2014/52/EU of the European Parliament and of the Council of16 April 2014;

b) The Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention) of the United Nations Economic Commission for Europe, and its First and Second Amendments (MM);

c) The provisions of Regulation (EU) No. 347/2013 of the European Parliament and the Council on guidelines for trans-European energy infrastructure, with regard to the co-ordination of environmental assessment procedures arising from the requirements of Council Directives 2014/52/EU, 92/43/EEC and other related Union legislation.

The objective of these regulations is to provide for a high level of protection of the environment and of human health, to contribute to the effective integration of environmental considerations into the permitting procedure for public and private projects, and to ensure that public and private projects which are likely to have significant effects on the environment are adequately assessed before any development consent is granted (DD).

XIII. NBSAP (Malta's National Biodiversity Strategy and Action Plan);2012-2020 – Government of Malta:

The main purpose of the NBSAP is to serve as a national policy driver to integrate biodiversity concerns into relevant sectoral or cross-sectoral plans, programs and policies, especially those that

can have a bearing on Malta's biological and natural resources. To achieve this, the document proposes:

- 19 national targets to be achieved by 2020;
- strategic directions seen as pre-requisites for reaching the targets; and
- a suite of focused, action- and outcome-oriented measures grouped under the 18 thematic areas (R). The most important for this survey purpose are: Theme 2 (Species and Habitats), Theme 3 (Ecological Network of Protected Areas), Theme 13 (Environmental Assessment) and Theme 15 (Biodiversity Monitoring).

While reflecting national priorities for biodiversity, these targets are also complementary to the 2020 global Aichi targets defined in the Strategic Plan under the framework of the UN Convention on Biological Diversity (CBD) as well as the targets defined in the EU Biodiversity Strategy to 2020.

XIV. Environment and Development Planning Act (Act X of 2010) – Law of Malta:

This plan consists of eight (VIII) Parts. The main subject of PART IV is the Environment and Development Planning, where the Strategic Plan and its preparation are reported. It is a strategic document regulating the sustainable management of land and sea resources; it shall be based on an integrated planning system that ensures the sustainable management of land and sea resources together with the protection of the environment (S). PART V gives information about Requirement of licenses and permission from the Authority to carry out all activities related to biodiversity (S).

XV. Environment Protection Act (Act X of 2016) - Law of Malta:

An ACT to make provision for the protection of the environment and for the establishment of an authority with powers to that effect and for matters connected therewith or ancillary thereto (T).

3.2.2 Italian Waters

3.2.2.1 National regulations

I. DPR n. 357 dell'8 settembre 1997: Regolamento recante attuazione della direttiva 92/43/CEE relativa alla conservazione degli habitat naturali e seminaturali, nonché della flora e della fauna selvatiche:

These regulations provide the provisions required for the implementation in Gela of Directive 92/43/EEC as above described.

II. Legge n. 308 del 15 dicembre 2004: Delega al Governo per il riordino, il coordinamento e l'integrazione della legislazione in materia ambientale e misure di diretta applicazione.

III. DL n. 152 del 3 aprile 2006: Norme in materia ambientale.

This DL regulates, as implementation of law 15 December 2004, n. 308, the following subjects:

a) VIA, VAS procedures;

b) soil and waters from pollution and water resources management;

c) waste management and the reclamation of the contaminated sites;

d) air protection and reduction of emissions in the atmosphere;

e) compensation for environmental damages.

IV. DM 14 aprile 2009, n. 56: Regolamento recante «Criteri tecnici per il monitoraggio dei corpi idrici e l'identificazione delle condizioni di riferimento per la modifica delle norme tecniche del decreto legislativo 3 aprile 2006, n. 152, recante Norme in materia ambientale, predisposto ai sensi dell'articolo 75, comma 3, del decreto legislativo medesimo».

These regulations provide the provisions required for the implementation of DL 3 aprile 2006.

V. DM 20 gennaio 1999: Modificazioni degli allegati A e B del decreto del Presidente della Repubblica 8 settembre 1997, n. 357, in attuazione della direttiva 97/62/CE del Consiglio, recante adeguamento al progresso tecnico e scientifico della direttiva 92/43/CEE:

These regulations provide the provisions required for the implementation in Gela of Directive 97/62/EC as above described.

VI. DPR n. 425 del 1 dicembre 2000: Regolamento recante norme di attuazione della direttiva 97/49/CE che modifica l'allegato I della direttiva 79/409/CEE, concernente la conservazione degli uccelli selvatici:

These regulations provide the provisions required for the implementation in Gela of Directive 97/49/EC as above described.

VII. DM 3 settembre 2002 di approvazione delle "Linee guida per la gestione dei siti Natura 2000" predisposte dal Ministero dell'Ambiente e Tutela del Territorio:

These regulations adopt guidelines for management of Natura 2000 sites.

VIII. DPR n. 120 del 12 marzo 2003: Regolamento recante modifiche ed integrazioni al decreto del Presidente della Repubblica 8 settembre 1997, n. 357, concernente attuazione della direttiva 92/43/CEE relativa alla conservazione degli habitat naturali e seminaturali, nonché della flora e della fauna selvatiche:

These regulations provide amendments and implementations in Gela of Directive 92/43/EEC as above described.

IX. DM 17/10/07 Criteri minimi uniformi per la definizione di misure di conservazione relative a Zone Speciali di Conservazione (ZSC) e a Zone di Protezione Speciale (ZPS):

These regulations provide the provisions required for the implementation in Gela of Directive 92/43/EEC and Directive 79/409/EEC as above described.

X. DM 22/01/09 Modifica del DM 17/10/07 concernente i criteri minimi uniformi per la definizione di misure di conservazione relative a Zone Speciali di Conservazione (ZSC) e Zone di Protezione Speciale (ZPS):

These regulations provide amendments of DM 17/10/07.

XI. DECRETO 2 aprile 2014 - Abrogazione dei decreti del 31 gennaio 2013 recanti il sesto elenco aggiornato dei siti di importanza comunitaria (SIC) relativi alla regione alpina, continentale e mediterranea:

Legislative decree for the abrogation of the decrees 31/01/2013 bearing the sixth updated list of SIC.

XII. Decreto MATTM 08/08/2014 – abrogazione decreto del 19/06/2009 e Elenco ZPS classificate ai sensi della Direttiva 79/409/CEE:

Legislative decree for the abrogation of the decree 19/06/2009 AND THE LIST OF ZPS classified under Directive 79/409/EEC..

XIII. DM 15 luglio 2016, n.172 - Regolamento recante la disciplina delle modalita' e delle norme tecniche per le operazioni di dragaggio nei siti di interesse nazionale, ai sensi dell'articolo 5-bis, comma 6, della legge 28 gennaio 1994, n. 84.

This decree regulates the procedures and the technical rules of dredging operations in harbor and coastal areas (located in the reclamation of sites of national interest), also for the purpose of movement and re-location of dredged sediments and materials.

XIV. DM 15 luglio 2016, n.173 - Regolamento recante modalita' e criteri tecnici per l'autorizzazione all'immersione in mare dei materiali di escavo di fondali marini.

In order to protect the marine environment, this decree regulates methods and technical criteria in order to standardize the immersion of seabed excavation sediment and materials in the sea.

3.2.2.2 Regional regulations

XV. Decreto Assessoriale 18 dicembre 2007 - Modifica del decreto 22 ottobre 2007, concernente disposizioni in materia di valutazione di incidenza attuative dell'art. 1 della legge regionale 8 maggio 2007, n.13:

This Decree provides amendments of Decree 22/10/2007.

XVI. Decreto Assessoriale 22 ottobre 2007. Disposizioni in materia di valutazione di incidenza attuative dell'articolo 1 della legge regionale 8 maggio 2007, n. 13:

This Decree provides the provisions required for the implementation of Regional law 08/05/2007, n. 13 Article 1, as below described.

XVII. Legge Regionale n. 13 dell'08.05.2007 - Disposizioni in favore dell'esercizio di attività economiche in siti di importanza comunitaria e zone di protezione speciale. Norme in materia di edilizia popolare e cooperativa. interventi nel settore del turismo. Modifiche alla legge regionale n. 10 del 2007:

The determinations on the impact assessments, established by article 5 of the D.P.R. 8 September 1997, n. 357, are attributed to the municipalities in whose territory the SIC and ZPS sites are located. The EIA involving SCI and SPA sites within natural parks are the Park Authorithy's responsibility.

The EIA concerning the current municipal, provincial and territorial planning, including the breeding and faunistic-hunting plans that have not yet been approved as of the date of entry are the responsibility of the Regional Department of the Territory and the Environment. in force of the present law.

XVIII. - D.A. 30 marzo 2007 - Decreto Assessoriale 30 marzo 2007 – Assessorato Territorio e Ambiente pubblicato nella Gazzetta Ufficiale della Regione Siciliana n. 20 del 27/04/2007. "Prime disposizioni d'urgenza relative alle modalità di svolgimento della valutazione di incidenza ai sensi dell'art. 5, comma 5, del D.P.R. 8 settembre 1997, n. 357 e successive modifiche ed integrazioni".

The Environmental Impact Assessment procedure is regulated as follows:

Letter A - Proponents

Letter B - Documentation

Letter C - Time for the proceeding

For details about this Decree please refer to full text QQ.

4.0.0 ENVIRONMENTAL AND BIODIVERSITY FRAMEWORK

4.1.0 Introduction

Historical, paleogeographic and ecological reasons make the Mediterranean Sea one of the world's biodiversity hotspots (Cuttelod *et al.,* 2009). However, the present-day Mediterranean biodiversity is undergoing rapid alteration under the combined pressure of climate change and human impact (such as shipping, aquaculture, aquarium trade, opening/widening of the Suez Canal). Nearly 1000 alien species were introduced in the Mediterranean Sea (Zenetos *et al.,* 2012). Their fast spreading is causing the loss of marine biodiversity, which is of major concern, though no extinction of native species has been recorded (Boudouresque, 2004). As such, during the last decades, the study of the Mediterranean marine biodiversity has received great attention, boosting the knowledge of the main faunal composition found within the basin. In order to protect the high environmental and biodiversity importance of the Mediterranean Sea, the national and European institutions created some protected areas, where the human activities are forbidden or highly regulated.

A portion of the survey corridor crosses an area included in the Natura 2000 network. Moreover, part of the nearshore of Gela is recognized as a SIN area, which is a site of national interest specifically regulated by the Italian legislation. The contaminated Sites of National Interest (SIN) have been defined by specific statutory provisions on the basis of site characteristics, quantity and hazardousness of pollutants, extent of the environmental impact in terms of health and ecological risk, and the detriment to cultural and environmental heritage. Therefore, any human activity must be carefully planned and managed in order to protect the environment and the marine biodiversity of the area.

4.2.0 Area of Interest General Framework

The Mediterranean Sea connects through the Strait of Gibraltar to the Atlantic Ocean in the west and through the Dardanelles to the Sea of Marmara and the Black Sea in the northeast. In the southeast, the Suez Canal links the Mediterranean to the Red Sea and the Indian Ocean (Figure 4.1). In the Strait of Sicily, a shallow ridge at 400 m depth separates the island of Sicily from the coast of Tunisia and divides the sea into two main subregions: the western (area = 0.85 million km^2) and the eastern (area = 1.65 million km^2) (Coll *et al.,* 2011; De La Hoz *et al.,* 2018).

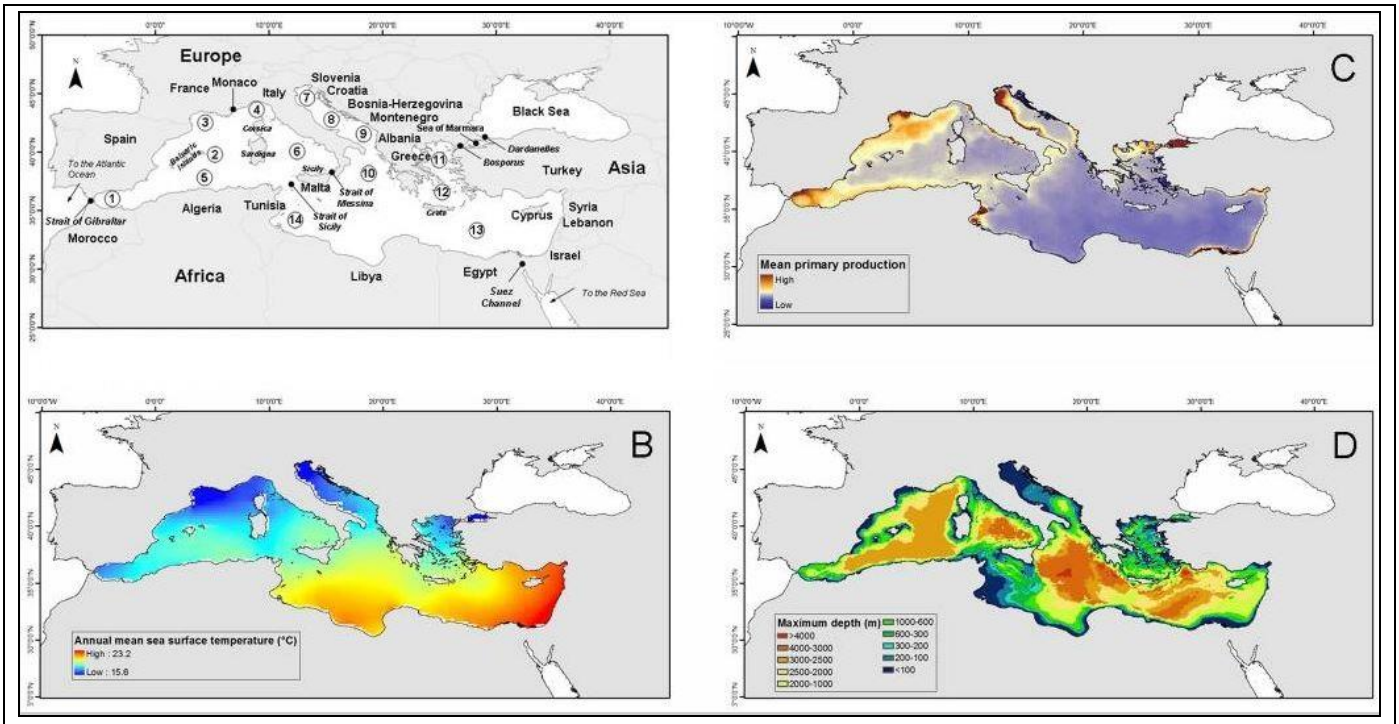
Nunziacarla *et al.* (2017) evidenced a complex dynamic situation in the water circulation of the seasonal circulation. The evaporation is higher in its eastern half (38.2–38.9%), causing the water level to decrease and salinity to increase from west to east. The resulting pressure gradient pushes relatively cool, low-salinity water from the Atlantic across the Mediterranean basin (Figure 4.2). This water warms up to the east, where it becomes saltier and then it sinks in the Levantine Sea before circulating west and exiting through the Strait of Gibraltar.

The annual mean sea surface temperature shows a high seasonality (being around 15°C during winter time and more than 22°C during summer time) and important gradients from west to east and north to south (Figure 4.1) (Hopkins, 1985).

The basin is generally oligotrophic, but regional features enrich coastal areas through changing wind conditions, temporal thermoclines, currents and river discharges, and municipal sewage (Estrada, 1996; Zavatarelli *et al.,* 1998; Bosc *et al.,* 2004) (Figure 4.1). The basin is characterized by strong environmental gradients (Danovaro *et al.,* 1999), in which the eastern end is more oligotrophic than

the western. The biological production decreases from north to south and west to east and is inversely related to the increase in temperature and salinity.

The recent marine biota in the Mediterranean Sea is primarily derived from the Atlantic Ocean (62%), but the wide range of climate and hydrology have contributed to the co-occurrence and survival of both temperate and subtropical organisms (18%) (Sarà, 1985; Bianchi and Morri; 2000). High percentages of Mediterranean marine species are endemic (20%) (Tortonese, 1985; Boudouresque, 2004). This sea has its own set of emblematic species of conservation concern, such as sea turtles, several cetaceans, and the critically endangered Mediterranean monk seal (*Monachus monachus*). It is the main spawning grounds of the eastern Atlantic bluefin tuna (*Thunnus thynnus*) (e.g. Delaugerre, 1987; MacKenzie *et al.,* 2009). There are several unique and endangered habitats, including the seagrass meadows of the endemic *Posidonia oceanica*, vermetid reefs built by the endemic gastropod *Dendropoma petraeum*, coralligenous assemblages (Green and Short, 2003; Goren and Galil, 2001), and deep-sea and pelagic habitats that support unique species and ecosystems (e.g. Sardà *et al.,* 2004; Gili *et al.,* 1998). Many sensitive habitats exist within the coastal ecosystems (Blondel and Aronson, 2005; Bellan-Santini *et al.,* 1994).



(A) Main biogeographic regions, basins and administrative divisions of the Mediterranean Sea. (B) Annual mean sea surface temperature (°C) (2003, NOAA). (C) Annual mean relative primary production (2002, Inland and Marine Waters Unit, Institute for Environment and Sustainability, EU Joint Research Centre, Ispra, Italy). (D) Maximum average depth (m) (NOAA).

Figure 4.1 –Mediterranean Sea

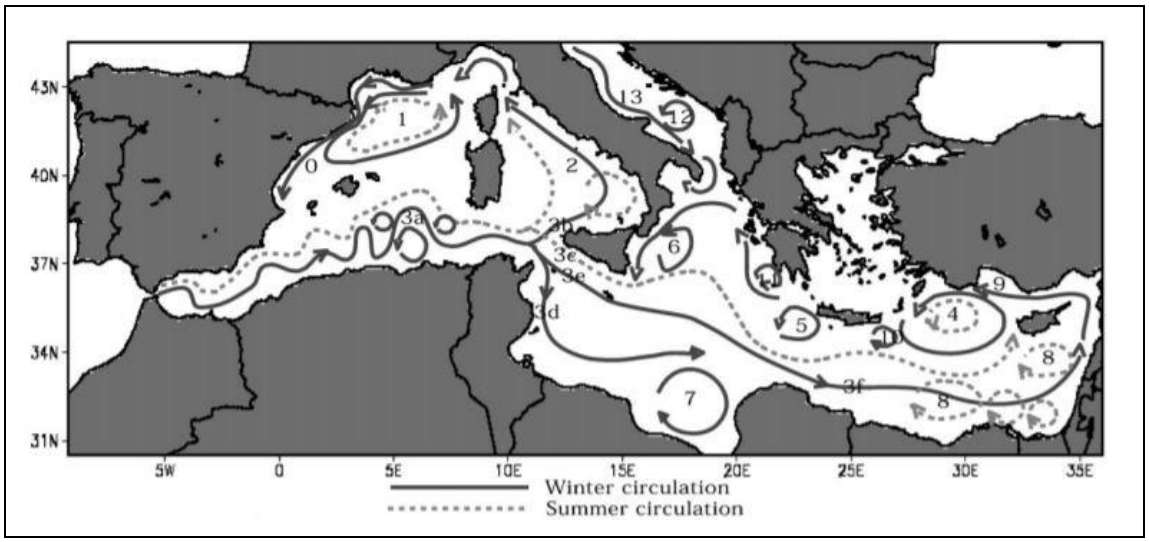


Figure 4.2 – Water Circulation within the Mediterranean Sea (Pinardi and Masetti, 2000)

4.2.1 Sicily Strait

The Strait of Sicily (or Sicily Channel) is located between Sicily and North Africa (Figure 4.3). It is considered a broad shallow shelf (350m depth on average, Morel *et al.,* 1971) which is geologically part of the African Plate. However, the morphology of the seafloor is complex, being characterized by deep basins filled by sediments (the Pantelleria basin 1317 m deep, the Malta basin 1721 m deep and the Linosa basin, 1529 m deep), seamounts (guyots) and 'banks'. The continental slope is incised by many canyons, trenches and steep cliffs. The Sicily Strait communicates with the western (WMED) and the eastern (EMED) Mediterranean Sea by a narrow sill, located NW of Pantelleria Island (400–500 m deep) and a wider channel, located SE of Malta (500–600m deep), respectively. Volcanism is still active in the area (Morel et al., 1971). The rise and successive wash-out of the Ferdinandea Island (now the Graham Bank), in front of Sciacca, occurred in the eighteenth century, represent the best example of active volcanic activity in this area.

Given its bathy-morphologic features, the Strait of Sicily is a comparatively shallow-water threshold preventing the exchange of waters of the same depths inside and outside the Mediterranean basin (Hopkins *et al.,* 1985). Therefore the Strait of Sicily represent a transition area characterized by several small scale and mesoscale oceanographic phenomena (e.g., Robinson *et al.,* 1999; Sorgente *et al.,* 2011) and great abundance of marine living resources (e.g., Coll *et al.,* 2010; Consoli *et al.,* 2016). Moreover, environmental gradients (such as the salinity and the temperature gradients), depending on their strength, act as barriers leading to differences in fish assemblages, or determine smooth community gradients (Bonanno *et al.,* 2018)

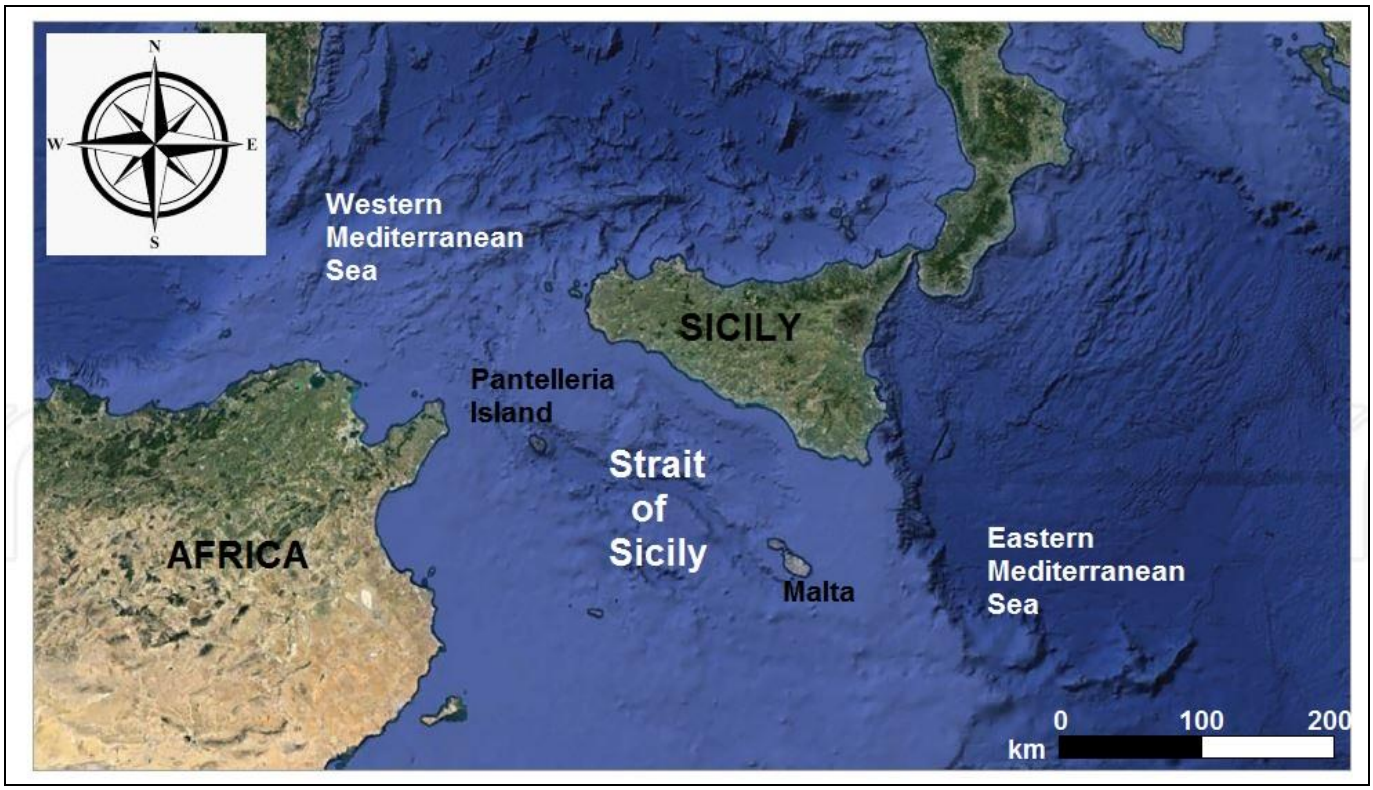
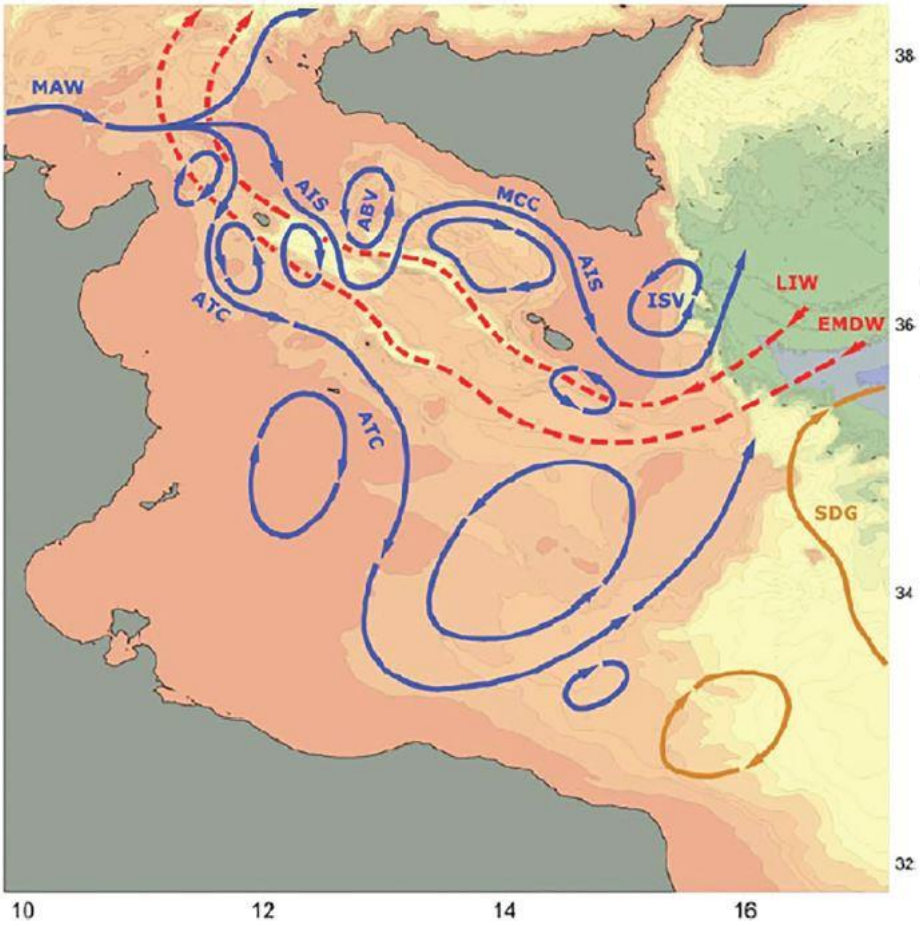


Figure 4.3 – Strait of Sicily. (http://earthobservatory.nasa.gov)

4.2.2 Currents and circulation patterns in the Sicily Strait

The Strait of Sicily is the site of active water circulation, regulated by the entrance of the Atlantic and the Levantine waters (AW and LW respectively), flowing in opposite directions. Their opposite motion lead to a stratification of the waters.



MAW: Modified Atlantic Water; AIS: Atlantic Ionian Stream; ATC: Atlantic Tunisian Current; ABV: Adventure Bank Vortex; MCC: Maltese Channel Crest); ISV: Ionian Chef Break Vortex; SDG: Sidra Gyre; LIW: Levantine Intermediate Water; EMDW: Eastern Mediterranean Deep Water (UNEP/MAP RAC/SPA, Tunis, 2015.

Data from http://www.myocean.eu/ (2010-2013 period).

Figure 4.4 - Current circulation patterns within the Strait of Sicily

The Strait of Sicily looks mostly influenced by the LW between 150–600m w.d and from 1000m to 1200m w.d. Bombace *et al.* (1972), while the AW flow mostly from 150m to 300m w.d., where they partially mix with the LW. (Bombace *et al.,* 1972; Tziperman *et al.,* 1991). The LW are more saline (38.5–38.8%) than the AW (38.0%). The bulk of these bodies of water follows the same path but in opposite directions, diverging only to the extremities (De Maio, 1969; Hopkins, 1985). The boundary layer has been estimated to coincide with the isohaline of 38%. According to the results of the inverse model (Tziperman *et al.,* 1991), the deep water circulation seems to become well separated from shallow water circulation at about 500–600 m w.d.

Although flows and speeds are reduced during the summer season, the water circulation maintains its characteristics throughout the year and the distribution of the salinity remains unchanged during the hot and cold seasons.

The system defined by the mentioned data has been recently confirmed by more recent CMEMS data, acquired from 2013 to 2016 (Figure 4.5). The prevailing currents are NW-SE oriented (approximately parallel to the Sicilian coast) with a speed of 0.1 ÷ 0.2 m/s.

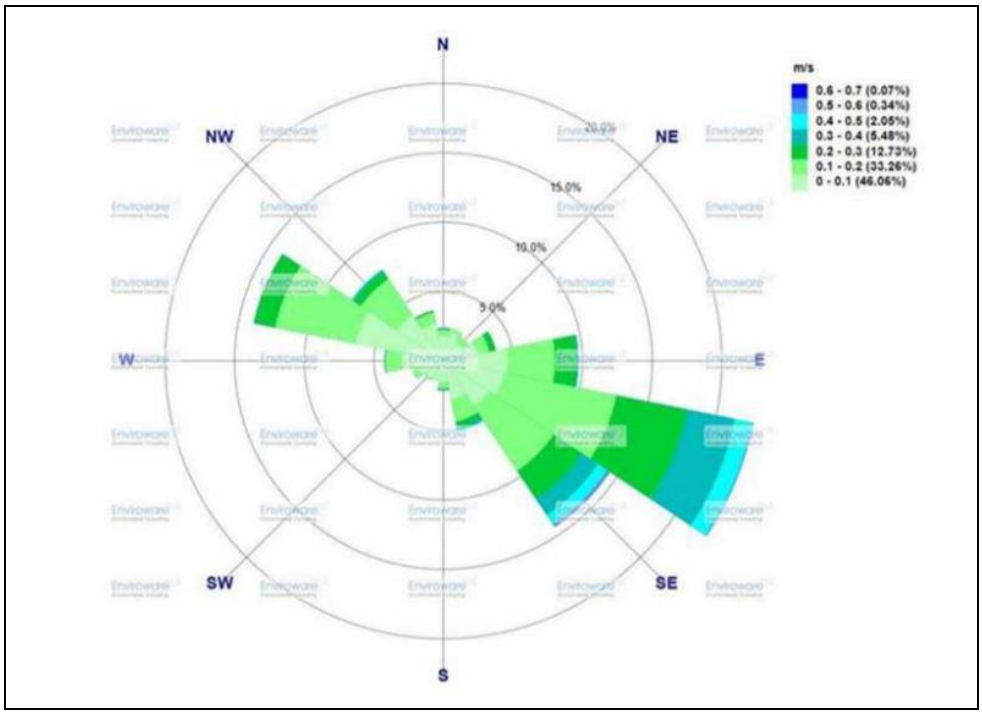


Figure 4.5 – Currents Rose (dataset CMEMS - Data Elaboration: Proger S.p.A.)

4.2.3 Gelatinous Zooplankton (Jellyfish populations and jellyfish bloom)

Jellyfish populations apparently have increased around the world. However, effects of jellyfish outbreaks in the ecosystems remain poorly understood and little or no information is available on their dietary preferences - in relation to the seasonal shifts of prey abundance - and on the potential variability of their impact on marine food webs. The mauve stinger *Pelagia noctiluca* (Forsskål, 1775) is by far the most common outbreak-forming scyphozoan jellyfish in the Western Mediterranean (Milisenda *et al.,* 2018).

Jellyfish also have indirect effects on fisheries by feeding on zooplankton and ichthyoplankton, and, therefore, are predators and potential competitors of fishes. Many human activities may contribute to an increase in jellyfish populations in coastal waters. Increased jellyfish and ctenophore populations often are associated with warming caused by climate changes and possibly power plant thermal effluents. Jellyfish may benefit from eutrophication, which can increase small-zooplankton abundance, turbidity and hypoxia. All conditions that may favour jellyfish over fish. Fishing activities can remove predators of jellyfish and zooplanktivorous fish competitors as well as cause large-scale ecosystem changes that improve conditions for jellyfish (Purcell *et al.,* 2007).

Studies of trophic relationships help to unravel mechanisms of marine ecosystem functioning by illuminating foraging patterns of key species and related flows of energy and matter (Milisenda *et al.,* 2018). Due to the inherent spatial and temporal variability of pelagic communities, tracing trophic relationships may be not as straightforward as in benthic habitats, leaving large gaps in the mechanistic interpretation of unpredicted biological events such as massive and recurrent outbreaks of gelatinous zooplankton communities in several coastal waters worldwide (Purcell *et al.,* 2007). For

instance, carnivorous jellyfish are mainly subject to bottom-up controls from their forage base rather than to top-down controls from predators (Pauly *et al.,* 2008). This suggests that knowing what, how much, and where they eat, it would be a key information to establish ecophysiological optima and trophic links supporting regime shifts in marine ecosystems coupled to local or temporary dominance of jellyfish. This knowledge is of particular importance for predicting the potential impact of jellyfish on marine ecosystem functioning and services, and eventually on human activities in coastal areas (Boero, 2013; Boero *et al.,* 1997).

The new CIESM Jelly Watch Programme shall gather for the first time baseline data on the frequency and extent of jellyfish outbreaks across the Mediterranean Sea. After the initial phase involving a few countries, a common, standardized protocol is adopted for both coastal and open sea sightings of jellyfish swarms in the whole Basin (Figure 4.6), enabling an unbiased assessment of the geographic and temporal scale of these mass events. Offshore observations will be taken aboard vessels of opportunity (ferries, coastguard boats) along selected Mediterranean routes cutting across the different sub-basins. Records will be related to both field (see CIESM TransMed Programme) and satellite hydrological data (salinity, temperature and currents).

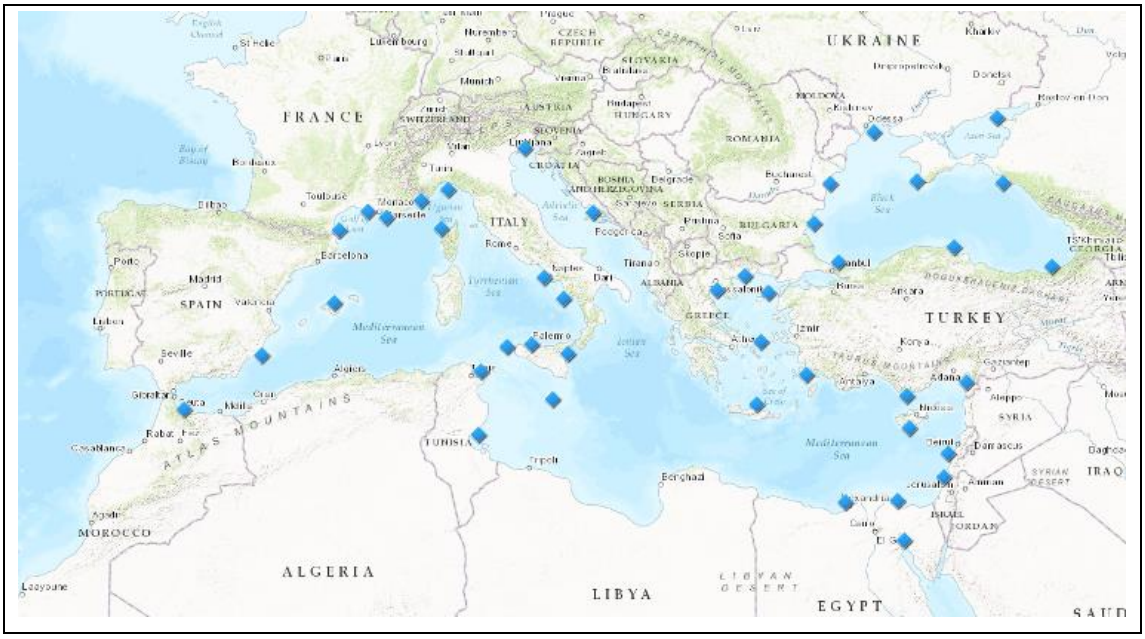


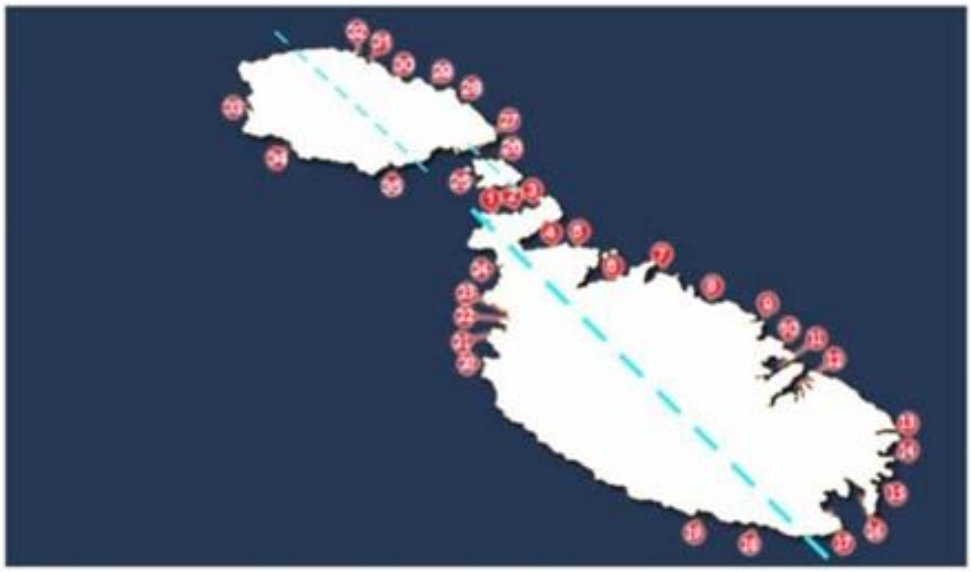
Figure 4.6 - Active Jellywatch Focal Points

The Spot of Jellyfish citizen science campaign was launched by the International Ocean Institute and by the University of Malta in the summer of 2010, with thousands of jellyfish spotting reports which have been submitted by sea-users through the campaign website, social media site, and smart phone app or even through email (Gatt *et al.,* 2018). Spatial differences in the abundance of jellyfish reports submitted along different parts of Maltese coastline emerged, with the highest number of such reports having been submitted along the north-eastern coastline of the island of Malta (Figure 4.7), and jellyfish sighting reports correlated well with the values of the selected water quality values.

Maltese bay reference, jellyfish species and the abundance of jellyfish sighted for reports were submitted between July 2011 and December 2015 (Gatt *et al.,* 2018). The six most commonly-reported gelatinous species were considered for the statistical analyses, namely *Pelagia noctiluca* (mauve stinger), *Cotylorhiza tuberculata* (fried-egg jellyfish), *Carybdea marsupialis* (Mediterranean box jellyfish), *Olindias phosphorica* (cigar jellyfish), *Velella velella* (by-the-wind sailor) and ctenophores.

The spatial distribution of each species was assessed by clustering together the reports received for each species from bays along the western flank of the island, and those originating from bays along the eastern flank, with a total of 35 bays being considered.

The delineation between the 'west' and 'east' flanks (as shown in Figure 4.7) was not determined along strictly geographical considerations but rather on the basis of the complex circulation within the Malta-Sicily shelf area and the Strait of Sicily (Drago, Sorgente & Olita, 2010), as a result of which the two identified 'areas' are subject to different hydrodynamic phenomena. IBM SPSS and PRIMER-E software (Clarke & Gorley, 2006) was used to test for any possible correlations between water quality parameter values and jellyfish sighting report data. The complete study is reported in the full report (Gatt *et al.,* 2018).



The blue line shows the delineation of the east (bays 1-17, 26-32) and the west (bays 18-25, 33-35).

Figure 4.7 - Maltese bays - Spot the Jellyfish Report Form.

From these results:

- the presence of *P. noctiluca* over a broad range of temperatures and salinities is reported and has been documented in several previous studies (Canepa, 2014).
- *Cotylorhiza tuberculata* sightings coincided with low phosphate and chlorophyll concentrations, and high nitrate, salinity and water temperature values.
- Contrary to the results of this study, a separate one-year phenological study carried out in Maltese waters found that high abundances of *C. marsupialis* were observed to coincide with low nitrate and low chlorophyll *a* values (Pulis, 2015). On the other hand, similarly to the findings of the present study, it was found that, at the two studied sites, *C. marsupialis* started to appear at the end of May, when water temperatures reached 22.2 °C, and experienced a decrease at lower temperatures, until they disappeared at temperatures lower than 16.3 °C. Within the same study, overall, the population dynamics for *C. marsupialis* strongly followed patterns in sea surface temperature.

Different approaches have been developed with the aim of mitigating the impact of jellyfish blooms in coastal areas. These include warning flags, specialized anti-jellyfish nets and, to a much lower extent, risk maps for jellyfish blooms. The Medjellyrisk Project (www.jellyrisk.eu) aimed to create a western and central Mediterranean Basin forecasting platform. An integrated Collaborative Citizen Science approach has combined abundance data on stranded individuals of jellyfish and those recorded in coastal waters from four different Mediterranean countries (Spain, Italy, Tunisia and Malta) in a single database.

4.3.0 Sicily Framework

Many studies were carried out to improve knowledge about the biodiversity and the distribution of endemic / alien species in these areas. In particular because the environment and marine life of the Mediterranean Sea have suffered multiple and interactive stresses due to pollution, eutrophication, excessive and destructive fishing, habitat loss and degradation, and, finally, the growing introduction of Lessepsian or non-indigenous species (Coll *et al.,* 2011). All studies represent the basis to eventually adopt some protection measures to preserve Mediterranean diversity.

The Strait of Sicily is known for the richness of the pelagic species populations (from the biggest pelagic species such as red tuna and swordfish up to anchovies and sardines) and for the demersal resources. In terms of fishing activity, the volume of the catch shows that the pink shrimp *Parapenaeus longirostris* is the most important demersal resource of the area. Other common species are the Norway lobster (*Nephrops norvegicus*), the red shrimp (*Aristaeomorpha foliacea*), the hake (*Merluccius merluccius*), the purple shrimp (*Aristeus antennatus*), the scorpionfish bottom (*Helicolenus dactylopterus*), the mud mostella (*Phycis blennioides*) and monkfish (*Lophius spp*.). (Rapporto Annuale sulla Pesca e sull'Agricoltura - Annual Report on Fisheries and Aquaculture, 2013).

Different studies on the benthic communities in the Strait of Sicily (Giaccone, 1972; Cinelli *et al.,* 1972) highlighted the dominance of the rheophilic species and of the species with an Atlantic affinity. Large prairies of the seagrass *Posidonia oceanica*, which represents the most widespread and typical ecosystem in the Mediterranean phytal zone (Pères, Picard, 1964), characterize wide infralittoral areas, down to 40–50 m (Cinelli *et al.,* 1972;Cinelli, 1980). The hard substrates in the infralittoral and in the deeper portion of the circalittoral areas are colonized by wide populations of large brown algae such as *Cystoseira*, *Sargassum*, and by *Laminaria rodriguezi* (Suriano *et al.,* 1992) . The sandy seafloor swept by unidirectional and oscillating currents between 40–120m host populations of calcareous red algae, the so-called 'Maerl' (Pères, Picard, 1964), in particular around Lampedusa Island. From 30m to 50m and from 150m to 200m the seafloor is characterized, using the Péres and Picard's classification (Pères, Picard, 1964), by the 'circalittoral' layer. The deeper level, generally associated with the continental slope and the deep steeps around the banks, is the 'bathyal' layer. In the hard substrates of the circalittoral layer, a peculiar biocoenotic series known as (*Corallium rubrum*), 'coralligenous bottoms', have been recognized. They are characterized by: calcareous red algae, sponges, cnidaria (*Eunicella cavolini*, *Astroides calycularis*), polychaetes (*Serpula vermicularis*), brachiopods (*Argyrotheca cuneata*), bryozoa, crustaceans (*Lissa chiragra*), echinoderms (*Ophidia sterophidianus*), sea squirts (*Rhodosoma callense*) and bivalves (*Manupecten pesfelis*, *Lima vulgaris*). Péres and Picard (1964) described another circalittoral biocoenosis of the hard bottoms, the 'off-shore rocks'. The characteristic group is represented by many sponges species, together with the cnidarians. Some species, e.g. the Sea urchin *Cidaris cidaris*, are considered as outsiders coming from the bathyal zone. In the area of the Sicilian Straits the circalittoral bottoms between 65 and 105 m are often sandy, with grains from coarse to very fine, nearly muddy, interspersed with abundant larger detritus of organic origin, such as shell fragments, calcareous plants and, less frequently, bryozoan remnants. Soft seaweeds are abundant too: at

lower depth the green seaweed *Cladophora fracta* is predominant, elsewhere other algae are common (e.g. *Dictyota dichotoma*, *Laminaria rodriguezii*). The presence of sponges is massive, with *Crambe crambe* and others. A non-peculiar distribution is shown by the cnidaria *Pennatula phosphorea*. These species are typical of a particular kind of terrigenous muddy-shelf assemblage, characterized by a viscous mud, and it is often associated with *Veretillum cynomorium* (Pères, 1985); bivalves are mainly occurring with the species, *Acanthocardia echinata*,, *Hiatella arctica*, *Pecten jacobaeus* (assumed to be characteristic of whole western Mediterranean (Pères JM., 1985); cephalopods presences are patchy, with *Eledone moschata*, *E. cirrhosa*, *Octopus vulgaris*, *Sepia officinalis* and *Loligo vulgaris*. Around Lampedusa, the crustacean galatheid *Munida curvimanna* is observed on sandy-muddy grounds, while *Galathea strigosa* lives on the 'Maerl' bottoms (GFCM, 1970).

According to Spanò and De Domenico, (2017) many fishes of commercial interest live in the meso littoral layer, among which the most important red mullets,(*Mullus surmuletus* and *M. barbatus*), and the pandora bream (*Pagellus erythrinus*); other demersal species are common, such as the Sea robins *Lepidotrigla cavillone*, the flatfishes *Solea kleini* and the scorpion fish *Scorpaena scrofa*. The Sicily Channel presents some species of sub-tropical attitude, such as the Portuguese sole *Synaptura lusitanica*, the corb *Umbrina ronchus*, *Cynoponticus ferox*, *Facciolella oxyrhyncha*, *Epigonus constanciae* (Fredj *et al.,* 1987). In the Sicily Channel, the hard bottoms of deeper bathymetric zones(bathyal layer), are characterized by many huge 'buildings' produced by madrepores (*Madrepora oculata*, *Lophelia prolifera*), generally forming scattered clumps, that give origin to the 'white coral assemblages' biocoenosis (Pères, 1964, Arena, 1985), locally known as 'cannelleri' (Spanò and De Domenico, 2017). They are made of strong and stony corms that make extended surfaces between 300 and 450 m and being a danger for the fishing activity, or even untrawlable altogether. Another white coral living at higher depths (*Dendrophyllia cornigera*) is softer but it is still an obstacle for fishing. In fact, it colonizes rocky substrates exposed to hydrodynamics, while the former corals prefer finer sediments. The most typical biological indicator species is the Sea pen *Funiculina quadrangularis*, even if it is now quite rare especially on the trawlable grounds; the occurrence of such a species is closely related to the abundance of food supply. In a few zones, the brachiopod *Terebratula vitrea* is dominant, but always associated with *F. quadrangolaris*. Among the crustaceans of this layer, the pink shrimp *Parapenaeus longirostris* (often associated with the presence of *Funiculina*) is the most interesting; the Norway lobster, *Nephrops norvegicus*, is caught here too; cartilaginous fishes are well and constantly represented in the layer with the dogfishes (*Etmopterus spinax*, *Scyliorhinus canicula*) and the skates (*Raja oxyrinchus*, *R. miraletus*). The northern part of the channel, i.e. the western Sicily, does not show significant differences from the other areas (Arena, Li Greci, 1973) while in the southernmost part (in front of Capo Passero) the wreck fish *Polyprion americanus*, the grouper *Epinephelus guaza* and various Sea robins Trigla spp. may be found (Scaccini *et al.,* 1970). The characteristic facies of this bionomic stratum is composed of Isidella elongata (Gorgonacea) that is associated with the red shrimps *Aristaeomorpha foliacea* and, depending on the zones, *Aristeus antennatus*. Parts of the same facies are the brachiopod *Tenebratula vitrea* and the echinoderm *Brisingella coronata* (GFCM, 1970). In western Sicily (i.e. the northern part of the Sicily Channel), the mesobathyal layer shows some typical and exclusive species, such as the sponges *Pheronema grayi* and *Poecillastra compressa*, the cnidaria *Lophogorgia sarmentosa*, *Madrepora oculata*, *Lophelia prolifera*, *Dendrophyllia cornigera*, Calliactis parasitica and *Amphianthus dohrni*, the crab *Anamanthia rissoana*, the gastropods *Natica millepunctata*, *Lunatia fusca*, *Buccinum humphreysianum* and *Fusinus rostratus*, the cephalopods *Bathypolypus sponsalis*, *Heteroteuthis dispar*, *Alloteuthis media*, *Abralia veranyi*, *Histioteuthis reversa*, *Chiroteuthis veranyi* and *Octopoteuthis sicula* (Arena, Li Greci, 1973); in the northern- most area, the fishes *Chlorophthalmus agassizi* and *Aulopus filamentosus* are present too (Scaccini *et al.,* 1970).

Whitin the "Hermes" and ESF Eurocores "Moundforce" EU programs (aimed at investigating the deep marine ecosystems of the Mediterranean), the biocenosis of deep corals have been studied. They are characterized by the presence of *Lophelia pertusa* (L.), *Madrepora oculata* (L.), *Desmophyllum*

dianthus (Esper, 1794), *Dendrophyllia sp.* E *Corallium rubrum* (L.) from the Strait of Sicily till South of Malta (Martinelli *et al.,* 2007).

4.3.1 Benthic / Pelagic biocenoses

The Sicily Channel, like other Mediterranean regions, is still lacking a comprehensive classification of marine habitats and communities (Fiorentino *et al.,* 2004). Recently, Garofalo *et al.* (2002b) proposed a first attempt to develop a large-scale thematic mapping of marine benthic biocenoses in this area, based on scientific trawl surveys (Figure 4.8). From a large data set collected over a ten-year period from 1990 to 2000, hauls with presence of indicator species and substrate-type records were selected. Through the analysis of this information, with catch data, a biocenosis category, based on the Pérès and Picard (1964) classification, was assigned to each sampling site. Nine biocenosis/facies types were identified: SFBC (well-graded fine sand), HP (*Posidonia oceanica* meadows), VTC (coastal terrigenous mud), C (coralligenous), DC (coastal detritus), DL (open-sea detrital bottoms), VB-VSG (sandy muds with gravels), VB-C (compacted muds), VB-PSF (soft muds with fluid surface film).

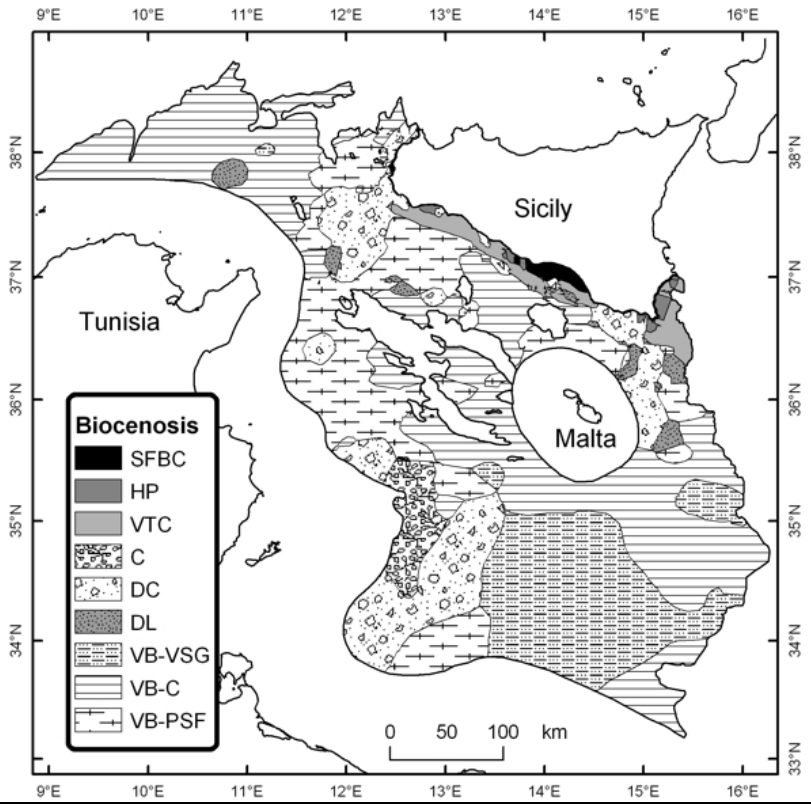


Image from Garofalo et al., 2002

Figure 4.8 - Map of the benthic biocoenoses in the Strait of Sicily

4.3.2 Flora

In the Mediterranean Sea there are five species belonging to the Magnoliophyta division of the marine environment: *Posidonia oceanica* (endemic), *Cymodocea nodosa*, *Zostera marina* and *Zostera noltii*, that can be also found in the Atlantic Ocean and the Lessepsiana, *Halophila stipulacea*

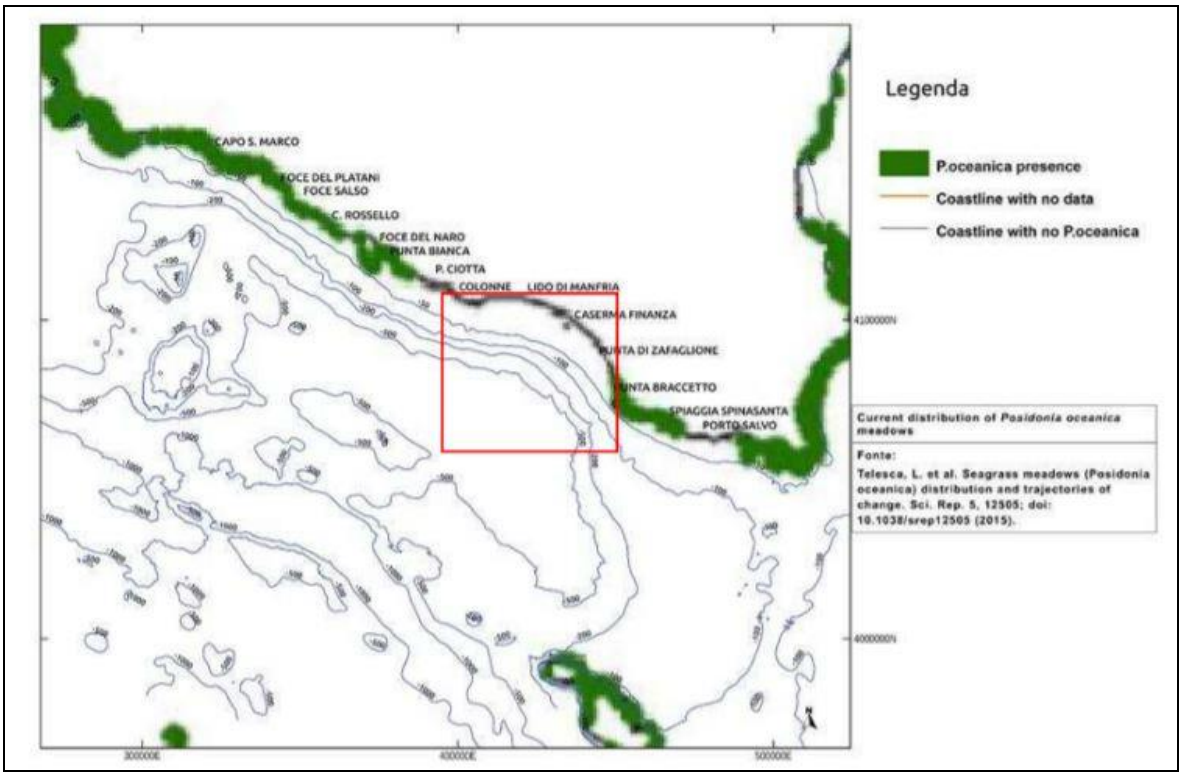
migrated through the Suez Channel. The most notorious and the best studied invasive species in the Mediterranean are the coenocytic chlorophytes: *Caulerpa taxifolia* (Vahl) C. Agardh (A.K.A. ''the killer Alga'', Meinesz et al., 2002), and *Caulerpa racemosa* var. cylindracea (Sonder) Verlaque, Huisman and Boudouresque (Verlaque et al., 2004). *C.taxifolia*'s dense clumps of rhizomes and stolons form an obstruction to fish feeding on benthic invertebrates. Indeed, total species richness, density and biomass of fish assemblages are significantly lower in *C. taxifolia*-invaded *Posidonia oceanica* beds.

- *Posidonia oceanica*

Within the infralittoral level, the *Posidonia ocea*nica is the most widespread phanerogram in the Mediterranean Sea. The *Posidonia* prairie constitutes the climax community of the sandy bottoms of the Mediterranean, and the maximum development and complexity level that this ecosystem can reaches. It is among the most important of the Mediterranean Sea and has been indicated as a habitat of community interest with the code 1120 of the Habitat Directive (Dir. No. 92/43 / CEE), as well as a "priority habitat" in Annex I of this Directive.

*Posidonia ocea*nica is present along almost all of the coasts of the Mediterranean Sea. It constitutes the most important species both for complexity and persistence of its ecosystem, and for the extension of its grasslands; it is in fact the only phanerogama able to colonize the entire coastal area, starting from the surface down to a water depth of approximalty 40m (Buia *et al.,* 2003).

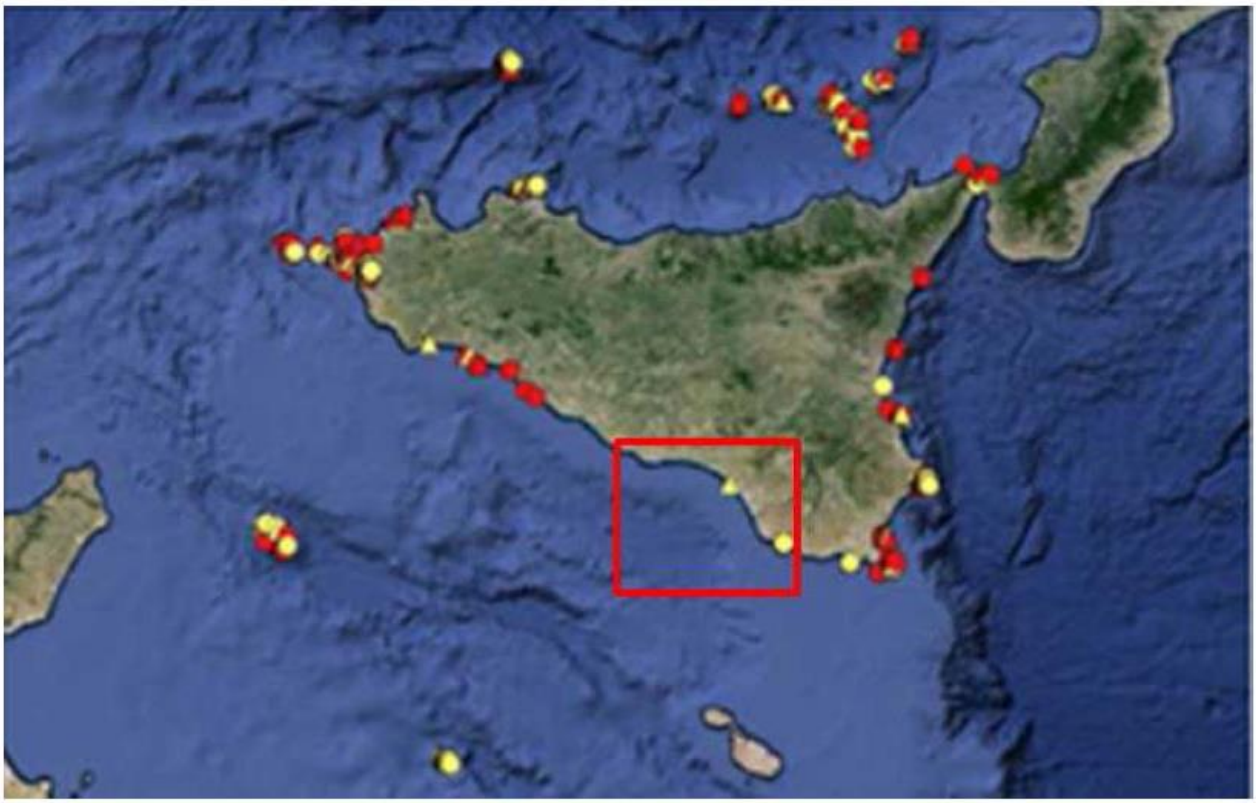
Figure 4.9 shows the distribution of the *Posidonia ocenica* along the Mediterranean coasts of Southern Sicily and Malta. With respect to our investigation area (Sicily coastline), the location indicates the presence of *P. oceanica* meadows only marginally and in the South-East portion near Punta Braccetto.



The studied area is shown in the red square. Data from Telesca et al., 2015

Figure 4.9 - Detail of the current distribution of *Posidonia oceanica* meadows in Sicily

These data are confirmed from MATTM database (Atlas of marine protected species in the MPAs and in the Natura 2000 sites in Sicily), except for only one point in Gela Gulf which data (prior to 2001) are not associated with punctual findings.



Red point: sightings after 2001; Yellow point: sightings before 2001.
The red square represents the studied area.
Image from http://www.isprambiente.gov.it/it/banche-dati/atlantedelle-specie-marine-protette/

Figure 4.10 – *Posidonia oceanica* (MATTM map)

The settlement and development of *Posidonia oceanica* along the Sicily coasts are conditioned by the features of the seafloor. Dense and extensive grasslands can be found along the south-eastern, north-western and western coasts, in correspondence to the most important carbonate emergencies and limestone of the island (ENI, 2018). However, in these sectors, grassland finds planting conditions even on bedrock, with the possible presence of organogenic sediments. Along the west coast, favorable ecological conditions allow the establishment and the development of one of the most impressive ever observed grasslands throughout the Mediterranean basin.

The *Posidonia oceanica* along Sicily coasts have been spotted down to 31.4m ± 5, 6 m (ARPA Sicilia and Università degli Studi di Palermo, 2007). However, this value might be different in other places, depending on the water column transparency.

The *Posidonia oceanica* is an environmental indicator of seawater quality, because it has a huge predisposition to accumulate high concentration of pollutants in its tissues and it is also very sensitive to environmental variations.

However, the main threat to *Posidonia oceanica* is the physical damage caused by fishing trawl anchors, and turbidity. Further damage is due to the coastal anthropization which promotes eutrophication, pollution and the presence of invasive alien species.

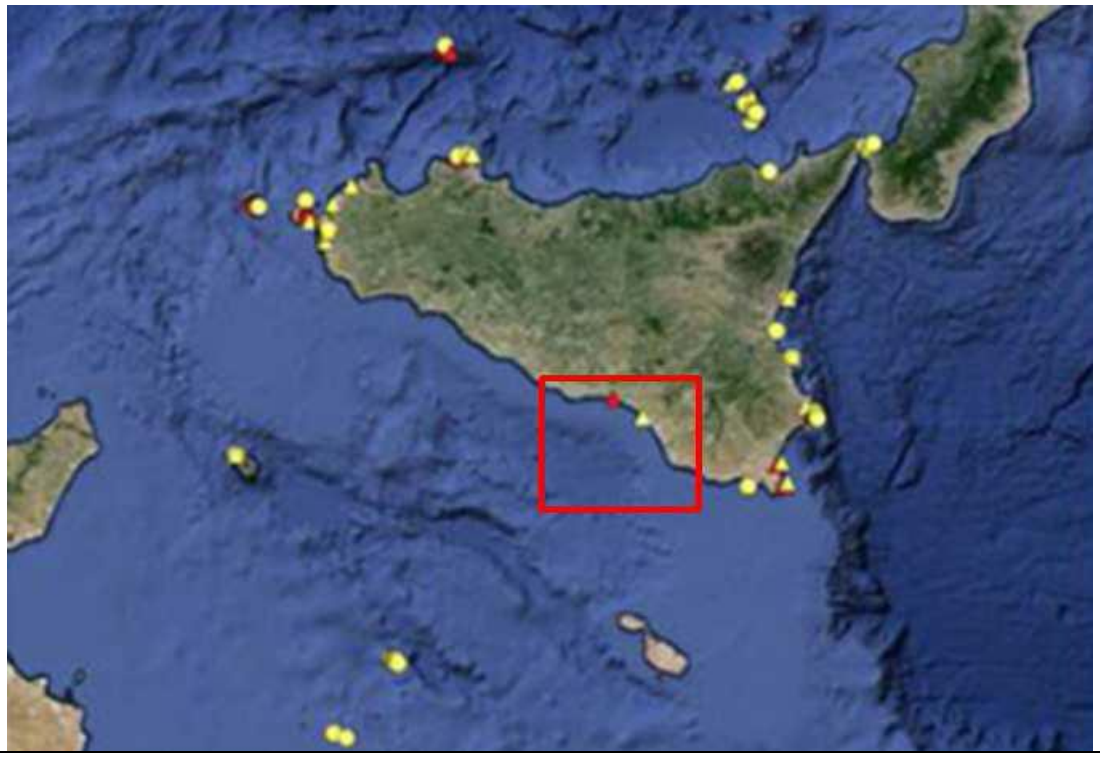
- *Cymodocea nodosa*

The *Cymodocea nodosa* is the second most developed species in the Mediterranean Sea.

It is particularly evident in the eastern part of the Levantine basin. Although mild local regressions of *Cymodocea nodosa* have been recorded in areas with human activities, this species seem to be more influenced by long term natural parameters, such as changes in salinity, the action of herbivores and the climate change. In several areas of the Mediterranean Sea, the *Cymodocea nodosa* took advantage of the *Posidonia oceanica* regression to allow its own development (Montefalcone *et al.,* 2007).

Figure 4.11 shows the distribution of *Cymodocea nodosa* in the Mediterranean Sea, given from IUCN, while Figure 4.12 shows the distribution based on the MATTM data.

Figure 4.11 – Distribution of *Cymodocea nodosa* in the Mediterranean Sea (IUCN, 2012)



Red point: sightings after 2001; Yellow point: sightings before 2001.
The red square represents the studied area.
Image from http://www.isprambiente.gov.it/it/banche-dati/atlantedelle-specie-marine-protette/

Figure 4.12 – *Cymodocea nodosa based on* MATTM map

The individuals of this species prefer fine sands and superficial muddy sands (also riches of organic material) as seabottom; sometimes rocks covered by sediments. It is a pioneer species and can be inserted in the *Posidonia* evolutionary series.

4.3.3 Coralligenous

Among the activities undertaken by ISPRA within the Regional Biodiversity Observatory of Sicily, two research campaigns were conducted in the Strait of Sicily, in order to fill the knowledge gaps on the biodiversity of these particular environments. The research campaigns were carried out from 18 to 29 July 2014 and from 15 to 23 June 2015 (http://www.isprambiente.gov.it).

Among the identified species 18 are protected by international agreements, conventions and directives, such as Washington Convention (CITES), Berne Convention, Directive 92/43 / EEC (Habitat Directive), and the SPA / BD protocol of the Convention of Barcelona. Furthermore, many are included in the IUCN red list: 3 endangered species; 2 vulnerable species; 10 species with declining trends, 2 almost at risk; 6 species with insufficient data and 10 species with unknown trends:

- Superficial waters: are characterized by sandy and rocky seafloor where *Posidonia oceanica* is the most common species associated with a lot of green, red and brown algae, some of which are protected, such as sargasso and laminaria (*Laminaria rodriguezii*), whose presence is ascertained only in a few Mediterranean sites. In some cases these environments are densely populated by a species of gorgonian, *Eunicella singularis* (Figure 4.13).

- Deeper than 70 meters depth the *Eunicella cavolini* species is more widespread.

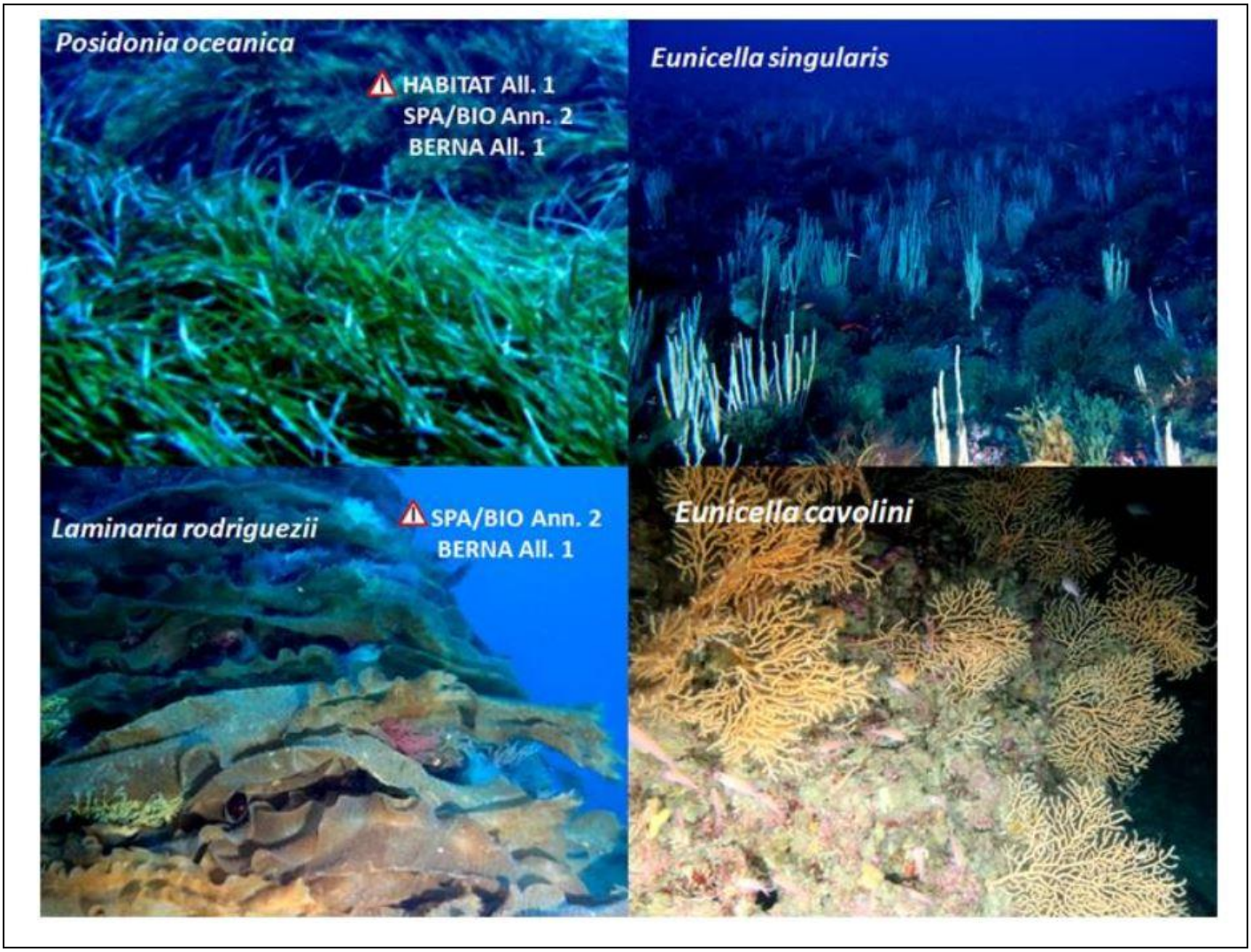


Figure 4.13 – Superficial waters: *Posidonia oceanica, Eunicella singularis, Laminaria rodriguezii, Eunicella cavolini*

Deeper than 80m of depth, up to around 300m, the seabed is characterized, in the rocky parts, by isolated branches or entire banks of living red coral (*Corallium rubrum*) (Figure 4.14) and, diffusely, by different species of black coral, such as *Antipathes dichotoma*, *Antipathella subpinnata*, *Parantipathes larix* and *Leiopathes glaberrima*, the false coral (*Savalia savaglia*), white corals and other calcified corals - such as *Dendrophyllia ramea* and *Dendrophyllia cornigera* (Figure 4.15). At these depths the seabed are colonized by other species of soft corals, such as *Veretillum cynomorium*, *Funiculina quadrangularis* and *Viminella flagellum*.

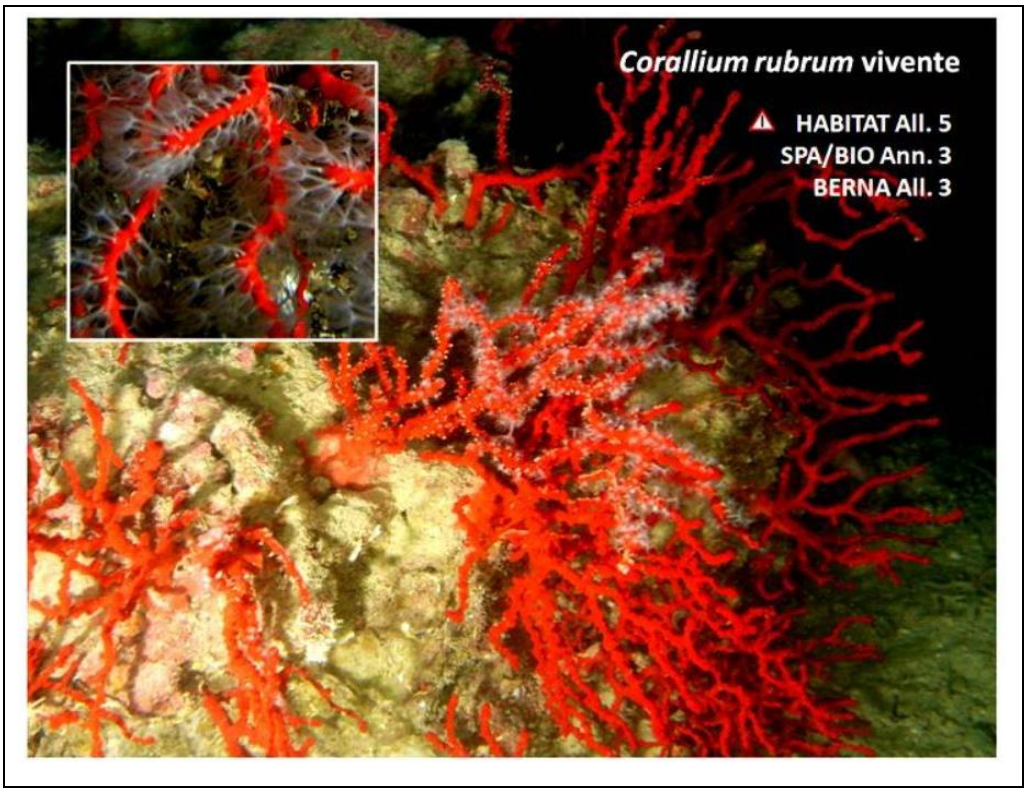


Figure 4.14 – Bank of *Corallium rubrum*

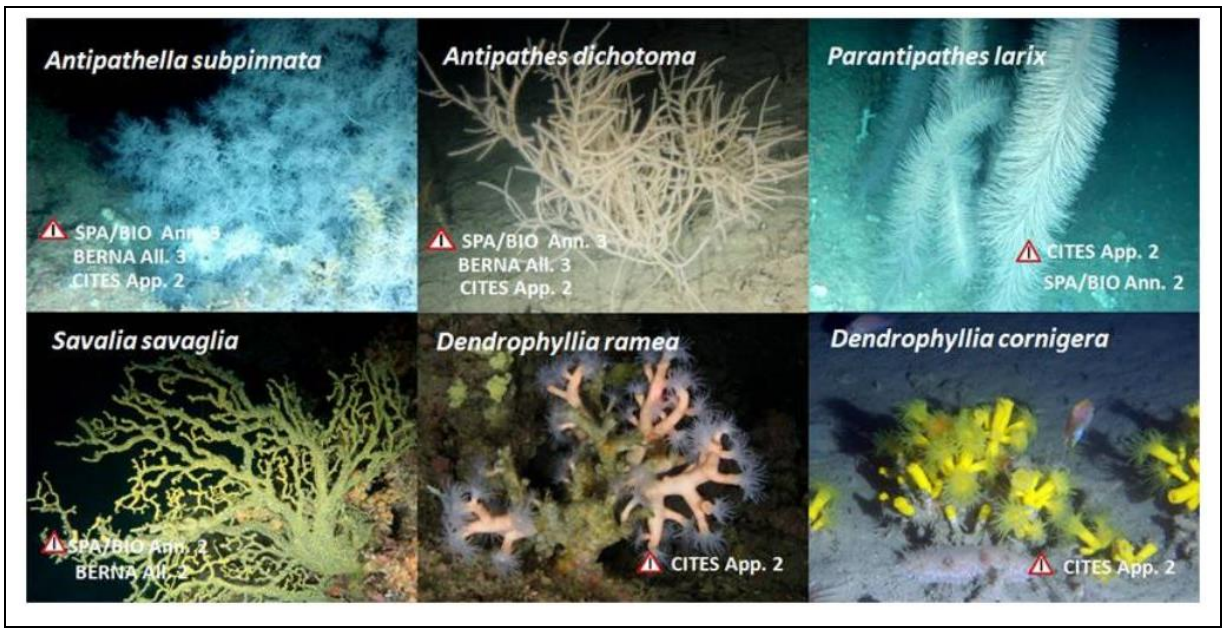


Figure 4.15 – Common species of corals in the Strait of Sicily

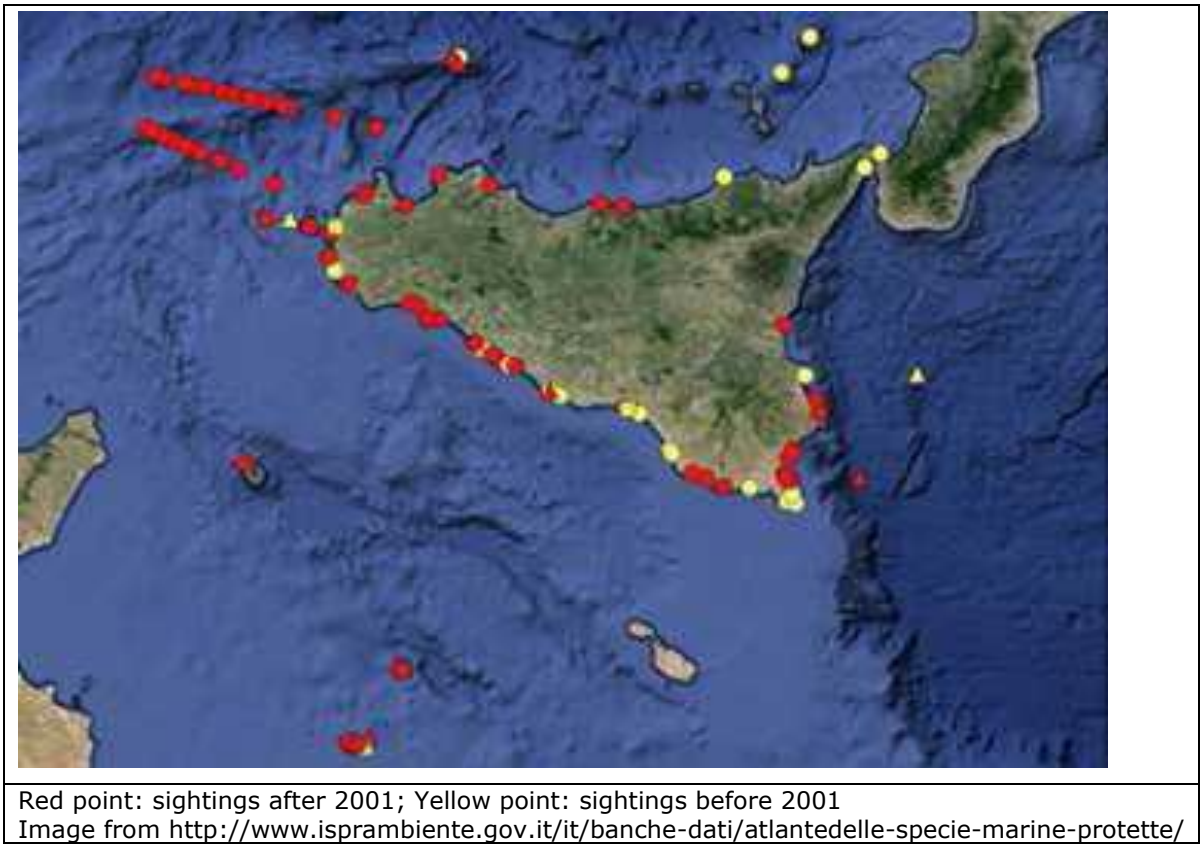
Other hard bottom habitats have been monitored by ISPRA at different depths: the coralligenous dominated by various species of coralline algae, bryozoans, such as *Pentapora fascialis*, sponges, such as *Axinella polypoides*, and gorgonians, such as *Paramuricea clavata*. Maerl and rhodolithic seabeds, made of coral red algae, have also been observed.

4.3.4 Marine Reptiles

The state of marine turtles in the Mediterranean Sea has been studied for the first time in the project for the species safeguard started in 1978 by the International Union for Conservation of Nature and Natural Resources (IUCN) and subsequently financed by WWF Italy. This study had the purpose to characterize the geographical distribution and migration behaviors connected to the reproduction and the nutrition habits. It allowed also the estimation of total population by capturing, marking and possibly recapturing of all individuals previously marked (Argano et al., 1991). The study focused on Caretta caretta species which is the most common in the Mediterranean. Other common species are the green turtle (Chelonia mydas) and the leatherback turtle (Dermochelys coriacea). This study allowed the description of probable routes along which these reptiles move. The Sicilian Channel was a place of transit for turtles moving from the eastern basin to the western one of the Mediterranean and vice versa, as subsequently described by Margaritoulis et al. (2003).

Another work was conducted by the "Centro Studi Cetacei (Cetacean Study Centre)" (2002). It was related to the recovery of sea turtles along the Italian coasts, and it reports a sightings percentage of 25% in winter and 75% in late spring and autumnal period.

In the following picture the Caretta *caretta* distribution MATTM map is shown:



Red point: sightings after 2001; Yellow point: sightings before 2001
Image from http://www.isprambiente.gov.it/it/banche-dati/atlantedelle-specie-marine-protette/

Figure 4.16 – Distribution of *Caretta caretta* based on MATTM map

This species is strongly threatened throughout the Mediterranean basin not only because of costal urbanization that limits suitable areas for the laying of eggs, but also because of the fishing activities, in particular longlines and nets accidentally cause the death of many individuals. In the

Red List prepared by the IUCN, the species is framed as "Vulnerable" while in the red list of Italian vertebrates is classified as EN "Endangered" (Eni, 2018).

4.3.5 Marine Mammals

Although the Sicilian Channel is a quite important area (because it represents the almost obligatory point of passage between the western and eastern parts of the Mediterranean basin), there are no systematic studies on the distribution and relative abundance of cetacean species in this portion of the Mediterranean Sea (ENI, 2018). Consequently, for this area there is no information on the possible "seasonality" of the species and on their use of the habitat.

However, it is possible to reconstruct the distribution and the frequency of sightings in the Strait of Sicily. It is based on the available literature, which mainly refers to studies conducted along the Italian coasts both in the summer-spring and winter seasons (Lewis *et al.,* 2003, Centro Studi Cetacei, 2001, 2002; Notarbartolo di Sciara *et al.,* 1993; Notarbartolo di Sciara and Demma, 1994, Giordano *et al.,* 1995; Watkins *et al.,* 1987), and along the Tunisian coasts (Ben Mustapha, 1986; Ktari- Chakroun, 1980 and 1981).

The observations can also be found from some oceanographic campaigns as the one of CNR in Mazara del Vallo (ENI, 2018) as well as information taken from the database GeoCetus on the beachings along the Italian coasts. In fact, strandings represent an important source of information on the presence of marine mammal's individuals in a specific area.

Overall, the bibliographic data reveals the presence of some common species in the Strait of Sicily waters: the bottlenose dolphin, *Tursiops truncatus*, *Stenella*, *Stenella coeruleoalba*, the dolphin common, *Delphinus delphis*, the grampus, *Grampus griseus*, the sperm whale*, Physeter catodon*. Notarbartolo di Sciara and Demma (1994) also reported the local presence of pseudorca, *Pseudorcacrassidens* and of the killer whale, *Orcinus orca*.

Based on sightings location data made in recent years, in accordance with observations obtained from Notarbartolo of Sciara et al. (1993) for summer months and by Arcangeli et al. (2001) for winter period, a relative poverty of marine mammals fauna in the area is evident, compared to that observed in other Italian waters. These data are confirmed by more recent information provided by the GeoCetus database.

More information regarding the cetacean's distribution in the Italian waters can be gathered from the database of the University of Pavia (http://www-3.unipv.it/cibra/spiaggiamenti.html). An example of the dataset is shown in Figure 4.17.

This link is referred to a systematic collection of marine mammals stretches information on the Italian coasts. It started in 1986 and it's active until now by hand of MATTM with the University of Padua and with the Natural History Museum of Milan.

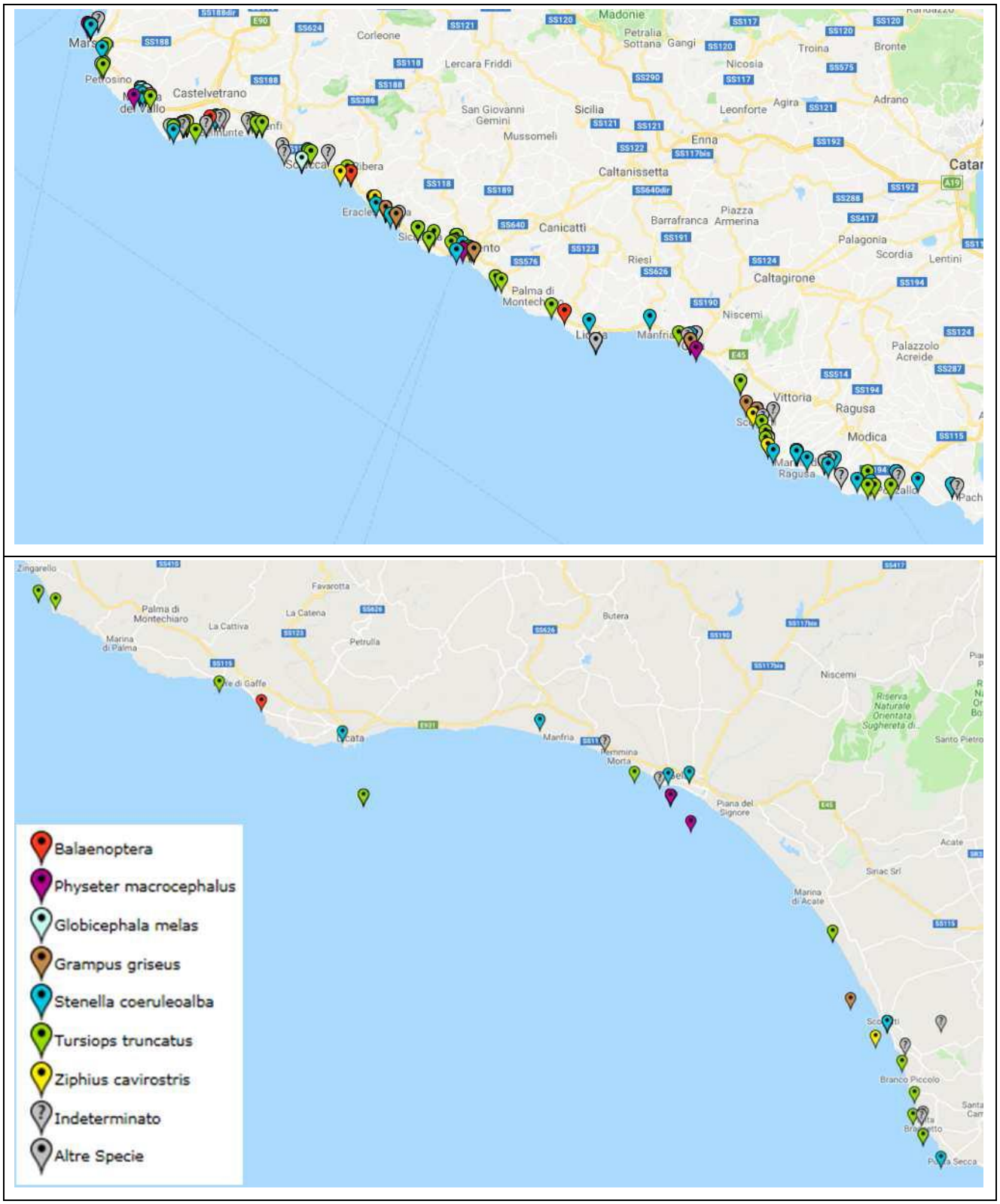


Figure 4.17 – Strandings map – Strait of Sicily (http://mammiferimarini.unipv.it/)

4.4.0 Malta Framework

Malta published two reports in 2007 and in 2013, regarding the implementation measures and the habitat conservation status in compliance with Article 17 of the Habitats Directive. An acceptable/improving status may pertain to more accurate data and improved data interpretation. The percentage of species with an unfavourable conservation status remained the same between 2007 and 2013. Half of these species were upgraded from an 'unfavourable - bad' to an 'unfavourable – inadequate' status, and thus the overall status is improving. The assessment reported in Table 4.1 shows an overall improvement across all habitat groups between the 2007 and 2013. While *Posidonia oceanica* beds and Mediterranean Salt steppes maintained a favourable status, grasslands and rocky habitats improved to a favourable status. However, the conservation status for forests/woodlands and sand dunes need to be improved.

Table 4.1 - Habitat types assessments in Malta (2007 and 2013 data)

Habitat Group	Code	Habitat Name	Year 2007	Year 2013
Coastal habitats	1210	Annual vegetation of drift lines	Inadequate – bad	Unfavourable – Inadequate
	1150	Coastal lagoons	Unfavourable – Inadequate	Unfavourable – Inadequate
	1420	Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*)	Unfavourable – Inadequate	Favourable
	1410	Mediterranean salt meadows (*Juncetalia maritimi*)	Inadequate – bad	Unfavourable – Inadequate
	1510	Mediterranean salt steppes (*Limonietalia*)	Favourable	Favourable
	1120	*Posidonia* beds (*Posidonion oceanicae*)	Favourable	Favourable
	1170	Reefs	Unknown	Favourable
	1310	*Salicornia* and other annuals colonizing mud and sand	Inadequate – bad	Unfavourable – Inadequate
	1110	Sandbanks which are slightly covered by sea water all the time	Unknown	Favourable
	1240	Vegetated sea cliffs of the Mediterranean coasts with endemic *Limonium* spp.	Unfavourable – Inadequate	Favourable
Dunes habitats	2210	*Crucianellion maritimae* fixed beach dunes	Inadequate – bad	Unfavourable – Inadequate
	2220	Dunes with *Euphorbia terracina*	Inadequate – bad	Inadequate – bad
	2110	Embryonic shifting dunes	Inadequate – bad	Unfavourable – Inadequate
Freshwater habitats	3140	Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.	Unknown	Unfavourable – Inadequate
	3170	Mediterranean temporary ponds	Unfavourable – Inadequate	Unfavourable – Inadequate
Schlerophyllus scrubs	5230	Arborescent matorral with *Laurus nobilis*	Unfavourable – Inadequate	Unfavourable – Inadequate
	5430	Endemic phryganas of the *Euphorbio-Verbascion*	Unknown	Favourable
	5420	*Sarcopoterium spinosum* phryganas	Unfavourable – Inadequate	Unfavourable – Inadequate
	5330	Thermo-Mediterranean and pre-desert scrub	Unknown	Favourable
	5410	West Mediterranean clifftop phryganas (*Astragalo-Plantaginetum*)	Unfavourable – Inadequate	Unfavourable – Inadequate
Grasslands	6220	Pseudo-steppe with grasses and annuals of the *Thero-Brachypodietea*	Unfavourable – Inadequate	Favourable
Rocky habitats	8210	Calcareous rocky slopes with chasmophytic vegetation	Unfavourable – Inadequate	Favourable
	8310	Caves not open to the public	Unknown	Favourable
	8330	Submerged or partially submerged sea caves	Unknown	Favourable
Forests	9540	Mediterranean pine forests with endemic Mesogean pines	Unfavourable – Inadequate	Unfavourable – Inadequate
	9320	*Olea* and *Ceratonia* forests	Unknown	Favourable
	9340	*Quercus ilex* and *Quercus rotundifolia* forests	Inadequate – bad	Unfavourable – Inadequate
	92A0	*Salix alba* and *Populus alba* galleries	Inadequate – bad	Inadequate – bad
	92D0	Southern riparian galleries and thickets (*Nerio-Tamaricetea*)	Unfavourable – Inadequate	Unfavourable – Inadequate
	9570	*Tetraclinis articulata* forests	Unfavourable – Inadequate	Unfavourable – Inadequate

Favourable
Unfavourable – Inadequate
Unknown
Inadequate – bad

Table 4.2 - Species assessment in Malta (2007 and in 2013 data)

Species Group	Code	Species Name	Year 2007	Year 2013
Non-vascular plants	1376	*Lithothamnium coralloides* (mäerl)	Unknown	Favourable
	1395	*Petalophyllum ralfsii* (petalwort)	Favourable	Favourable
	1377	*Phymatholithon calcareum* (mäerl)	Unknown	Favourable
	1391	*Riella helicophylla* (liverwort)	Inadequate – bad	Inadequate – bad
Vascular plants	4102	*Anacamptis urvilleana* – Maltese Pyramidal Orchid	Unfavourable – Inadequate	Unfavourable – Inadequate
	1424	*Asplenium hemionitis* (Mule's Fern)	Inadequate – bad	Unfavourable – Inadequate
	4079	*Cremnophyton lanfrancoi* – Maltese Cliff-orache	Unfavourable – Inadequate	Unfavourable – Inadequate
	4082	*Crepis pusilla* – Maltese Dwarf Hawksbeard	Inadequate – bad	Inadequate – bad
	4092	*Elatine gussonei* – Maltese Waterwort	Unfavourable – Inadequate	Favourable
	4083	*Helichrysum melitense* – Maltese Everlasting	Unfavourable – Inadequate	Unfavourable – Inadequate
	4084	*Hyoseris frutescens* – Maltese Hyoseris	Unfavourable – Inadequate	Favourable
	4114	*Linaria pseudolaxiflora* – Maltese Toadflax	Inadequate – bad	Unfavourable – Inadequate
	4105	*Ophrys melitensis* – Maltese Spider Orchid	Unfavourable – Inadequate	Unfavourable – Inadequate
	4106	*Orobanche densiflora* – Sand Broomrape	Unfavourable – Inadequate	Favourable
	4085	*Palaeocyanus crassifolius* – Maltese Rock-centaury	Unfavourable – Inadequate	Unfavourable – Inadequate
Molluscs	2578	*Gibbula nivosa* - Maltese Topshell	Unknown	Unfavourable – Inadequate
	4061	*Lampedusa imitatrix* – Maltese Door-snail	Unfavourable – Inadequate	Unfavourable – Inadequate
	4061	*Lampedusa melitensis* – Maltese Door-snail	Inadequate – bad	Inadequate – bad
	1027	*Lithophaga lithophaga* – Date Mussel	Unknown	Favourable
	1028	*Pinna nobilis* - Noble Pen Shell	Unknown	Unfavourable – Inadequate
Arthropods	4010	*Armadillidium ghardalamensis* – Ghar Dalam Cave Woodlouse	Unfavourable – Inadequate	Favourable
	4047	*Brachytrupes megacephalus* - Sand Cricket	Inadequate – bad	Unfavourable – Inadequate
	4051	*Myrmecophilus baronii* - Baroni's Ants Nest Cricket	Unknown	Inadequate – bad
	4025	*Pseudoseriscius cameroni* (Tenebrionid Beetle)	Inadequate – bad	Unfavourable – Inadequate
	1090	*Scyllarides latus* - Mediterranean Slipper Lobster	Unknown	Unfavourable – Inadequate
Fish	1152	*Aphanius fasciatus* – Mediterranean Killifish	Unfavourable – Inadequate	Unfavourable – Inadequate
Amphibians	1189	*Discoglossus pictus* - Painted Frog	Unfavourable – Inadequate	Unfavourable – Inadequate
Reptiles	1224	*Caretta caretta* – Loggerhead Turtle	Unknown	Favourable
	1274	*Chalcides ocellatus* - Ocellated Skink	Favourable	Favourable
	1284	*Coluber viridiflavus* - Western Whip Snake	Favourable	Favourable
	1293	*Elaphe situla* - Leopard Snake	Favourable	Favourable
	1237	*Podarcis filfolensis* – Maltese Wall Lizard	Favourable	Favourable
	1289	*Telescopus fallax* - Cat Snake	Favourable	Favourable
Mammals	2621	*Balaenoptera physalus* - Fin Whale	Unknown	Unknown
	4001	*Crocidura sicula* - Sicilian Shrew	Unknown	Favourable
	1350	*Delphinus delphis* - Short-beaked Common Dolphin	Unknown	Unknown
	5978	*Erinaceus algirus* - Algerian Hedgehog	Favourable	Favourable
	5365	*Hypsugo savii* - Savi's Pipistrelle		Unknown
	5005	*Myotis punicus* - Maghrebian Mouse-eared Bat	Unfavourable – Inadequate	Unfavourable – Inadequate
	1312	*Nyctalus noctula* - Noctule	Unknown	Favourable
	5031	*Physeter catodon* - Sperm Whale	Unknown	Unknown
	2016	*Pipistrellus kuhlii* - Kuhl's Pipistrelle	Favourable	Favourable
	1309	*Pipistrellus pipistrellus* - Common Pipistrelle		Favourable
	5009	*Pipistrellus pygmaeus* - Soprano Pipistrelle	Favourable	Favourable
	1329	*Plecotus austriacus* - Grey Long-eared Bat	Unfavourable – Inadequate	Unfavourable – Inadequate
	1303	*Rhinolophus hipposideros* - Lesser Horseshoe Bat	Unfavourable – Inadequate	Unfavourable – Inadequate
	2034	*Stenella coeruleoalba* - Striped Dolphin	Unknown	Unknown
	1333	*Tadarida teniotis* - European Free-tailed Bat	Unfavourable – Inadequate	Unfavourable – Inadequate
	1349	*Tursiops truncatus* -Bottlenose Dolphin	Unknown	Unknown
	2035	*Ziphius cavirostris* - Cuvier's Beaked Whale	Unknown	Unknown
Other invertebrates	1008	*Centrostephanus longispinus* - Hatpin Urchin	Unknown	Favourable
	1001	*Corallium rubrum* - Red Coral	Unknown	Unknown

Favourable
Unfavourable – Inadequate
Unknown
Inadequate – bad

Research and outreach activities are necessary for effective conservation. Surveying and monitoring are an important aspect of research to gain insight on the status and trending changes of biodiversity. In this regard, the effective conservation measures may be addressed and established. For instance, the MedPAN (Mediterranean Marine Protected Areas Network) North regional project taken as a continuation of the MedPAN project, in which MEPA (2004-2007) participated in the formation of a network of managers of marine protected areas in the Mediterranean.

A financial interpretation manual for marine habitats (within the fisheries management zone) was established along with two underwater trails and communication/awareness measures. In line with the provisions of the NBSAP, Malta embarked on various EU funded biodiversity-related projects, mainly under the LIFE+ programme (LIFE+ Malta Seabird Project, LIFE+ Migrate, LIFE+ BaĦAR for Natura 2000 and LIFE+ Arċipelagu Garnija).

The status of the fish stocks may often give an insight into the status of the marine environment. In Malta, data on fish stocks is normally collected by the Department of Fisheries and Aquaculture. Stocks of hake, common pandora, red mullet, black-bellied angler, striped red mullet and giant red shrimp, around Malta and between Malta and Sicily, were fished unsustainably in different years over the period 2010-2012. The contribution of Maltese landings to the exploitation of these commercial stocks is, still, relatively low and the level of pressure exerted by Maltese fishers on such shared stocks is unlikely to be significant (Table 4.3).

Table 4.3 - Fish landings in tonnes, in Malta over the period 2013-2014 (ERA, 2018)

Fish Type	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Diadromous fish	0	0	0	0	0	0	0	43	51	0	0	6
Marine fish	1094	1107	1366	1286	1143	1167	1478	1637	1702	2022[a]	2218	2254
Molluscs	7	5	10	12	48	56	51	105	93	93	46	86
Crustaceans	37	26	30	32	44	56	66	51	74	95	91	57
Total	**1138**	**1138**	**1406**	**1330**	**1235**	**1279**	**1595**	**1836**	**1920**	**2210**	**2355**	**2402**

[a]Note: This data is not referenced

Source: National Statistics Office, Malta

Though relatively small in terms of water bodies, inland surface and transitional waters, Malta plays a key role in terrestrial and coastal biodiversity. The water quality monitoring started relatively recently as part of Malta's first Water Catchment Management Plan. However, uncertainties still remain with respect to the ecological status of the waters, mainly as a result of their complex dynamics and unique characteristics. The present baseline monitoring carried out over the period from December 2011 to February 2012 has shown that a very limited number of contaminants have been found and many of them are not in excess with respect to the Environmental Quality Standards (EQS). It confirms however that both diffuse and point sources of pollution may be releasing contaminants in such water bodies.

4.4.1 Coastal and Marine waters

As the smallest island state in Europe, with the highest population density, the economic and social development of Malta is intrinsically linked and determined by its water and marine environmental resources including fisheries. Below a list of the main aspects regarding the ecological status of Maltese waters:

- In terms of "natural coastal water bodies": they constitute 7 out of the 9 coastal water bodies designated under the EU Water Framework Directive, and they are considered to be in high/good ecological status, with only one natural coastal water body assigned a moderate ecological status. The heavily modified coastal water bodies - the two harbour areas in Malta - are assessed in terms of their ecological potential rather than ecological status. The Grand Harbour and Marsamxett harbour are considered to be of moderate potential, while Marsaxlokk harbour is of good ecological potential.
- In terms of water quality, coastal waters show generally low levels of nutrients, with inlets and bays being more vulnerable to eutrophic conditions.
- In terms of contamination, the majority of the monitored contaminants are not considered to be of concern to Malta's coastal waters, with the exception of mercury, which was at least the third most common contaminant detected in the water column from all the sampling stations. Natural background levels of mercury in the Mediterranean and anthropogenic sources which could be contributing to the reported levels of mercury still need to be understood. This data gap is currently being addressed. When excluding mercury, all coastal water bodies would qualify for good chemical status.
- In terms of bathing water quality, 93% of all samples reached excellent quality criteria as stipulated by the Bathing Water Quality Directive. However, a more detailed trend analysis based on the concentrations of E. coli, indicates an overall improvement in most bathing areas. Nevertheless, Gozo and Comino sites show some loss in overall bathing quality.
- Marine litter in the local coastal waters is of concern, though present data suggest that their levels are comparable to those in other neighbouring countries. Floating marine litter densities were higher within harbours and bays than in offshore waters. Offshore waters exhibited a highly heterogeneous distribution of floating litter, with patches of relatively high concentrations being observed at distances from the shoreline varying from 200m to 800m.
- Microplastics were recorded from five popular beaches. At our knowledge (of their presence and profile) their occurrence is increasing (ERA, 2018).
- STECF and ICCAT regional stock assessments for demersal and pelagic commercial species consider most demersal species to be fished unsustainably, although the level of pressure exerted by Maltese fishers on shared stock is unlikely to be significant. The status of tuna is showing improvements, mainly attributed to compliance with catch limits. The status of the swordfish is uncertain.

According to the Water Catchment Management Plan for the Maltese Islands (NCSD, 2006) the coastal waters around the Maltese Islands can be divided in nine water bodies on the basis of their depth, as shown in Figure 4.18. The boundaries for the water bodies take into consideration the predominant physical and ecological characteristics, as well as the nature and magnitude of pressures on the coastal water environment. The nine water bodies include seven natural coastal water bodies and two heavily modified water bodies which have undergone significant physical changes. The greatly modified water bodies are located in the harbours of Marsamxett, Grand Harbour (MTC 105) and Marsaxlokk (MTC 107).

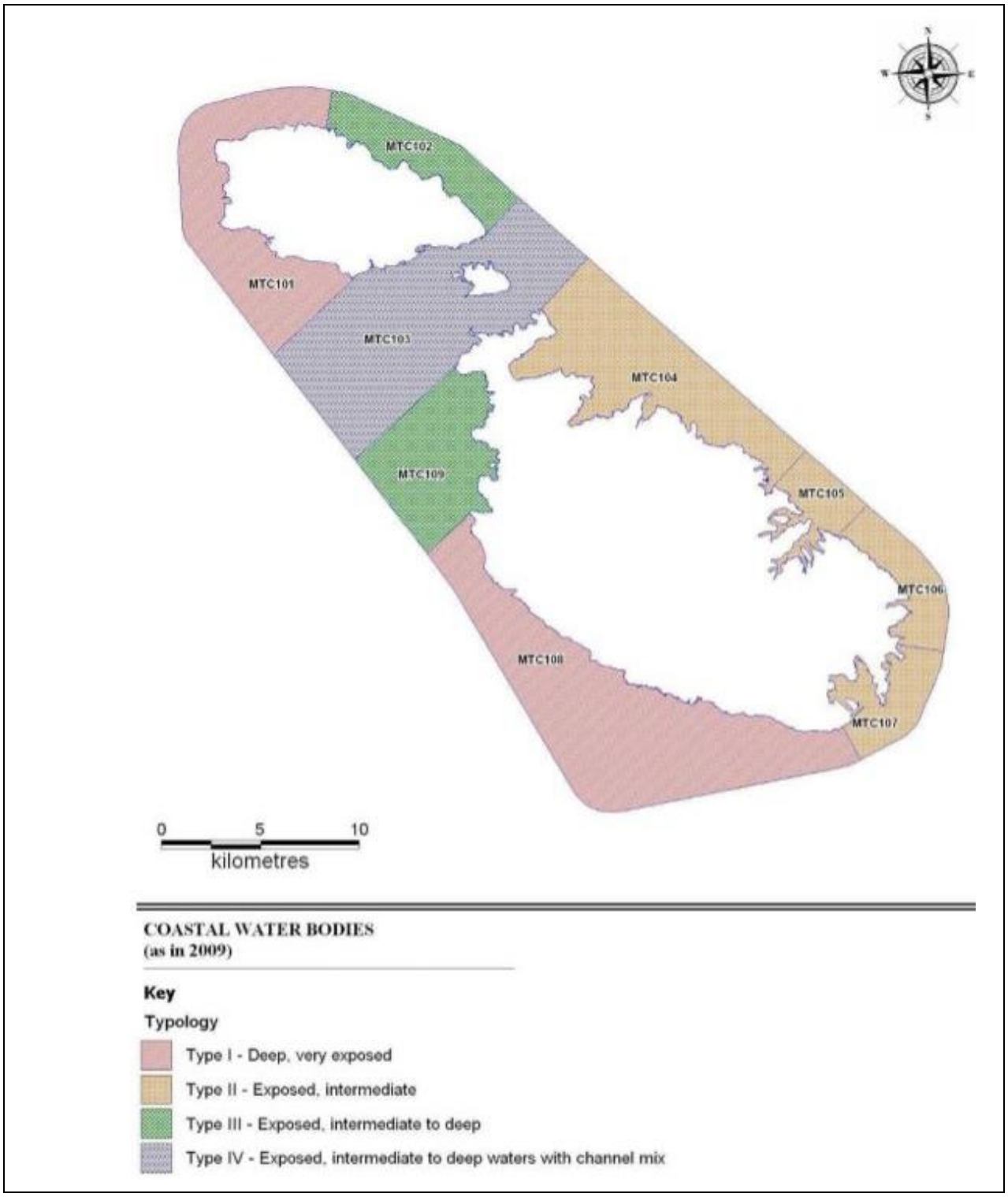


Figure 4.18 - The nine coastal water bodies designated in Malta, First WCMP (ERA, 2018)

4.4.1.1 Ecological status

The ecological status of the surface water bodies in terms of the WFD (EU Water Framework Directive) (2000/60/EC) is defined through Biological Quality Elements or BQEs. The ecological status of coastal waters of Malta is based on the occurrence of the following biological elements, through the application of biological indices:

- *Posidonia oceanica* meadows assessed through the application of the PREI (*Posidonia oceanica* Rapid Easy Index) index (Gobert *et al.,* 2009)
- Macroalgae assessed through the application of CARLIT (EC, 2014);
- The taxonomic composition, abundance and biomass of phytoplankton.
- Benthic invertebrates assessed through the application of the A Marine Biotic Index (AMBI) method (ERA, 2017);
- General chemical, physicochemical and hydro-morphological quality of the water body also need to be monitored to assess that such conditions support the biological quality elements at good status.

The ecological status of natural coastal water bodies as assessed on the basis of the 2012-2013 data is summarised hereunder and in Table 4.4 and below:

- *Posidonia oceanica* qualifies as 'High/Good' status in all water bodies;
- Macroalgae qualify as 'High/Good' status in the majority of WFD water bodies, with a 'Moderate' status in water body MTC105 incorporating the main harbour area;
- Benthic invertebrates qualify 'High/Good' status for all water bodies on the basis of an interim assessment of status (pending the definition of reference sites and intercalibrated status boundaries);
- Phytoplankton qualifies as 'High/Good' status for all water bodies with the exception of MTC 106.

The majority of the natural water bodies are considered to be in high/good ecological status. The moderate ecological status is assigned only to MTC 106 which, prior to the operation of the Urban Waste Water Treatment Plant in the south of Malta, was subject to discharge of raw sewage. The assessment of ecological status in harbour areas is undertaken separately, since these water bodies are designated as Heavily Modified Water Bodies (HMWB).

Due to their modified status, these water bodies are expected to achieve 'Good Ecological Potential' rather than Good Ecological Status. Good Ecological Potential for Malta's harbours refers to the values of the BQEs after all practical mitigation measures are successfully implemented. On the basis of the assessment of BQEs within these areas, the Grand Harbour and Marsamxett (MTC 105) is considered to be of moderate potential, while Marsaxlokk harbour (MTC 107) is of good ecological potential.

Table 4.4 - Ecological Status of Coastal Waters

			Biological Quality Elements			
WFD Water Body	Location (Figure 5.1 refers)	Overall Status	*Posidonia oceanica*	Macroalgae	Benthic Invertebrates	Phytoplankton
MTC 101	Il-Punent ta' Għawdex (*from Ta' Ċenċ up to Żebbuġ*)	High	High	High	High	High
MTC 102	Ir-Ramla l-Ħamra (*from Marsalforn to Qala*)	High	High	High	High	High
MTC 103	Il-Fliegu ta' Kemmuna (*Qala, Mġarr, Għajnsielem, Comino, Marfa, and Armier*)	High	High	High	High	High
MTC 104 [a]	Il-Mellieħa to Tas-Sliema	Good	Good	High	High	High
MTC 104 [b]	Il-Mellieħa to Tas-Sliema	Good	High	Good	Good	Good
MTC 106 [a]	Ix-Xgħajra to Wied il-Għajn	Moderate	Good	Good	High	Moderate
MTC 106 [b]	Ix-Xgħajra to Wied il-Għajn	Moderate	Good	Good	High	n/a
MTC 108	L-Irdumijiet ta' Malta (*from Ħal Far coastal stretch up to Baħrija*)	Good	Not Available [c]	High	High	Good
MTC 109	Il-Qammieħ – Fomm ir-Riħ	High	High	High	High	High

a/b = Two monitoring stations were used for these water bodies

c = The relevant BQE was not found at monitoring stations, and therefore not used in assessment of ecological status

Malta has not yet identified background levels or thresholds against which levels of nutrients can be compared to define the environmental status in the marine environment. Despite the lack of long-term data, the monitoring results are indicative of generally low nutrient concentrations (specifically nitrates, total nitrogen and total phosphorous). However, the harbour areas, in particular the Grand Harbour area, are vulnerable to nutrient enrichment.

Eutrophication was assessed using the trophic index method (TRIX) for Mediterranean coastal waters. The recorded TRIX index values indicate that the coastal waters are subject to moderate/high eutrophic conditions. The outcome of the TRIX index however does not reflect nutrient level, which is generally indicative of coastal waters which are oligotrophic in nature.

A good status for chlorophyll-a can be assigned to nearly all WFD water bodies with the exception of a moderate status for the water body border coastline, which, prior to the operation of the Urban Waste Water Treatment Plant in the south of Malta, was subject to discharge of raw sewage.

Mercury was the most common contaminant detected in the sea water column from all sampling stations, with concentrations exceeding the annual average EQS. However, the ubiquitous occurrence of mercury may not be attributed to releases from local land-based sources since this element has not been recorded onland and in the transitional waters. Naturally occurring background levels of mercury in the Mediterranean Sea are yet to be fully understood. Other chemicals which exceeded EQSs include lead, nickel and polyaromatic hydrocarbons (PAHs). Mercury, lead and PAHs are also of concern in the sediment matrix. If the levels of mercury are taken into consideration, all coastal water bodies would fail good chemical status. However, when excluding mercury, only 3 coastal water bodies out of 9 are failing good status.

Floating marine litter densities were higher within harbours and bays than in the offshore waters, which exhibited a highly heterogenous distribution of floating litter, with patches of relatively high

concentrations being observed at distances varying from 200m to 800m from the shoreline. The microplastics recorded from five popular beaches show higher levels in the dry season.

4.4.1.2 Presence of contaminants in local coastal environment

Contaminants in the marine environment may occur not just in the water column, but also in bottom sediments and biota. Substances as listed in Directive 2008/105/EC and other pollutants of national concern were monitored in the period 2012-2013/113 in all three environmental matrices (water, sediment and biota). The selection of matrices in which contaminants are monitored depends on the nature of the contaminants and their tendencies to accumulate in the relevant matrices.

The majority of the contaminants analysed in the water column were below detection limits and are thus not considered to be of concern to Malta's waters. In fact Malta's coastal waters are considered to be in good chemical status with respect to most pollutants, with the exception of mercury. Mercury was the most common contaminant detected in the water column from all sampling stations, with concentrations exceeding the annual average Environmental Quality Standard (EQS) as set in Directive 2008/105/EC of 0.05µg/L. 114. Naturally occurring background levels of mercury in the Mediterranean and anthropogenic sources which could be contributing to increments in mercury in Malta's waters still need to be understood. In order to address this data gap, Malta's Second Water Catchment Management Plan is seeking the establishment of a 'Mercury Management Plan' to investigate the potential sources of mercury and mitigation measures. The first step of the measure would be to carry out a thorough investigation of all potential sources of mercury pollution including potential land-based sources, sea-based sources and potential atmospheric sources to the coastal and marine environment. The second stage would led to the identification of potential measures to mitigate mercury contamination coming from sources that can be controlled from land.

Other heavy metals, specifically lead and nickel, exceeded the established EQSs for the water column on one-off occasions or within specific sampling locations. Polyaromatic hydrocarbons (PAHs) were the only organic contaminants reported in one-off monitoring stations, however these occurrences are considered to be anomalies and not of significance. The low incidence of such exceedances does not negatively affect the overall good chemical status of coastal waters. On the other hand, it is important to note that occurrences of PAHs coincide with areas in proximity to urban catchments, harbour activities and waste water treatment plants (ERA, 2018).

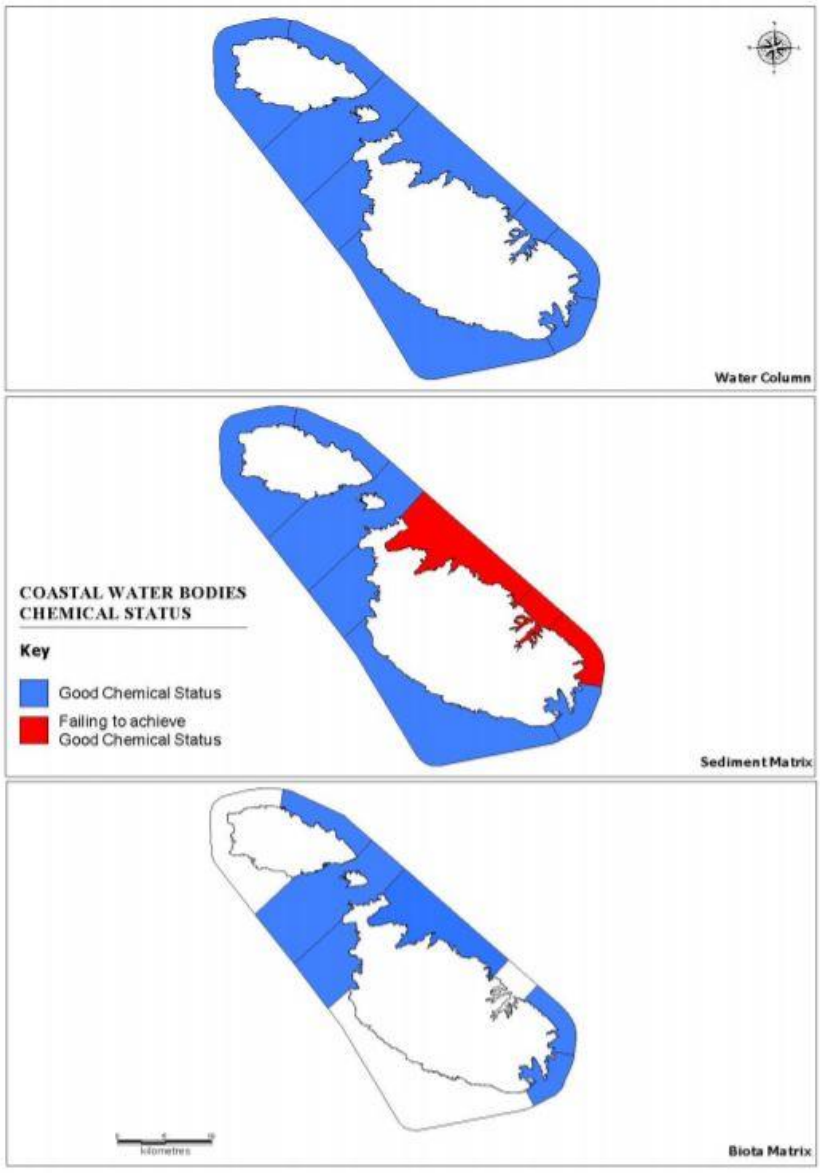
With respect to contaminants in the sediment matrix, mercury, lead and PAHs are of concern. Malta has not yet established Environmental Quality Standards (EQS) against which levels of contaminants in sediments can be compared to define status. However mercury and lead levels exceeded EQS's established in Italy with relatively high concentrations at three monitoring points. Polyaromatic hydrocarbons were also found at high concentrations within sediments of harbour areas.

Three contaminants - hexachlorobenzene, hexachlorobutadiene and mercury - were monitored in marine seagrass of *Posidonia oceanica*. This seagrass was selected as an indicator for contaminant levels in biota due to its perennial nature and wide distribution in Maltese coastal waters. Hexachlorobenzene and hexachlorobutadiene were either absent or lower than detection concentrations.

The measured concentrations of mercury were compared with two different types of reference values: the mean values collected along the Mediterranean coast and the measurements from marine zones that are generally considered to be relatively pristine areas. The levels of mercury in *Posidonia oceanica* in Malta are comparable with those from the reference sites and lower with respect to both mild and heavily impacted sites.

Therefore mercury levels in biota are of lower concern than in the other environmental matrices. On the basis of this data, the coastal water bodies around Malta were classified in terms of chemical status in line with WFD methodologies. The WFD applies the 'one-out-all-out' principle for the definition of status. Therefore water bodies in which one pollutant exceeds the EQS established in the water column would fail good chemical status. In Malta, mercury was the only pollutant that caused failure in chemical status classification for all the analysed waters.

Figure 4.19 indicates status of coastal water bodies on the basis of the measured levels of contaminants in water, sediment and biota.



Based on the measured levels of contaminants in various environmental matrices (excluding mercury)

Figure 4.19 - Chemical status of coastal water bodies

4.4.2 Biodiversity studies

4.4.2.1 Posidonia oceanica

Borg et al. (2019) described different bed types of *Posidonia oceanica* seagrass around the Maltese Islands. Several faunal species associated with seagrass beds constitute important commercially-fished species (Jackson *et al.,* 2001). In the Maltese Islands, the dominant habitat types in shallow coastal waters (up to 43 m w.d.) are represented by *Posidonia oceanica* beds, bare sand and infralittoral algae on hard substrata (Borg & Schembri, 1995; Borg *et al.,* 1997). The spatial distribution of *Posidonia oceanica* beds in some local coastal areas has been described (e.g. Borg & Schembri, 1995; Borg *et al.,* 1997; Borg & Schembri, 2003). In addition, a more detailed map showing the distribution of the seagrass around the Maltese islands is available from a side-scan sonar survey commissioned by the Malta Environment and Planning Authority in 2002 (GAS/MEPA, 2003; MIFSUD *et al.,* 2006). Four locations were selected for that study: Ramla Bay; Mellieha Bay; White Rocks; and St Thomas Bay. Since Mellieha Bay and St Thomas Bay comprised relatively large inlets compared to the other two study locations, only the north-western half of each bay was selected for the analysis. This ensured that the study areas had a broadly similar spatial extent (Borg et al., 2005).

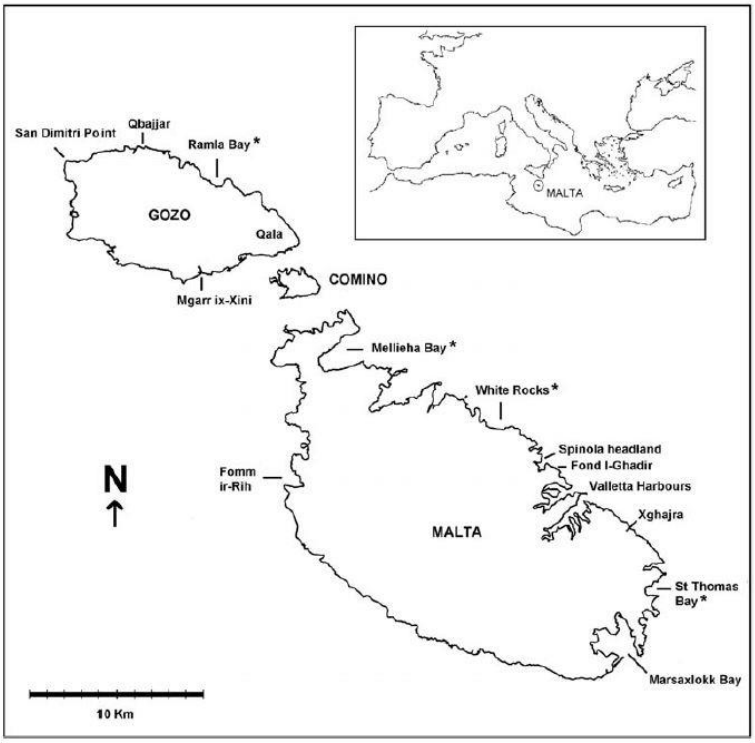


Figure 4.20 - Map showing the location of the Maltese Islands at the center of the Mediterranean (inset), the four study locations, and other localities mentioned in the text.

At each of the four locations, the general pattern of *Posidonia oceanica* distribution was as follows: in shallow waters (2 – 4 m), *Posidonia oceanica* occurred as small patches of varying size (< 1 m to several metres across) on a rocky substratum. In deeper waters (5 – 10 m), the patchy stands were often replaced by reticulate beds consisting of *Posidonia oceanica* growing on a soft sediment bottom and interspersed with bare sand. Further offshore and at deeper depths (11 – 13 m), there was a transition from reticulate to continuous beds, with both reticulate and continuous beds

occurring on a thick 'matte'. Continuous beds extended to water depths of between 25 m and 30 m, and eventually forming reticulate or patchy beds in deeper waters. Therefore, towards to offshore the *Posidonia oceanica* distribution become denser down to 25/30m w.d., being from patchy to reticulate to continuous. However, at depths deeper than 25/30m, the distribution changed again from reticulate to patchy.

Overall, the state of health of *Posidonia oceanica* at each of the four surveyed locations was good (Borg *et al.,* 2005). However, the seagrass at White Rocks and St Thomas Bay supported a higher epiphyte load than at Ramla Bay and Mellieha Bay (Table 4.5 and Figure 4.21).

Table 4.5 – Seagrass and fragmented/ continuous Posidonia oceanica beds

Locality	Total area surveyed (m^2)	Total seagrass cover (%)	Fragmented bed cover (F) (%)	Continuous bed cover (C) (%)	Cover ratio F/C
Ramla Bay	437,745	21.91	46.82	53.18	0.88
Mellieha Bay	391,966	78.30	40.70	59.29	0.69
White Rocks	393,987	92.70	35.99	64.01	0.56
St Thomas Bay	394,692	97.84	22.61	77.39	0.29

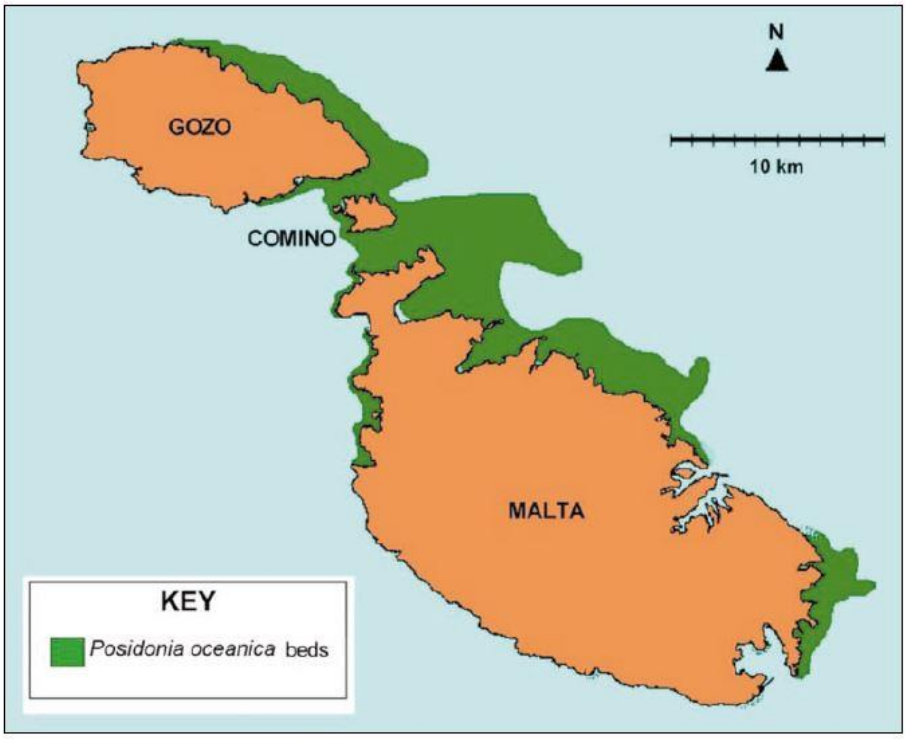


Figure 4.21 - Large-scale distribution of *Posidonia oceanica* around the Maltese Islands

4.4.2.2 Biocostructions / coralligenous / maerl

Bioconstructions such as coralligenous outcrops and maerl beds are typical Mediterranean underwater seascapes, comprising coralline algal frameworks that grow in dim light conditions (Ballesteros, 2006). They are the result of the building activities of algal and animal constructors, counterbalanced by physical, as well as biological, eroding processes. Maerl sediments are characterized by accumulations of calcareous rhodophytes (mostly Corallinaceae but also Peyssonneliaceae), that form habitats with a high species diversity over broad geographical and depth ranges (Barberá *et al.,* 2003; Foster 2001; Freiwald and Henrich 1994). Maerl beds cover large areas off the Maltese Islands at depths of ca. 40–100 m (Borg *et al.,* 1998; Dimech *et al.,* 2004). Two extensive maerl beds are known to date; one located in 1993 off the rocky shoal of 'is-Sikka l-Bajda' off the northeastern coast of Malta and extending northeastward off Gozo (Borg *et al.,* 1998), and the other located in 2004 off the southeastern coast of Malta at a maximum water depth of 85 m (Dimech *et al.,* 2004).

Because of their extent, biodiversity and production, coralligenous and maerl habitats rank among the most important ecosystems in the Mediterranean Sea (Ballesteros, 2006; Piazzi et al., 2012). Although not legally binding, the Barcelona Convention's 'Action plan adopted in 2008 for the conservation of coralligenous outcrops and other calcareous bio-concretions in the Mediterranean Sea' asserts that ''coralligenous/maerl assemblages should be granted legal protection at the same level as Posidonia oceanica meadows'' (UNEP-MAP-RAC/SPA, 2008). Coralligenous outcrops also appear in the EU's Habitats Directive (see I - under 1170 Reefs), and in the Bern Convention (Council of Europe, 1996). Two of the most common maerl-forming Mediterranean species, Lithothamnion corallioides and Phymatolithon calcareum, are included in Annex V of the Habitats Directive.

Scientific information on these two habitats remained unevenly distributed, essentially because the majority of systematic studies have taken place in the western Mediterranean. However, the areas for which information was previously unavailable were much better covered by Martin et al., 2014, particularly the eastern Mediterranean Sea.

Knowledge on maerl beds was somewhat limited compared to what was available for coralligenous outcrops; a significant update was nevertheless achieved. Previously unknown spatial information on maerl distribution was brought to light for Greece, France (Corsica), Cyprus, Turkey, Spain and Italy. Malta and Corsica, in particular, had significant datasets for this habitat as highlighted by fine-scale surveys in targeted areas (Martin et al., 2014).

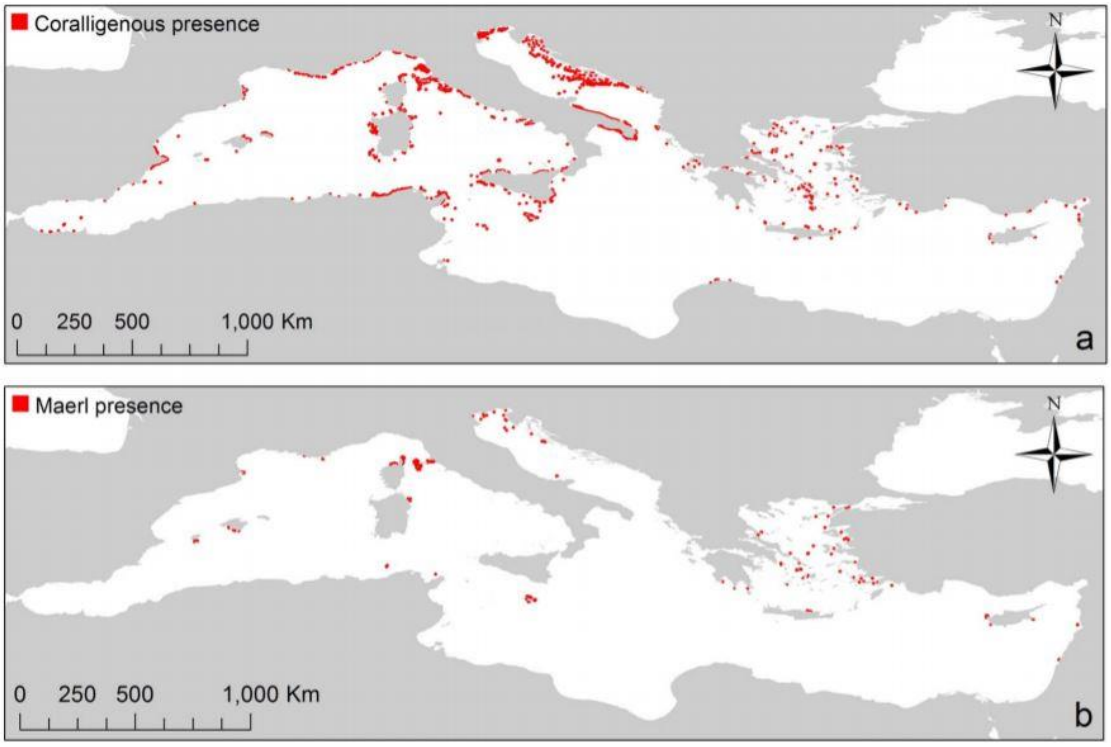


Figure 4.22 - Distribution of (a) coralligenous outcrops and (b) maerl beds across the Mediterranean Sea (Martin et al., 2014).

The MARCOS (Malta StRait of Sicily CORals) cruise conducted in the Strait of Sicily in springtime 2007 sampled, among other things, a number of sponges associated with coral banks off Linosa Island and south of Malta and, subordinately, with maerl beds at shallower depths. Twenty species belonging to Demospongiae and Hexactinellida (one) were detected. Most samples were collected from deep-water coral sites (from about 600 to 800 m), while three samples refer to shallower (88 m) maerl bottoms. These sampling locations were in SE Malta (Calcinai *et al.,* 2013).

4.4.3 Marine Reptiles / Marine Mammals

Marine mammals recorded in Maltese waters include eight species of regularly occurring cetaceans in the Mediterranean region, while marine reptiles are represented by a single species of marine turtles, the loggerhead turtle (*Caretta caretta*). Of the eight species of cetaceans, only three delphinids have been recorded at sufficient frequency to suggest the presence of resident populations. Assessment of status for marine reptiles and mammals pursuant to the MSFD thus focused on the three delphinids and the loggerhead turtle. This Initial assessment for marine reptile and mammal populations in Maltese waters, in accordance to MSFD Article 8 (1), may be accessed through the following links:

- https://eracms.gov.mt/en/Documents/MSFD-InitialAssessment-MarineTurtles.pdf
- https://eracms.gov.mt/en/Documents/MSFD-InitialAssessment-MarineMammals.pdf

4.4.3.1 Marine Reptiles

The loggerhead turtle (*Caretta caretta*), is the only reptile species regarded as a true member of Maltese fauna (Figure 4.23 and Figure 4.24), with resident breeding individuals within the Mediterranean Basin. Based on the data available for this species, its status was determined in terms of distributional range and population abundance. Expert judgement was used when conclusions were limited by data availability. The 2012 sightings indicated an even 2 distribution of the species within Maltese waters implying that the assessment area (25 nautical miles radius around the islands) forms part of the species' distributional range within the Mediterranean region. Hence distribution was considered in line with natural, geographic and climatic conditions and a 'good' status was attributed to *C. caretta* in terms of distributional range. As for population abundance, no significant declines were presumed on the basis of levels of by-catch per unit effort within long-line fishing for the 2008-2010 period. Nevertheless, this conclusion was not deemed robust enough, accentuating data gap issues. As a result of insufficient data for the assessment of population condition, the overall status of *C. caretta* could not be assessed.

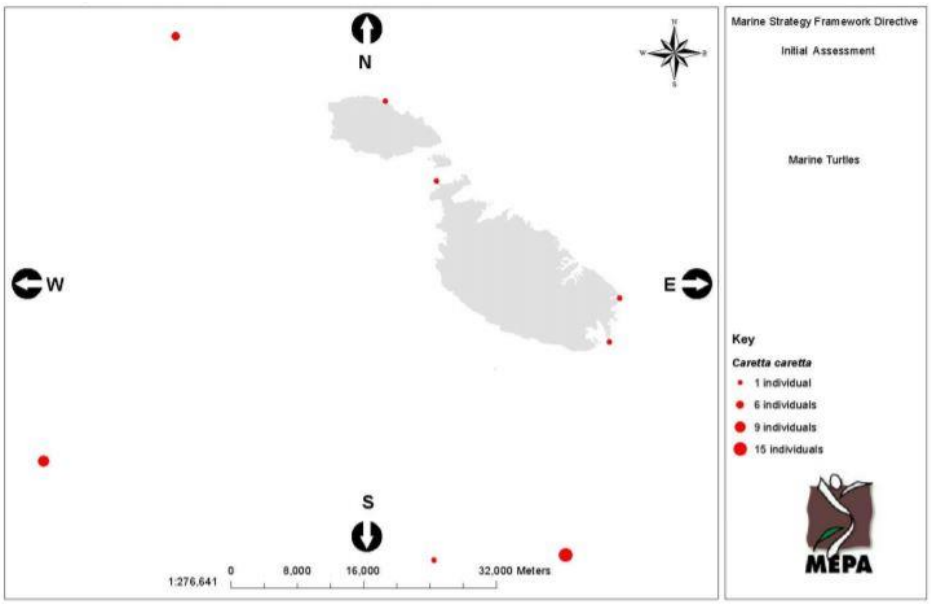


Figure 4.23 - 2013 Sightings of live marine turtles (Malta Environment and Planning Authority)

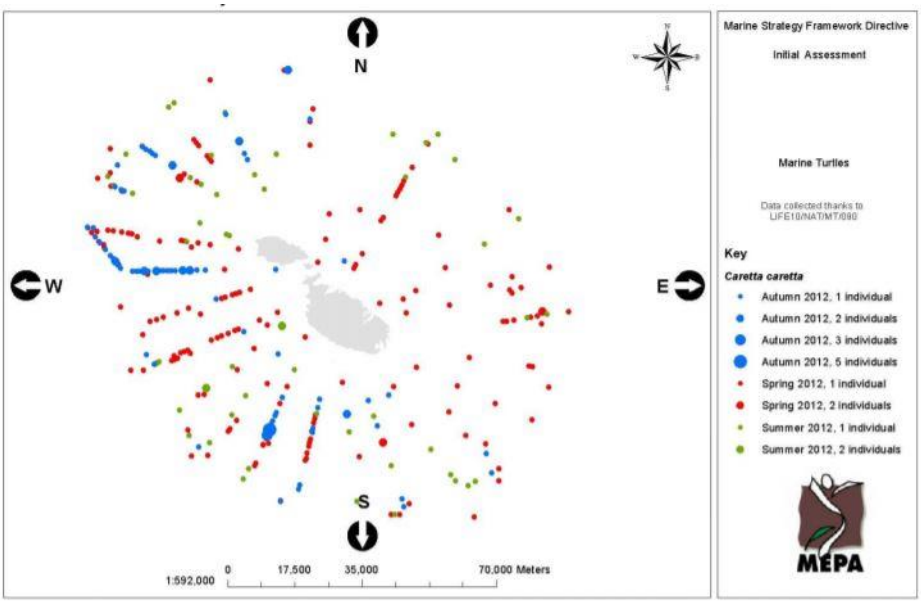


Figure 4.24 - Sightings of loggerhead turtles (as collated by BirdLife Malta for 2012)

4.4.3.2 Marine Mammals

About marine mammals, assessment of status was carried out at the level of the marine mammals functional group. Such assessment was mainly based on species composition taking into consideration all marine mammals recorded in Maltese waters and relative abundance of the more frequent species. Species composition was deemed stable on the basis of data collected over the last century, reporting the presence of all eight marine mammal species within local waters. Assessment on the basis of relative abundance on the other hand, solely considered the toothed cetaceans functional group, this being principally represented by the three delphinid species most frequently reported around Malta (Figure 4.25): *Tursiops truncatus* (common bottlenose dolphin), *Delphinus delphis* (short-beaked common dolphin) and *Stenella coeruleoalba* (striped dolphin). Birdlife sightings data collected in 2012 were indicative of 'relative abundance' whereby *Stenella coeruleoalba* was found to be the most abundant species, followed by *Tursiops truncatus* and *Delphinus delphis*. It is important to note that for longer term data are needed to confirm this ranking, the higher abundance of *S. coeruleoalba* in relation to *T. truncatus* reflected relative abundances in other central Mediterranean areas and was thus deemed to be in line with natural physiographic, geographic and climatic conditions of the Mediterranean region. On the other hand, due to insufficient data, it was not possible to compare the relative abundance of *Delphinus delphis* with its relative abundance in other Mediterranean areas (NN).

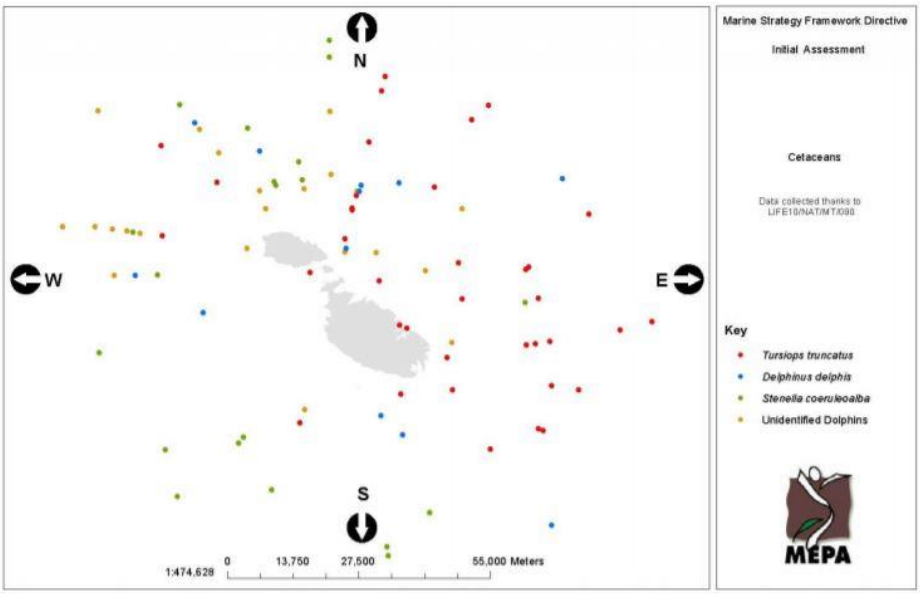


Figure 4.25 - Overall distribution of dolphins within the assessment area (2012 Sightings data collected by BirdLife Malta)

During the 2012 surveys carried out by BirdLife Malta as part of the EU LIFE+ Malta Seabird Project, 6 individuals of *Grampus griseus* were also encountered in groups of 1-3 individuals. *Grampus griseus* is a widely distributed species occurring throughout the Mediterranean Sea with sightings mostly concentrated in the Western basin. In general, Risso's Dolphin prefers deep offshore waters and continental slope areas. While this species is regularly sighted in the western Mediterranean, no population estimates exist for the species in this region, although it is generally considered scarce (Gaspari, S. & Natoli, A. 2012).

Sightings of this species in Malta are not frequent. At this stage, the range and population characteristics of this species in Malta are not known.

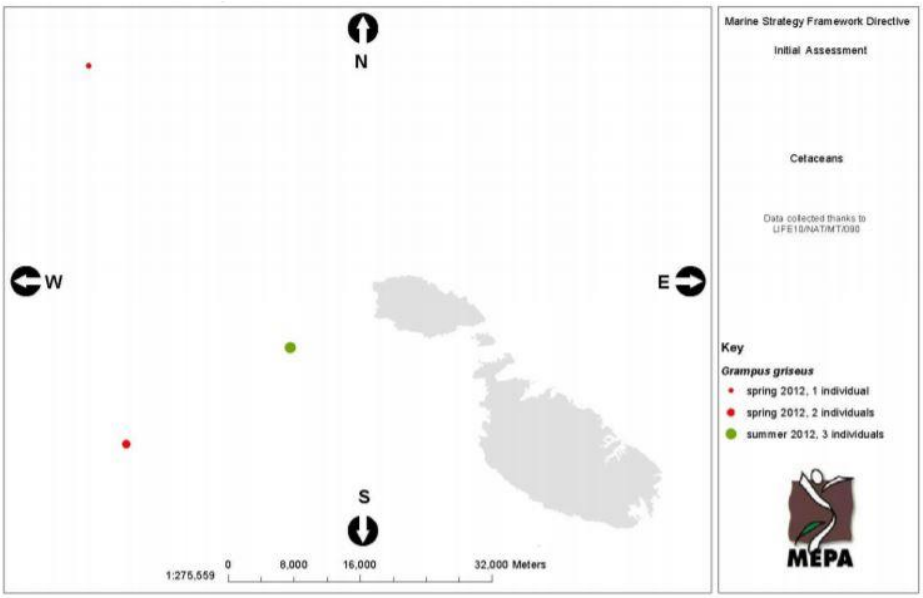


Figure 4.26 - Sightings of Grampus griseus (2012 Sightings data collected by BirdLife Malta)

5.0.0 VISUAL INSPECTION AND BIODIVERSITY MONITORING

The information included in this chapter was gathered from the data and the reports included in the WP1. The geophysical data (MBES, SSS, SBP and MAG) and the ROV images were collected during the Preliminary Marine Route Survey (PMRS), which has been carried out with the aim of obtaining a detailed bathy-morphologic model of the surveyed area.

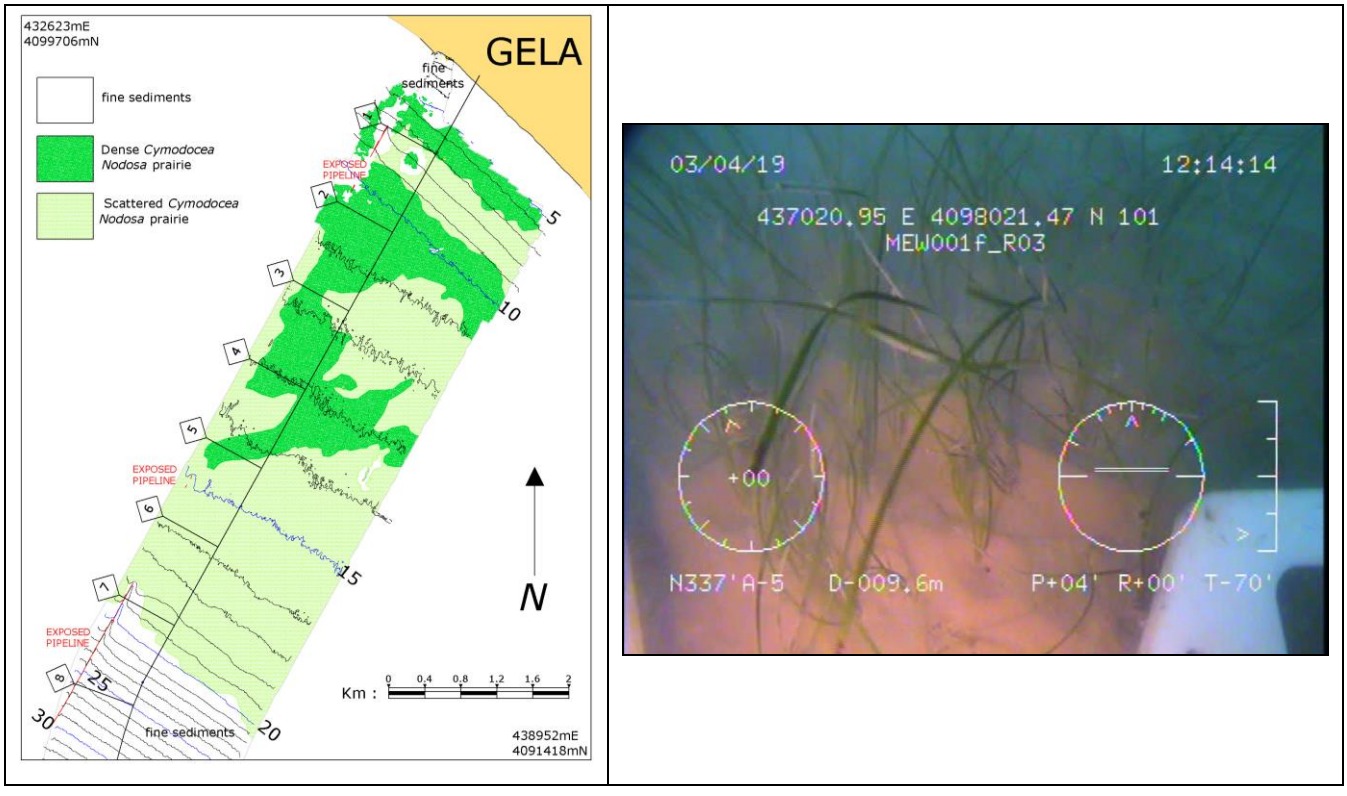
For the purpose of this report the Italian and Maltese coastal areas are defined as follows:

- Italy landfall/coastal area – Gela: from the coastline (KP0) to 30m w.d. (KP8.682), where KP 0.00 is the Gela shoreline.
- Malta landfall/coastal area – Delimara: from the coastline (KP150.302) to 40m w.d. (KP150.836).

5.1.0 Gela (Italy) Landfall

According to IUCN and MATTM data, the *Cymodocea nodosa* is widespread along the Sicilian coastline. From KP0.097 (437665.56E, 4098958.20N,) to KP9.705 (433557.78E, 4090361.11N) (Italy Inshore Area), the seafloor is covered by fine sediments and marine vegetation identified as *Cymodocea Nodosa*. Its distibution within the survey corridor is variable, passing from dense to scattered (Table 5.1). The lower limit of *Cymodocea Nodosa* distribution has been identified at 20m WD. Furthermore, a total of 23 seabed samples have been collected during the Environmental Survey (see latest revision of MEW001b_ENV_FINAL report): they confirmed the presence of *Cymodocea nodosa*; finally a detailed visual inspection has been performed in the locations of seabed samples collected for the benthos anayses revealing the presence of individuals of the green alga *Caulerpa* (possibly *Calulerpa taxifolia*).

Table 5.1 – Comparison between SSS interpretation and ROV inspection



5.2.0 Offshore Sicily-Malta

The ROV inspection for the offshore Sicily corridor showed a seafloor which mainly consists fine sediments, mainly silt and clay, with the presence of spotted outcrops, bioconstructions and maerl beds.

From KP9.705 to KP 40.500 the seabed along the basic design route corridor have been investigated only by means of geophysical data. No ROV transects have been acquired. The seabed deepens South-west in a regular way. The SSS data show a homogeneous acoustic response which has been associated to a fine sediment seabed (with presence of silt and clay in various proportions and a smaller component of sand). Between KP38.500 and KP39.000, 700m east of the propos red route, a first area with the presence of outcrops has been detected.

From KP40.500 (118.5m w.d.) to KP41.600 (122m w.d.), the combined SSS/SBP/MBES data interpretation allow the detection of wide structural relief surrounded by some scattered rocky outcrops extended to the whole eastern portion of the surveyed corridor. The basic design route is at a minimum distance of 39.6m from this relief (Figure 5.1 and Figure 5.2).

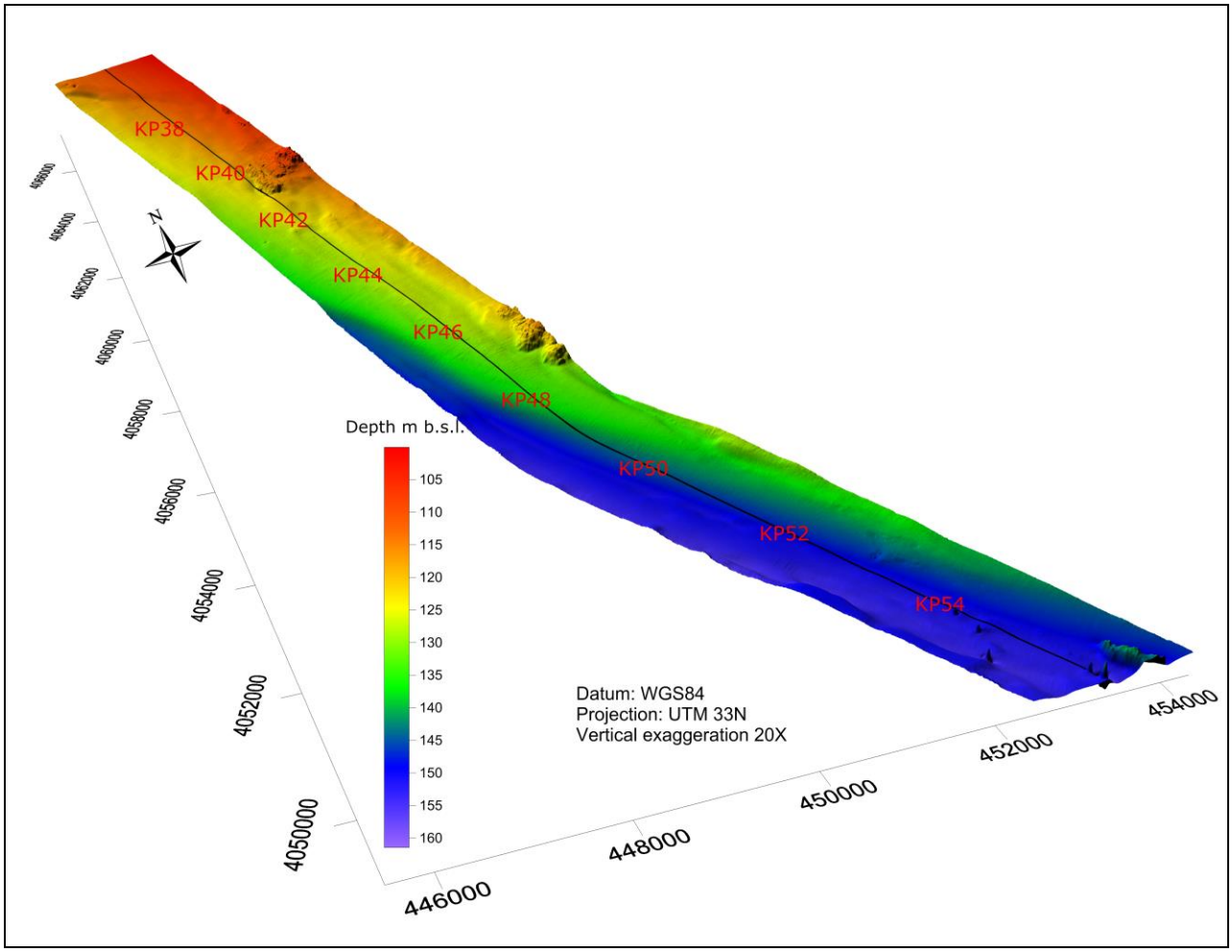


Figure 5.1 - 3D Bathymetry from KP36.129 to KP56.056

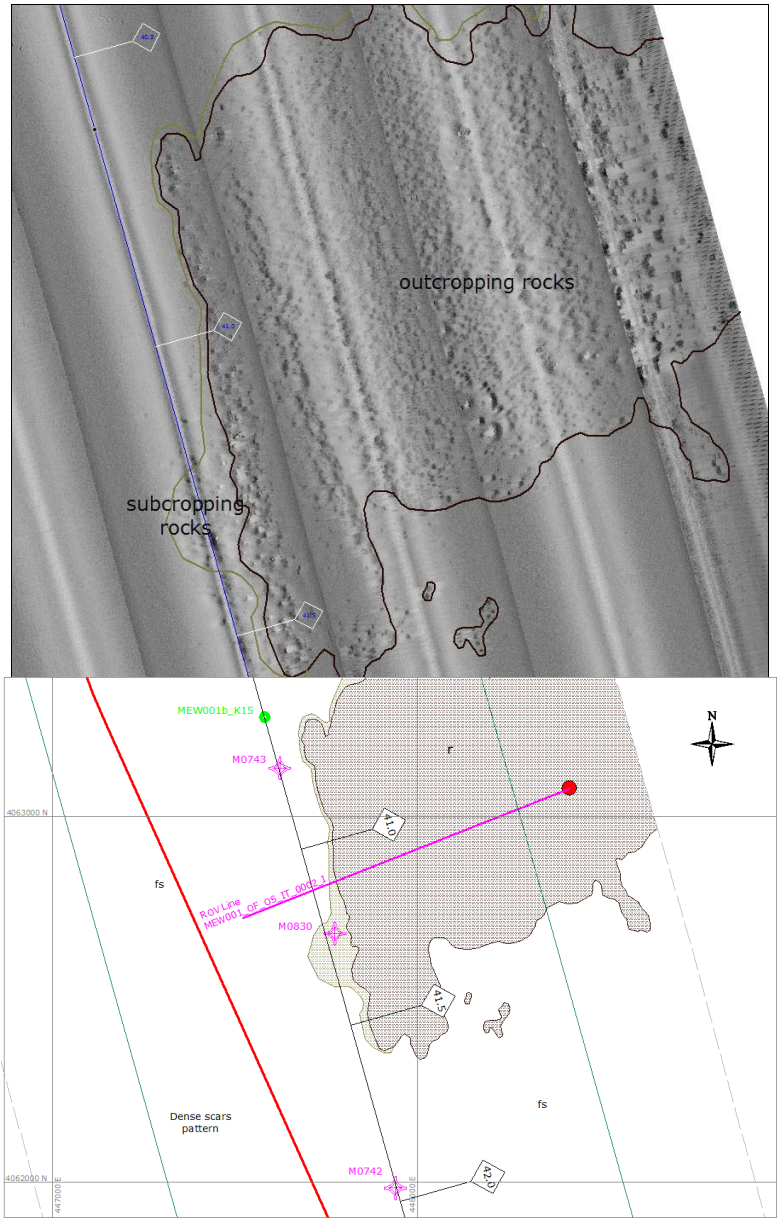


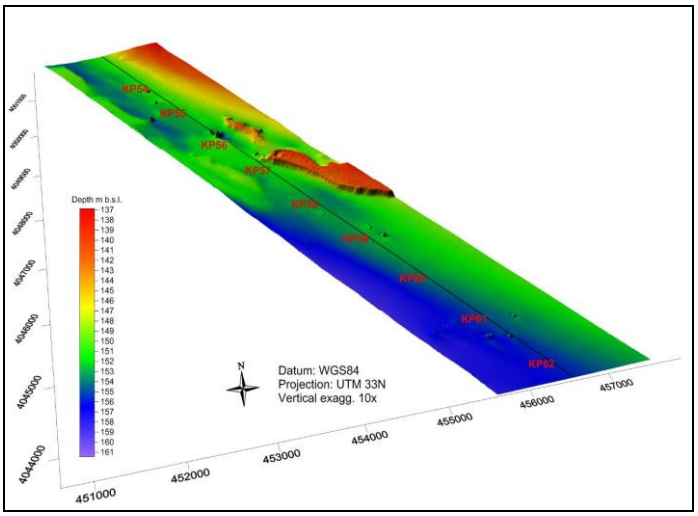
Figure 5.2 - SSS mosaic: outcrop at about KP40.5-KP41.5 and relative ROV transect (in red FEED proposed Route)

Moreover, from KP54 (151m w.d.) to KP 62 (156m w.d.) some scattered small sub-conical, dome-like features have been detected during the geophysical survey (see latest revisions of MEW001_GEOPHY_FINAL report and MEW001_WP2_POSMH_FINAL report). The rocky nature of the elongated ridges and the dome-like featurs, surrounded by soft fine sediments, has been confirmed by the ROV inspection. The northern elongated ridge area is covered by carbonates, with a rich occurrence of benthic fauna in hard-substrata (in particular the abundance of the gorgonian *Callogorgia verticillata*, see Table 5.4); similar images have been recorded on the dome-shaped features (Table 5.4). It has to be underlined that no ROV transects have been performed across the

southern and longest ridge detected East of the design route roughly from KP56.8 to KP58.5, but the same area has been investigated during three cruises in 2006 and 2007 by INGV and Milano-Bicocca University by means of MBES/SBES, SBP/Sparker, SSS, ROV and gravity cores (Savini et al., 2009). Images from the ROV were acquired at the top of the seaward steep flank of the largest ridge and clearly showed that most of the ridge area was covered by carbonates and by the same rich occurrence of benthic fauna detected during LGH survey. The small scale mounds and the presence of caves found along the flat top of all the ridges and well mapped on the SSS mosaics (see latest revision of MEW001_WP2_POSMH_FINAL Report – Figure 36) correspond to hard carbonate build-ups that host living fauna dominated by the presence of the gorgonian *Callogorgia verticillata* (Table 5.4 from Savini et al., 2009). From literature data (Savini et al., 2009) the domes of the Malta plateau, their seismic path, the muddy nature of the sediment and the occurrence of nannofossil assemblages in core samples with significant age mixing indicate that they are fine-grained sediment extrusions like those forming mud volcanoes: the domes found within the survey area may have formed as mud volcanoes, but at present they may be characterised by a dormant stage with a slow flux that leads to the formation of carbonate crusts at their tops (Savini et al., 2009).

In the following pictures it is possible to observe a comparison between MBES, SSS and ROV acquired data with the literature ones (Savini et al., 2009).

Table 5.2 –MBES acquired data (left) and literature data (right)



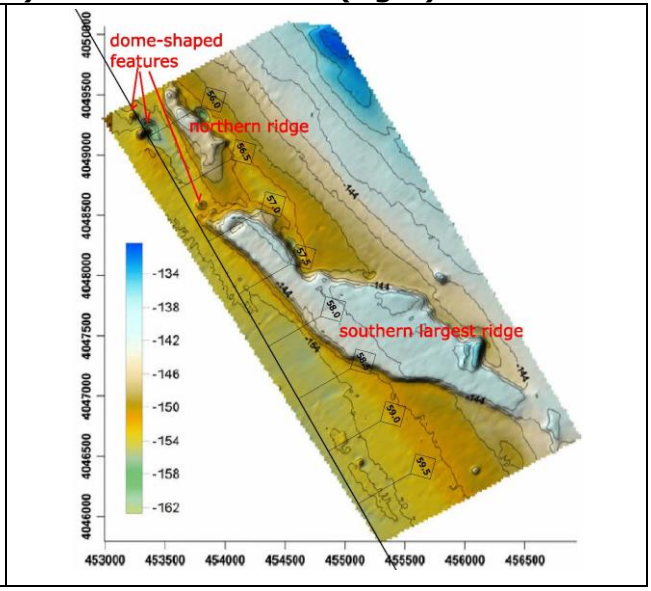


Table 5.3 –SSS acquired data (left) and literature data (right)

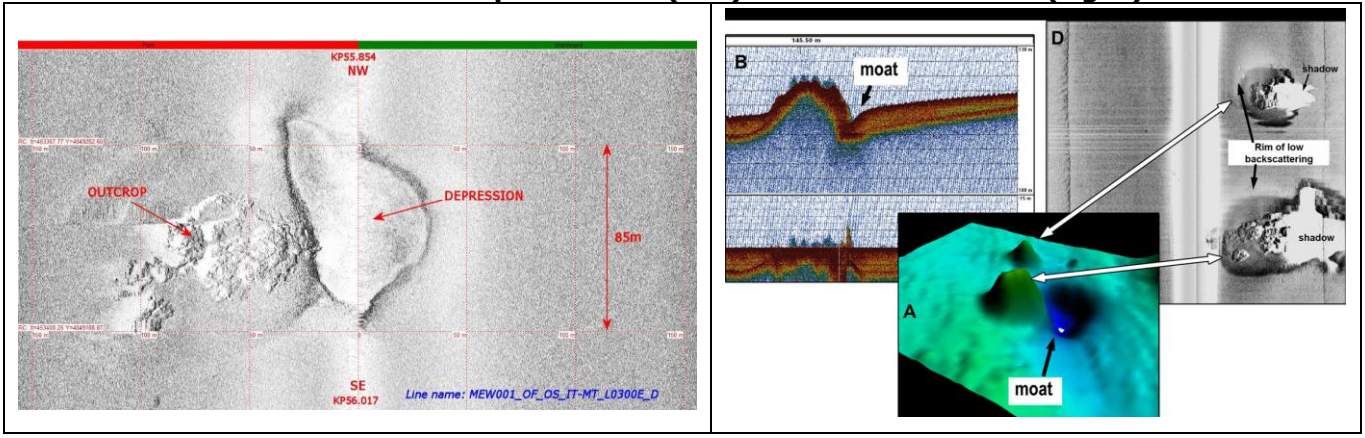
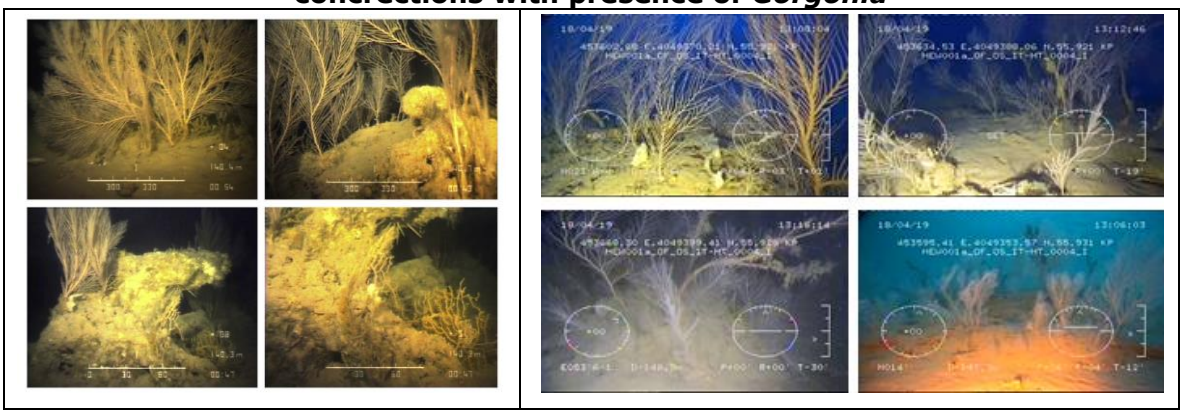


Table 5.4 - Visual inspection (right) and literature data (left) - Carbonate build ups and concrections with presence of *Gorgonia*



From **KP 41** to **KP 62** Flora and Fauna species coverage is very low if compared to the upper layers (Infralittoral zone). Some fouling organisms such as algae, bryozoans, porifera and polychaetes were observed (figures c, d below) in hard substrata. Moreover circalittoral bedrock biocenosis (figures a, b below) were identified (i.e. probable Scleractinia examples). Also some species of Echinodermata [i.e.: possible *Cidaris cidaris* (f), *Holothuria sp.* (j)], Actinopterygii [es: *Scorpaena scrofa* (g,h)], Crustacea Decapoda (e), and Gastropoda were recognized (Table 5.5). A lot of Cnidaria individuals [es: *Pelagia nucticula* (l)] were detected in accordance with bibliographic data reported in 4.2.3. Moreover a probable individual of the Vulnerable Pennatulacea specie (IUCN), *Virgularia mirabilis*, was also detected (m) (Table 5.5).

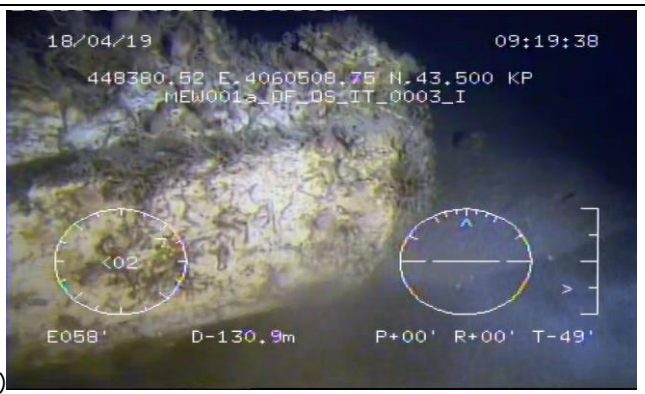
Table 5.5 – ROV inspection images examples

a)

b)

c)

d)



e)

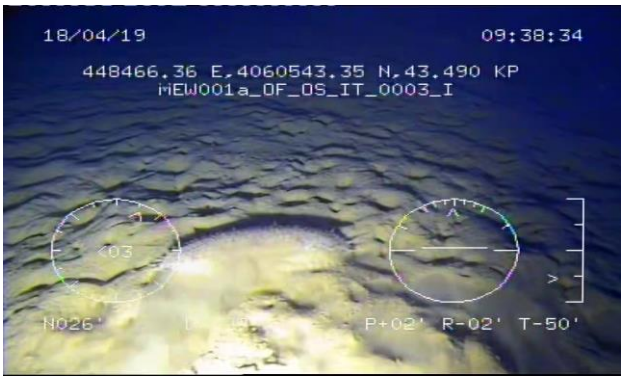
f)

g)

h)

i)

j)



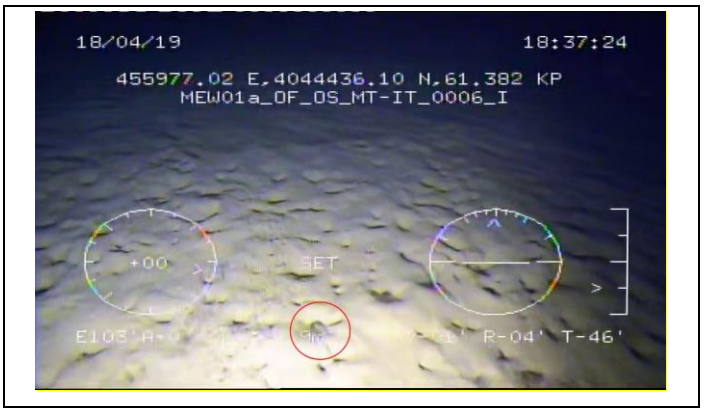
k)

l)

m)

The silty and clayey sea bottom is characterized by bioturbations and burrows. This could be due to the presence of shrimps (Massi, 2004), crabs and polychaetes that live inside the soft seabottom digging tunnels.

Table 5.6 – Sandy seabottom characterize by the presence of burrows



The abundance of echinoderms decreases with depth. The environment is dominated by the longspine snipefish *Macroramphosus scolopax* (b), gurnards (*Lepidotrigla sp.*), and boarfish (*Capros aper*). In deeper waters also crustaceans became common, in accordance with MEDITS campaign (Terribile *et al.,* 2016). In the deeper zone (near to 150-160m depth) typical deep-sea biocensis were detected (Table 5.7). In particular the critically endangered octocorals community, *Funiculina quadrangularis* (g) (Lauria *et al.,* 2017 and IUCN), was found in almost all ROV transects at this depth. Deep-sea coral assemblages play a significant structural role in marine benthic ecosystems by providing essential three-dimensional habitats for fish and invertebrate communities, acting as biodiversity hot spots and contributing to the maintenance of ecosystem functioning (Lauria *et al.,* 2017). Their life history traits make deep-sea corals highly vulnerable to human-induced impacts (e.g. fishing, pollution, coastal development, invasive species and climate change). Consequently, a lack of management to preserve deep-sea corals may have permanent or irreversible effects on the entire marine ecosystem. Associated with these coral individuals the most part of the sandy seafloor was characterised by the presence of a possible *Pennatula rubras* individuals (g, h, i, j). In the sandy seafloor (approximately at 160m w.d.) other benthic fauna was found: a high number of *Pelagia nocticula*, one individual belonging to Echinoidea class [probable *Brissus unicolor* (a)], two fish belonging to the Actinopterygii class (*Macroramphosus scolopax and Capros aper*), one crustaceous associated with Pennatulacea species [probable *Latreillia elegans* (f)], one buried organism, which can be identified as a possible weeverfish (c, d), one individual belonging to Phycidae taxus (e).

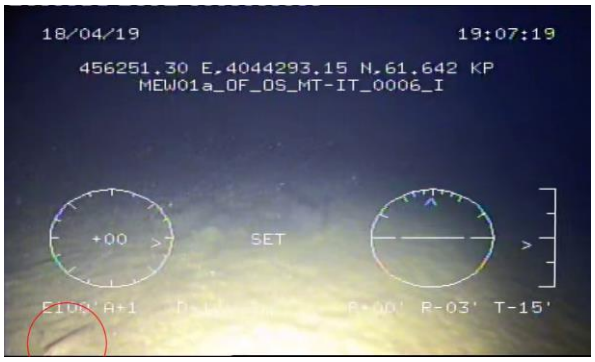
Table 5.7 – ROV inspection and Sandy seabottom biocenosis examples

a)

b)

c)

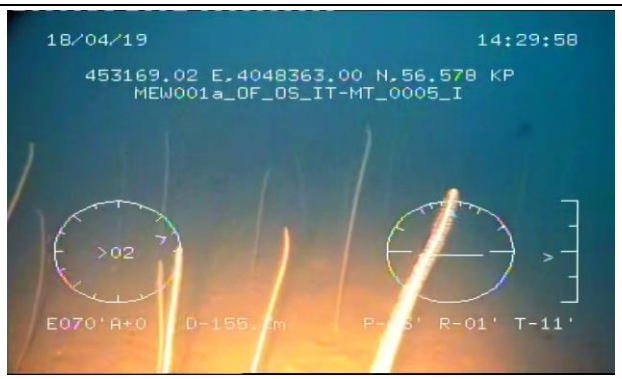
d)



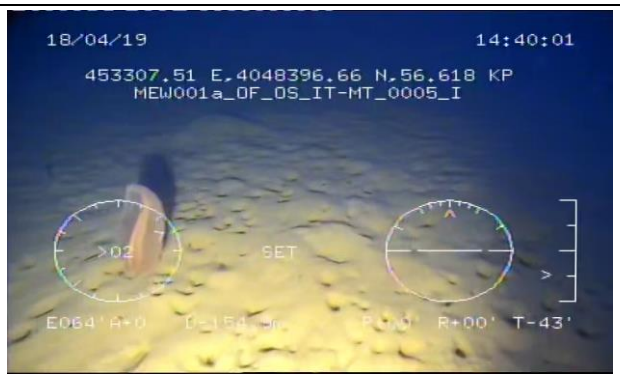
e)

f)

g)



h)



i)

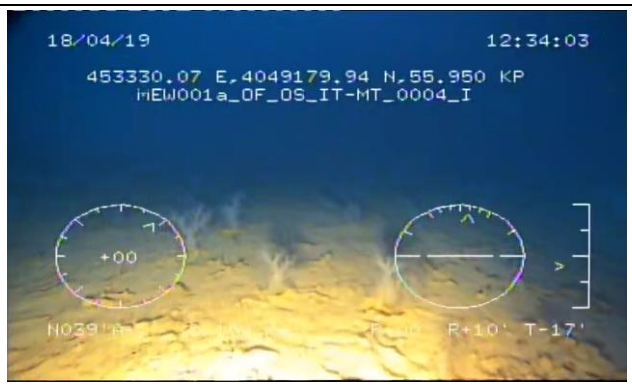
l)

At this depth, in rocky seafloor (Table 5.8), different biocenoses trends can be spotted, with individuals belonging to Octocorallia subclass [Gorgoniacea (b)] and Anthozoa colonies (a). Around

Gorgonie banks [i.e. Probable *Callogorgia verticillata* (b)] some shoals and some demersal fishes (c, d)], in accordance with other studies in these areas.

Table 5.8 - ROV inspection and Rocky seabottom biocenosis examples

a)



b)

c)

d)

From KP 84.8 (the EEZ limit between Italy and Malta) until the Nearshore Malta, eighteen (18) transects were investigated with ROV to check Geophysical results as targets, contacts and outcrops areas that could be associated with coralligenous biocenosis and other sensible habitats. In particular one transect has been done along the route from KP 106 and KP 106.8, with a depth of about 140m.

Both benthic and pelagic environment were similar to the one described above for Sandy seafloor.

The most abundant structuring epibenthic species, which characterised the identified assemblages, were the tall sea pen *F.quadrangolaris* and the probable red sea pen *Pennatula rubra* organisms. The seabottom shows the typical "bioturbations" morphology (Table 5.9). The following benthonic and pelagic organisms have been found during visual inspection similar to those already noticed in the offshore Sicily corridor: benthos and pelagic macrofauna with a high number of crustaceans (h) [i.e: probable *Latreillia elegans* (b)] and burrowing crustacean (e, f), *Lepidotrigla sp*. (i), *Boops boops* (a,c,), *Zeus faber* (d), probable *Serranus hepatus* (l), *Holothuria sp.* (g).

Table 5.9 – ROV inspection and Sandy seabottom biocenosis examples (from KP 106 and KP 106.8)

a)

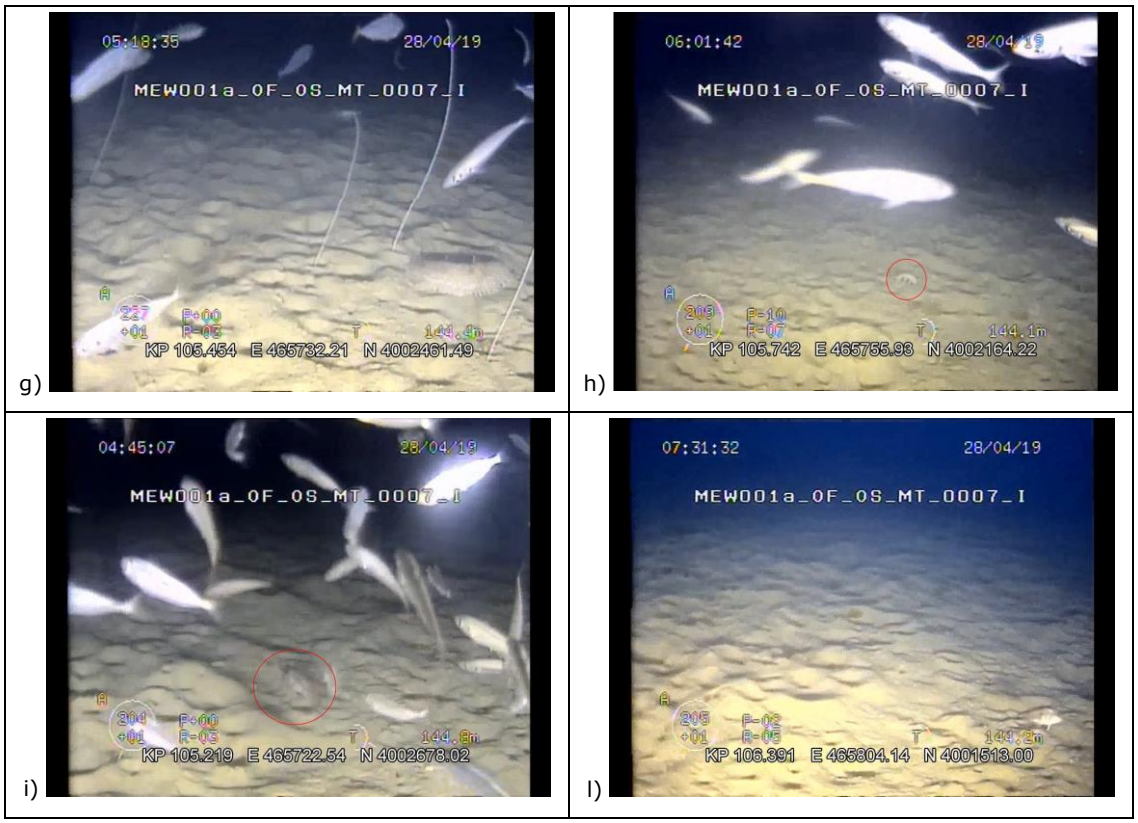
b)

c)

d)

e)

f)



From KP 129.5 and KP 134.5 the depth decrease again around 130-120m, the sandy seafloor is replaced by rock in correspondence of the outcrop area recorded from SSS survey.

The seabed structures in this area are characterized by circalitoral biocoenosis that consists of sediments and shells which form small aggregates (Table 5.10 e to n). A little biodiversity is associated with them. These biocenoses show limited coverage and are characterized by few taxa. In the sandy seafloor few Pennatuacea organisms (a) and many individuals belonging to *Bonellia viridis* species (b) were found. The seafloor is often characterized by the presence of many burrows. Moreover, the rocky seafloor shows the presence of possible Polychaeta, Porifera (probable *Axinellae sp.* (g, h, l and m), Briozoa and organism belonging to Coralligeno biocenosis. Some organisms were recognised as *Zeus faber* (c) individuals and few belonging to Triglidae taxum (d) (Table 5.10). They were already identified in the previous corridor areas.

Table 5.10 – ROV inspection images examples

a)

b)

c)

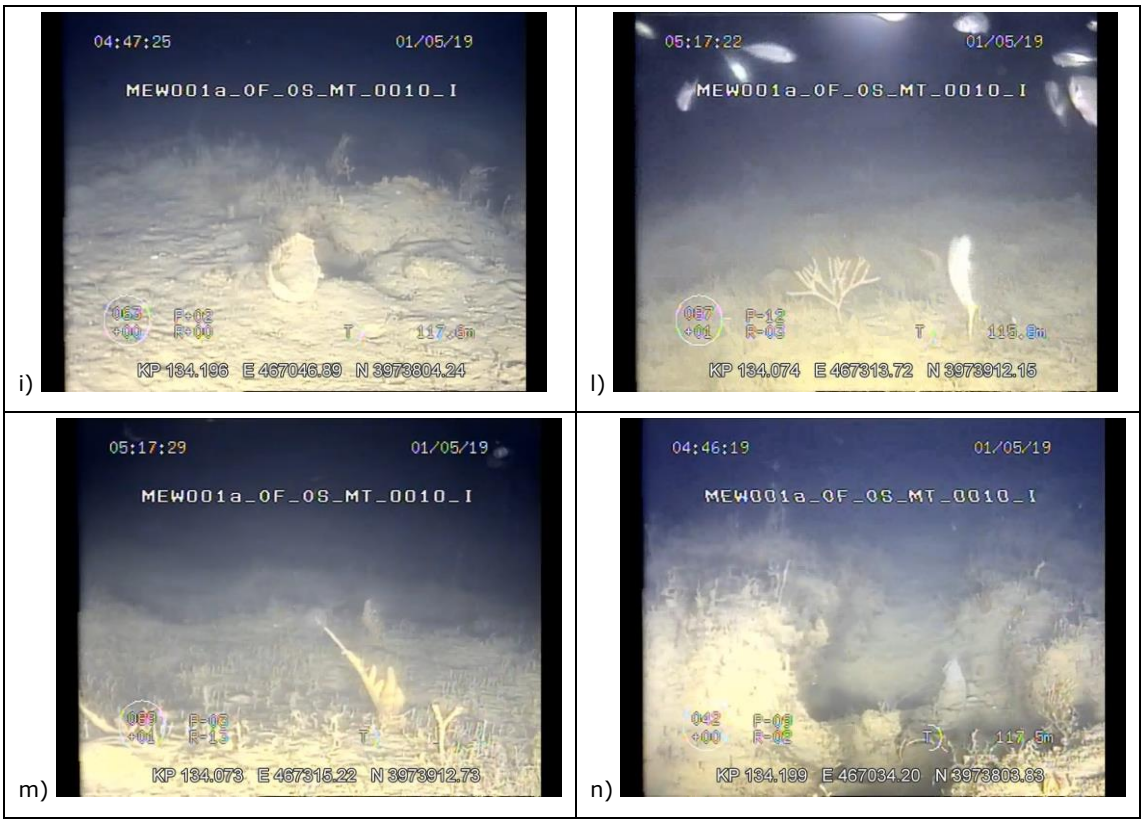
d)

e)

f)

g)

h)



From KP 137.5 and KP 139 outcrops identified by the geophysical survey were confirmed by visual inspections. Biocenosis assemblages were recognized as belonging to the 'nullipore facies' of the coastal detritic biocoenosis of Pérès and Picard (1964). Such bottoms and the assemblages are better known as 'maerl'. Maerl is characterized by accumulations of unattached, calcareous rhodophytes which take the form of either twig-like thalli, or ones encrusting some solid but mobile granule, usually a stone or shell (Borg *et al.,* 1998). Around 80m depth coralligenous and maerl biocenoses were found and reported in the following images.

Presence of Maerl Beds was reported in this report, following completion of the review of ROV visual inspection on agreed transects. The presence of Maerl beds is therefore to be associated ONLY with the ROV transect shown in Table 5.11 (from a to h). SSS data at the aforementioned ROV line did not show a variation of the response so it did not allow any definition of boundaries of Maerl Beds outside of the ROV line. From MEW001a_OF_OS_0012_I ROV line interpretation, the basic design route is affected by maërl bed at KP138.150. To be noted that sampling was carried out only by means of box corer and Van Veen Grab (ref. Environmental Report, WP1).

Table 5.11 – ROV inspection images examples. Maerl and Coralligenous biocenosis

a)

b)

c)

d)

e)

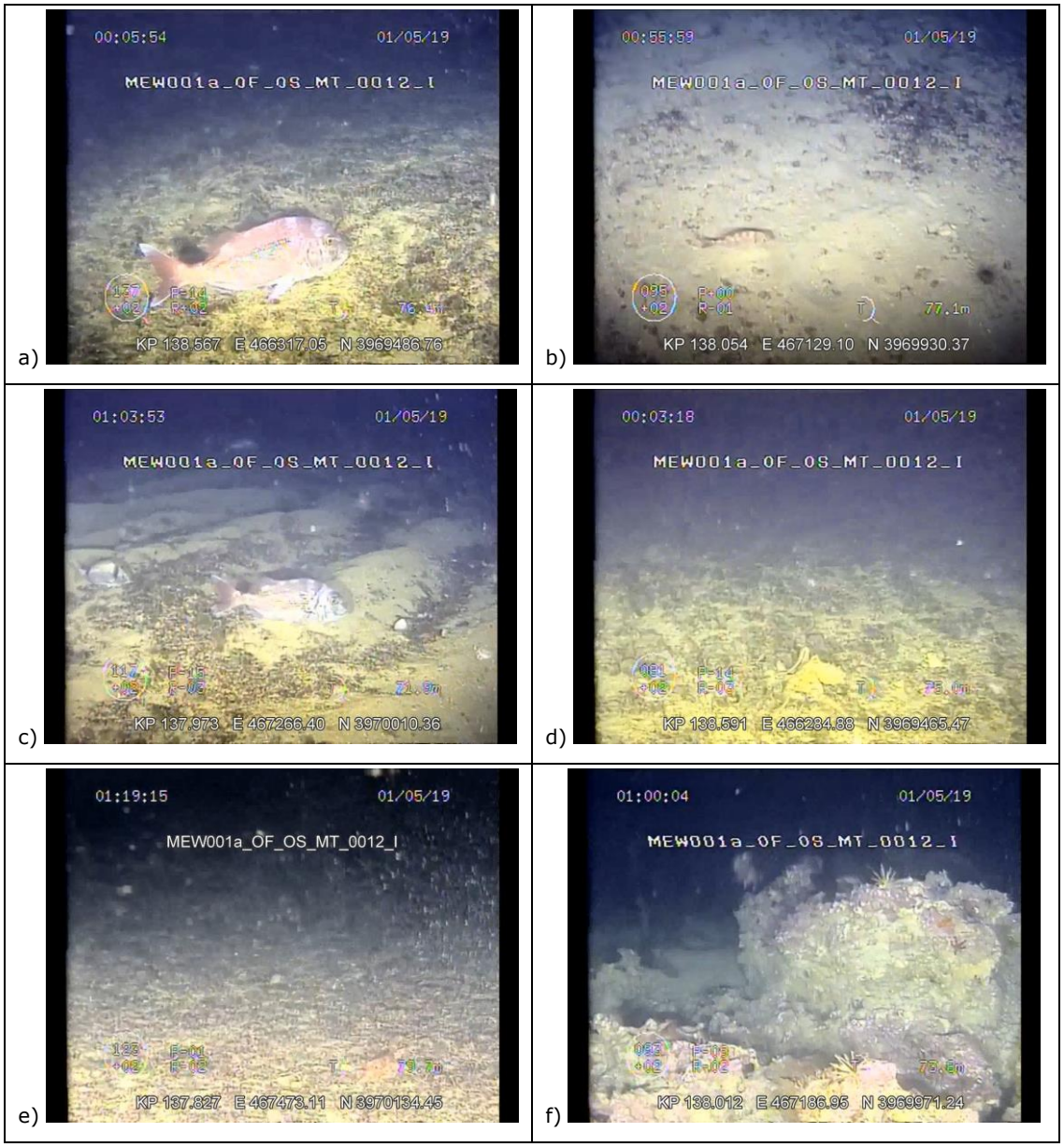
f)

g)

h)

The associated biodiversity (benthic, demersal and pelagic organisms) is varied and abundant, as expected for coralligenous and maerl biocenosi. In the following images some examples of ROV inspection analyses are reported in Table 5.12. It was possible to see many individuals belonging to Echinoidea [probable *Cidaris cidaris* (f)], Asteroidea (f), Sparidae (es: *Dentex dentex* (a), *Diplotus.vulgaris* (c), Octopodidae (d) and Triglidae (e, b) taxa.

Table 5.12 – ROV inspection biodiversity examples



From KP 145 and KP 146.5 the depth ranged around 100-115 meters and all ROV transects crossed the route, highlighting the dominance of a sandy seafloor (interspersed with spotted outcrops). The biodiversity and the environment is almost similar to the one described above at the same depth range. It's possible to observe a seafloor with many burrows and bioturbations (a,b). Associated

with outcrops a lot of *Bonellia viridis* individuals (d) were detected, as well as benthic organisms belonging to Echinoidea taxum (c) and one individual of probable *Palinurus elephas* (f). Regarding pelagic fauna, some organisms belonging to Sepiidae [i.e.: probable *Sepia officinalis* (e)], Labridae [i.e.: probable *Symphodus tinca* (h)] and probable Anthozoa taxa (g) were detected with ROV inspection as in Table 5.13 below:

Table 5.13 – ROV inspection images examples (from KP 145 to 146.5)

a)

b)

c)

d)

e)

f)

g)

h)

From KP 147.0 to KP 148.0 a ROV transect was done to investigate an area identified as "Pinnacles area" after SSS mosaic interpretation. The whole seafloor is characterized by outcrops and rocky pinnacles. In this region, depth is around 100m with a various fauna which is characterized by the presence of coralligenous biocenosi with probable Polichaeta, Cnidaria (es: Scleractinia), Briozoa and Porifera organisms [es: probable *Axinella sp.* (a)]. In Table 5.14 Figures (b to e) a possible arborescent colony of *Antipathes dichotoma* was also detected. It is possible to observe also the presence of other organisms such as *B.viridis* (f), probable *Ophidiaster ophidianus* (g) *and Cidaris cidaris* organisms (g). Some individuals belonging to Rajidae [probable *Raja clavata* (i)], Loliginidae [probable *Loligo vulgaris* (l)] and Triglidae taxa (h) were noticed. In the following table some examples of biodiversity associated with rocky seafloor are shown:

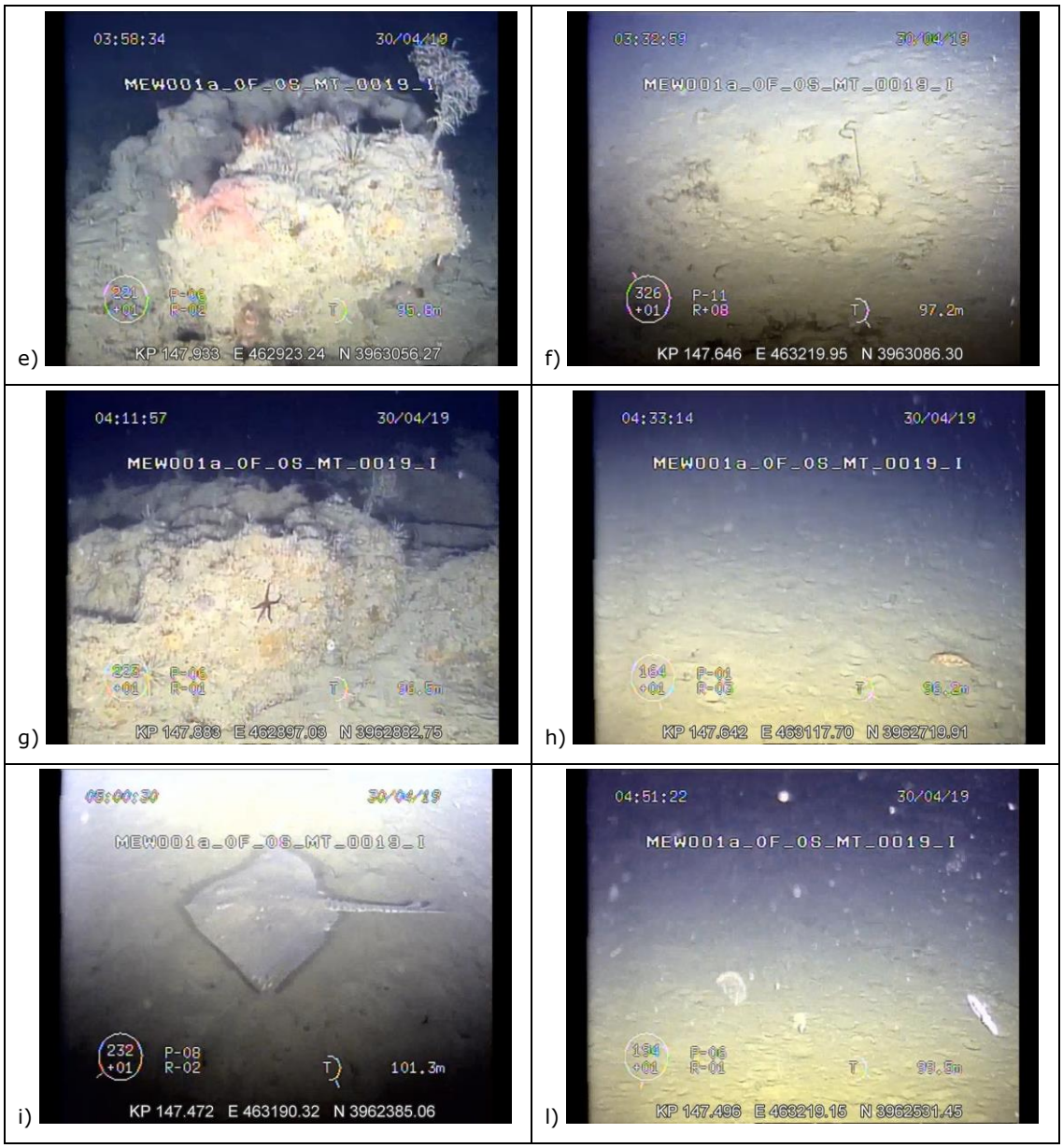
Table 5.14 – ROV inspection images examples (from KP 147.0 and KP 148)

a)

b)

c)

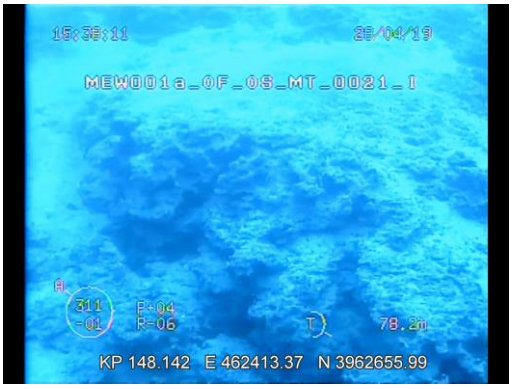
d)



From KP 148.0 to KP 149.0 the depth ranges between 65 and 80 meters and all the ROV transects show the evidence of a transition from the offshore environment to a different one associated to the coastal area. Indeed, from KP 149.0 all ROV transects were done perpendicular to the coast and parallel to the route. The area on the left of the route is characterized by an alternation of sandy and rocky seafloor (Table 5.15). The biodiversity is quite similar to the one explained above (a, c, g), but it is interesting to note the presence of the green alga [probable *Flabellia petiolate* (e, f, h)] which is an evidence of the environmental change ongoing towards the coastal area. Together with *Cidaris cidaris* (h), another Echinidae specie is present [probable *Centrostephanus longispinus* (b, d)].

Table 5.15 – ROV inspection images examples

a)



b)

c)

d)

e)

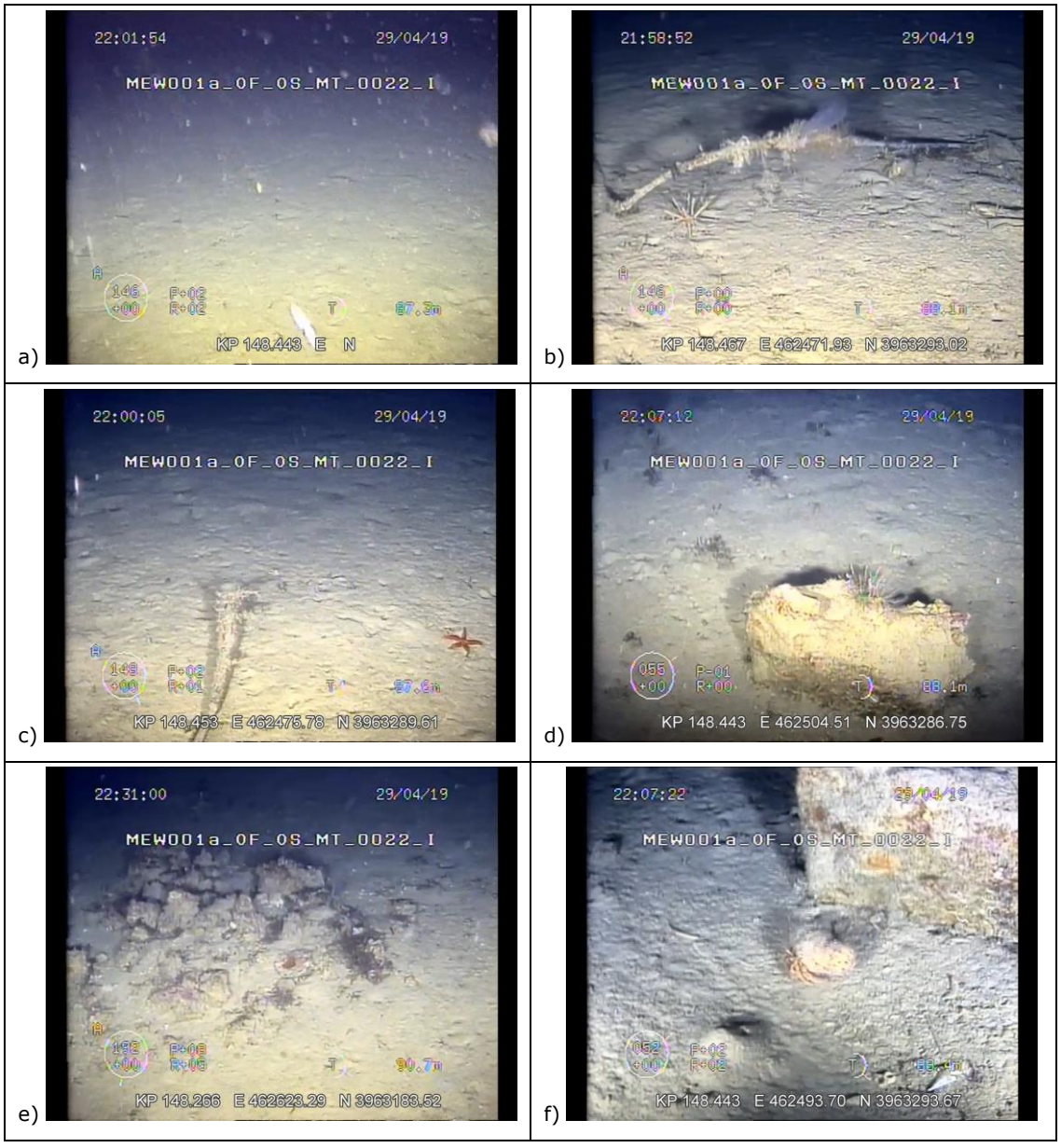
f)

g)

h)

As already mentioned the biodiversity is quite similar to the one explained above. In particular, along the route a transect was done and it did not show any evidence of obstacles. This environment is characterize by a features less seafloor with scattered rocky outcrops (d,e) and individual of the Asteroidea class (c). Organisms belonging to Echinoidea [i.e.: probable *Cidaris cidaris* (b)], Loliginidae [i.e.: probable *Loligo vulgaris* (a)], Paguridae (f) and Malacostraca (f) were detected and reported in table below:

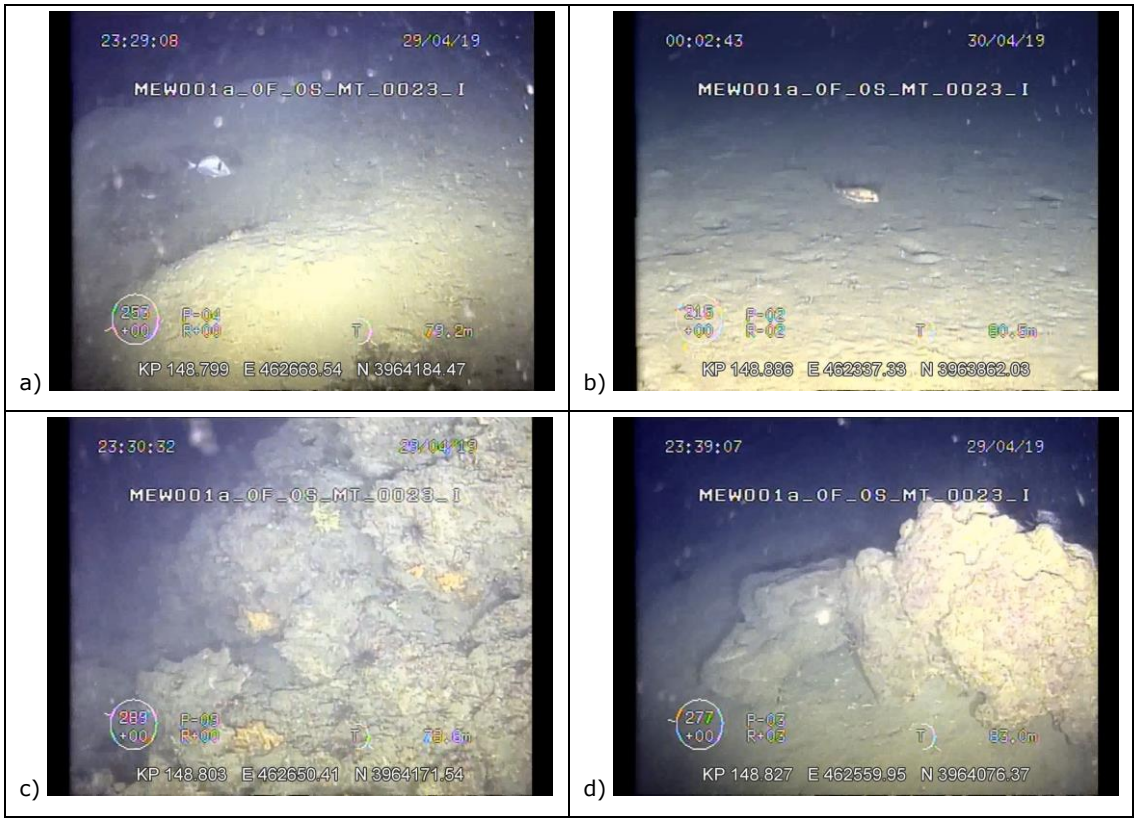
Table 5.16 – ROV inspection along the central part of the route



One transect was done perpendicular to the route and parallel to an area identified as subcrop (SSS\SBP interpretation). It showed evidence of a sandy seafloor with outcrops and its associated biodiversity. In particular it's possible to observe in Table 5.17 the presence of Porifera [i.e.:

possible *Axinella sp.* (c, d)], some specimens of *Diplodus vulgaris* (a) and some individuals belonging to Triglidae taxus (b). This marks the limit between the offshore and the nearshore ROV transects.

Table 5.17 – ROV inspection images examples

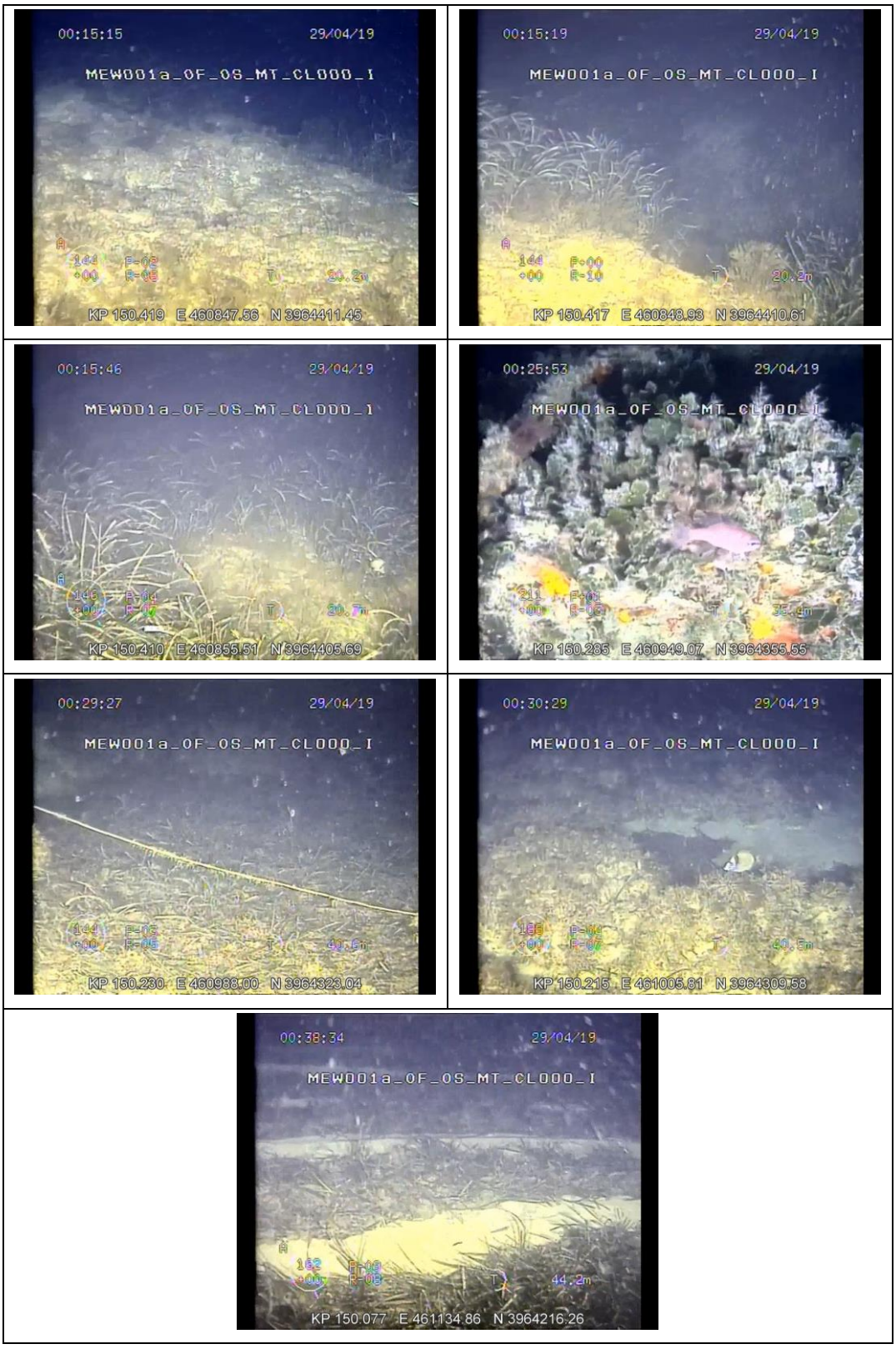


From KP 149 till the coast, five transects were done to connect the offshore corridor with the nearshore Malta and to cover the full surveyed corridor. Transects start from about 60m depth and continue up to almost 15m.

In the Maltese Islands, the lower limit of *P.oceanica* where stands of this species have been recorded, is 44m of depth (Borg *et al.,* 1998). These data were confirmed both from geophysical and ROV surveys.

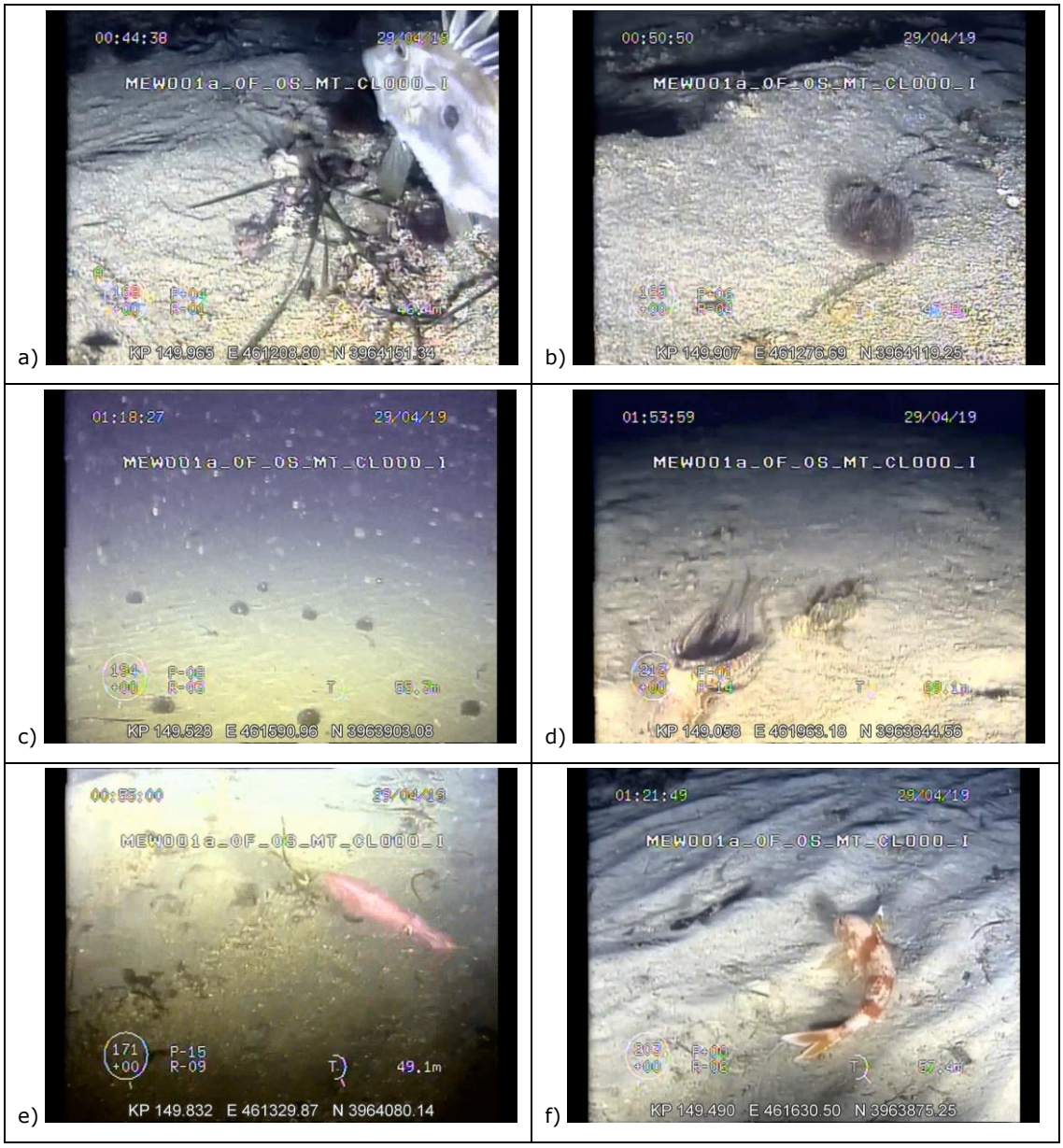
Along the route (MEW001a_OF_OS_MT_CL000_I), *Posidonia oceanica* was detected down to 40m depth approximately, both on rock and on sandy seafloor. The evidence of anthropic impact in the coastal area is evident and is proven by the presence of ropes, nets and anchors (see Geophysical reports). In the following table, some pictures of the environment and the biodiversity along the route are reported:

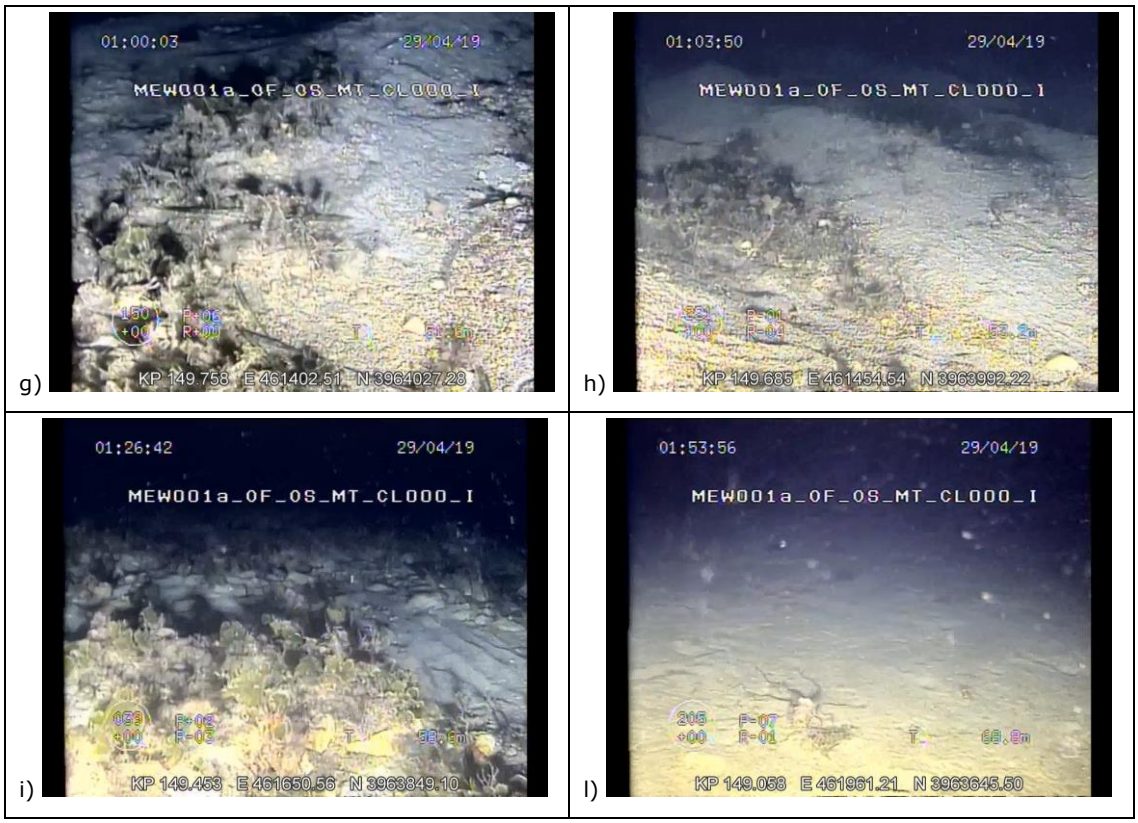
Table 5.18 – ROV inspection (central line) images examples



Starting from approximately 45 meters of depth, and going towards the coast, the presence of *P.oceanica*, other photophilic plants and algal species (es: probable *Flabellia petiolate*) dominate the environmental biodiversity, and this region is characterized by seabottom features with ripples and coastal-biogenic debris (Table 5.19 g,h) and accumulation of calcareous residues moved by the hydrodynamism of bottom currents. As it is possible to see in Table 5.19, the identified fauna includes an individual of *Zeus faber* (a), a huge distribution of a possible *Spatangus purpureus* (b, c) typical of sandy seafloor, an example of possible *Octopus macropus* (d, i, l), few probable *Loligo vulgaris* (e) and *Mullus surmuletus* (f) specimens.

Table 5.19 – ROV inspection and biodiversity images examples





The other ROV inspection transects confirmed the lower limit of *Posidonia* detected with Geophysical survey, except for MEW001a_OF_OS_MT_R0004_I, in which ROV found a rock seabottom with the dominance of green algae and other sessile macroorganisms (Table 5.20). MEW001a_OF_OS_MT_R0004_I is the extension of another inshore transect (MEW001c_WI_IS_MT_006__I) which confirmed the *Posidonia* limit. Even the seabottom morphology from SSS mosaic interpretation is verified and accepted by visual inspection.

In the following table, the lower *Posidonia* limit for each transect is shown (except for MEW001a_OF_OS_MT_R0004_I, as explain above):

Table 5.20 – *Posidonia oceanica* external limits

MEW001a_OF_OS_MT_CL000_I

MEW001a_OF_OS_MT_L0005_I

MEW001a_OF_OS_MT_R0003_I

MEW001a_OF_OS_MT_R0004_I

MEW001a_OF_OS_MT_R0006_I

On the left side of the route nothing of relevant from the environmental and biodiversity point of view was detected.

Moreover, on the right side (MEW001a_OF_OS_MT_R0003_I) it was identified a seabed showing an alternation of sand and rocky outcrops (Table 5.21), with a quite varied biodiversity, including some specimens of *C.conger* (a), a male individual of a probable *Raja clavata* (i), some *Diplotus vulgaris* individuals (l) and a lot of different species belonging to Echinoidea (b, d, f, g) and Asteroidea (c) taxa. The fauna is associated with *Posidonia oceanica* habitats and with outcrops where different species of possible Porifera and Anthozoa are also present (e, f, g, h).

Table 5.21 – ROV inspection (MEW001a_OF_OS_MT_R0003_I) images examples

a)

b)

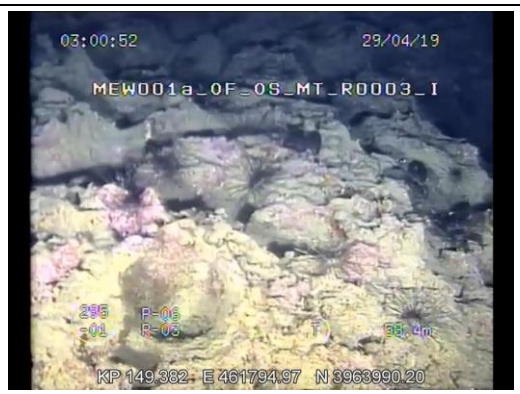
c)

d)

e)

f)

g)



h)

i)

l)

In the last two transects (MEW001a_OF_OS_MT_R0004_I and MEW001a_OF_OS_MT_R0006_I) nothing of relevant, from the biodiversity point of view, was identified and the environment was similar to the ones already described.

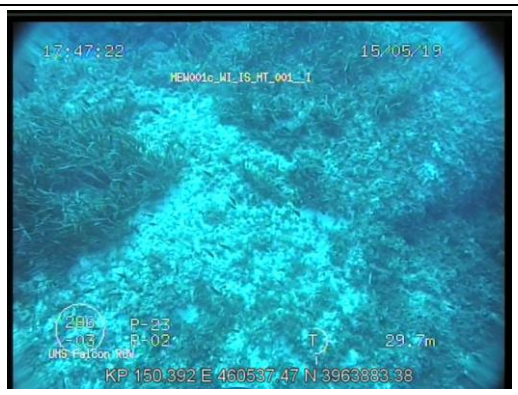
5.3.0 Nearshore Malta

The nearshore Malta environment was inspected with a different vessel (Wilfred: WI) which carried out eight (8) transects from the coast down to a maximum of 38m depth (MEW001c_WI_IS_MT_002__I). The distribution of seagrass coverage is almost continuous and always associated with different species of green and brown algae such as a possible *Dictyopteris polypodioides* (Table 5.23). The only exception where the vegetation is scattered (as per geophysical mosaic interpretation) is shown in Table 5.23 (p) where *Posidonia* seagrass is replaced by *Cymodocea nodosa*.

Patches of *Posidonia oceanica* have been found on both sand and rock associated with different species of green and brown algae such as a possible *Dictyopteris polypodioides and Cystoseira sp*, with leaves colonised. In the following table the lower limits of *Posidonia* (reached with inshore transects) are shown for each transect. In Table 5.22, referred to picture of MEW001c_WI_IS_MT_003__I, the limit of dense vegetation is reported, because the lower scattered vegetation limit is represented by *C.nodosa prairie*.

Moreover, transects MEW001c_WI_IS_MT_004__I and MEW001c_WI_IS_MT_005__I did not reach the *Posidonia* lower limit, so MEW001a_OF_OS_MT_CL000_I and MEW001a_OF_OS_MT_R0003_I ensure keep a continuous inspection of the area (Table 5.22 d, e, f, g).

Table 5.22 –External *P.oceanica* limits detected with inshore ROV inspection



MEW001c_WI_IS_MT_001__I

MEW001c_WI_IS_MT_002__I

MEW001c_WI_IS_MT_003__I

MEW001c_WI_IS_MT_004__I

MEW001a_OF_OS_MT_CL000_I

MEW001c_WI_IS_MT_005__I

MEW001a_OF_OS_MT_R0003_I

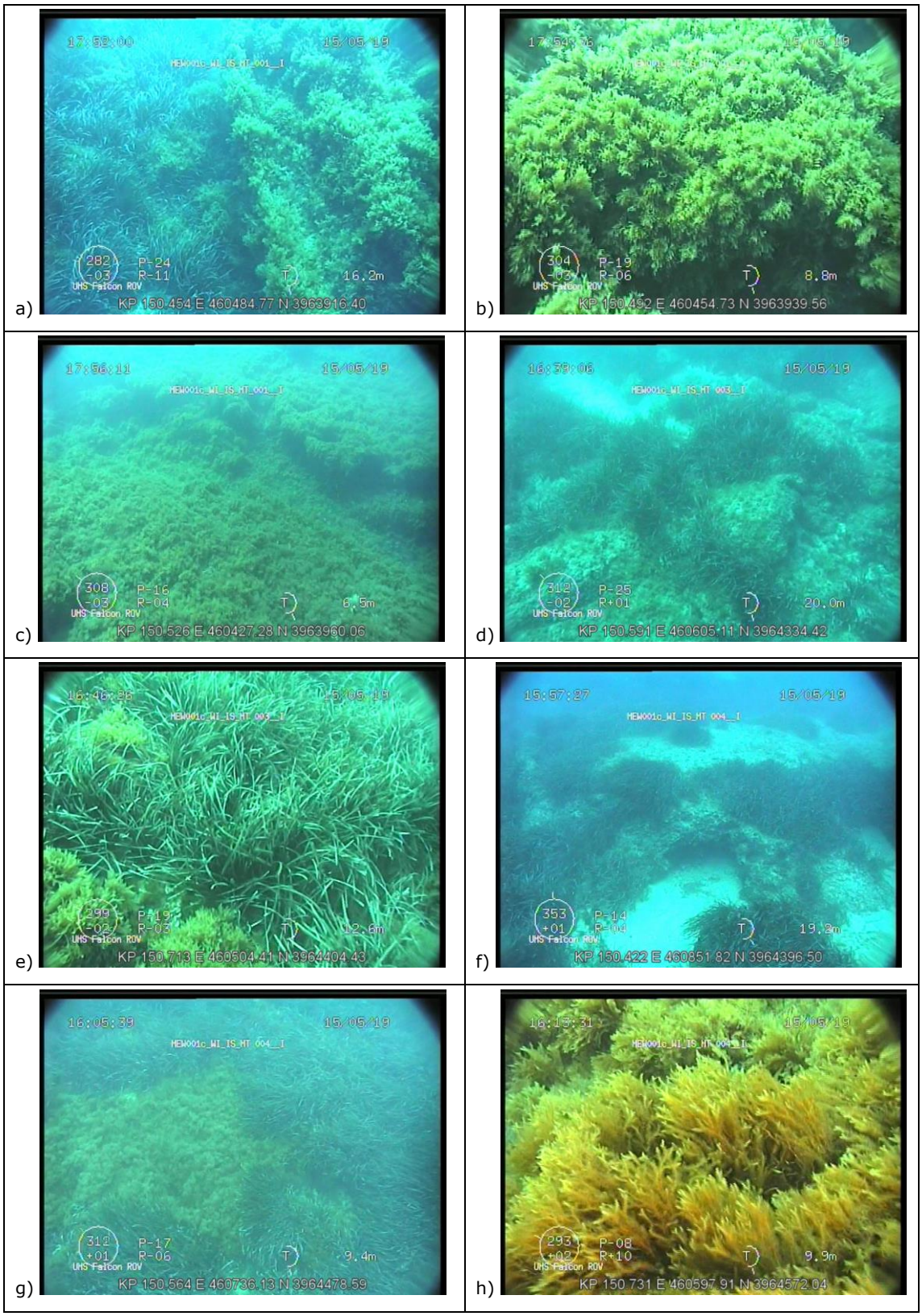
MEW001c_WI_IS_MT_006__I

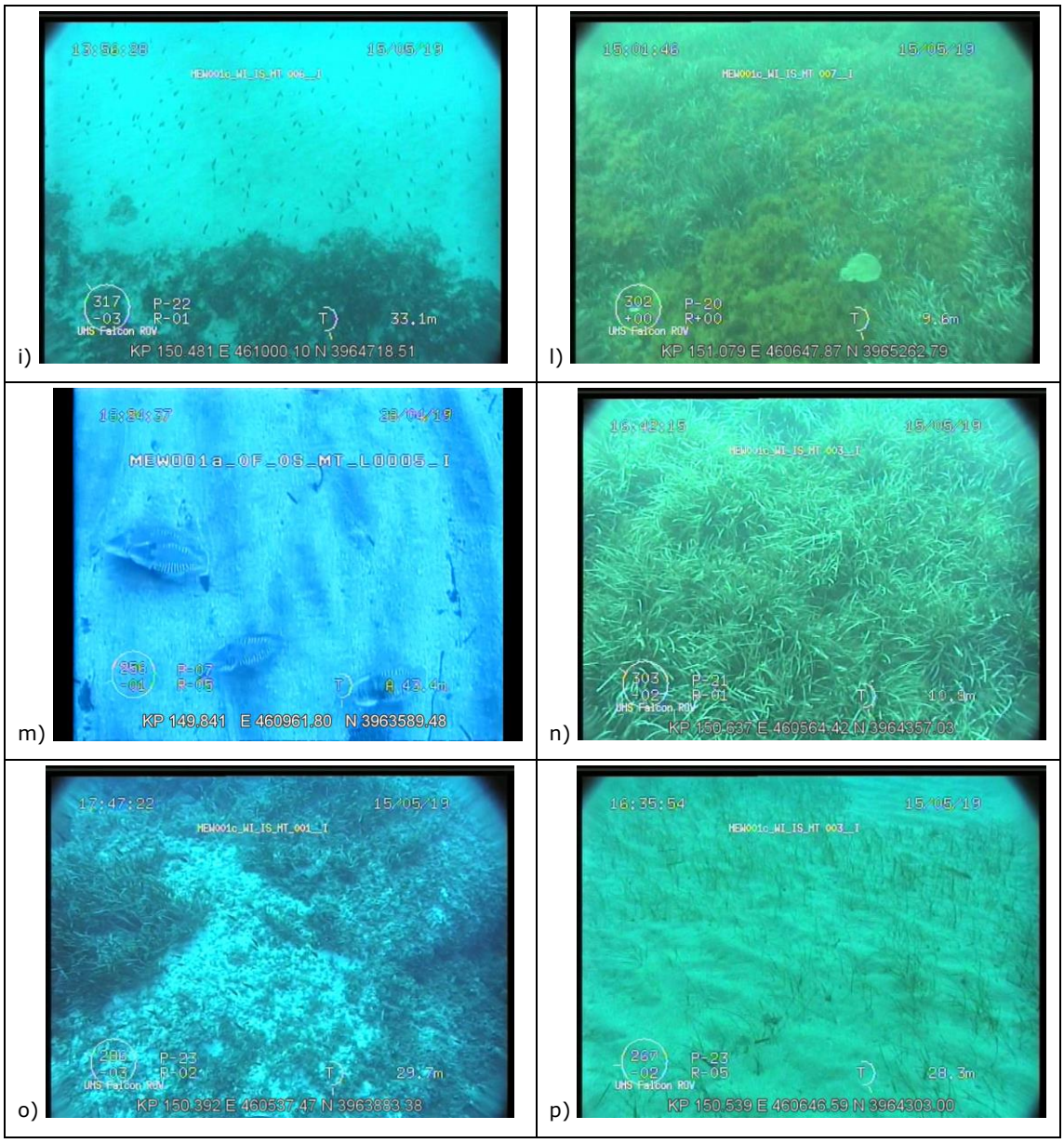
MEW001c_WI_IS_MT_007__I

MEW001c_WI_IS_MT_008__I

In the table below some examples of *Posidonia oceanica* habitats and its association with other photophilic species are shown. It's possible to notice how seagrass leaves are colonised by Melobesiae, and several sessile organism that are attached to the rhizomes (a to p) . Also some *Torpedo sp.* (l) and Sepiolidae specimens (m) were recognized:

Table 5.23 – *Posidonia oceanica* habitat images examples





5.4.0 SSS and ROV comparison

The combined interpretation of geophysical data (SSS, SBP and MBES), seabed samplings and ROV visual inspection analyses allowed the definition of the following main sensitive marine habitats:

- *Cymodocea nodosa* prairies at Gela coastal area;
- biogenic constructions at spotted areas along the design pipeline offshore section;
- biogenic constructions at Malta shallow water and Delimara coastal area;
- *Posidonia oceanica* prairies in association with green and brown algae and biogenic reef at Delimara coastal area.

The sensitive marine habitats mapping from the PMRS results are summarized in the following Table 5.24 and in the latest revision of MEW001_WP2_POSMH_FINAL report.

Table 5.24 – Summary of results

ID#	FROM KP – TO KP along the design route	WATER DEPTH RANGE	DESCRIPTION
1	KP0.643 – KP7.273	5m – 19.4m	Alternation of dense and scattered *Cymodocea nodosa* prairies at Gela coastal area
2	KP40.5 - KP41.6	105m – 120m	Biogenic concretions/Bioconstructions (coralligenous)
3	KP55.6 – KP61.5	140m – 155m	Biogenic concretions/Bioconstructions (coralligenous) both at two wide tabular NW-SE elongated flat-top ridges and at scattered small sub-conical, dome-like features
4	KP129.5 - KP134.	126m - 112m	Biogenic concretions/Bioconstructions (coralligenous)
5	KP137.8 - KP138.7	75m - 83m	Maërl beds and coralligenous biocenoses at the moderate to steep flanks of the northern subcropping area
6	KP139 – KP149.8	96m – 50m	Biogenic concretions/Bioconstructions (coralligenous) at the pinnacles outcrops; possible same interpretation of the subcropping and hardground areas in deeper w.d. not covered by ROV
7	KP149 – KP149.3	70m – 60m	Fine to Coarse SAND occasionally colonised by sparse growths of photophilic algae
8	KP149.5 - KP150.12	57m – 42m	Fine to Coarse SAND occasionally colonised by sparse growths of photophilic algae
9	KP150.156 - KP150.24	46m – 40m	Scattered vegetation (mainly on sand, covering subcropping rock) constituted by *Posidonia oceanica* and photophilic algae
10	KP150.50 – KP 150.54	28-30m roughly 190m SW of the route	Scattered *Cymodocea nodosa* on sand (N.B.: isolated patch, detected only on one ROV line)
11	KP150.24 – KP150.60	40m – 7m	Dense Posidonia oceanica meadows mainly settled on rock, in association with brown and green algae

5.5.0 MMO Results

The MMO report is attached in Appendix A.

5.5.1 MMO Report Conclusions

According to the results of the marine megafauna survey, the study area appears to be mostly visited by small odontocetes and loggerhead turtles, mainly in shallow waters and close to the coastlines.

The majority of sightings were made when the sources were silent. Just one of the many occurred during the Geophysical activity. There does not appear to be any significant differences between behavior during full power and no activities.

For most of the time the weather conditions were good. Observations of marine mammals were impacted by sea conditions being choppy. Visual monitoring are affected by these types of conditions especially those at a greater distance than the mitigation zone. It could also prove difficult to observe animals within the mitigation zone during choppy conditions.

There were 0 occasions where operations were delayed due to the presence of marine mammals or sea turtles.

5.5.2 MMO Report Recommendations

Presence of MMO on board did reduce any potential risk that may have affected marine mammals and turtles in the area. As marine mammals spend the vast majority of their lives submerged, it was probable that on occasions animals may have been detected acoustically but not visually. In order to determine the presence of mammals the PAM (Passive Acoustic Monitoring) is a particularly efficient tool. The use of PAM is normally envisaged when detailed seismic analyses are carried out, with the use of seismic guns which are known to bother the most marine mammals. Given the absence of seismic guns during this campaign, the use of PAM was not requested.

6.0.0 ENVIRONMENTAL SAMPLES AND RESULTS

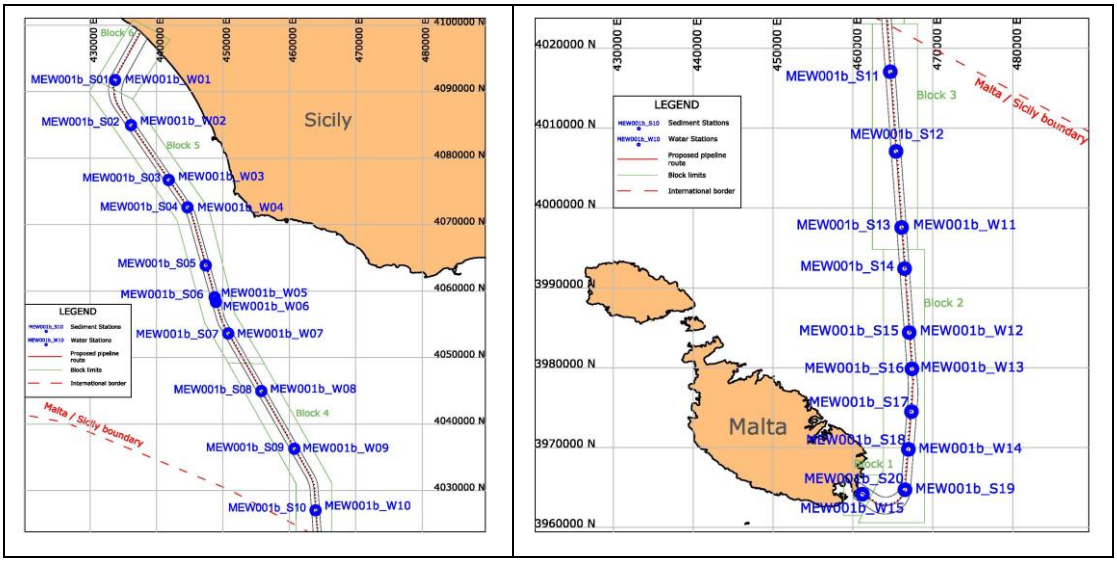
This section presents the results of the environmental analyses carried out on the samples collected during the survey, both nearshore and offshore.

It is to be noted that, with regards to Gela nearshore, the sampling plan took into account the regulations in place, (including but not limited to D.M. 172 and 173, see 3.0.0), as well as the input received from the "Ente Gestore Riserva Naturale Orientata Biviere di Gela". The latter was obtained following presentation of the sampling execution plan. The sampling method and laboratory analyses have then been adapted to suit the requests from relevant authorities.

The presence on board of ARPA representatives ensured that the activities were carried out in line with ICRAM regulations, defined within the "Schema attuativo del Piano di Caratterizzazione Ambientale dell'area marino costiera prospicente il Sito di Interesse Nazionale di Gela". Certificate of approval issued by ARPA is presented in Appendix 10.0.0.

6.1.0 Environmental Campaign

The locations of both water and sediment samples carried out during the survey are reported in Figure 6.1. All the Environmental campaign results are described in the final revision of MEW001_ENV_REPORT. A summary is reported in paragraph 6.2.0:



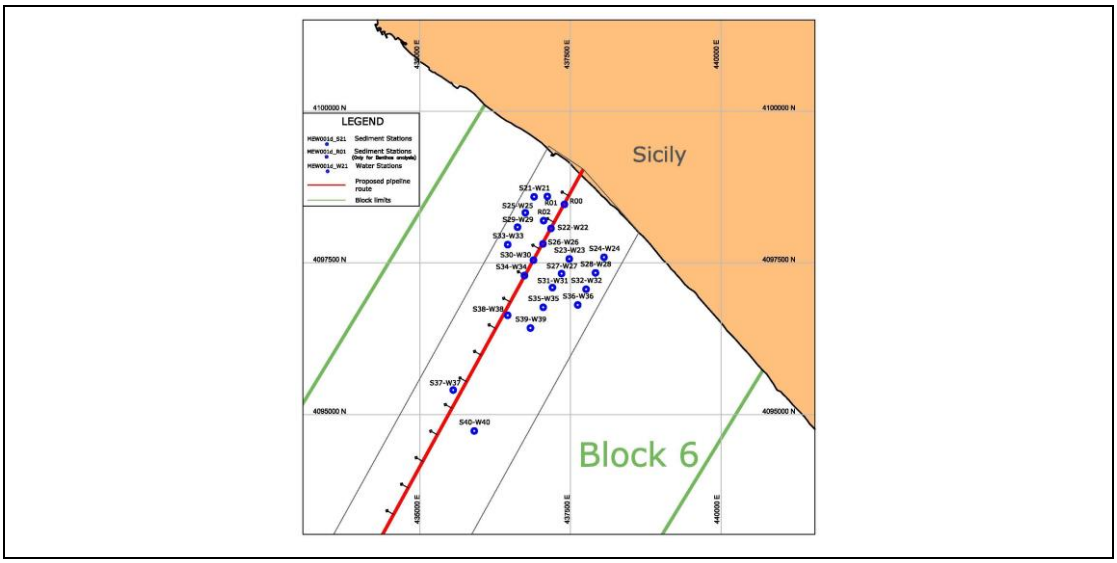


Figure 6.1 - Sediment and Water sampling in Malta, Italy and nearshore Gela

6.2.0 Environmental Results

Results and conclusions are summarized below (for more details refer to the final revision of MEW001_ENV_REPORT).

- **Physical, chemical and biological features of waters**

1) Malta – Offshore Italy

Sampling activity was performed from the 5/3/2019 to the 2/5/2019.

The transparency values are comprised between 13.0m in W15 and 25m in W14. Intermediate values of 15m in station W11, 17.5m in W01-W10, and 22.5m in W12, W13 were also found.

Moreover, from the transparency values, it is possible to obtain the depth of the euphotic zone (the upper water layer from the surface to the depth of effective light penetration: it is above the compensation level and therefore the zone of effective photosynthesis): on average this depth corresponds to three times the value of transparency, therefore in the surveyed stations the euphotic zone is more or less equal to 52 (W02-W10), 45 (W11), 67 (W12, W13), 75 (W14) and 39 (W15) metres.

In the fifteen (15) sampled stations (MEW001b_W01, W02, W03, W04, W05, W06, W07, W08, W09, W10, W11, W12, W13, W14, W15) the Temperature shows a huge difference between stations W01-W11 and W12-W15. In fact locations from W01 to W11 were performed in March, while stations W12-W15 were surveyed between the end of April and the beginning of May.

In particular during winter it's possible to notice an almost constant Temperature trend ranging between 14 and 16°C. In early summer the sea surface became warmer than in the previous month and the surface temperature ranges between 16 and 17°C until the depth of 20m, than slowly decrease to 14.5-15°C.

Salinity trends are quite the same. In particular the fifteen profiles show stable values around 41-42ppt till the depth of 40m; then they increase by about 1ppm at the final depths.

In the fifteen investigated stations, Dissolved Oxygen shows, for most part of samples, values between 5mg/l and 10mg/l and generally decreases going deeper.

The pH trends show a very low reduction and all the samples present values between 8.1 and 8.3 pH units and are constant for whole water column.

In the fifteen water locations the Redox potential values are always positive and they range between 184mV and 260mV.

For Turbidity and Chlorophyll no variations can be observed in the fifteen profiles for the shallower depth. In general Turbidity is characterized by very low values, in average equal to 4NTU.

Same trends are observed for all profiles of Chlorophyll: in general values are constant until the deeper depth with values ranging between 0 and 1.5 µg/l.

In all seawater samples the following analyses results were found:

In all collected samples the Nutrients (Ammonium, Orthophosphate, Phosphorus, Nitrite, and Nitrate) concentrations are almost always lower than the Detectable Limits, except for W04 location in which Nitrate major concentration is 17000µg/l in the surficial layer.

Concentrations of the metals in water samples are almost all below the detectable limit. Only for Arsenic, Iron, Beryllium and Selenium results are recorded. Cadmium and Antimony were recorded only in one depth of stations W10, W07 each one. Copper and Nickel, show a similar trend, but the elements were recorded only in W01, W02, W04. Mercury and Manganese were recorded only in one depth of two stations: Mercury was detected in W04 and W10, while Manganese in stations W01 and W04. Zinc has a range between 16 and 45 µg/l and was recorded in all sample depths of station W01 with the highest value of 45 µg/l. Chromium shows a range between 4.1 and 5.2 µg/l and was recorded in all sample depths of station W03 with the highest value of 5.2 µg/l.

In the fifteen locations Chlorophyll pigments were below the LoD only in three stations, with the highest value of 0.96 µg/L in W14, as expected in an oligotrophic environment.

In all the collected samples Hydrocarbons C≤ 10 has values all below the Detected limit. In locations W02-W05 Total Hydrocarbons values are below LoD (< 31 µg/l). In the other stations analytes were recorded in surface sample of W01 with a value of 41 µg/l and in all sampling depths of W06, W07, W09 and W10. The surface and mid-depth samples of station W08 recorded values of 47 and 56 respectively. The highest value is 180 µg/l that was recorded in station W10.

Regarding PAH it is to be noted that, excluding the superficial depth of W08, Pyrene only was recorded at all stations. The highest values have been identified at locations W04 (0.017 µg/l) and W01 (0.026 µg/l). Moreover, only one value associated with Benzo (b), fluoranthene and Dibenzo (a,h) anthracene, was detected, at W01. Generally, a low number of values associated with Benzo (a) Anthracene and Benzo (a) Pirene were recorded (with values as high as 0.01 and 0.0052µg/l, respectively).

All these elements show the highest value in W01. Benzo (g,h,i) Perylene values have a range between 0.0002 and 0.014µg/l, while the highest value is 0.0048 µg/l in W01. Chrysene shows most values below the LoD except in W02, W03, W04 where anyway very low values were recovered. The highest one is in W01 (0.023 µg/l).

BTEX are always below the LoD in stations W01-W03 (except for the mid depth in W01 and the maximum depth in W03). In the other stations Styrene and Toluene are always recorded with values slightly above to LoD; unlike Styrene, Toluene is not detected at each station depth.

Ethylbenzene and meta - Xylene + para – Xylene show the same trend where the most values were recorded in stations W05 and W06.

In all the collected samples the THMs compounds concentrations are almost below the Detectable Limit. Very few values are measured for Bromodichloromethane, Dibromodichloromethane and Tribromomethane in W01, for Trichloromethane (values till 0.0038µg/l in W01); 1,2 – Dichloroethane is always below the LoD, (< 0,0050 µg/l) except in W09 and W10. The total of Organoalogenated show most detected values in W01, W02, W03 and W10; anyway the highest value of 0.22 µg/l was recorded in W05.

2) Nearshore Gela

Sampling activity was performed from the 8/8/2019 to the 20/8/2019.

In most stations, Secchi Disk did not disappear along the water column (depth ranging between 5 and 14 meters). In few station only (W22, W24, W25, W29) transparency value was equal to 6 meters.

In the twenty (20) sampled stations (MEW001d_W21, W22, W23, W24, W25, W26, W27, W28, W29, W30, W31, W32, W33, W34, W35, W36, W37, W38, W39, W40) the Temperature curve shows

almost the same trend. In particular, values are between 27°C and 28°C at the surface then the temperature slowly decrease to almost 24°C at a depth of 6m.

Salinity graph shows values between 40ppt and 41ppt and generally remain almost stable going deeper down to the maximum depth.

Conductivity trends are very similar to the temperature ones. In general, they start at the surface from values between 62000µS/cm and 64000µS/cm, then decrease until values of 60500µS/cm (between 6m and 7m).

Dissolved oxygen shows, for most part of samples, values between 7mg/l and 10mg/l and generally remains stable down to 6m. They increase slowly from 6m until the maximum depth. W22 has lower value of DO in comparison to the other samples besides a different trend following the depth.

The pH trends show a very low reduction and all the samples present values between 8.1 and 8.2 pH units and are constant for the whole water column.

Oxygen-reduction potential (Eh) has values always positive and ranging between 170mV and 280mV maintaining a constant trend till the maximum depth. The lowest values are reached by the sampling W37 (around 170mV).

Turbidity values vary between 2NTU and 5NTU and generally slowly decrease from 6m going deeper until the maximum depth.

Chlorophyll graph shows a values variation between <0µg/l and 2.5µg/l, sampling W33 and W12 presents values >4 µg/l for the shallowest part of the water column.

In all collected seawater samples the following analyses results were found:

In the twenty locations Chlorophyll pigments are almost between 0.02µg/l and 1µg/l, as expected in oligotrophic environment. In sampling locations W03, W06 and W011 concentrations for this analyte are below the Detectable Limits (<0.01µg/l).

In the collected samples the Nutrients (Silica, Orthophosphate, Phosphorus, and Nitrite) concentrations are always lower than the Detectable Limits. Ammonium shows values ranging between 11 and 17µg/l, with the highest value in W33 (20µg/l). Only in water location W26 the analyte is below the LoD. Nitrate concentration values were detected in 13 location with a range between 310000 and 320000µg/l. Total phosphorus was detected in 8 water stations with the highest value in W25 (13µg/l) and the lowest in W30 (7.3µg/l).

Concentrations of the metals in water samples are almost all below the detectable limit. Only for Arsenic, Iron and Antimony (highlighted in blue in the tables below) results are recorded in all water locations. In particular, Iron concentration ranging between 14 and 19µg/l; Arsenic has a range between 1.2 and 1.6µg/l; Antimony values range between 0.13 and 0.3µg/l; Manganese was recorded in one water location (W25). Zinc was detected in three stations only (W21, W33, W40), with the highest value in S40 (49µg/l); Lead was detected in four stations, with the highest value in W21 (1.1µg/l); Aluminum was detected in six stations with the highest value of 7.4µg/l in W34 and the lowest one in W28 (4µg/l); Beryllium was recorded in almost all locations except for W34, W35 and W39 ranging between 0.19 and 0.75µg/l; Selenium is always above the LoD except for W22, W23 and W38, showing values between 0.22 and 1µg/l; Vanadium is always above the LoD except for W25 and W33, with a concentration ranging between 1 and 1.5µg/l.

Hydrocarbons C≤ 10 have values almost all below the Detected limit, except for W31, W33, W34, W35, W39 and W40, where the highest detected value was 300µg/l in stations W31 and W40, while the lowest one is in W33 (25µg/l);

In locations W21-W25, W27-W29, W32, W37, W38 Total Hydrocarbons values are below LoD (< 28µg/l). In the other stations analytes were recorded in surface sample of W01 with the highest value of 440µg/l and the lowest one in W33 (28µg/l).

Regarding PAH compounds, are almost all below the Detectable Limits. Pyrene is the only analyte that was detected in almost all locations with a range between 0.0048 and 0.00057µg/l. The highest value is in W36 (0.021µg/l). Very few values are measured for Benzo (g,h,i) Perylene, Indeno (1,2,3 –c,d) pyrene, Benzo (a) Pyrene. All these elements show the highest value in W36. In particular Indeno (1,2,3 –c,d) pyrene was detected in one station only with a value of 0.00075µg/l; Benzo (a) Pyrene was detected both in W31 (0.00036µg/l) and W36 (0.00043µg/l); Benzo (g,h,i) Perylene was detected in W31 with a really low value (0.00033µg/l) and in W36 (0.0051µg/l).

Benzene is above the LoD (< 0,010µg/l) in eleven locations, showing a range between 0.011 and 0.024µg/l; Ethylbenzene and meta - Xylene + para – Xylene show a similar trend. In particular, Ethylbenzene was detected in all the water locations except W40 with values between 0.011 and 0.033µg/l; meta - Xylene + para – Xylene was detected in all stations except W30 and W40 with a trend ranging between 0.029 and 0.08µg/l with the highest value in W24 and the lowest in W27; Toluene was recorded in one station only with a value of 0.15µg/l; Styrene was above the LoD only in stations W31 (0.02µg/l) and W34 (0.027µg/l).

In all the collected samples the THMs compounds concentrations are always below the Detectable Limit, except for Dibromochloromethane, Trichloromethane, Tribromomethane all detected in one station only (W21).
Only one value was measured for Bromodichloromethane, Dibromodichloromethane and Tribromomethane in W01, for Trichloromethane (values are all equal to 1µg/l).

The total of Organoalogenated was detected in only one station with a value of 1 µg/l; while M.T.B.E. analyte was recorded in three stations with the highest value in W37 (0.093µg/l) and the lowest one in W33 (0.07µg/l).

The only detected pesticides was Atrazine in the nearshore Gela water locations. The analyte concentration values show a range between 0.0005 and 0.0011µg/l except for W22-W24, W27, W29, W30, W32, W33, W36, W39 where Atrazine concentration is always below the LoD (0.00050µg/l).

For the aim of the environmental survey, the following indices were requested for Nearshore Gela working area:

- **TRIX** = Trophic Index
- **CAM** = Classificazione Acque Marine (Marine Waters Classification)

TRIX index shows values between 5.2 and 8.5 at almost all stations (taking into account only the mean values of each parameters). These parameters allow evaluating the trophic status of the water column. Most stations are characterized by Poor (Euthopic) seawater status and only few of them are found to be Moderate (Mesotrophic to Eutrophic).

With regard to CAM index, the mean value of Syntetic class is always 3, except for W21 and W28 which show a value of 2.

The complete results are shown in tables below.

Table 6.1 – TRIX Results in Nearshore Gela water locations

Lab Ref.	Station	TRIX index			Ecological water quality status (Qualitative)		
		MIN.	MAX.	MID.	MIN.	MAX.	MID.
19LA0046399	MEW001d_W21	6.8	9.0	8.3	Poor	Poor	Poor
19LA0049288	MEW001d_W22	8.0	8.7	8.3	Poor	Poor	Poor
19LA0049289	MEW001d_W23	6.4	8.7	7.7	Poor	Poor	Poor
19LA0049290	MEW001d_W24	6.8	9.1	8.5	Poor	Poor	Poor
19LA0049291	MEW001d_W25	7.0	8.4	8.1	Poor	Poor	Poor
19LA0049292	MEW001d_W26	6.1	7.8	7.2	Poor	Poor	Poor
19LA0049293	MEW001d_W27	6.0	8.5	7.5	Poor	Poor	Poor
19LA0049294	MEW001d_W28	6.7	8.1	7.6	Poor	Poor	Poor
19LA0049295	MEW001d_W29	6.9	8.8	8.2	Poor	Poor	Poor
19LA0049296	MEW001d_W30	6.8	9.3	8.5	Poor	Poor	Poor
19LA0049297	MEW001d_W31	5.0	6.6	5.6	Moderate	Poor	Moderate
19LA0049298	MEW001d_W32	6.3	8.4	7.7	Poor	Poor	Poor
19LA0049299	MEW001d_W33	6.3	9.0	8.2	Poor	Poor	Poor
19LA0049300	MEW001d_W34	4.8	6.3	5.7	Good	Poor	Moderate
19LA0049301	MEW001d_W35	4.6	6.5	6.0	Good	Poor	Poor
19LA0049302	MEW001d_W36	7.1	8.9	8.0	Poor	Poor	Poor
19LA0049303	MEW001d_W37	4.7	6.2	5.7	Good	Poor	Moderate
19LA0049304	MEW001d_W38	5.1	6.3	5.2	Moderate	Poor	Moderate
19LA0049305	MEW001d_W39	5.2	7.5	6.7	Moderate	Poor	Poor
19LA0049306	MEW001d_W40	4.4	7.1	6.2	Good	Poor	Poor

Table 6.2 - CAM Results in Nearshore Gela water locations

Lab Ref.	Station	CAM – Syntetic class			CAM – "Other seas" class		
		MID.	MIN.	MAX.	MID.	MIN.	MAX.
19LA0046399	MEW001d_W21	2	2	3	6	6	6
19LA0049288	MEW001d_W22	3	3	3	6	6	6
19LA0049289	MEW001d_W23	2	3	2	6	6	6
19LA0049290	MEW001d_W24	3	3	2	6	6	6
19LA0049291	MEW001d_W25	3	3	3	6	6	6
19LA0049292	MEW001d_W26	2	3	2	6	6	6
19LA0049293	MEW001d_W27	2	3	2	6	6	6
19LA0049294	MEW001d_W28	2	2	2	6	6	6
19LA0049295	MEW001d_W29	3	3	2	6	6	6
19LA0049296	MEW001d_W30	2	3	2	6	6	6
19LA0049297	MEW001d_W31	2	3	2	6	6	6
19LA0049298	MEW001d_W32	2	3	2	6	6	6
19LA0049299	MEW001d_W33	2	3	2	6	6	6
19LA0049300	MEW001d_W34	2	3	2	6	6	6
19LA0049301	MEW001d_W35	2	3	2	6	6	6
19LA0049302	MEW001d_W36	2	3	2	6	6	6
19LA0049303	MEW001d_W37	2	3	2	6	6	6
19LA0049304	MEW001d_W38	3	3	2	6	6	6
19LA0049305	MEW001d_W39	2	3	2	6	6	6
19LA0049306	MEW001d_W40	2	3	2	6	6	6

- **Zooplankton and Phytoplankton analysis**

1) Malta – Offshore Italy

Sampling activity was performed from the 5/3/2019 to the 2/5/2019.

For Zooplankton analyses in Malta area, W12 and are those in which the greatest number of individuals has been found. Most of species found belong to Crustacea Copepoda Celanoida taxa. In particular, the most representative species in the whole area is *Paracalanus parvus*.

Phytoplankton samples from both Italy and Malta areas belong to the families Bacillariophyceae and Dinoficeae dominated in all the investigated area.

It's interesting to notice a huge difference in abundance between station S11 and the other investigated stations: in particular laboratories results give an evidence about the high number of individuals belonging to *Navicula sp.* And *Coscinodiscus sp.* Taxa.

The presence of *Chaetoceros pendulus* is to be highlighted at station S11, given that the same was not identified in other stations. The morphological characteristics of the observed organism coincide perfectly with those of *C.pendulus*, which is known to be present in the Mediterranean sea. According to bibliography, its presence in the Mediterranean would not include the Ionian Sea. The proximity of the working area to Ionian sea could justify the absence of the *C.pendulus* in the other environmental stations.

2) Nearshore Gela

Sampling activity was performed from the 8/8/2019 to the 20/8/2019.

For Zooplankton analyses in nearshore Gela area, W36 and W34 samples are those in which the greatest number of individuals has been found. Most of species found belong to Crustacea Copepoda Celanoida taxa. In particular, the most representative species in the whole area is *Paracalanus parvus*.

Phytoplankton samples from nearshore Gela areas belong to the families Bacillariophyceae and Dinoficeae dominated in all the investigated area (as already see in Italian and Maltese waters).

It's interesting to notice a huge difference in abundance between stations W40, W25 and the other investigated stations: in particular laboratories results give an evidence about the high number of individuals belonging to *Pennate spp.* and *Ceratium gibberum* Taxa.

- **Physical, chemical and biological features of sediments**

1) Malta – Offshore Italy

Sampling activity was performed from the 5/3/2019 to the 2/5/2019.

From sediment measurements in situ, pH range in general between 7.2 and 7.9 pH unit and Temperature is for the most part between 15.2°C and 19°C, only few locations are close to 20°C.

Total Hydrocarbons concentrations (C<12) are below the LoD.

In most of the sampling locations Total Hydrocarbons concentrations (C>12) are below or close to 2500µg/kg. Sampling locations near the Italian and Maltese coast show higher concentrations if compared to offshore sampling locations. In stations S1, S2, S3, S4 values ranges between 5600 (S1) and 7400µg/kg (S2, S3). From stations S15 to station S20 general range is between 2700µg/kg and 6400µg/kg except for a subsamples of S16 location that reaches 17000µg/kg.

The PAH compounds have been observed especially in sampling locations close to Italian and Maltese coasts. The trend is very similar for all PAHs analytes. Station S3 shows the highest value for all elements. Also S14 and S17 have values quite far from the average.

The BTEX compounds are always below the LoD, except for Toluene and BTEX in S2, S11, S13, S16 locations, in which anyway very low values (ranging from 0.01 and 0.019 mg/kg) are measured.

Sulphite reducing bacteria do not show a well-defined trend. This analyte is lower than the Detectable Limit (<10MPN/g) in most of the sampling locations. For other samples, except for S20 location that presents a concentration of 2400MPN/g, the general range is between 11MPN/g and 420MPN/g

Fifteen metals have been measured in sediments. Among these, Sb is always below the LoDs. For the remaining ones, a defined trend is observed, except for Vanadium, Tin and Arsenic. In particular Lead shows values between 22 and 7.9 mg/kg; Chromium is in range between 25 and 8.9mg/Kg dry basis; Copper is between 20 and 2.8 mg/kg; Nickel range is between 25 and 2.5mg/Kg dry basis except for station S15 in which value reaches 44 mg/kg; Zinc is in general between 60 and 14mg/Kg dry basis, except for S2, S3, locations in which values till 60mg/Kg dry basis are measured and S4 in which value reaches 75mg/kg; Vanadium is in range between 17 and 55mg/Kg dry basis; Arsenic is in range between 9 and 39mg/Kg dry basis, the highest value is equal to 61mg/Kg dry basis in S11 location; Thallium is below the LoD in two replicates of station S18 and in station S19, in all the other stations it shows really low values ranging between 0.21 and 0.051mg/kg; Tin is always below the LoD except in stations S3, S4, S17 and S18 where values range between 1.4 and 1.1mg/kg; Selenium in range between 2.4 and 0.84mg/Kg dry basis; Mercury shows small value ranges between 0.2 and 0.017mg/kg; Cobalt values are below the LoD only in station S20, in all the others the range is between 9.6 and 1.6mg/kg. Cadmium is in range between 0.17 and 0.051mg/kg. Beryllium values are below the LoD only in station S20, while in all the other locations it is in the range between 0.67 and 0.19mg/kg.

2) Nearshore Gela

Sampling activity was performed from the 8/8/2019 to the 20/8/2019.

From sediment measurements in situ, pH range in general between 6.9 and 7.7 pH unit and Temperature is for the most part between 23.9°C and 29.5°C.

Regarding the grain size classification, all sediments have been classified as *Silty SAND* (S22, S26, S27, S28, S30, S33, S34 and S38), *Sandy SILT* (*S21*, S23), *Sandy Clayey SILT* (S24, S25, S29, S31, S35, S36, S37, S39 and S40) and *Sandy SILT/Silty SAND* (S32). In some stations (S21, S22, S23, S27, S28, S30, S31, S36 and S37) a small percentage of Gravel is present.

In more than half sampling locations Total Hydrocarbons concentrations (C≤12) are above the LoD with a range between 0.48 and 7.1mg/kg. In three (3) stations only values above 5µg/kg were detected and highest one in station S37 (7.1mg/kg).

In most of the sampling locations Total Hydrocarbons concentrations (C>12) are below the LoD. Few samples show value below 3500µg/kg (stations S24, S25 S34 and S37), with the lowest value in S37 (2600µg/kg). The other sampling locations have a range between 4400 and 7500µg/kg which is also the highest detected value (in station S29).

In all sediment locations PCB compounds values are below the LoD, except in station S21 where PCB summation, PCB169 and PCB77 have been detected. In particular, Total PCB value is 0.00054mg/kg, while PCB169 and PCB77 show similar values of 0.00028 and 0.00025mg/kg respectively, both of them very close or equal to the LoD (0.00025mg/kg).

PAH compounds have been observed especially in few sampling locations. The trend is very similar for almost all PAHs analytes and they were detected in only three stations (S21 or S32 only for Naphtalene, S26 and S30), except for Chrysene which is present in seven locations.

Station S21 shows the highest value for all elements, except for Naphthalene where the highest values was detected in station S26.

The BTEX compounds are always below the LoD.

Regarding the Organotin compounds, the Tributyltin were detected only in one sediment location (S26) with a value of 5 µg/kg. In all the other stations the concentration was below the LoD.

Eighteen (18) metals have been measured in sediments. All of them are above the LoD, except for Thallium, Tin, Chromium (VI) and Antimony. For the other elements a defined trend is observed, except for few analytes (Mercury, Arsenic and Vanadium). The highest values were generally detected in stations S31, S38 and S39 except for Nickel and Mercury which show the highest one in station S21. In particular Zinc shows values between 20 and 14mg/kg except for S31, S38, S40, locations in which values more than 25mg/kg were measured; Copper is in the range between 3 and 1.8mg/Kg dry basis, except for stations S31, S38 and S40 where values are above 5mg/kg; Lead measurements are quite closed to those of Copper analyte. Values ranging between 4 and 2.8mg/kg with the highest in S31, S38 and S40 (above 5mg/kg); Aluminum is almost in the range between 2000 and 1100mg/Kg dry basis except for stations S31, S38 and S40 in which values reach 3400mg/kg, 3100mg/kg and3800 mg/kg respectively; Beryllium values are below the LoD only in station S23, S24, S25, S36 and S39, while in all the other locations is in the range between 0.15mg/Kg dry basis and 0.11mg/Kg, except for S31, S30 and S40 where values are above 0.2mg/kg; Selenium shows a range between 1.1 and 0.74mg/Kg dry basis; Iron is in the range between 11000 and 7400mg/Kg dry basis and the highest value is equal to 11000mg/Kg dry basis in S31 and S40 locations; Cobalt shows values ranging between 5.4 and 3.6mg/kg; Cadmium shows really low values ranging between 0.086 and 0.06mg/kg; Chromium has a range between 5.5 and 3.7mg/Kg dry basis, with values above 6.5mg/kg in stations S21, S31, S38 and the highest one in station S40 (8.4mg/kg); Nickel shows a general trend between 7 and 4.3mg/kg with the highest value (16mg/kg) in station S21; Mercury shows really low values ranging between 0.023 and 0.012mg/kg and the highest one is 0.036mg/kg in station S21; Arsenic is in the range between 24 and 14mg/kg; Vanadium values are in the range between 25 and 14mg/kg, with the highest detected value (28mg/kg) in S40.

- **Macrobenthos Analyses**

1) Malta – Offshore Italy

Sampling activity was performed from the 5/3/2019 to the 2/5/2019.

In Malta working area, the species found during the analysis of the samples are: 1) bivalves, 2) gastropods 3) crustaceans 4) pteropods. During their life time they constitute significantly to the zooplankton population and upon death their shells sink to the ocean bed. Empty shells of pteropods constitute a major portion of shallow marine sediments, especially in the tropical and subtropical regions (Herman, 1968); 5) echinoderms 6) brachiopods.

A total of 20 taxa have been found, and include Gastropoda, Bivalvia, Malacostraca, Echinoidea, Scaphopoda, Anthozoa, Polichaeta and Craniata. In particular 12 species and 1 Unknown belong to Gastropoda, 5 species to Bivalvia, and 2 species to Malacostraca, 2 species to Echinoidea, 1 species to Scaphopoda, 1 species to Anthozoa, 1 species and 1 Unknown to Polichaeta and 1 species to Craniata.

All samples were dominated by few species such as *Turritella communis, Nucula nitidosa, Caryophyllia smithii, Echinocyamus pusillus.*

According to the Shannon Weaver H'(log2) indices values vary between 0.5 and 3. The Shannon index increases as both the richness and the evenness of the community increase.

Simpson 1-Lambda' (D) is a measure of dominance, so as D increases, diversity (in the sense of evenness) decreases. With this index, value 0 represents infinite diversity and 1, no diversity. The greater the value of D, the lower the diversity.

The range of Evenness (J') is between 0 and 1, 0 when the taxa belong in one major group and 1 when the species belong to different groups.

Margalef's index (D), indicates that when the species number increases in a sample, D also increases.

AMBI Index has values between 0 and 2.5. The results make evidence about the health of benthic communities and the High ecological status of each station except for S12 and S13 that is classified as Good.

M-AMBI has values between 0.5 and 1. The ecological status is high and good except for S15 and S20 where it's moderate, with values of 0.580 and 0.550.

BENTIX ranges between 0.4 and 5. Location S12 and S18 shows low values indices of a poor ecological status of the area.

2) Nearshore Gela

Sampling activity was performed from the 8/8/2019 to the 20/8/2019.

In nearshore Gela working area, the species found during the samples analysis are: 1) bivalves, 2) gastropods 3) crustaceans 4) polychaetes 5) scaphopods.

A total of 21 taxa have been found, and include Gastropoda, Bivalvia, Malacostraca, Scaphopoda and Polichaeta. In particular 4 species belong to Gastropoda, 11 species to Bivalvia.

A total of 20 taxa have been found, and include Gastropoda, Bivalvia, Malacostraca, Echinoidea, Scaphopoda, Anthozoa, Polichaeta and Craniata. In particular 12 species and 1 Unknown belong to Gastropoda, 5 species to Bivalvia, and 2 species to Malacostraca, 2 species to Echinoidea, 1 species

to Scaphopoda, 1 species to Anthozoa, 1 specie and 1 Unknown to Polichaeta and 1 species to Craniata.

According to the Shannon Weaver H'(log2) indices values vary between 0.971 and 2.845.

Simpson 1-Lambda' (D) values are between 0.143 and 0.520.

The range of Evenness (J') is between 0.627 and 1.000.

Margalef's index (D) values are between 0.256 and 1.489

AMBI Index values are between 0 and 1.2. The result obtained is an Unpolluted site with a normal benthic community health in S22 (II replicate), S26 (I replicate), S39, R01-R02 (I replicate) and an impoverished benthic community in all the other stations.

M-AMBI values range between 0.5 and 1.0. The result indicates that ecological classes in Stations S22, S26, S34, R01, R02, R00, S30 (II replicate), S38 (I replicate) are moderate, while in stations S30 (I replicate), S33-S38 (II replicate), and S39 are classified as good; only in station S33 (I replicate) the ecological status is moderate.

BENTIX values are between 0.5 and 5.7. According to index values, sampling sites are pristine in S22, R00, S30-S39 (II replicate); Slightly polluted in S38, S39 (I replicate), R01 (II replicate); Moderate polluted in S30 (I replicate), S34 and R02 (II replicate); Heavily polluted in R01-R02 (I replicate), S26 (II replicate) and Extremely polluted/Azotic in station S33 and S26 (I replicate).

7.0.0 SUMMARY AND CONCLUSIONS

This section presents a summary of the conclusions drawn by evaluation of both visual inspections and laboratory testing on the collected water and sediment samples.

A thorough comparison between literature and acquired data was carried out. It can herein be concluded that the environmental features expected to be found along the surveyed corridor have been confirmed. Details are summarised in 7.1.0.

Moreover, a comprehensive set of laboratory analyses was carried out, following the collection of the samples. This allowed comparing the conditions of the environment at this stage with the Environmental Quality Standards defined by the regulations in place. Generally, major deviations from the values defined by the regulations have not been found. Details of the comparison is summarised in 7.2.0.

Finally, a summary of the environmental assessment associated with the status of Natura 2000 and SIN sites along the route is presented in 7.3.0.

7.1.0 Visual Inspection and Biodiveristy Monitorning

The visual inspection for the Environmental and biodiversity analysis has been done along the corridor for the nearshore Gela, the offshore Gela-Malta and for the nearshore Maltese waters.

The SSS interpretation has been confirmed by ROV survey inspection. In particular:

- The *Cymodocea nodosa* area was identified from KP 0.643 to KP 7.273 in Gela Nearshore area. The seafloor is covered by fine sediment and marine vegetation (*Cymodocea nodosa*). The distribution of the marine vegetation is variable throughout the area, being denser in some areas.
- The offshore route corridor (From KP 9.705 to KP 148.971) crosses the circalittoral zone. This region extends from the lower limit of the infralittoral to the maximum depth at which photosynthesis is still possible. The sandy sea bottom is characterized by bioturbations and burrows. It represents a marine environment characterized by typical coralligenous outcrops and maerl beds.
- The area offshore Sicily (from KP 9.705 to KP 84.8) is characterized by a sandy featureless seafloor with many burrows and burrow specimens. The sandy seafloor is interspersed by outcrops and bioconstructions.
- From KP55.600 to KP58.800 two ridges, east of the basic design route, were detected by geophysical survey. These ridges show steep rocky slopes and a flat but rough top. The ROV inspection over the top of the smaller ridge showed the presence of soft fine sediment in alternation to coarse grained sediment. It pointed out the occurrence of crust and slabs of hard-substrata. The images also showed the presence of small-scale reliefs with irregular shape. These are associated to carbonate cemented build-ups. The most striking feature was the rich occurrence of benthic fauna in hard-substrata in particular the abundance of the gorgonian *Callogorgia verticillata*. These features were in accordance to Savini et al., 2009.
- From KP 41 to KP 62 Flora and Fauna species coverage is very low with respect to the upper layers (Infralittoral zone). Circalittoral bedrock biocenosis has been found where areas of rocky outcrops were detected by the geophysical survey.
- The area offshore Malta (from KP 84.8, which is the limit between Italy and Maltese Territorial waters) shows both benthic and pelagic environment similar to the one described above for sandy seafloor. The presence of outcrops areas showed the presence of coralligenous

biocenosis and other sensible habitats. In particular from KP 106 and KP 106.8, with a depth of about 140m.

- From KP 129.5 to KP 134.5 the sandy seafloor is replaced by rock. The seabed structures in this area are characterized by circalitoral biocoenosis that consist of sediments and shells that form small aggregates with little biodiversity associated with them. These biocenoses show limited coverage and are characterized by few taxa.
- From KP 137.5 to KP 144 all outcrops identified by the geophysical survey were confirmed by visual inspection. Biocenosis assemblages better known as 'maerl' were recognized. Maerl is characterized by accumulations of unattached, calcareous rhodophytes which take the form of either twig-like thalli, or ones encrusting some solid but mobile granule, usually a stone or shell (Borg et al., 1998). Around 80 meters depth coralligenous and maerl biocenoses were found.
- From KP 145 to KP 146.5 the depth ranged around 100-115 meters highlighting the dominance of a sandy seafloor (interspersed with spotted outcrops). The biodiversity and the environment is similar to the one described above at the same depth range.
- From KP 147.0 to KP 148 the area identified as "Pinnacles area" after SSS mosaic interpretation showed that the whole seafloor is almost characterized by outcrops. In this region, depth ranges around 100m with quite a various fauna characterized by the presence of coralligenous biocenosi.
- From KP 148 to KP 149 the depth ranges between 65 and 80 meters of depth. The seabed shows an alternation of sandy and rocky seafloor. The biodiversity is quite similar to the one explained above, but it's interesting to note the presence of the green algae which is an evidence of the environmental change going closer to the coastal area.
- In the nearshore Malta waters, *Posidonia* prairie have been detected down to 40-42 metres of depth. Locally *P. Oceanica* seagrass was colonized and replaced by *C. nodosa*. These Phanerogram meadows were always associated with other photophilic species and various algal specimens. The associated biodiversity (benthic, demersal and pelagic organisms) is varied and abundant, as expected for coralligenous and maerl biocenosi.

From KP 149 till the coast, the nearshore Malta environment show the presence of extended praire of *P. Oceanica.* The distribution of seagrass is almost continuous and always associated with different species of green and brown algae. The only exception where scattered vegetation is present, it is where *Posidonia* seagrass is replaced by *Cymodocea nodosa*. Patches of *Posidonia Oceanica* are settled on both sand and rock, with leaves colonised.

7.2.0 Environmental survey results

This paragraph presents the conclusions associated with the chemical analyses results. Wherever possible, a comparison between survey results and the environmental quality standards (EQS), defined by European and/or local regulations, allowed evaluating Maltese and Italian sampling stations.

In the Italian side: for the chemical state assessment, a list of *Environmental Quality Standards for priority substances and certain other pollutants* are established by Directive 2008/105/EC. As specified in 3.1.0, Directive 2008/105/EC was amended by Directive 2013/39/EU. At a regional level, the directives have been summarised within DM 2009/14 n.56, specific for coastal areas. The latter is therefore applicable to Gela nearshore and offshore Italy sediments.

The European EQSs and the MAC (Maximum Allowable Concentration) specified in the directives allowed a comparison with the results obtained during offshore and nearshore surveys.

In the Maltese side: for water locations a comparison with MAC – EQS standard values specified in Directive 2013/39/EU is presented within this conclusions.

Malta has not yet established Environmental Quality Standards (EQS) for sediments and thus, in order to carry out an indicative conclusion, a comparison analysis took into account the EQS's established in Italy (Decreto n.56/2009). The Italian quality standards were derived on the basis of field and laboratory ecotoxicology data. This approach is in line with the 2nd Water Catchment Management Plan for the Malta Water Catchment District.

- Sea water samples

1) Offshore Italy - Malta

Seawater Environmental Quality Standards are reported in Table 7.1. In the present Directive (2013/39/EU), EQS values are reported to evaluate the chemical marine water status. After checking the "*list of priority substances in the field of water policy*", it is to be highlighted that nutrients are not included. Analyses included both chemical and nutrient in Italy, with the latter being analysed in Malta.

Table 7.1 - Environmental Quality Standards (EQS); Directive 2013/39/EU

Determinant	AA – EQS [µg/l]	MAC – EQS [µg/l]	Determinant	AA – EQS [µg/l]	MAC – EQS [µg/l]
Aluminum	-	-	Hydrocarbons C<= 10	-	-
Antimony	-	-	Total hydrocarbons	-	-
Silver	-	-	Benzo (a) anthracene	-	-
Arsenic	-	-	Benzo (a) pyrene	1.7×10^{-4}	0.027
Beryllium	-	-	Benzo (b) fluoranthene	1.7×10^{-4}	0.017
Cadmium	0.2	≤ 0,45 (Class 1) 0,45 (Class 2) 0,6 (Class 3) 0,9 (Class 4) 1,5 (Class 5)	Benzo (k) fluoranthene	1.7×10^{-4}	0.017
Cobalt	-	-	Benzo (g,h,i) perylene	1.7×10^{-4}	8.2×10^{-4}
Chromium	-	-	chrysene	-	-
Chromium (VI)	-	-	Dibenzo (a,h) anthracene	-	-
Iron	-	-	Indeno (1,2,3 - c,d) pyrene	1.7×10^{-4}	not applicable
Mercury	-	0.07	Pyrene	-	-
Nickel	8.6	34	Benzene	8	50
Lead	1.3	14	Ethylbenzene	-	-
Copper	-	-	Styrene	-	-
Selenium	-	-	Toluene	-	-
Manganese	-	-	meta - Xylene + para - Xylene	-	-
Thallium	-	-	Bromodichloromethane	-	-
Zinc	-	-	Dibromodichloromethane	-	-
1,2 – Dichloroethane	10	not applicable	Tribromomethane	-	-
Sum Organoalogenated	-	-	Trichloromethane	-	-

Notes:

AA: annual average.
MAC: maximum allowable concentration.
EQS: Environmental Quality Standard

As it possible to notice, the Decree does not include the EQC for all the analyzed parameters. Therefore, the comparison was carried out when a value was available. Conclusions are summarised below:

About metals analytes, Cadmium was detected in one station (W10) and only in the superficial sample with a value of 0.8µg/l which is higher than AA – EQS value reported in Table 7.1. Mercury was recorded in two stations (W04 and W10) and both values exceed the maximum allowable concentration indicated in Directive 2013/39.

About Total Hydrocarbons, values are not reported in the Directive.

Some PAH compounds elements are reported in table above; Only Benzo (g,h,i) Perylene shows values above the maximum allowable concentration; in particular the half depth sample (in station W01) has a values of 0.0048µg/l; in station W03 this analyte was recorded in two depths with values of 0.0014 and 0.001µg/l.

With reference to the BTEX, THM compounds, values for neither Sum Organoalogenated nor 1,2-Dichloroethane are reported in the present Directive.

2) Nearshore Gela

Seawater Environmental Quality Standards included within the Directive considered for nearshore Gela are reported in Table 7.2.

Table 7.2 - Water Quality Standards; Dm 14 Aprile 2009, n.56

Determinant	Squa – MA [µg/l]	Squa – CMA [µg/l]	Determinant	Squa – MA [µg/l]	Squa – CMA [µg/l]
Aluminum	-	-	Hydrocarbons C<= 10	-	-
Antimony	-	-	Total hydrocarbons	-	-
Silver	-	-	Benzo (a) anthracene	-	-
Arsenic	5	-	Benzo (a) pyrene	0.05	0.1
Beryllium	-	-	Benzo (b) fluoranthene	= 0.03	-
Cadmium	0.2	≤ 0,45 (Class 1) 0,45 (Class 2) 0,6 (Class 3) 0,9 (Class 4) 1,5 (Class 5)	Benzo (k) fluoranthene	-	-
Tin	-	-	Benzo (g,h,i) perylene	= 0.002	-
Cobalt	-	-	chrysene	-	-
Chromium	4	-	Dibenzo (a,h) anthracene	-	-
Chromium (VI)	-	-	Indeno (1,2,3 - c,d) pyrene	-	-
Iron	-	-	Pyrene	-	-
Mercury	0.01	0.06	Benzene	8	50
Nickel	20	-	Ethylbenzene	-	-
Lead	7.2	-	Styrene	-	-
Copper	-	-	Toluene	1	-
Selenium	-	-	meta - Xylene + para - Xylene	-	-
Manganese	-	-	Dibromochloromethane	-	-
Thallium	-	-	Tribromomethane	-	-
Vanadium	-	-	Trichloromethane	2.5	-
Zinc	-	-	Atrazine	0.6	2
Sum Organoalogenated	-	-	M.T.B.E.	-	-
Notes:					

Squa - MA: Environmental Quality Standard - annual average.
Squa - CMA: Environmental Quality Standard - maximum allowable concentration.

As already specified for the offshore section, not all parameters are reported in the present decree.

About metals analytes, Lead concentration is always above the reference value; Nickel and Mercury were below the LoD (< 0,40 µg/l) at all stations.

PAHs compounds are almost all below the LoD, except for Pyrene and Indeno (1,2,3 – c,d) pyrene which are not reported in the decree. Benzo (a) Pyrene values are always below the maximum allowable concentration; Benzo (g,h,i) perylene was detected in two stations only (W31, W36) and in W36 the detected value is higher than Squa – MA reported in table above.

About BTEX compounds, Toluene was detected in station W34 only with a value below the Squa – MA reported in table above; Benzene was recorded at almost all stations, with values below the maximum allowable concentration.

THMs compounds were detected in one station only and Chloroform (the only one reported in the present decree) was below the CMA.

The Sum Organoalogenated and M.T.B.E. compounds are not reported in the standard values defined within the decree.

With reference to Organochlorine pesticides, only Atrazine was recorded, at almost all stations, with values always below the CMA.

- Sediment samples

1) Offshore Italy - Malta

Sediment Environmental Quality Standards considered for Maltese and Italian survey locations are reported in Table 7.3. Evaluation of the status of the sediments is generally quite complex; for this reason, in the decree, a deviation of 20% from the standard value is allowed to evaluate a good environmental chemical status.

As already specified above, not all parameters are reported in the present decree and the comparison is carried out wherever possible.

With regard to metals, Arsenic exceeds the reference value in some stations (S1-S7, S9-S16, two depth of S17, S19 and S20) as well as Nickel in station S15. All the other metals do not reach the standard values or their values are not present in the list of DM n.56.

Total Hydrocarbons standard concentrations are not present in the list of DM n.56.

About PAH compounds: some of them are not present in the list of DM n.56 (Table 7.3). All the other elements do not exceed the reference limits in most locations, except for S3 and S14. In particular: both Benzo (g,h,i) perylene and Indeno (1,2,3-c, d) pyrene exceed the reference value in station S3 (180µg/kg and 170µg/kg respectively); Benzo (a) pyrene is above the Squa – MA in station S3, S14 (mid depth) and S17 (Surface samples); Benzo (b) fluoranthene is above the reference value only in station S3. Benzo (k) fluoranthene is above the Squa – MA in station S3, S17 (mid depth), S19 (superficial sample). Anthracene, Fluoranthene and Naphthalene show values higher than Squa – MA only in station S3.

BTEX concentration values are not present in the list of DM n.15.

Table 7.3 - Sediment Quality Standards; Dm 14 Aprile 2009, n.56 – Considered for Offshore Italy and Malta

Determinant	Squa – MA [mg/kg]	Determinant	Squa – MA [mg/kg]
Antimony	-	Benzo (a) anthracene	-
Arsenic	12	Benzo (a) pyrene	30
Beryllium	-	Benzo (b) fluoranthene	40
Cadmium	0.3	Benzo (g,h,i) perylene	55
Cobalt	-	Benzo (k) fluoranthene	20
Chromium	50	chrysene	-
Mercury	0.3	Dibenzo (a, h) anthracene	-
Nickel	30	Indeno (1,2,3-c, d) pyrene	70
Lead	30	Pyrene	-
Copper	-	Anthracene	45
Selenium	-	Fluoranthene	110
Tin	-	Naphthalene	35
Thallium	-	Benzene	-
Vanadium	-	Ethylbenzene	-
Zinc	-	Styrene	-
Hydrocarbons C<=12	-	Toluene	-
Hydrocarbons C>12	-	m, p - xylene	-
Xylene	-	o - Xylene	-
BTEX (aromatic hydrocarbons)	-		-

Notes:

Squa - MA: Environmental Quality Standard - annual average.
µg /kg - PAH compounds unit.

2) Nearshore Gela

Sediment Environmental Quality Standards considered are reported in Table 7.4.

About metals analyses, some of them are not reported in the decree n.56. The other elements show values not exceeding the reference limits shown in table below, except for Arsenic which is higher than Squa – MA in all sediment locations.

Total Hydrocarbons concentration's values are not present in the list of DM. n.56.

About PAH compounds, they were detected in few stations and some of them are not present in the decree. All the others analytes do not exceed the reference limits shown in table below, except for Anthracene which is close to the reference value reported in DM. n.56.

BTEX compounds and Methylmercury are below the LoD in all sediment stations.

About Tributyltin, it was detected in only one station (S26), reaching the reference value shown in DM 56/2009 (Table below).

Table 7.4 - Sediment Quality Standards; Dm 14 Aprile 2009, n.56

Determinant	WHO TEF	Squa – MA [mg/kg]	Determinant	Squa – MA [mg/kg]
Aluminum		-	Hydrocarbons C≤12	-
Antimony		-	Hydrocarbons C>12	-
Arsenic		12	Benzo (b) fluoranthene	40
Beryllium		-	Benzo (g,h,i) perylene	55
Cadmium		0.3	Benzo (k) fluoranthene	20
Cobalt		-	chrysene	-
Chromium (VI)		2	Dibenzo (a, h) anthracene	-
Chromium		50	Indeno (1,2,3-c, d) pyrene	70
Mercury		0.3	Pyrene	-
Nickel		30	Anthracene	45
Lead		30	Fluoranthene	110
Copper		-	Naphthalene	35
Selenium		-	Benzene	-
Tin		-	Ethylbenzene	-
Thallium		-	Styrene	--
Vanadium		-	Toluene	-
Zinc		-	m, p - xylene	-
Iron		-	o - Xylene	-
Total PCB		8	Benzo (a) anthracene	-
PCB 169	0.03		Benzo (a) pyrene	30
PCB 77	0.0001		Tributyltin	5

Notes:

Squa - MA: Environmental Quality Standard - annual average.
µg /kg – PAH, PCB and Organotin compounds unit
WHO TEF: World Health Organization - Toxic equivalency factor

7.3.0 SIN and Natura 2000 areas

The combined interpretation of geophysical data (SSS, SBP and MBES), seabed samplings and ROV visual inspection analyses allowed the definition of the main sensitive marine habitats. The obtained results have been compared with the biodiversity and all biocenoses we expected to find in Natura 2000 sites. Results of Environmental and MMO surveys were also taken into account to proceed with a final discussion focalized on:

1) Natura 2000 site "Torre Manfria, Biviere e Piana di Gela" (ITA050012);

2) Natura 2000 site "Żona fil-Baħar tal-Grigal" (MT0000107);

3) Natura 2000 site "Żona fil-Baħar fil-Lvant" (MT0000108);

4) Natura 2000 site "Żona fil-Baħar fil-Lbiċ" (MT0000111).

More information about restricted areas, marine protected areas and sensitive areas were described in MEW001_WP2_SOGECORA_FINAL_REV01.

7.3.1 ZPS ITA050012 "Torre Manfria, Biviere e Piana di Gela"

The geotechnical and environmental sampling areas are included in the "Sandbanks with weak permanent cover of sea water" habitat type (Code 1110), is characterized by:

Table 7.5 – ZPS ITA050012 (Habitat type)

Habitat type	Cover (%)	Representatively	Relative surface	Conservation	Global
Sandbanks which are slightly covered by sea water all the time	2.14	C: Significant	0-2%	B: Good	B: Good

This habitat extends along Gela coast and from 3m down to almost 20m of depth (Figure 7.1). Despite this area being considerably conditioned by the strong anthropization, it has a significant naturalistic-environmental interest, as it preserves different floristic entities.

For the aim of this study it is considered useful the presence of *C. nodosa* along the coast as reported in figure below:

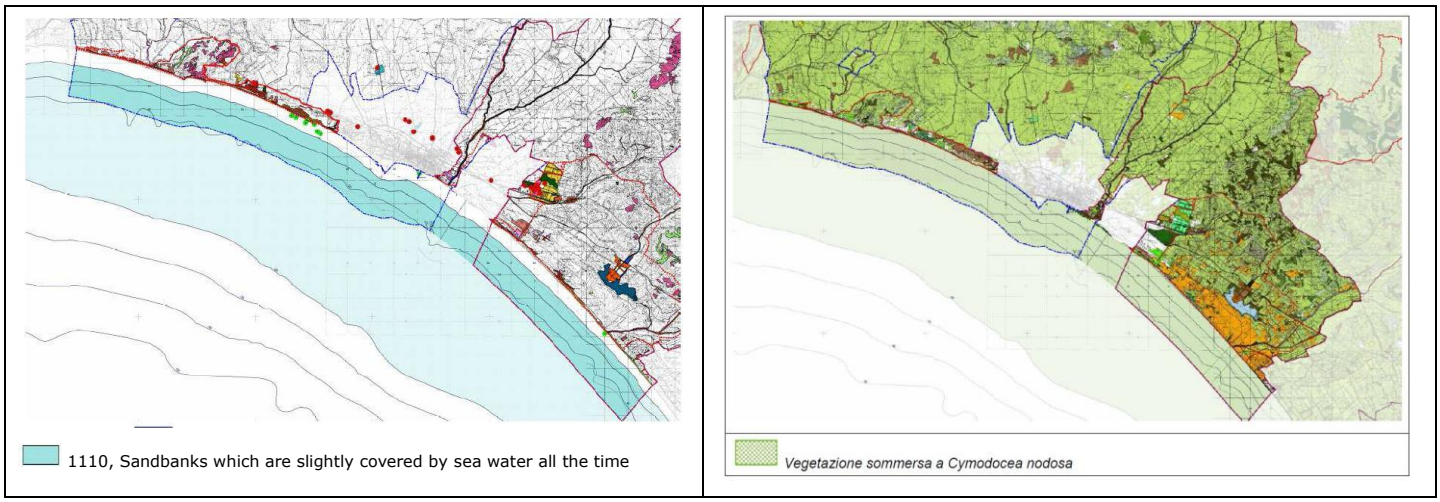


Figure 7.1 – Gela Habitat and Vegetation Maps (Management Plan)

The vegetation map in Figure 7.1 shows the presence of *C.nodosa* along Gela coast down to 20m of depth maximum.

This limit was also confirmed by the Geophysical survey and ROV visual inspection (see MEW001_GEOPHY_FINAL_REPORT_REV00).

Moreover, the species list recorded in Natura2000 network, points out 2 species: *Caretta caretta* (IUCN Red list – Endangered*)* and *Tursiops truncates* (IUCN Red List - Near Threatened). Dolphin's individuals were also detected during our MMO survey.

7.3.2 Natura 2000 Malta Sites

In Maltese waters, the route crosses three zones identified with different codes (MT0000107, MT0000107 and MT0000111). Each site is classified as Bird Directive Site (SPA). During MMO survey, only *Caretta caretta* and *Tursiops truncates* individuals were detected; however, no bird species have been sighted.

Furthermore, during visual surveys, sensitive and protected habitats which are typical of Maltese biocenoses (coralligenous, maërl beds, *Posidonia oceanica* meadows), were detected as described in 5.4.0 and in MEW001_WP2_POSMH_Draft of Final_REV01.

8.0.0 REFERENCES

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T. http://www.justiceservices.gov.mt/DownloadDocument.aspx?app=lp&itemid=27255&l=1
U. http://www.justiceservices.gov.mt/DownloadDocument.aspx?app=lom&itemid=11485&l=1
V. http://www.justiceservices.gov.mt/DownloadDocument.aspx?app=lom&itemid=12446&l=1
W. http://www.justiceservices.gov.mt/DownloadDocument.aspx?app=lom&itemid=11497&l=1
X. http://www.justiceservices.gov.mt/DownloadDocument.aspx?app=lom&itemid=11500&l=1
Y. http://www.justiceservices.gov.mt/DownloadDocument.aspx?app=lom&itemid=11506&l=1
Z. http://www.justiceservices.gov.mt/DownloadDocument.aspx?app=lom&itemid=11538&l=1
AA. http://www.justiceservices.gov.mt/DownloadDocument.aspx?app=lom&itemid=11548&l=1
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JJ. https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=URISERV:l28050&from=EN
KK. https://www.cms.int/sites/default/files/instrument/CMS-text.en_.PDF
LL. http://www.rac-spa.org/sites/default/files/protocole_aspdb/protocol_eng.pdf
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9.0.0 APPENDIX A – MMO REPORT

The Marine Fauna Observer Report is attached in digital format to this report.

10.0.0APPENDIX A – ARPA SAMPLING CERTIFICATE