Physical Loss & Physical Damage

1.1 Introduction

The EU Marine Strategy Framework Directive (hereinafter referred to as 'MSFD') calls for the assessment of physical loss and physical damage as pressures on the environmental status of marine waters. While the definitions of physical loss and physical damage are not specified, Annex III of the Directive implies that physical loss is generally a result of sealing and smothering by man-made structures or disposal of dredge spoil; while physical damage is attributed to changes in siltation and abrasion of the seabed.

Physical loss and physical damage are not directly linked to the descriptors of Good Environmental Status (GES) listed in Annex I of the Directive, however such pressures could hamper the achievement of GES particularly in terms of MSFD Descriptors 1[1] and 6[2].

This report provides a brief description of anthropogenic activities in Malta which could be associated with physical loss and physical damage.

1.2 Existing legislation

Given the wide range of activities associated with physical loss and physical damage, existing legislation deemed relevant to the different activities are described in sections below when appropriate.

1.3 Physical Loss

In accordance with Annex III of the MSFD, physical loss is associated with sealing from permanent construction, and smothering by man-made structures or disposal of dredge spoil. This section provides a brief overview of disposal of inert waste and construction at sea.

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[1] Descriptor 1: Biological diversity is maintained. The quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climatic conditions

[2] Descriptor 6: Sea-floor integrity is at a level that ensures that the structure and functions of the ecosystems are safeguarded and benthic ecosystems, in particular, not adversely affected.

1.3.1 Disposal at sea

Disposal at sea in Malta is permitted for specific types of waste streams and within a designated 'spoil ground' (Figure 1).

The type of waste which can be disposed at sea includes dredged material, inert geological material and spoilt cargo (considered suitable for disposal at sea). Disposal at sea is regulated in terms of the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972 (London Convention) and the Convention for the Protection of the Mediterranean Sea Against Pollution, 1976 (Barcelona Convention) and its Protocols. Disposal at sea is subject to a permitting procedure in terms of the Waste Regulations 2011 published by Legal Notice 184 of 2011 (transposing Directive 2008/98/EC on waste and repealing certain Directives).

Malta's draft Waste Management Plan[3], which at the time of writing this report was at public consultation stage, indicates that the majority of inert material disposed at sea originates from construction and demolition projects on land. The amount of such waste disposed at sea during the period 2004-2011 is indicated in Table 1.

During the period 2007-2011, approximately 1 million tonnes of waste was disposed at sea. In 2007-2009 the majority of the waste constituted clean geological material originating from construction and demolition projects on land, while in 2010-2011, the majority of the waste disposed at sea constituted dredged material. In 2010, 353 tonnes of spoilt cargo (grain) were also disposed at sea[4].

[3] Waste Management Plan for the Maltese Islands: A Resource Management Approach 2013-2020 – Consultation Document October 2013

[4] Waste Management Plan for the Maltese Islands: A Resource Management Approach 2013-2020 – Consultation Document October 2013

Figure 1: Location of spoil ground

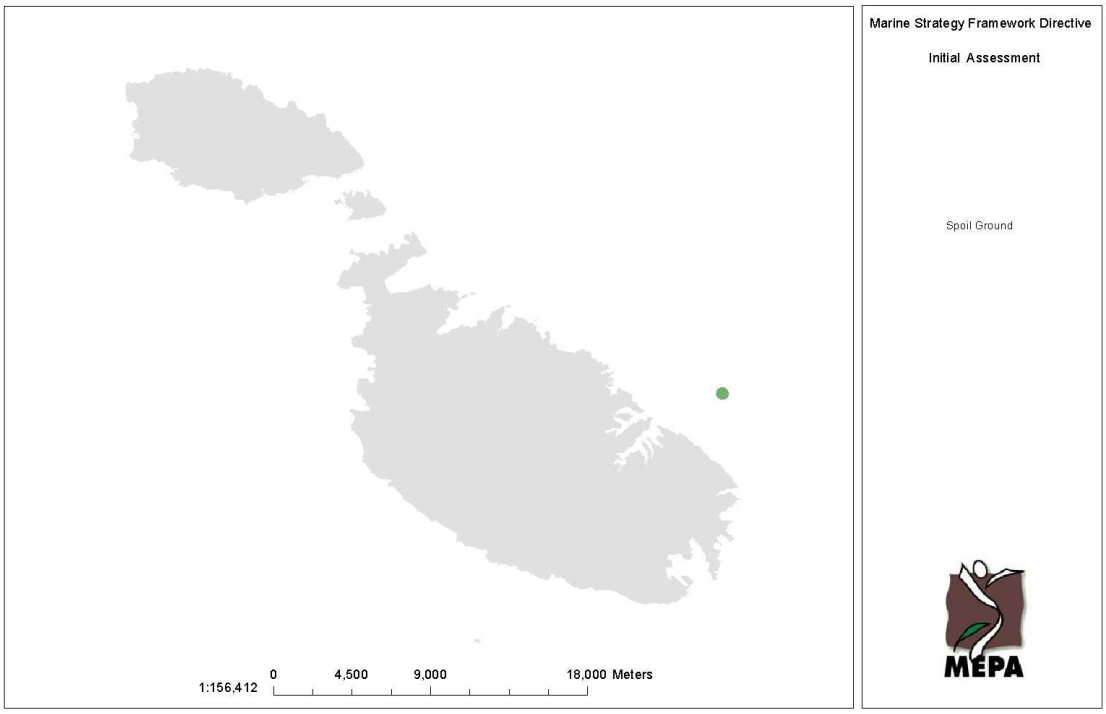

Table 1: Amount of waste generated from construction on land disposed at sea[5]

Year	Amount of inert waste generated by construction on land and disposed at sea (tonnes)
2004	210404
2005	357942
2006	329426
2007	146205
2008	300360
2009	74370
2010	290120
2011	149120

[5] Waste Management Plan for the Maltese Islands: A Resource Management Approach 2013-2020 – Consultation Document October 2013

In terms of impacts associated with disposal at sea, a preliminary survey of the seabed at the designated spoil ground and surrounding area[6] indicates significant alterations to the seabed where spoil has been dumped.

The seabed in this area is predominantly characterised by soft sediments and supports two main types of assemblages: the biocoenosis of circalittoral muds and sands and coralligenous biocoenosis, both of which were deemed to be impoverished[7]. The natural characteristics of the spoil ground and surrounding areas have been altered and the area is characterised by very large boulders and unconsolidated terrigenous material together with a variety of anthropogenic material. The largest accumulations of dumped material were located within the designated spoil ground, however distribution of spoil extended beyond the designated area.

Of particular note are the turbid conditions recorded throughout the surveyed area which conditions were attributed to the presence of fine sediments and other particulate matter originating from the regular spoil dumping activities. Such turbid conditions are a result of continuous sedimentation resulting both from fallout during dumping as well as re-suspension of sediment from the bottom. While such conditions are not necessarily associated with physical loss, increase in turbidity would generally result in physical damage to the benthic habitats.

The Programme of Measures put forward as part of the requirements of the EU Water Framework Directive[8] includes two measures related to the monitoring of the disposal of waste and assessment of the impacts associated with the designated spoil ground. These measures are reproduced hereunder:

- ***Monitor dumping operations at the spoil ground***
  The monitoring of the spoil ground is necessary to ensure that it is being operated in accordance with current regulations and does not pose a significant threat to the marine environment.
- ***Study the impacts of the national spoil ground off Xgħajra***
  This measure calls for a study on the impacts of the dump site on the water and sediment quality as well as on species and habitats.

Implementation of these measures should ensure minimisation of impacts from waste disposal at sea.

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6 Borg, J.A. & Schembri, P.J. (2008) Report of a survey of the physical and biological characteristics of the seabed at the marine spoil ground and surrounding area, off the Grand Harbour, Malta;

7 Borg, J.A. & Schembri, P.J. (2008) Report of a survey of the physical and biological characteristics of the seabed at the marine spoil ground and surrounding area, off the Grand Harbour, Malta;

8 http://www.mepa.org.mt/file.aspx?f=5832

1.3.2 Construction at sea

Construction at sea in Malta is mostly associated with port operations or development of marinas. Therefore the majority of the construction works are restricted to harbour or port areas. Development other than that related to port operations or marinas, as implied by an assessment of development permit applications submitted in the period 2000-2010, mainly pertains to small construction works such as construction of new slipways, ramps and quays and is not deemed to have a significant impact in terms of physical loss.

In July 2013, the Government of Malta issued a call for an expression of interest for land reclamation proposals. The relevant and applicable environmental assessments will be carried out, once Government decides on the possible projects that could in principle be accepted.

To date, no construction works have been carried out in offshore waters with the exception of the laying down of cables. Although this type of development may lead to some physical loss, the impact is considered to be localised and some habitats are able to recover. For example, macroalgae are likely to recolonise the disturbed areas.

The possibility for the development of offshore renewable energy installations cannot be excluded at this stage. At the time of writing this report, a development permit application for the development of a wind farm located on the North-East coast of Malta is pending environmental assessment. Such development could also lead to physical loss of marine habitats.

1.4 Physical Damage

Annex III to the EU Marine Strategy Framework Directive indicates that physical damage occurs as a result of:

(i) changes in siltation as a result of outfalls, increased run-off and dredging/disposal of dredge spoil;
(ii) abrasion as a result of impact on the seabed from commercial fishing, boating and anchoring;
(iii) Selective extraction for example exploration and exploitation of living and non-living resources on seabed and subsoil

This section provides a brief description of activities in Malta which could lead to physical damage in the marine environment.

1.4.1 Anchoring and Mooring (including bunkering areas and marinas)

Anchoring in Malta is mainly associated with recreational boating which is particularly intense in enclosed bays during the summer months and at important diving sites[9]. Currently, there are no designated anchoring zones in Malta, with the exception of one anchoring zone in Comino which is designated on a yearly basis (Figure 2). Nevertheless, impacts on benthic habitats in specific areas due to anchoring have been implied by published literature[10,11]. Studies on one of the typical species associated with *Posidonia oceanica* meadows, *Pinna nobilis*, carried out within Marine Protected Areas at Rdum Majjiesa – Ras ir-Raheb, the marine area off Mgarr ix-Xini (Gozo) and the marine area in Dwejra also refer to the potential impacts of anchoring on such species within these areas[12].

Figure 2: Anchoring zone designated on a yearly basis through Notices to Mariners

[9] Anchoring at dive sites is generally via continuous trawling of small anchors (Mr. Robert Vella, MEPA, personal communication)

[10] Borg, J.A.; Gauci, M.J.; Magro, M. & Micallef, M. 2006 Environmental Monitoring at St George's Bay (Malta) in connection with Beach Replenishment Works 2nd International Conference on the Management of Coastal Recreational Resources Beaches, Yacht Marinas and Coastal Ecotourism. 25-27th October 2006, Gozo, Malta.

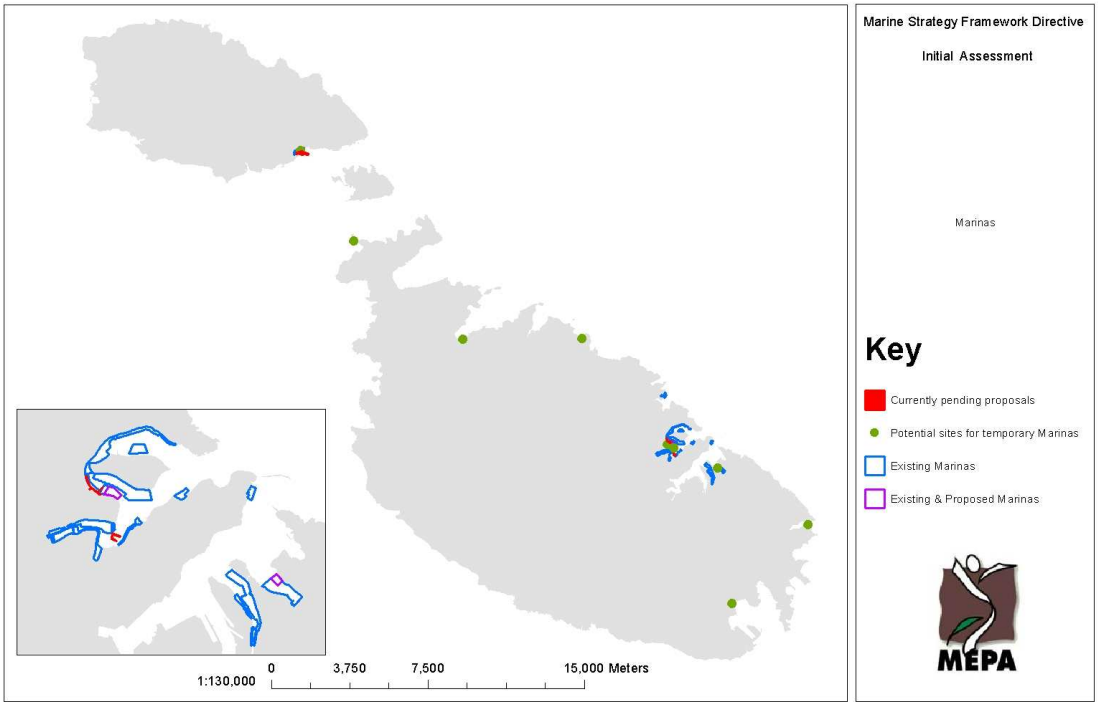
[11] Borg, J.A. & Schembri P.J. (1995): The state of *Posidonia oceanica* (L.) Delile meadows in the Maltese Islands (Central Mediterranean); Rapp Comm int Mer Medit 34 p123

[12] Ecoserv 2012 Study on the Noble Pen Shell (*Pinna nobilis*) populations in three Marine Protected Areas in Malta: marine area between Rdum Majjiesa to Ras ir-Raheb; marine area in the limits of Mgarr ix-Xini (Gozo) and marine area in the limits of Dwejra (Gozo). MEPA call for tenders: T 04/2011

Malta is seeking the growth of the yachting industry through the possible development of new permanent marinas and establishment of temporary marinas to address the need of additional berths[13]. Development of permanent marinas would necessitate the construction of permanent infrastructure at sea, which in shallow waters would be generally associated with environmental impacts. Due to such environmental constraints, most of the locations identified by Malta Maritime Authority (2009)[14] are within existing harbour areas. Temporary marinas on the other hand would involve the installation of temporary pontoons accommodating between 50-100 boats in the summer season, which pontoons would be stored away on land during the winter months (Figure 3).

Such additional berthing could increase pressures on the marine environment in terms of physical damage caused by moorings and/or anchoring, however any potential impacts would need to be assessed should the installation of such marinas be considered further. Any impacts arising from the development of new marinas and establishment of temporary marinas should be considered in a cumulative context.

Figure 3: Location of existing and proposed marinas

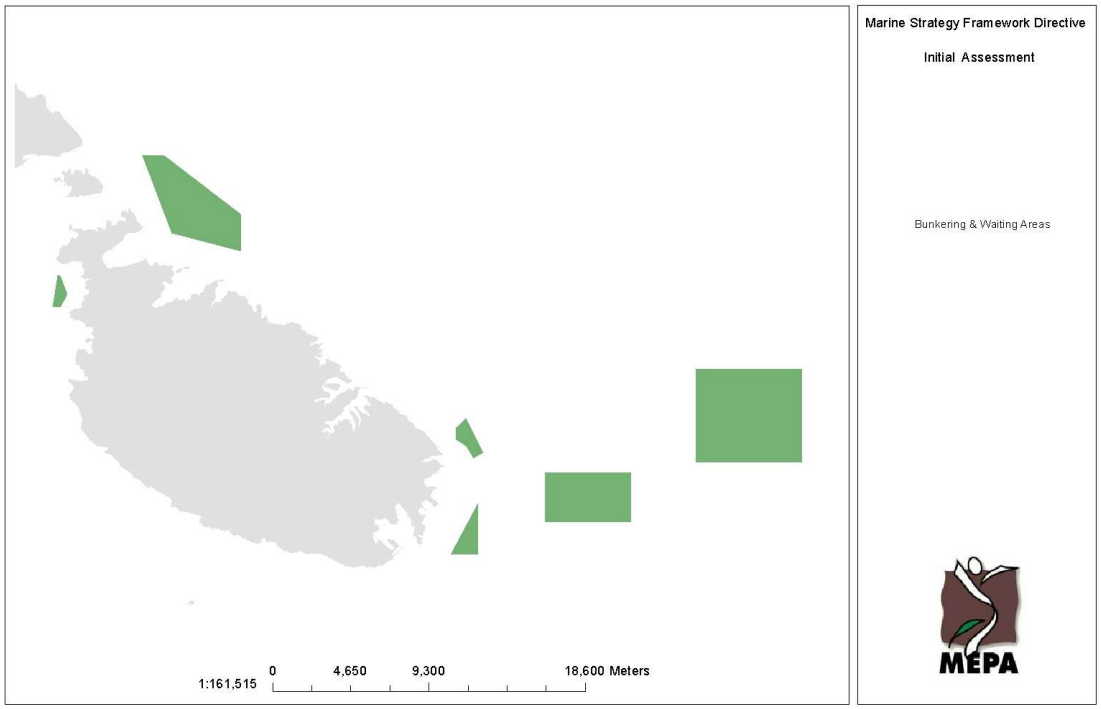


[13] Malta Maritime Authority (2009). Development of Yachting Facilities in Malta: Identification of Potential Sites for All-Weather Marinas and Temporary Marinas.

[14] Malta Maritime Authority (2009). Development of Yachting Facilities in Malta: Identification of Potential Sites for All-Weather Marinas and Temporary Marinas.

Anchoring by large vessels outside harbour areas would mainly occur within offshore areas designated for bunkering and waiting areas. The bunkering and waiting areas are shown in Figure 4, however areas are used depending on the weather and some areas are subject to more intense activities, for example Areas 3 and 4, are more heavily used than others. The impacts, if any, of anchoring occurring within bunkering areas have not been assessed.

Figure 4: Bunkering and Waiting Areas



1.4.2 Dredging

Dredging in Malta is generally undertaken for maintenance of fairways for navigation or development of port facilities. However, dredging may also be carried out in relation to coastal engineering projects, such as the building of platforms, quays and development of new marinas.

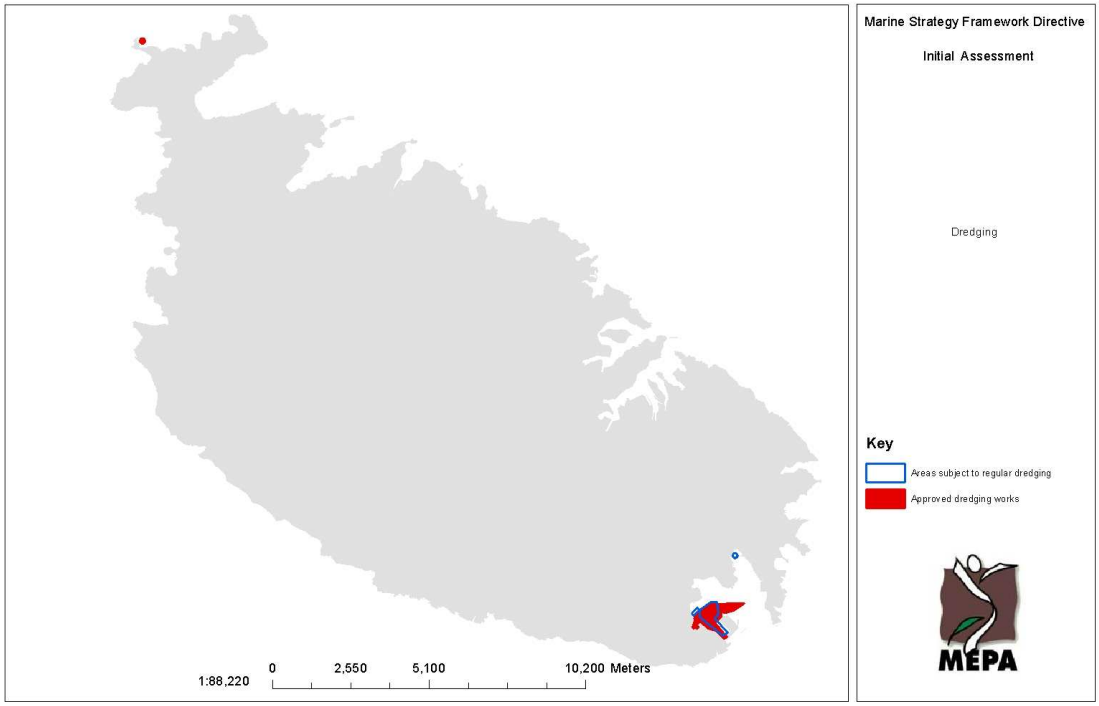
There are no areas designated for regular dredging, although some parts of Marsaxlokk harbour area are dredged every year (Transport Malta – Maritime – personal communication) (

Figure 5). A review of 'Notices to Mariners' issued for the purposes of navigational safety between 2007-2012 implies that in addition to dredging at Marsaxlokk harbour, some dredging works also take place within the Grand Harbour and Marsamxett harbour. Mariners were informed of dredging works within these harbour areas twice in 2009 and once in 2011[15]. A preliminary assessment of

[15] Notice to Mariners No. 14 of 2009; No. 21 of 2009 and No. 27 of 2011

development proposals submitted in the period 2000-2010, confirm that dredging activities are mainly restricted to harbour areas (Marsaxlokk harbour and Ċirkewwa).

Figure 5: Areas subject to regular dredging and approved dredging works

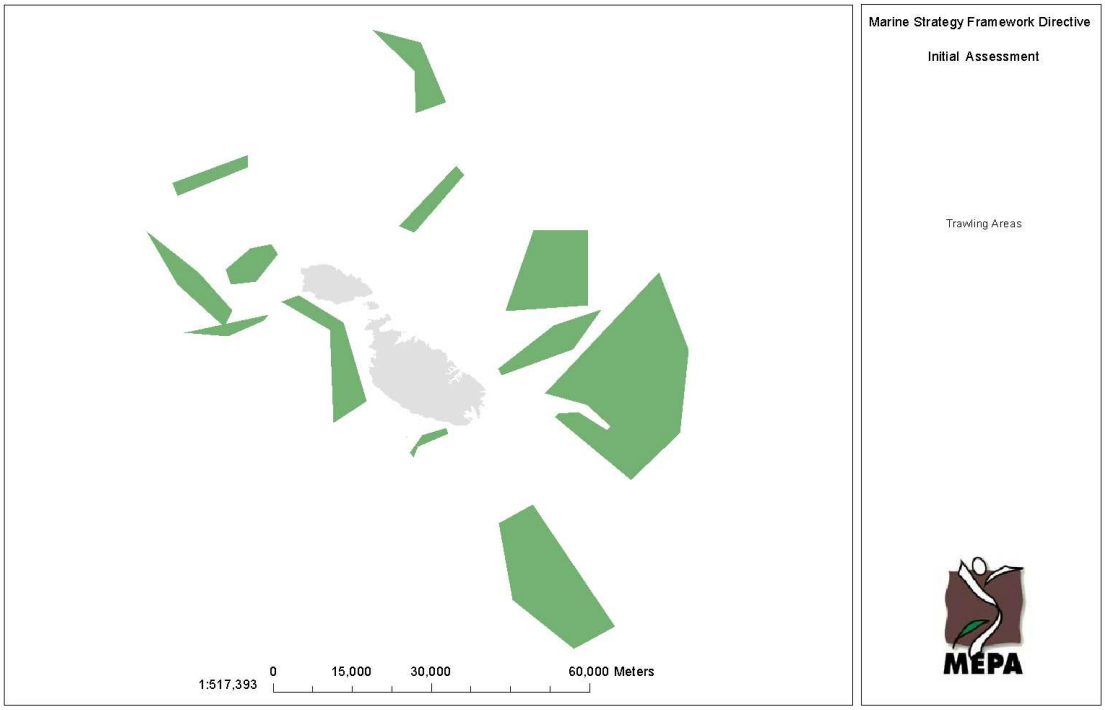


1.4.3 Trawling

Council Regulation 1967 of 2006[16] adopts the 25 nautical mile Fisheries Management Zone around the Maltese Islands and stipulates provisions to regulate fishing within this zone. Within this context, the regulation sets the authorized trawlable areas within the Fisheries Management Zone. 23 trawlers are currently licensed to operate on a full-time basis, 12 of which can operate within the 25 nautical mile Fisheries Management Zone. These 12 boats have an overall tonnage of 1056GT and a total main engine power of 3700kW.

Malta has adopted a Fisheries Management Plan for bottom otter trawling as part of the requirements of EC regulation 1967 of 2006 and Council Regulation 2371 of 2002 on the conservation and sustainable exploitation of fisheries resources under the Common Fisheries Policy. This Management Plan indicates that the Maltese authorities are currently studying the possibility of relocating part of these authorized trawlable areas due to a rationalization exercise that has led to the closure of parts of the areas due to protected habitats present in the zones. Specifically, the management plans point out that the authorized trawling zones as per Annex V of regulation 1967 of 2006 include areas which are found within the 3 nautical mile zone, which areas should be reconsidered to protect coastal resources from trawling activities and to give priority to artisanal fisheries. The current official trawling zones as presented by the Management Plan are indicated in Figure 6.

Figure 6: Official trawling areas as presented in Malta's Fisheries Management Plan



[16] Council Regulation (EC) No 1967/2006 concerning management measures for the sustainable exploitation of fishery resources in the Mediterranean Sea

EC Regulation 1967 of 2006 prohibits the use of towed fishing gear on *Posidonia oceanica*, coralligenous habitats, mäerl beds and corals. The trawlable areas in Malta set by the same regulation are located on shelf and upper bathyal sublittoral sediments mainly characterised by coarse silt and exclude areas characterised by *Posidonia oceanica* meadows and other sensitive habitats. While impacts on benthic community structures have been described in published literature[17], impacts of trawling in terms of abrasion on the seabed are not well documented.

1.4.4 Aquaculture

The aquaculture industry in Malta initiated in the late 1980s with the production of sea bass (*Dicentrarchus labrax*) and sea bream (*Sparus aurata*). In the past decade, interest switched to the penning of blue fin tuna (*Thunnus thynnus*). Currently, there are eight operators and nine established offshore cages. Most of the cages are inshore, with the exception of two installations located at 6km off Southeastern coast of mainland Malta, within the aquaculture zone. This zone is used by two operators with a licensed capacity of 1,500 tuna each.

Aquaculture is generally associated with nutrient enrichment, leading to changes in sediment characteristics, and with disturbance of such sediments through cage moorings (J.A. Borg & P.J. Schembri, personal communication). Offshore sea bass and sea bream farms sited in eight localities in Malta are located in relatively shallow waters in sheltered areas (Figure 7). A case study on the impacts of fish farms carried out on fish farm cages at depths of 12-16m which have now ceased operation, indicated that the observed impacts of this fish farm on benthic habitats could be mostly attributed to the elevated nutrient levels and high sedimentation rates near the cages[18]. The fish farm in question pre-dated current permitting systems which are geared towards preventing such impacts[19]. Within this context, reference is hereby being made to the aquaculture strategy for Malta (2012)[20].

Tuna penning farms in Malta are all sited 1km offshore and in waters exposed to strong currents, distant from ecologically sensitive benthic habitats. Monitoring of the effects of these farms has been ongoing since 2000 and indicates that adverse impacts are generally limited to the area in close proximity to the cages[21]. Changes in

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[17] Dimech, M., Camilleri, M., Hiddink, J.G., Kaiser, M.J., Ragonese, S. & Schembri, P.J. Differences in demersal community structure and biomass size spectra within and outside the Maltese Fishery Management Zone (FMZ) *Scientia Marina* 72(4): 669-682

[18] Dimech, M., Borg, J.A., and Schembri, P.J. 2002. Changes in the structure of a *Posidonia oceanica* meadow and in the diversity of associated decapods, mollusks and echinoderm assemblages resulting from inputs of waste from a marine fish farm (Malta, Central Mediterranean), Bulletin of Marine Science 71 (3): 1309-1321 in Mazik, K., Burdon, D., and Elliott, M. 2005. Seafood waste disposal at sea - a scientific review. Institute of estuarine and coastal studies, University of Hull, pp.70.

[19] http://www.mrra.gov.mt/page.aspx?id=80

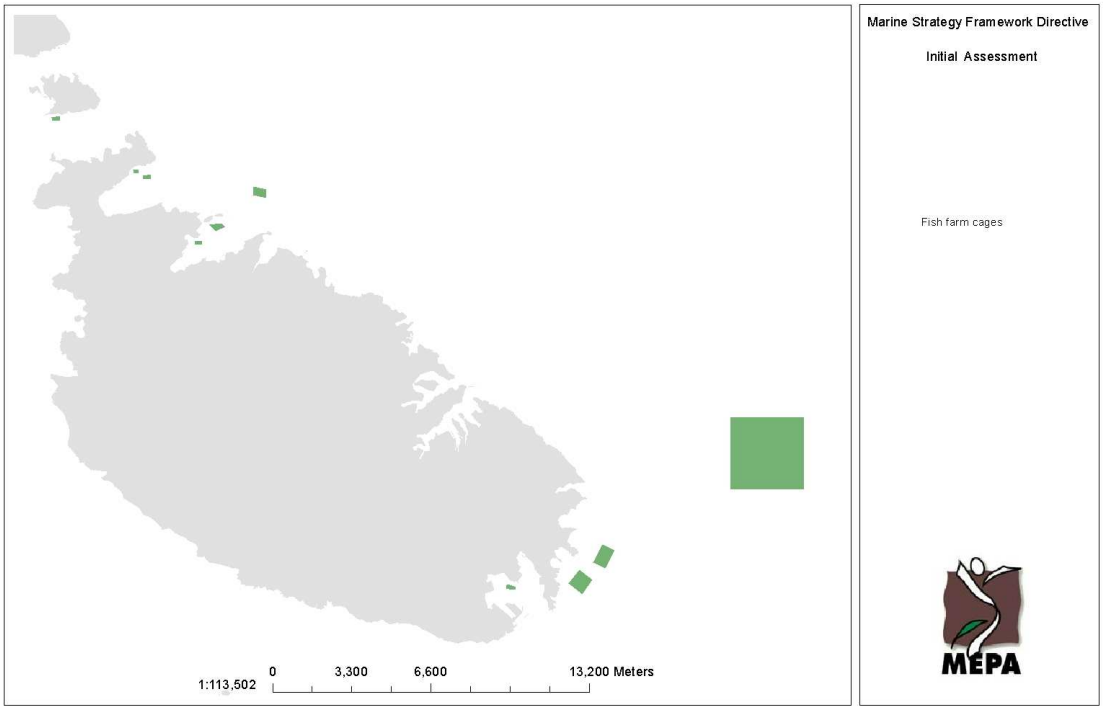
[20] http://www.mrra.gov.mt/loadfile.ashx?id=1bb77c1f-f3a5-43fd-974d-23b46d44f605

[21] Borg, J.A. and Schembri, P.J. 2006. Environmental monitoring of aquaculture activities in the Maltese Islands. Presentation at seminar ' Aquaculture and the environment' organized by the Cleaner Technology Centre, Malta and the Regional Activity Centre for Cleaner Production (UNEP Mediterranean Action Plan); Valletta, Malta, 16 November 2007.

monitored parameters, including lower levels of oxygen, reduced water transparency and elevated nutrient levels, were reported to occur during the farming season between July to December. Water quality studies, however, have not shown any consistent trend in the levels of monitored variables.

Impacts on benthic communities were mainly related to uneaten feed fish which accumulate on the seabed towards the end of each penning season (autumn), resulting in changes to the physical and biological characteristics of the seabed. However such impacts were localized to the area directly beneath the cages[22].

Figure 7: Location of fish farm cages



[22] Borg, J.A. and Schembri, P.J. 2006. Environmental monitoring of tuna-penning activities in Malta. Presentation at international conference on ' Offshore Mariculture 2006' organized by the Society for underwater Technology and the Greenwich Forum; Malta 11-13 October 2006 (Abstract 3pp).

1.4.5 Discharges into the Marine Environment

Marine discharges can lead to physical damage mainly as a result of increased water turbidity, hence through changes in siltation.

The National Baseline Budget (2008)[23] prepared within the framework of the Strategic Action Plan Programme (SAP) adopted by the Contracting Parties to the Barcelona Convention, provides estimates of total suspended solids discharged by land-based sources. Figure 8 provides an indication of the total suspended solids discharged by the sectors considered in the National Baseline Budget as estimated in 2003 and 2008[24].

According to these estimates, public sewers were, at that time, the main source of discharge of suspended solids into the marine environment. Axiaq (2004)[25] also indicated higher turbidity values in areas in the vicinity of sewage outfalls and describes that the most significant reduction in water quality occurred at iċ-Ċumnija (Southwestern coast of Malta) with a 25% reduction in water transparency from normal values at 50m away from the outfall.

The values estimated by the National Baseline Budget and the information provided by Axiaq (2004) pre-dates the operation of the urban waste water treatment plants in Malta and thus reflect a scenario whereby only a small fraction of sewage was being treated. Nowadays all municipal wastewaters are treated at three urban waste water treatment plants, two on mainland Malta and one on Gozo.

Table 2 provides an indication of the loads of total suspended solids to the marine environment through discharge of sewage effluent in 2003, 2008 and treated sewage effluents in 2011. This data clearly indicates a significant improvement in the discharge of total suspended solids to the marine environment from the sewerage network in 2011.

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[23] Axiak, 2009. Baseline Budget of Emissions/Releases for SAP targeted pollutants for Malta, 2008. As submitted to the United Nations Environment Programme, Coordinating Unit for the Mediterranean Action Plan. Environment Protection Directorate, Malta Environment and Planning Authority; 20pp.

[24] These reports were based on archived data in relation to the major point discharges into the marine environment, estimated flow rates and volumes of discharged wastewaters, as well as preliminary chemical profiles. While such data was considered to be reliably sourced, it was very limited and incomplete, and the authors deemed such data insufficient to ensure an accurate estimate of annual baseline budgets of marine pollutants. The loads quoted in this report on the basis of the NBB should thus take full consideration of such limitations.

[25] Axiaq, V. (2004) Marine Coastal Monitoring Programme: June 2003, March 2004

Figure 8: Total Suspended Solids (kg/year) discharged by various sectors as estimated in 2003 and 2008 by the National Baseline Budget [26, 27]

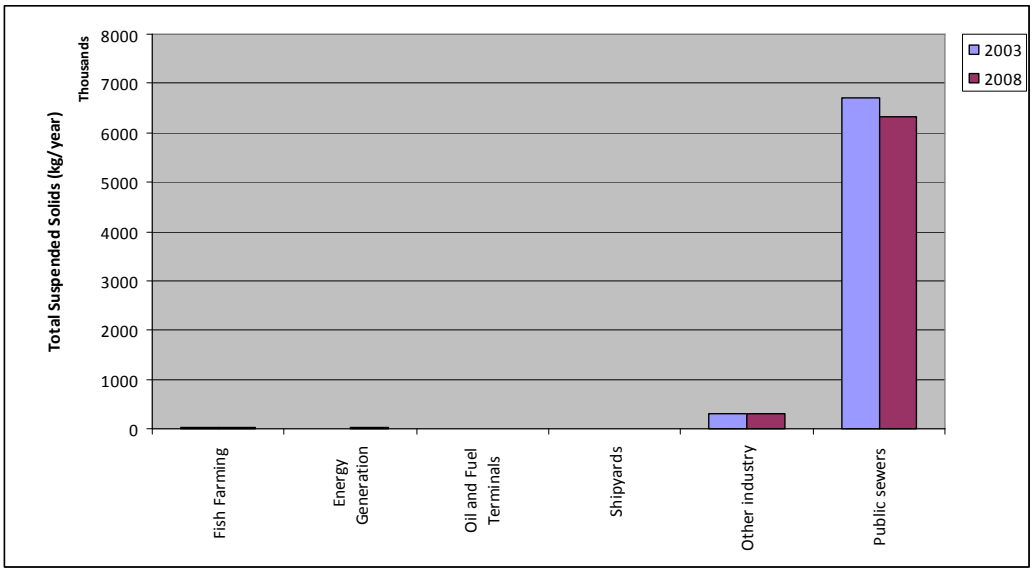


Table 2: Waste water loads of suspended solids in 2008 when not all sewage effluents were treated and in 2011 with all sewage effluents treated. 2011 data incorporates all effluent treated by the three sewage treatment plants on the Maltese Islands.

Nutrient Loads from waste water (kg/yr) according to the National Baseline Budgets			2011[28] Nutrient Loads from treated waste water (kg/yr)	
	2003[29]	2008[30]		
Total suspended solids	**6,695,434**	**6,322,209**	Total Suspended Solids	**664,341**

[26] Axiak, 2009. Baseline Budget of Emissions/Releases for SAP targeted pollutants for Malta, 2008. As submitted to the United Nations Environment Programme, Coordinating Unit for the Mediterranean Action Plan. Environment Protection Directorate, Malta Environment and Planning Authority; 20pp.

[27] 'Other Industry' includes a pig farm, food processing company and the location of the Malta Film Facilities.

[28] Data provided by the Water Services Corporation

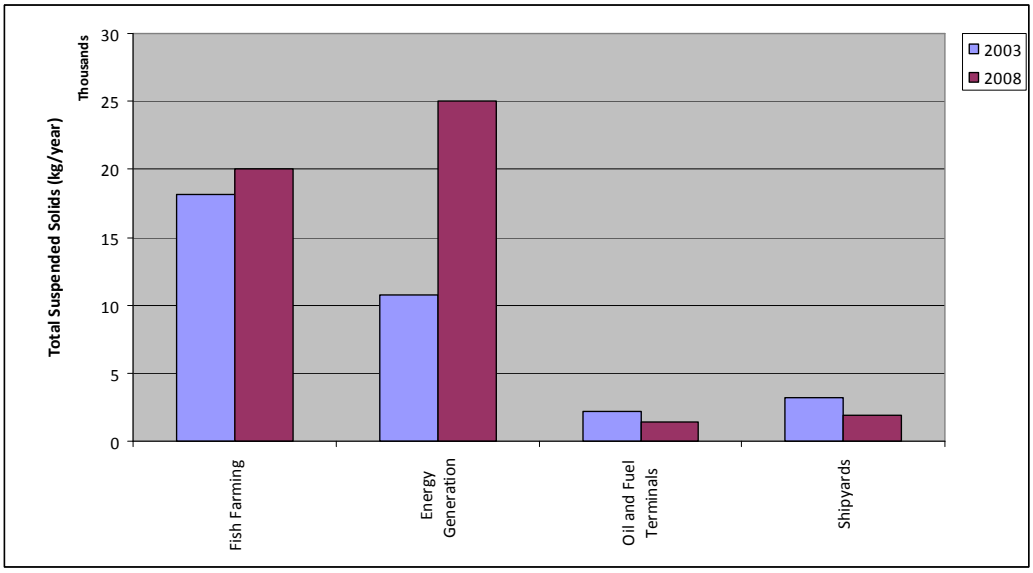
[29] Axiak, V. 2003. Baseline Budget of Emissions/Releases for SAP targeted pollutants for Malta. As submitted to the United Nations Environment Programme, coordinating unit for the Mediterranean Action Plan through the Environment Protection Directorate of the Malta Environment and Planning Authority. http://www.mepa.org.mt/file.aspx?f=3523

[30] Axiak, 2009. Baseline Budget of Emissions/Releases for SAP targeted pollutants for Malta, 2008. As submitted to the United Nations Environment Programme, Coordinating Unit for the Mediterranean Action Plan. Environment Protection Directorate, Malta Environment and Planning Authority; 20pp.

When excluding the higher contributions of suspended solids in the marine environment as estimated by the National Baseline Budget, other sectors associated with the discharge of suspended solids, albeit to a much lower extent, include the energy generation sector and land-based fish farms (Figure 9). Axiaq (2004)[31] has in fact reported high turbidity in areas exposed to discharges by power stations and port areas. Areas exposed to fish farms exhibited only marginally increased water turbidity.

Based on the above information and following the operation of the three urban waste water treatment plants, changes in siltation as a result of marine discharges are mostly localised within the main harbour areas, where the two main power plants, oil and fuel terminals and shipyards are located.

Figure 9: Total Suspended Solids (kg/year) discharged by sectors other than 'other industry' and 'public sewers' as estimated in 2003 and 2008 by the National Baseline Budget [32]



1.5 Data Gaps & Assessment of Status

Information gaps are in relation to the extent of habitats affected by physical loss, and the levels of pressures and impacts arising from physical damage.

[31] Axiaq, V. (2004) Marine Coastal Monitoring Programme: June 2003, March 2004

[32] Axiak, 2009. Baseline Budget of Emissions/Releases for SAP targeted pollutants for Malta, 2008. As submitted to the United Nations Environment Programme, Coordinating Unit for the Mediterranean Action Plan. Environment Protection Directorate, Malta Environment and Planning Authority; 20pp.

The extent to which benthic habitats have been affected as a result of physical loss and physical damage is not known. Therefore assessment of status of the marine environment in terms of these pressures is not possible at this stage.

Further monitoring is necessary on the basis of a risk-based approach, targeting the activities listed in this report.