ASSOCIATES

PA 02175/18

PROPOSAL TO CONSOLIDATE TEMPORARY TUNA FARMING AREA AT A PARCEL OF SEA APPROXIMATELY 5 KILOMETERS FROM THE SHORE (IN GENERAL AREA APPROVED FOR PA/03072/17 AND PA/05858/17) FOR A TOTAL BIOMASS OF 3,300 TONNES OF FISH

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Version 1: July 2018

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Quality Assurance

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July 2018

Report for: **AJD Tuna Ltd**

Revision Schedule

Rev	Date	Details	Written by:	Checked by:	Approved by:
00	Jul 2018	Submission to Client	**Krista Farrugia** Senior Consultant	**Adrian Mallia** Managing Director	**Rachel Xuereb** Director

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CONSULTANTS' DECLARATION

Adi Associates Environmental Consultants Ltd, Malta, prepared this Environmental Impact Assessment Report.

The *Environmental Impact Assessment Regulations, 2017* (S.L. 549.46), Section 17(3) requires that each of the Consultants declares that they have no conflict of interest that may affect any aspect covered by the Regulations.

We declare that Adi Associates Environmental Consultants Ltd has no conflict of interest in the proposed development.

Adi Associates Environmental Consultants Ltd has coordinated this EIA and has provided technical input to specific parts of the EIA Report as identified in the previous page.

Adi Associates Environmental Consultants Ltd takes responsibility for statements and conclusions contained in the parts of the report prepared directly by its staff. However, statements made and conclusions drawn by the independent sub-consultants who prepared the baseline studies reproduced in the Technical Appendices and which informed the Environmental Impact Assessment Report remain the responsibility of the individual sub-consultants.

Adrian Mallia
Managing Director, Adi Associates

The undersigned consultants and contributors hereby declare that they carried out the study or part thereof as identified on page v, that they have no personal or financial interest in the proposed development, and that they are not in any way associated with any individual, company, association or grouping that has any direct or indirect personal, professional or financial interest in the proposed development.

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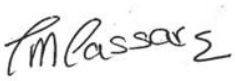
Chantal Cassar 

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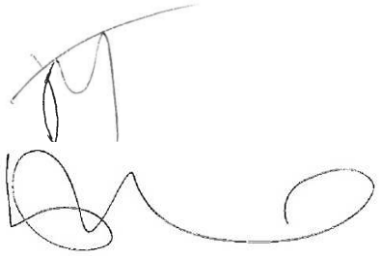

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APPENDIX

1. INTRODUCTION

1.1. This Environmental Impact Assessment Report was commissioned by AJD Tuna Ltd and is required as part of its planning application for a proposal to consolidate a temporary tuna farming area at a parcel of sea located off the northeast coast of Malta approximately 5 kilometers from the shore (in the general area approved for PA/03072/17 and PA/05858/17) for a total biomass of 3,300 tonnes of fish.

1.2. A Project Description Statement was submitted to the Environment and Resources Authority (ERA) (EA 00007/18) as part of the Environmental Impact Assessment screening process[1]. A development application was submitted to the Planning Authority (PA) and was assigned planning application number PA/02175/18. ERA has determined that the Application requires an EIA in accordance with Schedule 1, Category 1 Section 8.2.1.1 of the Environmental Impact Assessment Regulations, 2017 (S.L. 549.46) as amended.

1.3. Hereafter, in this EIA Report, the proposed development is referred to as 'the Scheme' and AJD Tuna Ltd is referred to as 'the Applicant'. A full description of the Scheme is provided in **Chapter 3**.

PURPOSE OF THE EIA REPORT

1.4. The purpose of this EIA Report is to present the findings of the Environmental Impact Assessment (EIA). EIA is the process of systematically assessing the likely significant environmental impacts of the proposal. EIA also aims to ensure that the significance of these impacts, and the scope for reducing them, is clearly understood by both the public and the ERA before a decision is made on whether or not the Scheme should be approved. It is important that the findings of the EIA are clearly presented to the decision-making authority, i.e. the PA Board in accordance with the spirit of the EIA Directive (2011/92/EU).

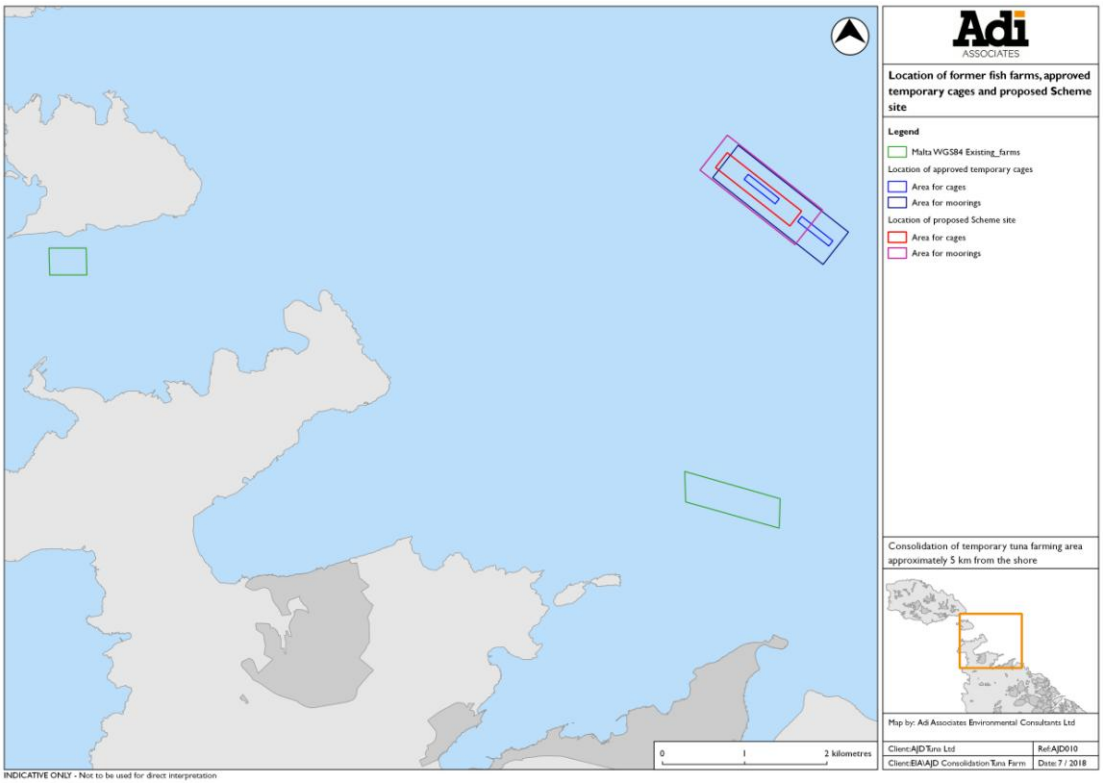
BACKGROUND TO THE SCHEME

1.5. In 2017, AJD Tuna Ltd applied to relocate its existing tuna penning farm from its former location approximately 2 km off Qawra Point, St Paul's Bay to a site further offshore (**Figure 1.1**). This was in response to a decision of the Planning Authority (PA) that all fish farms must relocate further offshore by May 2017 in order to mitigate the impacts that had been reported over the previous years, and in particular in summer 2016, on the marine environment, including social impacts related to amenity and nuisance from odour and water quality at affected areas of the coast. Previously, the farm had been operating under PA 07377/98 since 1999; however, in September 2016 the PA revoked this permit.

[1] The application description was initially to extend the existing tuna fish farm by placing another 12 tuna cages (for a total of 24 cages). This was subsequently clarified as not involving any increase in the number of fish reared.

1.6. Furthermore, permit PA 01741/01, to substitute part of the breeding of sea bream with tuna in cages located in the South Comino channel (**Figure 1.1**) was also revoked. This permit was operated by Malta Mariculture Limited (MML), a sister company to AJD Tuna Ltd. Although a permit was in hand, the cages at this site only ever harboured tuna twice. This is because the site experienced strong currents and was not appropriate for tuna farming. In 2017, following the revocation, MML too applied to relocate the farming operations further offshore and adjacent to the site identified by AJD Tuna Ltd. The two farms were hence set up in close proximity to each other and can virtually be considered as one operation that incorporates the total capacity of tuna farming permitted at the two farms.

Figure 1.1: Location of former farms off St Paul's Bay and South Comino Channel in relation to the new temporary location 5 km offshore



1.7. The current set up, consisting of 12 cages (see **Figure 3.16** in **Chapter 3**), has only been in operation for one season (2017) after the approval of the two planning permits that allowed the relocation for the former Comino and St Paul's Bay tuna farms and the deployment of two six-cage installations at the current location (one for each of the two companies – AJD Tuna Ltd and Malta Mariculture Limited). The present application is now submitted by AJD Tuna Ltd for the entire operation.

1.8. In 2017, the farms stocked approximately 2,220 tonnes of biomass, which over 12 cages meant a stocking density of approximately 225 tonnes at input, almost double the optimal stocking density based on the ICCAT recommendation (refer also to **Chapter 3**). With the current permitted setup, the following summarises the situation that arose on the farm in 2017 as explained by the Applicant:

- In view of existing contracts with fishermen that the farm operator was obliged to honour, the same amount of tuna as in previous years had to be purchased such that the stocking density in the permitted cages was double that of previous years. As a result, the tuna did not grow to full size due to excessive competition in a relatively small area;
- The delays in the permitting process meant that a substantial part of the purchased tuna had to be retained on tow for a considerable period of time before they could be caged[2]. During this period the tuna are not fed and hence rather than fattening they ended up losing weight; and
- It was necessary to cull earlier in the season[3] than would normally be carried out as a result of sub-optimal conditions within the cages (limited space and increased competition for food). This, together with the late caging, resulted in lower weight gain in the tuna in general.

1.9. Based on the above, including lessons learned during the 2017 season, the Applicant is applying to increase the number of cages within the same general farm area in order to support the biomass that he is permitted to farm (see **Figure 1.2**). In line with ICCAT concessions, this is a maximum of 3,300 tonnes of biomass in total.

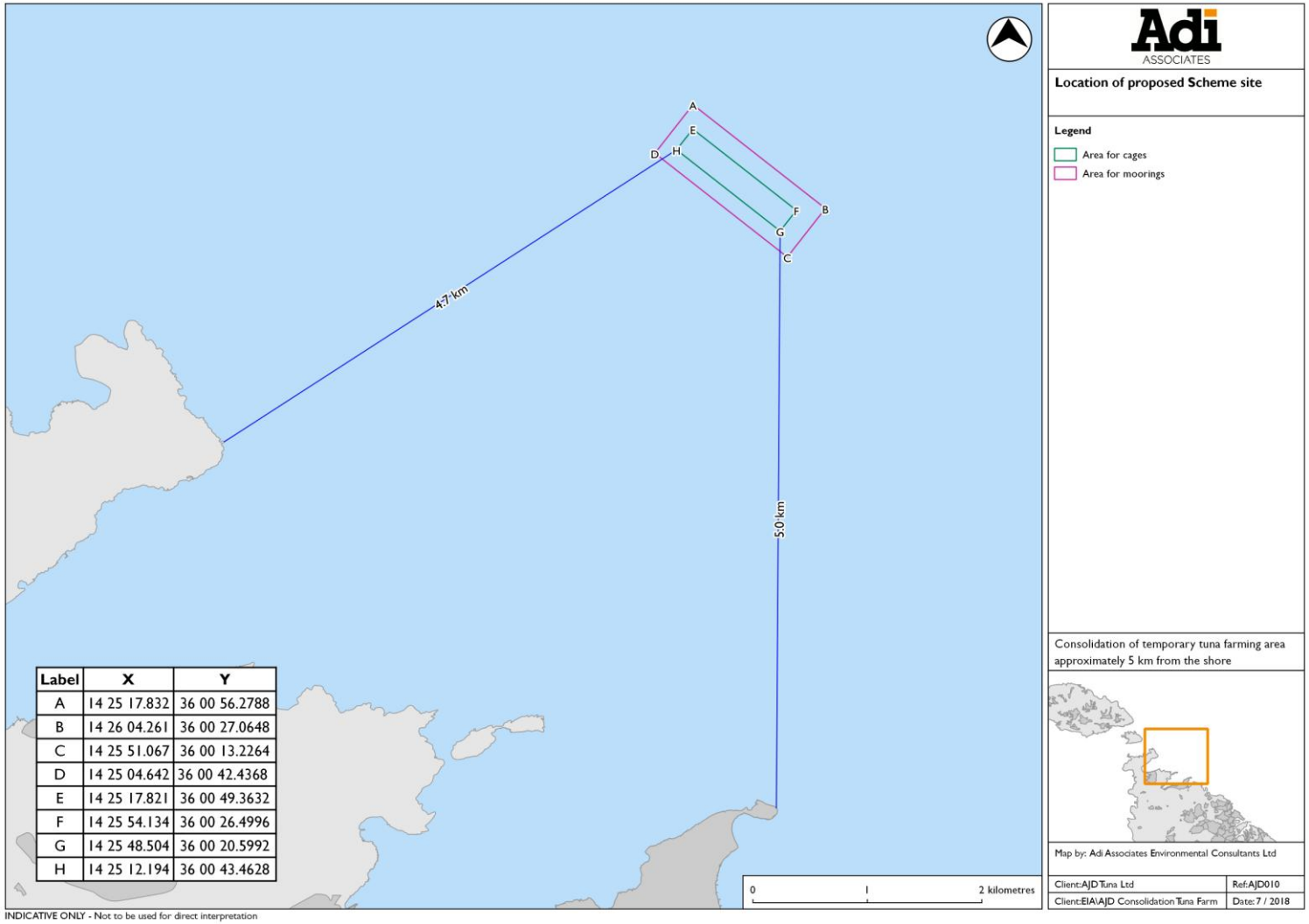
STRUCTURE OF THE EIA REPORT

1.10. Following this introduction, the EIA Report is structured as follows:

- Chapter 2: EIA Methodology
- Chapter 3: Description of Site and Scheme
- Chapter 4: Legislation and Policy Context
- Chapter 5: Marine Environment
- Chapter 6: Avifauna
- Chapter 7: Marine Archaeology
- Chapter 8: Effects on Human Populations
- Chapter 9: Key Impacts, Cumulative Effects and Summary of Mitigation
- Appendix 1: Summary notes from stakeholder consultation meetings
- Appendix 2: Specifications for navigational lights.

[2] First caging took place in the first week of August 2017 (instead of mid-June).
[3] The first harvesting took place in the third week of September.

Figure 1.2: Scheme location and distance from shore



Label	X	Y
A	14 25 17.832	36 00 56.2788
B	14 26 04.261	36 00 27.0648
C	14 25 51.067	36 00 13.2264
D	14 25 04.642	36 00 42.4368
E	14 25 17.821	36 00 49.3632
F	14 25 54.134	36 00 26.4996
G	14 25 48.504	36 00 20.5992
H	14 25 12.194	36 00 43.4628

1.10. The Environmental Risk Assessment is presented as **Volume 2** of the EIA Report.

1.11. The EIA Report also contains the following Technical Appendices (compiled separately as **Volume 3** of the EIA Report):

- Technical Appendix 1: Terms of Reference and Method Statements
- Technical Appendix 2A: Side Scan Sonar Survey Report 2017
- Technical Appendix 2B: Remote Sensing Survey Report 2018
- Technical Appendix 3: Wave study, hydrodynamics and environmental modelling Report
- Technical Appendix 4: Marine Ecology Baseline Report
- Technical Appendix 5: Avifauna Baseline Report
- Technical Appendix 6: Cultural Heritage Baseline Report

1.12. The EIA Report includes a Non-Technical Summary in Maltese and English.

2. EIA METHODOLOGY

INTRODUCTION

2.1. This chapter sets out the broad method that is used in the EIA for the proposed Scheme. It sets out the key stages that were followed in line with EIA best practice. This chapter also provides a section on how the significance of impacts was assessed, and describes how this was a consistent process throughout the EIA.

THE EIA PROCESS

2.2. The current guidance on the EIA process is contained in the Environmental Impact Assessment (EIA) Regulations, 2017. ERA has indicated that an EIA is required for the Scheme under Category I Section 8.2.1.1 of Schedule 1: "*Aquaculture establishments for any type of aquatic organism (including fish farms, hatcheries, tuna pens, shellfish or crustacean farms, seaweed production units, or similar establishments), or extensions to an existing establishment if covering an area of 2 ha or more and located within 6km of the coast*".

TERMS OF REFERENCE

2.3. The Terms of Reference (ToR) for the EIA were prepared by ERA in consultation with relevant Government Departments. The final ToR were issued by ERA in March 2018 and are reproduced in **Technical Appendix 1: *Terms of Reference and Method Statements***.

2.4. The ToR for the EIA were formulated following a scoping exercise organised by the ERA in February 2018 to identify the issues to be considered in the EIA. The ToR focus on those impacts of the proposal that ERA considers to be significant and, therefore, require further assessment, avoiding the examination of all potential environmental impacts. They also set out the various components of the EIA.

METHOD STATEMENTS

2.5. As required by the EIA Regulations, the Consultants who prepared this EIA Report were approved by ERA[4].

2.6. For the main topic areas to be covered by the EIA Report (i.e. marine environment, including bathymetry, sonar and video surveys, marine ecology, and cultural heritage), the Consultants undertaking the work, in collaboration with Adi Associates, produced a Method Statement. The Method Statements outline the baseline survey work to be carried out, the methods used to assess the predicted impacts of the Scheme, and the means by which their significance would be determined. The Method Statements include the following information:

[4] E-mails from [redacted] (ERA) dated 13th, 20th and 23rd April 2018.

- Introduction listing the objectives of the survey and reference to the ToR;
- Details of baseline survey methodology;
- Area of Influence;
- Field survey methodology;
- Analytical methodology;
- Evaluation of data;
- Identification of potential impacts;
- Prediction of impacts;
- Impact significance; and
- Mitigation.

2.7. All Method Statements were accepted by ERA. The accepted Method Statements are included in **Technical Appendix 1: *Terms of Reference & Method Statements***. The Method Statements were then used as the basis for carrying out the EIA.

EIA APPROACH

2.8. Good practice advises that EIA should be treated as an iterative process, rather than a one-off, post-design environmental appraisal. In this way, the findings from the EIA can be fed into the design process, leading to the production of a more environmentally sensitive project. This approach was adopted for this EIA.

2.9. The specialist sub-consultants used existing information, where available, and carried out further baseline surveys, where required, of the Scheme site and its immediate surroundings (as established in the ToR). This was based on the Area of Influence agreed with ERA for each topic area. In this way, important or sensitive features could be identified for protection and avoided during deployment.

2.10. A detailed assessment of the Scheme's impact on the features present on site and in its environs was undertaken and any potential environmental benefits of the Scheme identified.

STAKEHOLDER CONSULTATION

2.11. During the process of the EIA, consultation meetings were organised with several stakeholders. These included: Transport Malta, Environmental Health Directorate, Malta Tourism Authority, the Armed Forces of Malta, Mellieha Local Council, St Paul's Bay Local Council, Nature Trust –FEE Malta, Birdlife (Malta), the Amateur Fishermen Association, the Professional Diving Schools Association, and the environmental group 'Stop the Slime'. Notes from these meetings are reproduced in **Appendix 1** to the EIA Report; the issues raised are also discussed in **Chapter 8** .

SIGNIFICANCE OF IMPACTS

2.12. Assessment of the significance of impacts arising from the Scheme is a key stage in the EIA process. It is this judgement that is key in informing the decision-making process. However, defining what is significant is not a simple task. In general terms, environmental significance involves assessing the amount of change to the environment perceived to be acceptable to the community (Sippe, 1999[5]).

2.13. The following criteria have been used to assess the significance of an impact:

- Type of impact (adverse/beneficial);
- Extent and magnitude of impact;
- Direct or indirect impact;
- Duration of impact (short term/long term; permanent/temporary);
- Comparison with legal requirements, policies and standards;
- Sensitivity of receptor (residential dwellings, hotel, recreational areas, etc.);
- Probability of impact occurring (certain, likely, uncertain, unlikely, remote);
- Reversibility of impact;
- Scope for mitigation / enhancement (very good, good, none); and
- Residual impacts.

2.14. Using these criteria, the significance of the impacts arising from the Scheme has been categorised throughout the EIA Report, as follows:

- Not significant;
- Minor significance; and
- Major significance.

2.15. Definitions of the meaning of the "significance categories" above in relation to each topic area are included in the topic chapters.

2.16. The EIA Report contains an assessment of the significance of predicted impacts and, following the proposed mitigation measures, the significance of any residual impacts. A residual impact is any remaining impact that would exist following the implementation of proposed mitigation measures. Mitigation measures and residual

[5] Sippe R (1999) 'Criteria and Standards for Assessing Significant Impact' in Petts J 'Handbook of Environmental Impact Assessment, Volume 1.

impacts are addressed in the chapter of the EIA Report that deals specifically with the source of the significant effect. A summary of mitigation measures are tabulated at the end of each chapter and a summary of significant impacts is included in **Chapter 9**.

UNCERTAINTY

2.17. The EIA process is designed to enable good decision-making based on the best possible information about the environmental implications of a proposed development. However, there will always be some uncertainty as to the exact scale and nature of the environmental impacts. This arises through shortcomings in information, doubts, or lack of certainty on the likelihood that an incidence would occur, or due to the limitations of the prediction process itself. It is stated in the EIA Report where particular uncertainties have arisen and where they remain.

PRESENTATION OF THE EIA REPORT

2.18. The EIA Report is divided into three main sections after the Introduction and this chapter providing the EIA Methodology. Part I comprises **Chapter 3** and **Chapter 4**:

- **Chapter 3** provides a detailed description of the Scheme (including waste management issues) as well as of the site location and its surroundings, including information on land and sea uses; and
- **Chapter 4** summarises the relevant legislation and policy context.

2.19. Part 2 of the EIA Report (**Chapter 5** to **Chapter 7**) describes the potential environmental impacts of the Scheme in relation to a number of different topic areas. These topic areas were identified in the ToR. The information in each of these chapters is structured in a consistent way, as follows:

- Introduction: identifying key issues and how the chapter relates to the requirements of the ToR;
- Assessment Methodology: a summary of the methods used (desk study, surveys, consultations, etc.) in undertaking the EIA Report topic chapter;
- Existing Conditions: a summary of the baseline situation and trends irrespective of the development proposals; and
- An assessment of impacts associated with the operation of the Scheme, following the headings below:
    - Potential impacts: a summary of the potential impacts of the Scheme;
    - Prediction and significance of impacts: a prediction of the likely impacts of the Scheme against the baseline situation and an assessment of the significance of the impacts;

- Mitigation measures: a summary of potential mitigation / enhancement measures to offset any identified adverse impacts of the Scheme;
- Residual impacts: a clear statement of those impacts that still have an impact following mitigation, indicating the significance of the residual impact; and
- Summary: a summary table of the impacts.

2.20. Part 3 of the EIA Report (**Chapter 8** and **Chapter 9**) addresses the effects on human populations, and the cumulative effects of the Scheme, and presents a summary of the impacts and proposed mitigation measures.

3. DESCRIPTION OF THE SCHEME AND THE SITE

INTRODUCTION

3.1. This chapter describes the Scheme. It explains the purpose of the Scheme and includes a description of the Application Site and its surroundings. A more detailed description of the marine environment is included in **Chapter 5**.

PURPOSE OF THE SCHEME

3.2. The purpose of the Scheme is to improve the existing fish farm operation in an attempt to address some of the challenges that were encountered during the 2017 season (refer to **Chapter 1**), which were largely a result of not having sufficient cage space to optimally support the Applicant's tuna quota.

BACKGROUND TO THE SCHEME

Operations – the Tuna Penning Process

Tuna capture and transfer to farm

3.3. Tuna are caught by purse seining on the high seas. This activity is allowed under ICCAT[6] rules for a restricted time during the year as the fish are migrating through the Mediterranean Sea. There are no Maltese purse seiners and therefore the fish are caught by foreign vessels from whom the Applicant purchases stock.

3.4. The tuna caught in the purse seines normally range in size from 50 to 300 kg, with the vast majority of the fish being between 100 and 200 kg.

3.5. Once the tuna are caught in the purse seines and the required amounts are purchased, they are led through openings in the purse seine into the farm's towing cages. Once the cages are filled with the required stock, they are slowly towed to the on-growing site[7] where they are anchored in position to the mooring system that would have already been deployed at the site.

3.6. The entire operation is overseen by ICCAT international observers.

Penning

3.7. Once on the farm, the tuna are fed and fattened, largely a process of conditioning, through which the fat-to-protein ratio is adjusted through a high fat diet. The tuna are kept in the pens for between 3 and 7 months, after which they are harvested and sold to the Japanese market.

[6] ICCAT is the International Convention for the Conservation of Atlantic Tunas.
[7] Towing speeds rarely exceed 1 knot, with the transfer taking a number of weeks (depending on the distance between the catch area and the farm).

3.8. The transhipment of tuna to fattening pens is considered to be a landing operation and the catches involved must comply with regulations in force[8] as well as ICCAT requirements.

Feeding and feed management techniques

3.9. The tuna are fed small pelagic fish, usually, herring, mackerel, anchovy, sardines, etc. It is estimated that it takes 10-25 kg of baitfish to produce 1 kg of tuna (EC, 2004)[9]. Approximately 5,500 kg of baitfish per day are provided to each cage to feed the farmed tuna.

3.10. The feed is ordered from a number of international suppliers and five reefer containers with feed arrive in Malta on a daily basis; these are stored at the Freeport. Every day a number of containers (usually between 1 and 4, depending on the stock) are transferred to the Kordin land base facility operated by AJD Tuna Ltd (**Figure 3.1**). The fish are transferred from their transportation packing and placed in apposite jumbo bags (**Figure 3.2**). The bags are then placed in crates and stored on flat bed trailers, where they are allowed to partially thaw overnight (**Figure 3.3**). Following discussions with ERA as part of the environmental permit application for the permitted farm, the jumbo bags used for the transportation of the baitfish were changed to impermeable ones so that the thaw water, which includes fish oils, water, and mucus, is contained and not lost into the environment (including from the feeder vessel) until the feed is placed inside the fattening cages.

3.11. Early the next day (around 4:00 hrs), the baitfish are transferred to the Grand Harbour where they are loaded onto a feeder vessel (**Figure 3.4**). Once loaded, the vessel sets sail towards the farm.

3.12. The tuna are fed once a day, at dawn. Semi-frozen baitfish[10] are normally placed in small feeding cages floated at the centre of the pen (**Figure 3.5**), and once they have been thawed enough, the central cage is opened by divers and the fish dispensed into the pen. The divers monitor the tuna and control the amount of feed released into the pen to minimise wastage. Once the tuna are satiated, the diver stops feeding. The process may be repeated two hours later; however, if the tuna are satiated, any remaining fish can be lifted from the pen and transferred to other cages.

3.13. In order to optimise feeding efficiency it is necessary to ensure that when fed to the tuna the baitfish are not completely defrosted so that the high calorific oils are ingested too and not lost from the feed. Nonetheless, the process does involve the development of an oily slick originating from the semi-frozen feed. In order to

[8] Council Regulation (EU) 2016/72 of 22 January 2016 fixing for 2016 the fishing opportunities for certain fish stocks and groups of fish stocks, applicable in Union waters and, for Union fishing vessels, in certain non-Union waters, and amending Regulation (EU) 2015/104

[9] European Communities, 2004. Tuna: a global fishing activity. Fishing in Europe No. 23. Directorate-General for Fisheries, European Commission, September 2004;

[10] Herring, sardines, mackerel.

address this issue, a number of measures have been taken throughout the past season. These include:

- The baitfish is retained in the impermeable jumbo bags while transported from the land base in Kordin to the farm to contain the thaw water;
- An oil boom is permanently deployed inside each cage to contain any fish oils that may be released from the feed;
- When the baitfish are transferred to the fattening cages, they are transferred inside the impermeable jumbo bags referred to above and their contents emptied inside the cage when the tuna are ready to be fed. This would release both the baitfish and some of the thaw water inside the cages; however, the presence of the oil boom along the entire internal diameter of the cage contains most, if not all[11], such surface materials within the cage;
- The oily material so released and contained in the cages is then collected from the surface of the sea inside the cages by means of a skimmer (see **Figure 3.6**) operated by divers inside the cages. The collected oil is stored in IBCs and transferred to land for onward transmission to a waste oil recycling company.

3.14. The efficiency of these measures is currently being assessed through the monitoring required as part of the implementation of the environmental permit of the current farm; improvements may be proposed to address lacunae in the process. These measures may include deploying different (non-diver operated) proprietary oil skimmers, thawing of the baitfish on board and containing the thaw water prior to feeding the tuna the thawed fish, and deploying further oil slick collection measures outside the farm (e.g. a cleaning vessel), for any oil that escapes from the farm area.

[11] This would depend on the state of the sea. Under calm conditions, the surface slick is mostly retained inside the cage; on the other hand, strong swell could result in overtopping of the oily slick outside of the cage containment. In this case, external oil spill containment / spill collection vessels would need to be deployed.

Figure 3.1: Kordin land-base facility

Figure 3.2: Frozen feed transferred to jumbo bags

Figure 3.3: Flat-bed trailer with feed in jumbo bags left to partially defrost

Figure 3.4: Feed being loaded on to feeder vessel early in the morning

Figure 3.5: Loading of semi-frozen baitfish into feeding cage

Figure 3.6: Skimmer

Food conversion

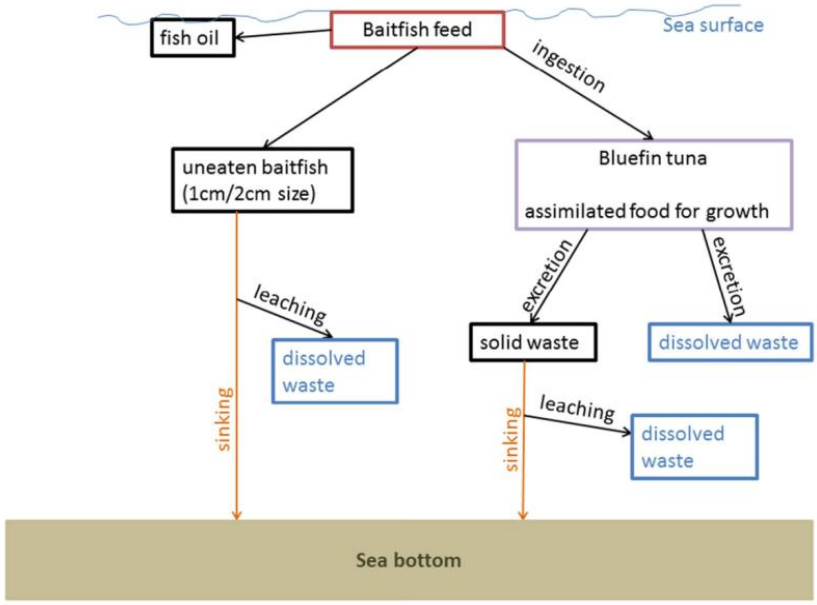
3.15. The following approximations are made for the daily baitfish feed (source: AJD Tuna Ltd):

- 0.5% passes through the net uneaten;
- 5% is lost as fish oil per day;
- 94.5% is ingested by tuna.

3.16. Therefore the amount of uneaten baitfish represents 27.5 kg/day/cage, the mass of fish oil released is 275 kg/day/cage, and the food intake by tuna is 5,197.5 kg/day/cage. Assuming the Scheme will have a total of 24 cages, the totals would equate to 660 kg of uneaten baitfish per day, 6.6 tonnes of fish oil released daily, and 125 tonnes of food ingested by the tuna on a daily basis.

3.17. **Figure 3.7** provides a schematic diagram of the food chain and by-products of fish-rearing.

Figure 3.7: Schematic of the food chain and by-products of fish-rearing



Source: Artelia, 2018

Harvesting and processing

3.18. Harvesting of fresh tuna is largely on demand, although the vast proportion of the tuna is today being harvested for the frozen fish market.

3.19. When harvesting occurs, the bottom of the net is raised to a degree, forcing the fish closer to the surface. Slaughtering is particularly delicate since the amount of stress the fish are subjected to must be kept low because if the fish are stressed their body temperature rises sharply, which would compromise the quality of the meat[12]. Slaughtering is carried out by divers who enter the cage and harvest the tuna one by one by shooting them in the head.

3.20. The tuna are transferred to a service vessel by crane (**Figure 3.8**) from where they are then quickly transported by service boats (**Figure 3.9**) to a waiting processing vessel anchored further out at sea (**Figure 3.10**). Onboard the ship, the tuna are weighed, heads and tails are cut off and the guts removed. Currently, the head, tails and guts are a waste by-product. These are currently being disposed of at sea beyond the 12 nautical mile limit as directed by the Veterinary and Phytosanitary Regulation Department. The option of incinerating the material was discounted as the abattoir incinerator is too small to handle the volume of waste generated by the tuna farms; the incinerator operator has rejected this possible waste stream. The operation typically generates approximately 8-10 tonnes of offal per day during the peak fattening period. The Applicant is studying the possibility of selling the by-product to foreign companies for the generation of fish meal to be used for feeding pets; however, to date, this has encountered difficulties in relation to maritime and EU legislation. Further discussions on this matter are being pursued with the relevant authorities in an attempt to identify an alternative option to offshore dumping. This is also a requirement of the environment permit issued by the ERA for the current tuna penning operations.

3.21. If the harvested fish are to be sold to the fresh fish market, they are normally processed onboard the service boats (not the processing vessels / freezer ships) and at the land base facility in Marfa (**Figure 3.11**). In this case, processing has to take place in a short time interval in order to minimise the length of time that the fish remain at ambient temperatures. The fish are processed in the same manner as described above, except that rather than blast frozen, the fish are cooled in an ice and salt mixture to the desired temperature and packed in purposely designed carton boxes for export.

3.22. The fresh fish produce is air freighted to its final destination, whereas the fish intended for the frozen fish market are transferred to a reefer vessel or exported on the same factory vessel on which they were processed.

Post-harvest

3.23. Following harvesting, between November and May, the Applicant is allowed to keep

[12] Tuna maintain body temperatures between 15 and 20 degrees centigrade above that of the surrounding water. However stress will lead to an alarm reaction and secretion of hormones in preparation for emergency action. As part of the process, the body temperature can rise up to 40 degrees centigrade above the surrounding water, compromising the redness of the flesh once the fish has been slaughtered (See http://www.niri.co.jp/agroup/maguro3.pdf).

up to 15% of the stock in the cages for research purposes[13]. The fish so retained are fed between two and three times a week during this period.

Stocking Density

3.24. The stocking density of the fish in the cages is a crucial factor in aquaculture that has an important bearing on mortality and the quality of the fish produced. With respect to the Scheme, each cage is proposed to contain approximately 1,200 fishes with an average mass of 115 kg, which means that each cage contains around 137.5 tons of fish. This stocking density in the cage corresponds to the maximum capacity of the farm, as defined by the ICCAT[14].

Antifouling and net cleaning

3.25. No anti-fouling or other chemicals are used on tuna nets, since unlike the nets of traditional finfish aquaculture units, which remain in the water for an extended time period, the tuna nets are removed at the end of the season for drying.

Feed supplements, chemicals and antibiotics

3.26. As explained earlier tuna are only fed baitfish. No feed supplements or other chemicals or vitamins are used to date. Equally, since the tuna are effectively wild and only kept on site for fattening, i.e. they are not actually farmed[15], no chemicals or antibiotics are used[16]. Mortalities are more effectively controlled by lowering stocking densities and monitoring the fish for any signs of stress.

Storage of feed and packing materials

3.27. The Applicant operates two land bases (see **Figure 3.12**). One land base is situated in Marfa and is used for packing and processing of fresh fish for export by air freight. The second land base is located at the Kordin industrial estate and is used to receive and prepare the bait fish as well as for the washing and storage of crates. A third site in Maghtab is used to store cage materials, nets, and ancillary farm materials.

[13] Research in tuna spawning and farming of fry has been undertaken by the Applicant over the past years in conjunction with the Department of Fisheries and Aquaculture, MCAST and the University of Malta (Azzopardi, C., pers. comm., Oct 2016).

[14] However, in view of ICCAT Regulations that tuna caught under different jurisdictions / certification cannot be mixed, the farm requires a degree of flexibility in the number of cages it can deploy within the approved farm area to cater for the approved biomass.

[15] The process is more appropriately called tuna ranching than tuna farming.

[16] Had these to be used, they would be similar to those already in use in the other finfish aquaculture operations.

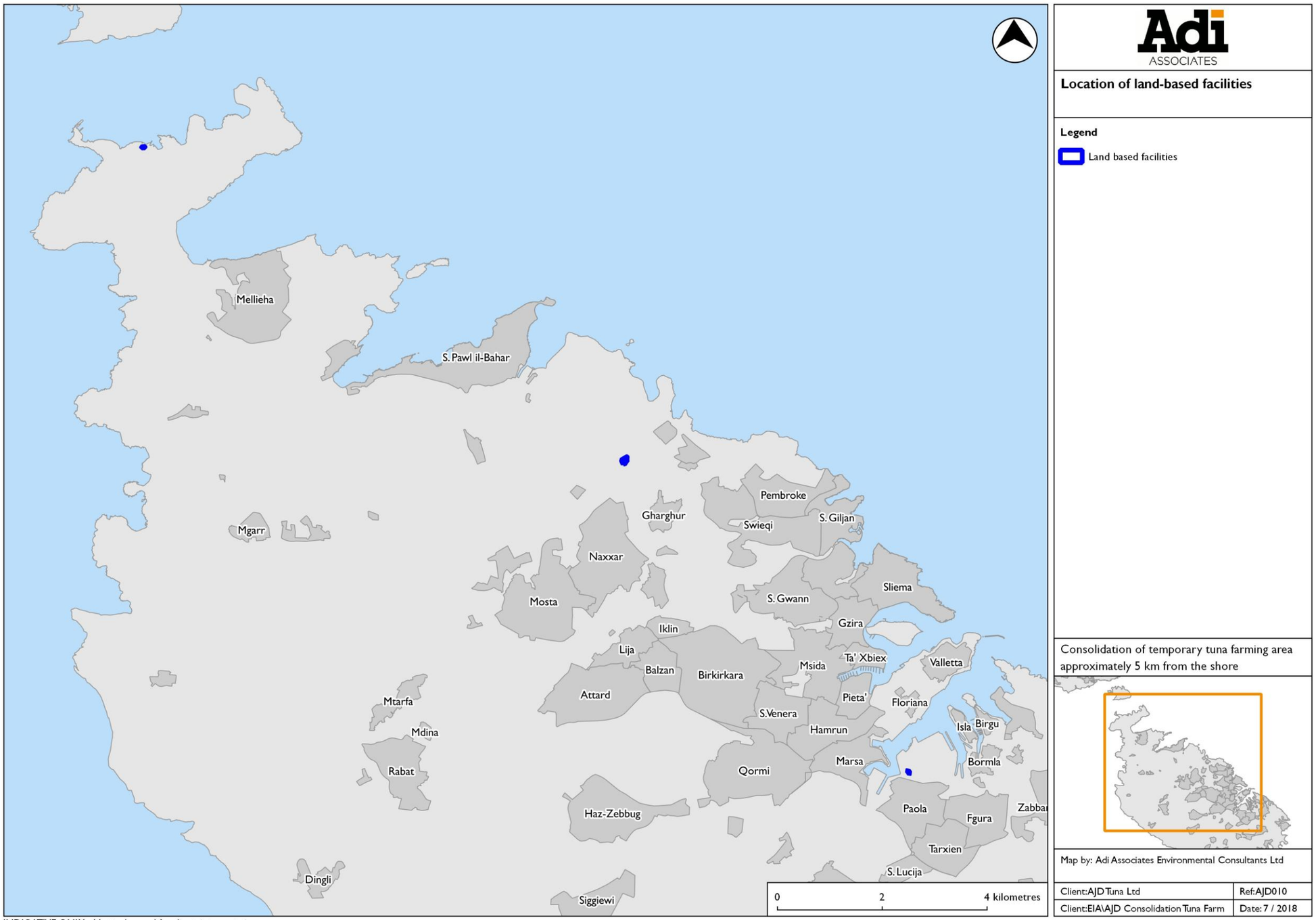
Figure 3.8: Tuna harvesting

Figure 3.9: Service boat transferring tuna to processing vessel

Figure 3.10: Processing vessel

Figure 3.11: Marfa land-based facility

Figure 3.12: Map indicating location of land-based facilities in Marfa, Maghtab, and Kordin



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Alternative Sites

3.28. The current operational site at sea was identified following a selection exercise, as described hereunder. To begin with, the site previously identified for the north aquaculture zone (for which planning approval had not been concluded) was reviewed. This site was, however, no longer considered to be suitable for consideration as a search area for the fish farm. This was mainly due to the fact that the proposed site also lies relatively close to the coast thereby potentially not fulfilling the spirit of the permit revocation and the PA conditions. Discussions with the ERA and the Department of Fisheries and Aquaculture indicated that a minimum distance of 4.5 – 5 km from the shore was expected for all relocated farms[17].

3.29. To this end, it was considered that an appropriate approach would be to identify a suitable search area within which to study parameters in order to identify a final relocation site for the cages. **Figure 3.13** identifies the search area that was studied. This is located north of Qawra Point, St Paul's Bay. This search area was chosen based on (i) technical requirements for operation set by the applicant, e.g. the cages should not be deployed in water that is significantly deeper than 50 m and not deeper than 100 m because it will be difficult for divers to work under such conditions; (ii) a desk-top analysis using GIS overlays to identify the various marine uses off the north and east coast of the islands; and (iii) any constraints associated with the relocation as specifically directed by relevant Authorities or entities. Notably, with respect to the latter, Transport Malta's Harbour Master directed that the search area should be located no closer than 300 m from the bunkering zone. **Figure 3.14** identifies the various other uses and constraints around the search area.

3.30. Following identification of the search area, the following studies were carried out under licence from the Continental Shelf Department of the Ministry for Transport and Infrastructure:

- Multibeam echo sounder and back scatter survey within the search area; and
- Initial video surveys of the benthic environment to identify benthic habitats in the area.

3.31. The benthic habitat survey revealed that the search area included maerl/rhodolith beds and coarse sand with rhodoliths. The proposed site was then located as far as possible over the area with predominantly coarse sand and muddy heterogeneous sediment, as shown in **Figure 3.15**.

[17] Meeting Adi Associates, ERA and Department of Fisheries and Aquaculture; October 2016.

Figure 3.13: Search area for relocation

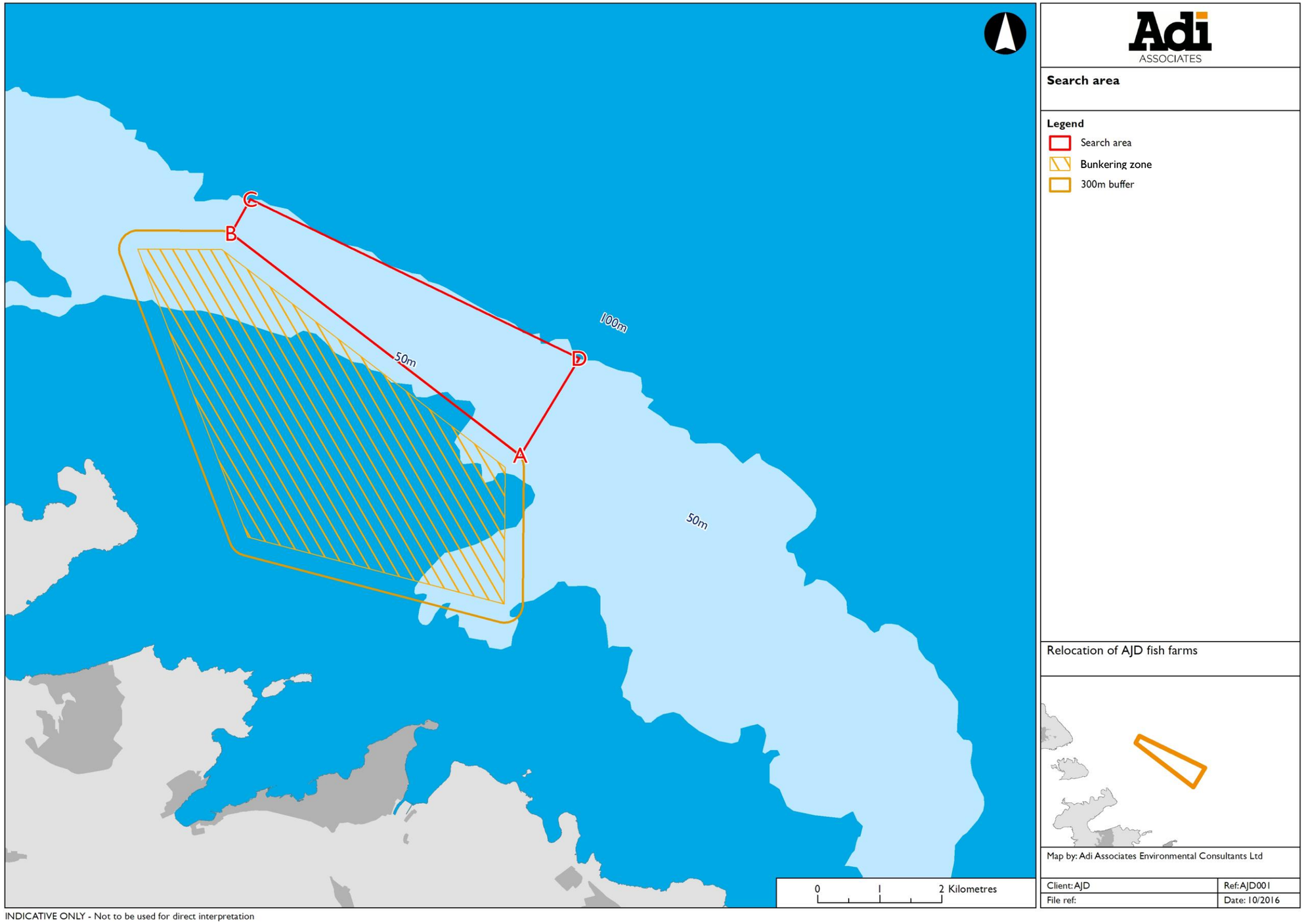

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Figure 3.14: Search area and other marine uses in the vicinity

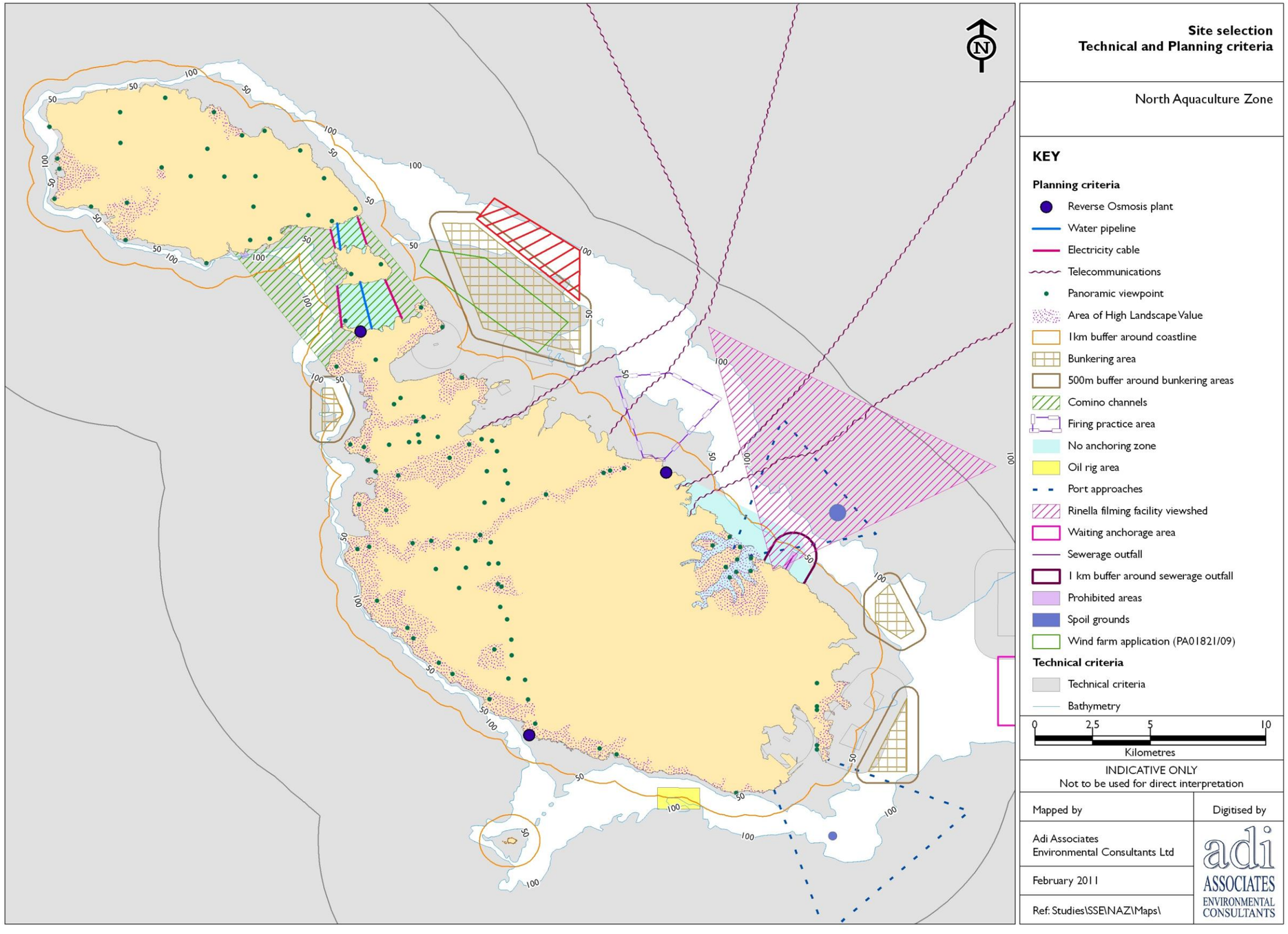
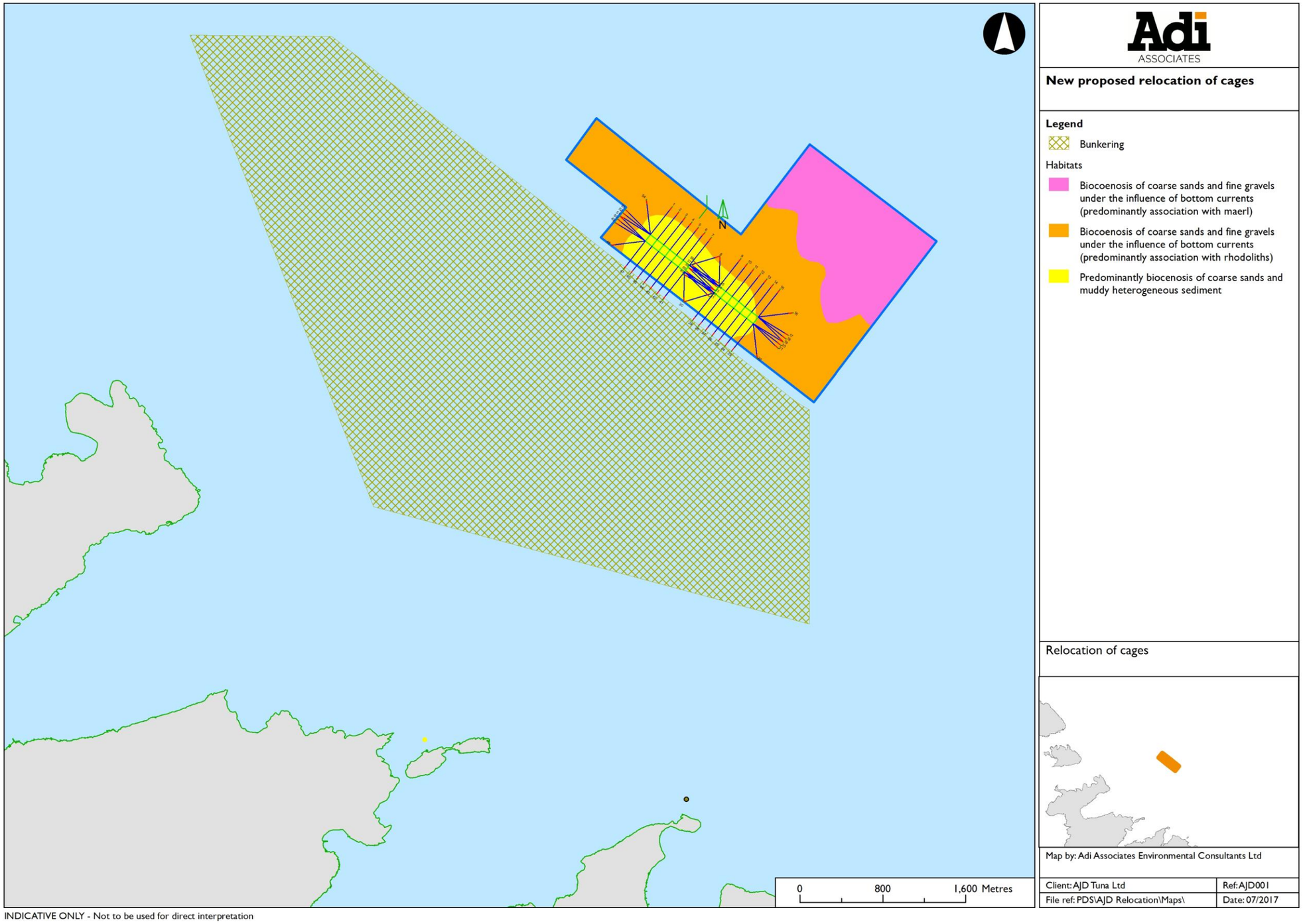


Figure 3.15: Site identified for relocation in the context of the identified benthic habitats



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SITE DESCRIPTION AND LOCATION

Location

3.32. As described earlier, the Scheme is a proposed extension to the temporary operations that were permitted in 2017. **Figure 3.16** illustrates the location of the existing cages including their moorings, located approximately 5 km offshore from Malta's northwest coast. The additional cages proposed by the current Scheme application will be located adjacent to and on the inshore side of the existing cages. Although a detailed benthic survey was carried out in 2016/17when identifying the site for the first set of cages, further studies were carried out in line with the ToR to cover a wider area south of the Scheme to ensure full coverage for the new moorings. The findings and associated impact assessments on the seabed are presented in **Chapter 5**.

Marine uses

3.33. The moorings will overlap into the bunkering area located off the northeast coast of Malta as well as the 8 nm AFM firing arc danger area (see **Figure 3.17**). **Figure 3.18** illustrates that the cages lie within marine protected areas (Special Area of Conservation: Żona fil-Baħar fil-Grigal ta' Malta, and Specially Protected Area: Il-Baħar ta' madwar Għawdex). The area of the farm and its general surroundings were also surveyed through remote sensing for the presence of any marine archaeology features, refer to **Chapter 7**.

3.34. There are no other known designated uses or infrastructure at the Scheme site. Other general maritime uses in the vicinity of the site include yachting / navigation and (in view of the presence of the Scheme) also recreational fishing. The location of the farm has to be appropriately marked by special marker buoys and navigational aids as instructed by Transport Malta. Details of the lights used are given in **Appendix 2**. The farm will also be charted on navigational charts. Though not officially designated for fishing, the tuna farm regularly attracts a number of amateur fishermen who take advantage of the farm's attraction to wild fish, including wild tuna. This activity is not regulated and though it is tolerated by the farm operators, concern has been raised by the Armed Forces of Malta in view of the presence of these fishermen within or in close proximity to the AFM's Pembroke High firing arc (see below). The activity of these fishermen is also of concern from an ecological point of view and rather than the fish farm acting as a haven for wild fish, it could instead be an "ecological trap". This issue is considered further in **Chapter 5**.

3.35. The Scheme site is located around 5 km from the nesting sites at Rdum tal-Madonna. As explained in **Technical Appendix 5: *Avifauna Baseline Report*** the area in front of the nesting cliffs and up to 5 – 7 km offshore (and including the Scheme site), are often used by the nesting seabirds for rafting.

Figure 3.16: Location of existing cages (showing moorings)

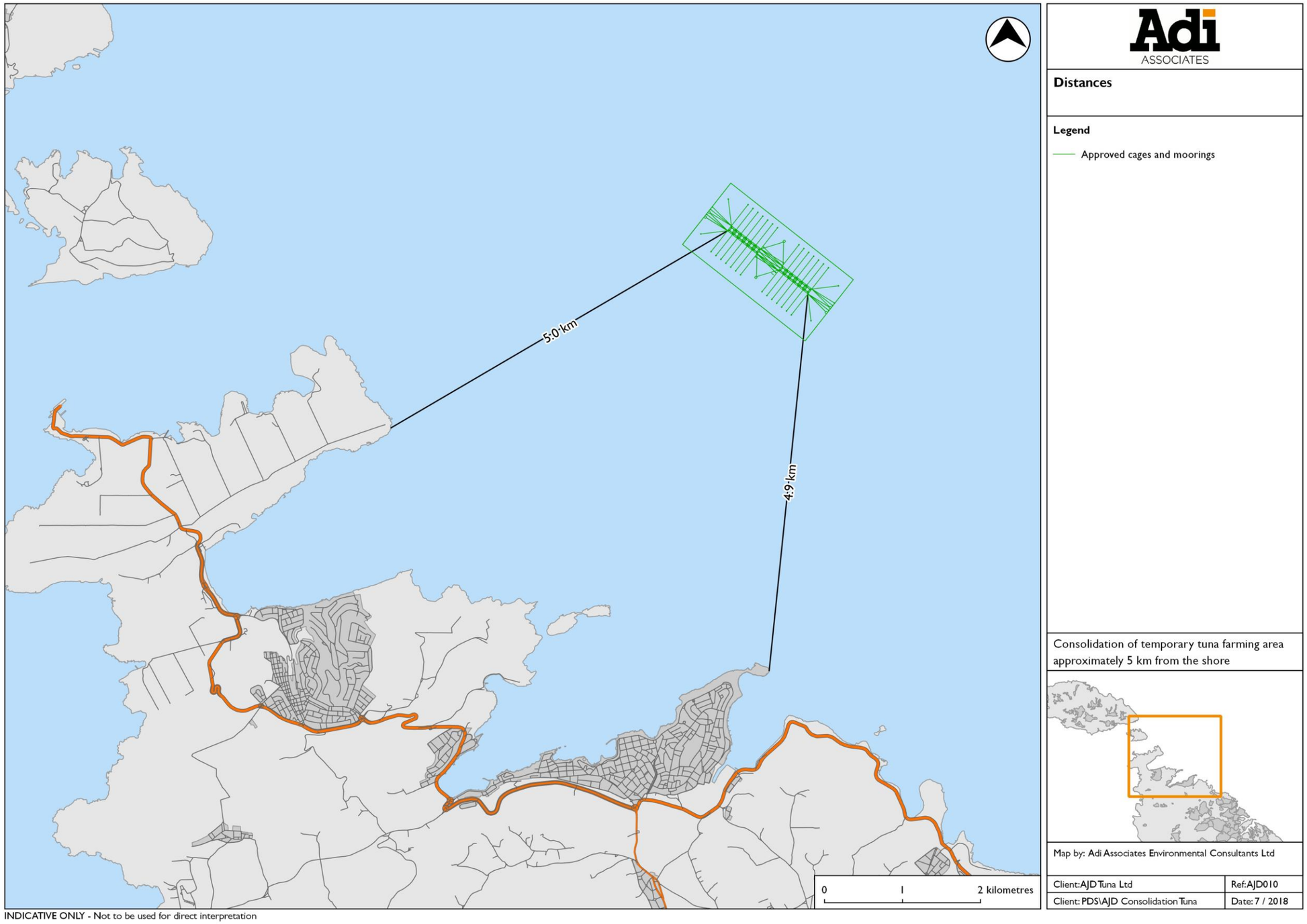

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Figure 3.17: Other uses in the vicinity of the Scheme

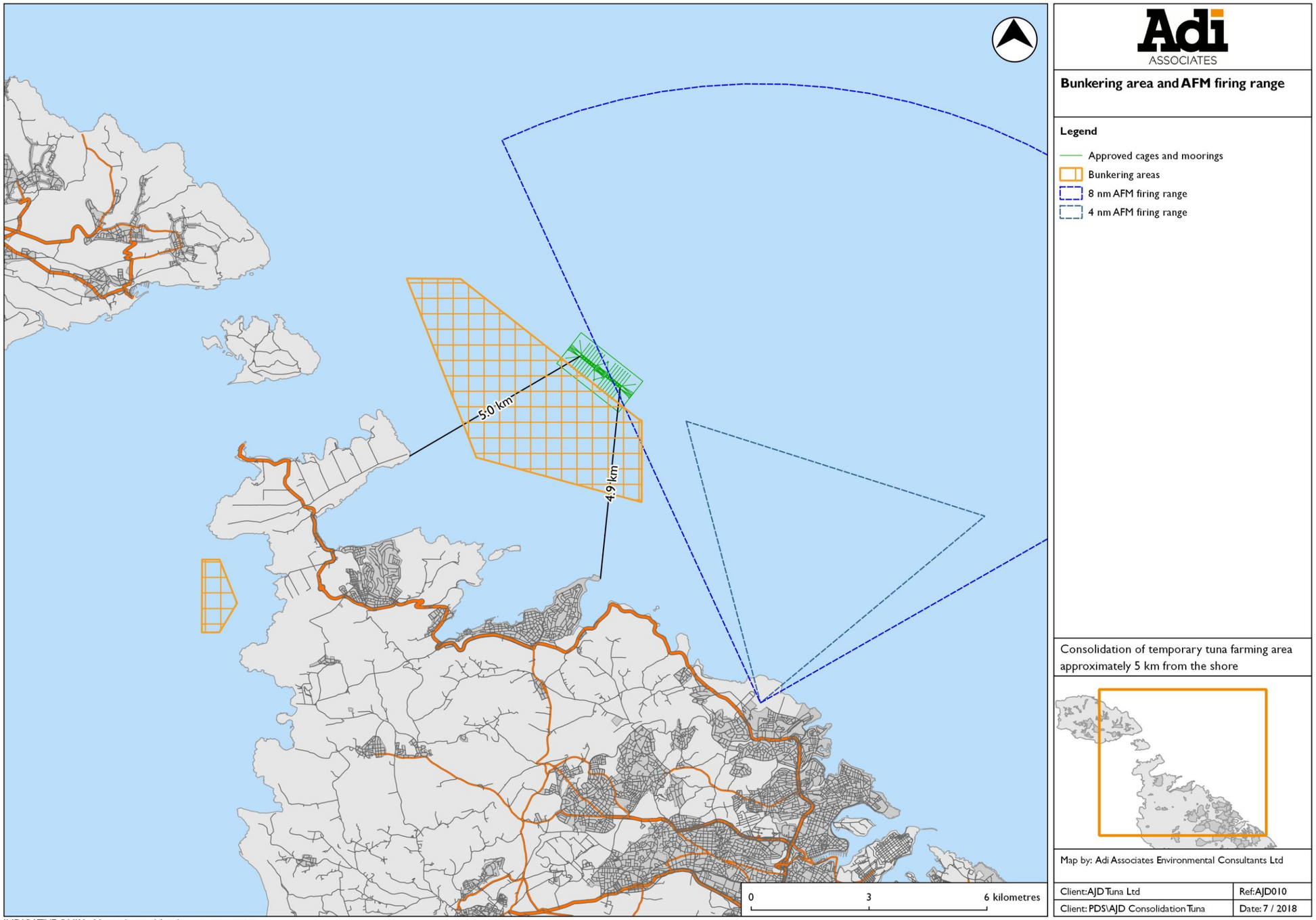

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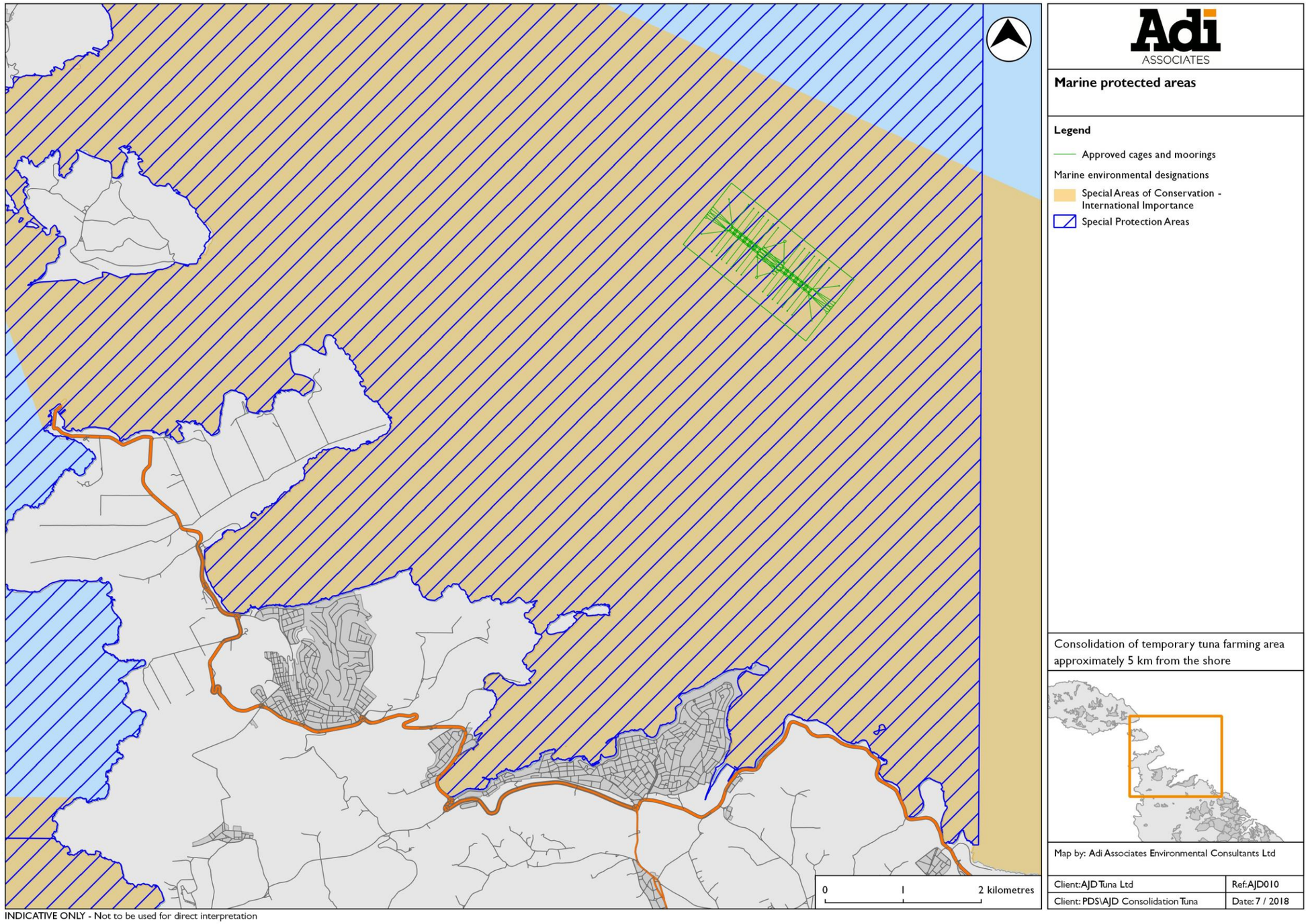
Figure 3.18: Marine protected areas within which the Scheme lies



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DESCRIPTION OF THE SCHEME

3.36. **Figure 3.19** illustrates the current cage layout (black cages) and the proposed additional cages (red). Each cage is a circular area with a diameter of 50 metres. The distance between the sides of the nets from the cages is 30 metres. The mesh size of the net is 70 x 70 mm and the twine diameter is 5 mm.

3.37. The proposed layout in **Figure 3.19** will need to be changed following the findings of this EIA and the meetings with relevant stakeholders (most notably the Armed Forces of Malta in view of the Pembroke High firing arc, and Transport Malta in view of the nearby bunkering zone).

3.38. As described, the applicant must avoid placing the farm cages above the benthic habitats having high coverage of live rhodoliths (maerl beds). Details of the benthic habitats in this area are given in **Technical Appendix 4: *Marine Ecology Baseline Report*** and in **Chapter 5**. Preliminary discussions with the ERA have been held with a view to understand ERA's view if the cages had to be moved slightly to the northwest of the cage sites approved in PA/03072/17 and PA/05858/17 while retaining the cages in around 50 m of water and over the habitats with 0-20% or 20 – 50% cover of live rhodoliths (see **Chapter 5**). This northwesterly shifting of the farm site will also shift the cages out of the AFM Pembroke High firing arc and will maintain a buffer of around 75 m from this danger area. At the same time, the farm will retain the current distance from the bunkering zone (see **Figure 3.20**).

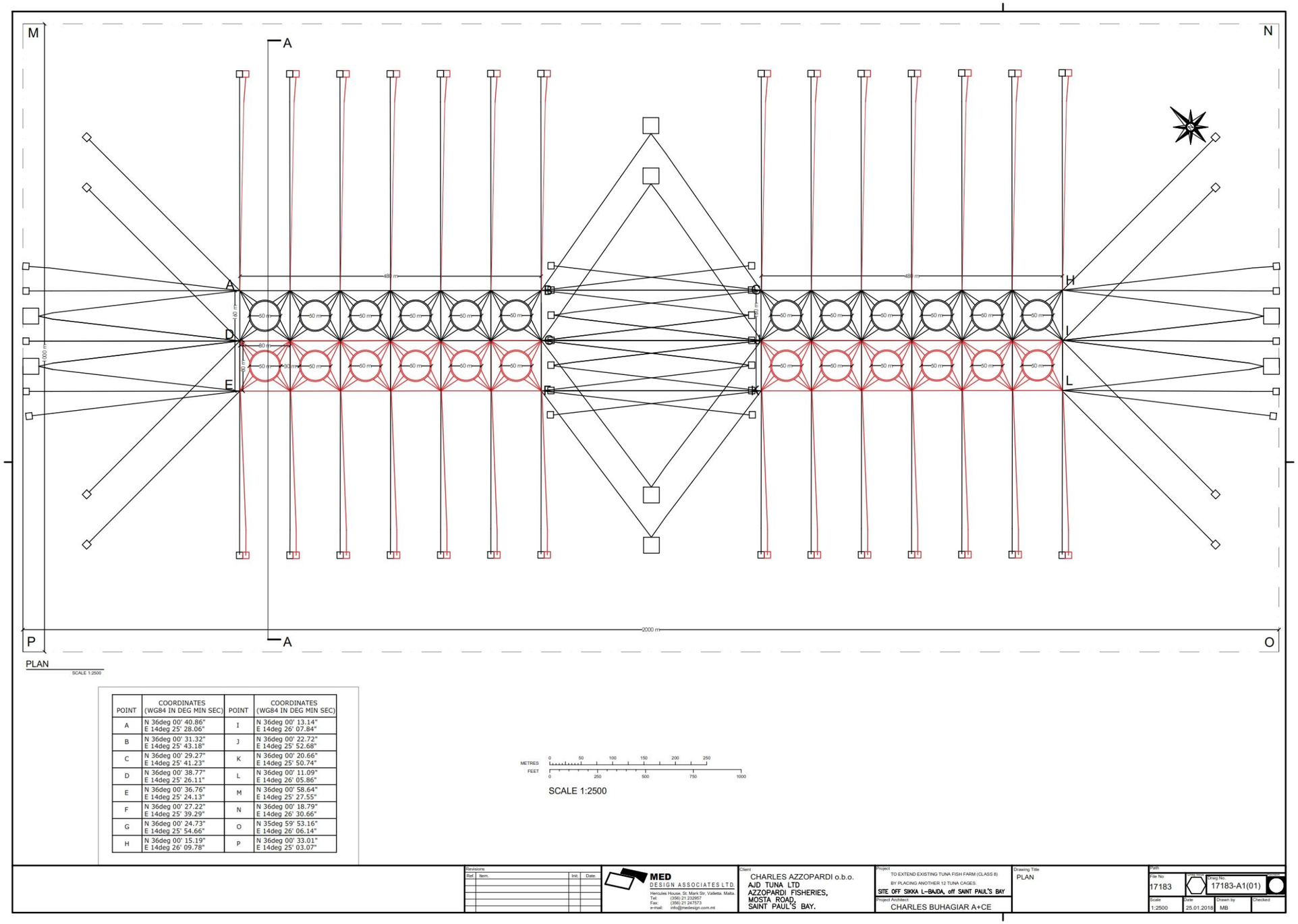
3.39. The Scheme area for this EIA Report will therefore be that shown in **Figure 3.20**, pending agreement with the relevant authorities. This moves the western boundary of the farm's mooring area approximately 200 m to the northwest and the eastern boundary of the mooring area approximately 400 m to the northwest.

3.40. The Scheme will essentially operate in the same way as it currently does. The following lists the types of vessels used in the operations, all of which are registered with ICCAT, as per requirements:

- One feeding vessel used to transport the feed to the cages;
- One service boat;
- Two other feeding vessels that are leased as required; and
- Vessel for transportation of offal waste offshore (see below).

3.41. The Applicant's main client sends over the processing ship where the fish are transferred and processed following harvesting.

Figure 3.19: Proposed cage layout



POINT	COORDINATES (WG84 IN DEG MIN SEC)	POINT	COORDINATES (WG84 IN DEG MIN SEC)
A	N 36deg 00' 40.86" E 14deg 25' 28.06"	I	N 36deg 00' 13.14" E 14deg 26' 07.84"
B	N 36deg 00' 31.32" E 14deg 25' 43.18"	J	N 36deg 00' 22.72" E 14deg 25' 52.68"
C	N 36deg 00' 29.27" E 14deg 25' 41.23"	K	N 36deg 00' 20.66" E 14deg 25' 50.74"
D	N 36deg 00' 38.77" E 14deg 25' 26.11"	L	N 36deg 00' 11.09" E 14deg 26' 05.86"
E	N 36deg 00' 36.76" E 14deg 25' 24.13"	M	N 36deg 00' 58.64" E 14deg 25' 27.55"
F	N 36deg 00' 27.22" E 14deg 25' 39.29"	N	N 36deg 00' 18.79" E 14deg 26' 30.66"
G	N 36deg 00' 24.73" E 14deg 25' 54.66"	O	N 35deg 59' 53.16" E 14deg 26' 06.14"
H	N 36deg 00' 15.19" E 14deg 26' 09.78"	P	N 36deg 00' 33.01" E 14deg 25' 03.07"

Revisions: Ref. | Item. | Init. | Date.

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Client: CHARLES AZZOPARDI o.b.o. AJD TUNA LTD AZZOPARDI FISHERIES, MOSTA ROAD, SAINT PAUL'S BAY.

Project: TO EXTEND EXISTING TUNA FISH FARM (CLASS 8) BY PLACING ANOTHER 12 TUNA CAGES. SITE OFF SIKKA L-BAJDA, off SAINT PAUL'S BAY

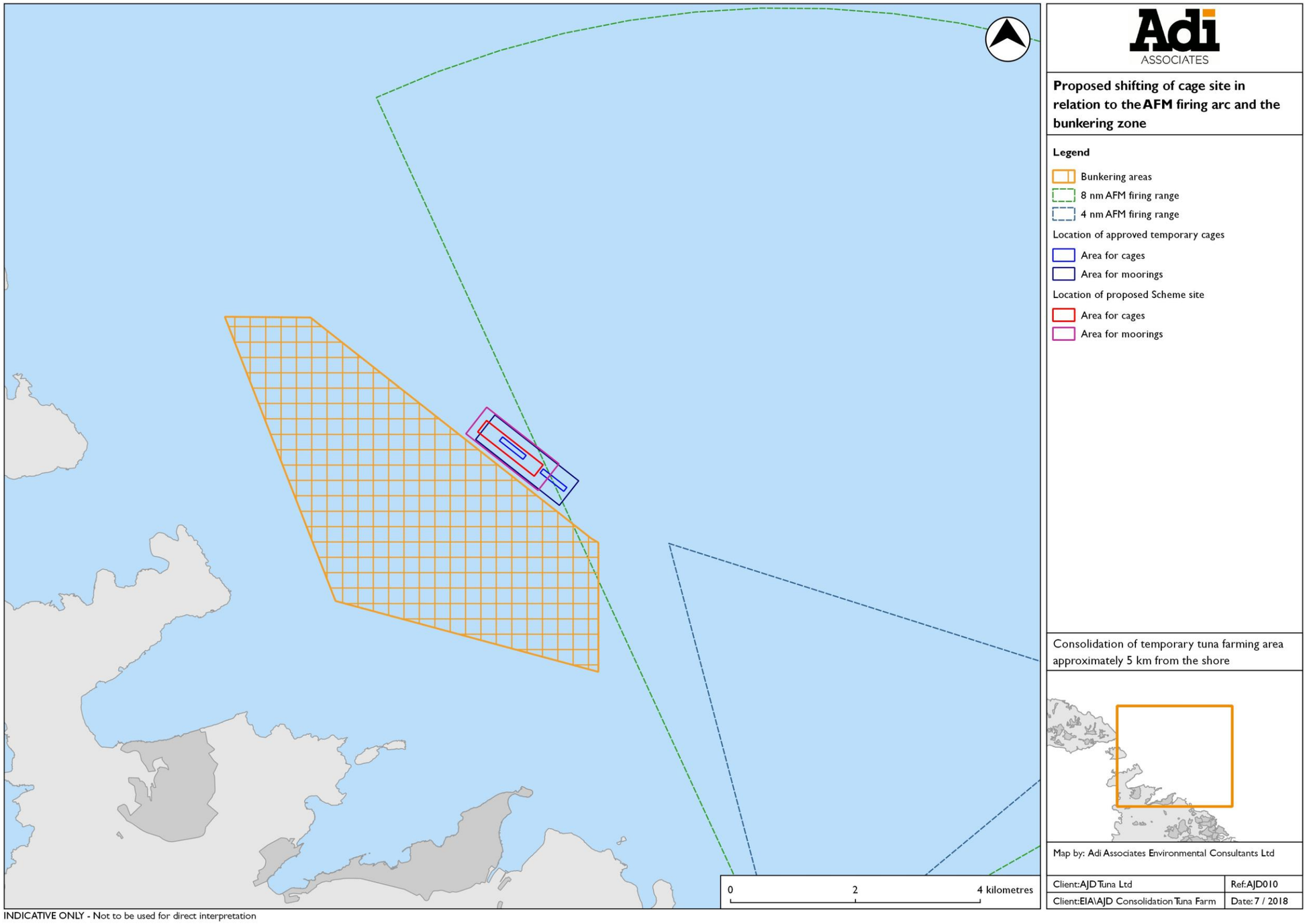
Project Architect: CHARLES BUHAGIAR A+CE

Drawing Title: PLAN

Path: File No: 17183 | Dwg No: 17183-A1(01)

Scale: 1:2500 | Date: 25.01.2018 | Drawn by: MB | Checked

Figure 3.20: Proposed shifting of cage site in relation to the AFM firing arc and the bunkering zone



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Waste management

3.42. Wastes generated by the Scheme are likely to include:

- Packaging waste from importation of baitfish;
- Thaw water from baitfish preparation;
- Oily slick (from baitfish);
- Uneaten feed;
- Fish excreta;
- Dead tuna;
- Blood (during slaughtering);
- Wastewater from onboard processing of fish (mixture of blood, water, and offal);
- Offal (gutted heads, tails, and internal organs);
- Algal and other net fouling marine growth; and
- Marine litter.

Packaging waste and thaw water

3.43. This waste stream is generated as a result of the importation of baitfish. The Applicant has a contract with a third party who takes the packaging waste away for reuse. Thaw water at the land base is collected in culverts (**Figure 3.21**) and directed to the sewer. The use of impermeable jumbo bags for the transportation of the baitfish from the landbase to the farm ensures that this oily material is not lost to the environment until the baitfish is placed inside the cages, from where it is collected – see below. If any water is lost once the bags are on the flat bed trailer, it is collected in a specially installed container retrofitted on the flat bed trailer (see **Figure 3.22**).

Oily slick

3.44. The oily slick generated at the farm is essentially a combination of fish oils, melting ice, body fluids, and fish mucus released from the baitfish as it thaws in the feeding cage. Although this oily slick can extend over a considerable area as it is carried on the surface of the water by surface currents, it is restricted to the immediate surface of the sea and does not dissolve into the rest of the water column, until it is dispersed or evaporates. In summer 2016, there were numerous complaints from other marine users (especially bathers, divers and boaters) who made specific reference to the amount and consistency of the oily slick. According to the Applicant, the main reason for this was the purchase of baitfish from a different supplier (in Morocco), which turned out to be of inferior quality. The baitfish supplier has since been changed and the fish are being imported from the Netherlands.

3.45. In addition, the Applicant has also undertaken the measures described earlier to contain and collect as much of this oily material as possible. As explained, the measures taken include the transportation of the baitfish in impermeable jumbo bags to minimise losses during the transfer to the farm, the permanent deployment of an oil boom inside each cage, and the collection of the oily slick by means of oil skimmers. Last year the skimmer was operated by a diver who collects the floating oil, which is then transferred to an IBC on board the vessel. While this skimmer is still available, the applicant has this year procured a different skimmer that is not diver operated[18]. Once full the IBC is transferred to land where the collected materials are allowed to separate and the water phase decanted. The oily phase is collected by a licensed waste oil recycling company.

Uneaten feed

3.46. In addition to adding to the costs of the fish farming operation, uneaten feed (especially the baitfish used in tuna penning operations) passes through the net and settles on the seabed, which, depending on the amounts lost in unit time, can result in overloading of the scavenging community and an accumulation of organic carbon and nitrogen in the sediment beneath the cages or in the direction of the prevailing currents.

3.47. Uneaten baitfish that deposits on the bottom of the sea will start to decompose, releasing gases such as hydrogen sulphide[19] and ammonia. These gases are insoluble in seawater and therefore rise through the water column until they reach the surface where they produce unpleasant odours, which, depending on the prevailing wind currents at the time, could be blown towards the coast.

3.48. The capacity of the environment to assimilate the pollutants settling on the seabed depends largely on the amount of settlement of material and the capability of seabed bacteria and scavengers to utilise this material.

3.49. The Applicant has carried out monitoring of the seabed, sediment and water quality as per permit conditions pertinent to the former location of the cages. In the early years of farm operation (between 2001 and 2004) towards the end of each penning season, significant amounts of dead fish were recorded littering the seabed in the area lying directly below the pens. As summarised by Borg (2014)[20], this resulted in changes to the physical and biological characteristics of the seabed. By the end of the penning season little of the uneaten dead fish remained although thick layers of fish bones and decomposing organic material were recorded by Borg (2014). Borg (2014) observed that once the source of the impact was removed, i.e. following harvesting, the benthic environment eventually largely returned to its original state, as attested to by the shift in species that dominate the benthic environment, i.e. during

[18] See www.lamor.com/products.
[19] Hydrogen sulphide is also very poisonous to farmed fish.
[20] Borg, J.A. 2014. Azzopardi Fisheries Tuna Penning Project: Report on a video survey of the seabed in the vicinity of the tuna-pens made in April-July 2014. Ecoserv.

feeding the area is dominated by scavenger and detritus feeders, once the uneaten fish is gone, the site returns to its previous ecology and species typical of a bare sand habitat are again noted.

3.50. In 2005, the monitoring surveys recorded a significantly lower amount of uneaten fish under the cages indicating an improvement in feed management. This trend continued up to 2007 although the benthic ecology was noted to have altered and species typical of bare habitat were absent from the area.

3.51. In 2008, large amounts of uneaten feed were again noted and high populations of detritus feeders and scavengers were recorded. Borg (2014) emphasised that when the amount of uneaten feed overwhelms the scavenger feeders, the feed decomposes slowly resulting in a significant adverse effect on the benthic habitat. Eventually, anoxic conditions persist such that the environment is no longer favourable for scavengers. This means that it is left to the physical environment, waves and currents, to disperse the decomposing material.

3.52. The situation with feed management improved again in 2009 although the changes to the seabed ecology remained.

3.53. The previous improved situation with feed management appeared to have reversed again in 2010. The surveyors noted significant differences between the amounts of uneaten feed beneath different cages. Similar observations were recorded in 2012. AJD Tuna Ltd assigns specific divers to specific cages and therefore they can pinpoint who may need additional training with regards to feeding management.

3.54. Also in the 2012 survey large whole dead tunas and decomposing parts were recorded on the seabed. The Applicant explained that the source of this tuna was not the tuna farm. Amateur fishermen that angle around or in the vicinity of the fish farms often capture then release (accidentally or deliberately) tuna that may be attracted to the area (see also **Technical Appendix 4: *Marine Ecology Baseline Report***). This could not be verified.

3.55. In 2014, uneaten fish was only recorded underneath one of the nine pens. The reason for this was attributed to the fact that the survey was carried out during the fallow period. Dead specimens of other organisms such as sea urchins and bivalves, that form part of the fouling community on the nets, were also recorded in places under the cages. During the survey, the scientific divers removed the first few centimetres of the surface sediment, which uncovered black anoxic layers. Particulate organic matter was released from the sediment into the water column when the sediment was disturbed.

3.56. The 2014 survey also recorded the alien alga *Caulerpa cylindracea* in places under most of the cages. A pink filamentous alga, possibly *Lophocladia* sp. was also present. Both species were located in patches of coarse sediment. The survey again confirmed the alteration of the benthic ecology in the area.

3.57. With respect to sediment analysis at the location of the former farm, except for the initial year, the results indicate that the parameters tested for, i.e. sediment grain size, organic carbon content, organic nitrogen content and recently organic phosphorus content, as well as heavy metals and organic compounds were not altered as a result of the tuna penning activities (Borg *et al*, 2013)[21].

3.58. With regards to water quality, Borg & Evans (2016)[22] concluded that overall, the Applicant's penning activities do not appear to have affected the water quality in the vicinity of the farms in terms of the parameters tested for; however, a fishy odour was recorded and a film of fish oil and residues at the water surface were recorded at two of the five monitoring stations. Again these results pertain to the former location of the farm.

3.59. **Technical Appendix 3: *Wave study, hydrodynamics and environmental modelling Report*** includes results from a model that analysed the settlement of uneaten feed for the Scheme. See also **Chapter 5**.

Fish excreta

3.60. Like uneaten feed, fish excreta contain or release ammonia, nitrates, and phosphate in soluble form. These nutrients can enhance the growth of marine plants and algae (including phytoplankton). Some of these nutrients are taken up by algae and net-fouling assemblages and also by benthic dwellers and scavengers. Faeces are nitrogen depleted and phosphorus enriched compared with feed (Fernandes *et al*., 2007)[23]. Fernandes *et al* (2007) studying dissolved nutrient release from solid wastes of southern bluefin tuna (*Thunnus maccoyii*) identified that the phosphorus available for leaching from baitfish and faeces of baitfish-fed tuna was around 17-21% whereas the proportion of soluble nitrogen was 35-43%. They concluded that more than 90% of nitrogen loads and approximately 50% of phosphorus are likely to be released into seawater before solid wastes reach the seafloor. **Technical Appendix 3: *Wave study, hydrodynamics and environmental modelling Report*** includes results from a model that analysed the dispersal of fish excreta for the Scheme. See also **Chapter 5**.

Dead tuna

3.61. Tuna deaths are mainly a result of stress or panic, especially when the nets billow under strong currents. The number of deaths is limited as far as possible by closely monitoring the tuna and culling any fish that shows signs of stress or are moribund. Hence, few if any deaths actually occur.

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[21] Borg, J.A., Debono, S., Evans, J. 2013. Azzopardi Fisheries Tuna Penning Project: Environmental Monitoring Programme (Sediments) – Report on analyses of sediment samples collected in October 2012 from Azzopardi Fisheries' tuna penning site and control sites, off the St Paul's Bay/Qawra coast. Ecoserv.

[22] Borg, J.A., Evans, J. 2016. Azzopardi Fisheries Ltd Tuna Penning Activities: Report of a water quality survey at Azzopardi Fisheries Ltd's tuna penning site off the St. Paul's Bay/Qawra area, made in July 2016. Ecoserv.

[23] Fernandes, M., Angove, M., Sedawie, T., Cheshire, A. 2007. Dissolved nutrient release from solid wastes of southern bluefin tuna (*Thunnus maccoyii*, Castelnau) aquaculture. Vol 36 (4). Aquaculture Research.

Blood

3.62. As explained, the tuna have to be killed in a very short time interval so as to avoid a sudden increase in body temperature that would negatively affect the quality of the meat. Some blood is released into the sea when the fish are killed and handled prior to being transported to the processing vessel.

Wastewater from onboard processing of fish (tuna)

3.63. The further processing of the tuna onboard the service vessels invariably results in the generation of wastewaters mixed with blood and possibly some offal. The vessels have holding tanks where wastewater is collected (Azzopardi, C., pers. comm.; Nov 2016).

Offal

3.64. Tuna processing creates a substantial amount of offal, which is composed of the internal organs, the tails, and the heads of the tuna. As identified earlier, during harvesting, the current farm generates between 8 and 10 tonnes of offal per day. Despite an initial policy and regulatory direction to transport this waste back to land for incineration, the incinerator at the abattoir does not have the capacity to process the amount of waste generated during this period and thus no longer accepts this waste. In view of this, the accepted practice has returned to offshore offal disposal[24]. A VMS-equipped vessel[25] takes the waste from the processing vessel and transports it further offshore to a dumping site as agreed with the Competent Authorities. The vessels are monitored by the Fisheries Department to ensure that the offal is dumped at the designated sites. The possibility of identifying alternative options for the disposal of the offal is a condition of ERA's environment permit and will be discussed in detailed with the relevant authorities as part of that process.

Net fouling marine growth

3.65. Marine growth on tuna nets is removed through air drying on the collars and later by scraping on land. The growth that is removed on land is disposed of as organic waste (see earlier).

[24] Offal is disposed beyond the 12 nautical mile limit.

[25] VMS (Vessel Monitoring System) is a satellite surveillance system primarily used to monitor the location and movement of commercial fishing vessels and other craft. The system uses satellite-based communications from on-board transceiver units, which certain vessels are required to carry. The transceiver units send position reports that include vessel identification, time, date, and location, and are mapped and displayed on the end user's computer screen. Each vessel typically sends position reports once an hour, but these can be increased when the vessel is approaching an environmentally sensitive area. Alerts can be sent to the VMS technicians and other personnel when a particular vessel location might require additional inquiry or contact with the vessel operator. VMS allows enforcement to use advanced technologies to monitor compliance, track violators, and provide substantial evidence for prosecution. (see www.nmfs.noaaa.gov).

Marine litter

3.66. Other wastes generated by the farms could include anthropogenic material such as rope, boxes, and municipal-type wastes from the service vessels that may occasionally find their way overboard. The monitoring reports for this site have repeatedly made reference to the presence of anthropogenic waste associated with the fish farm operations on the sea bed. Any such material will need to be collected and disposed onshore. In addition, the environment permit issued by ERA for the current operation also includes an obligation for the operator to collect any floating anthropogenic materials in the farm area, whether they originate from the operations or from outside.

Environmental Management System

3.67. In order to fulfil the environmental permit conditions, the Applicant is devising an Environmental Management System (EMS) that will be integrated with the current operational system. The EMS will include:

- An assessment of how the Applicant's activities, processes, services might affect the environment including (i) the evaluation of significant environmental aspects; (ii) development of a register of environmental aspects; and (iii) development of a register of legislation;
- The development of an environmental policy;
- Developing objectives and targets and setting up an Environmental Management Programme (EMP) to achieve them;
- Defined roles and responsibilities for all employees;
- A training and awareness programme;
- Procedures to control activities with a significant environmental impact (also in relation to the EMP);
- A controlled system of records;
- Periodic auditing to ensure effective operation; and
- A formal review by senior management.

Employment

3.68. The Applicant currently employs 40-45 full-timers and 40 part-timers. Employees include divers, boatmen, handymen, and drivers. The number of full-time employees is expected to increase to 55 whereas the part-timers will remain 40 once the additional cages are deployed.

Figure 3.21: Culvert system at Kordin land base

Figure 3.22: Collection of thaw water from trailer

4. POLICIES AND LEGISLATION

INTRODUCTION

4.1. This chapter considers the relevance of international and national legislation, and Maltese planning policy, and the compatibility of the Scheme with this legislation / policy. It highlights and assesses the policies of Government Ministries, where relevant, and outlines those European Union (EU) Directives and Regulations and other international obligations that are applicable to the Scheme.

4.2. The legal basis for ERA's request for the preparation of an Environmental Impact Assessment (EIA) stems from the *Environmental Impact Assessment Regulations, 2017* (S.L. 549.46).

AQUACULTURE

International

United Nations Convention on the Law of the Sea, 1982

4.3. The United Nations Convention on the Law of the Sea (UNCLOS) came into force on 16th November 1994 and establishes nations' rights as well as duties with regards to the use of the world's oceans. These duties include environmental protection[26] and sustainable management of natural resources. With regards to the latter, Articles 61 and 62 relate to the conservation and utilisation of living resources respectively, referring to stocks within States' exclusive economic zone and the need to ensure that these are managed sustainably. Article 64 considers the management of highly migratory species (as listed in Annex I of the Convention). *Thunnus thynnus* is one of these species. Article 64 states that: *The coastal State and other States whose national fish in the region for the highly migratory species listed in Annex I shall cooperate directly or through appropriate international organisations with a view to ensuring conservation and promoting the objective of optimum utilisation of such species throughout the region, both within and beyond the exclusive economic zone.*

Implications for the Scheme:

- The tuna fish quotas allocated to the Scheme are regulated by ICCAT (see below).

International Commission for the Conservation of Atlantic Tunas

4.4. The International Commission of the Conservation of Atlantic Tunas (ICCAT) was set up in 1966 to coordinate international research and management of highly migratory tunas and billfish in the north Atlantic. The Commission adopts

[26] Article 194(1)
States are required to take "…all measures consistent with [the] Convention that are necessary to prevent, reduce and control pollution of the marine environment from any source".

Recommendations and Resolutions aimed at maintaining the populations of ICCAT species, including Bluefin Tuna, at levels which will permit maximum sustainable catch. The Compendium on Management Recommendations and Resolutions adopted by ICCAT for the Conservation of Tunas and Tuna-like Species 2016 provides a complete set of currently active ICCAT Recommendations and Resolutions.

4.5. ICCAT's regulations are binding; however, enforcement is under the remit of the individual country members. If a member does not comply, ICCAT may enact quota reductions for overages or, as a last resort, authorize trade restrictive measures.

Implications for the Scheme:

- The activities of the Applicant are regulated within this framework.

EU Aquaculture Priorities

4.6. At EU level, aquaculture is a key component of both the Common Fisheries Policy and the Blue Growth agenda and the main are to:

- Simplify administrative procedures;
- Ensure access to space through coordinated spatial planning;
- Enhance the competitiveness of EU aquaculture; and
- Promote a level playing field for EU operators.

4.7. Funding to support the sustainable development of aquaculture is available through the European Maritime and Fisheries Fund (EMMF). The EU also published Strategic Guidelines for sustainable aquaculture in 2013 (COM/2013/229). The Guidelines provide a framework for national plans in sustainable aquaculture.

Implications for the Scheme

- The Scheme operates within the legal context established in Malta.

National policies and legislation

Aquaculture Strategy for the Maltese Islands: Towards Sustainability 2014-2025

4.8. Malta's National Aquaculture Strategy requires that all aquaculture activities must be carried out within designated Aquaculture Zones and declares all existing cage locations as Aquaculture Zones (subject to adherence with the carrying capacity limits established through regulatory and environmental monitoring measures). All Aquaculture Zones are the property of the Department of Fisheries and Aquaculture and fish farming operations require a license / permit from the Department to be able to operate.

4.9. The Strategy addresses sustainable growth of aquaculture with specific mention to the identification of new search areas. It requires that future farms for capture based

species will need to be sited at water depths of 50 metres or more within areas identified as Aquaculture Zones.

Implications for the Scheme:

- The Scheme site has not been declared as an official Aquaculture Zone. Simultaneously to the processing of this application, the Department of Fisheries and Aquaculture has applied for the development of an Aquaculture Zone in the northern waters of the Islands.
- In the meantime, the Applicant will continue to operate in accordance with its existing operational permit, EP00025/17/A issued by ERA in July 2017[27].

Fisheries Conservation and Management Act (Cap. 425)

4.10. The Fisheries Conservation and Management Act (Cap. 425) makes provisions for the regulation, conservation, and management of fisheries and aquaculture in Malta. It defines, among other things, the fishing waters of Malta, and aquaculture, and provides for the:

- Conservation of naturally occurring fish stocks;
- Protection of fish stocks from pollution;
- Assessment of fish stocks and collection of appropriate fisheries statistics (including catches and fishing fleet);
- Monitoring, control, and surveillance of fishing operations (including aquaculture);
- Issue and management of permits and licences; and
- Safeguarding of protected species.

Implications for the Scheme:

- All aquaculture operations, including the Scheme, require a permit from the Department of Fisheries and Aquaculture in accordance with this Act.

Aquaculture Operations Regulations, S.L. 425.12

4.11. Legal Notice 157 of 2017 establishes the need for a permit for any aquaculture operation that will be issued by the Director of Aquaculture.

Implications for the Scheme:

- AJD Tuna Ltd and MML Ltd were issued operational permits 008/A/17 and 009/A/17, respectively, associated with the temporary permit issued by the Planning Authority: PA/03072/17 and PA/05858/17, respectively, for

[27] This permit is currently under review and is expected to be renewed in the coming weeks.

the relocation of the cages (see **Chapter 3**). The aquaculture permits remain valid for 25 years or until such time as the period of validity of the planning permit expires, whichever comes first.

PLANNING

4.12. The planning policy relevant to the Scheme is set out in the *Strategic Plan for the Environment and Development (SPED), 2015*.

Strategic Plan for the Environment and Development, 2015

4.13. The Strategic Plan for the Environment and Development (SPED) outlines "*proposals for the future spatial distribution of development and the protection of the environment on land and sea in a manner that is consistent with national policies and integrates Government's social, economic and environmental objectives*". The SPED identifies distinct spatial areas, including the Coastal Zone (up to 12 nautical miles), and the Marine Area (between 12 and 25 nautical miles); the island of Gozo is also identified as a distinct spatial area.

4.14. The vision for the Coastal Zone and Marine Area is described as follows:

> *"The Coastal Zone and Marine Area shall maximise the potential for sustainable socio-economic growth and renewable energy infrastructure, shall accommodate legitimate compatible uses, sustain the livelihood of the fishing community, remain rich in biodiversity and visually striking and become pollution free and accessible for public enjoyment. It shall play a significant enabling role for the Maltese Islands to reduce their impact on climate change and strengthen their capacity to adapt to climate change".*

4.15. The SPED outlines a National Spatial Framework (NSF) for the Maltese Islands. The General Principles of this NSF advocates the sustainable use of resources and the efficient use of available space. In relation to the Coastal Zone and Marine Area, the NSF outlines a planning framework "*to integrate socio-economic growth and environmental management*".

4.16. In relation to guiding socio-economic development, and with relevance to the Scheme, **Thematic Objective 1** of the NSF advocates:

> *"To manage the available potential space and environmental resources on land and sea sustainably to ensure that socio-economic development needs are met whilst protecting the environment by:*
>
> *.. 5. Achieving a wider mix of compatible uses on land and sea".*

4.17. In relation to protecting the environment, and with relevance to the Scheme, **Thematic Objective 8** of the NSF advocates:

> *"To safeguard and enhance biodiversity, cultural heritage, geology and geomorphology by:*

.. 2. Safeguarding protected areas, including SACs, SPAs and MPAs whilst enabling activities aimed at enhancing their management objectives".

Implications for the Scheme:

- The impacts of the Scheme in respect of the marine environment (including marine ecology), avifauna, and cultural heritage are described in **Chapter 5, Chapter 6**, and **Chapter 7,** respectively.

4.18. In relation to the Coastal Zone and Marine Area, and with relevance to the Scheme, **Coastal Objective 1** of the NSF advocates:

"To prioritise uses that necessitate a location in the Coastal Zone and Marine Area in a manner which minimises user conflicts, does not accelerate coastal erosion, protects biodiversity, cultural heritage, landscapes and visual access to them, public access and use and increases resilience to climate change impacts".

Implications for the Scheme:

- The Scheme is a use which necessitates a location in the Marine Area. The impacts of the Scheme in respect of biodiversity (marine ecology and avifauna) and cultural heritage are described in **Chapter 5**, **Chapter 6** and **Chapter 7**, respectively.

4.19. **Coastal Objective 3** of the NSF advocates:

"To ensure that existing coastal recreational resources are protected, enhanced and accessible and to facilitate the provision of new recreational facilities which do not restrict or interfere with physical and visual public access of the coast and in a manner which does not have an unacceptable adverse impact on protected areas, species and areas of high landscape sensitivity by:

.. 4. Protecting designated beaches and swimming zones and identified diving sites from conflicting uses".

Implications for the Scheme:

- Impacts on the marine environment and therefore impacts on beaches, swimming zones and protected areas are assessed both in **Chapter 5** and **Chapter 8**.

Development Planning Act (Act VII of 2016)

4.20. This Act is the second act that replaces the *Environment and Development Act X, 2010*. The Act makes "*provision for sustainable planning and management of development and for the establishment of an authority with powers to that effect and for matters connected therewith or ancillary thereto".*

4.21. Various duties fall to the Government:

3(a) to preserve, use and develop land and sea for this and future generations, whilst having full regard to environmental, social and

economic needs;

3(b) to ensure that national planning policies are unambiguous, accessible and clear to the general public;

3(c) to deliver regular plans in accordance with the needs and exigencies from time to time;

3(d) to identify regional planning shortcomings and address any problems found in relation thereto;

3(e) to apply scientific and technical knowledge, resources and innovation for the effective promotion of development planning; and

3(f) to consider public values, costs, benefits, risks and uncertainties involved when taking any decisions.

4.22. The Act makes provision for the establishment of an authority to implement the duties of Government under the Act – the Planning Authority. The functions of the Planning Authority with relevance to the Scheme include:

- to formulate, implement and update plans and policies relating to the promotion of proper land and sea use, both public and private; development planning of land and at sea, both public and private; and such other matters as may be necessary, ancillary, incidental or conducive to the better carrying out of the provisions of this Act, whilst taking into account the protection and management of the environment and the sustainable management of natural resources;
- to enforce the control of such development in accordance with plans, policies and permissions in terms of this Act;
- to seek the co-operation of, or make arrangements with, other entities or persons to enable it to better monitor the implementation of, and compliance with, the provisions of the Act;
- to advise the Minister on the making of guidelines and regulations under the Act;
- to provide support and advisory services, relating to development planning on land and at sea in a sustainable manner, to Government and local authorities in relation to the performance of their functions; and
- to undertake research and conduct consultations with Government departments, non-governmental organisations, private organisations and international organisations and other persons relating to the development of planning methods and models relating to development planning on land and at sea and any other related matters.

4.23. In determining an application for development permission, the Planning Authority is

required to have regard to:

- Development plans;
- Planning policies;
- Representations from the public; and
- Any other material consideration the Authority deems relevant.

4.24. In making an application for development permission, an applicant must certify to the Planning Authority that s/he is the owner of the site, or that s/he has notified the owner of his intention to apply for development permission, and that the owner has granted his consent to the development, or s/he is authorised to carry out the development under any other law or through an agreement with the owner.

4.25. The Act X also empowers the Planning Authority to issue Scheduling Orders in respect of "*areas, buildings, structures and remains of geological, palaeontological, cultural, archaeological, architectural, historical, antiquarian, artistic or landscape importance*", as well as "*areas of natural beauty, of ecological or scientific value*".

Implications for the Scheme:

- The development plans and planning policies relevant to the Scheme are explained below, and their implications in respect of the Scheme are described.

ENVIRONMENT

International

Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean, 1976

4.26. This Convention, known as the Barcelona Convention, requires the Contracting Parties to *"…individually or jointly take all appropriate measures in accordance with the provisions of this Convention and those Protocols in force to which they are party to prevent, abate, combat and to the fullest possible extent eliminate pollution of the Mediterranean Sea Area and to protect and enhance the marine environment in that Area so as to contribute towards its sustainable development"* (UNEP, 2004[28]).

International Convention for the Prevention of Pollution from Ships (MARPOL) 73/78

4.27. The International Convention for the Prevention of Pollution from Ships (MARPOL) is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes. The MARPOL

[28] http://www.unep.ch/seas/main/med/medconvii.html

Convention was adopted on 2 November 1973 at IMO[29]. The Protocol of 1978 was adopted in response to a spate of tanker accidents in 1976-1977. As the 1973 MARPOL Convention had not yet entered into force, the 1978 MARPOL Protocol absorbed the parent Convention. The combined instrument (73/78) entered into force on 2 October 1983. In 1997, a Protocol was adopted to amend the Convention and a new Annex VI was added which entered into force on 19 May 2005. MARPOL has been updated by amendments through the years.

4.28. The Convention includes regulations aimed at preventing and minimizing pollution from ships, both accidental pollution and that from routine operations, and currently includes six technical Annexes as listed hereunder[30]. Special Areas with strict controls on operational discharges are included in most Annexes.

- **Annex I: Regulations for the Prevention of Pollution by Oil** (entered into force 2 October 1983)
    - This Annex covers prevention of pollution by oil from operational measures as well as from accidental discharges; the 1992 amendments to Annex I made it mandatory for new oil tankers to have double hulls and brought in a phase-in schedule for existing tankers to fit double hulls, which was subsequently revised in 2001 and 2003. This Annex is based on the principle that oil and water do not mix and are therefore easily separated. It contains requirements regarding the operation, construction and equipment of ships. The operational requirements stipulate the conditions under which ships may discharge water/oil mixtures into the sea.
- **Annex II: Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk** (entered into force 2 October 1983)
- **Annex III: Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form** (entered into force 1 July 1992)
- **Annex IV: Prevention of Pollution by Sewage from Ships** (entered into force 27 September 2003)
    - This Annex contains requirements to control pollution of the sea by sewage; the discharge of sewage into the sea is prohibited, except when the ship has in operation an approved sewage treatment plant or when the ship is discharging comminuted and disinfected sewage using an approved system at a distance of more than three nautical miles from the nearest land; sewage which is not comminuted or disinfected has to be discharged at a distance of more than 12 nautical miles from the nearest land.

[29] International Maritime Organization.
[30] Annexes relevant to the Scheme are described.

- **Annex V: Prevention of Pollution by Garbage from Ships** (entered into force 31 December 1988)
    - This Annex seeks to eliminate and reduce the amount of garbage being discharged into the sea from ships. It deals with different types of garbage and specifies the distances from land and the manner in which they may be disposed of; the most important feature of the Annex is the complete ban imposed on the disposal into the sea of all forms of plastics. The Annex also obliges Governments to ensure the provision of adequate reception facilities at ports and terminals for the reception of garbage without causing undue delay to ships, and according to the needs of the ships using them.
- **Annex VI: Prevention of Air Pollution from Ships** (entered into force 19 May 2005)
    - This Annex sets limits on sulphur oxide and nitrogen oxide emissions from ship exhausts and prohibits deliberate emissions of ozone depleting substances; designated emission control areas set more stringent standards for SOx, NOx and particulate matter. A chapter adopted in 2011 covers mandatory technical and operational energy efficiency measures aimed at reducing greenhouse gas emissions from ships.

European

4.29. The Treaty establishing the European Community (Article 174) indicates that members should pursue the preservation, protection and improvement of the quality of the environment, aim at a high level of environmental protection and apply policies *"….based on the precautionary principle and on the principles that preventive action should be taken, that environmental damage should as a priority be rectified at source".*[31]

4.30. The relevant EU Directives include Directive 85/337/EEC (amended by Directive 97/11/EU) on the assessment of the effects of certain public and private projects on the environment, that has been promulgated by the Maltese *Environmental Impact*

[31] Article 174 (ex Article 130r):
1. Community policy on the environment shall contribute to pursuit of the following objectives:
   - Preserving, protecting and improving the quality of the environment;
   - Protecting human health;
   - Prudent and rational utilisation of natural resources;
   - Promoting measures at international level to deal with regional or worldwide environmental problems.
2. Community policy on the environment shall aim at a high level of protection taking into account the diversity of situations in the various regions of the Community. It shall be based on the precautionary principle and on the principles that preventive action should be taken, that environmental damage should as a priority be rectified at source and that the polluter should pay. In this context, harmonisation measures answering environmental protection requirements shall include, where appropriate, a safeguard clause allowing Member States to take provisional measures, for non-economic environmental reasons, subject to a Community inspection procedure.

Assessment Regulations, 2017, and various Directives that relate to waste, water quality and noise have been transposed into national legislation and are enforced by ERA.

4.31. The Birds Directive 2009/147/EC (as amended) and the Habitats Directive (92/43/EEC) are relevant given that the Scheme site lies within both a marine Special Protection Area and a Special Area of Conservation. In this regard, ERA requested an Appropriate Assessment under the Habitats Directive, which was also submitted together with the EIA for consideration by the authorities.

4.32. Waste generated as a result of operations will need to be managed in line with the Waste Framework Directive (75/442/EEC as amended by Dir 91/156/EEC, and Commission Decision 96/350/EC). This Directive lists disposal operations in Annex IIA, which include release into seas / oceans, but (Art. 4) requires Member States to "*... take the necessary measures to ensure that waste is recovered or disposed of without endangering human health and without using processes or methods which could harm the environment.*"

4.33. The *Water Framework Directive* (2000/60/EC) is also applicable, insofar as it covers coastal waters, which are defined as surface waters on the landward side of a line within one nautical mile from the coast. The Directive defines "pollution" as the *"direct or indirect introduction, as a result of human activity, of substances or heat into the air, water or land which may be harmful to human health or the quality of aquatic ecosystems or terrestrial ecosystems directly depending on aquatic ecosystems, which result in damage to material property, or which impair or interfere with amenities and other legitimate uses of the environment"*. The Directive further requires Member States to take *"all appropriate steps not to increase pollution of marine waters"*. The main thrust of the Directive remains the protection of surface and ground waters to ensure that the quality of these waters does not deteriorate and, where it is below an acceptable standard, it is improved.

4.34. The *Marine Strategy Framework Directive* (2008/56/EC) aims to provide more effective protection of the marine environment around Europe, aiming to achieve Good Environmental Status (GES) by 2020. It adopts an ecosystem approach to environmental protection and sustainable use. Member States are required to develop a Marine Strategy that will be reviewed periodically every six years.

4.35. The Directive also lists priority substances (pollutants) that should be eliminated from the surface waters of the Community. Other substances that are not on the Priority List but which may *"prevent Member States from achieving the objectives for the bodies of surface water"* should also be progressively controlled.

National

The Constitution of Malta

Declaration of Principles

4.36. The Constitution of Malta (Section 9) declares that the State shall safeguard the landscape and the historical and artistic patrimony of the Nation. These are the only

aspects of the environment referred to in the Constitution, underlining the importance of the landscape and historical heritage.

Environment Protection Act (Act 1 of 2016)

4.37. This Act is one of two that replaces the *Environment and Development Act X, 2010*. The Act makes "*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"*. The Act stipulates that *"It shall be the duty of every person and entity, whether public or private, to protect the environment and to assist in the taking of preventive and remedial measures to protect the environment and manage natural resources in a sustainable manner."*

4.38. Various duties fall to the Government. Those relevant to the Scheme are:

> *4(a) to manage the environment in a sustainable manner by integrating and giving due consideration to environmental concerns in decisions and policies on land use, socioeconomic, educational and other matters;*
>
> *4(b) to take such preventive and remedial measures as may be necessary to address and abate the problem of pollution and any other form of environmental degradation in Malta and beyond, in accordance with the polluter pays principle and the precautionary principle;*
>
> *4(e) to apply scientific and technical knowledge and resources in determining matters that affect the environment;*
>
> *4(f) to ensure the sustainable management of waste, to promote the reduction of waste and the proper use, reuse and recovery of matter;*
>
> *4(g) to safeguard biological diversity;*
>
> *4(h) to combat all forms of pollution and environmental degradation;*
>
> *4(i) to consider the environment as the common heritage and common concern of mankind; and*
>
> *4(j) to provide incentives leading to a higher level of environmental protection".*

4.39. The Act makes provision for the establishment of an authority to implement the duties of Government under the Act – the Environment and Resources Authority (ERA). ERA's principle duties include:

> *4(b) to formulate and implement policies relating to the protection and management of the environment and the sustainable*

management of natural resources, and on such other matters as may be necessary for the better carrying out of the provisions of this Act;

4(c) to carry out and or commission surveys, studies, assessments, investigations, audits, monitoring and promote research on any matter relating to the environment and the natural resources regulated by or under this Act;

4(e) to establish measures for the protection of the environment and to promote the efficient use of natural resources in, and through, the practices, operations, activities and functions regulated by or under this Act;

4(f) to ensure that national and international obligations relative to the matters regulated by or under this Act are entered into force and complied with;

4(g) to permit, assess, investigate, audit, monitor, and take action on, any activity, intervention, project, operation or land use that may have an effect on the environment; and

4(j) to carry out, review or request others to carry out environmental assessments, environmental audits and environmental monitoring of activities and works having an impact on the environment.

4.40. The Authority will authorise activities or operations relating to or affecting the environment. Activities and operations requiring authorisation are included in the Schedule of the Act and include the following:

a) in relation to biodiversity and other natural features;

(xii) carry out any activity which goes counter to the principles of ecological, geological, geomorphological, hydrology and landscape restoration or of good-practice conservation and management of biodiversity, natural features, landscapes and protected areas, as may be prescribed, including but not limited to:

1. activities which are expected to cause permanent or prolonged or otherwise significant alterations;

3. activities expected to generate, intensify or modify ambient noise, vibrations, light pollution, currents or other disturbances to the environment;

4. *activities considered to have an effect on biological diversity, on the physical aspect of the site, or on the integrity of the site and the landscape*;

(xiii) modify, endanger the stability of or demolish any natural physical features, or any rural structures affording a habitat for flora and fauna or otherwise contributing to the integrity of the landscape or the physical environment, as may be prescribed;

b) in relation to waste management

(i) store, treat, collect, transfer, recover or otherwise manage or handle such waste as may be prescribed.

4.41. In addition to issuing environmental permits, ERA regulate according to specific legislation as already noted. This includes S.L. 549.47 (Legal Notice 152 of 2007) European Pollutant Release and Transfer Register (EPRTR) Reporting Regulations the implementation of which aim to fulfil reporting obligations under the EC Regulation No 166/2006 of the European Parliament and of the Council of 18 January 2006 concerning the establishment of a European Pollutant Release and Transfer Register for which the potential production volumes of the relocated farm will ensure that this operation lies within the remit of reporting requirements in accordance with this legislation.

Implications for the Scheme:

- The Scheme must operate in accordance with permits issued by ERA and other competent authorities.

Legal Notices

4.42. A number of legal notices related to environmental protection are in force, issued under the Environment Protection Act.

Waste Management

- **Legal Notice 106 of 2007, S.L. 549.45**: *Waste Management (Activity Registration) Regulations* and **Legal Notice 184 of 2011** (as amended), **S.L. 549.63**: *The Waste Regulations*. These Regulations regulate the production and disposal of hazardous and non-hazardous wastes. The Regulations aim to control all operations relating to the production and management of waste and promote sound waste management practices so as to safeguard human health and the environment.

Implications for the Scheme:

- As described above, the Scheme must operate under an environment permit, the conditions of which include requirements to ensure that waste generated is managed in line with legislation and must also be reported on every year through the submission of an Annual Environmental Report.

Biodiversity

- **Legal Notice 311 of 2006** (as amended)**, S.L. 549.44**: *Flora, Fauna and Natural Habitats Protection Regulations*. These Regulations set up a national ecological

network of special areas of conservation (SACs). Until recently, five Marine Protected Areas were designated. An additional eight areas have designated as just announced by ERA (June 2018) located mainly along and off the western coast of Malta, designated for their importance in supporting examples of marine caves and coral reefs. The Regulations also declare a number of natural habitats, the conservation of which requires the designation of special areas of conservation. The Regulations include a number of planning provisions that help to integrate these Regulations into the local development control process. The Regulations introduce the precautionary principle in relation to SACs. The Regulations also deal with other issues, including the re-introduction of species into the wild, the control of alien species affecting Maltese biodiversity, surveillance and monitoring of biodiversity and environmental education.

- **Legal Notice 79 of 2006** (as amended) **S.L. 549.42**: *Conservation of Wild Birds Regulations*. These Regulations transpose the Birds Directive and call for the provision of Special Protection Areas (SPAs) to be designated with respect to certain birds species. The legislation covers additional aspects relating to handling and taking of birds, naming bird sanctuaries, etc.

Implications for the Scheme:

- The Scheme lies within both a marine SAC and a marine SPA. The impacts of the Scheme on marine biodiversity are described in **Chapter 5** and **Chapter 6** and in the Appropriate Assessment.

<u>Water</u>

- **Legal Notice 345 of 2015, S.L. 549.100**: *Water Policy Framework Regulations*. These Regulations establish a framework for the protection of coastal waters, as well as inland surface waters, transitional waters and groundwater. The framework is intended to prevent further deterioration, and to protect, enhance, and restore the status of aquatic systems.

Implications for the Scheme:

- Impacts on water quality are assessed in **Chapter 5**.

<u>Marine environment</u>

- **Legal Notice 73 of 2011, S.L. 549.62**: *Marine Policy Framework Regulations* transposes the Marine Strategy Framework Directive and names ERA as the Competent Authority for technical implementation of the Directive.

Implications for the Scheme:

- Impacts on the marine environment are assessed in **Chapter 5**.

CULTURAL HERITAGE / ARCHAEOLOGY

International legislation

4.43. From an international perspective there are two main conventions that are relevant to this study:

- The Convention on the Protection of the Underwater Cultural Heritage, 2001; and
- The European Convention on the Protection of the Archaeological Heritage (Revised) Valletta, 1992.

The Convention on the Protection of the Underwater Cultural Heritage, 2001

4.44. Although this convention has been ratified by UNESCO, Malta is not yet a signatory. Despite this, the elements contained within this convention are to be taken as guidelines for the management and protection of underwater cultural heritage. This is done in numerous European states.

4.45. Article 2.5 of this convention states: "*The preservation in situ of underwater cultural heritage shall be considered as the first option before allowing or engaging in any activities directed at this heritage*".

4.46. Also relevant is Article 2.6, which states: "*Recovered underwater cultural heritage shall be deposited, conserved and managed in a manner that ensures its long-term preservation*".

European Convention on the Protection of the Archaeological Heritage (Revised) Valletta, 1992

4.47. Despite this convention being signed in Valletta, Malta is yet to be included as a signatory. The Convention aims to *protect the archaeological heritage as a source of the European collective memory and as an instrument for historical and scientific study* (Article 1.1). Archaeological remains underwater are included within the definition of the archaeological heritage (Article 1.3). The Convention also aims to integrate preservation and conservation of cultural heritage into planning policy and sets guidelines in this regard. The Monitoring Committee seeks to strengthen and coordinate archaeological heritage policies across Europe.

National

Cultural Heritage Act, 2002

4.48. This Act provides overall protection to *"...all movable or immovable objects of artistic, architectural, historical, archaeological, ethnographic, palaeontological, and geological importance..."* and includes information and data relative to cultural heritage in Malta. It also *includes "archaeological, palaeontological or geological sites and deposits, landscapes, groups of buildings…which have an historical value".*

4.49. The Act also controls interventions that may be made on cultural property, all of which require a permit from the Superintendent of Cultural Heritage and are subject

to tests, examinations or investigations. Furthermore, "*archaeological or palaeontological excavations or explorations on land as well as in the territorial waters or in the contiguous zone of Malta can only be made by the Superintendent, or with written permission of the Superintendent" [Section 43(1)].* Chance discoveries of archaeological remains are also regulated by the Act: "*Any person who, even accidentally, discovers any object, site or building to which this Act applies in accordance with article 3, shall immediately inform the Superintendent, keep the object found in situ, and shall not for a period of six working days after informing the Superintendent proceed with any work on the site where the object of cultural property is discovered".* The details about rights and obligations by all parties in the eventuality of an archaeological discovery are described in Sections 43(3), 43(4), 43(5), 43(6), and 43(7).

Implications for the Scheme:

- In the case of the Scheme, the marine archaeology survey undertaken as part of the EIA Report identified one potential artefact within the Area of Study (see **Chapter 7**).

5. MARINE ENVIRONMENT

5.1. This chapter focuses on a description of the marine environment, including: (i) the physical conditions at the Scheme site, including bathymetry, sediment and water quality and a description of the wave and hydrodynamic modelling that was carried out for this EIA; and (ii) the biological components at the site. The findings and the bearing these findings are likely to have with regards to potential effects on the marine environment during the Scheme operations are assessed.

5.2. This Chapter is based on existing information, on direct observations of the EIA team, on the remote sensing surveys undertaken for this EIA by Seastar Surveys Ltd of the UK (see **Technical Appendix 2B: *Remote Sensing Survey Report 2018***) and two baseline studies: the wave and hydrodynamic modelling studies performed on the tuna farm site subject of this EIA by Artelia Eau et Environnement of France (see: **Technical Appendix 3: *Wave study, hydrodynamics and environmental modelling Report***) and the marine benthos study undertaken by Ecoserv Ltd (see **Technical Appendix 4: *Marine Ecology Baseline Report***)

5.3. The potential key issues of the Scheme on the marine environment include:

Key Issues:

- **Change to the water dynamics at the farm site from the presence of the cages**
- **Reduction in water quality as a result of fish oils, mucus, blood and offal**
- **Increased nutrient levels in the water column from re-suspension of pollutants, fish wastes, uneaten feed, etc**
- **Burial of seabed habitats under farm mooring blocks**
- **Disturbance to habitats and species through sand scouring resulting from the presence of the moorings**
- **Effects on seabed habitats from settlement of uneaten feed and faeces**
- **Attraction of pelagic species (including predatory fish) to the farm because of the presence of food and prey species and including changes in ecological relationships**
- **Changes in species composition of benthic assemblages as a result of changes in sediment and attraction of scavengers / benthic predators**
- **Changes in species composition of benthic assemblages (especially**

algae) from shading effects of the cages

- **Disturbance to habitats and species from increased human activity in the area**
- **Increased pollution risks (oils, fuels, sewage, litter) as a result of increased maritime traffic**
- **Possible marine littering from items lost overboard**
- **Potential introduction of alien species and diseases via baitfish.**

Terms of Reference

5.4. The Terms of Reference provided by ERA require a description of the site and its surroundings, hydrodynamic modelling, and an assessment of the impacts on water quality and marine ecology. The Terms of Reference for the various studies as well as the Method Statements are found in **Technical Appendix 1:** ***Terms of Reference and Method Statements.***

METHODOLOGY

5.5. The study on the marine environment of the Scheme site is based on desk and field studies.

Desk Studies

5.6. Aerial / satellite imagery of the Scheme site and its surroundings were reviewed as part of the desk study. Existing sidescan sonar data was available for much of the area and this was reviewed in order to pre-assess the site, identify any lacunae in the data that needed addressing, and to plan the detailed videographic / photographic survey for the benthic ecology studies. A previous video survey (undertaken by Ecoserv Ltd in 2017) for part of the Scheme site was also reviewed.

5.7. Following the remote sensing surveys (see below), extensive desk studies involving wave and hydrodynamic modelling were conducted for the Scheme site (see **Technical Appendix 3:** ***Wave study, hydrodynamics and environmental modelling Report***). The findings of the modelling studies are reported upon below.

Field surveys

5.8. In addition to the desk study, field data was also gathered as follows (see **Technical Appendix 2B:** ***Remote Sensing Survey Report 2018***):

- Bathymetric data (echosounder) to inform the hydrodynamic models; and
- Side scan sonar data to identify seabed features and sediment types.

5.9. A videographic / photographic survey of the benthic areas not previously surveyed

was also undertaken, which was used for the detailed benthic ecology study (see **Technical Appendix 4: *Marine Ecology Baseline Report***).

5.10. Fieldwork in relation to the water and sediment quality survey was undertaken on 4th April 2018. This day was chosen at random but subject to good sea conditions to ensure successful undertaking of fieldwork and data collection. Fieldwork was carried out using a 12 m vessel equipped with hoisting jib and winch (see **Technical Appendix 4: *Marine Ecology Baseline Report***). It is noted that during this period, there were still some tuna in some of the cages on site.

Remote sensing surveys

5.11. The objectives of the surveys were to collect bathymetric data to inform a numerical model and to collect sidescan sonar data to identify seabed features and sediment types, which would be ground-truthed during a subsequent environmental survey using a drop-down camera system. The data used in this EIA Report were sourced either from existing survey data for the Scheme site or from new data collected purposely for this study.

5.12. Bathymetric data for most of the area currently occupied by the AJD Tuna Ltd farm had already been collected in previous surveys undertaken for development permit applications PA/03072/17 and PA/05858/17. Additional data was collected to the west, east, and southwest of the cages to cover a larger area than that surveyed in 2017 and which is currently occupied by moorings (see below).

5.13. Side scan data was also available for part of the site. This was supplemented by additional side scan sonar surveys to the southwest of the farm.

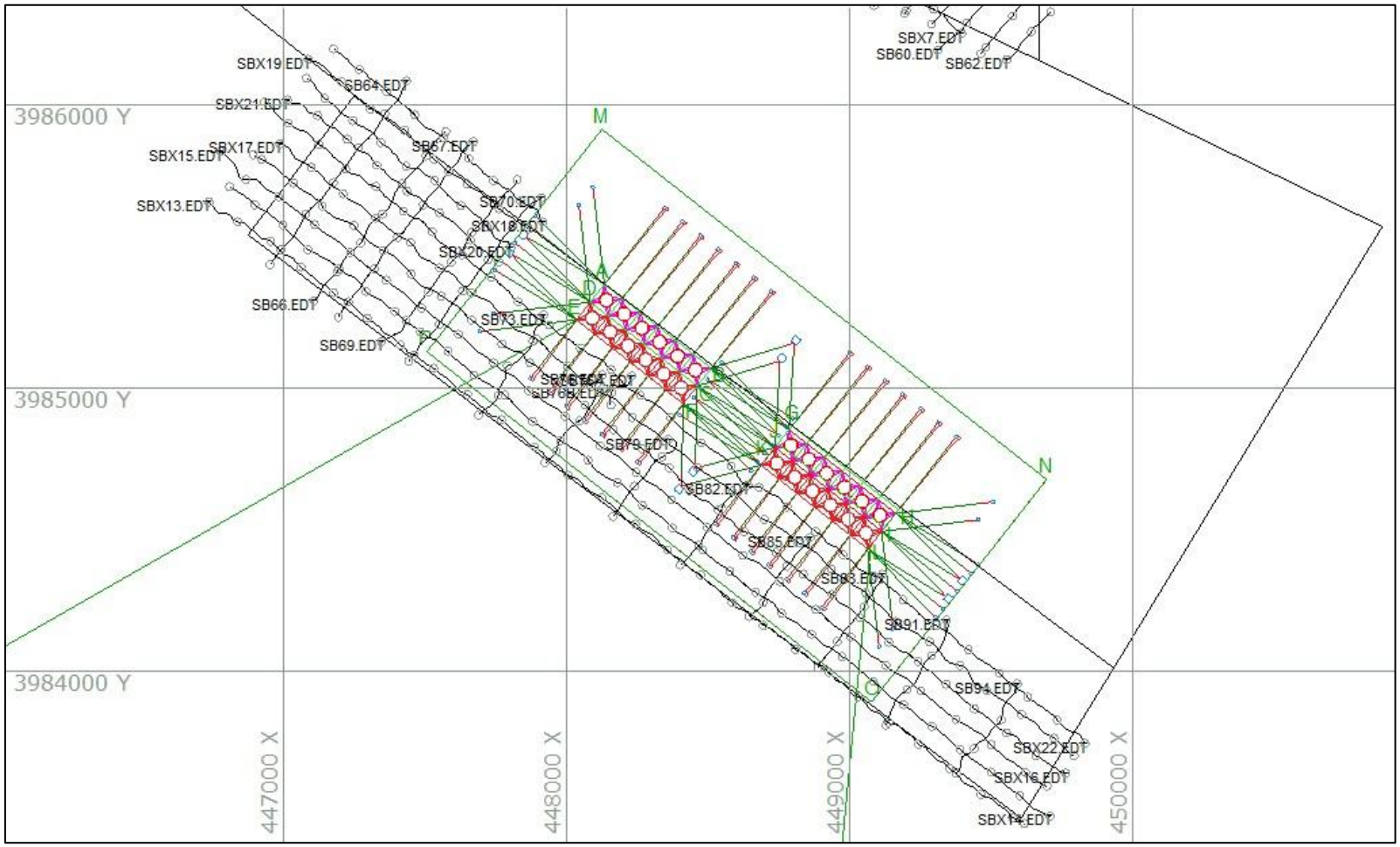
5.14. The acoustic survey equipment was mobilised and tested on the MV *Awrata* on Monday 23 April 2018.

5.15. Prior to the fieldwork, line plans for the various surveys were created using the survey management software Hypack. The survey design ensured that all of the survey area was ensonified to a high standard.

<u>Bathymetric Survey</u>

5.16. For the bathymetric survey, 34 main lines were planned at 100 m line spacing in a NE-SW direction. These were intersected by 10 perpendicular cross-lines at 75 m line spacing. However, the survey plan had to be altered during the fieldwork due to the prevailing wind and sea conditions during the survey days. This resulted in fewer NE-SW main lines and additional cross-lines being run. **Figure 5.1** shows the track plot for the achieved bathymetric survey lines. Further details on the survey method are available in **Technical Appendix 2B: *Remote Sensing Survey Report 2018***.

Figure 5.1: Bathymetric survey track plots for all successful survey lines



Side Scan Sonar

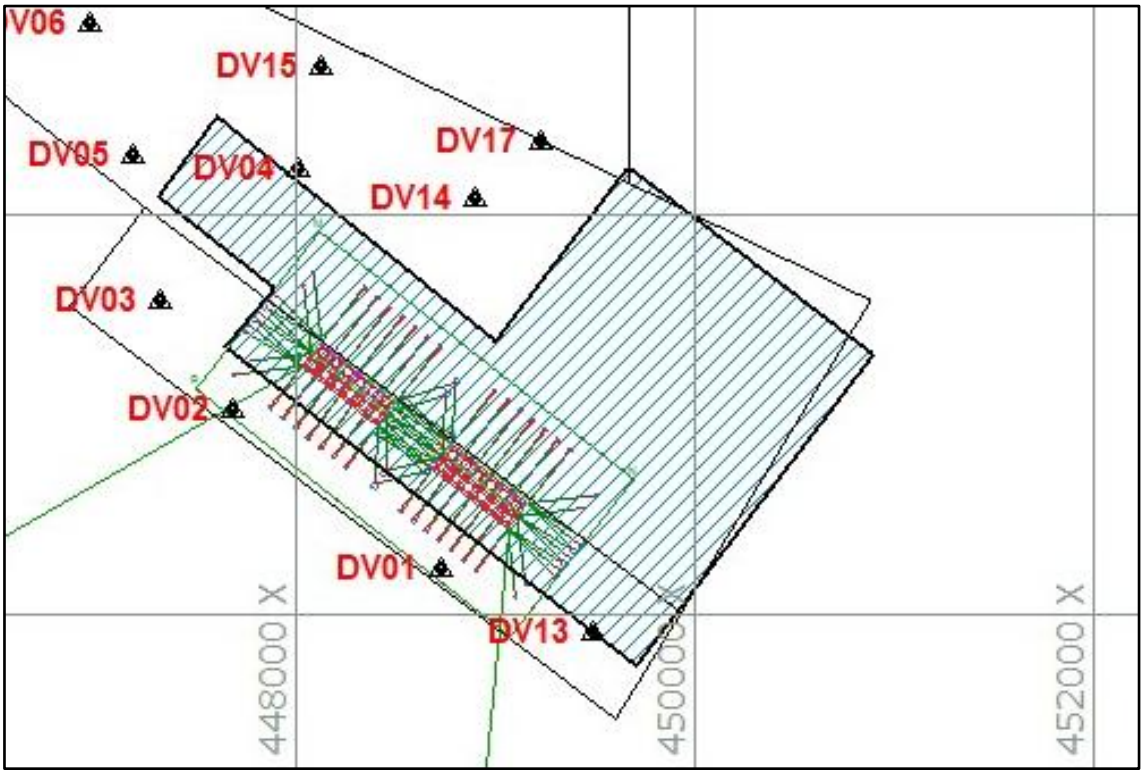
5.17. As explained, much of the area had already been previously surveyed and data was made available for this EIA. Additional surveying was restricted by the anchors and ropes that hold the current fish farm in place. As a result, only two survey lines on the south west of the fish farm area were run using sidescan sonar. Further details on the survey methodology employed are available in **Technical Appendix 2B: *Remote Sensing Survey Report 2018***.

Camera Survey

5.18. Following the completion of the acoustic surveys, the camera system was mobilised and tested on 7 May 2018.

5.19. The sidescan data available from previous surveys and the additional side scan data collected by Seastar as part of this EIA were analysed in order to identify potential features of interest; in total 9 features of interest were identified in the AoS for the Scheme. Target positions for these were plotted in Hypack (**Figure 5.2**). Further details on the survey methodology employed are available in **Technical Appendix 2B: *Remote Sensing Survey Report 2018***.

Figure 5.2: Targets of potential features of interest (DVxx) identified from the sidescan sonar data. The hatched area was surveyed during the 2017 drop-down camera survey.



5.20. All targets were surveyed and an additional transect running along the length of the fish farm was also undertaken. **Figure 5.3** shows the track plots of the camera transects across the identified target locations of interest (shown in **Figure 5.2**

above) and along the length of the existing fish farm.

Figure 5.3: Track plots of the camera transects.

Data Processing – Bathymetric Survey

5.21. The raw bathymetry data were processed in Hypack using the Single Beam Editor tool. All spikes, multiple returns, and other erroneous data were removed before applying draught, sound velocity, and tidal corrections. Edit soundings, relative to local chart datum, were then saved before being sorted to a 2 m grid. Data quality control checks were made against the paper trace, and by comparing edited depths at all of the main survey lines and cross lines "crossover points". In total there were 339 intersections checked with a mean difference between main lines and cross lines of 0.13 m.

5.22. The bathymetric map for the Area of Study is shown in **Figure 5.4**. As shown, the water depth ranges from 45 m in the shallower southwestern area to 65 m in the deeper northwestern area of the AoS. The Scheme site is generally flat with a shallow slope towards the northeast. The bathymetry beyond the AoS becomes steeper until the edge of the drop-off located to the northeast. Beyond the drop-off, the water depth increases rapidly to 130 m and then deepens more gradually with distance from the shore.

Data processing – Side Scan Sonar

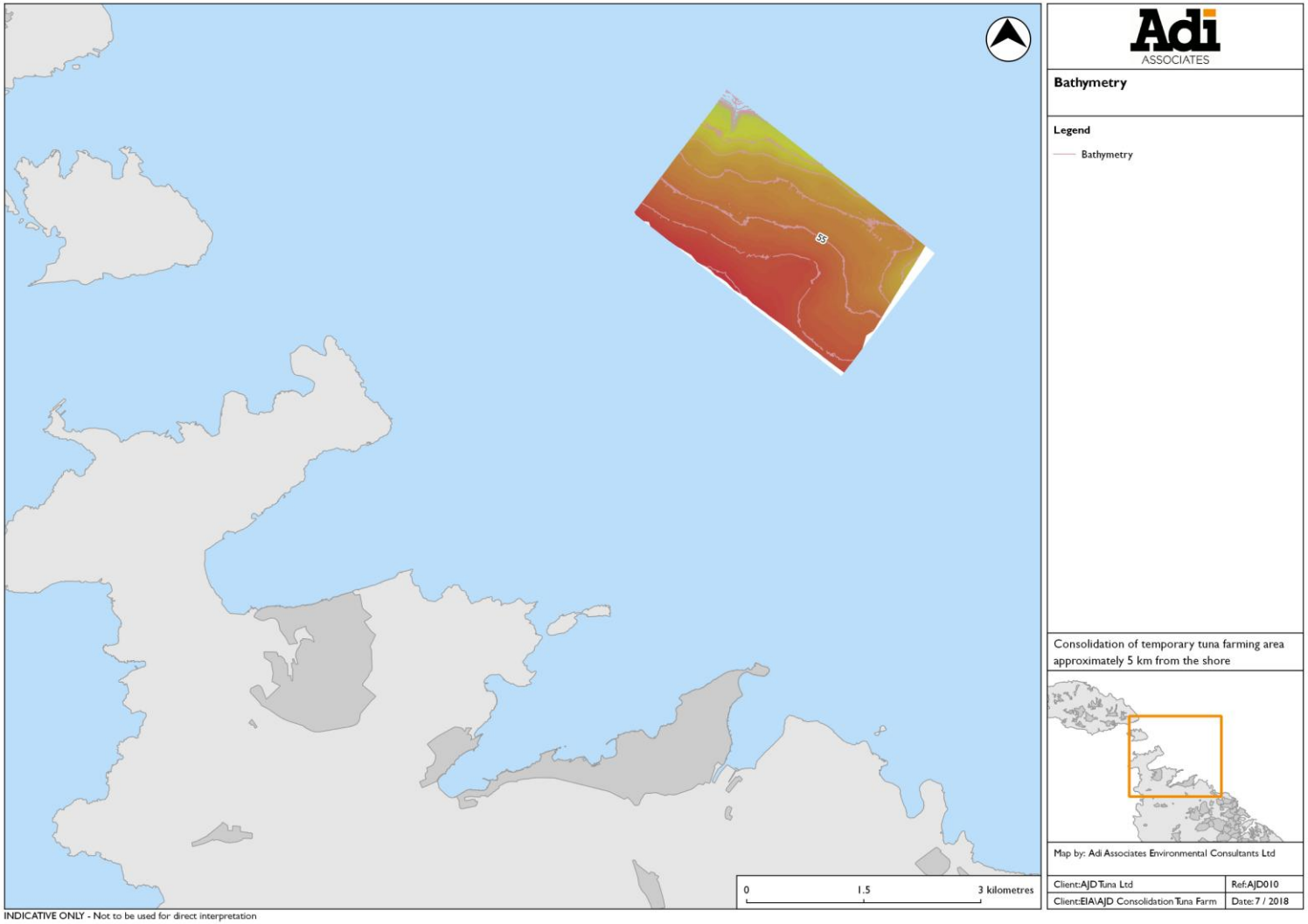
5.23. The raw sidescan data were recorded in the Discover software and saved as .jsf files. These were converted into a Hypack compatible format (.hsx files) and processed in

Hypack. The recorded layback was checked by identifying targets on adjacent lines and cross checking their position. The output from the side scan sonar was used to guide the camera survey and also for marine archaeology / cultural heritage assessment (see **Chapter 7**).

Data processing – video and stills

5.24. The output from the camera survey was first analysed by Seastar to identify general polygon areas and then by Ecoserv Ltd who derived a benthic habitats map for the Area of Study (see section on Benthic Ecology below and **Technical Appendix 4: *Marine Ecology Baseline Report***).

Figure 5.4: Bathymetry



WAVE AND HYDRODYNAMIC MODELLING STUDIES

5.25. The wave and hydrodynamic modelling studies for this EIA Report were conducted by Artelia Eau et Environnement of France. These were intended to satisfy the requirements of the Terms of Reference (see **Technical Appendix 1: *Terms of Reference and Method Statements***) and involved the following tasks:

- Task A: wave study:
    - offshore wave modelling; and
    - establishment of local wave climate and extreme waves;
- Task B: hydrodynamic study:
    - set up of the hydrodynamic model;
    - hydrodynamic modelling:
        - baseline hydrodynamic situation;
        - settlement of uneaten feed;
        - dispersion of dissolved nutrients; and
        - dispersion of a fish oil spill from the fish farm.

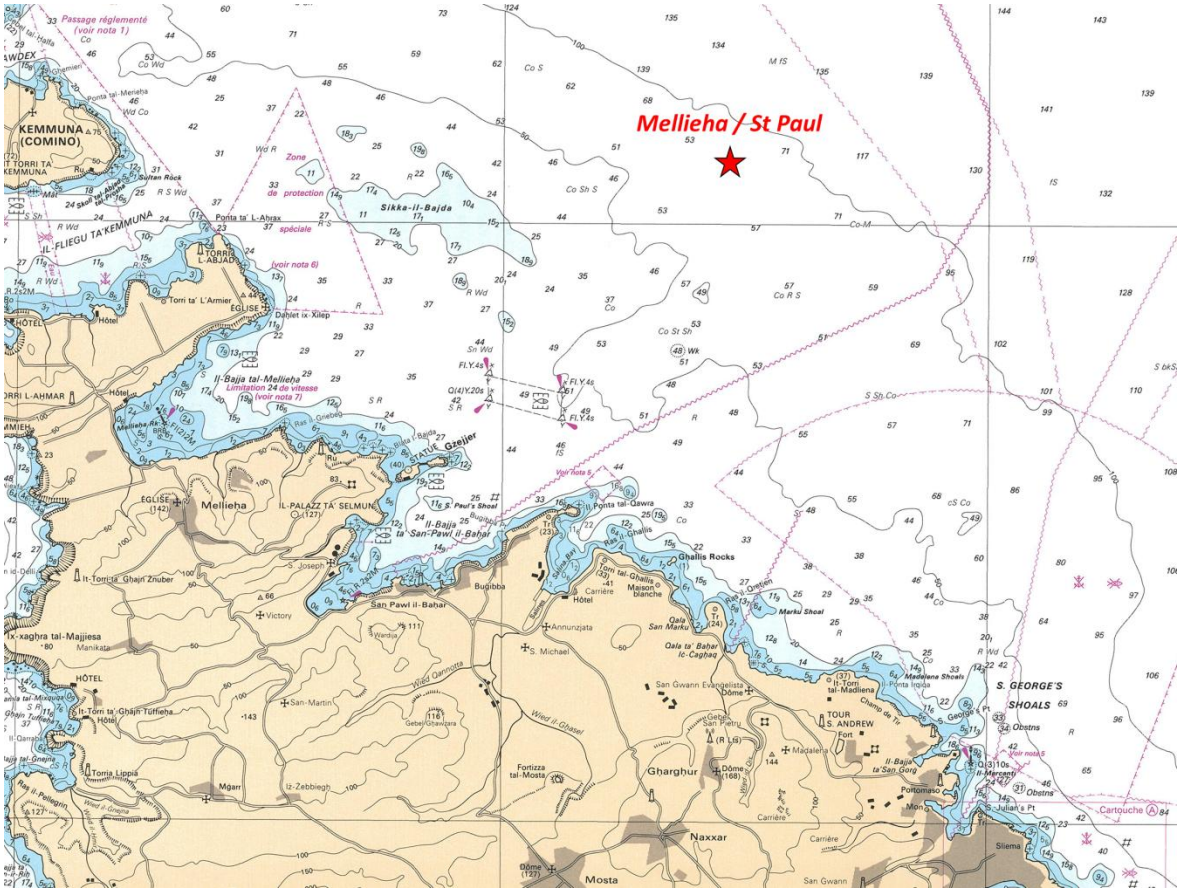
Wave Study

Wind and wave modelling

5.26. The methodology for the wind and wave modelling is described in **Technical Appendix 3: *Wave study, hydrodynamics and environmental modelling Report***. This involved model construction, extraction of wind fields over the wave generation area, calibration and validation of wind fields, construction of third generation wave model, simulation of offshore sea states and validation of same, and construction of third generation model for nearshore sea states and simulation of the generation and propagation of sea states around Malta.

5.27. From the 13 output points for sea state spectra around the Maltese Islands, only one is relevant for this study – "Mellieha/ St Paul" located at 14.457°E and 36.007°N and a water depth of 56 m (see **Figure 5.5**).

Figure 5.5: Location of the "Mellieha/St Paul" output point



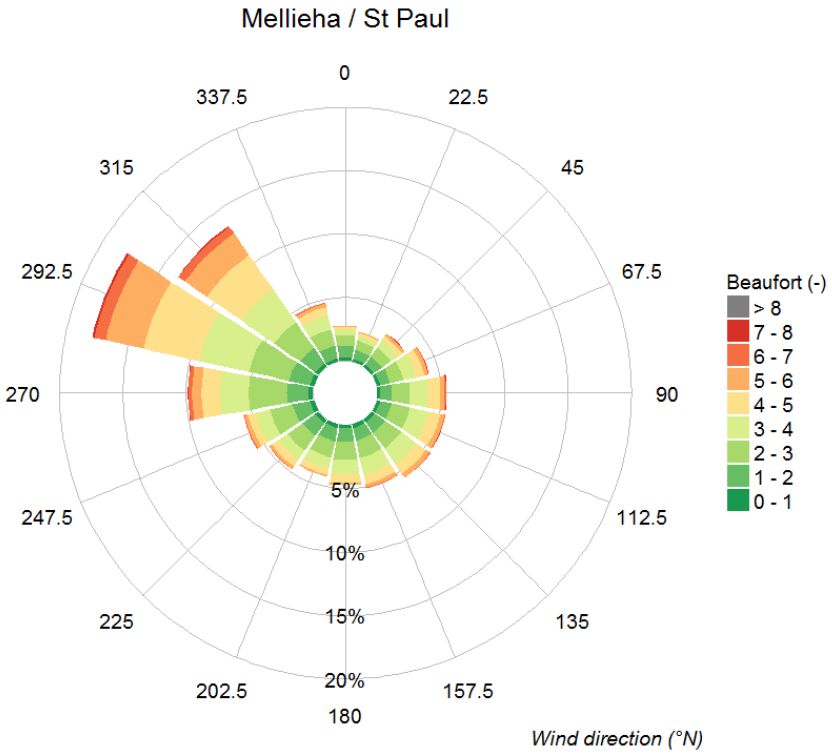
Analysis of Winds and Waves

5.28. Extreme wind speeds and wave heights are estimated for the different directional sectors (wind and wave populations) identified through the assessment of the wind and wave climates. The estimation is performed through statistical extrapolation and is described in **Technical Appendix 3:** ***Wave study, hydrodynamics and environmental modelling Report***.

5.29. **Figure 5.6** presents the wind rose off Valletta. The largest wind speeds (> 20 m/s) occur from a wide NE (gregale) to SE (sirocco or *xlokk*) sector. For the study, therefore, two directional sectors were defined:

- ESE sector [0°N, 202.5°N[: 39.8% of occurrences (the wind rose and the wind velocity / direction scatterplot do not allow to distinguish the NE and SE winds);
- NW sector [202.5°N, 360°N[: 60.2% of occurrences.

Figure 5.6: Wind rose



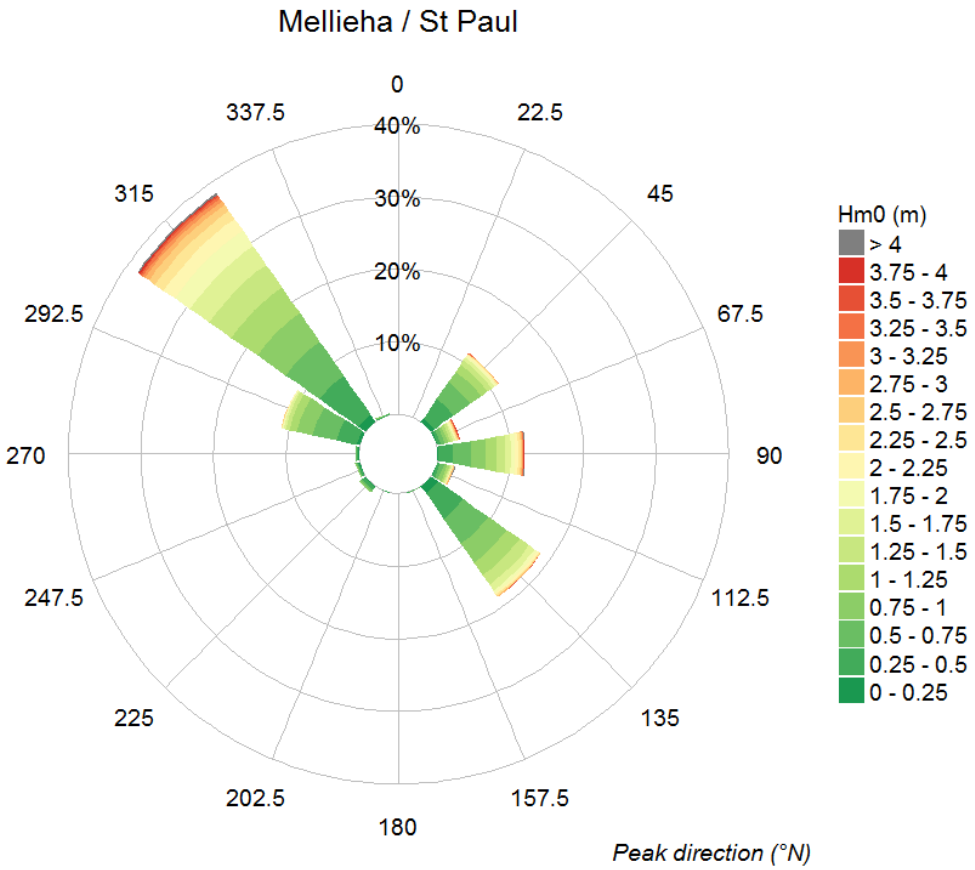
5.30. **Table 5.1** presents the data from the statistical extrapolation of extreme wind speeds.

Table 5.1: Results of the statistical extrapolation of extreme wind speeds

Sector	Return period (year)	Wind speed (m/s)	
		Best estimation	90% confidence interval
ESE [0°N, 202.5°N[	1	17.4	17.1 – 17.8
	5	19.4	18.7 – 20.0
	10	20.1	19.3 – 20.9
	50	21.6	20.5 – 23.0
	100	22.3	20.9 – 23.8
NW [202.5°N, 360°N[	1	19.4	19.1 – 19.8
	5	21.5	20.8 – 22.2
	10	22.3	21.5 – 23.2
	50	24.2	22.9 – 25.6
	100	24.9	23.5 – 26.6

5.31. **Figure 5.7** illustrates the wave rose for Malta in significant wave height. The NW sector (*majjistral*) is still predominant (around 45% of the sea states); however, a significant part of the sea states come from the NE, E, and SE directions.

Figure 5.7: Wave rose off Valletta



5.32. The following directional sectors can be distinguished:

- NE sector [0°N, 67.5°N[: 14.0% of sea states;
- E sector [67.5°N, 112.5°N[: 13.9% of sea states;
- SE sector [112.5°N, 157.5°N[: 19.9% of sea states;
- SW sector [180°N, 275°N[: 2.4% of sea states;
- NW sector [275°N, 360°N[: 49.7% of sea states.

5.33. The extreme wave heights for the main directional sectors relevant to the study (E, Ne, and NW) as extrapolated are shown in **Table 5.2**.

5.34. As can be seen from **Table 5.2**, although the NW sector is the predominant sector in terms of size, the largest wave heights come from the E sector. However, the large width of the confidence interval associated to the extrapolation of this sector shows a large uncertainty for the highest return periods.

Table 5.2: Results of the statistical extrapolation of extreme wave heights

Sector	Return period (year)	Hm0 (m)		Tp (s)
		Best estimation	90% confidence interval	
NE [0°N, 67.5°N[	1	3.41	3.24 – 3.59	7.0 – 10.0
	5	4.54	4.16 – 4.95	8.0 – 11.5
	10	5.01	4.51 – 5.55	8.5 – 12.0
	50	6.07	5.27 – 6.98	9.5 – 13.0
	100	6.51	5.57 – 7.61	9.5 – 13.0
E [67.5°N, 112.5°N[	1	3.66	3.45 – 3.90	7.5 – 11.5
	5	5.16	4.70 – 5.67	9.0 – 13.0
	10	5.75	5.11 – 6.45	9.5 – 14.0
	50	6.99	5.70 – 850	10.5 – 15.0
	100	7.47	5.82 – 9.53	10.5 – 15.5
NW [275°N, 360°N[	1	4.47	4.36 – 4.58	8.5 – 11.5
	5	5.12	4.91 – 5.33	9.0 – 12.5
	10	5.35	5.09 – 5.63	9.5 – 12.5
	50	5.85	5.45 – 6.30	9.5 -13.0
	100	6.05	5.59 – 6.57	10.0 – 13.5

Hydrodynamic Study

Input data

5.35. In undertaking the hydrodynamic study the structural characteristics of the Scheme (distance from shore, number and size of cages, net mesh size and twine diameter), as well as the details of the local bathymetry, the farming details (stocking density, average weight of fish, number of fish in each cage, amount of baitfish fed to each cage, and total feed per day), and the waste products released from the farm were taken into consideration.

5.36. As described in **Chapter 3**, the waste products from tuna fattening includes fish oil released from baitfish feed, uneaten baitfish, and solid and dissolved waste excreted by the tuna (see **Figure 3.7**). Uneaten baitfish, solid and liquid wastes are a source of nitrogen and phosphorus to the marine environment. The uneaten baitfish and the tuna faeces are subject to degradation in the water column and therefore release nutrients in dissolved form in the marine environment.

5.37. The following assumptions with regards to the baitfish fed to the tuna were made:

- 0.5% passes through the net uneaten;
- 5% is lost as fish oil per day;
- 94.5% is ingested by tuna.

(Source: AJD Tuna Ltd)

5.38. Therefore, the amount of uneaten baitfish represents 27.5 kg/day/cage, the mass of fish oil released is 275 kg/day/cage, and the food intake by tuna is 5,197.5 kg/day/cage.

Hydrodynamic Model

5.39. This study is based on the set up of a 3D numerical model using the TELEMAC-3D modelling software. This makes use of the flexibility of unstructured grids, which allows increasing the number of computational grid points near areas of interest or of complex features (irregular coastline, bathymetry, harbours, etc). The main results obtained at each point of the computational grid are the water level, velocity in three directions, and the concentration of tracers like salinity, temperature, pollutants, etc. Further details on the modelling software and the methodology applied in the study can be found in **Technical Appendix 3: *Wave study, hydrodynamics and environmental modelling Report***.

5.40. The unstructured computation grid, called mesh, is composed of triangles of different sizes according to interest zones. In the present study, the size of the mesh is greater than 8 km offshore and is reduced to less than 5 m around the fish pens. The horizontal grid is composed of approximately 36,000 nodes and 70,000 elements (**Figure 5.8**). The horizontal mesh is then reproduced on the vertical to create the three-dimensional mesh consisting of triangular-based prismatic elements. The lower plane follows the bathymetry while the upper plane follows the evolution of the free surface over time. The three-dimensional mesh is composed of 13 horizontal planes.

Analysis of drag force for cages

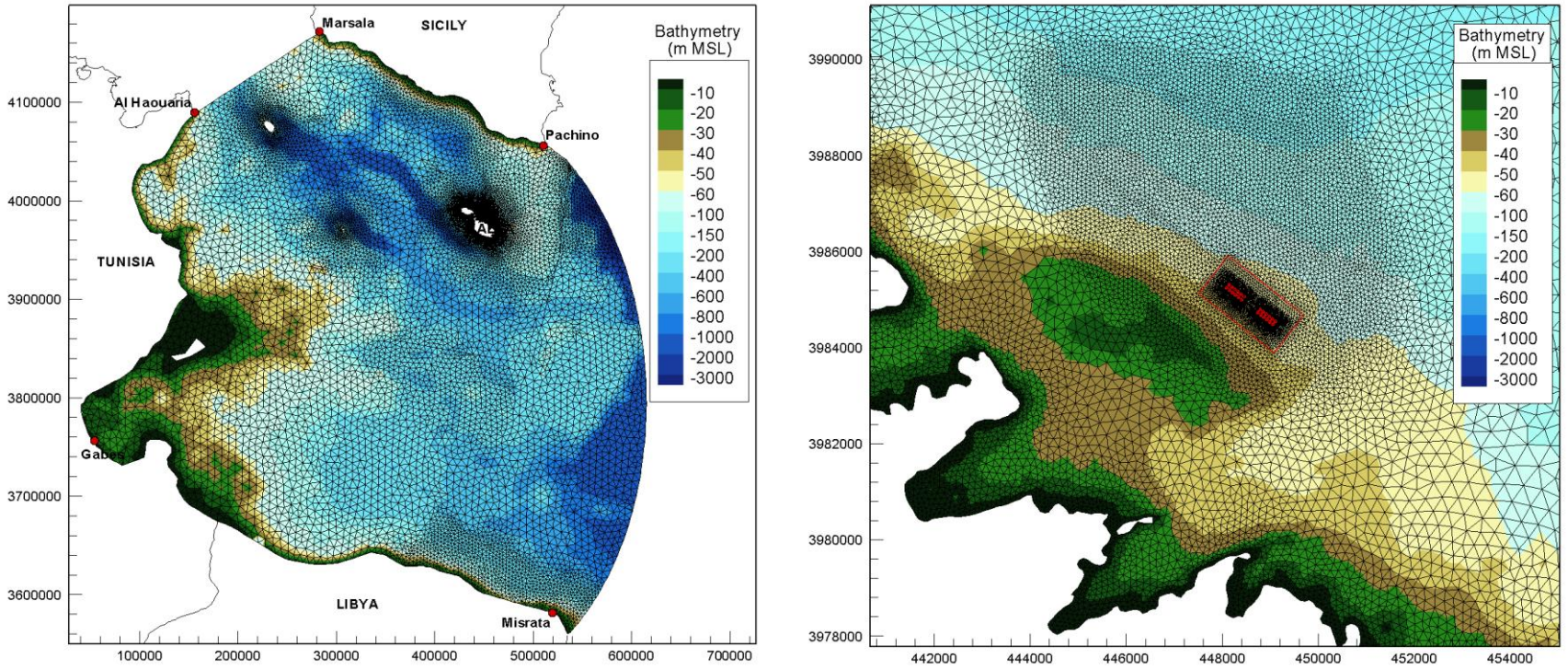
5.41. The flow around the fish pens is reduced by the cage net. This influence is represented by a drag force applied locally on the fish pen. Model details are provided in **Technical Appendix 3: *Wave study, hydrodynamics and environmental modelling Report***. The study included a series of tests to ensure that the model can correctly simulate the flow field around the project. The flow fields near the cages were investigated with different upstream velocities: 10 cm/s, 50 cm/s, and 1 m/s.

5.42. **Figure 5.9** presents the calculated flow field on a vertical plane through the first row of six cages with an upstream velocity of 50 cm/s. The flow velocity continuously decreases along the flow direction due to the drag force exerted by the netting. A slight increase of the flow velocity is also observed beneath the first net cages. These observations are consistent with the laboratory experiments (Aarsnes *et al,* 1990[32]).

5.43. The attenuation of flow velocity in the wake of the first three cages is given in **Table 5.3**, at 10 m below the surface. The simulated velocity reduction is about 15% from one cage to the next cage, which is consistent with figures quoted in the literature (e.g. Aarsnes *et al,* 1990) for experiments for the same range of the solidity ratio.

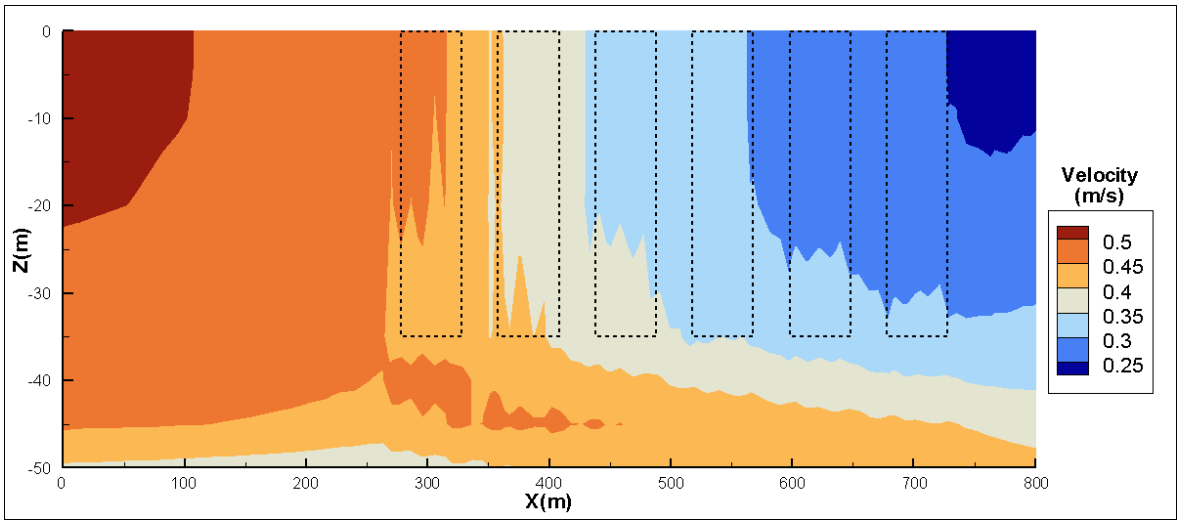
[32] Aarsnes JV, H Rudi and G Loland, 1990. Current forces on cage, net deflection. Engineering for offshore fish farming. Proceedings of a conference organised by the Institution of Civil Engineers, Glasgow, UK, 17-18 October 1990., pp 137–152.

Figure 5.8: Global model mesh and zoom on project area



Source: Artelia, 2018

Figure 5.9: Flow field on a vertical plane along the cages with an upstream velocity of 50 cm/s. Locations of the six cages are indicated by the dotted lines



Source: Artelia, 2018

Table 5.3: Velocity reduction in the wake of cages

Source	Solidity ratio	Upstream velocity	Velocity behind the cage (% of upstream velocity)		
			Wake of 1st cage	Wake of 2nd cage	Wake of 3rd cage
Aarsnes et al, 1990	*0.197*	*1 m/s*	*80%*	*64%*	*51%*
calculated	0.138	1 m/s	85%	72%	64%
calculated	0.138	0.5 m/s	84%	71%	63%
calculated	0.138	0.1 m/s	82%	70%	65%

Period selected for the hydrodynamic simulations

5.44. The direction and intensity of the wind from available datasets on the Scheme site from June to September 2015 were plotted. Winds blowing from the northwest are predominant. In June and September 2015, periods of wind intensity above 10 m/s occurred. A lower dispersion of the pollutants occurs when wind intensity is the lowest, therefore July and August represent the most unfavourable conditions over the whole summer period. The wind field from the 1st to 31st August 2015 is selected for the simulations, as it is characterised by:

- light to moderate wind condition with a wind intensity below 10 m/s;
- varying direction of the wind, and more specifically a period of time with a persistent wind blowing from East to West from 25th to 30th August 2015.

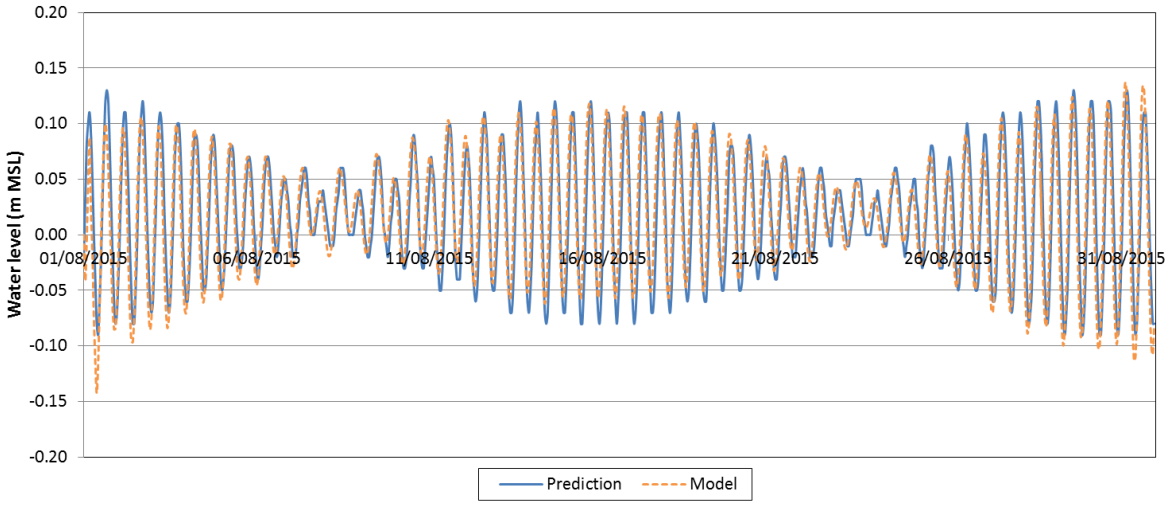
These time series are representative of typical summer wind conditions.

Baseline situation and model validation

5.45. A first simulation was carried out over August 2015, without taking into account the existing fish pens at the Scheme site. This calculation validated the model and serves as a reference state for calculating the hydrodynamic impact of the pens.

5.46. **Figure 5.10** shows the comparison of the water levels calculated by the model to the predictions provided by the Shom (French national hydrographic service) at the port of Valletta.

Figure 5.10: Comparison of water levels



5.47. Changes in tidal water levels are very low in Valletta. The maximum tidal range is about 20 cm. The model accurately reproduces the variation in tidal range between neap tide and spring tide.

5.48. No current measurement is available at the Scheme site. The maps in **Figure 5.11** show the current fields from the model (on the right) at different moments of the simulation and at 2 m below the surface, compared to those extracted from the MyOcean model (on the left), which serve as forcing conditions. The results of the MyOcean model are provided on a 1/16 degree resolution grid (5.63 km x 6.94 km). Due to the coarse model resolution, it does not correctly represent the hydrodynamics close to the coast, and especially in the project area.

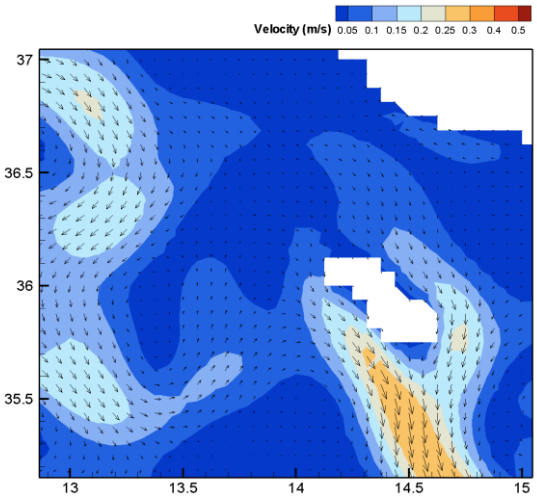
5.49. The general circulation around the island of Malta is comparable to the global ocean model MyOcean. More specifically, the following specific features are represented:

- the Atlantic Ionian Stream on the Malta channel flowing from the Northwest to the Southeast direction is represented; and
- presence of mesoscale features like eddies and meanders, whose positions vary.

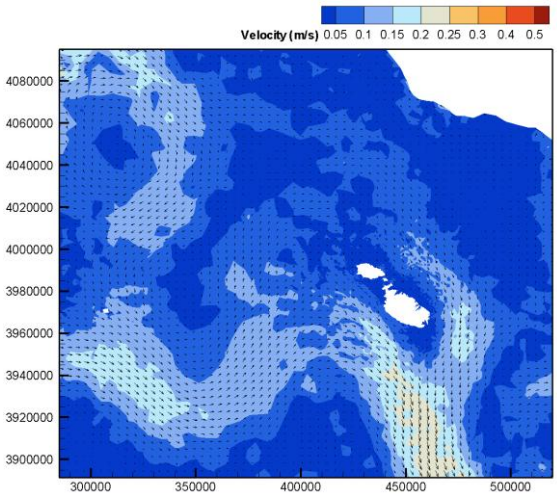
Current intensity is lower in the Telemac model by 5 cm/s compared to the global model in some areas.

Figure 5.11: Comparison of the velocity fields at 2 m under the sea surface

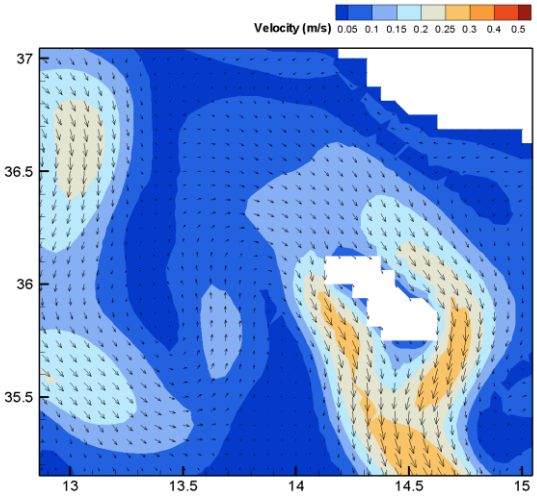
6 August 2015 - MyOcean



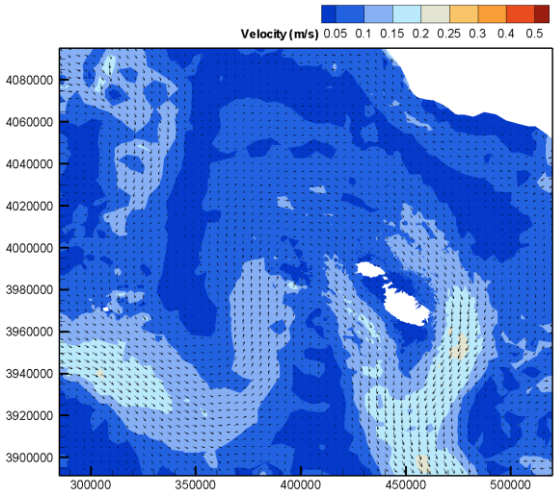
6 August 2015 - TELEMAC-3D



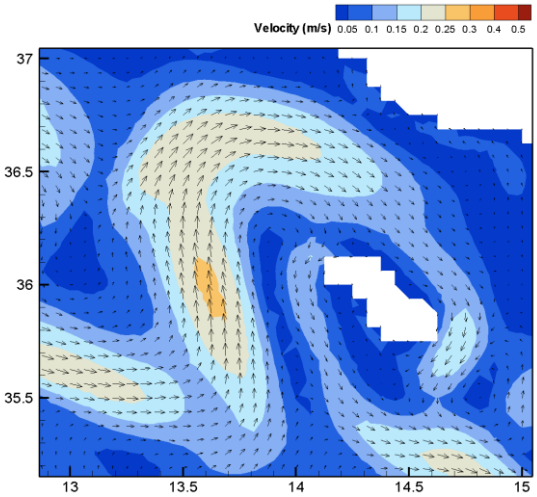
15 August 2015 - MyOcean



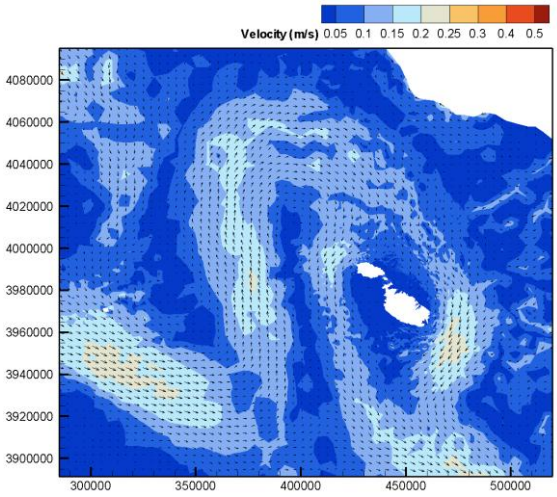
15 August 2015 - TELEMAC-3D



28 August 2015 - MyOcean



28 August 2015 - TELEMAC-3D



Impact of the fish cages on the velocity field

5.50. The model considered the temporal evolution of the current velocity at a point within the Scheme site (central between the current AJD and MML farms) at 2 m below the sea surface. The data shows that the current velocity on site is always below 10 cm/s. Due to the global currents offshore, the main direction of the current in the project area is South-South-East. The influence of the tide on currents (velocity and direction) is low.

5.51. In analysing the effect of the cages on the current field, comparison between the reference state (no cages) and the "with cages" scenario was made for different times. Given the low speed of the ambient currents, the impact of the fish pens on the current velocity is less than 5 cm/s (in absolute value) and remains in the immediate vicinity of the cages. At no stage during the simulation did the current velocity exceed 10 cm/s in the reference situation and the future configuration of the Scheme site. The influence of the cages is therefore not visible on the maximum velocity reached during the simulation and was deemed to be negligible by the modellers.

Environmental Modelling

5.52. Three environmental models were run as part of the study:

- Enrichment in dissolved nutrients;
- Settlement of uneaten feed; and
- Dispersion of fish oil.

Enrichment in dissolved nutrients

5.53. The fish farming operation results in an increase of nutrient loads (Nitrogen N and Phosphorus P) into the water column. Dissolved nutrients originate from three sources (see **Figure 3.7**):

- liquid wastes excreted directly by the fish metabolism;
- dissolved nutrients leached by tuna solid wastes; and
- dissolved nutrients leached by uneaten feed.

5.54. For the assimilated food, the following amount of nutrients is estimated to be excreted directly by the Bluefin tuna metabolism as dissolved wastes (Aguado-Gimenez *et al*, 2006[33]):

- 51.69 mg P/kg fish/day; and

[33] Aguado-Gimenez F., Garcia-Garcia B., Hernandez-Lorente M. D., and Cerezo-Valverde J. 2006. Gross metabolic waste output estimates using a nutritional approach in Atlantic Bluefin tuna (*Thunnus Thynnus*) under intensive fattening conditions in western Mediterranean Sea. Aquaculture Research (37) pp 1254:1258

- 694.27 mg N/kg fish/day on average.

5.55. For a cage of approximately 137.5 tons of fish, the total amount of N and P in dissolved form per day is estimated as:

- 95.46 kg P/cage/day;
- 7.11 kg N/cage/day.

5.56. For the dissolved nutrients originating from the degradation of solid wastes, the estimation of the dissolved nutrients leached is based on the calculation of the total contents in nutrients in the solid wastes per cage (**Table 5.4**). The calculation gives the following values:

- 2.38 kg P/cage/day;
- 1.64 kg N/cage/day.

Table 5.4: Dissolved nutrient leached from Bluefin tuna faeces

Parameter	Nitrogen	Phosphorous	Source
Nutrient contents in faeces per day and per fish	49.45 mg /kg fish/day	70.01 mg/kg fish/day	Aguado-Gimenez *et al*, 2006
Nutrient contents in faeces per day in a cage	6.80 kg/cage/day	9.63 kg/cage/day	Aguado-Gimenez *et al*, 2006
Percentage of nutrient contents available for leaching in faeces	35%	17%	Fernandez *et al*, 2007[34]
nutrient contents from faeces available for leaching	2.38 kg/cage/day	1.64 kg/cage/day	calculated

5.57. As mentioned earlier, a total of 27.5 kg of baitfish remains uneaten per day in a cage. As the water content of baitfish is 71% (Fernandez *et al*, 2007), the dry mass of uneaten baitfish is therefore 8 kg. The amount of nitrogen and phosphorus released by uneaten baitfish is then calculated from the nitrogen content available for leaching in the remaining baitfish (see **Table 5.5**). Therefore, the final amount of nitrogen and phosphorus contents leached by uneaten feed is the following:

- 0.36 kg N/cage/day; and
- 0.04 kg P/cage/day.

[34] Fernandes M., Angove M., Sedawie T. Cheshire, 2007. Dissolved nutrient release from solid wastes of southern Bluefin tuna (*Thunnus maccoyii*, Castelnau) aquaculture. Aquaculture Research 38 pp 388-397

Table 5.5: Soluble fraction of nitrogen and phosphorous in uneaten baitfish

Parameter	Nitrogen	Phosphorous	Source
Total nutrient contents in baitfish	111 mg N /g DW35	21 mg P /g DW	Fernandez *et al*, 2007
Total nutrient contents in baitfish per cage	885.23 g N /cage/day	167.48 g P /cage/day	calculated
Percentage of nutrient contents available for leaching	41%	21%	Fernandez *et al*, 2007
nutrient contents available for leaching	0.36 kg N/cage/day	0.04 kg P/cage/day	calculated

5.58. The final release of nutrient contents in dissolved form in each cage of the tuna farm is the sum of all sources of nutrients (degradation of uneaten baitfish, solid wastes and liquid wastes). Hence, the final estimation of the dissolved nitrogen and phosphorus loads is:

- 98.20 kg N/cage/day; and
- 8.78 kg P/cage/day.

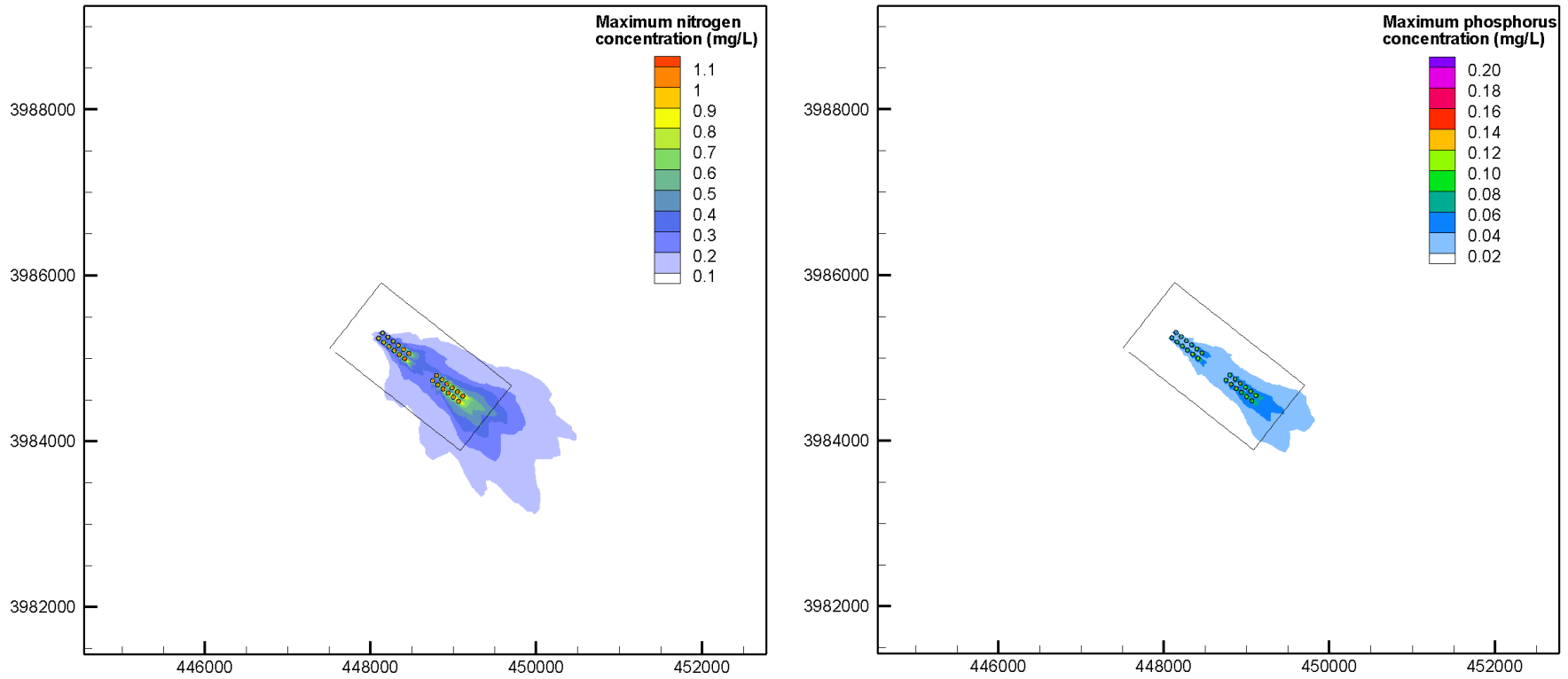
5.59. In the model, each nutrient category (nitrogen and phosphorous) is represented by a passive tracer (i.e. a tracer with no impact on hydrodynamics). The tracer injection is done at one point in the centre of each fish pen at -5 m MSL and at a constant flow. The evolution of the tracer is followed throughout the simulation.

5.60. **Figure 5.12** shows the plume of maximum nutrient concentration reached at each point during the simulation. At the Scheme site, currents come mainly from the North-West, so the nutrient plume is orientated towards the South-East. The maximum concentration is located at the centre of the pens, where the tracer is injected. The threshold of 0.1mg/L of total nitrogen is obtained about 1.5 km southeast of the last cages. The threshold of 0.02 mg/L of phosphorus is obtained less than 1 km southeast of the last cages.

5.61. The simulation also considered the evolution of the concentration of dissolved nutrients at 200 m behind the cages and at -5 m MSL (see **Figure 5.13**). At this distance from the cages (see black point in **Figure 5.13**), the maximum nitrogen concentration reached was 0.5 mg/L but the threshold of 0.1 mg/L is only exceeded by 10% over the total simulation time. The maximum concentration of phosphorous is 0.04 mg/L.

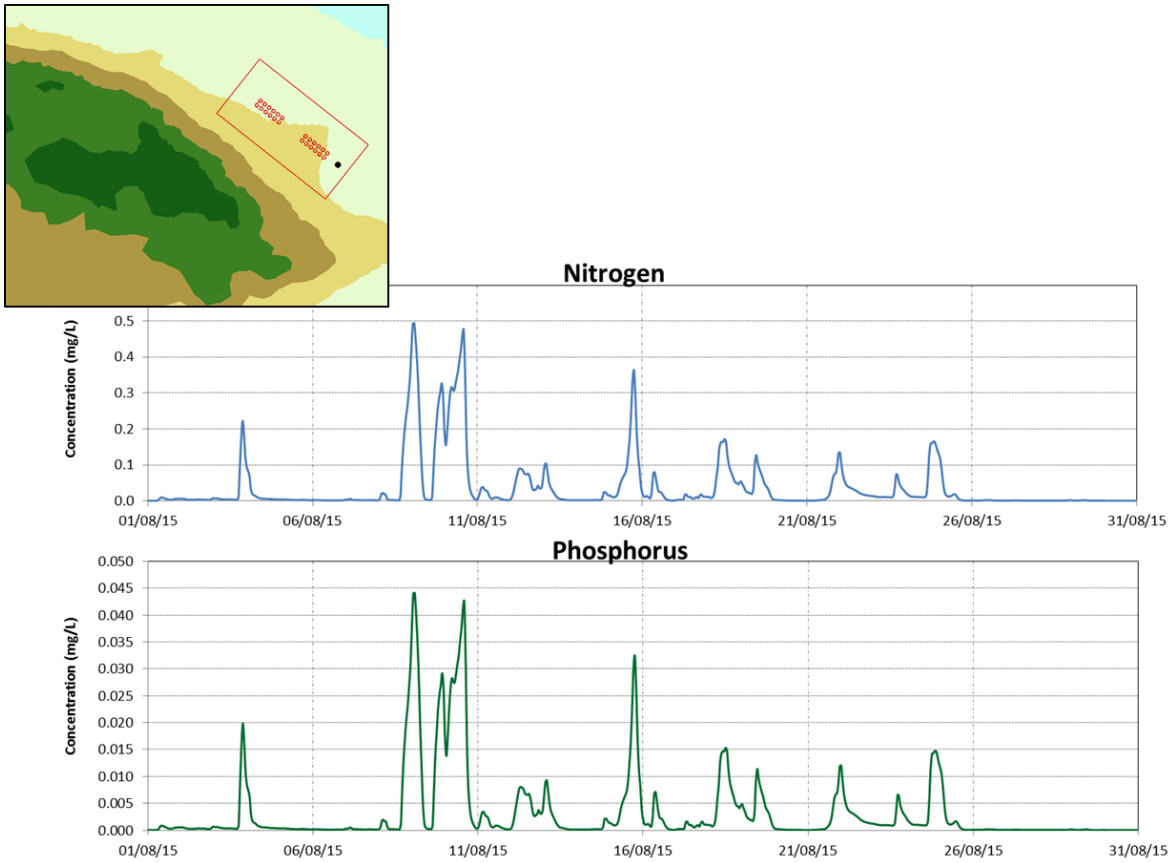
[35] DW = dry weight

Figure 5.12: Maps of maximum nitrogen (left) and phosphorous (right) concentration



Source: Artelia, 2018

Figure 5.13: Time-series of the nutrient concentrations



Source: Artelia, 2018

Settlement of uneaten feed

5.62. Pieces of uneaten baitfish feed remaining in the water are approximately 1 - 2 cm in size. The settling rate of these baitfish pieces is 7.2 cm/s as measured by experiments in water columns (Fernandes *et al*, 2007). According to the tuna farm operator, 0.5% of the daily feed passes through the net uneaten; this means that, for each cage, 27.5 kg of baitfish reach the seabed each feeding day. Assuming that the density of uneaten feed is close to neutral, just above the specific density of seawater as is the case for small living pelagic fish, its value can be taken as the density of fresh fish muscle (Waterman, 1971[36]). On this basis, the final uneaten feed characteristics are given in **Table 5.6**.

Table 5.6: Characteristics of uneaten feed particles

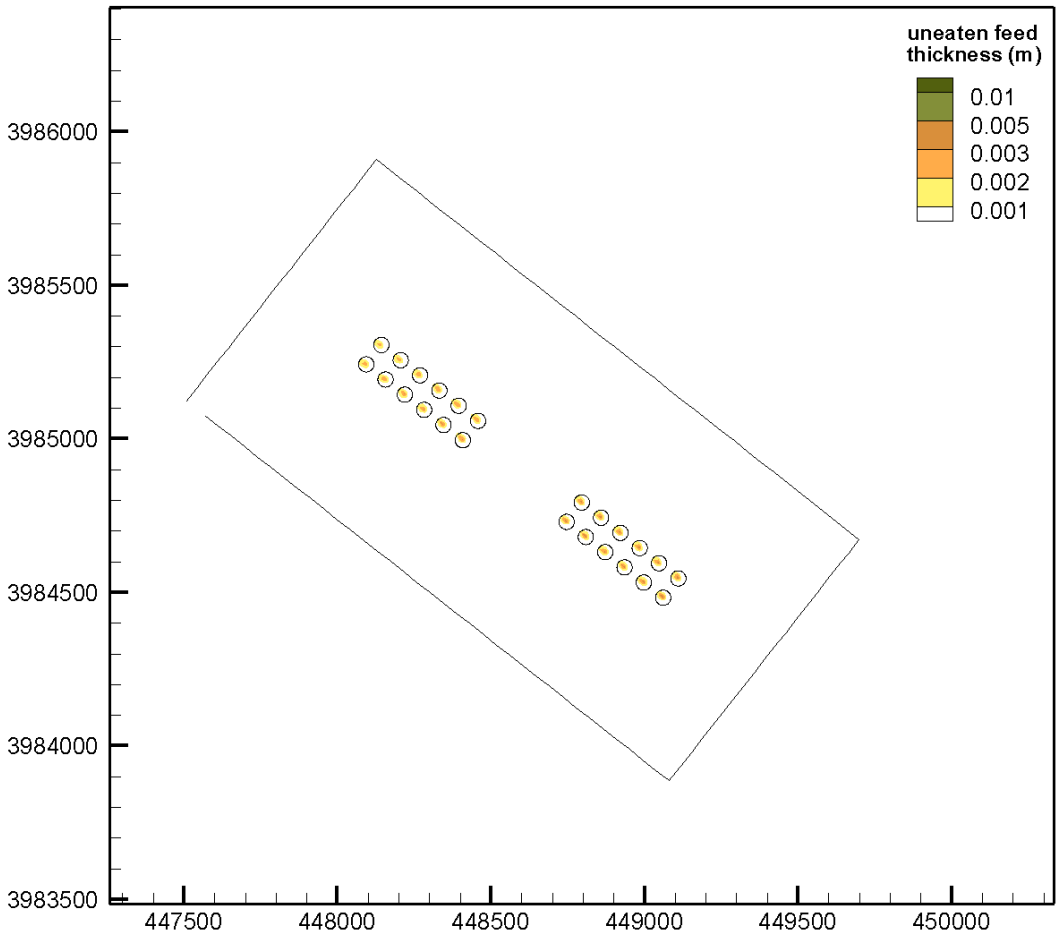
Parameter	Value	Source
Density of uneaten feed	1,054 kg/m^3	Waterman, 1971
Uneaten feed per day	27.5 kg	AJD Tuna Ltd
Typical uneaten baitfish size	1 – 2 cm	AJD Tuna Ltd
Settling rate	7.2 cm/s	Fernandes *et al*, 2007

5.63. The above characteristics were inputted into the model, which considered the uneaten baitfish passing through the net as a cohesive sediment. The calculation parameters were also adjusted so that once deposited the particles are not subject to re-suspension as uneaten baitfish undergo fast biodegradation on the bottom.

5.64. After 30 days of simulation, the uneaten feed deposit remains located under the tuna pens and its thickness is less than 0.5 cm (**Figure 5.14**). This result is explained by the settling rate. For a water depth of 50 m, the time necessary for a particle to reach the bottom is 12 minutes. These results do not take into account the natural degradation of the feed.

[36] Waterman J. J. 1979. Measures, stowage rates and yields in fishery products. Department of Scientific and industrial research. Torry research station, advisory notes n°17. FAO publications.

Figure 5.14: Thickness of uneaten feed after 30 days



Source: Artelia, 2018

Dispersion of fish oil

5.65. In modelling the dispersion of the fish oil, the following were taken into consideration:

- It is estimated that 5% of the gross weight of the feed is lost as fish oil; this represents 275 kg of fish oil released per cage every day.
- Contrary to petroleum hydrocarbon, little is known about the fate of non-petroleum hydrocarbon in the marine environment.
- The fish oil is subject to drifting, spreading, and advection.
- The biodegradation and evaporation is not taken into account, as too many uncertainties exist on this process in the marine environment and no laboratory data are available to parameterise these processes.

5.66. **Table 5.7** lists the physical parameters of the fish oil considered in the model.

Table 5.7: Oil physical parameters

Parameter	Value	Source
Kinematic Viscosity (20°C)	65.2 mm^2/s	Young, 1986
Density (25°C)	920.0 kg/m^3	Young, 1986

5.67. The volume of fish oil released by the whole farm (24 cages) is 7.17 m^3 per day.

5.68. In the model, the oil slick is represented as a set of particles. Each particle is subject to drifting, spreading, and advection, while biodegradation and evaporation are not taken into account[37]. For each modelled scenario, 900 particles are released; the whole set of particles represents 7.17 m^3 of fish oil.

5.69. Two scenarios were simulated, which correspond to different wind conditions:

- **Scenario 1**: starting on 2 August 2015 (wind initially from the South and then predominantly from the North-West);
- **Scenario 2**: starting on 27 August 2015 (wind predominantly from the East).

5.70. The results show that the velocity field and the wind field both influence the trajectory of the slick. Near the fish farm, the velocity field has an intensity in the range of 5 cm/s to 10 cm/s. The wind drift component of the slick velocity is 3.6% of the wind, which means around 0.15 cm/s for a wind intensity of 5 m/s. In this area, wind intensity is the major contributor of the slick trajectory. The slick drift is in the range of 5 cm/s to 15 cm/s in the scenarios simulated.

5.71. In Scenario 1, the oil slick moves first towards the North. Then it is transported by the Atlantic Ionian Stream offshore and moves southward. After two days, the slick changes its direction towards the Maltese coast. After 2 days and 15 hours it hits the coast.

5.72. In Scenario 2, the oil slick flows westward, along the southern coast of Comino. Then it joins the southeastward offshore currents located on the western side of the Maltese islands.

5.73. **Figures 5.15** and **5.16** reproduce snapshots of the particle position at various times for Scenario 1 and Scenario 2, respectively. A dashed line delineates the trajectory of the fish oil slick in both cases.

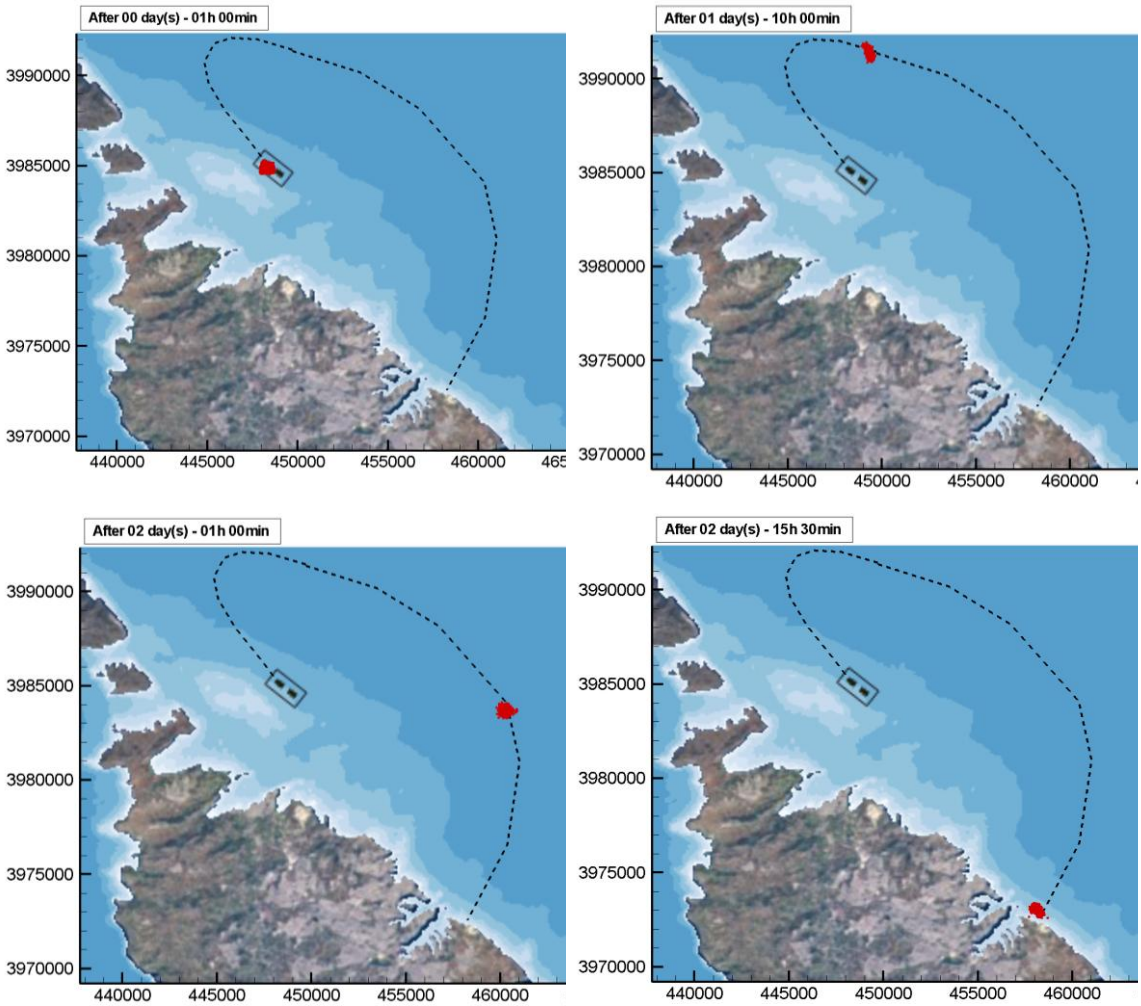
5.74. It must be emphasised that depending on the hydrodynamic conditions, a wide range of trajectories can be obtained and since the tuna are fed each day, a new oil slick could be generated daily and each one could be under the influence of different winds and currents and follows a different trajectory. The scenarios can therefore be very

[37] Biodegradation and evaporation would act to reduce the size or concentration of the slick; hence, their omission constitutes a worse case scenario.

complex. The outputs from these models are therefore not absolute and represent a qualitative assessment showing a high variability due to wind and are mostly useful for comparisons. A quantitative assessment, on the other hand, will require a long modelling duration and must be carefully chosen to consider also previous problematic spills.

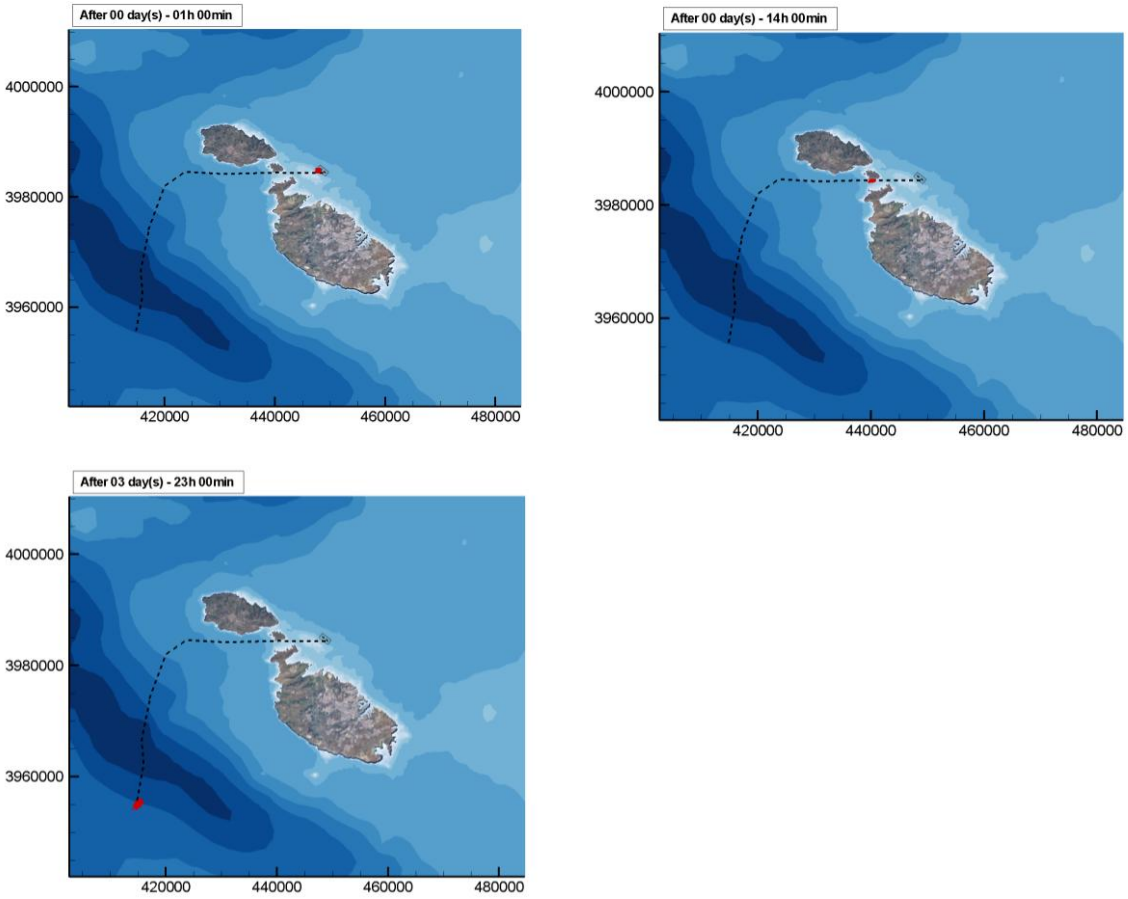
5.75. What can be inferred from the two scenarios, therefore, is that the oil slicks are subject to a wide range of trajectories, depending on the hydro meteorological conditions prevailing on site. Wind significantly influences the trajectories near the fish farm, and the oil slick reaches the coast in under 3 days from release under the worst case scenario with no containment, collection and under calm sea conditions.

Figure 5.15: Location of particles depending on time elapsed in Scenario 1



Source: Artelia, 2018

Figure 5.16: Location of particles depending on time elapsed in Scenario 2



Source: Artelia, 2018

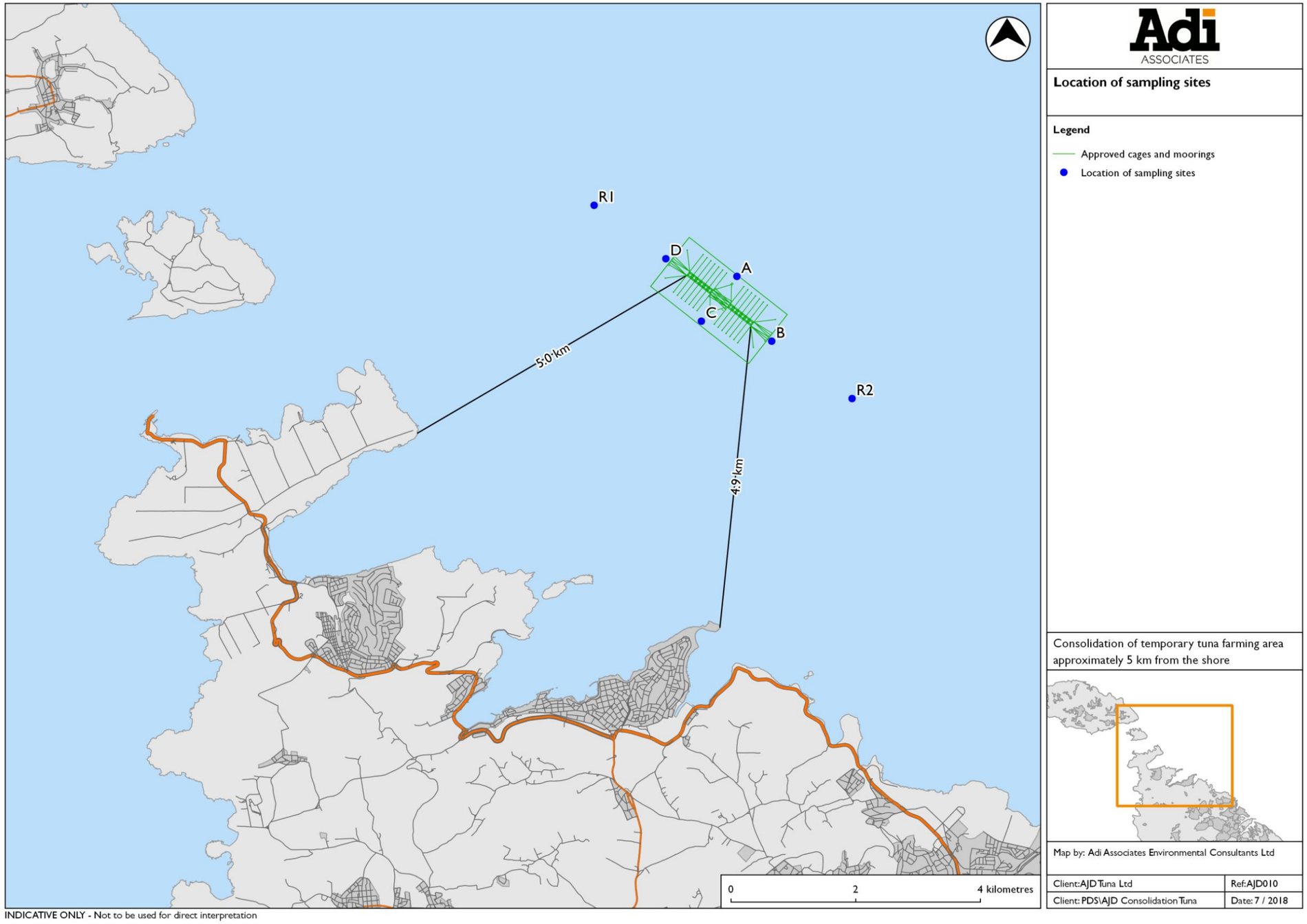
WATER AND SEDIMENT QUALITY

5.76. The locations of the six sampling stations, A – D and two reference sites (R1 and R2), are shown in **Figure 5.17** and their geographical coordinates and water depths are given in **Table 5.8**.

Table 5.8: Geographical coordinates and water depths at the water and sediment quality sampling stations

Station	Latitude / Longitude	Depth (m)
A	36° 00.584' / 14° 25.780'	50 m
B	36° 00.131' / 14° 26.127'	48 m
C	36° 00.163' / 14° 25.508'	45 m
D	36° 00.567' / 14° 25.367'	48 m
R1	36° 00.848 / 14 24.474'	46 m
R2	35° 59.597 / 14 26.815'	48 m

Figure 5.17: Location of sampling stations



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5.77. **Table 5.9** lists the physico-chemical parameters that were analysed for the water samples. Measurements of temperature, salinity, turbidity, and dissolved oxygen in water were made *in-situ* at each of the six stations using a YSI 650 MDS meter connected to a 6920 V2 multi-parameter probe. The meter was calibrated according to the manufacturer's instructions immediately before use. Measurements using the *in-situ* meter were made at the surface (0.5 m below the surface). Two replicate measurements were taken at each of the six stations A – D, and R1 and R2. Two replicate samples of seawater were then collected from each of the same six stations; samples were collected at a depth of 0.5 m using a standard Van Dorn water sampler of 3 L volume. All water samples were transported in a cooler box and maintained at a temperature of 4°C.

Table 5.9: Physico-chemical parameters for water quality analysis

Parameter	Method	Units
Temperature	In-situ / Portable Meter	°C
Salinity	In-situ / Portable Meter	psu
Dissolved Oxygen	In-situ / Portable Meter	%, mg/l
Turbidity	In-situ / Portable Meter	NTU
Turbidity (Secchi Depth)	Secchi Disk	m
pH	pH meter	pH units
Chlorophyll a	APAT CNR IRSA 9020 Man 29 2003	µg/l
Total Nitrogen	APAT CNR IRSA 5030 Man 29 2003 + APAT CNR IRSA 4040 A1 Man 29 2003 + APAT CNR IRSA 4050 Man 29 2003	µg/l
Total Phosphorus	APAT CNR IRSA 4110 Man 29 2003	µg/l
Total Carbon	UNI EN 1484:1999	µg/l
Total suspended matter	APAT CNR IRSA 2090 B Man 29 2003	mg/l

5.78. Estimates of current velocity and direction at the two reference stations were made using drogues according to the La Grange method. The drogues employed for this purpose had four rectangular perspex vanes, each of which has a surface area of 0.2 m^2. The drogues were suspended from an inflatable surface float by means of a length of twine which was 1 m long. The position of the release point (determined using the GPS) and time of the release were recorded. After allowing the drogues to float for a given period of time, the position of the collection point and the time of collection were recorded.

5.79. As regards sediment quality, samples were collected using a 0.1 m^2 Van Veen grab that was deployed from a 12 m vessel equipped with hoisting jib and winch. Two replicate grab samples were collected from each of the six stations. Samples were tested for chemical composition and granulometry. **Table 5.10** lists the physico-chemical attributes that were included in the sediment quality survey.

Table 5.10: Physico-chemical parameters for sediment quality analysis

Parameter	Method	Units (on D.M.)
Granulometry	Buchanan 1984	g
Total Organic Carbon (TOC)	UNI EN 13137:2002	%
Redox Potential	CNR IRSA 2 Q 64 Vol 3 1985	mV
Sulphide	CNR IRSA 12 Q 64 Vol 3 1986	µg
pH	CNR IRSA 1 Q 64 Vol 3 1985	pH units
Total Nitrogen	CNR IRSA 6 Q 64 Vol 3 1985	mg/g
Total Phosphorus	DM 13/09/1999 SO n°185 GU n°248 21/10/1999 Met XV.I	mg/g

5.80. The results for the water and sediment quality analysis are given in **Technical Appendix 4: *Marine Ecology Baseline Report***. The results of *in situ* measurement of physico-chemical parameters of the water column indicate temperature values and levels of salinity, water transparency and dissolved oxygen that are expected of local pristine offshore coastal waters during spring. The Secchi Disc measurements indicated a high water transparency of between 24 m and 29 m.

5.81. Detectable but low levels of total organic carbon (TOC), total suspended solids (TSS), total nitrogen, and total phosphorous were recorded from the sampling stations, while levels of Chlorophyll *a* were below the limit of detection, thereby indicating a low phytoplankton abundance.

5.82. A weak southeasterly surface sea current having a speed of between 0.11 m/s and 0.13 m/s was recorded at the two reference stations R1 and R2.

5.83. As regards sediment quality, the results indicated detectable but low levels of total organic carbon (TOC), total nitrogen, and total phosphorous, while levels of sulphide were below the limit of detection. Values of pH and redox potential were of an order that is expected of background levels for local offshore sediments. The results of granulometric analysis indicate that the sediments characterising the six sampling stations comprise poorly sorted coarse sand having a mean grain size of between 0.55 mm and 0.95 mm.

5.84. For the full set of results see **Technical Appendix 4: *Marine Ecology Baseline Report***.

BENTHOS

5.85. The studies of the benthos included both benthic diversity studies using grab samples and benthic habitat mapping.

Benthic diversity

5.86. To collect data for benthic diversity studies, a grab sample was taken from each of the four stations A – D using a 0.1 m^2 Van Veen grab that was deployed from a 12 m vessel equipped with hoisting jib and winch. After the grab was brought on board, surplus seawater was drained from the sample by placing it on a 1mm-mesh sieve; the retained sediment and biota were temporarily preserved in 10% formaldehyde in seawater. In the laboratory, each sample was first washed to remove the fine sediment (<0.5 mm fraction) and the preservative, and it was then sorted to separate out all macrofauna (animals larger than 0.5 mm). The motile macrofauna was then identified as far as possible. Where identification to species level was not possible, the different species present were labelled using an alphabetical code (e.g. Mysidacea sp. A, etc.).

5.87. A classified list of species and their respective abundance as recorded from the four grab samples collected from Stations A – D is available in **Technical Appendix 4: *Marine Ecology Baseline Report***. A total of 1,763 individuals comprising 79 macrofaunal species were recorded. Analysis of the grab samples showed the presence of macrofauna that is typical of the benthic biotic assemblages that characterise the lower infralittoral to circalittoral transition zone and the upper circalittoral zone that occurs off the northeastern coast of the Maltese islands. (cf. Borg *et al*., 1998[38]; Schembri 1998[39]; Sciberras *et al*., 2009[40]). A high diversity of macrobenthic fauna was recorded from the grab samples; the two most represented taxonomic groups, in terms of species richness and abundance, were the polychaetes and the crustaceans. No protected species were recorded from any of the grab samples.

Benthic habitats map

5.88. Fieldwork in relation to the videographic survey was undertaken in two parts – an initial phase undertaken by Ecoserv Ltd using ROV in May 2017 (Area "1" in **Figure 5.18**), and a later part undertaken by Seastar Surveys Ltd of the UK in May 2018 (Area "2" in **Figure 5.18**). The data collected was used to characterise the benthic

[38] Borg J.A., Howege H.M., Lanfranco E., Micallef S.A., Mifsud C. & Schembri P.J., 1998. The macrobenthic species of the infralittoral to circalittoral transition zone off the northeastern coast of Malta (Central Mediterranean). Xjenza 3(1): 16-24. [Malta].

[39] Schembri P. J., 1998. Maerl ecosystems of the Maltese islands. In: Dandria, D. [ed.] Biology abstracts MSc, PhD 1998 and contributions to marine biology: pp.35-37. Msida, Malta: Department of Biology, University of Malta; iv+38pp. [Malta].

[40] Sciberras M., Rizzo M., Mifsud J. R., Camilleri K., Borg J. A., Lanfranco E. & Schembri P. J., 2009. Habitat structure and biological characteristics of a maerl bed off the northeastern coast of the Maltese Islands (central Mediterranean). Marine Biodiversity 39: 251 - 264.

assemblages using the scheme of Borg *et al.* (2013)[41], which is based on the EUNIS typology that has been adapted for local use. The findings from both surveys and the methods used are reported in **Technical Appendix 4: *Marine Ecology Baseline Report***.

5.89. In summary, the seabed in the Area of Study consisted predominantly of coarse mobile sediments. A 10 – 25 m high drop-off characterised by rock exposed to sedimentation is present in the north-western part of the Area of Study. The water depth varied from 43 m to just over 100 m. Underwater visibility was good (> 25 m) throughout the Area of Study but flocculate material was noted in the water column along some of the transects.

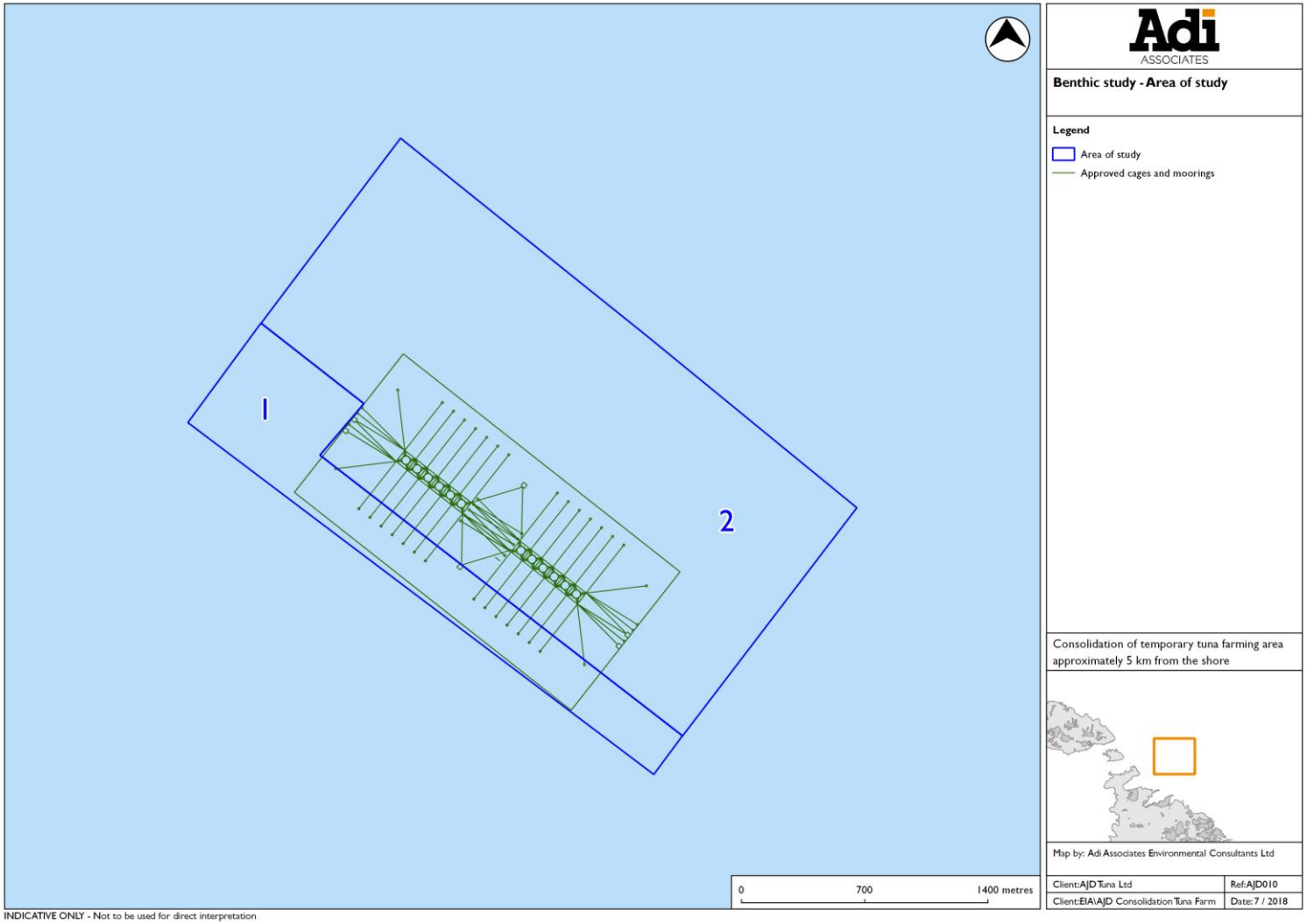
5.90. What are usually referred to as 'maerl[42] beds' but which are more properly termed 'rhodolith beds' occupy a large part of the Area of Study, which were more dense and continuous in the northeastern (and deeper) half of the survey area. In many places, the rhodolith beds were interspersed with a bare sand bottom that supported sparse rhodoliths[43]. In the southwestern half of the survey area, the rhodolith density varied such that they are less dense in the shallower part (45 m – 50 m) of the survey area, where large expanses of bare sand that supported little or no rhodoliths were present. Overall, the seabed had physical features that corresponded with the bathymetry: coarse sand with sparse accumulations of rhodoliths (0% - 20% rhodolith cover) was present at a water depth of between 43 m and 50 m; between a water depth of 50 m and 55 m, the seabed comprised coarse sediment having denser rhodolith accumulations (20% - 50% rhodolith cover); and in waters deeper than 55 m, the seabed mainly consisted of dense rhodolith beds (50% - 100% rhodolith cover). Beyond the rocky drop-off, at water depths exceeding 100 m, the seabed mainly consisted of bare muddy sand.

[41] Borg J.A., Knittweis L. & Schembri P.J. (2013) Compilation of an interpretation manual for marine habitats within the 25 NM Fisheries Management Zone around the Republic of Malta. [MEPA tender reference: T2/2013]. MEPA, Malta; 218pp.

[42] 'Maerl' is a term used to describe calcareous sediments dominated by coralline algae. Maerl as used here describes sedimentary habitats in which living or dead unattached calcareous rhodophytes are a dominant component. These algae may take the form of nodules (rhodoliths) or fragmented thalli. However, according to Basso *et al.* (2016), 'rhodolith beds' should be identified and delimited as those areas of the sea floor with >10% cover of live rhodoliths over a minimum surface of 500 m^2, while the term "maerl" refers to a specific type of rhodolith bed that is composed of non-nucleated, unattached growths of branching, twig-like coralline algae. 'Maerl' as used here conforms to the definition of Basso *et al.* (2016).

[43] Rhodoliths consist either of free-living calcareous rhodophytes (red algae), or else of an inner nucleus, such as stone or shell, encrusted by calcareous rhodophytes.

Figure 5.18: Benthic habitats mapping Area of survey



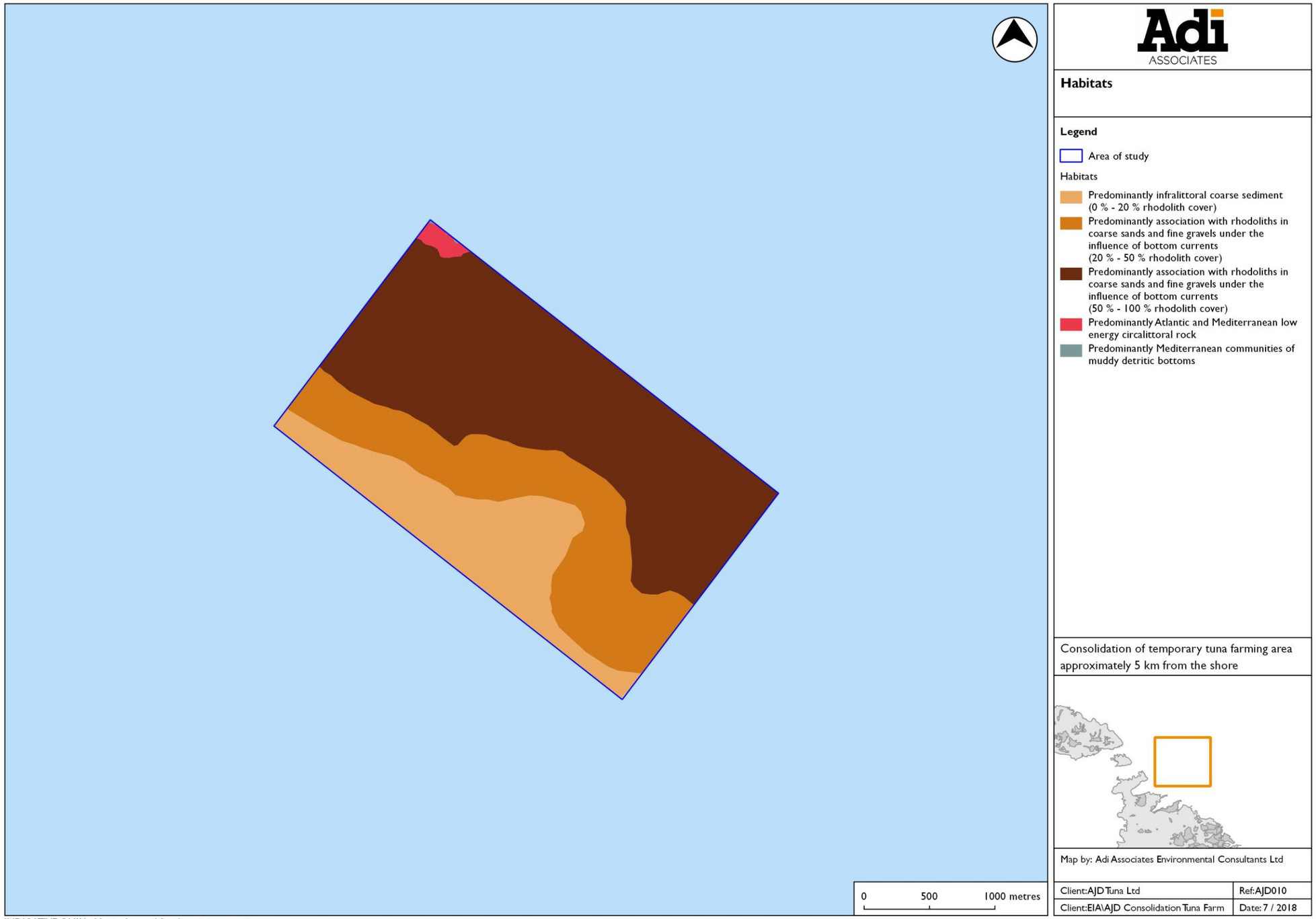
5.91. The main outcome of the benthic survey carried out in May 2018, in combination with data from the survey carried out by Ecoserv in May 2017 is a map showing the distribution of the main benthic habitats and assemblages present in the area surveyed (see **Figures 5.19**).

5.92. The following biotic assemblage types were recorded from the Area of Study:

- Association with rhodoliths in coarse sands and fine gravels under the influence of bottom currents (EUNIS code A5.515);
- Infralittoral coarse sediment (EUNIS code A5.13);
- Mediterranean communities of muddy detritic bottoms (EUNIS code A5.38); and
- Atlantic and Mediterranean low energy circalittoral rock (EUNIS code A4.3).

5.93. A description of each of these assemblages is available in **Technical Appendix 4: *Marine Ecology Baseline Report***.

Figure 5.19: Map showing the main benthic habitats present within the survey area



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5.94. It must be emphasised that although in general the area surveyed mainly supported the assemblage types and subtypes as described above and as depicted in **Figure 5.19**, parts within the shaded areas shown in the habitat map supported patches with a different assemblage type, such that:

- The area which supported the association with rhodoliths in coarse sands and fine gravels under the influence of bottom currents (dense rhodolith bed) had, in places, patches with the association with rhodoliths in coarse sands and fine gravels under the influence of bottom currents (sparse rhodolith bed) ;
- The area which supported the association with rhodoliths in coarse sands and fine gravels under the influence of bottom currents (sparse rhodolith bed) had, in places, patches with the association with rhodoliths in coarse sands and fine gravels under the influence of bottom currents (dense rhodolith bed) or patches with the assemblage of coarse infralittoral sediment; and
- The area which supported the assemblage of coarse infralittoral sediment had, in places, the association with rhodoliths in coarse sands and fine gravels under the influence of bottom currents (sparse rhodolith bed).

5.95. Furthermore, differences in the spatial distribution of the assemblage of coarse infralittoral sediment and of the association with rhodoliths in coarse sands and fine gravels under the influence of bottom currents (sparse rhodolith bed) were evident when comparing data from video transects made during Borg & Evans' 2017 survey with data from the survey made by Seastar Survey Ltd in May 2018. These differences, which are mostly applicable to the shallower (43 m – 55 m) parts of the Area of Study indicate that the soft sediment seabed there is dynamic and undergoes changes that involve shifting of accumulations of rhodoliths from one place to another, possibly even over large distances of several hundred metres. Such changes would happen during very strong wave action, typically during strong northeasterly winds, such as ones that characterised autumn 2017 and winter 2018. As a result, the spatial distribution of the aforementioned two habitat types changes.

Demersal and Pelagic Fauna

5.96. The demersal fish fauna recorded during the survey mainly comprised large shoals of Picarel *Spicara* sp. and individuals of the Comber *Serranus cabrilla*. Several individuals of the Mauve Stinger *Pelagia noctiluca* were recorded in the water column during the survey.

NATURE PROTECTION

5.97. As mentioned in **Chapter 3**, the Area of Study is located within the boundaries of the 'MT0000105 Marine Area in the Northeast of Malta' Special Area of Conservation of International Importance declared by Government Notice 851 of 2010 under the provisions of the Flora, Fauna and Natural Habitats Protection Regulations, 2013. This area forms part of the European Union's NATURA 2000 network.

5.98. In Maltese waters, the main rhodolith-forming algae in rhodolith/maerl beds are *Lithothamnion corallioides* and *Phymatolithon calcareum/Lithothamnion minervae.* with *Peysonnelia rosa-marina*, *Mesophyllum* sp., and *Neogoniolithon brassica-florida* constituting a minor component (Lanfranco *et al*., 1999). Associations with rhodoliths are a habitat type that qualifies sites for inclusion in national inventories of natural sites of conservation interest as required by the Protocol for Specially Protected Areas and Biodiversity in the Mediterranean (SPA/BD) of the Barcelona Convention. Furthermore, the coralline algae *Lithothamnion corallioides* and *Phymatolithon calcareum* are listed in Annex V (Animal and plant species of Community interest whose taking in the wild and exploitation may be subject to management measures) of the European Union's 'Habitats Directive' as amended. Both species probably occur in the rhodolith beds in the present Area of Study; however, only microscopic examination of samples of rhodoliths collected from the area will confirm this.

5.99. *Lithothamnion corallioides, Phymatolithon calcareum*, together with *Lithothamnion minervae* are listed in Schedule III (Animal and plant species of national interest whose conservation requires the designation of Special Areas of Conservation), and the first two named also in Schedule VII (Animal and plant species of Community interest whose taking in the wild and exploitation may be subject to management measures) of the Flora, Fauna and Natural Habitats Protection Regulations, 2013, which transpose the requirements of the EU's Habitats Directive to local legislation.

5.100. Rhodolith and maerl beds are included in the UNEP/MAP/RAC-SPA "Reference list of marine habitat types for the selection of sites to be included in the national inventories of natural sites of conservation interest" (UNEP/MAP/RAC-SPA, 2006) while an action plan for their conservation has been formulated (UNEP/MAP/RAC-SPA, 2008), both within the ambit of the Barcelona Convention. Within European legislation, Council Regulation (EC) 1967/2006, concerning management measures for the sustainable exploitation of fishery resources in the Mediterranean Sea, bans the use of specific fishing gear (trawl nets, dredges, shore seines or similar nets) on coralligenous or maerl beds. In order to conform to the requirements of EC 1967/2006, the local 'Implementation and Enforcement of Certain Fisheries Management Plans Order' (Legal Notice 354 of 2013) amends Zones C and G referred to in Annex V of EC 1967/2006 that originally overlapped with rhodolith beds as well as closed to trawling all areas where conclusive evidence exists for the presence of such beds (see Figure 44 in LN 354/2013).

5.101. The Needle-spined sea-urchin, *Centrostephanus longispinus* is listed in the Habitats Directive under Annex IV (Animal and plant species of Community interest in need of strict protection), in Appendix II of the Bern Convention, and in Annex II of the SPA/BD Protocol). This species is also protected locally under the Flora, Fauna and Natural Habitats Protection Regulations, 2013, where it is listed in Schedule V (Animal and Plant Species of Community Interest in need of Strict Protection).

IMPACT ASSESSMENT

Potential impacts

5.102. The potential impacts on the marine environment associated with the proposed Scheme may result from the deployment works and the farming operations on site.

5.103. The impacts that may be experienced as a result of the activities undertaken on site (as described in **Chapter 3**) include:

Marine environment (Water Quality):

- **During Deployment:**
    - Increased potential for oil pollution due to increased maritime traffic (deployment craft) in area;
    - Reduction in bottom water transparency due to re-suspension of sediment particulates by mooring blocks;
- **Operational Phase:**
    - Reduction in water quality of surface waters due to release of fish oils and mucus from baitfish during feeding;
    - Deterioration in water quality due to increased nutrient loads from fish waste and uneaten feed;
    - Deterioration in water quality and transparency from blood and offal released during culling, harvesting, and processing;
    - Pollution from operational release of petroleum hydrocarbons and bilge waters, and from litter and sewage from vessels associated with the Scheme;

Benthic Ecology:

- **During Deployment:**
    - Loss of habitats through burial under the mooring blocks; and
    - Damage or disturbance to habitats and species in the Area of Influence through increased human presence.
- **Operational Phase:**
    - Loss of habitats through permanent burial under the mooring blocks;
    - Disturbance to habitats and species through sand scouring as a result of alteration to currents and sediment movement around the mooring blocks;

- Loss of habitats and decimation of biota from settlement of uneaten feed and faeces on the seabed;
- Disturbance to habitats and species from increased organic input in the area;
- Availability of new habitat space for colonisation;
- Availability of new food sources, shelter, etc.;
- Disturbance to habitats and species from increased human activity, including littering;
- Attraction of pelagic and benthic species (including predators and scavengers) as a result of the presence of food and prey fish;
- Potential introduction of alien species and disease-causing organisms via baitfish; and
- Changes in ecological relationships and succession.

5.104. The effect of the Scheme on the benthic assemblages and the marine environment (water quality) will depend on:

- the importance and sensitivity of the habitats and species in the A of I;
- the type of interventions envisaged;
- the method of deployment;
- the extent of farming activities planned / amount of biomass kept on site;
- the condition of the craft used for deployment and the ships and support vessels used during the fattening and harvesting stages;
- the effectiveness of monitoring and management of operations, in particular the feeding;
- the diligence adopted by the operators of the installations and the seriousness of their management operations; and
- the effectiveness of the mitigatory / enforcement measures put in place.

Prediction and significance of impacts

Marine Environment – Water quality

5.105. The impacts of the Scheme on water quality resulting from the deployment and operational phases are of two types:

- Reduction in water quality or transparency; and
- Increased potential for pollution from oils, sewage, and litter.

5.106. In assessing the significance of the potential impacts on the marine environment arising from the Scheme, the following criteria were used:

- **Not significant** – no material change in water quality;
- **Minor significance** - Small-scale or temporary material change in water quality within the Scheme site and its immediate environs or a moderate to large scale or a long-term[44] change that can be mitigated; and
- **Major significance** - Moderate / large-scale or long-term material change in water quality within the Scheme site, its immediate environs, and beyond.

5.107. The concept of "material change" needs to be viewed in the context of the Scheme, as described in **Chapter 3**. In terms of water quality, material change is considered to be a change that is of sufficient duration and magnitude as to permanently affect sensitive receptors.

5.108. In applying the above criteria the Consultants are mindful of the fact that the disturbance of certain species is prohibited by law, in which case, even small-scale changes or alterations that may disturb a legally protected species or its habitat would be a major impact.

5.109. In the following sections, the significance of each impact is based on the criteria outlined above.

Impact: Reduction in water quality or transparency

<u>During Deployment</u>

Reduction in bottom water transparency due to re-suspension of sediment particulates by mooring blocks

5.110. Cages are anchored on site by means of mooring blocks. The placement of these structures on the sea bed results in the re-suspension of sediment particulates and entrapped nutrients, leading to a temporary reduction in water transparency and potentially increased productivity. However, in view of the considerable depth of water at the Scheme site, this impact will be limited in vertical extent to the bottom layers, and it will be temporary and largely localised. The impact is therefore considered to be not significant.

<u>During Operations</u>

Reduction in water quality of surface waters due to release of fish oils and mucus from baitfish during feeding

[44] "Long-term" is here taken to mean more than one tuna season (i.e. water / sediment quality conditions do not return to baseline levels following one fallowing period).

5.111. Experience from tuna farming operations indicates that considerable amounts of natural fish oils and mucus may be released from the frozen baitfish. These natural oils are released into the marine environment when they are fed to the tuna. Once released into the water column, unless contained, these oils quickly spread out over the surface forming sheens, which normally take the shape of extended narrow stripes (or windrows) spread over a few kilometres, parallel to the wind direction.

5.112. Surface oils will disperse, dissolve, and /or form emulsions. The spatial extent that may be impacted upon by such natural oils will depend on the strength and direction of prevalent surface sea currents as well as on the amount of oils released. As described above, the oil slicks would be subject to a wide range of trajectories, depending on the hydro meteorological conditions prevailing on site, with wind significantly influencing the trajectories near the fish farm. The modelling undertaken for this EIA shows that the winds and currents at the Scheme site vary and any uncontained oil released from the farm would reach the coastline.

5.113. These oils typically emit bad odour and their presence is aesthetically unpleasant, they additionally leave an oily slime over anything they come into contact with (including divers and bathers when the oil reaches inshore areas). It is acknowledged that the aesthetic impacts of the oily sheen, the odours, and the impacts on bathers and recreational users of the sea are a considerable nuisance[45]. However, given that these oils are natural products and that they rapidly biodegrade, impacts on marine ecology, including shore habitat where they may be deposited are considered to be minor to not significant.

Deterioration in water quality due to increased nutrient loads from fish excreta and uneaten feed

5.114. Fish waste (soluble excreta and faeces) and uneaten baitfish may potentially lead to enhanced nutrient levels in the area, increased biochemical oxygen demands of the water column (as well as within sediments), and increased sedimentation rates of organic particulates. Dissolved and particulate waste from fish excretion and uneaten feed may potentially expose the water column to increased nutrient levels and reduced water transparencies.

5.115. Data from past monitoring programmes at operational tuna farm sites show that nutrient levels within the water column at all stations exhibit wide fluctuations,

[45] This impact on humans is considered to be of major significance and is dealt with elsewhere in this EIA Report (see Chapter 8). It is here not considered further as it is not a significant water quality issue. However, it is to be recalled that the release of oils is directly proportional to the amount of feed, which in turn is directly proportional to the amount of tuna stocked. Hence, a lower stocking density should lead to a lower release of oils per cage. Likewise, the impact of oil release decreases as harvesting progresses (and the number of tuna in the cages decreases), being completely eliminated when all the tuna are harvested. Obviously, the release of oils is at its peak in summer, which is when the marine environment has its greatest social use. Mitigation measures aimed at minimising the release and maximising the collection of these oils before they disperse into the marine environment is of utmost importance.

mostly due to natural causes. Nonetheless, evidence of occasional nutrient enrichments (nitrates and phosphates) near the tuna pens as a result of the tuna penning operations themselves (rather than natural fluctuations) does exist. The modelling on the dispersal of fish excreta undertaken for this EIA (see above) confirms this, with the threshold for nitrogen and phosphorous reached within 1.5 and 1 km of the last cage, respectively. The spatial extent of these impacts are hence limited and transient in nature, such that the impact of such increased nutrients from fish waste is considered to be minor.

5.116. Based on monitoring experience at local tuna farms, the water transparency at the surface layers is not expected to suffer any long-term reduction. However, in view of the impacts of uneaten baitfish settling on the sea bed beneath the cages, it is expected that the water transparency at bottom layers would be severely affected through the release of organic material from the decomposing flesh. This impact has been modelled as part of this EIA Report (see above), which has shown that after 30 days of simulation, the uneaten feed deposit remains located under the tuna pens and its thickness is less than 0.5 cm. This impact is directly proportional to the amount of uneaten baitfish lost (often a function of feed management) and the extent and efficiency of scavenging. The impact is therefore uncertain, though the modelling and the monitoring data shows that it is likely to be minor to major beneath the cages becoming minor to not significant with increasing distance from the cages.

Deterioration in water quality and transparency from blood and offal released during culling, harvesting, and processing

5.117. As described in **Chapter 3**, a considerable amount of blood is released when the tuna are culled and processed. Culling takes place in the pens, and processing takes place on board the ships, the latter resulting in blood and offal (heads, tails, and internal organs). The blood is mostly released immediately into the marine environment, whereas the offal is stored and disposed at sea, under instructions from the Department of Fisheries and Aquaculture. Current permit conditions require the operators to dispose of the offal outside territorial waters (12 nautical miles), however, stakeholder reports of offal turning up on shores in the vicinity of tuna farms raises concerns that either this waste is not being disposed of far enough or the method of disposal is not as effective as originally thought[46]. It is, therefore, important that offshore offal disposal as currently permitted is properly monitored and permit conditions enforced.

5.118. In order to eliminate the possibility of gas-filled and buoyant internal organs reaching the coastline or inshore waters, the competent authorities should consider imposing a requirement for the operators to macerate the offal prior to its disposal into the marine environment. This would ensure that only liquid waste is released into the

[46] However, there is also the possibility that this offal that ends up beached on the shore is not originating from the tuna farms *per se,* but from wild tuna caught by amateur fishermen attracted to the tuna farm (see below and Arechavala-Lopez *et al.* (2015) in **Technical Appendix 4: *Marine Ecology Baseline Report***.

sea allowing its easier dispersal offshore.

5.119. While offal and blood disposal in the sea has conjured images of shark attraction in local media, no such evidence exists to date, although vigilance should be maintained in this respect. Alternatives to blood disposal are few, if any. Culling of the tuna must happen rapidly in order for the quality of the fish not to deteriorate through an increase in body temperature and stress. This means that the release of blood into the sea at culling cannot be avoided. This blood is rapidly dispersed and being biodegradable, its impact on water quality is minor to not significant.

Disposal of dead tuna

5.120. Under normal circumstances some mortalities are expected to occur, mainly as a result of stress, such as that caused by the billowing of nets and enclosure of the tunas. The actual percentage of tuna loss will vary according to a number of factors, but under normal conditions it is generally expected to be between 1 and 2%. Therefore, as much as 30 to 60 tonnes of tuna may be expected to be lost from the Scheme site (maximum production) over a single year.

5.121. In the event of death from stress as a result of net damage during strong storms, a much larger percentage of tuna loss may be expected. Disposal of the resultant dead tuna will be through incineration at the Thermal Facility in Marsa under supervision of the Veterinary and Phytosanitary Regulation Department. Operators are required by the environment permit issued by the Environment and Resources Authority to prepare contingency plans in case of large scale mortalities. The impact is considered to be major to minor depending on the scale of the deaths.

5.122. The formulation of contingency plans to deal with such eventualities is an important first step; however, it is important that the persons concerned are aware of their responsibilities under the plans to ensure timely action in time of need. A proper contingency plan (which is periodically updated and which requires properly trained personnel) can ensure a quick and effective response in case of an emergency, so as to reduce and possibly prevent marine environmental impacts arising from the need to dispose of large amounts of dead fish.

Impact: Increased potential for pollution

5.123. Most operational pollution generated by maritime transport are common to all types of ships, including the tuna service ships and deployment craft. Some are related to propulsion plant, including: atmospheric emissions, oily water, and wastes collected in the machinery space bilge tanks, nitrogen acid, and other gaseous pollutants in machinery exhaust fumes. Other potential impacts are related to the crew activities, including generation of sewage and garbage, and incidences of marine litter.

<u>During Deployment</u>

Increased oil pollution due to increased maritime traffic (deployment craft) in area

5.124. Cages are towed to site by means of tug boats or similar craft. These operations are bound to increase the presence of maritime traffic in the area and which may give

rise to marine contamination by diesels/lubricants and other petroleum products. Such impacts are considered to be temporary and given the small volume of traffic associated with the Scheme - not significant to minor except in the case of a large spill, in which case the impact would be minor to major. Furthermore, the deployment craft will only be on site for a short period of time, and in the event of a spill, the extent of coastline that may be exposed to such impacts is very small.

5.125. Nonetheless, it is important that good operational practice and proper project management is adhered to in order to minimise the potential for such operational releases of diesels/lubricants. Furthermore, the farm operator has a contractual agreement with a spill response company in the event of accidental release of oils.

During Operations

Pollution from operational release of petroleum hydrocarbons and bilge waters, and sewage from vessels associated with the Scheme

Oil (operational losses and bilge waters)

5.126. The farm will make use of the following vessels:

- Two Processing Vessels (from end September till end November);
- Five Feeder Vessels; and
- Three Support Vessels (to assist divers and recover fish oil from cages).

5.127. Operational losses of oils and fuels from the smaller craft are possible, as with all marine craft; however, as long as the craft are maintained in good condition and good working practices are adopted, these impacts are expected to be temporary and not significant to minor given the relatively low amount of vessels. Only in the unlikely event of a larger spill would the impact be of minor to major significance.

5.128. Impacts from the larger processing vessels are bound to be more significant, especially if reconditioned vessels (often more than 10 years old) are used. It has been estimated that this type of vessel would produce roughly 15m^3 of oily bilge water per year, which bilge water could contain up to 5% by volume, lubricating oils and other petroleum products (Axiak, 2005[47]). The impact would therefore be potentially major.

5.129. According to MARPOL regulations 73/78, the discharge of bilge waters with an oil content in excess of 15ppm prior to dilution is not allowed anywhere within the Mediterranean (which is designated as a Special Area under MARPOL). If the bilge water generated by such processing vessels will have oily contents in excess of this

[47] Axiak, V., 2005. Water Quality Baseline Study. Prepared in support of the Environmental Impact Statement for PA 00087/04 – Development of an Aquaculture Zone East of Malta. EIS coordinated by Adi Associates Environmental Consultants Ltd. 57 pp.

legal limit, then no discharge of such bilge waters will be allowed and the ships are to have adequate holding tanks and they would be required to transfer the bilge waters to a port reception facility. In this scenario the management of bilge waters reduces the impact on the marine environment to one of minor significance.

Sewage

5.130. It is estimated that approximately 156 litres of sewage per crew member is produced daily on non-passenger ships (Helmepa, 1987[48]). Therefore, it is estimated that between 187,000 and 280,000 litres of sewage are generated by each processing vessel assuming they will be present on site for 2 months.

5.131. According to Annex IV of MARPOL regulation 73/78 (applying to all ships above 200 GRT carrying 10 persons or over), the processing vessel will not be allowed to discharge such sewage effluents within 4 nautical miles from land, unless it is equipped with an approved sewage treatment plant.

5.132. Release of sewage from the ships[49] close to the tuna pens is counterproductive to the farm's operations; discharge further offshore, in line with MARPOL regulations, would be more advisable. This would also help mitigate impacts of such discharges, effectively rendering them minor.

Pollution from ship litter and loss of packaging waste into the marine environment

Packaging waste

5.133. Following processing on board the factory vessels, the tuna are packed in purpose made carton boxes lined with plastic. The boxes are loaded at the harbour. A considerable amount of cartons and packaging material will be required per harvesting season. Axiak (2000[50]) estimated that approximately 4,000 cartons are used by a 500-tonne tuna production unit. Provided that all cartons and other packaging material are supplied to the service vessel in flat-pack form, then no carton cuttings or plastic off-cuts will be produced on board the service vessel. Therefore, no risks of marine contamination by paper or plastic litter will arise from such packaging operations. Nonetheless, the operators must be vigilant to ensure that none of this material ends up overboard (accidentally or otherwise) and staff and crew are to be made aware of the environmental impacts of marine litter. The environmental permit for the current tuna farming operation includes provisions aimed at addressing marine littering and its monitoring.

Litter

5.134. Axiak (2000), citing other literature sources, has estimated that for merchant ships

[48] Helmepa (1987) Guide against ship generated pollution. Commission of European Communities. 41pp.
[49] Both the factory ships and the ones in the bunkering zone.
[50] Axiak, V. 2000. A Contribution to An Environmental Impact Statement For The Proposed Tuna Penning Farm Off Selmunett, NE Malta With Special Reference to Risks of Marine Contamination. April 2000.

and fishing vessels, approximately 0.8 kg of garbage will be produced per crew member per day. Therefore, assuming that processing ships will carry a crew of 20-30 people, it may be estimated that a total of 1 to 1.5 tonnes of galley litter will be produced per processing ship assuming they will be on site for two months.

5.135. According to Annex V of MARPOL regulation 73/78, marine discharges of all types of galley litter, except for food remains, is prohibited within the Mediterranean. Food remains may be discharged beyond 12 nautical miles from the nearest land. Competent authorities are to ensure that these regulations are adhered to by the factory vessels in line with Malta's international obligations. As long as these are adhered to, the impacts from discharge of galley litter are expected to be minor.

5.136. The results of video surveys made below tuna cages at local tuna penning sites have indicated that, in places, a considerable amount of anthropogenic items is present below the pens that appear to originate from the farm operations; these include concrete weights with ropes attached, sheets and sacks of fabric and other material, car tyres, lengths of rope and other unidentified items. While plastic items are known to be hazardous to marine life, items deposited on the seabed lead to physical alteration of the bottom leading to potential changes to the benthic habitat present in the vicinity of the fish farm.

5.137. Good practice and measures to reduce littering of the seabed by anthropogenic items originating from the tuna penning activities are the main mitigation measures that can be adopted to avoid littering of the seabed. Should any items originating from the fish farm accidentally end up in the sea, whether floating or deposited on the seabed, these should be recovered immediately.

5.138. The overall level of impact when anthropogenic items originating from the fish farm end up in the sea, whether floating or deposited on the seabed, is predicted to be minor to major depending on the type of items and whether they can be transported away from the site if not removed imminently

Benthic Ecology

5.139. As explained, the benthic biotic assemblages at the Scheme site and the Area of Study are characteristic of the ones present in the infralittoral and circalittoral zones off the northeastern coast of the Maltese Islands. The two most represented taxonomic groups, in terms of species richness and abundance, were the polychaetes and the crustaceans.

5.140. The only protected species recorded from the Scheme Site were the sea urchin *Centrostephanus longispinus* and the coralline algae *Phymatholithon calcareum* and *Lithothamnion minervae.* Associations with rhodoliths are a habitat type that qualifies sites for inclusion in national inventories of natural sites of conservation interest as required by the Protocol for Specially Protected Areas and Biodiversity in the

Mediterranean (SPA/BD) of the Barcelona Convention[51]. Furthermore, the coralline algae *Lithothamnion corallioides* and *Phymatolithon calcareum* are listed in Annex V (Animal and plant species of Community interest whose taking in the wild and exploitation may be subject to management measures) of the European Union's 'Habitats Directive' as amended[52]. Both species probably occur in the rhodolith beds in the present Area of Study; however, only microscopic examination of samples of rhodoliths collected from the area will confirm this.

5.141. The Needle-spined sea-urchin, *Centrostephanus longispinus* is listed in the Habitats Directive under Annex IV (Animal and plant species of Community interest in need of strict protection), in Appendix II of the Bern Convention[53], and in Annex II of the SPA/BD Protocol)[54]. This species is also protected locally under the Flora, Fauna and Natural Habitats Protection Regulations, 2006 as amended, where it is listed in Schedule V (Animal and Plant Species of Community Interest in need of Strict Protection).

5.142. Impacts on the protected species or assemblages would, from a policy/legislation point of view, be considered to be of major significance, irrespective of the extent of

[51] The Convention for the Protection of the Mediterranean Sea against Pollution (the Barcelona Convention) was adopted on 16th February 1976. A number of protocols were adopted under this convention, amongst which is the Protocol concerning Mediterranean Specially Protected Areas done at Geneva on 3 April 1982. The parties later amended this protocol and its name changed to Protocol for Specially Protected Areas and Biodiversity in the Mediterranean (SPA/BD). Malta ratified this new Protocol on 28th October 1999. A draft reference list of habitat types for the selection of sites to be included in the National Inventories of Natural Sites of Conservation Interest was drawn up at the Fourth Meeting of National Focal Points for Specially Protected Areas (Tunis, 12-14 April 1999) [see UNEP(OCA)/MED WG.154/7]. The most recent 'Classification of benthic habitat types of the Mediterranean' dated 2006 is available from the UNEP RAC/SPA at http://rac-spa.org/sites/default/files/doc_fsd/lrhm_en.pdf

[52] The European Union's Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora is known as the 'Habitats Directive'. Annexes I and II of this Directive have been amended by Council Directive 97/62/EC of 27 October 1997. Annex I of the Habitats Directive lists natural habitats whose conservation requires the designation of Special Areas of Conservation. Annex II lists species of plants and animals whose habitats must be protected for their survival. Annex III lists criteria for selecting sites eligible for consideration as "Sites of Community Importance" and designation as Special Areas of Conservation, while Annex IV lists species of Union interest in need of strict protection. Annex V lists species of plants and animals of Union interest whose taking from the wild and exploitation is subject to management, and Annex VI lists prohibited methods and means of capture and killing of mammals and fish, and prohibited modes of transport. In anticipation of the 2004 enlargement of the EU, the Annexes of the Habitats Directive were modified by the Act of Accession signed in Athens on 16th April 2003, to take into account the expanded geographical area of the EU15+10. The annexes were further amended by Council Directive 2006/105/EC of 20 November 2006 in anticipation of Bulgaria and Romania joining the European Union in 2007 and then again by Council Directive 2013/17/EU of 13 May 2013 due to the accession of the Republic of Croatia.

[53] The Bern Convention is the Convention on the Conservation of European Wildlife and Natural Habitats. Malta acceded to this Convention on the 26th November 1993. Appendix II of the Bern Convention lists strictly protected species of fauna and the Convention prohibits the deliberate capture, the destruction of breeding or resting sites, the deliberate destruction, and the deliberate killing of, and trade in, these species.

[54] A number of species are listed in annexes to the SPA/BD Protocol: Annex II lists endangered or threatened species and Annex III lists species whose exploitation is regulated.

the impact. However, when assessed in the context of the Scheme, and taking account of proposed mitigations, the potential impact on the protected species or habitats may range from major to minor significance. Impacts will depend on (i) the actual status of the species[55], (ii) the extent of the impact[56], (iii) the effectiveness of the mitigation measures, and (iv) the adoption of good working practices (especially with regards to deployment of moorings and in feed management[57]).

5.143. In the following sections, the significance of each impact is based on the criteria outlined above.

Impact: Habitat loss

Loss through burial under the mooring blocks

5.144. Placement of the mooring blocks on the seabed will lead to a direct impact on the seabed within their footprint. All benthic flora and fauna, the latter mostly comprising sessile and slow moving invertebrates, that will end up underneath the mooring block will be decimated. The more motile fauna, such as fast moving invertebrates and fishes are expected to move away rapidly from a mooring block that is being deployed and will not be affected adversely.

5.145. As the mooring block makes contact with the seabed, sediment disturbance will lead to its suspension into the water column. Upon re-settling, the suspended sediment can smother flora and sessile fauna, resulting in potential adverse effects on such organisms (depending on the extent of smothering). These sessile organisms are typically adapted to disturbance from suspended sediments and will recover quickly, while the high energy environment of the area will help to rapidly remove sediment particles that may have been deposited on the biota.

5.146. Good practice approaches in the deployment of the mooring blocks to reduce adverse effects on the seabed especially through dragging of blocks, would minimise the effects of such deployment on the seabed habitats.

5.147. The impact of mooring block deployment is of major significance for the biota located beneath the blocks, which will be decimated, as explained; however, considering that the surface area of the mooring blocks is limited compared to the extent of the farm area, and assuming that there will be no movement / dragging of

[55] For example, although the sea urchin *Centrostephanus longispinus*is included in the Habitats Directive Annex IV, and is therefore a protected species locally, it is actually a common species in Maltese waters (unlike, for example, France), so that the impact of the Scheme on this species in Maltese waters, is not considered to be high.

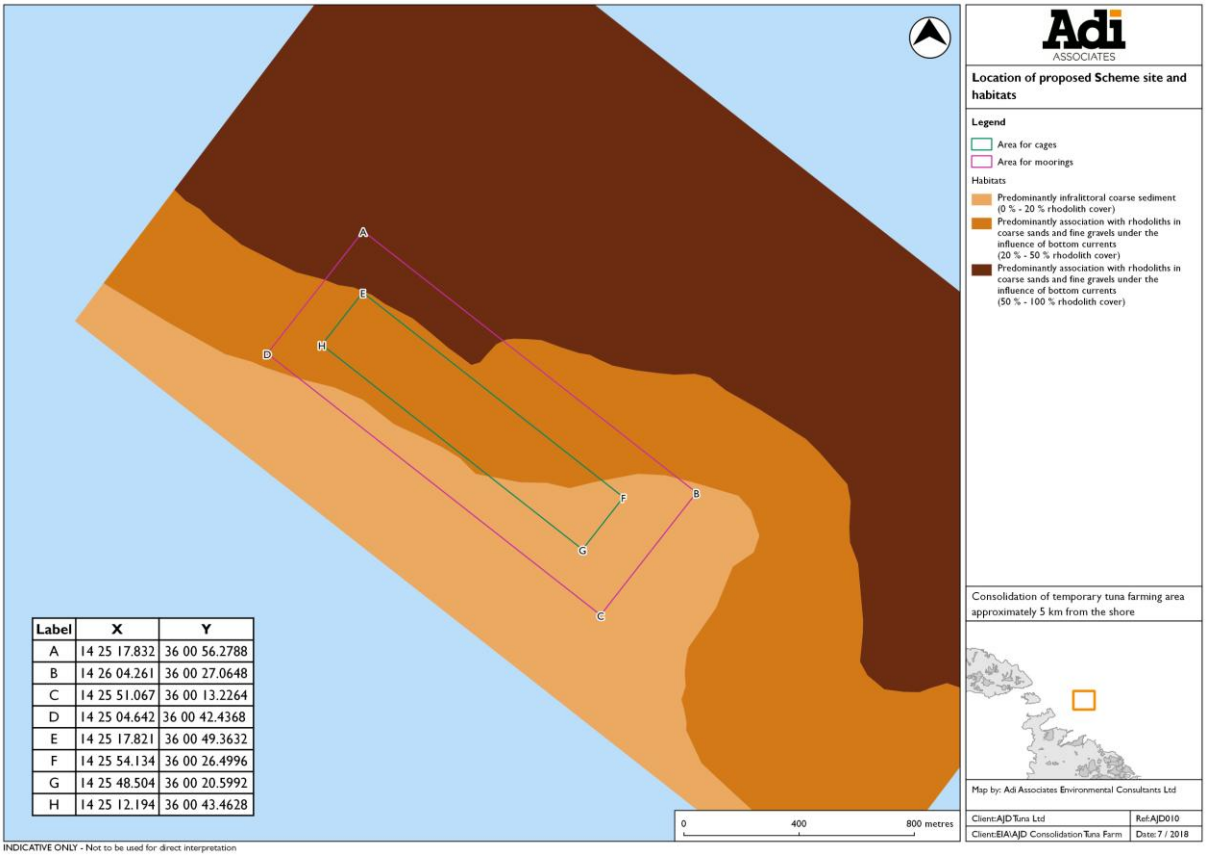
[56] For example, occasional churning of sediment containing maerl-forming coralline algae is actually beneficial, as shown in local research (BIOMAERL). However, burying of the coralline algae under considerable amounts of uneaten feed would lead to their decimation.

[57] It has been shown that the occasional settlement of small number of uneaten baitfish does not cause a significant impact on the benthos, but the deposition of layers of uneaten and decomposing fish will destroy the benthic communities.

blocks, the overall impact is expected to be minor on the general sessile benthic species within the farm area.

5.148. The impact of mooring block placement also depends on the type of habitat it impacts. As shown in **Figure 5.20**, most of the mooring blocks will be located on the 'predominantly infralittoral coarse sediment (0 – 20% live rhodolith cover)' and the 'predominantly association with rhodoliths in coarse sands and fine gravel under the influence of bottom currents (20 – 50% live rhodolith cover)'. The impact on these habitats, which are characterised mostly by coarse sediments, is deemed to be of minor significance if the mooring blocks do not drag. A small part of the moorings in the northwestern area of the Scheme will be placed on the area predominantly with 'association with rhodoliths in coarse sands and fine gravel under the influence of bottom currents (50 – 100% live rhodolith cover)'. The impact on this latter habitat is deemed to be of major significance.

Figure 5.20: Location of Scheme and impact on benthic habitats



Loss of habitats and decimation of biota from settlement of faeces and uneaten feed on the sea bed

5.149. Impact from fish wastes (urine and faeces) is considered to be not significant in terms

of its impacts on habitats since the urine will be diluted and the faeces readily disintegrate in water[58]. Any such waste will mostly disperse or disintegrate in the water column and any waste that does reach the bottom will do so over a wide area where it should be readily decomposed by microbial organisms in the sediment, especially given the usually nutrient-limited conditions of local waters.

5.150. As described above and in **Technical Appendix 3: *Wave study, hydrodynamics and environmental modelling Report***, impacts on the sediment from uneaten feed are restricted to the area immediately beneath the tuna pens. The model indicated that over a 30 day simulation, the feed accumulation is not more than 0.5 cm. This is corroborated by the monitoring data available from operational farms to date (see **Technical Appendix 4: *Marine Ecology Baseline Report***) and though largely dependent on feed management, increasing controls at the tuna farms, coupled with environmental permit conditions, helps to reduce these impacts further. These impacts are therefore judged to be minor to major directly under the cages and minor to not significant in the area outside the cages general seabed occupied by the tuna farm, depending on the level of feed management (in the case of the uneaten baitfish) and the stocking density (fish faeces).

5.151. It is therefore crucial that the management of feed is continually improved at the Scheme site. More regular monitoring and closer supervision and/or the use of new technologies, including underwater video cameras, and greater liaison between the environmental monitors, the regulators (ERA, PA and DFA), and the farm operators are required, as are more prompt actions by the farm operators and their staff in rectifying over-feeding or loss of baitfish.

5.152. Equally important is the training and sensitising of the staff on the farms to the impacts associated with over-feeding and the settlement of uneaten baitfish. Specific training programmes should be run to target the various operators and to ensure that all the staff is knowledgeable of the impacts the operation can cause and how these can be minimised through best practice on the farm. Such training requirement is a condition of the environmental permits.

Impact: Damage or disturbance to habitats or species

<u>Change in currents and sediment movement</u>

5.153. In addition to the smothering of the portion of seabed under the mooring blocks, the presence of the blocks on the seabed can produce alterations in the surrounding substratum as a result of modifications in the bottom current and, as a consequence, variations in the sediment size distribution and the silting rate around the structures (Badalamenti & D'Anna, 1996[59]). Such mooring blocks have the same effects as those

[58] Impact on water quality from fish wastes is addressed in the water quality section above.

[59] Badalamenti, F., and D'Anna, G., 1996. Monitoring techniques for zoobenthic communities: influence of the artificial reef on the surrounding infaunal community. In: Jensen, A.C. [ed]. Proceedings of the 1st Conference of the European Artificial Reef Research Network; Ancona, Italy, 26-30 March 1996; pp 347-358.

brought about by artificial reefs, so that studies undertaken on the latter can inform us on the potential impacts of the former.

5.154. Few studies have been carried out on the infaunal community surrounding artificial reefs, and how these structures have affected the communities, and these studies have produced different results. Some report modifications of both sediment texture and community structure (e.g. Fricke *et al*., 1986[60]; Ambrose & Anderson, 1990[61]; Lindquist *et al*., 1994[62]; Nelson *et al*., 1994[63]), whereas others did not find any significant differences (e.g. Davis *et al*., 1982[64]; Jensen *et al*., 1994[65]).

5.155. These studies, however, seem to indicate that there is a close relationship between changes in sediment characteristics and distance from the reef, such that the greatest difference occur within 1m of the reef edge.

5.156. The gravelly nature of the sea bed would probably minimise settlement of the mooring blocks, if it would happen at all, but there might be scour on the side of the block under the action of the prevailing bottom currents and accumulation on the opposite side. Such scour or settlement is not expected to have any significant impact on the stability of the cages or on the seabed, more than the actual placement of the blocks themselves will.

Disturbance to habitats and species from increased organic input in the area

5.157. As explained above the increased organic input from fish excreta is not expected to create a significant impact in view that fish excreta are either diluted immediately or readily disintegrate to disperse over wide areas.

5.158. This is expected to hold true even in the case of the Scheme, which presents a scenario where a total biomass of 3,300 tonnes could be potentially kept in a relatively confined area, but, due to the highly oligotrophic nature of the sea in the central Mediterranean, would not be expected to overload the system. The modelling (see earlier) showed that following release of the fish wastes in the pens, the thresholds of nitrogen and phosphorous would be reached within a maximum of

[60] Fricke, A.H., Koop, K., and Cliff, G., 1986. Modification of sediment texture and enhancement of interstitial meiofauna by an artificial reef. Transactions of the Royal Society of South Africa. 46 (1): 27-34.

[61] Ambrose, R.F., and Anderson, T.W., 1990. Influence of an artificial reef on the surrounding infaunal community. Marine Biology, 107: 41-52.

[62] Lindquist, D.G., Cahoon, L.B., Clavijo, I.E., Posey, M.H., Bolden, S.K., Pike. L.A., Burk, S.W., and Cardullo, P.A., 1994. Reef fish stomach contents and prey abundance on reef and sand substrata associated with adjacent artificial and natural reefs in Onslow Bay, North Carolina. Bulletin of Marine Science, 55 (2-3): 308-318.

[63] Nelson, W.G., Neff, T., Navratil, P., and Rodda, J., 1994. Disturbance effects on marine infauna near stabilised oil-ash reefs: spatial and temporal alteration of impacts. Bulletin of Marine Science, 55 (2-3): 1348.

[64] Davis, N., VanBlaricom, G.R., and Dayton, P.K., 1982. Man-made structures on marine sediments: effects on adjacent benthic communities. Marine Biology, 70: 295-303.

[65] Jensen, A.C., Collins, K., Lockwood, A.P.M., Mallison, J.J., and Turnpenny, W.H., 1994. Colonisation and fishery potential of a coal-ash artificial reef, Poole Bay, United Kingdom. Bulletin of Marine Science, 55 (2-3): 1263-1276.

1.5 km and 1 km from the eastern most cages (see also **Technical Appendix 3: *Wave study, hydrodynamics and environmental modelling Report***).

5.159. As also reported in **Technical Appendix 4: *Marine Ecology Baseline Report***, water quality surveys have been carried out at local tuna penning sites since the early 2000s. During these surveys, standard water quality attributes, namely dissolved oxygen, temperature, salinity, turbidity, nitrates, phosphates, Chlorophyll *a*, ammonia, and counts of intestinal bacteria, as well as sea currents, were measured at a number of sampling stations located in the immediate vicinity of the tuna farms and at up-current and down-current reference stations. The results of such surveys indicate that, very rarely, lowered levels of oxygen, reduced water transparency, and elevated nutrient (nitrates and/or phosphates and/or ammonia) levels were recorded from the tuna penning sites during the farming season (July – December). However, the observed changes in the monitored attributes were often sporadic and not statistically significant, and have not resulted in appreciable alteration of water quality. Obviously good practice and measures to reduce loading of the water column with nutrients and organic matter will be important. These impacts are therefore expected to be not significant to minor and mostly restricted to the farming period, with progressively reduced effects as the tuna are harvested and the reared biomass reduced.

Availability of new habitat, food, shelter, etc.

5.160. The presence of new structures (mooring blocks, chains, ropes, and the cages themselves), in a previously "barren" area, compounded by the presence of food (uneaten baitfish and increased plankton production as a result of the presence of added organic nutrients), has the potential to attract marine life to the area. Indeed, existing tuna farms are known to attract both fish life, especially wild tuna and smaller pelagics (such as amberjack *Seriola dumerilii*, spicarel *Spicara* spp., and bogue *Boops boops*, amongst others), as well as a considerable amount of scavengers and detritus feeders, attracted by the uneaten food accumulating on the sea bed, and sessile organisms that grow on the mooring blocks, ropes, chains, and nets. In this respect these structures can function in the same way as artificial reefs.

5.161. This attraction of marine life and the barrier to fishing within the area (in view of the maze of cages, ropes and chains), can in itself provide additional shelter to the fish, and thereby lead to a decrease in exploitable biomass. The Scheme site (which is of considerable size), will thus serve as a no-fishing zone[66], which may help to provide a safe haven to marine organisms in the area and an overall minor beneficial impact.

Attraction of new species and changes in ecological relationships

5.162. The presence of uneaten feed on the seabed will attract a host of species, from scavengers and detritus feeders (both invertebrates and vertebrates), as well as

[66] Nonetheless, amateur fishermen regularly congregate around the tuna farms targetting the wild fish attracted to the farm.

predators, attracted to the site by the presence of the scavenging population and the tuna themselves. Though the potential for the tuna farms to attract sharks has often been touted as an impact of such developments, there has been no firm evidence to date (in Malta and abroad) of such attractions. Locally, pelagic predators attracted to tuna farms have included wild tuna, dolphinfish (*Coryphaena hippuris*) and amberjack (*Seriola dumerilii*), amongst other smaller pelagics. Cetaceans (namely dolphins) have also been recorded in the vicinity of the tuna farms.

5.163. Such aggregations of wild pelagic fauna are not envisaged to be adversely affected by the tuna penning activities *per se*, since they will be acquiring food that will potentially lead to enhanced local production. However, the aggregations tend to attract fishermen who carry out fishing activities in the vicinity of tuna farm such that they will harvest the wild fish present there; indeed because of such 'facilitated' harvesting of wild fish, fish farms have been described by marine ecologists as serving as 'ecological traps'. Indeed, anecdotal evidence from local amateur fishermen points to increased catches in the vicinity of tuna farms. The problem at local tuna farms gets more complicated since fishermen who target the wild tunas and carry out their activities in the vicinity of the farms may actually be the cause of whole dead tunas ending up on the seabed in the vicinity of the tuna farms. This problem is highlighted in Arechavala-Lopez *et al.* (2015)[67] (see also **Technical Appendix 4: *Marine Ecology Baseline Report***). This impact on pelagic wild species is expected to be of minor significance.

5.164. The presence of the several species attracted to the farms could affect the ecological relationships in the area in view of the presence of a higher number of predators than is normally expected, and the effects of a high number of scavengers on the original benthic assemblages. The impacts of such changes in ecological relationships and increased scavenging or predation depends on the exact number of species attracted and their effects on the assemblages at the site, which would result in an insignificant to minor impact.

5.165. Changes to benthic assemblages (especially algae) could also result from shading effects caused by the presence of the cages themselves. Such a phenomenon was reported from at least one operational site that was located in around 45 m depth of water. It is likely that similar impacts occur at the other sites; although this impact is often masked by the more important changes to the benthic assemblages resulting from the settlement of uneaten feed (see above). At the Scheme site, the reduced light availability will have an adverse effect on any rhodoliths present on the seabed, even if these are present in small accumulations or are sparsely distributed on the bottom, given that the photosynthetic capacity of the algae making up the rhodoliths will be decreased such that they will stop growing or die. With regard to any associated megafauna and macrofauna; the sparse rhodolith accumulations recorded from the site identified for tuna penning are not known to support a high diversity of

associated fauna, at least compared to dense rhodolith beds, while the fauna that occurs in association with such habitat is more typical of lower infralittoral and upper circalittoral coarse sediments. Therefore, the main adverse impact is expected to be mostly on the rhodoliths. This impact on any rhodoliths present in the area to be occupied by the tuna cages is expected to be of major significance; however, the impact will be not significant in the case of other benthic assemblages.

5.166. One aspect that is often overlooked is the effect of the deployment of new structures in the marine environment on the surrounding infauna, in particular fish predation on the infaunal assemblages. Studies on artificial reefs seem to indicate the presence of a strong trophic linkage between natural outcrops and the adjacent soft bottom habitats, with a "halo" of decreased prey abundance adjacent to predator refuges. Nelson *et al*. (1994) found an infaunal reduction within 1 m of the edges of small artificial reefs, which was attributed to the synergism of direct predation and physical disturbance on the sediment by the reef fish. Changes in the sediment size distribution and infaunal community structure where also recorded by Ambrose and Anderson (1990).

5.167. Whether the Scheme will result in such impacts or not will depend on a number of factors, including the type of species present in the area, the number and type of species attracted to the area, the strength of current and whether it would aid or impede settlement, and the type of community that would eventually establish itself. The grab sampling study did not indicate the presence of commercial invertebrate species at the Scheme site. However, the habitats surveyed may serve as important feeding grounds for commercial demersal fishes and cephalopods. The presence of uneaten baitfish may further increase secondary productivity in the area, which will lead to increased production of demersal fishery species, particularly cephalopods and fishes that scavenge the seabed (e.g. skates, rays, and dogfish).

5.168. At this stage of the assessment it is difficult to predict what the outcome would be; however, in the case of the Scheme, where the greatest impact on the benthic communities is a result of the settlement of uneaten feed, the impact on infauna from the attraction of species into the area is considered to be minor to not significant.

<u>Damage or disturbance to habitats and species from increased human presence</u>

5.169. Deployment of the farms does not only attract fish but also humans, in the form of farm operators and staff, divers, and ship crew. Increased human activity in the area could negatively affect habitats and/or species by taking of specimens (e.g. octopuses and fish), increased pollution (oil, sewage, foul water, etc.), anchoring activities by the processing vessels, etc. These activities are not expected to result in a material change to habitat quality or extent and are therefore not significant.

5.170. During the deployment of the cages and ancillary tackle, as well as during the operations of the farm (both during fattening and harvesting), the concentration of vessels and human activity is expected to result in some disturbance to pelagic fauna present in the general area of the farm, mainly through the generation of underwater noise. Although detailed data on the pelagic fauna that occur within the Area of

Study are lacking, it is expected that several species of pelagic fish, turtles, and cetaceans migrate in its vicinity. Such fauna will be exposed to disturbance, mainly through the generation of underwater noise, from the increased vessel activity and from deployment of the cage moorings, ropes, and tuna pens. However, such fauna, being highly mobile, will swim away from the affected area such that there will be a small deviation of the migratory route without significant adverse effects to the animals. This impact is therefore expected to be temporary in nature and not significant to minor.

5.171. The use of vessels has the potential to introduce hazardous substances and chemicals into the marine environment (whether deliberately, accidentally, or indirectly). Such chemicals can include fuels and lubricants. However, except in the case of accidents, such introductions are expected to be minimal in nature and will depend on work practices, such that good management and work practices on the farm will significantly minimise such incidents. Nonetheless, the introduction of such chemicals into the marine environment may have toxic effects on marine flora and fauna, which could include reduction in reproductive potential and capacity, fertilisation success, and development and physiological functions. However, the location of the Scheme site in deep offshore waters characterised by a high hydrodynamic regime, is expected to result in a rapid dispersal of any such small spill so that the impact on the marine biota present in the vicinity of the farm will be not significant to minor and of a temporary and very short duration.

5.172. The results of video surveys made below tuna cages at local tuna penning sites have indicated that, in places, a considerable amount of anthropogenic items is present below the pens that appear to originate from the farm operations; these include concrete weights with ropes attached, sheets and sacks of fabric and other material, car tyres, lengths of rope and other unidentified items. While plastic items are known to be hazardous to marine life, items deposited on the seabed lead to physical alteration of the bottom leading to potential changes to the benthic habitat present in the vicinity of the fish farm. The impact on the seabed habitats from littering is considered to be of minor to major significance depending on the effectiveness of the mitigation measures applied.

<u>Impacts from the introduction of alien species and disease-causing organisms</u>

5.173. An issue that is rarely considered in the debate on tuna farm development is the potential for the introduction of alien species or disease-causing organisms with the baitfish. It is reported that most of the local tuna farms import baitfish from outside the Mediterranean. This could be a source of algal material as well as parasites or viruses from a different region. Although this can be considered to be a remote possibility, it cannot be discounted. One event in South Australia that resulted in the decimation of the population of pilchards by a virus, was blamed on the importation of pilchards as baitfish for tuna farms (Earthbeat, 2002), although the connection was not conclusively proven. WWF (2005) also sounded the alarm on the potential

impacts of this practice and called on the European Union to ban the use of non-Mediterranean fish as feed in tuna farming (WWF, 2005[68]).

1.157. Should such an event occur, the significance of this impact could be major or it could be insignificant depending on whether the connection mentioned above is proven and on the severity of the 'outbreak'. In such circumstances it is not possible to assign impact significance. However, even though it is very unlikely to happen, the precautionary principle is paramount and the environmental monitoring programme for the farms must include an early warning system.

MITIGATION

5.174. As explained above, most of the negative impacts of the Scheme can be mitigated through good operational practices, which in turn will be supervised through the environmental permit conditions. In particular, the requirement for the establishment and implementation of an environmental management system is expected to assist in implementation of mitigation.

5.175. The most important mitigation measures are those linked to the improved management of feeding practices and the containment and collection of fish oils before these leave the farm area. The mitigation measures proposed are listed hereunder:

- Deployment Stage:
    - Good practice during moorings deployment to ensure against dragging of blocks on the seabed;
    - Ensuring that the design of the mooring equipment and layout is optimal to ensure against drifting of the farm under storm conditions;
    - Good project management to minimise operational losses of oils and fuels from maritime vessels and their consequent water quality effects;
    - Good project management and use of proper mooring technology to minimise sediment re-suspension;
- Operational Stage:
    - Good feed management to minimise carbon loading in sediments from uneaten feed and nutrient loadings in the water column, namely:
        - Feeding of the tuna should be carefully monitored and stopped as soon as the fish are satiated, in order to avoid as much as possible

[68] WWF Mediterranean Programme, 2005. Risk on local fish populations and ecosystems posed by the use of imported feed fish by the tuna farming industry in the Mediterranean; April 2005. - http://www.panda.org/downloads/europe/wwfonenvironmentalriskoftunafarming.doc

uneaten feed ending up on the bottom.

- Implementing a procedure to ensure proper feed management by having random checks of the seabed below the tuna pens made by an independent environmental monitor;
- In the case of accident, should an inordinate amount of dead uneaten feed-fish end up on the bottom, every attempt should be made to recover as much of the material as possible and as quickly as possible after the event in order to minimise the adverse effects on the seabed habitat;

- Avoidance of large stocking densities;
- Consider the benefits of thawing and washing of baitfish on shore prior to feeding to reduce the amount of fish oils and mucus released into the marine environment;
- Deployment of permanent oil booms inside all tuna pens to contain any released fish oils inside the cages and the use of oil skimmers or similar equipment to collect the released fish oils from within the cages.
- Availability of additional oil collection services outside the farm to ensure immediate collection of any slick escapes from the farm to avoid wide dispersal of same;
- Consider the deployment of additional oil booms on the farm perimeter if acceptable from a navigational safety point of view (partial deployment in the direction of the prevailing currents could also be considered);
- Appropriate contingency planning including ensuring that all stakeholders are aware of their responsibilities in the event of an accident;
- Ensuring that offal and dead tuna remains are managed in line with EC Regulation 1069 of 2009;
- Use of flat form cartons as packaging material and proper disposal of wastes at shore-side facilities;
- Deployment of nets on cage collars to be done as late as possible just before the arrival of the towing cages and once the tuna from a cage is harvested, the net should be removed immediately in order to minimise the length of time with net shading effects on the seabed;
- Good practices aboard ships to minimise discharges, noise, light, and littering;
- Proper control of marine discharges in line with MARPOL Regulations;
- Immediate recovery of any items that may accidentally end up in the sea

(whether floating or deposited on the seabed) and collection of any third party marine litter that may float towards the farm; and

- Prohibition / strict control of fishing activities in the vicinity of tuna farms.

RESIDUAL IMPACTS

5.176. Assuming that the Scheme is approved and good working practices are adopted and legislation enforced, only residual impacts of minor significance are foreseen on the water quality at the Scheme site. Updating and enforcement of permit conditions by the Competent Authorities is a crucial requisite, as is the continued and improved monitoring of operations and environmental impacts in order to address the issues at source. As regards impacts on the benthic ecology, a major residual impact remains with regards to the shading of habitats containing significant amounts of rhodoliths; otherwise, only residual impacts of minor significance are foreseen, some of which may also be beneficial to benthic communities.

Table 5.11: Summary of impacts

Predicted Impact	Beneficial /Adverse	Nature, Scale and Type of Impact						Probability of Impact Occurring (Certain / Likely / Unlikely / Remote / Uncertain)	Significance of Impact (Major / Minor /Not Significant)	Proposed Mitigation Measures	Significance of Residual Impact (Major / Minor / Not Significant)
		Deplo't /Oper'n	Extent of Impact (Nat / Local / Site)	Direct/ Indirect	S term/ L term	Perm/ Temp	Revers/ Irrevers				
Reduction in Water Quality or Transparency											
Re-suspension of sediment particles by mooring blocks	Adverse	Deploy't	Site	Direct	S term	Temp.	Revers.	Likely	Not significant		Not significant
WQ changes from fish oils / mucus from baitfish during feeding	Adverse	Oper'n	Local	Direct	S term (twice daily during fattening)	Temp. (as long as tuna are present on site)	Revers.	Certain	Minor to Not significant[69]	Deployment of oil booms and collection of fish oils using skimmers from inside the cages to minimise release outside of farm area	Not significant to Minor
Deterioration in WQ from increased nutrient loads from fish excreta	Adverse	Oper'n	Site	Direct	S term	Temp. (as long as tuna are present on site)	Revers.	Likely	Minor	Optimise stocking density in cages not to overload the water column	Minor to Not significant

[69] As explained above, this refers to the impact of fish oils on water quality and the natural environment. Aesthetic and nuisance effects are considered to be of major significance and are considered in **Chapter 8**.

Deterioration in WQ from increased nutrient loads from uneaten feed	Adverse	Oper'n	Site	Direct	L term	Perm. ? (depends on amount of uneaten feed settling on seabed)	Possibly Revers.	Likely	Uncertain (likely to be minor to major under the cages becoming minor to not significant with distance from the cages)	Strict feed management; monitoring of tuna feeding (possibly using new technologies), greater liaison with regulators, prompt action by farmers to collect sinking baitfish, lengthening of statutory fallowing period	Uncertain
Impacts from release of blood during culling, harvesting and processing	Adverse	Oper'n	Site (of discharge)	Direct	S term	Temp.	Revers.	Likely	Minor to not significant		Minor to Not significant
Impacts from release of offal during culling, harvesting and processing	Adverse	Oper'n	Site (of discharge)	Direct	S term	Temp.	Revers.	Likely	Minor to not significant (if disposal is controlled and carried out over a wide area to avoid overloading)	Collection, handling and management of this waste stream to be in line with the provisions of EC Regulations on handling of fishery products and animal by-products; Monitoring and supervision l to ensure disposal beyond 12 nautical miles; maceration of offal prior to disposal	Not significant to Minor

Organic loading from tuna carcasses	Adverse	Oper'n	Site (of disposal)	Direct	L term	Perm. ?	Possibly Revers.	Unlikely	Uncertain (*can range from major to minor depending on effectiveness of response in case of mortalities*)	Prohibit disposal of tuna carcasses at sea and manage in line with the provisions of Regulation (EC) No 1069 of 2009; Farm operators to ensure recovery of carcasses in the event of accidents / mass mortality during storms. Prohibit / strictly control fishing activities in the vicinity of tuna farms	Not significant (as long as provisions of Reg 1069 / 2009 are observed and rapid response in case of mortalities).
Increased potential for pollution from oils, sewage, and litter											
Oil and bilge waters from maritime traffic	Adverse	Both	Local	Direct	S term	Temp.	Revers.	Unlikely	Not significant to minor (for small craft) (*minor to major in the case of an accidental large spill*) Minor to Major (for larger processing vessels)	Good operational practices; Adherence to MARPOL Regulations (oil content, prohibition of discharge, holding tanks, etc); Ensure craft is in good working order; Availability of oil spill response capabilities	Not significant (small craft) Minor (larger processing vessels)

Sewage from ships	Adverse	Oper'n	Local	Direct	S term	Temp (while factory vessels are on site)	Revers.	Unlikely	Minor to Major (depending on measures available on vessel)	Good operational practices; Adherence to MARPOL Regulations	Minor
Pollution from packaging waste	Adverse	Oper'n	Site	Direct	S term	Temp. (during harvesting)	Revers.	Remote	Not significant to minor	Use of flat-pack cartons for packaging; Good operational practices; Adherence to MARPOL Regulations; collection of marine litter	Not significant
Pollution from ship litter	Adverse	Oper'n	Site	Direct	S term	Temp. (especially during harvesting)	Revers.	Likely	Minor (galley litter) Minor to Major (other litter and anthropogenic items lost overboard)	Good operational practices; Adherence to MARPOL Regulations; Immediate collection of any items lost overboard (whether floating or on the seabed); collection of marine litter; monitoring of seabed condition	Minor to Not significant (galley litter) Minor (other litter)

Habitat Loss											
Loss through burial under mooring blocks	Adverse	Deploy't	Site	Direct	L term	Perm. (as long as blocks remain in place)	Revers.	Likely	Major for sessile fauna and flora under blocks; Minor to not significant for general sessile benthic species in farm area Major (for habitats with 50 – 100 % live rhodolith cover) Minor (for habitats with < 50 % live rhodolith cover)	Good practice approaches in the deployment of the mooring blocks to reduce adverse effects on the seabed especially to eliminate dragging of blocks Optimise mooring design to ensure against drifting Optimise mooring layout to minimise impact on habitats with 50 -100% live rhodolith cover	Major for sessile fauna and flora under blocks Not significant to Minor for general farm area Major (for habitats with 50 – 100 % live rhodolith cover) Minor (for habitats with < 50 % live rhodolith cover)

Loss through settlement of faeces	Adverse	Oper'n	Local	Direct	S term (for duration of fattening)	Temp. (as long as farm is in operation)	Revers.	Unlikely	Not significant	Optimise stocking density	Not significant
Loss through settlement of uneaten food	Adverse	Oper'n	Site	Direct	L term	Perm. ? (depends on amount of feed)	Possibly Revers.	Likely	Minor to Major (seabed directly under cages) Minor to Not significant on seabed in general farm area	Strict feed management; monitoring of tuna feeding (possibly using new technologies), greater liaison with regulators, prompt action by farmers to collect sinking baitfish, lengthening of statutory fallowing period; staff training	Minor to Not significant
Damage / Disturbance to habitats and species											
Changes in currents and sediment movement	Adverse	Oper'n	Site	Direct	L term	Uncertain	Revers.	Uncertain	Not significant		Not significant

Disturbance from increased organic input	Adverse / Beneficial	Oper'n	Local	Direct	S term (for as long as the fish are on site)	Temp.	Revers.	Unlikely	Not significant to minor (during farming period with reduced effects as harvesting progresses) Potential minor beneficial due to oligotrophy	Good practice farm management to reduce loading of water column with nutrients and organic matter. Control stocking density in each cage	Not significant to minor beneficial
Availability of new habitat, food, shelter, etc.	Beneficial	Oper'n	Site	Direct	L term	Perm (as long as area remains in use)	Revers.	Likely	Minor beneficial	None	Minor beneficial
Attraction of new species and changes in ecological relationships	Adverse / Beneficial	Oper'n	Local	Direct	L term	Perm (as long as area remains in use)	Revers.	Uncertain	Not significant to Minor	Monitor colonisation process and change in community structure from attraction of new species (scavengers and predators)	Not significant to Minor

Changes to benthos from shading effects by cages	Adverse	Oper'n	Local	Direct	L term	Perm (during farming as long as area remains in use)	Revers./ Irrevers.	Likely	Major (for rhodoliths) Not significant for other benthic assemblages	Nets on cage collars to be deployed as late as possible in season just before arrival of towing cages and nets removed from each cage as the tuna is harvested	Minor to Major (for rhodoliths) Not significant (for other benthic assemblages)

Increased human presence	Adverse	Both	Site	Indirect	L term	Temp	Revers.	Likely	Not significant to Minor (noise from vessels and release of chemicals) Minor to Major (effects of littering on seabed)	Monitor human activities on site; implement Environmental management system through the environmental permit conditions. Regular monitoring of seabed condition and retrieve any lost items deposited on the seabed Prohibit / strictly control fishing activities in the vicinity of tuna farms.	Not significant to Minor (noise from vessels and release of chemicals) Minor (effects of littering on seabed)
Introduction of alien species and disease-causing organisms	Adverse	Oper'n	National	Indirect	L term	Perm / Temp	Revers. / Irrevers.	Remote (low risk)	Uncertain	Monitor for evidence of introductions and act accordingly	Uncertain

6. AVIFAUNA

INTRODUCTION

6.1. This chapter describes the avifauna within the Area of Influence (A of I) and an assessment of the potential impacts and risks posed by the Scheme on the avifauna therein. This assessment draws on the avifauna baseline report prepared by John J Borg (Ecoserv Ltd) for this EIA Report- (see **Technical Appendix 5: *Avifauna Baseline Report***).

6.2. The potential key issues with regards to avifauna are outlined below:

Key Issues:

- **Competition for sea space between the Scheme site and operations and the ecology of breeding Procellariiformes**
- **Disturbance due to light pollution interfering with seabird behaviour**
- **Disturbance due to noise pollution that may result in impacts on breeding population behaviour**
- **Change in prey abundance at the Scheme site providing an additional food source**
- **Increasing population of Yellow-Legged Gull that may result in competition for nesting space and predation on other breeding seabird species that are listed in Annex I of the Birds Directive**
- **Entanglement in nets when seabirds dive for food resulting in drowning**
- **Accidental ingestion of marine debris that can affect both individuals and their young.**

Terms of Reference

6.3. The Terms of Reference for the avifauna assessment were provided by ERA and are reproduced in **Technical Appendix 1: *Terms of Reference and Method Statements***.

ASSESSMENT METHODOLOGY

Area of Influence

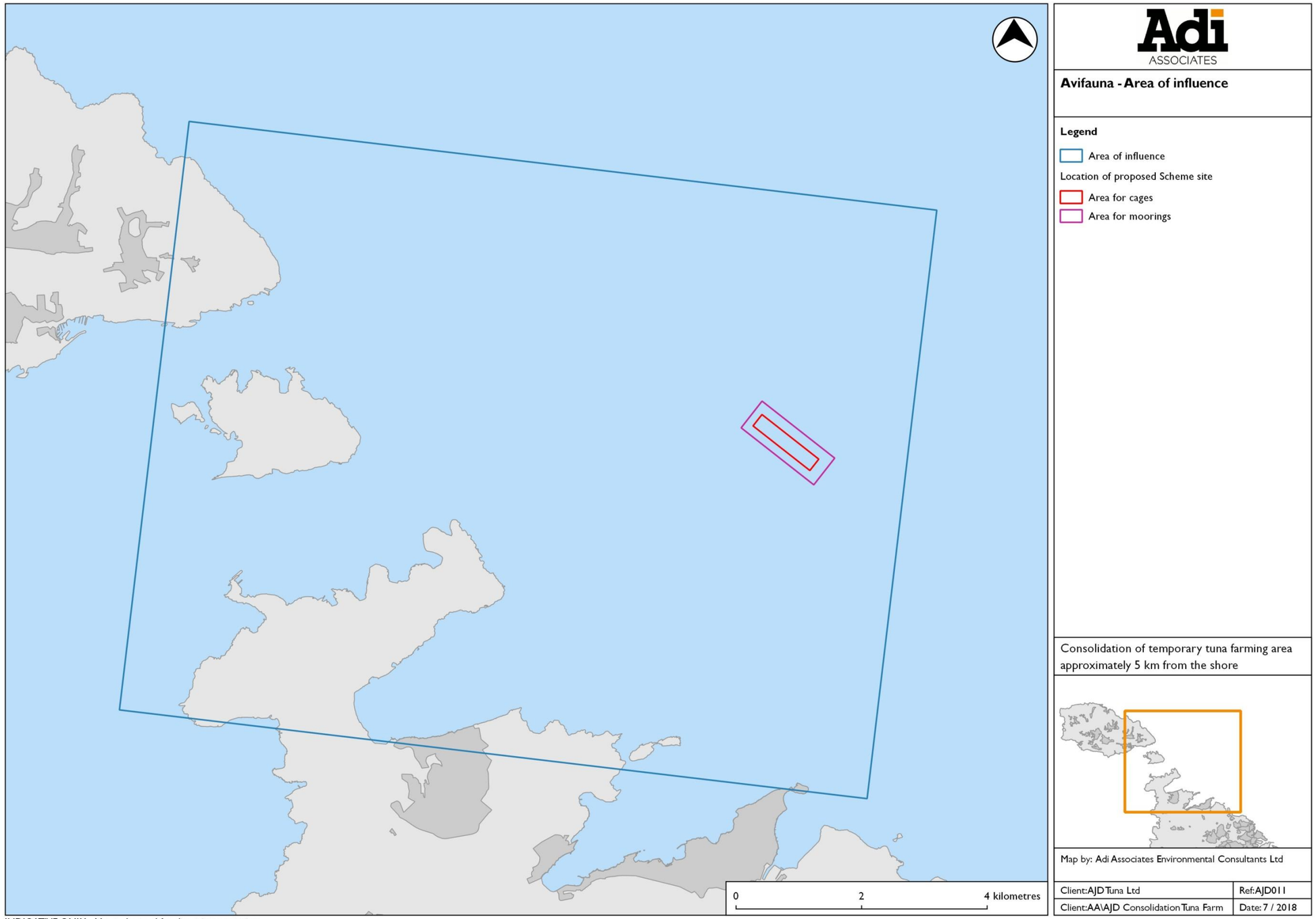
6.4. **Figure 6.1** illustrates the A of I for the avifauna study.

Methodology

6.5. The avifauna study took the form of:

- Desk-top study of the ornithological features of interest in the A of I and bird groups and species that have been recorded within the A of I;
- Description of the findings;
- Assessment of the impacts resulting from the Scheme on the avifauna and an evaluation of the significance of these effects; and
- Description of mitigation measures designed to minimise adverse impacts on avifauna.

Figure 6.1: Avifauna Area of Influence



INDICATIVE ONLY - Not to be used for direct interpretation

Desk-top study

6.6. This assessment is based on accumulated data obtained from long-term observations on the breeding biology and ecology of Malta's breeding seabirds (1982-2018) as well as published and unpublished reports from three EU LIFE funded projects:

- EU LIFE+ Progett Garnija (2006-2010);
- EU LIFE+ Malta Seabird Project (2012-2016); and
- EU LIFE funded Arcipelagu Garnija (2016-2020).

6.7. The technical report is reproduced in **Technical Appendix 5: *Avifauna Baseline Report***.

BASELINE SURVEY RESULTS

Breeding seabirds in the Maltese Islands

6.8. The Maltese coastal cliffs support four breeding seabird species, namely Scopoli's Shearwater (*Calonectris diomedea*), Yelkouan Shearwater (*Puffinus yelkouan*), Mediterranean Storm-petrel (*Hydrobates pelagicus melitensis*), and the Yellow-legged Gull (*Larus michahellis)*.

6.9. Shearwaters are members of the Order Procellariiformes which includes also the albatrosses and petrels. They are pelagic species with the characteristic tube-noses on the base of the upper mandible. They visit land during the breeding season and do so under cover of darkness. A single egg is laid in a deep crevice or burrow or under loose boulders and vegetation. Sometimes, rabbit burrows are also used as breeding sites.

6.10. **Table 6.1** illustrates the breeding cycle of the three pelagic breeding seabird species and **Table 6.2** indicates their presence at the colonies throughout the year.

Table 6.1: Breeding biology and ecology of *P. yelkouan, C. diomedea*, and *H. pelagicus*

	Arrival at colonies	Egg laying	Hatching	Fledging
Puffinus yelkouan	mid October	early February	early May	mid June/early July
Calonectris diomedea	end February	end May	mid July	mid October
Hydrobates pelagicus	end February	April-June	May-August	August to October

Table 6.2: Presence in colonies of the three pelagic breeding seabird species

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Calonectris diomedea												
Puffinus yelkouan												
Hydrobates pelagicus												

Importance of areas of ornithological conservation interest in the A of I

6.11. The following summarises the importance of the areas of conservation present within the A of I:

- **Ramla tat-Torri/Rdum tal-Madonna area MT0000009**: This area holds the most important Yelkouan Shearwater (*Puffinus yelkouan*) colony in the Maltese Islands as well as a small colony of Scopoli's Shearwater (*Calonectris diomedea*). **Figure 6.2** shows the cliff area occupied by the seabird colonies. In 2016 the Mediterranean Storm-petrel (*Hydrobates pelagicus melitensis*) was found breeding inside one of the numerous caves in the area. Other breeding bird species are the Blue Rock Thrush (*Monticola solitarius*), Short-toed Lark (*Calandrella brachydactyla*), Sardinian Warbler (*Sylvia melanocephala*) and Spectacled Warbler (*Sylvia conspicillata*).

- **Kemmuna, Kemmunett, il-Ħaġriet ta' Bejn il-Kmiemen u l-Iskoll ta' Taħt il-Mazz MT0000017**: The eastern coast is of particular interest for this study as it supports breeding colonies of Yelkouan and Scopoli`s Shearwaters, see **Figure 6.3**.

- **Il-Gżejjer ta' San Pawl (Selmunett) MT0000022**: In the last decade, a small colony of Yelkouan Shearwaters has been re-discovered breeding on the island.

- **Il-Baħar madwar Għawdex MT0000112 and il-Baħar tal-Grigal MT0000107**: Two marine conservation areas identified during the EU Life funded project Malta Seabird Project (2012-2016) for their importance as feeding grounds for the three pelagic species, namely *Calonectris diomedea, Puffinus yelkouan* and *Hydrobates pelagicus*.

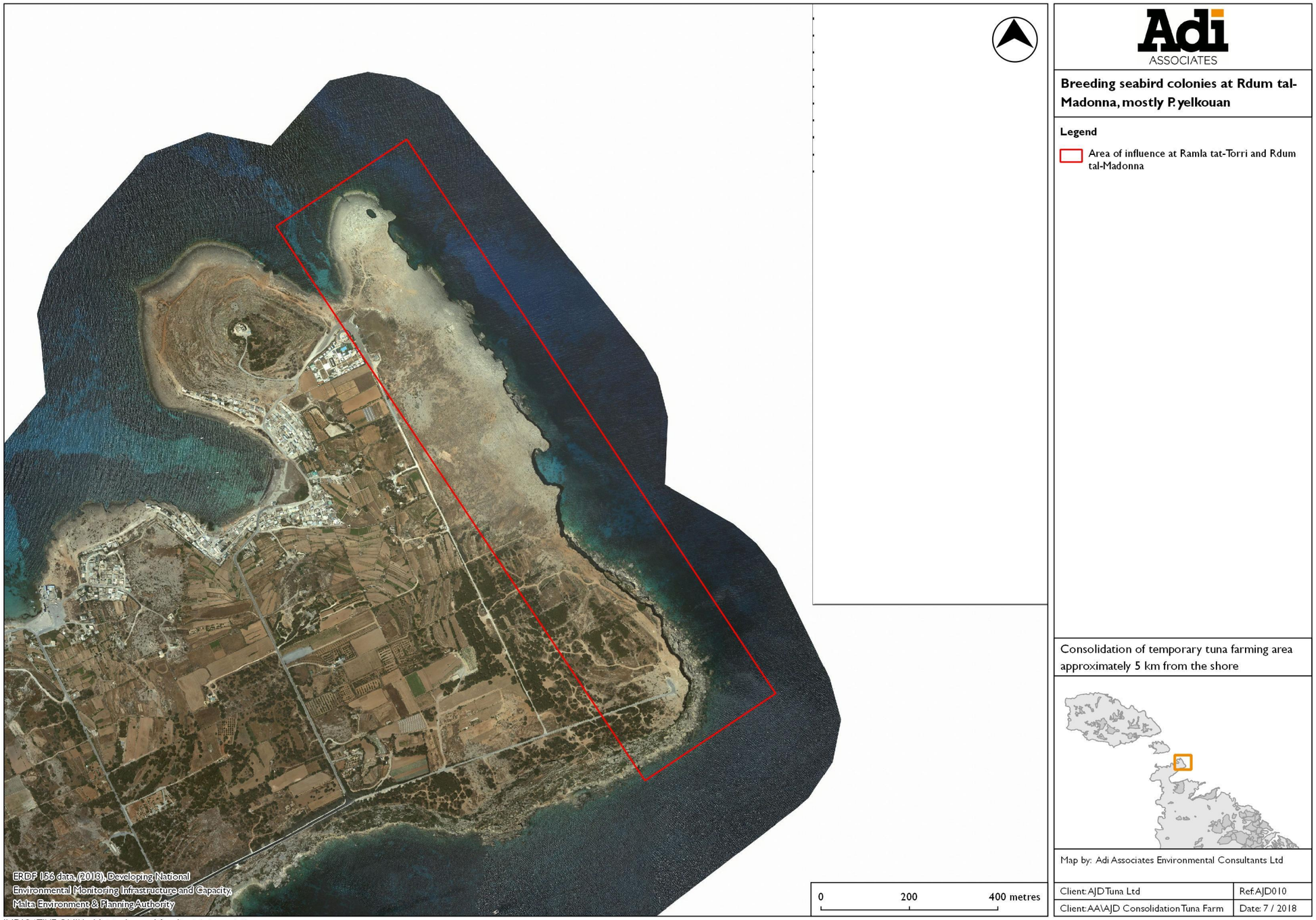
Priority areas in the marine environment for the three Procellariiformes

6.12. **Technical Appendix 5: *Avifauna Baseline Report*** makes reference to the IBA Inventory, 2015 (Metzger *et al*., 2015), which provides additional detail on how each breeding seabird species uses the marine environment. This report helped to provide the basis for the designation of marine SPAs.

6.13. For the Maltese breeding population of *P. yelkouan*, three main hotspot areas

were identified, one around Gozo, including the Gozo-Comino Channel and along the west- and southwest coast of Malta, a second one offshore in the northeast of Malta and a third one offshore in the southwest of Malta (see **Technical Appendix 5: *Avifauna Baseline Report***). For the Maltese breeding population of *C. diomedea*, five priority areas were identified in the Maltese Exclusive Fishing Zone (EFZ), the first one around and north of Gozo and a second one along the west and southwest coast of Malta. In addition, three offshore areas were identified east, southeast, and south of Malta (see **Technical Appendix 5: *Avifauna Baseline Report***). For *H. pelagicus melitensis* breeding in the Maltese Islands the core area covers a coastal zone around Malta and a larger area of sea east of the island. Additionally, a small area is found in the Pantelleria channel northwest of Gozo as well as an area southwest of Malta (see **Technical Appendix 5: *Avifauna Baseline Report***). **Figure 6.4** depicts these priority areas.

Figure 6.2: Area of importance for seabird colonies at Rdum tal-Madonna



INDICATIVE ONLY - Not to be used for direct interpretation

Figure 6.3: Seabird colonies on Comino

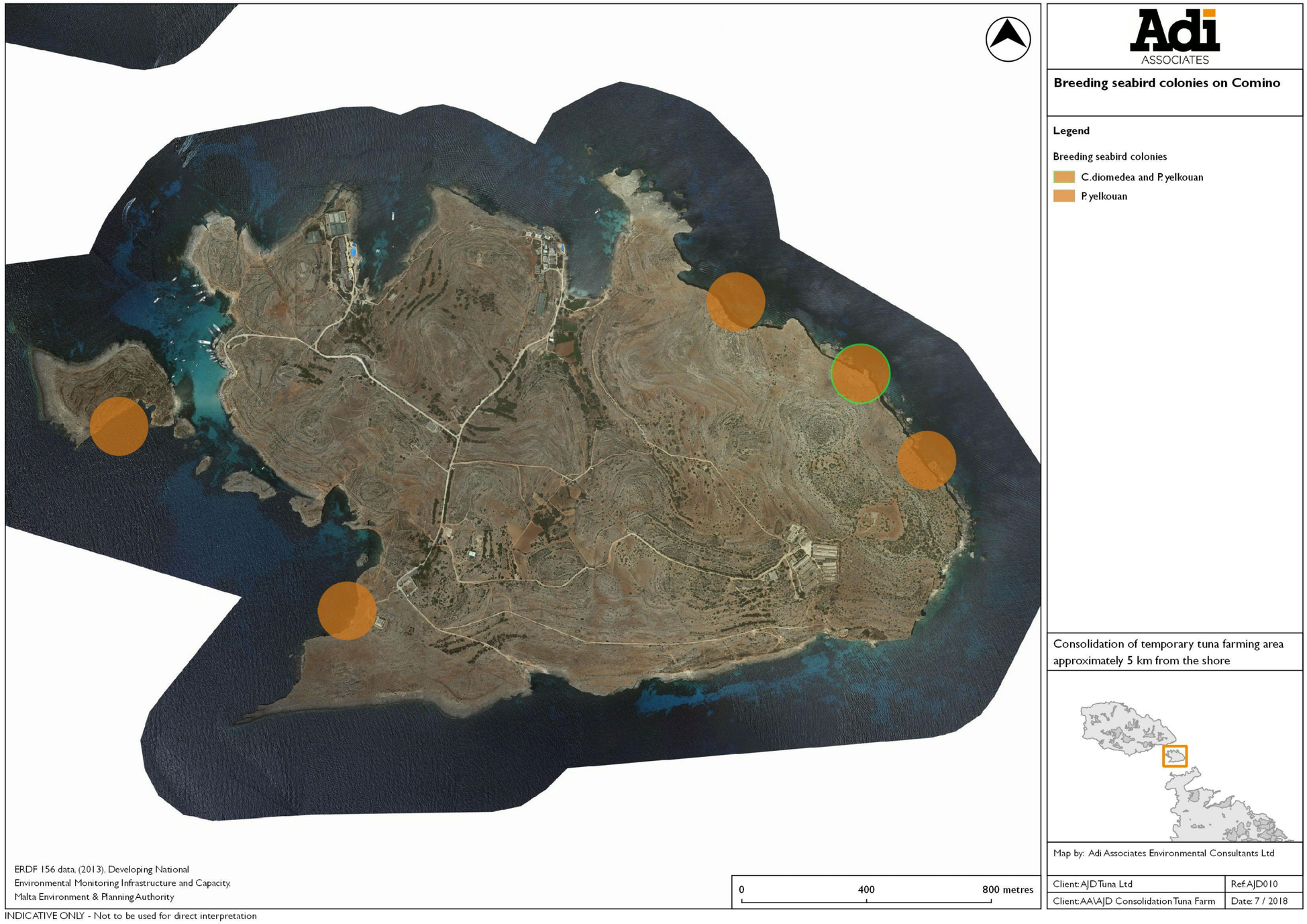


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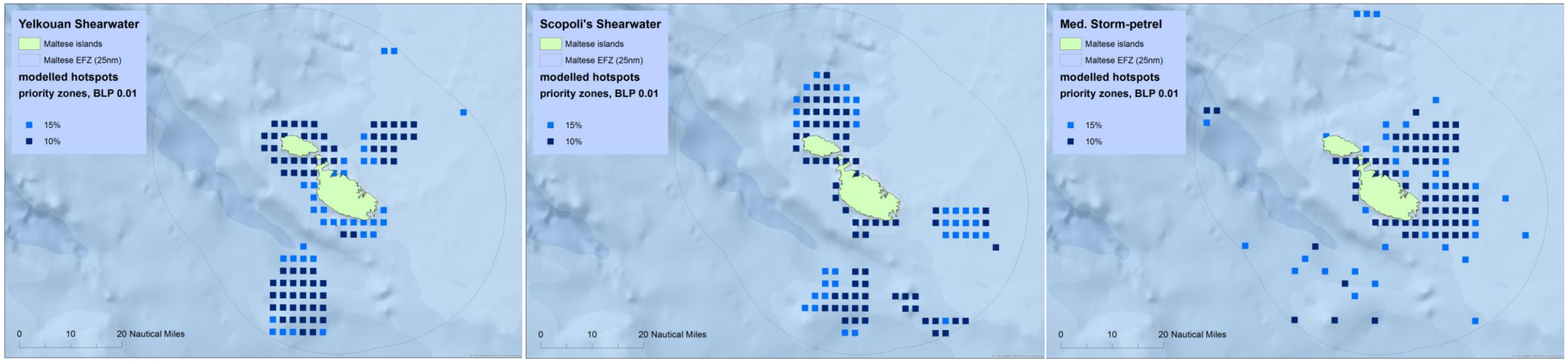
Figure 6.4: Maps showing priority areas for breeding Procellariiformes



Priority areas for *P. yelkouan* within the Maltese EFZ, dark blue squares: 10%, light plus dark blue squares: 15%

Priority areas for *C. diomedea* within the Maltese EFZ, dark blue squares: 10%, light plus dark blue squares: 15%

Priority areas for *H. pelagicus melitensis* within the Maltese EFZ, dark blue squares: 10%, light plus dark blue squares: 15%

Source: Metzger *et al.*, 2015

Daily movements by Procellariiformes

6.14. Shearwaters travel vast distances to and from their breeding colonies in search of food. During the breeding season of *C. diomedea*, large numbers can be seen flying offshore in an east to west direction. Distance from land is conditioned by wind direction and strength. During strong north-westerly winds the shearwaters can be seen flying at a distance of less than 50 metres from the coast.

6.15. The same area is also used by Yelkouan Shearwaters, especially birds originating from the Rdum tal-Madonna colony (Borg *et al,* 2002[70], Borg *et al,* 2010[71], Raine *et al,* 2010[72], 2011[73] and 2012[74]) and more recently from the St. Paul's Islands (**Technical Appendix 5: *Avifauna Baseline Report***).

Other bird species

6.16. Another regular visitor to the study area and immediate whereabouts is the Yellow-legged Gull (*Larus michahellis*). This resident breeding bird is present almost all year round.

Rafting

6.17. Rafting is the convergence of birds on water, normally in the vicinity of their breeding colonies. During calm afternoons these congregations of birds can reach large numbers with several hundreds of birds waiting for darkness. Birds start assembling about two to three hours before sunset and then start to dissipate around dusk when the whole congregation is within a few hundred metres from the cliffs. The main reason for birds rafting is to rest, and it is safest to do this in large numbers when many birds are looking out for danger. For example, both the Scopoli's and Yelkouan Shearwaters raft offshore in the evenings, waiting to return to their breeding colonies under the safety of darkness. Rafting is a time to socialise, and is an important aspect of a seabird's life. As noted in **Technical Appendix 5: *Avifauna Baseline Report***, it has also been hypothesised that seabirds use these congregations to assess the health of their population, although this is now highly disputed considering the fact that individual birds from other colonies in other countries form part of these rafts.

Fish pens: supplementary food source for seabirds

6.18. Borg (2012) presented some preliminary results from studies into tuna farms acting

[70] **Borg. J.J.** & J. Sultana. 2002. Status and Distribution of the Breeding Procellariiformes in Malta. (30) **Il-Merill**.

[71] **Borg, J.J.,** H., Raine, A.F. Raine, & N. Barbara, 2010. Protecting Malta's wind chaser: The EU LIFE Yelkouan Shearwater Project Report. **Malta: EU LIFE Yelkouan Shearwater Project**.

[72] Raine, A., H. Raine, A. Meirinho & **J.J. Borg**. 2010. Rafting behaviour of Yelkouan Shearwater *Puffinus yelkouan* breeding at Rdum tal-Madonna, Malta. (32) **Il-Merill**.

[73] Raine, A., H. Raine, **J.J. Borg** & A. Merinho. 2011. Post-fledging dispersal of Maltese Yelkouan Shearwaters *Puffinus yelkouan*. Vol.26 (2) **Ringing & Migration.**

[74] Raine, A., **J.J. Borg**, H. Raine & R.A. Philips. 2012. Migration Strategies of the Yelkouan Shearwater *Puffinus yelkouan* (154) **Journal of Ornithology**.

as a supplementary food source for storm petrels. It was noted that the use of raw, unwashed fish food is fundamental in attracting storm petrels closer to these tuna pens, in view of the birds' strong olfactory sense. The same food supply attracts a constant presence of small fish around the pens which in turn attract gulls and terns, especially the Black Tern (*Chlidonias niger*).

6.19. Observations have shown that the majority of storm petrels frequenting the IBA are adult birds undergoing primary wing moult, suggesting breeders, probably not venturing far away from the colonies during the chick rearing period. A smaller number of birds seen during the site visits were juvenile birds covered in a fresh coat of dark plumage. These young birds are present from the latter part of August to early September. Tuna penning is locally carried out during the summer and autumn months (mid-July to November / December).

6.20. Past studies recommended that further investigations should focus to identify if this reliable food source has any effect on the breeding success and fledglings survival in storm petrels. While adult storm petrels regularly fall prey to Yellow-legged Gulls on Filfla (Borg *et al*., 1992-94, Sultana *et al,* 2011) no interactions between gulls and storm petrels were ever noted near the tuna pens to date. Further research is required to determine the extent of dependency by storm petrels on this food source provided by the tuna farms.

Threats

Light pollution

6.21. The use of light sources from land and at sea is of particular concern. It is known that light interferes with the behaviour of birds and other animal groups, including bats. In those areas where electricity has been installed especially close to seabird colonies, birds have completely deserted the site. Birds and other animals found close to light sources are known to behave in an abnormal way; several species of birds remain active during night time. Light also disrupts the normal cycle of other vertebrates as well as numerous species of invertebrates making them susceptible to predation.

6.22. In some cases, seabird breeding colonies have been abandoned when electricity was introduced in the area, places like Xlendi Bay, Ħal-Far, Għar Lapsi and Wied iż-Żurrieq, where colonies of both Scopoli's and Yelkouan Shearwaters have been negatively affected.

Noise

6.23. Noise has a negative effect on the normal patterns of incoming shearwaters during night time. Birds tend to fly away from any sound source as was observed on numerous occasions. When a boat passes close to a breeding colony, all activity stops until the boat (noise source) is no longer audible.

DETERMINING IMPACT SIGNIFICANCE

6.24. In assessing the significance of the potential negative impacts arising from the Scheme on the avifauna conservation interest in the area, the following criteria have been used:

- **Not significant** - no material change in site integrity[75] and / or conservation status[76] of habitats and species of conservation interest in particular Annex I habitats and species listed in the Birds Directive. No material change expected to other species of ecological value and conservation in terms of range, population and habitat important for the ecology of the species;
- **Minor significance** - small-scale loss / disturbance including to species populations / extent of habitat that is unlikely to affect the integrity of the overall site/habitat and species populations of conservation interest; and
- **Major significance** - large-scale loss / disturbance / change in habitat that is likely to affect the ecological integrity and/or species populations' viability whereby the conservation status of the habitat and/or species is likely to be compromised within the Natura 2000 area of interest.

6.25. The concept of 'material change' needs to be viewed in the context of the Scheme. For a change to be material, it must affect the long-term interactions of the species present at the site more than they would be affected by impacts from natural processes or by the continuation of the uses already extant in the area and to which the ecology may be accommodated.

ASSESSMENT OF IMPACTS

Description and assessment of impacts

6.26. The significant impacts and risks posed by the proposed project on the avifauna, both in bringing in new cages and during operation, were assessed. The impacts included:

- Impinging on sea area that is used by the seabirds for activity including rafting, social interaction, potentially feeding, etc;

[75] Integrity is not defined in the Habitats Directive, although it is introduced under Article 6. Official guidance on nature conservation in the UK provides a definition in relation to European sites that can be applied more generally: *'The integrity of a site is the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and / or the levels of populations of the species for which it was classified.'* (Box, J. 2006. A guide to Ecological Impact Assessment. Town and Country Planning).

[76] Conservation status for a natural habitat is defined under Article 1 (e) as follows: '*...the sum of the influences acting on a natural habitat and its typical species that may affect its long-term natural distribution, structures and functions as well as the long-term survival of its typical species within the territory...*' Conservation of a species means: '*...the sum of the influences acting on the species concerned that may affect the long-term distribution and abundance of its populations within the territory...*'.

- Disturbance due to light pollution;
- Disturbance due to noise pollution;
- Change in prey abundance;
- Increasing population of Yellow-Legged Gull (predator);
- Entanglement; and
- Ingestion of marine debris.

Prediction and significance of impacts

Competition for sea space

6.27. As described in **Chapter 3**, importantly, the Scheme falls within the SPA Il-Baħar ta' madwar Għawdex, which was designated on account of its importance for the ecology of *C. diomedea* and *P. yelkouan* breeding populations. **Technical Appendix 5: *Avifauna Baseline Report*** reports on the priority marine areas identified that are used by the three species of Procellariiformes (see also **Figure 6.4**) and upon which the eventual designation of the marine SPAs was based (refer also to Malta's IBA Inventory Report, 2015)[77]. These first maps show too that the sea space in this SPA is also used by *H. pelagicus melitensis*. As described in Malta's IBA Inventory Report, 2015, each species has been recorded spending time in the marine environment close to their colonies before entering the colonies. They use these areas for gathering, rafting, social interaction, and possibly also sometimes foraging. These areas are therefore considered to be seaward extensions to the terrestrial breeding colonies. The extent of these areas used is species-specific and considered by Metzger *et al* (2015)[78] to be as follows:

- *Puffinus yelkouan* up to 7 km;
- *Calonectris diomedea* up to 4km; and
- *Hydrobates pelagicus melitensis* up to 1km.

6.28. It is also noted that these areas are used by prospective individuals that may not yet have bred as well as other non-breeding species.

6.29. Additionally, these three breeding seabird species carry out pelagic foraging in areas further offshore. Such areas were also identified as part of the 2015 IBA Inventory.

6.30. Thus, analysing the importance of Il-Baħar ta' Madwar Għawdex SPA for each of the

[77] Metzger, B., Oppel, S., Carroll, M., Merihnho, A., Dias, M., Barbara, N., Lago Barreiro, P. 2015. *Malta Marine IBA Inventory Report*. EU LIFE+ Malta Seabird Project. LIFE10 NAT/MT/090. Creating an inventory of marine IBAs for *Puffinus yelkouan*, *Calonectris diomedea*, and *Hydrobates pelagicus* in Malta.
[78] Ibid.

species and how they use this area allows for a better understanding of the potential impact on each species.

6.31. The Scheme is located approximately 4.8 km from the Rdum tal-Madonna seabird colonies at its closest point, and 6.6 km from the eastern Comino colonies. Thus, the Scheme is located in an area that lies within the seaward boundary of the *P. yelkouan* breeding colony. According to the maps as reproduced in **Technical Appendix 5: *Avifauna Baseline Report*,** the Scheme site is also part of the priority area for *H. pelagicus*, and could be important for foraging for this species. From the findings of the desk study, the Scheme site does not lie within a priority area for *C. diomedea*.

6.32. Although the Scheme lies within an area of importance, in particular for *P. yelkouan*, the Scheme takes up an area of approximately 0.26 km^2. Considering that this species has a relatively extensive seaward colony extension and considering also that *P. yelkouan* prefers to raft in relatively small groups[79], the presence of the Scheme is not expected to disrupt the behaviour of *P. yelkouan* to such an extent that could affect the breeding success of the identified colonies on the coast. Similarly with regards to foraging within this area, Forrest *et al.* (2007)[80] noted that if any adverse effects of habitat exclusion occurred, then their significance will depend on the spatial scale of the aquaculture facility in relation to the distribution and abundance of prey species. The impact is therefore considered to be of minor significance.

Impacts on seabirds from light pollution

6.33. As noted in **Technical Appendix 5: *Avifauna Baseline Report***, light poses a threat to birds, affecting their behaviour, sometimes to such an extent that can affect breeding colonies and therefore, possibly also breeding success. Lights can cause disorientation, collision, and death of seabirds transiting through the site at night due to inappropriate navigation or vessel level lighting.

6.34. The addition of the Scheme will include lights as a safety precaution to alert mariners to the presence of the cages at night time. A total of six solar-powered navigational lights will be installed at the periphery of the aquaculture area, as instructed by Transport Malta (see **Appendix 2** for specifications). In addition, one solar marine light will be fixed to each cage[81]. The Scheme is located adjacent to a bunkering area; another artificial light source. It is considered that the Scheme will potentially contribute cumulatively to the existing light pollution seaward of the breeding sites. It is difficult to assess the extent of this impact in the absence of data related to how

[79] Raine, A., Raine, H., Merinho, A., Borg. J.J. 2010. *Rafting behaviour of Yelkouan Shearwater,* Puffinus yelkouan *breeding at Rdum tal-Madonna, Malta*. 32. Il-Merill.

[80] Forrest, B.M, Keeley, N., Gillespie, P., Hopkins, G., Knight, B., Govier, D. (2007). *Review of the ecological effects of marine finfish aquaculture: Final report*. Prepared for Ministry of Fisheries. Cawthron Report 1285. Cawthron Institute, Nelson, New Zealand.

[81] The possibility of reducing further the number of lights on the cages (not the outer navigational lights) is being considered.

the existing situation affects seabirds and to what extent. It is also noted that the lights are not downward facing, which could help mitigate the extent of impact. In light of this, the impact is judged to be of minor to major significance reflecting the uncertainty on the impact to the breeding seabird populations. If only navigational lights (six lights) remain on during the breeding season, the impact may be more likely to be minor. Monitoring would be required in order to provide a more robust understanding of the extent of the impact on each of the species' breeding populations.

Impacts on seabirds from noise pollution

6.35. The Scheme will be a potential source of noise generally as a result of the movement of the boats which will intensify during fattening and harvesting operations. Thus, the increase in noise will mostly be during the day time when the seabirds are away from their colonies. Moreover, *Puffinus yelkouan* would have already left the colonies by the time harvesting operations start (refer to **Table 6.1** and **Table 6.2**). The impact of noise as a result of Scheme operations on the breeding seabirds is thus considered to be not significant to minor.

Change in the abundance of prey

6.36. Aquaculture facilities can act as fish aggregating devices / "artificial reefs" and increases in abundance and diversity of small fish species looking for shelter and foraging on falling food pieces is well documented (e.g. Forrest, 2007)[82]. All of the breeding seabirds include fish as part of their diet. Consequently, the birds may be attracted to the area occupied by the Scheme and benefit from an increased abundance of prey as well as a reduction in the energy spent in order to obtain the prey. It is considered, however, that further studies are required in this regard because it is not certain to what degree this is exploited by the seabirds in the area and the *P. yelkouan* breeding population is particularly large so it is unlikely that the population as a whole is sustained by the presence of the fish farm[83]. Moreover, it is also noted that *P. yelkouan* leaves the colony by the beginning of the fattening season. The impact is considered to be minor to not significant in the absence of any further data. *H. pelagicus melitensis* may also be attracted, the smaller population and the presence of the species during fattening time could result in at least a minor and potentially a major impact if all birds in the colony frequent the site regularly, noting, however, that these birds are not exclusively piscivorous.

Increasing population of increaser species – Yellow-Legged Gull

6.37. During stakeholder consultation, BirdLife Malta raised the concern of the potential increased vulnerability of, in particular, storm petrels to seagulls that may also be

[82] Ibid.

[83] Indeed, in recent experiences on trawlers (A Mallia pers. obs.), the seabirds, in particular *P. yelkouan*, *C. diomedea*, and *L. michahellis* are attracted in large numbers to fishing vessels as these haul their nets. During the fishing only a handful of birds are visible but as soon as the gear starts to be hauled up, the birds congregate around the boat only to disappear once the net is deployed once again.

attracted to the farm and are known to predate on the much smaller storm petrels. However, evidence of predation has been recorded locally largely on nesting petrels. It is not clear at this stage whether gulls would actively hunt storm petrels aggregating in a similar area. Monitoring is required and therefore the impact is considered to be uncertain.

6.38. The presence of the farms may provide particular opportunity for the increaser species[84], Yellow-legged Gull. The farms use semi-defrosted bait fish to feed the tuna. This provides an additional food source for foraging seabirds. Gulls are particularly likely to take advantage of this food source. This, together with the additional prey available as a result of the farm acting as an FAD (fish aggregating device), may serve to increase the success of this species resulting in an increase in its population. Moreover, gull species are also known to feed around lights, further enhancing the benefits that this species may obtain from the presence of the Scheme (Surman & Dunlop, 2015)[85]. If these introduced opportunities result in an increase in the gull population, this could directly and indirectly impact upon the breeding population of the other breeding seabirds through increased predation and competition for nesting sites. Such a scenario could ultimately result in a major significant negative effect if the breeding success of the colonies of the Annex I seabirds is reduced as a result. However, although the Scheme occurs at a new site, the proposed degree of operation is not new and therefore, the Scheme does not introduce additional capacity for subsidising the diet of gulls and subsequently increasing their breeding / population success. The conservation status assessment of the breeding colonies along the east coast of the north of Malta and Comino, as described in the respective Management Plans, does not indicate an increase in gull populations that could be threatening the other seabird populations. Therefore, with the data currently available, the actual impact is considered to be uncertain.

Entanglement

6.39. Shearwaters and the Storm Petrel are all diving birds and therefore risk entanglement in the fish farm nets, resulting in drowning. Entanglement from any lost ropes or netting as well as other marine debris from operations is also a risk. Further data is required locally to provide a better understanding of the extent of this problem for the populations of breeding seabirds in the Maltese Islands. Consultant John J. Borg has noted that no such incidences have yet been reported (personal communication). Impact is considered to be not significant to minor with the limited data available.

[84] Increaser species are more generalist in their requirements. Some may also benefit from modification of habitat and increase in abundance. Decreaser species, on the other hand, are more sensitive to changes.

[85] Surnam, C., Dunlop, J.N. 2015. Impact Assessment of aquaculture on seabird communities of the Abrolhos Islands, to support the Mid West Aquaculture Development Zone proposal. Halfmoon Biosciences for Government of Western Australia, Department of Fisheries.

Ingestion of marine debris

6.40. Ingestion of marine litter, particularly plastics, is common among seabirds and can cause death by dehydration, blockage of the digestive tract, or toxins released in the intestines (Sagar, 2013)[86]. Ingestion of plastics by adults may also be passed on to chicks when being fed through regurgitation. Fish farms could be a source of such marine debris. If unmanaged, this impact could range from minor to major depending on the number of birds affected and the extent of marine litter.

MITIGATION MEASURES

6.41. The way the fish farm is managed will have an important influence on the significance of any residual impacts. The following lists mitigation measures that should be put in place to ensure that as far as possible there are few or no residual impacts:

- If feasible, consider relocation outside of priority areas for breeding Procellariiformes species;
- Minimise use of lights to the minimum required for navigational safety purposes and on vessels use only downward-facing shaded light sources;
- Adopt seasonal lighting plan, with all internal cage lights (i.e. not the external navigational lights) to be switched off after the harvesting period when the nets are empty or only cage collars are present on site;
- Minimise requirements to operate at night;
- Remove the need for vessels to be in the area at night;
- Set up a seabird monitoring programme, including digital camera monitoring to monitor which bird species are visiting the cages and their behaviour at the farm;
- Use visual bird deterrents;
- Improve the control on the feed rate to reduce feed waste;
- Remove dead fish from cages immediately;
- Prepare and implement waste management plan – all wastes, including food scraps should be disposed of on-shore;
- Monitoring of gull colonies annually if observed feeding at the farm;
- To reduce risk of entanglement, nets should be kept taut, mesh size should be within the 6-7 cm range and nets should be well-maintained (any holes should be

[86] Sagar P. 2013. *Literature Review of Ecological Effects of Aquaculture: Chapter 6 Seabird Interactions*. Cawthorn Institute & NIWA Taihoro Nukurangi for Ministry of Principal Industries, Mahatu Ahu Matua.

repaired);

- Reduce lines and riggings on vessels;
- Train staff in appropriate bird handling and reporting;
- Ensure regular maintenance of farm infrastructure; and
- Screen vessel scuppers to prevent loss of material overboard.

RESIDUAL IMPACTS

6.42. Residual impacts will depend upon the implementation of mitigation measures. Monitoring will be an important aspect of identifying any long term impacts that may be accrued as described above and summarised in **Table 6.3**.

Table 6.3: Summary of Impacts on Avifauna

Predicted Impact	Beneficial/ Adverse / Neutral	Nature, scale and type of impact						Probability of impact occurring	Significance of impact	Proposed mitigation measures	Significance of residual impact
		Deploy't / Oper'n	Extent of impact (Nat / Local / Site)	Direct/ Indirect	S term / L term	Perm / Temp	Revers / Irrevers	(Likely, Unlikely, Remote, Uncertain)	(Major, Minor, Not significant)		(Major, Minor, Not significant)
Competition for sea space	Adverse	Oper'n	Local	Direct	S term if cages are required to move next season; otherwise L term	Temp if cages move next year, otherwise permanent	Revers	Likely	Minor	(If feasible), relocation outside of priority areas for Procellariiformes	Not significant
Disturbance to avifauna from light pollution resulting from the Scheme	Adverse	Oper'n	Local	Direct	L term	Temp/Perm	Revers	Likely	Minor to major	Minimise use of lights to minimum required for navigational safety and on vessels use only downward-facing shaded light sources Adopt seasonal lighting plan	Minor
Disturbance to avifauna from noise resulting from the Scheme	Adverse	Both	Local	Direct	L term	Temp/Perm	Revers	Likely	Not significant to Minor	Minimise requirements to operate at night Remove the need for vessels to be in the area at night	Not significant
Change in the abundance of prey	Beneficial	Oper'n	Site	Indirect	L term	Temp/Perm	Revers	Likely	Minor to Not significant (*P. yelkouan*) Minor to Major (*H. pelagicus*)	Seabird monitoring, including digital camera monitoring to monitor which bird species are visiting the cages and their behaviour at the farm	Not significant to Major

Predicted Impact	Beneficial/ Adverse / Neutral	Nature, scale and type of impact						Probability of impact occurring	Significance of impact	Proposed mitigation measures	Significance of residual impact
		Deploy't / Oper'n	Extent of impact (Nat / Local / Site)	Direct/ Indirect	S term / L term	Perm / Temp	Revers / Irrevers	(Likely, Unlikely, Remote, Uncertain)	(Major, Minor, Not significant)		(Major, Minor, Not significant)
Increase in population of *Larus michahellis*	Adverse	Oper'n	National	Indirect	L term	Perm	Revers	Uncertain	Not significant to Major	Use visual bird deterrents Control feeding rate to reduce feed waste Remove dead fish from cages Prepare and implement waste management plan – all wastes, including food scraps should be disposed of on-shore Digital camera monitoring to monitor which bird species are visiting the cages and their behaviour at the farm Monitoring of gull colonies annually if observed feeding at the farm	Not significant to Major
Entanglement	Adverse	Oper'n	Local	Direct	L term	Perm	Revers	Uncertain	Not significant to minor	To reduce risk of entanglement, nets should be kept taut, mesh size should be within 6-7 cm range, and nets should be well-maintained (any holes should be repaired) Reduce lines and riggings on	Not significant to minor

Predicted Impact	Beneficial/ Adverse / Neutral	Nature, scale and type of impact						Probability of impact occurring	Significance of impact	Proposed mitigation measures	Significance of residual impact
		Deploy't / Oper'n	Extent of impact (Nat / Local / Site)	Direct/ Indirect	S term / L term	Perm / Temp	Revers / Irrevers	(Likely, Unlikely, Remote, Uncertain)	(Major, Minor, Not significant)		(Major, Minor, Not significant)
										vessels Train staff in appropriate bird handling and reporting	
Ingestion of marine debris	Adverse	Oper'n	National	Indirect	L term	Perm	Irrevers	Likely	Minor to Major (depending on number of birds affected)	Waste management plan Ensure regular maintenance of farm infrastructure Screen vessel scuppers to prevent loss of material overboard	Minor

7. MARINE ARCHAEOLOGY

INTRODUCTION

7.1. This chapter describes the findings of the marine archaeology/cultural heritage survey carried out for the Scheme site and its surroundings. The study included a desk study on the archaeology and cultural heritage of the Scheme site (based also on the remote sensing data collected for this EIA (see **Technical Appendix 2B: *Remote Sensing Survey Report 2018***) and assesses the impacts on potential finds that may arise as a result of the implementation of the Scheme.

7.2. The potential key issues are outlined below.

Key Issues

- **Potential damage to buried artefacts from mooring deployment**
- **Loss, damage, or disturbance to artefacts from increased human activity**

Terms of Reference

7.3. The ToR formulated by ERA require the consideration of potential impacts on marine archaeology and material assets; the ToR are found in **Technical Appendix 1: *Terms of Reference and Method Statements***.

OBJECTIVES OF THE ASSESSMENT

7.4. The objectives of the marine archaeology and cultural heritage assessment were to:

- Identify the potential for archaeological remains in the area based on desk study research;
- Identify in the field the presence of any artefacts;
- Assess the impact of deploying additional moorings for the proposed additional cages and evaluate the significance of these effects;
- Describe any mitigation measures designed to minimise any adverse impacts; and
- Describe appropriate monitoring.

ASSESSMENT METHODOLOGY

Area of Study

7.5. The Area of Study (AoS) is shown in **Figure 7.1** and includes the area occupied by the cages.

National Policy and Legislation

7.6. Guidance on the protection of cultural heritage in the context of planning was taken from the Cultural Heritage Act 2002, the Strategic Plan for Environment and Development (SPED), and the former Structure Plan for the Maltese Islands. The latter includes specific policies that help in assigning importance to archaeological artefacts and therefore, in the absence of any newer similar direction (the SPED takes a more strategic approach) these policies are considered to remain relevant and have been drawn upon to assist in this impact assessment.

Cultural Heritage Act, 2002

7.7. This Act provides overall protection to all *movable or immovable objects of artistic, architectural, historical, archaeological, ethnographic, palaeontological and geological importance and includes information or data relative to cultural heritage pertaining to Malta or to any other country (section 2). It also includes archaeological, palaeontological or geological sites and deposits, landscapes, groups of buildings…which have an historical value.* In section 3 it also specifies that *For the purposes of this Act, an object shall not be deemed to form part of the cultural heritage unless it has existed in Malta, including the territorial waters thereof, or in any other country, for fifty years, or unless it is an object of cultural, artistic, historical, ethnographic, scientific or industrial value, even if contemporary, that is worth preserving*.

7.8. *No person shall make any interventions on such cultural property or classes thereof without first having obtained a permit therefore from the Superintendent* (Section 44.3). Applications are determined subject to the results of prior investigation: *Before determining an application under sub-article (3) hereof the Superintendent may require such information including the results of such tests, examinations or inspection by such persons accredited under this Act for the purpose as may be required by the Superintendent* (Section 44.4).

7.9. The restrictions on archaeological excavations are stated in Section 43(1) whereby *Archaeological or palaeontological excavations or explorations on land as well as in the territorial waters or in the contiguous zone of Malta can only be made by the Superintendent, or with written permission of the Superintendent.* Chance discoveries of archaeological remains are also regulated by Section 43(2): *Any person who, even accidentally, discovers any object, site or building to which this Act applies in accordance with article 3, shall immediately inform the Superintendent, keep the object found in situ, and shall not for a period of six working days after informing the Superintendent proceed with any work on the site where the object of cultural property is discovered.* The details about rights and obligations by all parties in the eventuality of an archaeological discovery are described in Sections 43(3), 43(4), 43(5), 43(6), and 43(7).

Structure Plan 1990 policies

7.10. The former Structure Plan contained policies that refer to the grading of archaeological sites and buildings. This classification applied only to terrestrial sites and the Structure Plan did not provide an equivalent grading system for marine archaeological sites. Indeed, the only policy referring to marine archaeology in the Structure Plan is Policy MCO 2, which states, "*The Planning Authority will, as far as*

possible, include marine archaeological sites and structures within the boundaries of Marine Conservation Areas. Access to archaeological sites and wrecks will be strictly regulated".

7.11. Though not completely applicable, in the absence of a marine archaeology-specific classification, the PA and ERA have been using the same grading system adopted by the Structure Plan for terrestrial sites even for marine sites (see for example GN 402/96). This classification system is outlined in Policy ARC 2, and Policies ARC 3, ARC 6, and ARC 7 provide further guidance.

7.12. Structure Plan Policy ARC 2, indicates that if an area is considered for top priority conservation (i.e., Class A) no development will be allowed that would adversely affect the natural setting of the monuments or sites. A development-free buffer zone of at least 100 metres will be established around the periphery of the monument or site.

7.13. Features qualifying for Class B protection under Structure Plan Policy ARC 2 are regarded as *very important and should be preserved at all costs. Adequate measures to be taken to preclude any damage from immediate development and, for features that are listed as Class C, every effort must be made for preservation, but may be covered up after proper investigation, documentation and cataloguing. Provision for subsequent access shall be provided*. Class D features are those of which there are numerous examples, and they may be covered or destroyed after recording.

7.14. The allowable effects of the development on archaeological remains are controlled by policy ARC 3. … *development affecting ancient monuments and important archaeological areas and sites, including areas and sites having such potential, will normally be refused if there is an overriding case for preservation. Where there is no overriding case for preservation, development of such sites will not normally be permitted until adequate opportunities have been provided for the recording and, where desirable, the excavation of such sites.*

7.15. All of the catalogued archaeological features may be included in the National Protective Inventory of MEPA according to Policy ARC 7 for which protection is granted by means of Policy ARC 6.

Policy Importance of Archaeological Features

7.16. The classification of archaeological features according to their policy importance is guided by legislation, including the Cultural Heritage Act 2002, Structure Plan policies, and Government or Legal Notices regarding specific cultural features. Each of these assigns its own degree of importance and remedies. In applying these to the EIA process three categories are used:

- Features of International Importance (major importance);
- Features of National Importance (major importance); and
- Features of Local Importance (minor importance).

7.17. The laws, policies, grades, etc., pertaining to the conservation of archaeological

artefacts or deposits, as applied by the PA to marine sites have been assigned to these categories of policy importance for the purposes of this EIA as follows:

Features of International Importance

- Cultural features of 'international importance' are those:
    - Protected specifically by legislation;
    - Qualifying for Class A priority conservation under Structure Plan Policy ARC 2; or are
    - Similarly identified by the Minister responsible for cultural heritage or the Superintendent of Cultural Heritage.

Features of National Importance

- Features of international importance would also be of national importance. Cultural features of 'national importance' are additionally those protected under:
    - Structure Plan Policy ARC 2 Class B, and are especially important and should be preserved at all costs; or are
    - Similarly identified by the Minister responsible for cultural heritage or the Superintendent of Cultural Heritage.

Features of Local Importance

- Cultural features of 'local importance' are those protected by:
    - Structure Plan Policy Arc 2 Class C. They are protected in so far as every effort must be made for their preservation, but may be covered up after proper investigation, documentation and cataloguing. Provision for subsequent access shall be provided;
    - Structure Plan Policy Arc 2 Class D. They may be covered or destroyed after recording; or are
    - Similarly identified by the Minister responsible for cultural heritage or the Superintendent of Cultural Heritage.

Remaining Features

7.18. All catalogued cultural features (including marine archaeological sites) may be included in the National Protective Inventory (NPI), and those not already protected will be afforded protection under Structure Plan Policy ARC 6, which indicates that all sites listed in the NPI will be protected in accordance with the Development Planning Act powers and by reference to the ratings given in Policy ARC 2.

7.19. Developments in cultural heritage protection in later years have seen the emergence of a new category, Class E: these are features that have been referred to in historical documents but have yet to be re-identified. Although such a precautionary category would have very valid applications in the marine environment (especially for areas in the approaches to ports and harbours), it has yet to be used in this context. For

terrestrial sites, the PA currently assigns a substantial buffer (100 metres) around such designated areas. No development is permitted in the buffer before the appropriate archaeological investigations are completed. In the event that the proposed development is affected by a Class E feature, it will be necessary to actively search for the feature in order to determine its location and appropriate protection status. This may require the permission of the Superintendent of Cultural Heritage. If and when the feature is re-discovered, it will be assessed and re-classified accordingly and a new grade / class assigned to it.

Literature search

7.20. The desk-based investigation did not unearth any previous knowledge of archaeological finds or features present in the Area of Study. This includes the Cultural Heritage Inventory Management System (CHIMS), the Malta Scheduled Property Register (MSPR), and Museums Annual Reports. The Malta Maritime Museum was also consulted in relation to any potential archaeological finds or known sites of cultural heritage interest within the Area of Study.

7.21. As described in **Technical Appendix 6: *Cultural Heritage Baseline Report***, historically, the area would have served as a shipping route with access to several of Malta's bays. Indeed, the general Area of Study is believed by some to be the site of St Paul's shipwreck, with a bay and island being named after the potential site of the shipwreck. Despite some disagreement on the location of the shipwreck it is conceivable that shipwrecks may have occurred in the area, possibly during storm conditions. Furthermore, archaeological evidence has been discovered in the nearby bays suggesting previous use of the sea in proximity to the Area of Study. Ancient anchors have also been found off Qawra, Għallis, St Paul's Bay, and Salina Bay; yet all located outside of the Area of Study.

7.22. The closest known cultural heritage feature is the remains of the WW2 submarine *HMS Stubborn*. This site lies less than a kilometre-and-a-half southeast of the Area of Study.

Field survey

7.23. A Side Scan Sonar was deployed to survey the seabed and investigate the presence of any underwater archaeological features in June 2017. The frequency of the side scan was 450kHz with a range of 100 m. The spacing for each line was 180 m. Details of this survey are presented in **Technical Appendix 2A: *Side Scan Survey Report 2017***. This survey was supplemented with a further side scan sonar survey aimed at collecting data for previously unsurveyed seabed areas. This latter survey was undertaken in May 2018 and is reported upon in **Technical Appendix 2B: *Remote Sensing Survey Report 2018***.

Determining impact significance

7.24. The significance of the impacts of the Scheme on the marine archaeology of the Area of Study is dependent upon the archaeological importance assigned to each of the features identified, either through legislation or by the Consultant Archaeologists, and the degree of disturbance or damage likely to arise from the construction or

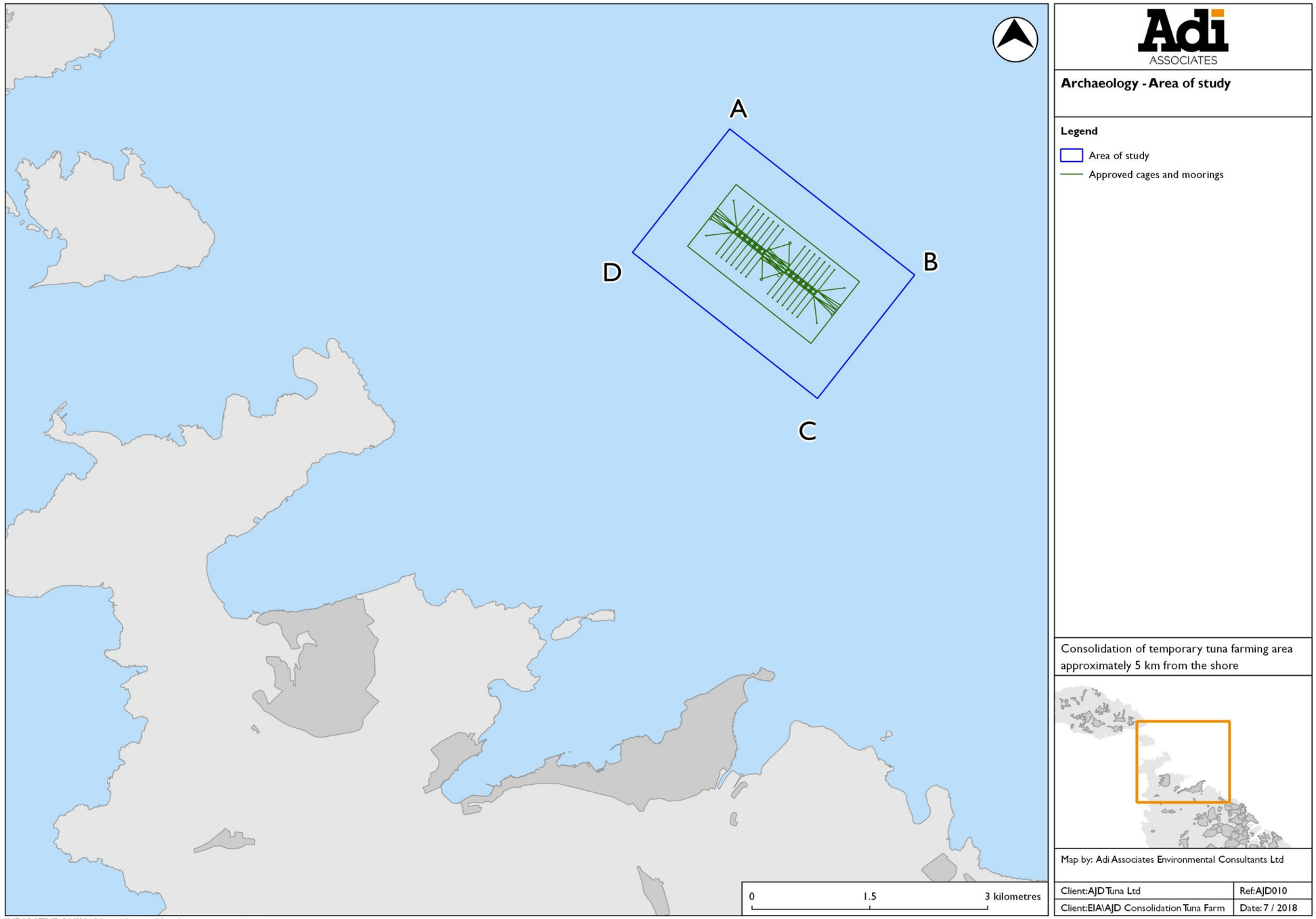
operation of the Scheme.

7.25. The assessment of the significance of potential negative impacts of the Scheme on the marine archaeology of the Site assigns the following levels: not significant, minor significance, and major significance. The assessment criteria applicable to each of these levels are described in **Table 7.1**, which correlates the protection ratings adopted by the Structure Plan and cultural significance with significance of impact.

Table 7.1: Impact Significant Criteria

Potential damage or destruction to features / class or grade of feature	**Cultural significance**			
	Class A	**Class B**	**Class C or D**	**No Class**
No material change to the archaeological feature or setting	Insignificant	Insignificant	Insignificant	Insignificant
Small scale changes, such as alterations to the archaeological feature or deposit that are unlikely to affect its integrity or setting	Major	Minor	Minor	Insignificant
Loss of or disturbance to the archaeological feature or deposit that is likely to affect its integrity or setting	Major	Major	Minor	Insignificant

Figure 7.1: Marine archaeology Area of Study

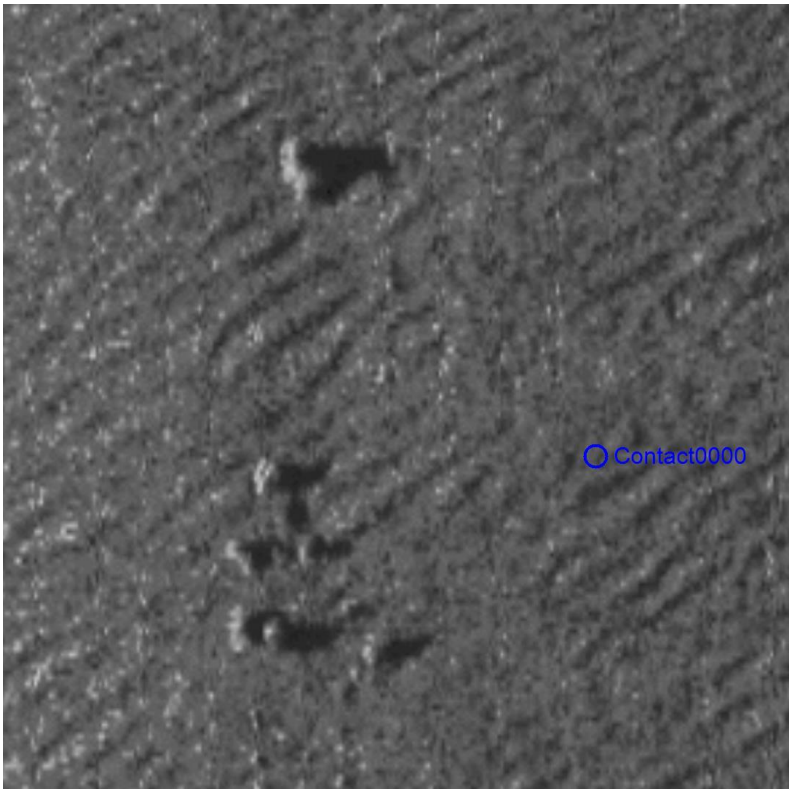


INDICATIVE ONLY - Not to be used for direct interpretation

Baseline Survey Results

7.26. The remote sensing survey has identified one target of interest on the 21st June 2017 within the AoS. Contact 0000 at coordinates (36° 0'35.02"N, 14°25'17.35"E) is likely to be of cultural significance (see **Figure 7.2**). The location of the target in respect of the Scheme is shown in **Figure 7.3**. No other cultural heritage assets of likely archaeological significance were identified.

Figure 7.2: Side-scan data of target 0000 which is of likely cultural significance



IMPACT ASSESSMENT

Prediction and significance of impacts

7.27. One artefact of potential cultural heritage significance was identified during the survey. As noted in the baseline report (see **Technical Appendix 6: *Cultural Heritage Baseline Report***), the recommendation is to designate a 100 m exclusion zone around the target within which area there should be no disturbance (i.e. no cages or mooring blocks). **Figure 7.3** illustrates the location of the target with a 100 m buffer around it in relation to the Scheme's cage and mooring areas.

7.28. As described in **Chapter 3**, the existing cages will be slightly shifted to avoid the

AFM area. In so doing, the farm operator must ensure that any new moorings or cages are not deployed within the 100 m exclusion zone identified in **Figure 7.3**. This has been communicated to the applicant.

7.29. As per policy and legislative direction (described above), the target has so far been left *in situ* such that it is not possible to determine its cultural heritage importance; whether it is in fact a marine archaeological artefact, and if it is, what classification should be assigned to it. Nonetheless, the assessment has identified that the proposed mooring layout of the Scheme in this area as shifted to avoid the AFM firing arc danger area, must be amended to avoid damaging this target.

7.30. In the absence of further detail about the target, there is a degree of uncertainty and the impacts on the target can be classified as insignificant to major. Applying the precautionary principle, the assessment considers possible mitigation measures that should be implemented to avoid damage or loss to the target.

7.31. Although only one target was spotted during the survey, it cannot be ruled out that other objects could be present, buried in the area. There are numerous moorings to be deployed as part of the Scheme and, therefore, if there are more artefacts in the area, these could be damaged during the deployment of the new cages and shifting of the existing ones. Such an impact would result in a major impact if damage occurs to a Class A or Class B artefact. In the absence of further information, however, the impact is judged to be remote but uncertain.

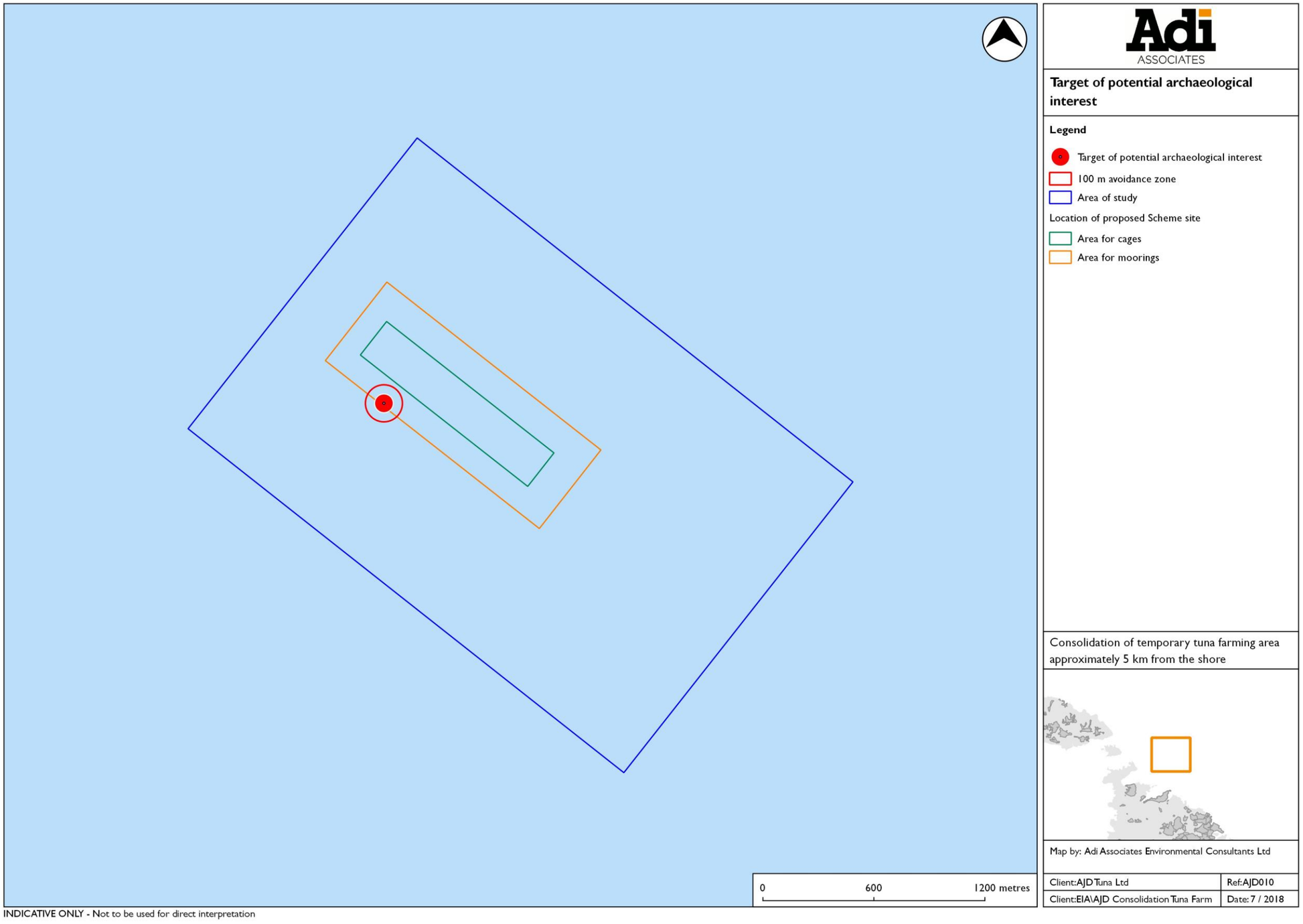
MITIGATION MEASURES

7.32. The location of the moorings of the cages to be shifted should be planned to ensure that no moorings will be located within the 100 m exclusion zone around the target. The placement of moorings should also be supervised to ensure that the identified target is avoided.

RESIDUAL IMPACTS

7.33. If the mitigation measures identified are employed, no residual impacts are expected on known targets. Possible residual impacts could arise in the event that unknown (buried) artefacts are exposed following deployment of the moorings. The significance of the residual impact would depend on the type and importance of the exposed artefacts.

Figure 7.3: Location of target within site boundary



INDICATIVE ONLY - Not to be used for direct interpretation

Table 7.2: Summary of Impacts

Predicted Impact	Beneficial/ Adverse	Nature, Scale and Type of Impact						Probability of impact occurring	Significance of Impact	Proposed Mitigation Measures	Significance of Residual Impact
		Deploy't / Oper'n	Extent of impact (National / Local / Site)	Direct/ Indirect	S term/ L term	Perm/ Temp	Revers./ Irrevers	(Likely, Unlikely, Remote)	(Major, Minor, Not significant)		(Major, Minor, Not significant, Neutral)
Potential damage to buried artefacts from moorings	Adverse	Deploy't	Local	Direct	L term	Perm	Irrevers.	Uncertain but Remote	Not significant to Major	Monitor areas around moorings once yearly and after major storms	Not significant to Major
Loss, damage or disturbance to identified target from moorings	Adverse	Deploy't	Local	Direct	L term	Perm	Irrevers.	Unlikely	Minor to Major	Plan mooring layout to avoid target and keep all moorings and cages outside the 100 m exclusion zone	Not significant
Loss, damage or disturbance to unidentified target/s from moorings	Adverse	Deploy't	Local	Direct	L term	Perm	Irrevers.	Unlikely	Not significant to Major	Monitoring during deployment	Not significant

8. EFFECTS ON HUMAN POPULATIONS

INTRODUCTION

8.1. This Chapter deals with the effects of the Scheme and its operations on human populations. Though not strictly environmental in nature, the ToRs require *an identification of the impacts of the development on the surrounding and visiting population that may result from impacts on the environment. In addition, the EIA is to include a detailed description of the measures envisaged to prevent, minimise and where possible offset any significant adverse health effects, including cumulative impacts of the development on the general public, their social activities and on the area affected by the proposed development. This should include details of the monitoring programmes that may be proposed. The EIA shall also identify, describe and discuss in detail the possible health effects of any residual impacts that cannot be mitigated* (see **Technical Appendix 1: *Terms of Reference and Method Statements***).

8.2. In addressing these issues, the EIA has considered a number of impacts as described in **Chapters 5** to **7** above. Most of these are direct environmental impacts that do not have direct impacts on human populations. The main effects of the Scheme are those impacting:

- Amenity / views from the shore;
- Bunkering activities;
- AFM firing practice;
- Navigation;
- Amateur fishing;
- Diving and related recreational pursuits;
- Bathing and similar recreational pursuits;
- Tourism;
- The potential for attracting large predatory fish.

ASSESSMENT METHODOLOGY

Data Sources

8.3. In compiling this assessment, data was obtained from various sources, including tuna farm operators, public authorities, baseline surveys undertaken for the current and other EIAs or environmental investigations, and various stakeholders.

Consultations

8.4. Throughout the compilation of this EIA Report, consultations were held with various relevant stakeholders. These included:

- Government Authorities:
    - Environmental Health Directorate
    - Transport Malta
    - Malta Tourism Authority
    - Department of Fisheries and Aquaculture
    - Armed Forces of Malta.
- Local Authorities:
    - Mellieha Local Council
    - St Paul's Bay Local Council
- Non-governmental Organisations:
    - Nature Trust-FEE Malta
    - Birdlife Malta
    - Professional Diving Schools Association
    - Amateur Fisherman Association
    - "Stop the Slime" Campaign.

EFFECTS ON HUMAN POPULATIONS

8.5. The potential impacts of the Scheme on humans and their activities relate to the perceived effects that it may have on:

- Peoples' way of life – how they live, work, play and interact with one another on a day-to-day basis;
- Their culture – shared beliefs, customs and values; and
- The quality of their environment – the quality of air and water, safety and fears about security, etc.

Information derived through consultations

8.6. Information gathered through the consultation process that is relevant to the assessment of the Scheme's impact on humans and their activities are described in **Table 8.1.** Summary notes of stakeholder consultation meetings are available in **Appendix 1**.

Table 8.1: Socio-economic data derived through consultation

Subject	Socio-economic data
Amenity / views from the shore	The Scheme site is located a substantial distance from the shore (5 km), which is an improvement over the previous inshore sites. The offshore move is supported from a tourism and recreation point of view as well. The Mellieha Local Council also prefers a more northward move of the Scheme site (once the North Aquaculture Zone is set up) but as long as the zone will not be too large. The oily sheen from the farms may be visible more than the cages themselves, especially under certain atmospheric conditions and when viewed from high ground (e.g. High Ridge).
Bunkering activities	The Scheme is located northward of the largest bunkering zone in the Maltese Islands- that at Is-Sikka l-Bajda. The Scheme moorings are located at the boundary of the bunkering zone, but the cages themselves are located at approximately 250 – 300 m from the bunkering zone boundary. It is imperative that all the navigational aids (special marker buoys and navigational lights) are maintained by the farm operator throughout the use of the site. The farming activities at the Scheme site are no t expected to affect the economic activities related to bunkering.
AFM firing practice	The Scheme site's original location overlapped with the AFM's Pembroke High firing practice arc. This was only tolerated for one year and the farm must be moved to an area outside of the firing arc. The ranges ad their firing arcs cannot be touched. Activities such as bunkering and fish farming are prohibited within these areas.
Navigation	There are three principal directions from which the majority of shipping to Malta approaches: North (down the coast) from the east and from the southeast. The Scheme site is situated along the approach to the Grand Harbour from the north and west. TM advised that the placing of the moorings close to (or within) the bunkering zone is only being tolerated; however, the cages must not be deployed any closer than 250 – 300 m from the bunkering zone boundary to ensure safety of navigation. However, the Scheme's location at this site is only considered as a temporary solution and the Scheme will need to be shifted to the new North Aquaculture Zone once this is set up. The location of the North Aquaculture Zone further to the north is preferred from a safety of navigation point of view. The approaches to Mellieha Bay / St Paul's Bay for the north must remain unencumbered for free navigation.
Amateur fishing	Amateur fishermen tend to use sites situated 1 to 1.5 km from the coast, although some may also venture further offshore. The tuna farms are a recognised fishing attraction.

Subject	Socio-economic data
	Fish farms typically act as a magnet for fish. This is especially in view of the presence of uneaten feed, which could attract wild fish to the area, with the possibility that fisheries could be enhanced. However, such a concentration of fish from other areas could also lead to over-fishing and depletion of stocks in the same way that artificial reefs may make the fish more easily caught. Fishermen observed that the attraction of wild fish to the pens can depopulate other areas. Fishermen also highlighted the problem with wild tuna attracted to the farm pens and remaining in local waters. These tuna would then prey on the smaller fish, which would typically be targeted by the amateur fishermen. Fishermen claim to have seen a drastic reduction in prey species in certain areas; others attribute the increase in fish in their area to the presence of the farm. The Scheme proposal is not deemed to affect fisheries as long as the area enclosed by the outer perimeter buoys does not increase from that already permitted.
Diving and related recreational pursuits	The nearest "official" dive site to the Scheme site is the wreck of the HMS Stubborn. Fish farming and diving activities are not really compatible but acknowledging that fish faming is also a legitimate use of the marine environment, the diving industry highlights the need for enforcement of regulations and permit conditions by all concerned. Operational management on farms also need to improve to minimise impacts on dive sites. The offshore relocation of the Scheme site (from its previous location off South Comino coats and St Paul's Bay, is considered as a positive move. Further relocation to a site even further offshore would be preferable.
Bathing and similar recreational pursuits	Local recreation comprises the use of the coastal areas and adjacent waters by pleasure craft and the use of the coastal lands for recreation. Two issues are relevant to socio-economics: a) the current use of waters close to the Scheme site by pleasure craft, and b) the effect that the operation of the Scheme may have on users of the coast. The latter includes considerations such as the likelihood of currents carrying fish oils and detritus to the coast, and the visual impact of the farms on the users of the coast. The dispersal of fish oils was modelled as part of this EIA Report (see Chapter 5) and shown to impact the coastline within 2 days of release unless contained and collected. Disposal of offal, even if beyond the 12 nautical mile limit, may still impact the coastline if the entrails float and are carried by the current. Pleasure craft typically operate within 800 metres of the coast although very occasionally they are seen 1.5 -2 Km from the coast. It is unlikely that pleasure craft traverse / frequent the Scheme site (5 km).

Subject	Socio-economic data
	Farm discharges (uneaten feed, fish oils, fish wastes (excreta), litter, and operational discharges from craft can all impact the quality of the water (see Chapter 5). Such discharges need to be controlled and appropriately managed to minimise nuisance and inconvenience to coastal users, especially from oily slicks and fish slime in the water, odours from decomposing / uneaten fish, offal, or carcasses.
Tourism	The Mellieha/St Paul's Bay area is an important tourism zone and the relocation of the Scheme site from their previous location was a positive move. Further offshore relocation once the North Aquaculture Zone is set up would be encouraged. The main concern from a tourism/recreation point of view is the oil/slime problem encountered in recent years. The MTA would like all farms to commit to positive and practical measures to minimise these impacts (including possibly R&D initiatives). The farming activity should not impact diving or marine archaeological sites.
The potential for attracting large predatory fish	Since fish farms are reported to attract wild tuna and other fish, it is possible that they might also attract other predator species, such as sharks. Although current fish farm operators have not reported that their operations have attracted predator fish, there is evidence abroad that sharks have been attracted to tuna cages when under tow[87]. The same source indicates that "*there is no scientific proof that (white pointer) sharks are attracted to tuna cages. There has been no scientific research done into whether sharks are attracted to tuna cages. But there is a lot of anecdotal evidence to suggest that sharks are appearing around tuna cages, and I believe that the decision makers should be exercising caution.*"

Assessment of Impacts

Amenity / views from the shore

8.7. The Scheme will be located a substantial distance from the shore (5 km), which is an improvement on the previous inshore sites, which were so visible from the shore. The largest part of the Scheme is located underwater and hence is not visible from shore. The only visible items are the cage collars, which, being black and low-lying, are invisible from most of the coastline and under most atmospheric conditions, and the marker buoys, which, of necessity have to be visible to passing boats.

8.8. **Figure 8.1** is a photograph of the Scheme site taken from the coast road at Il-Madliena. The photograph was taken on 2 February 2018. The vessels in the photo are located within the bunkering zone and are not related to the fish farm itself. The

[87] Parliament of South Aurstralia, Environment, Resources and Development Committee, 29th Report, *Aquaculture*. 30 June 1998

Scheme site is located beyond these. At the time of the photo, twelve tuna cages deployed under PA/03072/17 and PA/05858/17 were present on site; however, these were not visible from this location.

8.9. Views from the coastline will likely be even less prominent in view of the shallower angle of view.

Figure 8.1: View of Scheme site from coast road at Il-Madliena

8.10. In consultation meetings with stakeholders, a point was raised that the oily sheen from the fish oils will be very visible from this general location. While this may be true, if the oil is not effectively contained and collected (see mitigation measures proposed in **Chapter 5**), the visual amenity issues are not deemed to be significant. Indeed, as can be seen in the photo in **Figure 8.1**, which was taken when there were no fish in the cages, the sea surface exhibits different hues and sheens as a result of natural phenomena, including currents and temperature changes.

Bunkering activities

8.11. The establishment and operation of the Scheme at this location should not affect the activities in the adjacent bunkering zone. The cages are located around 250 m from the northern boundary of the zone and will be appropriately charted and marked on site, including with navigational lights as required by maritime regulations.

8.12. From a navigational point of view, Transport Malta has highlighted that the location of the Scheme at this site is considered to be "too close for comfort" to the bunkering

zone in the event of an incident at sea. For this reason, the use of this site is currently only considered on a temporary basis until the North Aquaculture Zone is set up[88].

AFM firing practice

8.13. The current Scheme location, which was established on the basis of seabed ecological data, actually overlaps with the Armed Forces of Malta's Pembroke High firing practice arc. In a consultation meeting with the AFM, it was made clear that the tuna farm cannot remain within this area for safety reasons – not only of the farmers themselves but also in view of the farm's attraction to amateur fishermen who congregate at this location to target the wild fish attracted to the farm (see also **Chapter 5**). The current location curtails some activities within the firing ranges and this is not acceptable.

8.14. As instructed by the AFM, the farm operator has submitted an interim proposal to the AFM for the shifting of three cages outside of the firing arc but also, as described in **Chapter 3**, has amended the application for the Scheme to be shifted entirely to the northwest and maintain a buffer area of approximately 75 m from the firing arc on the Scheme's eastern boundary.

Navigation

8.15. The location of the Scheme site is currently only allowed by Transport Malta due to its temporary nature. The location close to the bunkering zone at Is-Sikka l-Bajda (see above) and on the approaches to the Grand Harbour from the north and west creates some navigational concerns. However, as long as the farm is properly charted and marked by means of special marker buoys, and all navigational aids are maintained by the farm operator, the risks to navigation should be contained. Nonetheless, Transport Malta still requires the Scheme to relocate to the North Aquaculture Zone once this is set up. The setting up of the latter zone further offshore (away from the bunkering zone) and in deeper waters is favoured from a navigational point of view; as long as the zone is properly marked and charted, navigation will adjust. The site selection for the North Aquaculture Zone is still underway as part of a separate EIA.

Amateur fishing

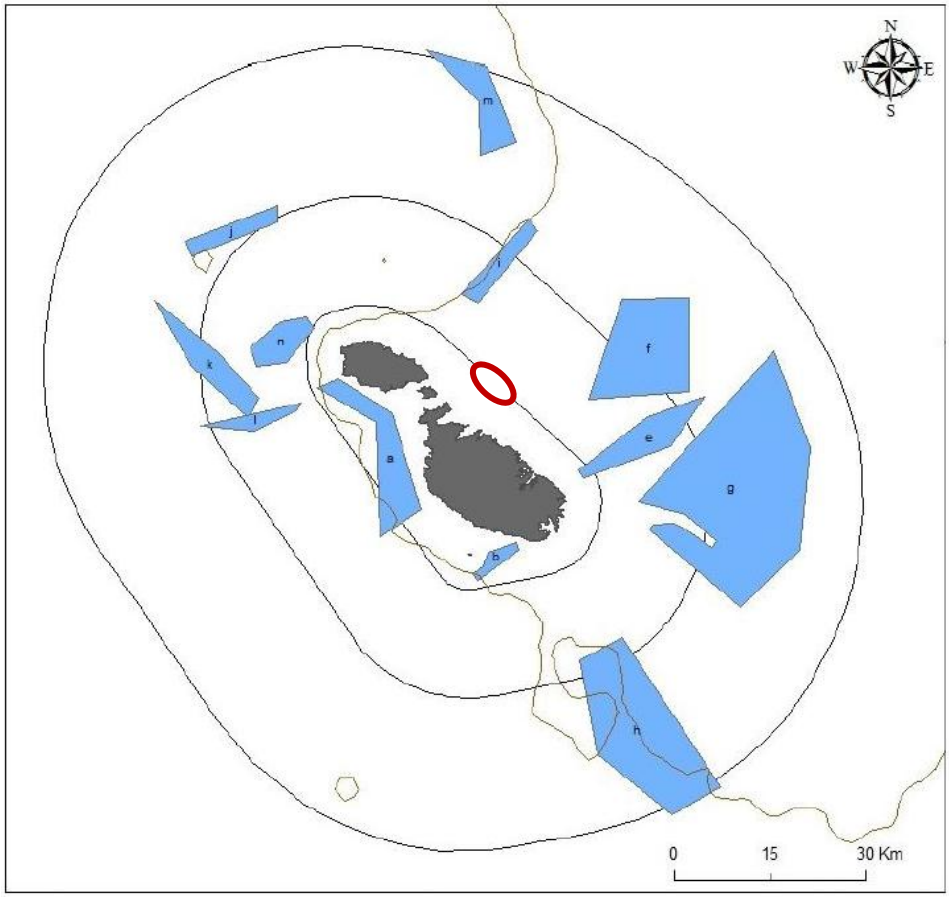
8.16. In the absence of the Scheme, the Scheme site is not a particularly popular fishing area, being located next to a bunkering zone. It is also not a designated trawling zone (see **Figure 8.2**). However, since the establishment of the tuna farm in 2017, the site has attracted a number of fishermen who target the wild fish attracted to the cages (see also **Chapter 5**).

8.17. As confirmed by some amateur fishermen, the presence of the tuna cages at the site

[88] The development of the North Aquaculture Zone is the subject of a separate EIA.

contributes beneficially to fish life through the provision of nutrients/uneaten baitfish; as long as the marine system is not overloaded. Fishermen from the St Paul's Bay area attribute the increase in fish numbers and their catches to the presence of the farms. Other fishermen (e.g. those from Gnejna), however, claim that the farms attract fish from a wider area leading to depopulation of other sites located away from the farm.

Figure 8.2: Location of designated trawling zones and approximate location of Scheme site



8.18. The attraction of wild fish, in particular wild tuna, to the farms, and especially when these remain in local waters in view of the availability of feed, creates concerns to the fishermen since, these predatory fish prey on the smaller fish that the fishermen would normally target. During the stakeholder consultation meeting, there wasn't consensus on the impact of the farms on the fish stocks, with some fishermen praising the tuna farms and others blaming them for a reduction in fish species (see **Appendix 1**).

Bathing, diving and related recreational pursuits

8.19. Local recreation is not likely to be affected by the Scheme's new location in view of its location 5 km offshore. Pleasure craft do not regularly frequent this area and there is no reason to conclude that they will be attracted to the Scheme site. Yachts

and boats sailing between Mata and Gozo typically stay closer to shore. On the other hand, the removal of the cages from the inshore site (2 km off St Paul's Bay) in 2016/17 has helped to free up these popular inshore waters.

8.20. The Scheme also does not directly impact any established diving sites; the nearest being the wreck of the HMS Stubborn and, though not an official dive site due to its designation as a bunkering zone, the nearby Is-Sikka l-Bajda.

8.21. The main impact of the Scheme on bathing, diving, and similar marine recreational pursuits is the release of fish oil and slime from the farming operation. This impact reached alarming proportions in the summer of 2016, when large swathes of sea were reported to be impacted by fish slime. This led the Planning Authority to revoke all tuna farm permits and to order the relocation of the farms to established Aquaculture Zones (see **Chapter 3**).

8.22. In the meantime, the Environment and Resources Authority has also processed environmental permit applications for the farms making up the Scheme. These permits require the establishment of specific procedures and adherence to best practice in farm management in order to minimise impacts on the environment, and, indirectly, on human populations. Amongst the measures required, the farm operators are to: (i) provide a report on the containment of baitfish residue and other wastes on board the service vessels, (ii) submit and implement a monitoring plan, (iii) enter into an agreement with third party contractors to provide cleanup operations extending beyond the farm to collect any oils that escape the cages, (iv) provide a proposal on the alternative disposal of offal, (v) consider alternative feeding methods to reduce impacts on the surrounding environment, and (vi) prepare and implement an environmental management system for the farm operations.

8.23. As described in earlier chapters, a number of mitigation measures to address the release of fish oils have been implemented already on site and others will be deployed this season. These include:

- the containment of baitfish thaw water inside impermeable jumbo bags to eliminate losses from the service vessel while the baitfish are transported to the site;
- the deployment of a permanent oil boom inside each cage to contain any oils and slime emptied from the jumbo bags with the baitfish;
- the use of proprietary oil skimmers in the cages to collect the contained oils and collection of same in IBCs prior to their transfer to land;
- training of personnel in dealing with Tier One oil spills;
- availability of spill kits on board all vessels;
- deployment of additional oil booms at the farm perimeter, if required; and
- availability of oil spill contractor on stand-by in the event of a large spill escaping

from the farm.

8.24. If all the mitigation measures are put in place and maintained, the impact from the fish oils should be contained and greatly reduced, thereby eliminating or greatly mitigating the nuisance factor from the farms.

8.25. Another impact that affects bathing areas and similar recreational activities is the disposal of offal. This is currently collected and disposed of beyond the 12 nautical mile limit, as instructed by the Veterinary authorities. Unfortunately, entrails, tuna head, and whole carcasses have often washed up on shores to the great annoyance and inconvenience to bathers and other coastal users. This matter needs to be better managed. At the moment, such disposal is carried out under instruction from the Veterinary authorities. Nonetheless, if such disposal is to continue, then the possibility of macerating the offal prior to disposal to reduce the possibility of such matter floating inshore, should be actively investigated and enforced.

8.26. The source of such offal, however, is not necessarily the farming operation. The farm operators claim (and there has been some confirmed evidence to this effect; see Arechavala-Lopez *et al*., 2015) that some of this material is originating from wild tuna caught (legally or otherwise) by amateur fishermen who then either gut and process the fish while throwing the entrails overboard, or, in some cases, losing the large tuna, complete with hook and line, which eventually dies and gets washed ashore. A number of such tuna carcasses with hooks in their mouth have been recorded in the past years. To this end, it is important that the authorities prohibit or strictly control fishing activities around the farms.

Tourism

8.27. Tourism has benefited from the relocation of the tuna farms from their previous inshore locations to the current Scheme site by freeing up the inshore waters for other recreational pursuits and moving the cages to a location where they are much less visible. From a tourism point of view, the major concern was always the fish oil/slime problem especially that encountered in recent years. The mitigation measures to counter this problem will improve the tourism product as well.

The potential for attracting large predatory fish.

8.28. EIA Reports prepared for past tuna farming proposals in Malta also indicated that there was no evidence of sharks being attracted to the fish farms operating in Maltese waters. Vigilance and monitoring was recommended. The same recommendation would be appropriate for the Scheme. The elimination of offal disposal at sea, if possible, would further reduce the possibility of predator attraction.

Mitigation Measures

8.29. The mitigation measures described for the environmental impacts in **Chapters 5**, **6** and **7** above, would be equally important to mitigate effects on human populations.

Table 8.2: Summary of Impacts on Human Populations

Predicted Impact	Beneficial/ Adverse	Nature, Scale and Type of Impact						Probability of impact occurring	Significance of Impact	Proposed Mitigation Measures	Significance of Residual Impact
		Deploy't / Oper'n	Extent of impact (Nat / Local / Site)	Direct/ Indirect	S term/ L term	Perm/ Temp	Revers./ Irrevers	(Likely, Unlikely, Remote)	(Major, Minor, Not significant)		(Major, Minor, Insignificant)
Views from shore	Beneficial	Both	Local	Direct	L term	Perm (until relocation to NAZ)	Revers.	Likely	Not significant		Not significant
Bunkering activities	None										
AFM Firing Practice arc	Adverse	Both	National	Direct	L term	Temp	Revers.	Likely	Minor to Major	Shift Scheme to the northwest to move completely out of the firing practice arc and leaving a buffer zone	Not significant
Navigation	Adverse	Oper'n	Local	Direct	L term	Temp	Revers.	Unlikely	Minor to Major	Maintain navigational aids and markers; farm to be officially charted; Relocation of Scheme to NAZ (if applicable)	Minor to Not significant
Local recreation	Adverse	Oper'n	Local	Direct	L term	Perm	Revers.	Likely	Minor to Major	Deploy oil mitigation	Minor to Not significant

Predicted Impact	Beneficial/ Adverse	Nature, Scale and Type of Impact						Probability of impact occurring	Significance of Impact	Proposed Mitigation Measures	Significance of Residual Impact
		Deploy't / Oper'n	Extent of impact (Nat / Local / Site)	Direct/ Indirect	S term/ L term	Perm/ Temp	Revers./ Irrevers	(Likely, Unlikely, Remote)	(Major, Minor, Not significant)		(Major, Minor, Insignificant)
									(depending on amount of discharges)	measures in the form of oil booms, skimmers, collection of oil, stand-by oil spill contractor; Maceration of offal prior to disposal at sea; disposal beyond 12 nautical miles and in different locations to avoid overloading; Consider prohibiting disposal of offal at sea; Training of personnel	(depending on success of mitigation measures)
Diving	Adverse	Oper'n	Local	Direct	L term	Perm	Revers.	Likely	Minor to Major	Deploy oil mitigation	Minor to Not significant

Predicted Impact	Beneficial/ Adverse	Nature, Scale and Type of Impact						Probability of impact occurring	Significance of Impact	Proposed Mitigation Measures	Significance of Residual Impact
		Deploy't / Oper'n	Extent of impact (Nat / Local / Site)	Direct/ Indirect	S term/ L term	Perm/ Temp	Revers./ Irrevers	(Likely, Unlikely, Remote)	(Major, Minor, Not significant)		(Major, Minor, Insignificant)
									(depending on amount of discharges)	measures in the form of oil booms, skimmers, collection of oil, stand-by oil spill contractor; Maceration of offal prior to disposal at sea; disposal beyond 12 nautical miles and in different locations to avoid overloading; Consider prohibiting disposal of offal at sea; Training of personnel	(depending on success of mitigation measures)
Tourism	Adverse (impacts	Oper'n	Local	Direct	L term	Perm	Revers.	Unlikely (Adverse);	Minor to Major	Deploy oil mitigation	Minor to Not significant

Predicted Impact	Beneficial/ Adverse	Nature, Scale and Type of Impact						Probability of impact occurring	Significance of Impact	Proposed Mitigation Measures	Significance of Residual Impact
		Deploy't / Oper'n	Extent of impact (Nat / Local / Site)	Direct/ Indirect	S term/ L term	Perm/ Temp	Revers./ Irrevers	(Likely, Unlikely, Remote)	(Major, Minor, Not significant)		(Major, Minor, Insignificant)
	from fish oils and slime on coastal areas) / Beneficial (relocation of inshore cages)							Likely (beneficial)	(Adverse) / Minor (Beneficial)	measures in the form of oil booms, skimmers, collection of oil, stand-by oil spill contractor; Maceration of offal prior to disposal at sea; disposal beyond 12 nautical miles and in different locations to avoid overloading; Consider prohibiting disposal of offal at sea; Training of personnel	(Adverse) / Minor (Beneficial)
Amateur fishing within and in the	Adverse / Beneficial	Oper'n	Local	Direct	L term	Perm	Revers.	Likely	Minor (Adverse) /	Regulate fishing around the	Minor (Adverse) /

Predicted Impact	Beneficial/ Adverse	Nature, Scale and Type of Impact						Probability of impact occurring	Significance of Impact	Proposed Mitigation Measures	Significance of Residual Impact
		Deploy't / Oper'n	Extent of impact (Nat / Local / Site)	Direct/ Indirect	S term/ L term	Perm/ Temp	Revers./ Irrevers	(Likely, Unlikely, Remote)	(Major, Minor, Not significant)		(Major, Minor, Insignificant)
vicinity of the Scheme Site									Minor (Beneficial)	Scheme to minimise adverse impacts; Monitor impact of tuna farms on wild stock	Minor (Beneficial)
Impact of the attraction of predator fish	Adverse	Oper'n	Local	Direct	L term	Perm	Revers.	Remote	Not significant	Keep vigilant lookout and inform authorities immediately in the unlikely event of such attractions	Not significant

9. SUMMARY OF KEY IMPACTS, INTERACTION BETWEEN IMPACTS AND MITIGATION

INTRODUCTION

9.1. The purpose of this chapter is to provide a summary of the key environmental impacts, their interaction and cumulative effects, and their mitigation. The chapter addresses the requirements set out in the Terms of Reference (ToR) to describe mitigation measures to *"prevent, eliminate, reduce or offset (as relevant) the identified significant adverse effects of the project"* and to identify cumulative and residual impacts. The chapter concludes with a summary of the mitigation measures proposed in the Environmental Impact Assessment Report as well as a description of the required authorisations.

SUMMARY OF KEY IMPACTS

9.2. **Chapters 5** to **8** of the EPS describe the predicted impacts of the Scheme in relation to marine environment (including marine ecology), avifauna, cultural heritage / marine archaeology, and effects on human populations, in accordance with the topic areas identified in the ToR.

9.3. For each predicted impact, an assessment has been made as to whether the impact is likely to be of major or minor significance, or of no significance; the criteria that were used to judge significance are described in each of the chapters. Predicted major and minor impacts have been identified, and, in the case of negative impacts, there is a description of how these could be mitigated. All the residual impacts identified are summarised in **Table 9.1** at the end of this Chapter.

9.4. The unmitigated major impacts identified during the assessment relate solely to benthic ecology, arising from the placing of mooring blocks on the seabed and changes to benthic habitats containing live rhodoliths from shading effects by the cages.

9.5. Other impacts may be of major significance under certain circumstances, but a degree of uncertainty or a range of possible conditions do not allow the impact to be conclusively defined. These include:

- Water Quality impacts:
    - Deterioration in water quality from increased nutrient loads from uneaten feed;
    - Operational discharges of oil and bilge waters from maritime traffic associated with the Scheme;
    - Discharge of sewage from processing vessels;
    - Marine pollution from ship litter;

- Impacts on Marine Ecology:
    - Loss of habitats through settlement of uneaten feed;
- Impacts on avifauna:
    - Disturbance to avifauna for light pollution;
    - Predation impacts on seabirds from increased gull population;
    - Impacts on birds from ingestion of marine debris;
- Archaeology impacts:
    - Potential damage or disturbance to unknown buried artefacts and to the identified target from moorings;
- Effects on humans and their activities:
    - Impacts on the use of the AFM firing practice area;
    - Impacts on navigation near the Scheme site;
    - Deterioration of inshore waters and impact on local recreation, including diving, from discharge of fish oils and slime;
    - Impacts on tourism and tourism activities from fish oil and slime in coastal areas.

9.6. These impacts, relevant mitigation measures, and the residual impacts are discussed hereunder.

Benthic Ecology

9.7. The impact on benthic habitats from the placement of moorings is considered to be of major negative significance for those sessile fauna and flora located beneath the mooring blocks. This is more so for those blocks located in areas with increased cover of live rhodoliths.

9.8. Benthic habitats are also affected by the uneaten feed settling on the seabed. This impact could be major for the area of seabed directly beneath the cages but reduces to not significant with distance from the cages. The extent of this impact depends on the effectiveness of feed management and the amount of feed actually lost / uneaten. Good feed management can significantly reduce this effect.

Water Quality

9.9. It is considered that the Scheme may have a major negative impact on marine water quality from increased nutrient loading resulting from uneaten feed settling on the seabed, operational discharges of oil and bilge waters, discharge of sewage from marine vessels, and discharge of marine litter or loss of anthropogenic items

overboard.

9.10. Most of these impacts are either uncertain or can vary depending on a number of factors. Impacts from uneaten feed will depend on the amount of such material settling on the seabed, with the impact likely to be higher directly under the cages and reducing in extent with distance from the cages. Impacts from oil or bilge losses depend on the amount of pollutant lost; likewise the impacts from sewage, which will also depend on the maintenance of available containment or treatment measures on board (e.g. holding tanks or sewage treatment plant). The impact from marine litter can be severe, both on avifauna and on benthic species. Evidence of considerable amount of anthropogenic material at and near tuna farms has been recorded in past monitoring reports. Effective action to minimise such accidental losses or deliberate discharges are required to mitigate this impact.

Avifauna

9.11. The Scheme has the potential to create impacts of major significance on the breeding seabird populations. Impacts can result from increased light pollution, predation effects from gulls attracted to the farm, and ingestion of marine debris. All these impacts depend on the extent of intervention, e.g. amount of lights and intensity thereof applied to cages, or amount of marine litter lost; the impact from gull predation depends on whether the gull population does increase as a result of the Scheme, and whether the gulls actually do attack the other seabirds or compete with them for food and nesting sites.

Archaeology

9.12. The Scheme could impact archaeology either through direct impact of the identified target or through exposure of as yet unknown buried artefacts. The impact is unlikely for the former since the target is known and hence can be avoided, and uncertain for the latter since it depends on the presence or otherwise of such artefacts.

Effects on Human Populations

9.13. The effects on humans and their activities can be split into two types: effects from the presence of the Scheme and effects from the discharge of fish oils and slime.

9.14. The presence of the Scheme can affect the AFM firing practice area and may also impact navigational safety. The impact on the AFM range will only be major if the Scheme remains in its current location. The fact that the current application subject of this EIA has been changed to shift the farm completely out of the firing arc and maintain a buffer area in between should mitigate this impact. As regards navigational safety, this can be mitigated though normal navigational safety practices, including proper charting and on site marking of the farm.

9.15. The unmitigated discharge of fish oils and slime can affect inshore waters, as has been registered in recent years. This would impact bathing, yachting, diving, and related recreation, tourism, and the general quality of life of coastal residents and visitors.

The significance of the impact will depend on the amount of fish oil released into the marine environment during feeding and the amount of oils that escape the farm and the collection systems deployed to counteract this issue.

INTERACTION OF IMPACTS

9.16. The interaction of impacts with the current baseline is described in **Chapters 5** to **8** of the EIA Report. The interactions are summarised in **Table 9.1** below. The interaction between impacts describes the potential cumulative or reactive nature of the various disturbances caused by the Scheme during deployment and operation.

9.17. During deployment, the only impacts of major significance identified in the EIA relate to impacts on benthic assemblages from the placing of the mooring blocks; this impact can then interact with the operational impacts that directly affect the benthic habitats, especially the settling of uneaten baitfish and marine litter sinking to the seabed.

CUMULATIVE IMPACTS

9.18. Cumulative impacts are those that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the Scheme.

9.19. The various impacts identified in **Chapters 5** to **8** of the EIA Report were assessed in the context of the existing baseline (encompassing the past and present context). No major developments were noted to be underway in the immediate area of the Scheme site during the baseline surveys, and there are no known committed major developments in the area.

9.20. The Scheme involves the deployment of cages within the identified area, with the amount of fish kept on site regulated by the ICCAT quota allotted to the applicant. The Scheme is also temporary in nature, in that the farm will have to be relocated to the new North Aquaculture Zone once this is set up (unless the Aquaculture Zone is set up in the same location occupied by the Scheme). At this stage there are no evident consequential developments on site because of the Scheme; the site selection for the North Aquaculture Zone is still ongoing and subject of a separate Environmental Impact Assessment procedure.

9.21. The operation of the Scheme, however, does have potential cumulative effects with other external activities. Of particular concern are:

- Cumulative effects of operational discharges of oil with possible spills from the adjacent bunkering zone; and
- Cumulative light pollution effects from the navigational markers and additional cage lights with lighting from vessels present at the adjacent bunkering zone.

MITIGATION

9.22. The EIA Report, including its supporting Technical Appendices, reports the findings of the EIA, in accordance with the ToR. Where appropriate, mitigation measures have

been recommended and these have been agreed to by the Applicant. These mitigation measures are described at the end of each topic area chapter, and are summarised in **Table 9.1**. Some of the mitigation measures are already taken account of in the Scheme design (in-built mitigation); other mitigation measures are recommended arising from the EIA; most are operational in nature.

9.23. The following is the list of in-built and recommended further mitigation measures. It would be appropriate for, and it is recommended that, these mitigation measures be taken account of in the conditions of any eventual development permit.

In-built Mitigation Measures:

- Mooring design optimised to ensure against drifting during storms;
- Tuna feeding is supervised by divers to avoid overfeeding and loss of feed;
- Deployment of permanent oil booms inside each cage and use of oil skimmers to collect oil released in each cage;
- Use of flat-form cartons as packaging material;
- Control of marine discharges from processing vessels in line with MARPOL Regulations.

Further Mitigation Measures:

- Deployment Stage:
    - Good practice during moorings deployment to ensure against dragging of blocks on the seabed;
    - Good project management to minimise operational losses of oils and fuels from maritime vessels and their consequent water quality effects;
    - Good project management and use of proper mooring technology to minimise sediment re-suspension;
    - If feasible, consider relocation outside of priority areas for breeding Procellariiformes species;
- Operational Stage:
    - Good feed management to minimise carbon loading in sediments from uneaten feed and nutrient loadings in the water column, namely:
        - Careful monitoring of tuna feeding to avoid overfeeding; experiment with stopping feeding before satiation to minimise food loss;
        - Implementing a procedure to ensure proper feed management by

having random checks of the seabed below the tuna pens made by an independent environmental monitor;

- In the case of accident, should an inordinate amount of dead uneaten feed-fish end up on the bottom, every attempt should be made to recover as much of the material as possible and as quickly as possible after the event in order to minimise the adverse effects on the seabed habitat;

- Avoidance of large stocking densities;
- Consider the possibility of thawing and washing of baitfish on shore prior to placement in the impermeable jumbo bags and transfer to the farm to reduce the amount of fish oils and mucus released into the marine environment;
- Use skimmers with improved efficiency to those deployed until now;
- Availability of additional oil collection services outside the farm to ensure immediate collection of any slick escapes from the farm to avoid wide dispersal of same;
- Consider the deployment of additional oil booms on the farm perimeter if acceptable from a navigational safety point of view (partial deployment in the direction of the prevailing currents could also be considered);
- Appropriate contingency planning including ensuring that all stakeholders are aware of their responsibilities in the event of an accident;
- Ensuring that offal and dead tuna remains are managed in line with EC Regulation 1069 of 2009;
- Macerate offal prior to disposal at sea;
- Deployment of nets on cage collars to be done as late as possible just before the arrival of the towing cages and once the tuna from a cage is harvested, the net should be removed immediately in order to minimise the length of time with net shading effects on the seabed;
- Good practices aboard ships to minimise discharges, noise, light, and littering;
- Preparation and enforcement of waste management plan to ensure proper disposal of wastes onshore. Staff to be trained on the need of eliminating marine litter from the Scheme operations;
- Screen vessel scuppers to prevent loss of material overboard;
- Immediate recovery of any items that may accidentally end up in the sea (whether floating or deposited on the seabed) and collection of any third

party marine litter that may float towards the farm;

- Prohibition / strict control of fishing activities in the vicinity of tuna farms.
- Minimise use of lights to the minimum required for navigational safety purposes and on vessels use only downward-facing shaded light sources;
- Adopt seasonal lighting plan, with all internal cage lights (i.e. not the external navigational lights) to be switched off after the harvesting period when the nets are empty or only cage collars are present on site;
- Minimise requirements to operate at night and remove the need for vessels to be in the area at night;
- Set up a seabird monitoring programme, including digital camera monitoring to monitor which bird species are visiting the cages and their behaviour at the farm;
- Use visual bird deterrents;
- Remove dead fish from cages immediately;
- Monitoring of gull colonies annually if observed feeding at the farm;
- To reduce risk of entanglement, nets should be kept taut, mesh size should be within the 6-7 cm range and nets should be well-maintained (any holes should be repaired);
- Reduce lines and riggings on vessels;
- Train staff in appropriate bird handling and reporting; and
- Ensure regular maintenance of farm infrastructure.

REQUIRED AUTHORISATIONS

9.24. The required authorisations are referred to in the relevant topic area chapters (**Chapters 5** to **8**).

9.25. An environmental permit / registration will be required from the Environment and Resources Authority (ERA). The existing farms are already operating under two separate environmental permits. The consolidated Scheme will have its own updated environmental permit.

9.26. The Scheme will also require an aquaculture permit from the Department of Fisheries and Aquaculture in order to be able to operate. In addition, all necessary ICCAT certification will also be required.

9.27. The land base at Kordin will also likely require a sewer discharge permit from the Water Services Corporation.

9.28. The deployment of the cages will also require clearance from Transport Malta. The Authority will also set out the requirements of special markers and other navigational aids to be installed at the Scheme site and maintained by the applicant. The vessels operating at the Scheme will also require licences and certification in line with maritime legislation.

9.29. Waste carriers servicing the Scheme will require licences and permits from the ERA.

Table 9.1: Summary of Impacts

Predicted Impact	Beneficial /Adverse	Nature, Scale and Type of Impact						Probability of Impact Occurring (Certain / Likely / Unlikely / Remote / Uncertain)	Significance of Impact (Major / Minor /Not Significant)	Proposed Mitigation Measures	Significance of Residual Impact (Major / Minor / Not Significant)
		Deploy't /Oper'n	Extent of Impact (Nat / Local / Site)	Direct/ Indirect	S term/ L term	Perm/ Temp	Revers/ Irrevers				
Marine Environment											
WQ changes from fish oils / mucus from baitfish during feeding	Adverse	Oper'n	Local	Direct	S term (twice daily during fattening)	Temp. (as long as tuna are present on site)	Revers.	Certain	Minor to Not significant	Deployment of oil booms and collection of fish oils using skimmers from inside the cages to minimise release outside of farm area	Not significant to Minor
Deterioration in WQ from increased nutrient loads from fish excreta	Adverse	Oper'n	Site	Direct	S term	Temp. (as long as tuna are present on site)	Revers.	Likely	Minor	Optimise stocking density in cages not to overload the water column	Minor to Not significant

Predicted Impact	Beneficial /Adverse	Nature, Scale and Type of Impact						Probability of Impact Occurring (Certain / Likely / Unlikely / Remote / Uncertain)	Significance of Impact (Major / Minor /Not Significant)	Proposed Mitigation Measures	Significance of Residual Impact (Major / Minor / Not Significant)
		Deploy't /Oper'n	Extent of Impact (Nat / Local / Site)	Direct/ Indirect	S term/ L term	Perm/ Temp	Revers/ Irrevers				
Deterioration in WQ from increased nutrient loads from uneaten feed	Adverse	Oper'n	Site	Direct	L term	Perm. ? (depends on amount of uneaten feed settling on seabed)	Possibly Revers.	Likely	Uncertain (likely to be minor to major under the cages becoming minor to not significant with distance from the cages)	Strict feed management; monitoring of tuna feeding (possibly using new technologies), greater liaison with regulators, prompt action by farmers to collect sinking baitfish, lengthening of statutory fallowing period	Uncertain
Impacts from release of blood during culling, harvesting and processing	Adverse	Oper'n	Site (of discharge)	Direct	S term	Temp.	Revers.	Likely	Minor to not significant		Minor to Not significant

Predicted Impact	Beneficial /Adverse	Nature, Scale and Type of Impact						Probability of Impact Occurring (Certain / Likely / Unlikely / Remote / Uncertain)	Significance of Impact (Major / Minor /Not Significant)	Proposed Mitigation Measures	Significance of Residual Impact (Major / Minor / Not Significant)
		Deploy't /Oper'n	Extent of Impact (Nat / Local / Site)	Direct/ Indirect	S term/ L term	Perm/ Temp	Revers/ Irrevers				
Impacts from release of offal during culling, harvesting and processing	Adverse	Oper'n	Site (of discharge)	Direct	S term	Temp.	Revers.	Likely	Minor to not significant (if disposal is controlled and carried out over a wide area to avoid overloading)	Collection, handling and management of this waste stream to be in line with the provisions of EC Regulations on handling of fishery products and animal by-products; Monitoring and supervision l to ensure disposal beyond 12 nautical miles; maceration of offal prior to disposal	Not significant to Minor

Predicted Impact	Beneficial /Adverse	Nature, Scale and Type of Impact						Probability of Impact Occurring (Certain / Likely / Unlikely / Remote / Uncertain)	Significance of Impact (Major / Minor /Not Significant)	Proposed Mitigation Measures	Significance of Residual Impact (Major / Minor / Not Significant)
		Deploy't /Oper'n	Extent of Impact (Nat / Local / Site)	Direct/ Indirect	S term/ L term	Perm/ Temp	Revers/ Irrevers				
Organic loading from tuna carcasses	Adverse	Oper'n	Site (of disposal)	Direct	L term	Perm. ?	Possibly Revers.	Unlikely	Uncertain (*can range from major to minor depending on effectiveness of response in case of mortalities*)	Prohibit disposal of tuna carcasses at sea and manage in line with the provisions of Regulation (EC) No 1069 of 2009; Farm operators to ensure recovery of carcasses in the event of accidents / mass mortality during storms. Prohibit / strictly control fishing activities in the vicinity of tuna farms	Not significant (as long as provisions of Reg 1069 / 2009 are observed and rapid response in case of mortalities).

Predicted Impact	Beneficial /Adverse	Nature, Scale and Type of Impact						Probability of Impact Occurring (Certain / Likely / Unlikely / Remote / Uncertain)	Significance of Impact (Major / Minor /Not Significant)	Proposed Mitigation Measures	Significance of Residual Impact (Major / Minor / Not Significant)
		Deploy't /Oper'n	Extent of Impact (Nat / Local / Site)	Direct/ Indirect	S term/ L term	Perm/ Temp	Revers/ Irrevers				
Oil and bilge waters from maritime traffic	Adverse	Both	Local	Direct	S term	Temp.	Revers.	Unlikely	Not significant to minor (for small craft) (*minor to major in the case of an accidental large spill*) Minor to Major (for larger processing vessels)	Good operational practices; Adherence to MARPOL Regulations (oil content, prohibition of discharge, holding tanks, etc); Ensure craft is in good working order; Availability of oil spill response capabilities	Not significant (small craft) Minor (larger processing vessels)
Sewage from ships	Adverse	Oper'n	Local	Direct	S term	Temp (while factory vessels are on site)	Revers.	Unlikely	Minor to Major (depending on measures available on vessel)	Good operational practices; Adherence to MARPOL Regulations	Minor

Predicted Impact	Beneficial /Adverse	Nature, Scale and Type of Impact						Probability of Impact Occurring (Certain / Likely / Unlikely / Remote / Uncertain)	Significance of Impact (Major / Minor /Not Significant)	Proposed Mitigation Measures	Significance of Residual Impact (Major / Minor / Not Significant)
		Deploy't /Oper'n	Extent of Impact (Nat / Local / Site)	Direct/ Indirect	S term/ L term	Perm/ Temp	Revers/ Irrevers				
Pollution from packaging waste	Adverse	Oper'n	Site	Direct	S term	Temp. (during harvesting)	Revers.	Remote	Not significant to minor	Use of flat-pack cartons for packaging; Good operational practices; Adherence to MARPOL Regulations; collection of marine litter	Not significant
Pollution from ship litter	Adverse	Oper'n	Site	Direct	S term	Temp. (especially during harvesting)	Revers.	Likely	Minor (galley litter) Minor to Major (other litter and anthropogenic items lost overboard)	Good operational practices; Adherence to MARPOL Regulations; Immediate collection of any items lost overboard (whether floating or on the seabed); collection of marine litter; monitoring of seabed condition	Minor to Not significant (galley litter) Minor (other litter)

Predicted Impact	Beneficial /Adverse	Nature, Scale and Type of Impact						Probability of Impact Occurring (Certain / Likely / Unlikely / Remote / Uncertain)	Significance of Impact (Major / Minor /Not Significant)	Proposed Mitigation Measures	Significance of Residual Impact (Major / Minor / Not Significant)
		Deploy't /Oper'n	Extent of Impact (Nat / Local / Site)	Direct/ Indirect	S term/ L term	Perm/ Temp	Revers/ Irrevers				
Marine Ecology											
Loss through burial under mooring blocks	Adverse	Deploy't	Site	Direct	L term	Perm. (as long as blocks remain in place)	Revers.	Likely	Major for sessile fauna and flora under blocks; Minor to not significant for general sessile benthic species in farm area Major (for habitats with 50 – 100 % live rhodolith cover) Minor (for habitats with < 50 % live rhodolith cover)	Good practice approaches in deployment of mooring blocks Optimise mooring design to ensure against drifting Optimise mooring layout to minimise impact on habitats with 50 -100% live rhodolith cover	Major for sessile fauna and flora under blocks Not significant to Minor for general farm area Major (for habitats with 50 – 100 % live rhodolith cover) Minor (for habitats with < 50 % live rhodolith cover)

Predicted Impact	Beneficial /Adverse	Nature, Scale and Type of Impact						Probability of Impact Occurring (Certain / Likely / Unlikely / Remote / Uncertain)	Significance of Impact (Major / Minor /Not Significant)	Proposed Mitigation Measures	Significance of Residual Impact (Major / Minor / Not Significant)
		Deploy't /Oper'n	Extent of Impact (Nat / Local / Site)	Direct/ Indirect	S term/ L term	Perm/ Temp	Revers/ Irrevers				
Loss through settlement of uneaten food	Adverse	Oper'n	Site	Direct	L term	Perm. ? (depends on amount of feed)	Possibly Revers.	Likely	Minor to Major (seabed directly under cages) Minor to Not significant on seabed in general farm area	Strict feed management; monitoring of tuna feeding (possibly using new technologies), greater liaison with regulators, prompt action by farmers to collect sinking baitfish, lengthening of statutory fallowing period; staff training	Minor to Not significant
Disturbance from increased organic input	Adverse / Beneficial	Oper'n	Local	Direct	S term (for as long as the fish are on site)	Temp.	Revers.	Unlikely	Not significant to minor (during farming period with reduced effects as harvesting progresses) Potential minor beneficial due to oligotrophy	Good practice farm management to reduce loading of water column with nutrients and organic matter. Control stocking density in each cage	Not significant to minor beneficial

Predicted Impact	Beneficial /Adverse	Nature, Scale and Type of Impact						Probability of Impact Occurring (Certain / Likely / Unlikely / Remote / Uncertain)	Significance of Impact (Major / Minor /Not Significant)	Proposed Mitigation Measures	Significance of Residual Impact (Major / Minor / Not Significant)
		Deploy't /Oper'n	Extent of Impact (Nat / Local / Site)	Direct/ Indirect	S term/ L term	Perm/ Temp	Revers/ Irrevers				
Availability of new habitat, food, shelter, etc.	Beneficial	Oper'n	Site	Direct	L term	Perm (as long as area is in use)	Revers.	Likely	Minor beneficial	None	Minor beneficial
Attraction of new species and changes in ecological relationships	Adverse / Beneficial	Oper'n	Local	Direct	L term	Perm (as long as area is in use)	Revers.	Uncertain	Not significant to Minor	Monitor colonisation process and change in community structure from attraction of new species (scavengers and predators)	Not significant to Minor
Changes to benthos from shading effects by cages	Adverse	Oper'n	Local	Direct	L term	Perm (during farming as long as area is in use)	Revers./ Irrevers.	Likely	Major (for rhodoliths) Not significant for other benthic assemblages	Nets on cage collars to be deployed as late as possible in season just before arrival of towing cages and nets removed from each cage as the tuna is harvested	Minor to Major (for rhodoliths) Not significant (for other benthic assemblages)

Predicted Impact	Beneficial /Adverse	Nature, Scale and Type of Impact						Probability of Impact Occurring (Certain / Likely / Unlikely / Remote / Uncertain)	Significance of Impact (Major / Minor /Not Significant)	Proposed Mitigation Measures	Significance of Residual Impact (Major / Minor / Not Significant)
		Deploy't /Oper'n	Extent of Impact (Nat / Local / Site)	Direct/ Indirect	S term/ L term	Perm/ Temp	Revers/ Irrevers				
Increased human presence	Adverse	Both	Site	Indirect	L term	Temp	Revers.	Likely	Not significant to Minor (noise from vessels and release of chemicals) Minor to Major (effects of littering on seabed)	Monitor human activities on site; implement Environmental management system through the environmental permit conditions. Regular monitoring of seabed condition and retrieve any lost items deposited on the seabed Prohibit / strictly control fishing activities in the vicinity of tuna farms.	Not significant to Minor (noise from vessels and release of chemicals) Minor (effects of littering on seabed)
Introduction of alien species and disease-causing organisms	Adverse	Oper'n	National	Indirect	L term	Perm / Temp	Revers. / Irrevers.	Remote (low risk)	Uncertain	Monitor for evidence of introductions and act accordingly	Uncertain

Predicted Impact	Beneficial /Adverse	Nature, Scale and Type of Impact						Probability of Impact Occurring (Certain / Likely / Unlikely / Remote / Uncertain)	Significance of Impact (Major / Minor /Not Significant)	Proposed Mitigation Measures	Significance of Residual Impact (Major / Minor / Not Significant)
		Deploy't /Oper'n	Extent of Impact (Nat / Local / Site)	Direct/ Indirect	S term/ L term	Perm/ Temp	Revers/ Irrevers				
Avifauna											
Competition for sea space	Adverse	Oper'n	Local	Direct	S term if cages are required to move next season; otherwise L term	Temp if cages move next year, otherwise permanent	Revers	Likely	Minor	(If feasible), relocation outside of priority areas for Procellariiformes	Not significant
Disturbance to avifauna from light pollution resulting from the Scheme	Adverse	Oper'n	Local	Direct	L term	Temp/Perm	Revers	Likely	Minor to major	Minimise use of lights to minimum required for navigational safety and on vessels use only downward-facing shaded light sources Adopt seasonal lighting plan	Minor

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		Deploy't /Oper'n	Extent of Impact (Nat / Local / Site)	Direct/ Indirect	S term/ L term	Perm/ Temp	Revers/ Irrevers				
Disturbance to avifauna from noise resulting from the Scheme	Adverse	Both	Local	Direct	L term	Temp / Perm	Revers	Likely	Not significant to Minor	Minimise requirements to operate at night Remove the need for vessels to be in the area at night	Not significant
Change in the abundance of prey	Beneficial	Oper'n	Site	Indirect	L term	Temp / Perm	Revers	Likely	Minor to Not significant (*P. yelkouan*) Minor to Major (*H. pelagicus*)	Seabird monitoring, including digital camera monitoring to monitor which bird species are visiting the cages and their behaviour at the farm	Not significant to Major

Predicted Impact	Beneficial /Adverse	Nature, Scale and Type of Impact						Probability of Impact Occurring (Certain / Likely / Unlikely / Remote / Uncertain)	Significance of Impact (Major / Minor /Not Significant)	Proposed Mitigation Measures	Significance of Residual Impact (Major / Minor / Not Significant)
		Deploy't /Oper'n	Extent of Impact (Nat / Local / Site)	Direct/ Indirect	S term/ L term	Perm/ Temp	Revers/ Irrevers				
Increase in population of *Larus michahellis*	Adverse	Oper'n	National	Indirect	L term	Perm	Revers	Uncertain	Not significant to Major	Use visual bird deterrents; Control feeding rate to reduce feed waste; Remove dead fish from cages Prepare and implement waste management plan – all wastes, including food scraps should be disposed of on-shore Digital camera monitoring of bird visits to cages and behaviour at the farm Monitoring of gull colonies annually if observed feeding at the farm	Not significant to Major

Predicted Impact	Beneficial /Adverse	Nature, Scale and Type of Impact						Probability of Impact Occurring (Certain / Likely / Unlikely / Remote / Uncertain)	Significance of Impact (Major / Minor /Not Significant)	Proposed Mitigation Measures	Significance of Residual Impact (Major / Minor / Not Significant)
		Deploy't /Oper'n	Extent of Impact (Nat / Local / Site)	Direct/ Indirect	S term/ L term	Perm/ Temp	Revers/ Irrevers				
Entanglement	Adverse	Oper'n	Local	Direct	L term	Perm	Revers	Uncertain	Not significant to minor	To reduce risk of entanglement, nets should be kept taut, mesh size should be within 6-7 cm range, and nets should be well-maintained (any holes should be repaired) Reduce lines and riggings on vessels Train staff in appropriate bird handling and reporting	Not significant to minor

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		Deploy't /Oper'n	Extent of Impact (Nat / Local / Site)	Direct/ Indirect	S term/ L term	Perm/ Temp	Revers/ Irrevers				
Ingestion of marine debris	Adverse	Oper'n	National	Indirect	L term	Perm	Irrevers	Likely	Minor to Major (depending on number of birds affected)	Waste management plan Ensure regular maintenance of farm infrastructure Screen vessel scuppers to prevent loss of material overboard	Minor
Marine Archaeology											
Potential damage to buried artefacts from moorings	Adverse	Deploy't	Local	Direct	L term	Perm	Irrevers.	Uncertain but Remote	Not significant to Major	Monitor areas around moorings once yearly and after major storms	Not significant to Major
Loss, damage or disturbance to identified target from moorings	Adverse	Deploy't	Local	Direct	L term	Perm	Irrevers.	Unlikely	Minor to Major	Plan mooring layout to avoid target and keep all moorings and cages outside the 100 m exclusion zone	Not significant

Predicted Impact	Beneficial /Adverse	Nature, Scale and Type of Impact						Probability of Impact Occurring (Certain / Likely / Unlikely / Remote / Uncertain)	Significance of Impact (Major / Minor /Not Significant)	Proposed Mitigation Measures	Significance of Residual Impact (Major / Minor / Not Significant)
		Deploy't /Oper'n	Extent of Impact (Nat / Local / Site)	Direct/ Indirect	S term/ L term	Perm/ Temp	Revers/ Irrevers				
Loss, damage or disturbance to unidentified target/s from moorings	Adverse	Deploy't	Local	Direct	L term	Perm	Irrevers.	Unlikely	Not significant to Major	Monitoring during deployment	Not significant
Effects on Human Populations											
AFM Firing Practice arc	Adverse	Both	National	Direct	L term	Temp	Revers.	Likely	Minor to Major	Shift Scheme to the northwest to move completely out of the firing practice arc and leaving a buffer zone	Not significant
Navigation	Adverse	Oper'n	Local	Direct	L term	Temp	Revers.	Unlikely	Minor to Major	Maintain navigational aids and markers; farm to be officially charted; Relocation of Scheme to NAZ (if applicable)	Minor to Not significant

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		Deploy't /Oper'n	Extent of Impact (Nat / Local / Site)	Direct/ Indirect	S term/ L term	Perm/ Temp	Revers/ Irrevers				
Local recreation	Adverse	Oper'n	Local	Direct	L term	Perm	Revers.	Likely	Minor to Major (depending on amount of discharges)	Deploy oil mitigation measures in the form of oil booms, skimmers, collection of oil, stand-by oil spill contractor; Maceration of offal prior to disposal at sea; disposal beyond 12 nautical miles and in different locations to avoid overloading; Consider prohibiting disposal of offal at sea; Training of personnel	Minor to Not significant (depending on success of mitigation measures)

Predicted Impact	Beneficial /Adverse	Nature, Scale and Type of Impact						Probability of Impact Occurring (Certain / Likely / Unlikely / Remote / Uncertain)	Significance of Impact (Major / Minor /Not Significant)	Proposed Mitigation Measures	Significance of Residual Impact (Major / Minor / Not Significant)
		Deploy't /Oper'n	Extent of Impact (Nat / Local / Site)	Direct/ Indirect	S term/ L term	Perm/ Temp	Revers/ Irrevers				
Diving	Adverse	Oper'n	Local	Direct	L term	Perm	Revers.	Likely	Minor to Major (depending on amount of discharges)	Deploy oil mitigation measures in the form of oil booms, skimmers, collection of oil, stand-by oil spill contractor; Maceration of offal prior to disposal at sea; disposal beyond 12 nautical miles and in different locations to avoid overloading; Consider prohibiting disposal of offal at sea; Training of personnel	Minor to Not significant (depending on success of mitigation measures)

Predicted Impact	Beneficial /Adverse	Nature, Scale and Type of Impact						Probability of Impact Occurring (Certain / Likely / Unlikely / Remote / Uncertain)	Significance of Impact (Major / Minor /Not Significant)	Proposed Mitigation Measures	Significance of Residual Impact (Major / Minor / Not Significant)
		Deploy't /Oper'n	Extent of Impact (Nat / Local / Site)	Direct/ Indirect	S term/ L term	Perm/ Temp	Revers/ Irrevers				
Tourism	Adverse (impacts from fish oils and slime on coastal areas) / Beneficial (relocation of inshore cages)	Oper'n	Local	Direct	L term	Perm	Revers.	Unlikely (Adverse); Likely (beneficial)	Minor to Major (Adverse) / Minor (Beneficial)	Deploy oil mitigation measures in the form of oil booms, skimmers, collection of oil, stand-by oil spill contractor; Maceration of offal prior to disposal at sea; disposal beyond 12 nautical miles and in different locations to avoid overloading; Consider prohibiting disposal of offal at sea; Training of personnel	Minor to Not significant (Adverse) / Minor (Beneficial)

Predicted Impact	Beneficial /Adverse	Nature, Scale and Type of Impact						Probability of Impact Occurring (Certain / Likely / Unlikely / Remote / Uncertain)	Significance of Impact (Major / Minor /Not Significant)	Proposed Mitigation Measures	Significance of Residual Impact (Major / Minor / Not Significant)
		Deploy't /Oper'n	Extent of Impact (Nat / Local / Site)	Direct/ Indirect	S term/ L term	Perm/ Temp	Revers/ Irrevers				
Amateur fishing within and in the vicinity of the Scheme Site	Adverse / Beneficial	Oper'n	Local	Direct	L term	Perm	Revers.	Likely	Minor (Adverse) / Minor (Beneficial)	Regulate fishing around the Scheme to minimise adverse impacts; Monitor impact of tuna farms on wild stock	Minor (Adverse) / Minor (Beneficial)

Appendices

Appendix 1: Summary notes from stakeholder consultation meetings

Proposed development by the Department of Fisheries and Aquaculture of a North Aquaculture Zone off is-Sikka l-Bajda, St Paul's Bay

Proposed extension of the temporary tuna farm operated by AJD Tuna Ltd off Is-Sikka l-Bajda through the addition of 12 cages to increase the number of cages to 24 without increasing the amount of fish farmed (PA/02175/18)

Stakeholder Consultation during the formulation of the EIA Report

Consultee: Environmental Health Directorate

Date of Meeting: 16 April 2018

Present: Mr Charles Bonnici, Marie Angele Magro

Issues discussed:

The EHD representatives explained that they had already highlighted the Directorate's concerns in a consultation letter to ERA (copy provided). The main issues are listed hereunder:

- Effects on water quality during operations;
- Need for a detailed waste management plan addressing packaging waste, thaw water, oily slick, uneaten feed, fish excreta, dead tuna, blood and wastewater from onboard processing of tuna;
- Need for monitoring and implementation of mitigation measures to reduce / avoid the amount of dead fish and uneaten feed littering the seabed;
- To look into possible containment of thaw water on vessels;
- Social and cumulative impacts on the general public, especially bathers and coastal users;
- Require details of measures to be taken to prevent nuisances at all stages of the project, especially with regards to odours from decomposing / uneaten fish, oil slick from baitfish, etc on bathing areas and the coastline in general.

Proposed development by the Department of Fisheries and Aquaculture of a North Aquaculture Zone off is-Sikka l-Bajda, St Paul's Bay

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Stakeholder Consultation during the formulation of the EIA Report

Consultee: Transport Malta

Date of Meeting: 17 April 2018

Present: Capt. David Bugeja, Capt. Fritz Farrugia, Mr Joe Bianco

Issues discussed:

AJD Tuna Ltd:

- TM's main concern is that the farms are not maintaining the special marker buoys at the surface showing the area for exclusive use.
- TM's interest is in navigational safety. To this end, it is imperative that the outer perimeter of the farm / Aquaculture Zone must be marked with special marker buoys.
- The operators are to shoulder responsibility for the maintenance on navigational aids (TM monitors the position of the farms and the maintenance of navigational aids)
- Current AJD site (5 km) is "too close for comfort" from a safety of navigation point of view. The position of the moorings inside the bunkering zone is only being tolerated. However, the surface marker buoys must be located outside the bunkering zone.

North Aquaculture Zone:

- Location of the survey area is close to the approaches to Mellieha / St Paul's Bay for the north, which must remain unencumbered for free navigation
- Extensions preferred to be located further outward >100 m depth with industry good practice moorings
- DFA should push for the industry to work in deeper waters

- Designated NAZ should be located in the outer area (> 100 m depth), well clear of the bunkering area. This outer area should be also discussed with the AFM in view of the firing arcs
- Locating the NAZ further offshore should not be a problem from a navigation point of view as long as the farms are properly marked and charted. Navigation will adjust.

Proposed development by the Department of Fisheries and Aquaculture of a North Aquaculture Zone off is-Sikka l-Bajda, St Paul's Bay

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Stakeholder Consultation during the formulation of the EIA Report

Consultee: Nature Trust FEE Malta

Date of Meeting: 17 April 2018

Present: Vincent Attard

Issues discussed:

The meeting focused on the overall environmental impacts of tuna farming in Malta. The main issues pointed out by Nature Trust FEE Malta were:

- Nature Trust does not see much of an issue with the NAZ being located so far offshore, especially in view of the presence of the bunkering area in between the shore and the NAZ location.
- The main issues remain noise, vibrations, light pollution, especially their effects on the avifauna.
- Also, concerned at the oil and slime discharges and the dumping of offal at sea.

Proposed development by the Department of Fisheries and Aquaculture of a North Aquaculture Zone off is-Sikka l-Bajda, St Paul's Bay

Proposed extension of the temporary tuna farm operated by AJD Tuna Ltd off Is-Sikka l-Bajda through the addition of 12 cages to increase the number of cages to 24 without increasing the amount of fish farmed (PA/02175/18)

Stakeholder Consultation during the formulation of the EIA Report

Consultee: Malta Tourism Authority

Date of Meeting: 24 April 2018

Present: Perit Kevin Fsadni, Stephanie Attard

Issues discussed:

The main issues discussed at the meeting highlighted the importance of the area for tourism in its wider sense, and includes social effects, as follows:

- The Mellieha – St Paul's Bay area is an important tourism zone
- The location of the NAZ further out at sea should not create visual issues (the further out the better)
- Sport diving should not be negatively impacted by the farming activities (the NAZ should be located away from known sites, e.g. the HMS Stubborn wreck)
- Archaeology should also not be impacted
- The main concern from a tourism/recreation point of view is the oil/slime problem encountered in recent years
- MTA would like the farms to commit to positive and practical measures (e.g. R&D initiatives re: feeding to minimise these impacts)

Proposed development by the Department of Fisheries and Aquaculture of a North Aquaculture Zone off is-Sikka l-Bajda, St Paul's Bay

Proposed extension of the temporary tuna farm operated by AJD Tuna Ltd off Is-Sikka l-Bajda through the addition of 12 cages to increase the number of cages to 24 without increasing the amount of fish farmed (PA/02175/18)

Stakeholder Consultation during the formulation of the EIA Report

Consultee: Malta Amateur Fishermen Association

Date of Meeting: 21 May 2018

Present: Dr Joe Carabot Damato, Mr Frank Abela, Mr Reno Falzon, Mr Angelo Attard, Mr Tony Cauchi, Me=r Victor Chircop

Issues discussed:

The meeting was attended by representatives of different amateur fishing associations located in different parts of Malta. In view of this, there were distinct positions from the different fishermen, depending on their personal experiences (which depends on the areas that they fish). The main issues raised were:

- Fish farms are typically a magnet for fish. These can affect other areas as they attract fish to the farm, depopulating other areas.
- Fishermen are seeing problems with wild tuna remaining in local waters as they are attracted to the pens. These wild tuna then prey on the smaller fish that the fishermen would normally target. As a result they claim to have seen a drastic reduction in numbers of prey species in certain areas.
- Other fishermen praised the farms as they attribute the increase in fish to their presence.

AJD Tuna Ltd:

- With regards to AJD's proposal to increase the number of cages, the Association members found no objection as long as the area taken up (enclosed by the outer perimeter buoys) does not increase.

Proposed development by the Department of Fisheries and Aquaculture of a North Aquaculture Zone off is-Sikka l-Bajda, St Paul's Bay

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Stakeholder Consultation during the formulation of the EIA Report

Consultee: Birdlife Malta

Date of Meeting: 21 May 2018

Present: Nicholas Barbara, Janina Laurent

Issues discussed:

The meeting focused mainly on the potential impacts of tuna farming off the north eastern coast of Malta and the impacts these can have on the breeding seabird colonies in the north of the island.

- According to international criteria, rafting is considered to take place within 7 km from the nesting sites . This has been modelled over 2 years, which has shown that the areas in front of the colonies are important for rafting and possibly also feeding.
- Tuna farms as proposed might result in the displacement of the rafting birds (no hard and fast evidence as yet).
- Birdlife is also looking into the attraction of gulls to the fish farms. Gulls are predators of seabirds and hence, if they are attracted in large numbers the predation pressures on the breeding seabird colonies may increase.
- Light and increased traffic are also of concern (though Birdlife acknowledged that the activity in the bunkering zone may be a greater source of impacts, even if the two together can lead to further cumulative concerns).
- Seabirds have a very well developed olfactory sense – they might be attracted to the farm from the oils or feed.
- Birdlife wants to avoid displacement of seabirds, which could lead to the abandonment of nests. Recently seabirds have recolonised Selmunett and Rdum tal-Madonna is recovering from rat eradication.
- The biggest threats to seabird populations are light pollution, coastal development and increased shipping activity (including noise).

- Birdlife requests the establishment of a proper monitoring regime to determine the impacts on the seabird communities.

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Stakeholder Consultation during the formulation of the EIA Report

Consultee: 'Stop the Slime' Campaigners

Date of Meeting: 23 May 2018

Present: Nicolai Abela and Mark Gatt

Issues discussed:

Mr Abela and Mr Gatt represented the 'Stop the Slime' campaign, which was launched to raise awareness and counteract the effects of emissions from fish farms operating in St Paul's Bay. The main issues raised were:

- The main concern is with the oil slicks from the tuna farms in St Paul's Bay.
- They have met the fish farmers over the past months but they have seen very little progress to date.
- The group's focus and interest is St Paul's Bay. They claim that the odour from the farms can be smelt even from the St Paul's Bay by-pass.
- Also, they claim that the oil sheen from the farms would likely be very visible from high places such as High Ridge.
- In discussing environmental issues, they recognised that maerl (which is found growing in extensive areas of seabed off Is-Sikka l-Bajda is important but they consider the Sikka l-Bajda itself and its surroundings, including caves that used to be full of marine life (including Groupers), is more important.
- The Group appreciate that the AJD cages have been moved outwards but they would like to see them moved further offshore, away from Is-Sikka l-Bajda, either along or beyond the drop-off.
- They are also concerned at the processing vessel and its activities. This vessel should be located well offshore and further out at sea than the cages. They claim that in past years it has often been located on Is-Sikka l-Bajda itself.
- The Group provided copies of reports they had produced on this matter.

Proposed development by the Department of Fisheries and Aquaculture of a North Aquaculture Zone off is-Sikka l-Bajda, St Paul's Bay

Proposed extension of the temporary tuna farm operated by AJD Tuna Ltd off Is-Sikka l-Bajda through the addition of 12 cages to increase the number of cages to 24 without increasing the amount of fish farmed (PA/02175/18)

Stakeholder Consultation during the formulation of the EIA Report

Consultee: Armed Forces of Malta

Date of Meeting: 28 May 2018

Present: AFM: Brig. Jeffrey Curmi, Col. Clinton J. O'Neill, Jonathan Borg, James Grech,

AJD: Charles Azzopardi

Issues discussed:

The main issues discussed at the meeting focused on the location of the AFM firing arcs at the Pembroke Rifle Ranges and in particular the Pembroke High danger area and the impact this has on the location of the temporary tuna farm operated by AJD Tuna Ltd and the selection of the location of the proposed North Aquaculture Zone.

- The Brigadier made it clear that the ranges cannot be touched and the Arcs of fire established in the navigational charts (both the inner and the outer live practice firing arcs) cannot be moved. These have been established through detailed studies and are also recognised by the control tower.
- Activities such as fish farming, bunkering, etc., inside these areas are prohibited.

AJD Tuna Ltd:

- AFM had acceded to a 1 year tolerance for the AJD Tuna Ltd farm but this cannot be extended also in view that the farm attracts amateur fishermen that can be put in danger.
- The AFM strongly recommended that AJD reconfigure the cages layout so as to push all the cages outside of the danger area.
- Brigadier asked if tuna farms had considered pooling resources to check moorings of all fish farms by using a team, of specialised technical divers. Cages can be checked normally as they do not go deeper than 35 m, but the moorings require technical divers.

North Aquaculture Zone:

- AFM insists that the NAZ must be located outside the danger area as well.
- AFM commented that there aren't many places within 50 – 60 m depth of water. For this reason, the tuna farming industry should be looking into deeper waters > 80 – 100 m. This would require purposely designed moorings. Most of the work can then be done remotely and farms should stop using sport divers in any case.
- It would be advisable for farms to team up and commission a commercial diving outfit to carry out all maintenance on the cages etc using special gas mixes or a direct surface air supply. Most divers working with fish farms at the moment are sport divers and should not be doing this work at such depth. A lot of the work can be done remotely by video and use of cranes. This will require investment but by teaming up the cost can be shared and the liability passed on to the contractors.

Proposed development by the Department of Fisheries and Aquaculture of a North Aquaculture Zone off is-Sikka l-Bajda, St Paul's Bay

Proposed extension of the temporary tuna farm operated by AJD Tuna Ltd off Is-Sikka l-Bajda through the addition of 12 cages to increase the number of cages to 24 without increasing the amount of fish farmed (PA/02175/18)

Stakeholder Consultation during the formulation of the EIA Report

Consultee: Professional Diving Schools Association

Date of Meeting: 11 June 2018

Present: Simon Sciberras, President

Issues discussed:

The meeting focused on the effects of fish farming in general and its impacts on the marine environment and the diving industry particularly. The main issues raised were:

- PDSA are against fish farming in general as an activity but they understand that the operators of these establishments need to work.
- They however insist that regulations are followed and enforced and breaches rectified immediately.
- Authorities must ensure that the permit conditions (planning, environment and aquaculture permits) are followed and honoured by all operators. If not, then the permits should be revoked.
- Operational management on the farms must also be improved to eliminate the external effects on the surrounding seas and the other legitimate activities.

Proposed development by the Department of Fisheries and Aquaculture of a North Aquaculture Zone off is-Sikka l-Bajda, St Paul's Bay

Proposed extension of the temporary tuna farm operated by AJD Tuna Ltd off Is-Sikka l-Bajda through the addition of 12 cages to increase the number of cages to 24 without increasing the amount of fish farmed (PA/02175/18)

Stakeholder Consultation during the formulation of the EIA Report

Consultee: Mellieha Local Council

Date of Meeting: 18 June 2018

Present: Mellieha Council Members

Issues discussed:

The following were the main issues raised at the meeting:

- In principle the Mellieha Local Council agrees with the proposals (i.e. the extension of the AJD Tuna Ltd farm as long as the amount of fish (biomass) is not increased, and the location of the North Aquaculture Zone to contain the tuna farms).
- Re: AJD Tuna Ltd's proposal, the Council asked whether the number of cages and the biomass would increase if the ICCAT increases the catch quotas for the tuna (it was explained that the farm quotas are established through the aquaculture permits and the change in catch quotas does not lead to an increase in farm quotas).
- The Council would support a northward relocation of the farms.
- The Council would prefer the zone not to be too large. They would expect this to be the minimum size required for the amount of biomass being planned.
- They also expect there to be only one zone in the north, with the AJD Tuna Ltd farm being relocated to the North Aquaculture Zone if this is established at a different location.
- The Mellieha Council prefers (and will support) the location of the NAZ further to the northwest away from Mellieha Bay

Proposed development by the Department of Fisheries and Aquaculture of a North Aquaculture Zone off is-Sikka l-Bajda, St Paul's Bay

Proposed extension of the temporary tuna farm operated by AJD Tuna Ltd off Is-Sikka l-Bajda through the addition of 12 cages to increase the number of cages to 24 without increasing the amount of fish farmed (PA/02175/18)

Stakeholder Consultation during the formulation of the EIA Report

Consultee: St Paul's Bay Local Council

Date of Meeting: 4 July 2018

Present: Executive Secretary

Issues discussed:

The following were the main issues raised at the meeting:

AJD Tuna Ltd:

- The Council supports the relocation of the AJD Tuna Ltd farm from its previous site off St Paul's Bay to its current (temporary) site.
- The Council also does not object to the increase in the number of cages but the farm must eventually move to the North Aquaculture Zone once this is set up.

North Aquaculture Zone:

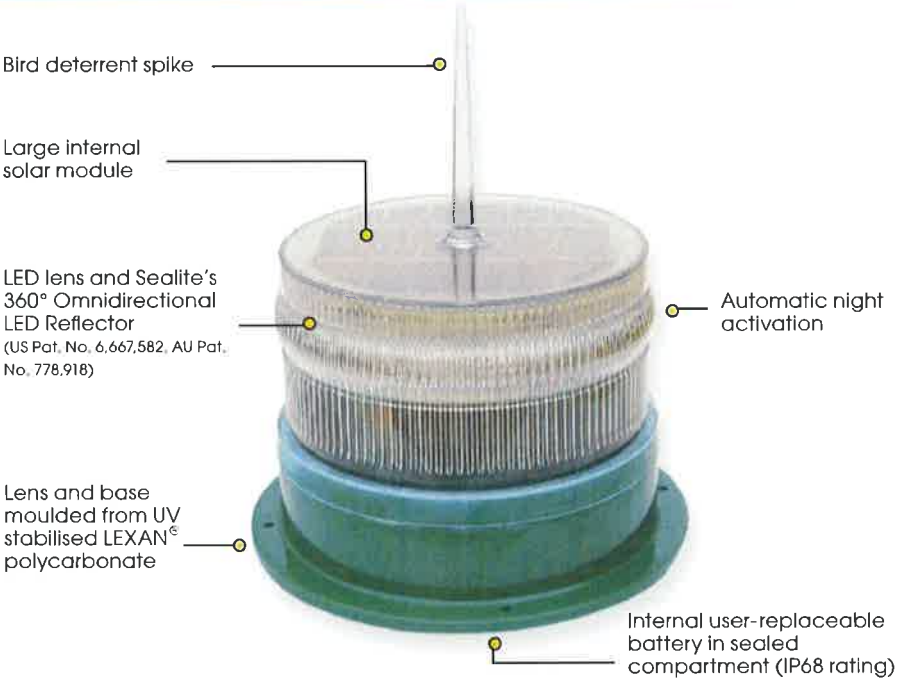
- If the Department of Fisheries opt for an "inshore" site (e.g. where AJD Tuna Ltd is currently operating temporarily), for the establishment of the NAZ, the Council would not object if this is found through the assessment to be the best site; however, they would object to the establishment of a NAZ and AJD remains outside of it. Two sites will not be acceptable to the Council.
- If it is technically possible for the NAZ to be located further out at sea it would be preferable. This also in view of congestion of maritime uses and the close proximity of the bunkering zone to the temporary site used by AJD Tuna Ltd.
- Council suggested that if the cost of relocating the AJD Tuna Ltd farm to a deeper location is greater, but the best NAZ location is found to be the deeper one beyond the drop-off, then the Department of Fisheries could consider assisting financially in meeting the difference in the expense of relocating the farm

Appendix 2: Specifications for navigational lights

SL60
2nm Solar Marine Light

Sealite
www.sealite.com.au

This equipment complies with requirements of the U.S. Coast Guard in 33 CFR part 66



The Sealite Advantage

- Red, green, yellow, white or blue
- 256 IALA flash patterns, user-adjustable without the need for external devices
- User-replaceable battery in sealed battery compartment
- 4 user-adjustable intensity settings
- ON/OFF storage switch
- Bird deterrent spike
- IP68 waterproof

Shown with optional 200mm OD base pattern

The Sealite SL60 is the most popular and versatile 2nm solar marine light available. Made from tough, durable polycarbonate and using the latest high-intensity LED's, no expense has been spared in the design and development of this lantern.

The SL60 can be installed in minutes, and requires no operator intervention. The flash-characters are easily adjusted on-site by the user, and the lantern has a permanent ON/OFF switch for easy storage.

During daylight hours the solar module will charge the battery, and the lantern will automatically begin operation at dusk – once the ambient light threshold drops sufficiently.

The SL15, SL60 & SL70 lanterns are the only compact marine lanterns available with a sealed battery compartment, allowing the battery to be replaced after years of service – don't throw the light away at the end of the battery service life.

The unit is sealed using polycarbonate bonding compounds similar to those used by major automobile manufacturing companies.

The SL-CGC 60W, an enhanced version of the SL60, is United States Coast Guard approved for use on Class "C" structures.

SL60's marking gas transfer lines, Guajira Peninsula, Colombia

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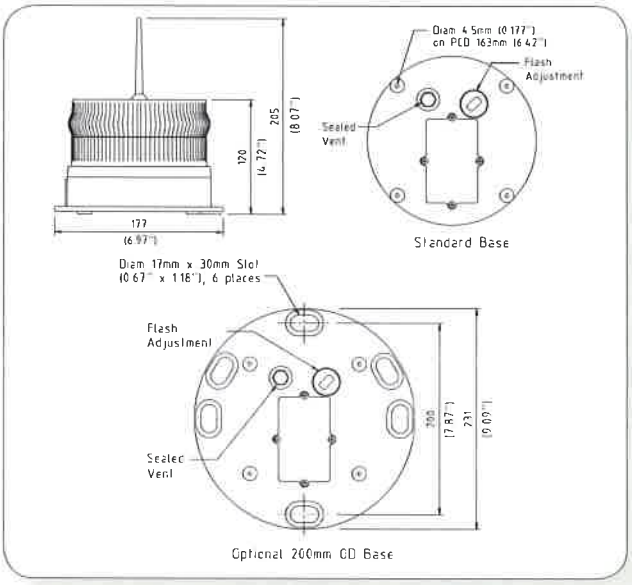
SL60
2nm Solar Marine Light

Battery access via sealed compartment



SPECIFICATIONS •

Light Characteristics	
Light Source	6 ultra-high intensity LEDs
Available Colours	Red, Green, White, Yellow, Blue
Peak Intensity (cd)	>8.3
Visible Range (nm)	>2
Horizontal Output (degrees)	360
Vertical Divergence (degrees)	9
Reflector Type	Omnidirectional 360° LED Reflector (US Pat. No. 6,667,582. AU Pat. No. 778,918)
Available Flash Characteristics	Up to 256 IALA recommended (user adjustable)
Intensity Adjustments	Adjustable in 25% increments
LED Life Expectancy (hours)	100,000
Electrical Characteristics	
Current Draw (mA)	Minimal
Circuit Protection	Integrated
Operating Voltage (V)	3.6
Autonomy (days)	>20 (14 hour darkness, 12.5% duty cycle)
Solar Characteristics	
Solar Module Type	Multicrystalline
Output (watts)	1.4
Solar Module Efficiency (%)	14
Charging Regulation	Microprocessor controlled
Power Supply	
Battery Type	High grade NiMH - Environment friendly
Battery Capacity (Ah)	4
Nominal Voltage (V)	3.6
Physical Characteristics	
Body Material	LEXAN ® Polycarbonate – UV stabilised
Lens Material	LEXAN ® Polycarbonate – UV stabilised
Lens Diameter (mm/inches)	140 / 5½
Lens Design	External optics with interior flute design
Mounting	4 x 4.5mm mounting holes
Height (mm/inches)	205 / $8\frac{1}{8}$
Width (mm/inches)	177 / $7_{\frac{3}{8}}$
Mass (kg/lbs)	1.1 / $2\frac{3}{8}$
Product Life Expectancy	Up to 12 years
Certifications	
CE	EN61000-6-3:1997, EN61000-6-1:1997
Quality Assurance	ISO9001:2000
Waterproof	IP68
Intellectual Property	
Patents	US Pat. No. 6,667,582. AU Pat. No. 778,918
Trademarks	SEALITE® is a registered trademark of Sealite Pty Ltd
Warranty	3 years
Options Available	• 8Ah battery • 200mm OD base • Hard wire synchronisation • 50mm pole mount adaptor plate

CE

• Specifications subject to change or variation without notice

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