**PA/05908/23 & EA/00007/18**

**PROPOSED CONVERSION FROM A TEMPORARY TO A PERMANENT TUNA FARMING AREA AS ESTABLISHED IN PA/02175/18; RETAINING THE APPROVED TOTAL BIOMASS OF FISH AND ALL RELATIVE CONDITIONS**

---

# ENVIRONMENTAL IMPACT ASSESSMENT UPDATE REPORT
# VOLUME 1: COORDINATED REPORT

**Version 1: January 2025**

**Report Reference:**

**Adi Associates Environmental Consultants Ltd, 2025. PA/05908/23 & EA/00007/18 - Proposed Conversion from a Temporary to a Permanent Tuna Farming Area as Established in PA/02175/18; retaining the approved total biomass of fish and all relative conditions. Environmental Impact Assessment Update Report. Version 1. San Gwann, January 2025; vi + 101pp + 2 Appendices.**

THIS IS A DIGITAL COPY OF THE REPORT.

RESPECT THE ENVIRONMENT – KEEP IT DIGITAL

# Quality Assurance

**PA/05908/23 & EA/00007/18 - Proposed Conversion from a Temporary to a Permanent Tuna Farming Area as Established in PA/02175/18; retaining the approved total biomass of fish and all relative conditions**
**Environmental Impact Assessment Update Report**
January 2025

Report for: **Department of Fisheries & Aquaculture**

## Revision Schedule

| Rev | Date | Details | Written by: | Checked by: | Approved by: |
|---|---|---|---|---|---|
| 00 | Jan 2025 | Draft to client | **Adrian Mallia**<br>EIA Coordinator | **Eilis McCullough**<br>Senior Planning Consultant | **Rachel Xuereb**<br>Director |

File ref: G:_Active Projects\EIA\DFA009 - Conversion from temporary to permanent tuna farming area North Malta\EIA Update Report\PA 05908-23_EIA Report Addendum_FINAL.docx



**Kappara Business Centre**
**113 Triq Birkirkara**
**San Gwann SGN 4197**
**MALTA**

**Tel.: 21378172**

**Email: mgmt@adi.com.mt**
**Web: www.adi-associates.com**

# CONSULTANTS' DECLARATION

Adi Associates Environmental Consultants Ltd, Malta, prepared this Environmental Impact Assessment Update 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

# CONTENTS

# FIGURES

# TABLES



# APPENDIX

# 1. INTRODUCTION

1.1. This Environmental Impact Assessment Update Report (EIA Update Report) describes an update to the EIA originally commissioned by AJD Tuna Ltd for their planning application to consolidate a temporary tuna farming area at a parcel of sea located off the northeast coast of Malta approximately 5 kilometres 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. The proposal, which was the subject of development permit application PA/02175/18, was approved by the Planning Authority in May 2019.

1.2. The current proposal is for the conversion of the tuna farming facility approved in 2019 from a temporary to a permanent one as described in development permit application PA/05908/23. The change is being proposed by the Department of Fisheries and Aquaculture (DFA) as the owner of the aquaculture zone on behalf of AJD Tuna Limited (the operator of the tuna farming facility). The DFA is hereinafter referred to as 'the Applicant'; the proposed conversion project is hereinafter referred to as 'the Scheme'.

## BACKGROUND

1.3. As mentioned, an EIA was first prepared in July 2018 on behalf of AJD Tuna Limited to support application PA/02175/18, which proposed the consolidation of two tuna farming operations that had already been approved under two separate applications (PA/03072/17 and PA/05858/17). The original scheme site was located at 5 km offshore and had a total biomass of 3,300 tonnes. This development came about following a decision by the Planning Authority to revoke all permits for all tuna farms in Maltese waters in September 2016 and ordering all farms to relocate to approved aquaculture zones by May 2017.

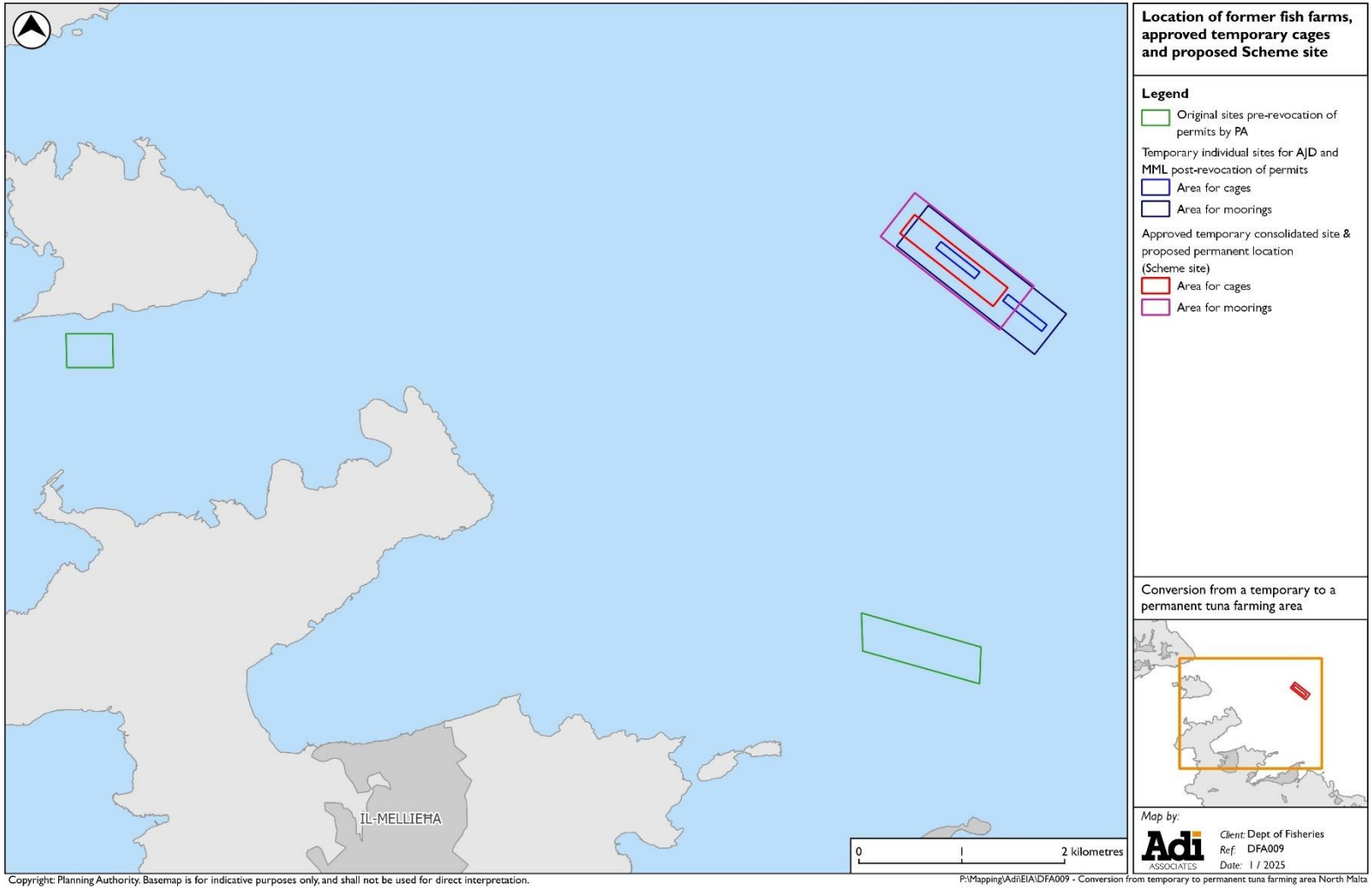
1.4. The ERA had requested an EIA as the proposal fell under Schedule 1, Category 1, Section 8.2.1.1 of the Environmental Impact Assessment Regulations, 2017 (S.L. 549.46).

1.5. The permit was approved in May 2019 and covered the consolidation of the former AJD Tuna Ltd and MML tuna farms relocated from St Paul's Bay and the South Comino Channel, respectively, in one area approximately 5 km offshore. The biomass reared did not increase and covered the cumulative biomass allowed to be reared in the two farms mentioned. **Figure 1.1** shows the location of the two original farms in Comino and St Paul's Bay, their temporary relocation site 5 km offshore and the final approved consolidated area, subject of application PA/02175/18 and of the current proposal for conversion to a permanent facility. **Figure 1.2** shows the location of the Scheme site with distances from shore.

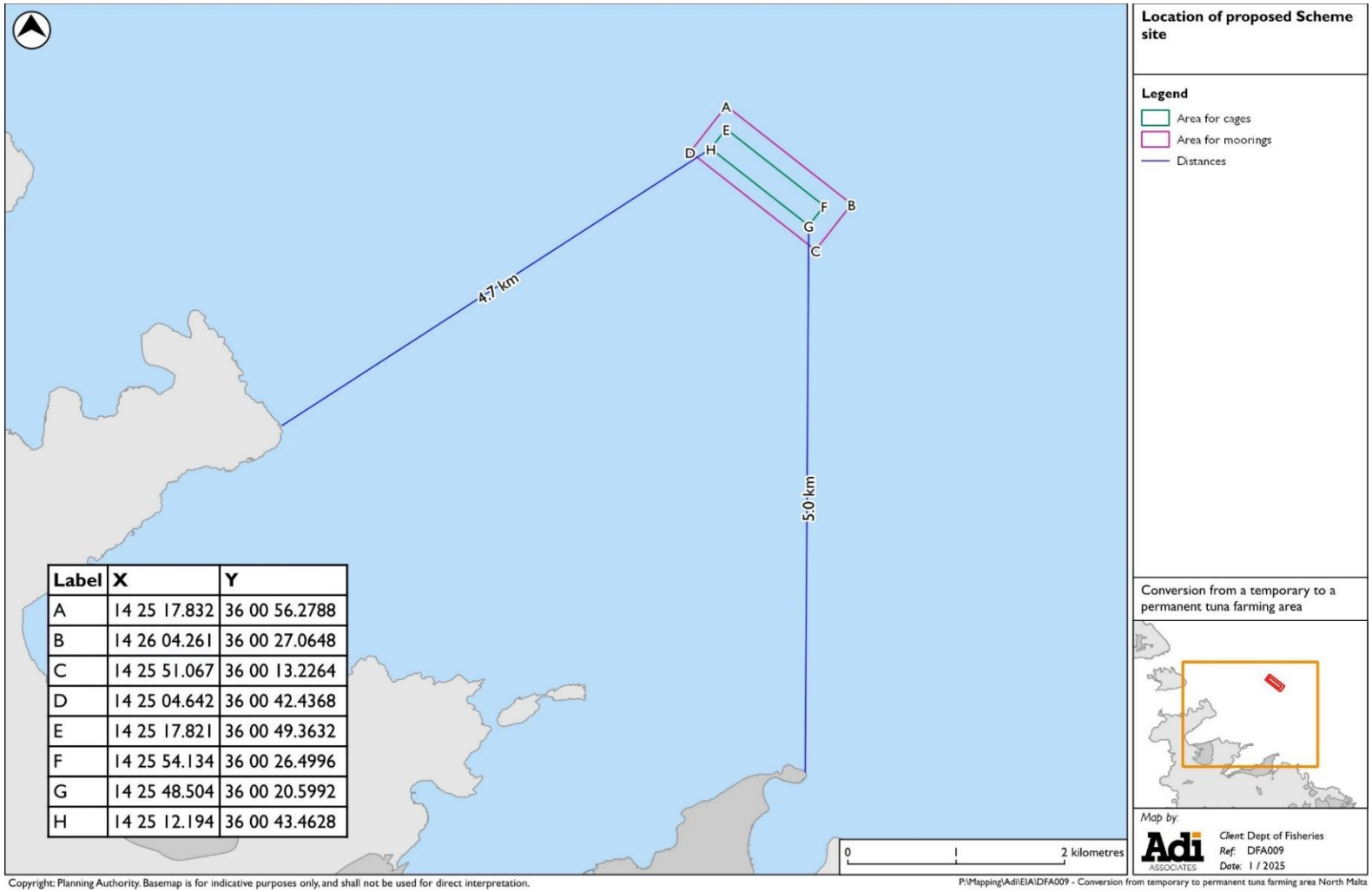
1.6. In addition to this application, whose location was deemed to be only a temporary solution (see below), a second application, this time by the Department of Fisheries and Aquaculture (PA/04811/19) was submitted for the establishment of a North Aquaculture Zone (NAZ) to complement that already set up in the South of the island, approximately 6.3 km off Marsaskala in 2006. The application proposed to relocate tuna farms in the north of Malta for a total biomass of approximately 5,000 tonnes of fish. The application for the NAZ was itself the subject of an EIA process.

The application is still awaiting a decision, and the process is currently on hold in view of a re-evaluation by the DFA of the country's aquaculture strategy for the future, which is likely to include a diversification away from tuna farming.

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



## 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 |

1.7. The operation by AJD Tuna Ltd at the Scheme location includes an average of 24 cages, with each cage containing approximately 1,200 fishes with an average mass of 115 kg (or a total of 137.5 tonnes of fish per cage). This stocking density corresponds to the maximum capacity (3,300 tonnes) of the farm as defined by ICCAT.

1.8. Transport Malta's Harbour Master directed that the search area should be located no closer than 300 m from the bunkering zone.

1.9. 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.

### Proposed changes to the Scheme

1.10. As explained by the project architect, the Scheme as proposed in development permit application PA/05908/23 is identical to that approved in PA/02175/18 in terms of the location of the Scheme, the number of cages / amounts of biomass to be reared, and the number, type, and area of moorings for the cages deployed. The only difference is that instead of a temporary facility that would move to a further offshore location once the NAZ is established, it will become a permanent one at this same location such that the impacts assessed as "short-term and/or temporary (for as long as the fish farm is in operation)", will now become permanent and long-term.

1.11. The full set of plans for the Scheme as proposed are included in **Appendix 1**.

1.12. In a communication to the Planning Authority dated 6 November 2023, the Environment and Resources Authority (ERA) advised the following:

> *"ERA notes that the above-mentioned project proposes a change of use of the site from temporary as per in PA/02175/18 to a permanent one. In this regard, ERA requires a Statement from the EIA Coordinator outlining whether the said change will affect the conclusions of the EIA and AA Reports undertaken for PA/02175/18.*
>
> *Following the receipt of the said Statement, ERA would be in a position to determine whether the proposal (PA/ 05908/23) requires an EIA update or otherwise."*

1.13. On 31 January 2024, Adi Associates, as EIA Coordinators of the original EIA Report for PA/02175/18, submitted a statement to ERA assessing whether the proposed conversion of the tuna farming facility from a temporary one to a permanent one, as submitted to the Planning Authority and subject of development permit application PA/05908/23 would have a significant impact on the environment beyond that which had already been assessed in the original EIA Report.

1.14. The EIA Statement concluded that while individually the impacts are not expected to differ from those assessed in the original EIA, impacts assessed as being short term or temporary could become long-term and/or permanent. This could, in the long

run, lead to chronic effects on the environmental resources impacted. In addition, it was noted that detailed consideration should be given to the fate of the proposed NAZ and its pending development permit application (PA/04811/19), since the cumulative effects from the Scheme and the NAZ could further exacerbate the negative impacts. This is still an uncertain scenario, and a detailed assessment would be required once this matter is clarified.

1.15. On 9 February 2024, ERA issued a further instruction, which stated:

> *The assessment of long-term impacts on the seabed that can potentially occur as a result of the proposed conversion of AJD Tuna Limited cages from a temporary to a permanent installation, should be based on updated studies and compared with the baseline studies that were undertaken for the EIA/AA for the temporary sites.*
>
> *In this regard, the assessment should include the following potential impacts:*
>
> - *impacts on seabed habitats including rhodoliths/maerlbeds and associated ecosystems from fish waste and uneaten feed;*
> - *impacts on water quality from nutrient loads and other pollutants;*
> - *the extent of the area affected throughout the operations and the recovery potential of such areas;*
> - *effect on the conservation objectives of Natura 2000 marine sites*

1.16. ERA also requested that the response be submitted as an EIA Report Update in line with regulation 24 (3) of the EIA Regulations.

## PURPOSE OF THE EIA REPORT

1.17. The purpose of this EIA Report is to present the findings of the EIA Update. EIA is the process of systematically assessing the likely significant environmental impacts of development proposals. EIA also ensures that the significance of these impacts, and the scope for reducing them, is clearly understood by both the public and by ERA and the Planning Authority (PA), before a decision is made on whether the development should be approved.

## THE EIA PROCESS

1.18. The current legislation on the EIA process is contained in the *Environmental Impact Assessment Regulations* (as amended, S.L. 549.46). As explained above, the ERA has advised that the Scheme requires an EIA, where it falls within the scope of Schedule I (Category I, Section 8.2.1.1) of the EIA Regulations. This EIA Update is required in terms of regulation 24(3) of the Regulations which deals with updates to the EIA as a result of changes to proposals.

### Terms of Reference for the EIA Update

1.19. The ERA did not issue formal Terms of Reference for the EIA Update; however, it

provided the guidance referred to above.

1.20. The EIA Coordinator discussed the requirement for the new studies with ERA and, in view of the existence of regular marine monitoring reports undertaken at the site in connection with the tuna facility's environmental monitoring programme, it was agreed that these data could be used to assess the actual impact from the facility against the predicted impact in the EIA.

1.21. As agreed, this EIA Update Report assesses the Scheme impacts in respect of the impacts on the seabed and the benthic habitats, impacts on water quality, and effects on the Natura 2000 site conservation objectives, including impacts on seabirds.

1.22. It should also be noted that ERA also requested an update to the Appropriate Assessment undertaken for the same Scheme, which is reported upon separately.

### EIA Approach

1.23. Good practice necessitates that EIA 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, resulting in a more environmentally sensitive project. This approach was adopted for this EIA Update.

1.24. Baseline studies for the specialist EIA topics were undertaken to inform the original EIA. The method statements for these studies were agreed with the ERA. The ERA agreed that these baseline studies will be used as the benchmark against which the impacts for the operations can be compared and hence remained relevant for the EIA Update. As mentioned, it was also agreed that new data from the environmental monitoring programmes for the tuna facility (undertaken by third party consultants between 2019 and 2023[1]) will be reviewed and used in assessing the actual impacts from the operations on the seabed habitats and the water quality.

### Significance of Impacts

1.25. Assessment of the significance of impacts arising from a development is a key stage in the EIA process. This judgement is critical in informing the decision-making process. However, defining significance can be difficult. In general terms, environmental significance involves assessing the amount of change to the environment perceived to be acceptable to the community (Sippe, 1999).

1.26. The same criteria used in the original EIA were used in this EIA Update to assess the significance of an impact, namely:

- Type of impact (adverse / beneficial);
- Extent and magnitude of impact;
- Direct or indirect impact;

[1] Environmental monitoring programme undertaken by Ecoserv Ltd for AJD Tuna Limited.

- Duration of impact (short term / long term; permanent / temporary);
- Comparison with legal requirements, policies and standards;
- Sensitivity of receptor (residential dwellings, hotels, 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.

1.27. Using these criteria, the significance of the impacts arising from the Scheme was categorised in the EIA Report, as follows:

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

1.28. Definitions of the meaning of the 'significance categories' above in relation to each topic area are included in the individual topic area chapters (see **Chapter 3** and **Chapter 4** of the EIA Update Report). However, in general terms, if an impact is 'not significant', it is considered to be environmentally acceptable; an impact of 'minor significance' refers to an impact that is considered to be manageable; and an impact of 'major significance' refers to an impact that is considered to be environmentally damaging such as to require that the Scheme be redesigned, or that mitigation measures be put in place to minimise the impact.

1.29. The EIA Update Report includes an assessment of the significance of predicted impacts on the aspects identified by ERA and, following the implementation of any proposed mitigation measures, the significance of any residual impacts. A summary of the identified significant impacts and a comparison with those assessed in the original EIA of 2019 is included in **Chapter 5**. The recommended mitigation measures, and the residual impacts, are described in respect of each topic area, at the end of the relevant chapter (see **Chapter 3** and **Chapter 4**).

## UNCERTAINTY

1.30. The EIA process is designed to enable good decision-making based on the best possible information on the environmental implications of a development. There will always be some uncertainty in predicting potential impacts, as to the exact nature and scale of the impacts. This arises through shortcomings in information, doubts, or lack of certainty on the likelihood that an incidence would occur, and / or due to the limitations of the prediction process itself. In this case, an assessment is also being made based on monitoring data, which reduces significantly the uncertainty; however, forecasting further impacts for future operations will retain a degree of uncertainty. Where uncertainties have arisen, and where they remain, this is clearly stated in this EIA Update Report.

## CONSULTATION

1.31. There has been consultation with ERA throughout the EIA Update process. Additionally, at the outset of the EIA Update process, the Consultants invited the St Paul's Bay, Mellieha, Għajnsielem, and Qala Local Council, the Malta Tourism Authority, Transport Malta, and the Armed Forces of Malta, as well as the non-governmental organisations (NGOs) Din l-Art Ħelwa, Flimkien għal Ambjent Aħjar, Nature Trust – FEE Malta, Birdlife Malta, and Moviment Graffitti, and the Federazzjoni tal-Għaqdiet tas-Sajjieda Dilettanti Maltin and the Professional Diving Schools Association (PDSA) to meet to discuss the matters they considered to be important for the EIA Update.

1.32. The Consultants met with the St Paul's Bay, Mellieha, Għajnsielem, and Qala Local Councils, Transport Malta, the Malta Tourism Authority, the Armed Forces of Malta, Birdlife Malta, Moviment Graffitti and the PDSA in November 2024. The feedback from these consultations is described in **Chapter 2** of the EIA Update Report. At the time of writing this EIA Update Report, the other NGOs and associations had not responded to the request to meet with the Consultants.

## PRESENTATION OF THE EIA UPDATE REPORT

1.33. Following this Introductory chapter, this EIA Update Report includes the following chapters:

- **Chapter 2** – describes the purpose of the original Scheme and the changes being proposed, and includes a description of the Scheme, as well as the site and its surroundings;
- **Chapter 3** – Marine Benthos;
- **Chapter 4** – Marine Environment (water quality)
- **Chapter 5** – Conclusions and Recommendations.

1.34. The EIA Update Report also contains the following Technical Appendices (compiled separately as **Volume 2** of the EIA Report):

- **Technical Appendix 1**: Remote Sensing Survey Report 2018;
- **Technical Appendix 2**: Marine Ecology Baseline Report; and
- **Technical Appendix 3**: Environmental Monitoring – Integrated assessment reports (2019-2023).

# 2. DESCRIPTION OF SCHEME AND SITE

## INTRODUCTION

2.1. This chapter describes the Scheme. It explains the purpose of the Scheme and includes a description of the Scheme site and its surroundings (including ancillary supporting land bases). A more detailed description of the marine environment is included in **Chapters 3** and **4**.

## PURPOSE OF THE SCHEME

2.2. As explained in the original EIA of 2019, the purpose of the consolidation of the tuna farming operations into one operation was to improve the existing farming operation to address some of the challenges encountered in previous years, which were largely a result of not having sufficient cage space to optimally support the farm's tuna quota. The proposed changes to the Scheme are intended to maintain the current operation in the longer term, with the facility being converted to a permanent one as opposed to the current temporary nature established by the development permit, which requires the tuna farm to be relocated to the new North Aquaculture Zone when this is established.

## TUNA PENNING OPERATIONS

2.3. As described in the original EIA, the Atlantic Bluefin tuna are caught by purse seiners on the high seas, an operation overseen by ICCAT[2] observers and allowed for a restricted time during the year as the fish are migrating through the Mediterranean Sea. The fish stock is then purchased by the Applicant from the foreign fishermen. The tuna normally range in size between 50 and 300 kg, with the vast majority being between 100 and 200 kg. This has not changed over the past years and the same operations and arrangements are made to obtain the fish stocks for each year's ranching process.

2.4. The purchased tuna are transferred from the purse seiners to the farm's towing cages and once the cages are filled they are slowly towed back to the on-growing site in Malta, where they are anchored in position to the existing mooring system.

2.5. Once the tuna reach the farm, they 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 mainly to the Japanese market.

2.6. The transhipment of tuna to fattening pens is considered to be a landing operation

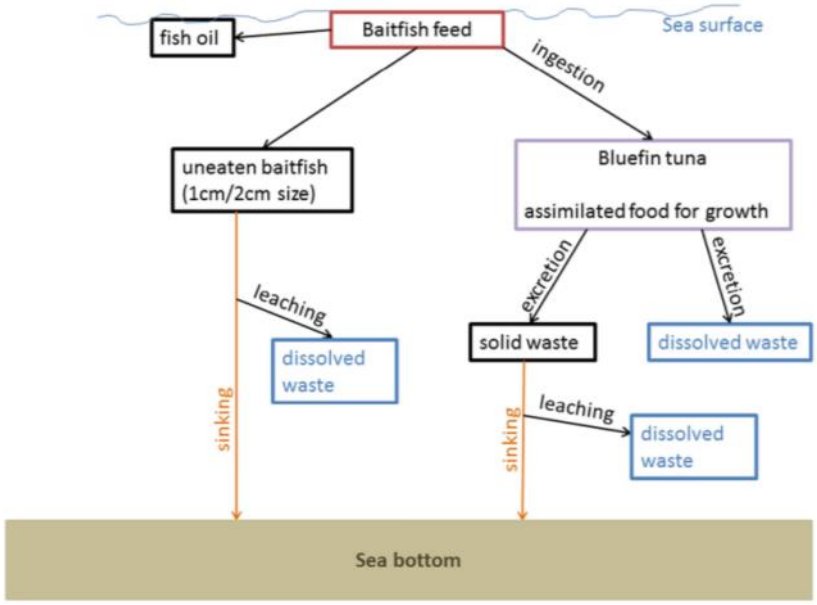
[2] ICCAT is the International Convention for the Conservation of Atlantic Tunas.

and the catches involved must comply with regulations in force[3] as well as ICCAT requirements.

2.7. The feed given to the tuna consists of small pelagic fish (herring, mackerel, anchovy, sardines, etc), which is purchased from international suppliers. Approximately 2%[4] of the stock housed in the cage is provided as feed to the tuna. At the peak of the penning season, this equates to approximately 3,000 kg of baitfish/cage/day. It is estimated that 10-25 kg of feed are required to produce 1 kg of tuna meat (EC, 2004)[5]. A more recent study (Guillen et al., 2024[6]) puts this at approximately 10 kg (FCR = 11%).

2.8. **Figure 2.1** provides a schematic diagram of the food chain and by-products of fish-rearing.

**Figure 2.1: Schematic of the food chain and by-products of fish-rearing**




Source: Artelia, 2018

[3] 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.

[4] At the start of tuna penning, this used to reach 3-4%. The amount of feed has since been reduced to 2%.

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

[6] Guillen J, Asche F, Carvalho N, Druon J-N, Llorente I, Sciberras A, Visnic´ Novakovic´ S and Vukov I (2024) How sustainable is tuna aquaculture? A methodology to assess the sustainability of seafood production systems. Front. Aquac. 3:1422372

## Feed management

2.9. The feed is delivered in reefer containers, with five containers arriving in Malta daily during the farming season; 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 2.2**). The fish are transferred from their transportation packing and placed in impermeable jumbo bags (**Figure 2.3**) and then placed in sealed trucks, where they are allowed to partially thaw overnight (**Figure 2.4**).

2.10. Early the next day (around 4:00 hrs), the baitfish are transferred to the Grand Harbour where they are delivered alongside and loaded onto a feeder vessel (**Figure 2.5**). Once loaded, the vessel sets sail towards the farm. The thaw water in the trucks is drained into IBCs and collected by a licensed waste contractor.

2.11. The tuna are fed once a day, at dawn. Semi-frozen baitfish[7] are normally placed in small feeding cages floated at the centre of the pen (**Figure 2.6**), 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.

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

- The baitfish is being imported as IQF, i.e. "individually quick frozen." IQF foods are notable for the fact that each individual piece of food is frozen separately from all the others. In this case, rather than a block of frozen fish (as used to be the case in the past years, each baitfish is now individually frozen and delivered as a separate fish. They are also typically in a semi-frozen state, which minimise the production of oils in thaw water.

- The baitfish is retained in the impermeable jumbo bags in the sealed trucks while transported from the land base in Kordin to the farm to contain the thaw water;

- The jumbo bags are delivered to the farm onboard feeder vessels. These vessels are bunded / sealed so that the thaw water from the bags is contained onboard. The vessels are certified by NAS. The thaw water is then collected from the feeder vessel by the oil containment vessels;

[7] Herring, sardines, mackerel.

- 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 much of the oil that rises to the surface inside the cages[8];
- 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 2.7**) 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;
- The tuna farm operators also appointed Aquaculture Resources Ltd to deploy three oil containment vessels to patrol the seas between the tuna penning locations to help contain and collect any oils that escape, including oils that may rise to the surface outside the cages themselves[9].

2.13. These measures have been monitored as part of the implementation of the environmental permit of the current farm.

[8] 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.
[9] Unfortunately, as also confirmed by the Environment & Resources Authority (consultation meeting, December 2024), sometimes, the oils from the baitfish are released in deeper water as the baitfish sink inside the cage. This oil often drifts out of the cage (possibly also as a result of the swimming frenzy of the tuna during the feeding) and the oil ends up surfacing some distance from the cages. In these circumstances, the oily sheen and the possible formation of oily slime might not be noticed in time for the patrolling vessels to intervene and collect it resulting in the slimy material drifting away from the farm under the action of currents and waves.

**Figure 2.2: Kordin land-base facility**

**Figure 2.3: Frozen feed transferred to jumbo bags**

**Figure 2.4: Truck with feed in jumbo bags left to partially defrost**

**Figure 2.5: Feed being loaded on to feeder vessel early in the morning**

**Figure 2.6: Loading of semi-frozen baitfish into feeding cage**

**Figure 2.7: Skimmer**

***Harvesting and processing***

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

2.15. 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[10]. Slaughtering is carried out by divers who enter the cage and harvest the tuna one by one by shooting them in the head.

2.16. The tuna are transferred to a service vessel by crane (**Figure 2.8**) from where they are then quickly transported by service boats (**Figure 2.9**) to a waiting processing vessel anchored further out at sea (**Figure 2.10**). Onboard the ship, the tuna are weighed, heads and tails are cut off and the guts removed. The head, tails and guts of the tuna, which amount to approximately 30% by weight, are a waste by-product of the industry. These used to be disposed of at sea beyond the 12 nautical mile limit as directed by the Veterinary and Phytosanitary Regulation Department. However, following the establishment of Aquaculture Resources Ltd by the Federation of Maltese Aquaculture Producers and the construction of a rendering plant in Hal Far, this waste by-product is being collected and transformed into valuable products, including protein-rich fish meal and Omega-3 and Omega-6 fish oils. These materials are essential for the cosmetic, pharmaceutical, and agricultural industries (Aquaculture Resources Ltd, 2024[11]). The operation typically generates approximately 8-10 tonnes of offal per day during the peak fattening period.

2.17. Any tuna that die are either sent to the rendering plant (if still in a good state), incinerated at the Abattoir facility, or disposed beyond the 12 nm limit.

2.18. 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 or the Azzopardi fish shop in St Paul's Bay (**Figure 2.11**). 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.

[10] 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).

[11] Aquaculture Resources Ltd website. https://aquacultureresources.com (last accessed on 20 December 2024).

2.19. 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***

2.20. Following harvesting, between November and May, the Applicant is allowed to keep up to 15% of the stock in the cages for research purposes[12]. The fish so retained are fed between two and three times a week during this period. However, over the past two years, no overwintering has taken place.

***Stocking Density***

2.21. 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[13].

***Antifouling and net cleaning***

2.22. 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***

2.23. 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[14], no chemicals or antibiotics are used[15]. Mortalities are more effectively controlled by lowering stocking densities and monitoring the fish for any signs of stress.

***Storage of feed and packing materials***

2.24. The Applicant operates two land bases (see **Figure 2.12**). 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.

---

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

[13] 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.

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

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

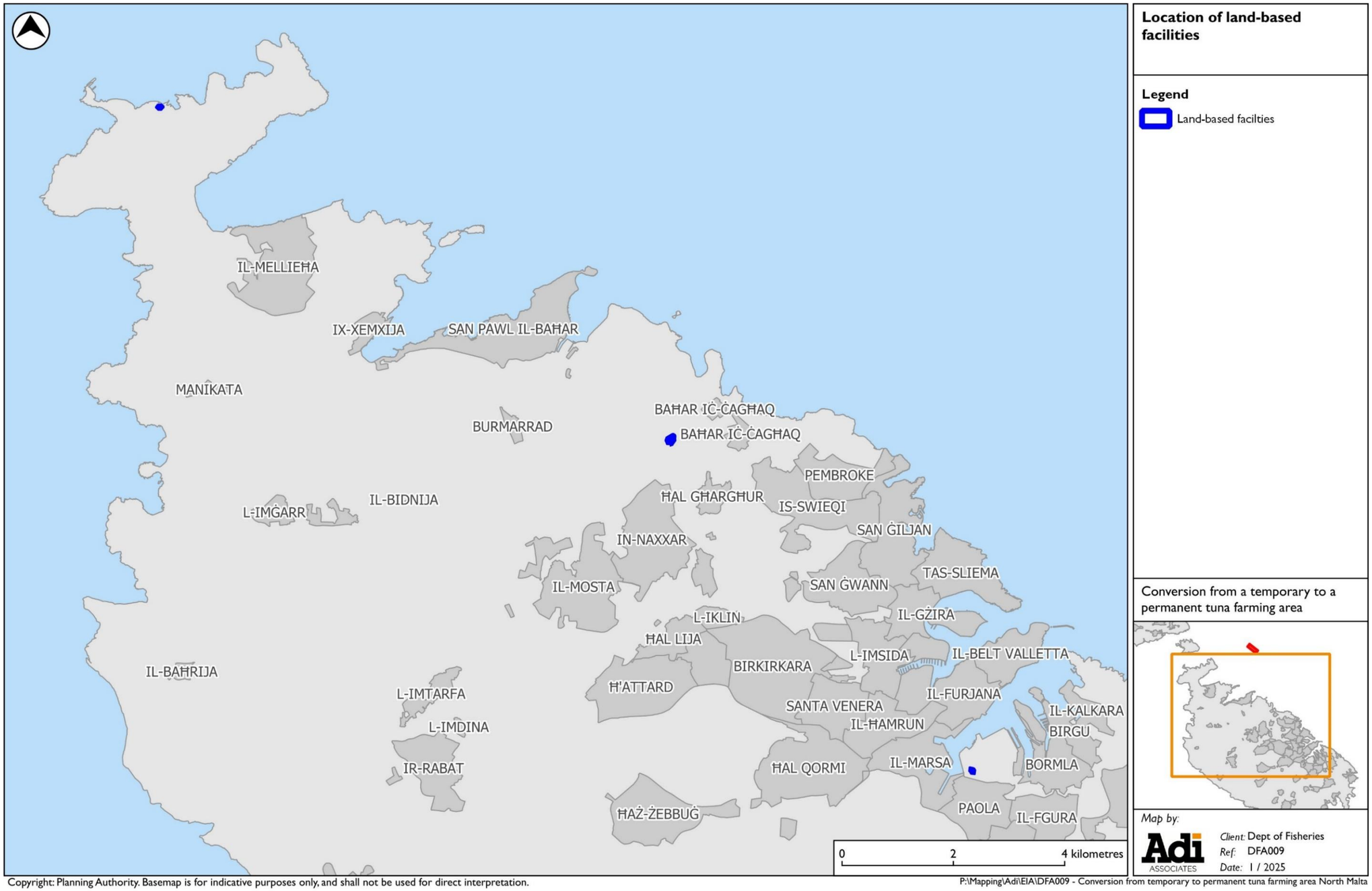
**Figure 2.8: Tuna harvesting**


**Figure 2.9: Service boat transferring tuna to processing vessel**

**Figure 2.10: Processing vessel**

**Figure 2.11: Marfa land-based facility**

**Figure 2.12: Map indicating location of land-based facilities in Marfa, Maghtab, and Kordin**




Copyright: Planning Authority. Basemap is for indicative purposes only, and shall not be used for direct interpretation.

P:\Mapping\Adi\EIA\DFA009 - Conversion from temporary to permanent tuna farming area North Malta

## CONSULTATION

2.25. As mentioned in **Chapter 1**, consultation invitations were issued to the St Paul's Bya, Mellieha, Ghajnsielem, and Qala Local Councils, the Malta Tourism Authority, Transport Malta, the Armed Forces of Malta, the Federazzjoni tal-Għaqdiet tas-Sajjieda Dilettanti Maltin, the Professional Diving Schools Association (PDSA), and the non-governmental organisations (NGOs) Din l-Art Ħelwa, Flimkien għal Ambjent Aħjar, Nature Trust – FEE Malta, Birdlife Malta, and Moviment Graffitti, and during the preparation of this EIA Update Report. The purpose of this consultation was to identify the issues these entities considered important in connection with the proposal to retain the tuna farming operation in this location as a permanent facility, and to inform the EIA Update.

2.26. Meetings were held with the St Paul's Bay, Mellieha, Għajnsielem, and Qala Local Councils, Transport Malta, the Armed Forces of Malta, the PDSA, Birdlife Malta, and Moviment Graffitti in November 2024. At the time of writing this EIA Update Report, none of the other entities / NGOs has responded to the request to meet.

2.27. Transport Malta explained that its remit is the safety of sea navigation and while they were never happy with the location of the tuna farm in its current location adjacent to the busiest bunkering zone, they will retain their no objection to the development subject to conditions to ensure safety to vessels and adherence to regulatory requirements throughout the operations.

2.28. The Malta Tourism Authority does not object to the proposal of converting the current Scheme into a permanent one if no other suitable location is available (and the farm is not brought any closer to shore); however, it recommended further oversight of operational management measures and mitigation to ensure that fish oils do not escape from the farms and any that do, are collected immediately before the slime reaches the inshore areas. Furthermore, the MTA recommended further research into the possibility of converting the feed from bait fish to artificial feed to eliminate the formation of slime.

2.29. The Armed Forces of Malta explained that it objects to the location of the current Scheme falling inside the LM-D1 firing arc and has expressly requested that the cages overlapping this arc are moved outside. The AFM will not accept the farm's current location due to liability issues. If the farm moves outside of the firing arc, they will not object to it. However, it is also important that the chains and lines are not too slack to avoid the cages dragging and rifting back into the firing arc.

2.30. The Professional Diving Schools Association was not against the tuna farming per se, but they would prefer it if the farm were to be moved further outwards beyond the drop-off to minimize the chances of pollution in the shallower areas and the chances of discharges reaching the coast. However, the activity to date has not affected diving on the closest sites (the HMS Stubborn). Their main concern is why the Comino fish farm has remained there. They would like to see this area cleared.

2.31. Moviment Graffitti were glad to be consulted but they explained that they do not

provide technical advice. They explained that they will discuss with others in the group and provide a position at a later stage as part of the planning process. This was also the position adopted by the St Paul's Bay Local Council, who preferred to discuss the matter at Council level and provide formal feedback to the Planning Authority.

2.32. The Mellieha Local Council stated that the current situation at the Scheme site is known and the only safeguard against environmental damage is the regular reporting on the basis of observations made through site inspections by independent competent entities to the Environmental and Planning Authorities.

2.33. The Ghajnsielem Local Council explained that their main concern is the guarantee that the fish slime is kept away from the coastline. Moving the farms closer to Gozo is a non-starter and will be objected to. Given a choice of leaving it where it is or moving it to the proposed NAZ, they would prefer that the farm stays put, since the impacts of the current location are well known, but if it can be moved further away from the coastline (of both Malta and Gozo), then that would be the best decision.

2.34. The Qala Local Council's main concern is also the fish slime, especially following the incident they had this year at Ħondoq ir-Rummien. The Council is not against tuna farming *per se*, but they cannot accept these instances of slime. They want better management on the farm to ensure good practices and stricter enforcement. The Council prefers the farm to stay at the Scheme site rather than moving it closer to Gozo as was proposed previously.

2.35. Birdlife Malta reported that they have had issues with seabirds oiled in fish slime, especially the storm petrels, which tend to visit the farms. The birds have their own oils to keep them waterproof, but the slime interacts with that, so we are finding either dead birds or some with hypothermia. They also explained that the number of birds frequenting the fish farms (especially those n the South Aquaculture Zone) has grown. This includes petrels, terns, and gulls. Birdlife had requested that part of the planning gain be used for a study on the birds that frequent the fish farms and the related impacts, but nothing seems to have come of that, despite reminders. This study is becoming even more important with the impacts being registered.

## ASSESSMENT OF ALTERNATIVES

### Alternative Sites

2.36. Since the proposal for the Scheme is to retain the current site and operation and simply convert the operation from a temporary to a permanent one, no alternative sites have been considered for the Scheme. As mentioned, the North Aquaculture Zone (now referred to as Northeast Aquaculture Zone – NEAZ), which was originally intended to house the present operation, is now earmarked for a different form of aquaculture, focusing on other species and excluding bluefin tuna.

### Zero Option (Do-nothing Scenario)

2.37. The Terms of Reference for EIA requires that the alternative assessment considers the zero option, or do-nothing scenario, which envisages there being no intervention

in connection with the Scheme. Since the Scheme effectively proposes the continuation of the current operations at the same site indefinitely, two "do-nothing" scenarios can be considered: (i) not changing the status quo operationally, which is effectively the Scheme proposal; and (ii) not amending the policy direction, which would mean that the do-nothing scenario would entail the removal of the tuna farming operation from this site and its relocation elsewhere. This latter scenario would mean that the current site used by the Scheme would experience the elimination of impacts currently experienced from the farming operation and would likely revert to a state that very much approximates the situation prior to the installation of the farm (assuming that the site is not used for some other operation). In this scenario and seeing that the tuna farming operation is a permitted operation but has a condition for relocation, would mean that any impacts from the aquaculture operation would simply be transferred to another site. The impacts of this relocation would depend on the characteristics and conditions of the relocation site, which, as explained, will no longer be the site originally identified for the setting up of the NAZ.

2.38. The "Do nothing" scenario which leaves the current operations unaltered, is the Scheme proposal itself. In this scenario, which is further assessed in the following chapters, the impacts identified in the original EIA, and which were considered to be temporary and reversible, could become permanent and potentially irreversible. The impacts of the Scheme are considered in the next chapters.

### Alternative Layouts and Techniques

2.39. The Scheme's retention at the site would not result in any change to the design or techniques used for its operation. The same moorings, mooring lines, cages etc, would be used for the permanent installation. The only change would be the shifting of some of the cages to be permanently outside of the Armed Forces of Malta firing arc.

## DESCRIPTION OF THE SCHEME SITE

2.40. The Scheme site is located approximately 5 km to the north of St Paul's Bay just off the northern flank of Is-Sikka l-Bajda (see **Figure 1.2** above). The current proposal does not affect the location in any way and no changes are proposed in the Scheme size or layout.

## DESCRIPTION OF THE GENERAL SURROUNDINGS

### Sea Uses

2.41. As described in the original EIA, the moorings of the tuna farm overlap into the bunkering area located off the northeast coast of Malta and the easternmost cages are located within the boundary of the 8 nm AFM firing arc danger area. These cages were meant to be moved outside the danger zone but for some reason they were not shifted and instead a temporary verbal arrangement with the AFM was reached for the farm to continue to operate and not to have any workmen on site during army practice exercises. Nonetheless, as explained by the AFM Commander, this

situation was meant to have a limited (1-year) duration and cannot be tolerated any longer and the AFM are insisting that these cages must be moved. The DFA has, in the meantime, issued instructions to AJD Tuna Ltd to move its cages to within the approved farm boundaries with a deadline of 31 March 2025.

2.42. No other specific uses are designated in this area (except for the general shipping and fishing activities by amateur fishermen) and there is no other known infrastructure at the Scheme site. The location of the farm is marked by special marker buoys and navigational aids as instructed by Transport Malta.

### Environmental Designations

2.43. The Scheme site lies within the following marine protected areas (see **Figure 2.13**):

- Special Area of Conservation: Żona fil-Baħar fil-Grigal ta' Malta (MT0000105); and
- Specially Protected Area: Il-Baħar ta' madwar Għawdex.

## DESCRIPTION OF THE SCHEME

2.44. **Figure 2.14** illustrates the proposed cage layout of the Scheme, which is the same as that of the current temporary operation. 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.

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

- Three feeding vessels (one also used to collect and transport offal);
- Two service boats; and
- One vessel for oil collection operations.

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

**Figure 2.13: Marine Protected Areas**

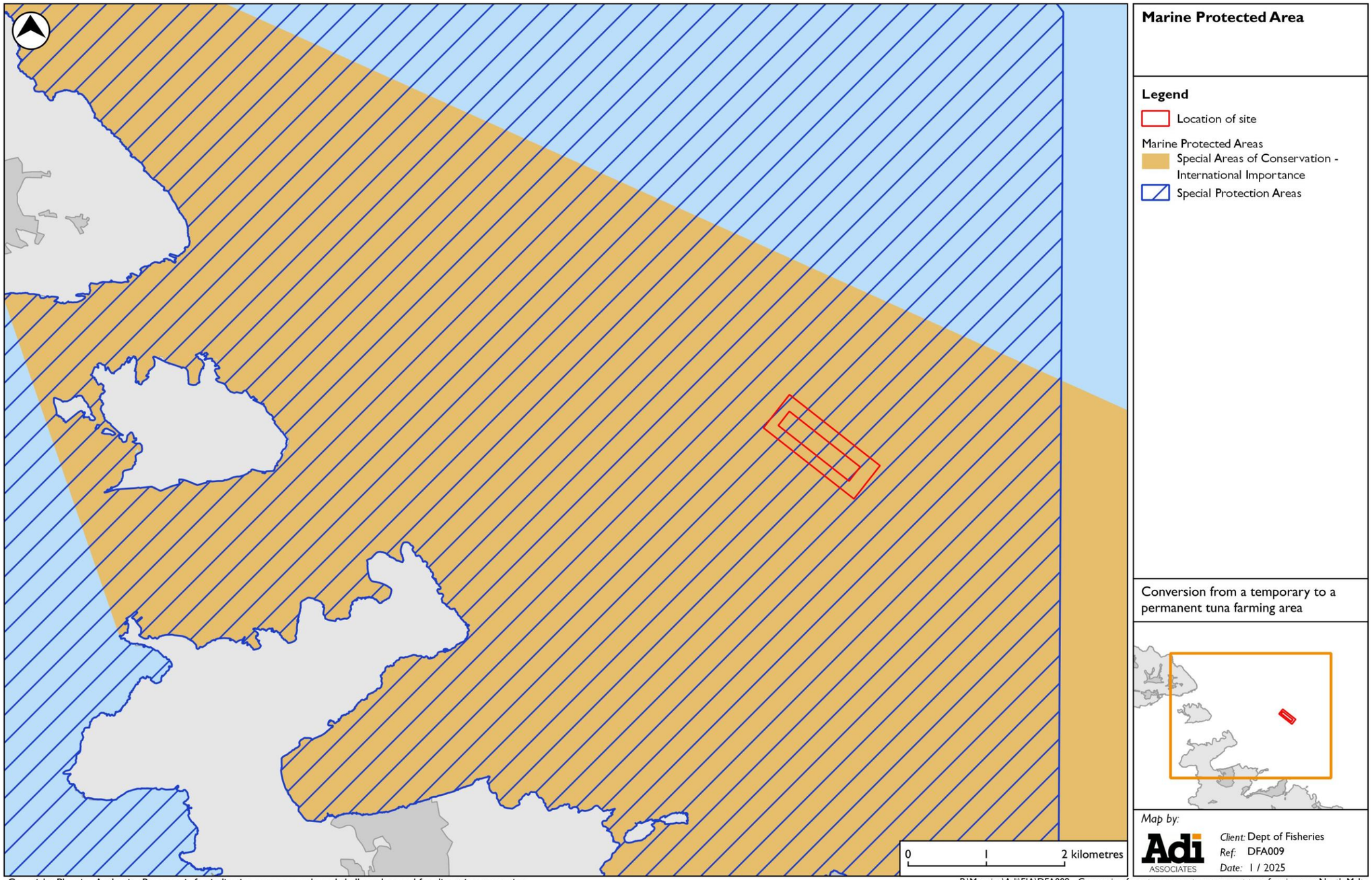
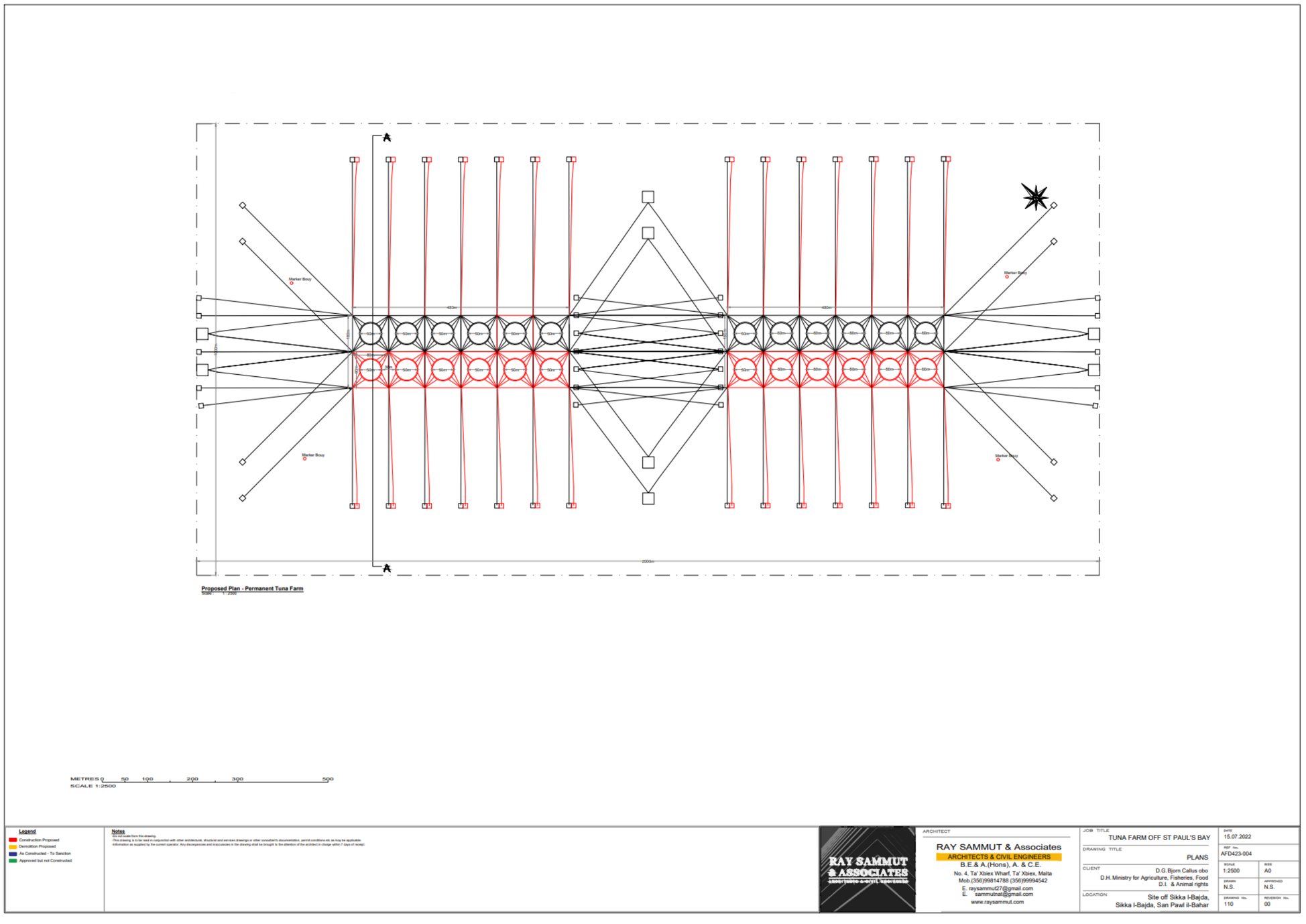


**Figure 2.14: Cage layout**



## Waste management

2.47. Wastes generated by the Scheme 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*

2.48. This waste stream is generated at the land bases 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 the sealed trucks (see earlier) and drained into IBCs. These are collected by a licensed waste contractor authorised to handle such wastes. The use of impermeable jumbo bags for the transportation of the baitfish from the land base 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.

### *Oily slick*

2.49. 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. Nonetheless, this "slime" creates significant nuisance to bathers and other marine users and for the past years, the tuna farm operators have been taking strict measures to reduce these impacts through pre-feeding collection of thaw water, use of oil booms and skimmers at the farm and deployment of vessels to track and collect escaped oil slicks. These measures are reported in the farm's annual environmental report in line with their environmental permits. Unfortunately, despite the deployment of vessels and the increased reporting, the containment or

collection of oily slime is not 100% effective and occasionally escapes of this material do take place. On 6 August 2024 a major incidence fuelled by increased slime production and prolonged current action towards the coast resulted in the slime hitting the beach at Ħondoq ir-Rummien in Qala, Gozo. Following this incident, the ERA instructed the Federation of Maltese Aquaculture Producers to increase its resources and cleaning vessels patrolling the coast (ERA, pers. comm, 2024[16]).

***Uneaten feed***

2.50. 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.

2.51. Uneaten baitfish that deposits on the bottom of the sea will start to decompose, releasing gases such as hydrogen sulphide[17] 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.

2.52. 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.

2.53. The Applicant has carried out monitoring of the seabed, sediment and water quality on an annual basis as per permit conditions at the Scheme site since 2019. In addition, the ERA have started to request annual sediment sampling at the tuna farms during the peak season.

***Fish excreta***

2.54. 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)[18]. 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

[16] Consultation meeting with ERA held on 26 November 2024.
[17] Hydrogen sulphide is also very poisonous to farmed fish.
[18] 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.

nitrogen loads and approximately 50% of phosphorus are likely to be released into seawater before solid wastes reach the seafloor

***Dead tuna***

2.55. 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. Any dead tuna are either processed through the rendering plant (if still of good quality), or taken to the abattoir for incineration, or disposed off at sea beyond the 12 nm limit.

***Blood***

2.56. During harvesting, 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)***

2.57. The further processing of the tuna onboard the processing vessels invariably results in the generation of wastewaters mixed with blood and possibly some offal. The vessels have holding tanks (bilges) where wastewater is collected (Azzopardi, C., pers. comm.; Nov 2024). The bilge waters are typically released into the marine environment in international waters in line with IMO regulations.

***Offal***

2.58. Tuna processing creates a substantial amount of offal, which is composed of the internal organs, the tails, and the heads of the tuna. During harvesting, the current farm generates between 8 and 10 tonnes of offal per day. As explained, offal used to be disposed of beyond the 12 nm limit, whereas following the setting up of the rendering plant in Hal Far by Aquaculture Resources Ltd, the offal is being transferred to land and processed into other valuable products, such as fish meal or fish oils.

***Net fouling marine growth***

2.59. 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.

***Marine litter***

2.60. 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 seabed. 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.

### Employment

2.61. The Applicant currently employs 55 full-timers and 40 part-timers. Employees include divers, boatmen, handymen, and drivers. This will not change.

# 3. MARINE BENTHOS

3.1. This chapter focuses on the benthic environment at the Scheme site and the impacts that the current operations may have had on the benthic assemblages on site.

3.2. This Chapter is based on the information in the original baseline studies undertaken for the EIA, namely: the remote sensing surveys undertaken by Seastar Surveys Ltd of the UK (see **Technical Appendix 1: *Remote Sensing Survey Report 2018***), the marine benthos study undertaken by Ecoserv Ltd (see **Technical Appendix 2: *Marine Ecology Baseline Report***), and on the monitoring data collected by Ecoserv Ltd on behalf of AJD Tuna Ltd for the period 2019 – 2023 (see **Technical Appendix 3: *Environmental Monitoring – Integrated assessment reports (2019-2023)***).

3.3. The potential key issues of the Scheme on the marine benthos as assessed in the original EIA Report, were:

**Key Issues:**

- **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**
- **Possible marine littering from items lost overboard**
- **Potential introduction of alien species and diseases via baitfish.**

### Terms of Reference

3.4. In requesting an EIA Update Report for the current proposal, the ERA requested the

following:

> *The assessment of long-term impacts on the seabed that can potentially occur as a result of the proposed conversion of AJD Tuna Limited cages from a temporary to a permanent installation, should be based on updated studies and compared with the baseline studies that were undertaken for the EIA/AA for the temporary sites.*
>
> *In this regard, the assessment should include the following potential impacts:*
>
> - *impacts on seabed habitats including rhodoliths/maerl beds and associated ecosystems from fish waste and uneaten feed;*
> - *impacts on water quality from nutrient loads and other pollutants;*
> - *the extent of the area affected throughout the operations and the recovery potential of such areas;*
> - *effect on the conservation objectives of Natura 2000 marine sites.*

## METHODOLOGY

3.5. In view that the Scheme site is the subject of a long-term monitoring programme, it was decided that the data from the monitoring programme would provide a better overview of the impacts on the seabed from the tuna farming operations than any new benthic survey, which would provide a snapshot of the situation today. Therefore, this analysis is based on the data collected over the entire operational phase of the AJD Tuna Limited farm at the Scheme site to date.

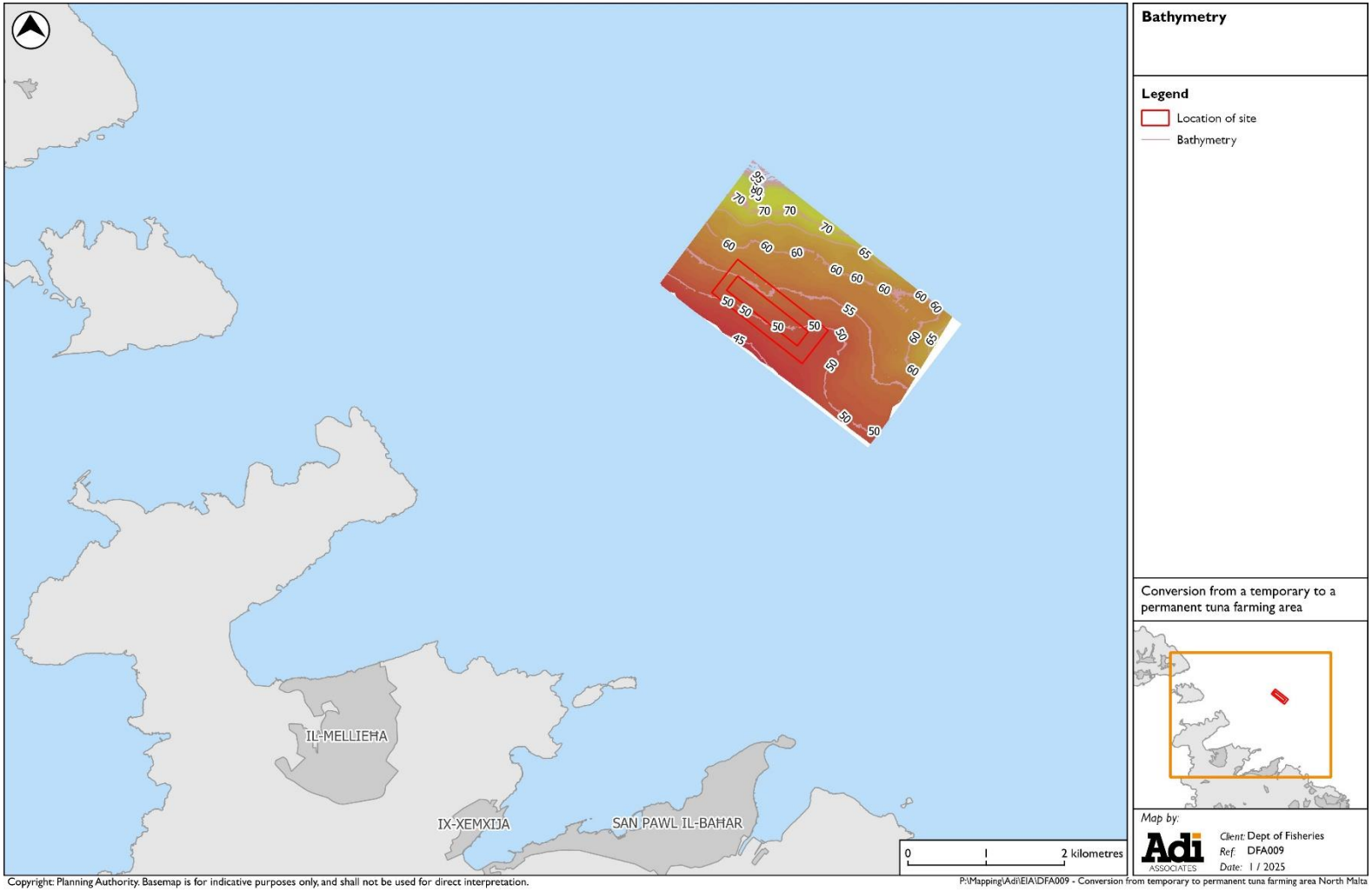
## BASELINE INFORMATION

3.6. The baseline information for the original EIA included remote sensing data from side-scan sonar surveys and surveys using a drop-down camera system / ROV. Data had been collected over a period of time through different surveys. The remotely sensed data was analysed in order to identify potential features of interest, which were subsequently surveyed by camera.

### Bathymetry

3.7. The bathymetric map for the Area of Study is shown in **Figure 3.1**. 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 is reached. Beyond the drop-off, the water depth increases rapidly to 130 m and then deepens more gradually with distance from the shore.

## Figure 3.1: Bathymetry



### Benthos

3.8. The benthic study in the original EIA included both benthic diversity studies using grab samples and benthic habitat mapping. The detailed information on the species recorded from the grab samples is available in **Technical Appendix 2: *Marine Ecology Baseline Report***. In summary, 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.

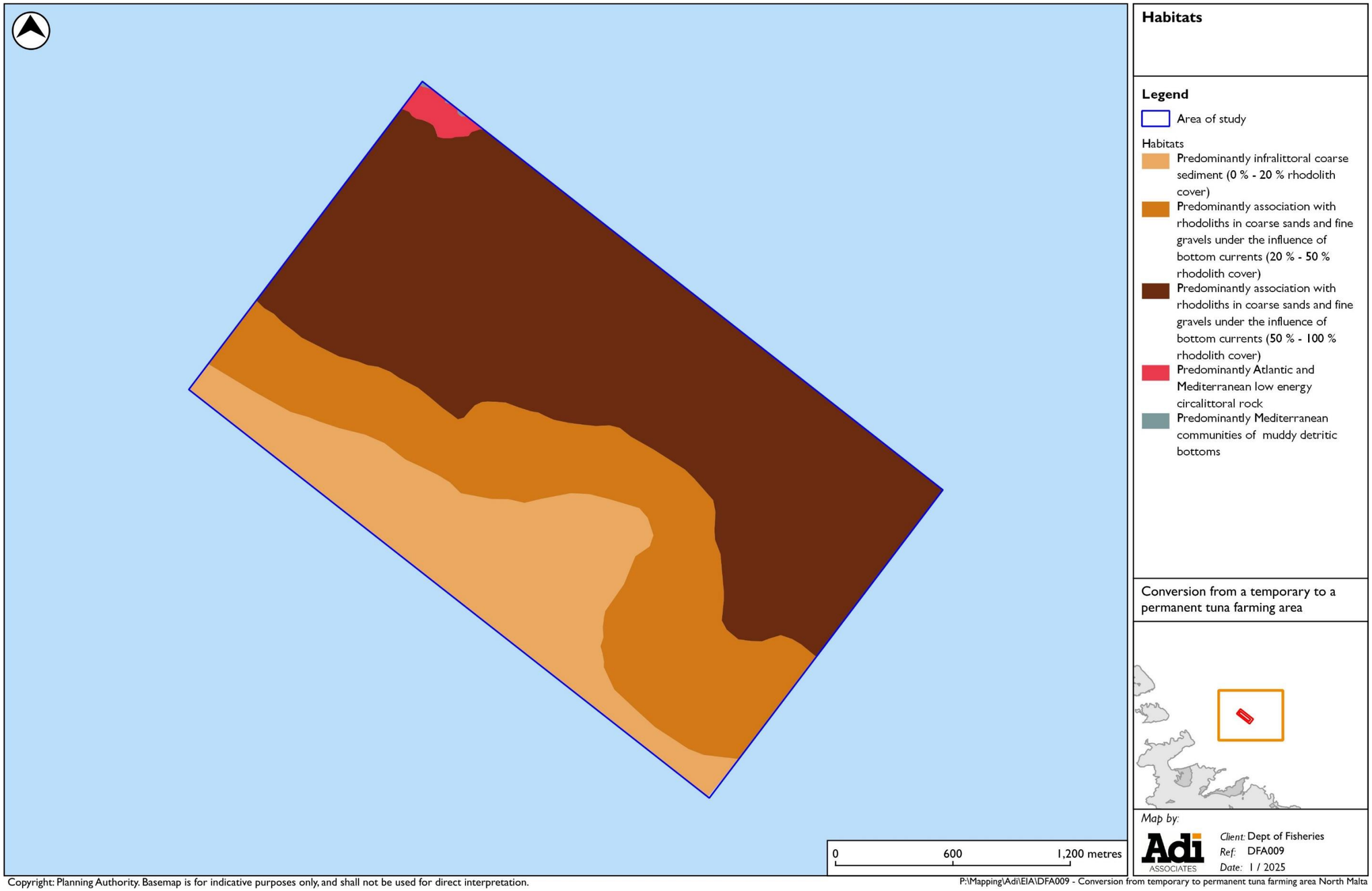
3.9. The baseline data from the grab samples and the ROV / camera surveys was used to characterise the benthic assemblages using the scheme of Borg *et al.* (2013)[19], which is based on the EUNIS typology that has been adapted for local use. The findings from both surveys and the methods used are reported in **Technical Appendix 2: *Marine Ecology Baseline Report***.

3.10. 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. 'Rhodolith beds' occupy a large part of the Area of Study; these were denser and more 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[20]. 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. **Figure 3.2** reproduces the benthic map of the Area of Study as published in the original EIA. The tuna farm was deployed largely in the area with bare sand / least rhodolith cover, as shown in **Figure 3.3**.

[19] 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.

[20] 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.

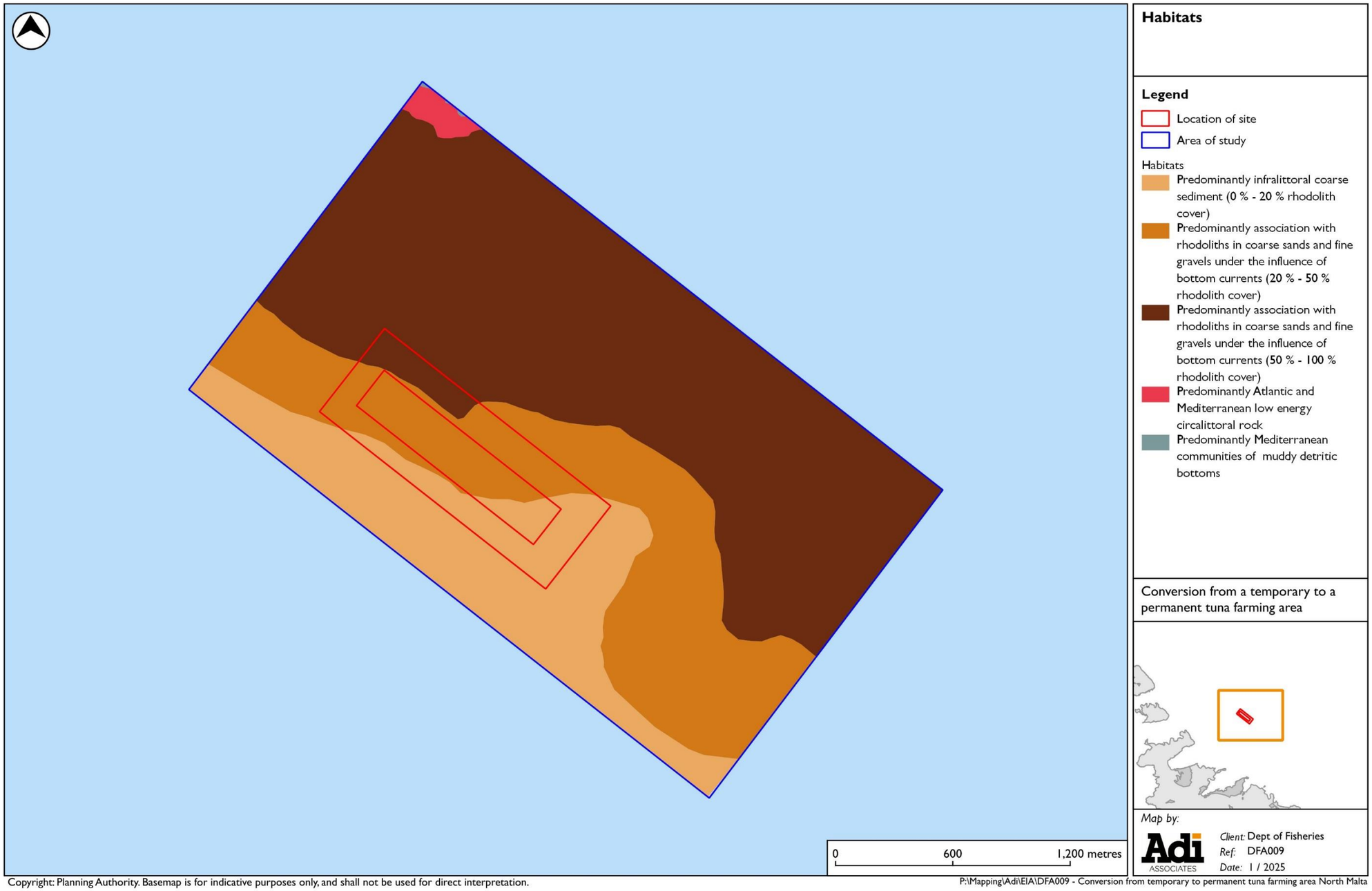
**Figure 3.2: Map showing the main benthic habitats present within the survey area**






P:\Mapping\Adi\EIA\DFA009 - Conversion from temporary to permanent tuna farming area North Malta

**Figure 3.3: Map showing the location of the approved temporary tuna farm superimposed on the benthic habitats at the Scheme site**






P:\Mapping\Adi\EIA\DFA009 - Conversion from temporary to permanent tuna farming area North Malta

3.11. 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).

3.12. It must be emphasised that although the area surveyed generally supported the assemblage types and subtypes as described above and as depicted in **Figure 3.2**, some parts supported patches with a different assemblage type, such as:

- 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).

3.13. 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 different surveys. 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 with time. It is therefore important to bear this in mind when comparing changes to the benthic assemblages over time since the changes that may be recorded are not necessarily attributable (solely) to the farming operation but may be a result of the dynamic nature of the benthic habitat itself (Borg, J.A., pers. comm, 2024).

### Demersal and Pelagic Fauna

3.14. 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.

## IMPACT ASSESSMENT

3.15. The original EIA Report identified the following impacts as relevant to the benthic environment at the Scheme site:

**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.

## Determining Impact Significance

3.16. In assessing the significance of the potential negative impacts arising from the Scheme on the marine habitats and species of conservation interest in the area, the following criteria have been used:

- **Not significant** - no material change in site integrity[21] and / or conservation status[22] of habitats and species of conservation interest in particular Annex I habitats and Annex II species as listed in the Habitats Directive. No material change expected to other species of ecological value and conservation interest, including those listed in the Red Data Book for the Maltese Islands 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.

3.17. 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.

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

---

[21] 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).

[22] 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...*'.

3.19. The only protected species recorded from the Scheme site were the following:

| Species | Habitats Directive | Bern Convention | SPA/BD Protocol | Flora, Fauna and Habitats Protection Regulations 2006 |
|---|---|---|---|---|
| *Centrostephanus longispinus* | Annex IV (*Animal and plant species of Community interest in need of strict protection*) | Appendix II | Annex II | Schedule V (*Animal and Plant Species of Community Interest in need of Strict Protection*). |
| *Phymatholithon calcareum* | Annex V (*Animal and plant species of Community interest whose taking in the wild and exploitation may be subject to management measures*) | | As part of Rhodolith beds | |
| *Lithothamnion minervae* | Annex V (*Animal and plant species of Community interest whose taking in the wild and exploitation may be subject to management measures*) | | As part of Rhodolith beds | |

## Impact Assessment in original EIA Report

3.20. **Table 3.1** outlines the impact assessment on the benthic ecology as described in the original EIA Report. The Table lists the relevant impacts and describes the assessment and the mitigation measures proposed. A review of the mitigation measures proposed at EIA stage and whether these have since been implemented is also provided.

3.21. In **Chapter 5**, the impacts as originally assessed are analysed against the new benthic data collected through the environmental monitoring reports and an assessment is provided of the long-term impacts from the farming operation on the seabed habitats (including the rhodolith beds and associated ecosystems), especially from uneaten feed and fish waste, if the tuna farm is converted to a permanent installation.

## Table 3.1: Summary of Impacts on benthic ecology as assessed in original EIA

| Impact description | Impact analysis (original EIA Report) | Mitigation Measures proposed in original EIA Report | Have Mitigation Measures been implemented? |
|---|---|---|---|
| Loss through burial under the mooring blocks | 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.<br><br>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.<br><br>**Impact:**<br>• **major significance** for the biota located beneath the blocks, which will be decimated.<br>• **minor** on the general sessile benthic species within the farm area (due to limited surface area of mooring blocks).<br>• impacts of mooring block placement on the predominant infralittoral coarse sediments (0 – 20% live rhodolith cover) and the predominantly association with rhodoliths in coarse sands and fine gravel under the | Good practice approaches in the deployment of the mooring blocks to reduce adverse effects on the seabed especially to eliminate dragging of blocks<br><br>Optimise mooring design to ensure against drifting<br><br>Optimise mooring layout to minimise impact on habitats with 50 -100% live rhodolith cover | Yes. Mooring blocks placed outside of area occupied by rhodolith habitats with cover>50%.<br><br>No reports of mooring block dragging.<br><br>It is important that when the cages located in the AFM firing arc are shifted to be completely outside, the mooring blocks are carefully retrieved and lowered in their new position and not dragged. |

| Impact description | Impact analysis (original EIA Report) | Mitigation Measures proposed in original EIA Report | Have Mitigation Measures been implemented? |
|---|---|---|---|
| | influence of bottom currents (20 – 50% live rhodolith cover) is considered to be of **minor significance**.<br>• placing of mooring blocks on association with rhodoliths in coarse sands and fine gravel under the influence of bottom currents (50 – 100% live rhodolith cover) is deemed to be of **major significance**. | | |
| Loss of habitats and decimation of biota from settlement of faeces and uneaten feed on the seabed | 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. 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.<br><br>Hydrodynamic modelling indicated that 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.<br><br>**Impact:**<br>• Impacts are judged to be **minor to major** directly under the cages and **minor to not significant** in the area outside the cages in the general seabed occupied by the tuna farm, depending on the level of feed management (in the case of the uneaten | Optimise stocking density.<br><br>Lengthening of statutory fallowing period.<br><br>Improved feed management including 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.<br><br>More prompt actions by the farm operators and their staff in rectifying over-feeding or loss of baitfish.<br><br>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 | Yes. Stocking density linked to quota and number of cages.<br><br>Over the past two years, no overwintering has taken place such that the site has been allowed to fallow.<br><br>Monitoring of feeding is a staple of the farm operations.<br><br>Environmental monitoring undertaken annually, including through video imagery.<br><br>Annual training of farm staff by environmental consultants. |

| Impact description | Impact analysis (original EIA Report) | Mitigation Measures proposed in original EIA Report | Have Mitigation Measures been implemented? |
|---|---|---|---|
| | baitfish) and the stocking density (fish faeces). | staff is knowledgeable of the impacts the operation can cause and how these can be minimised through best practice on the farm. | |
| Change in currents and sediment movement | 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.<br><br>The gravelly nature of the seabed 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.<br><br>**Impact:**<br>• 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. | Impact not significant – no mitigation measures proposed | |
| Disturbance to habitats and species from increased organic input in the area | 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.<br><br>Good practice and measures to reduce loading of the water column with nutrients and organic matter will be important. | Good practice farm management to reduce loading of water column with nutrients and organic matter.<br><br>Control stocking density in each cage | Stocking density controlled through license / ICCAT quota and number of cages. |

| Impact description | Impact analysis (original EIA Report) | Mitigation Measures proposed in original EIA Report | Have Mitigation Measures been implemented? |
|---|---|---|---|
| | **Impacts:**<br>• These impacts are 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. | 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.<br><br>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.<br><br>**Impact:**<br>• Overall **minor beneficial** impact | Impact deemed minor beneficial – no mitigation measures proposed | |
| Attraction of new species and changes in ecological relationships | 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 predators, attracted to the site by the presence of the scavenging population and the tuna themselves.<br><br>Locally, pelagic predators attracted to tuna farms have included wild tuna, dolphinfish (*Coryphaena hippuris*) and amberjack (*Seriola dumerilii*), amongst other smaller pelagics. Cetaceans (namely | Monitor colonisation process and change in community structure from attraction of new species (scavengers and predators) | Yes. Annual environmental monitoring programme at the farm undertaken by independent environmental consultants. |

| Impact description | Impact analysis (original EIA Report) | Mitigation Measures proposed in original EIA Report | Have Mitigation Measures been implemented? |
|---|---|---|---|
| | dolphins) have also been recorded in the vicinity of the tuna farms.<br><br>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'.<br><br>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.<br><br>Changes to benthic assemblages (especially algae) could also result from shading effects caused by the presence of the cages themselves. 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. | | |

| Impact description | Impact analysis (original EIA Report) | Mitigation Measures proposed in original EIA Report | Have Mitigation Measures been implemented? |
|---|---|---|---|
| | **Impact:**<br>• The impact on pelagic wild species is expected to be of **minor significance**.<br>• **Insignificant to minor significance** for changes in ecological relationships and increased scavenging or predation.<br>• Impacts from shading are expected to be of **major significance** on the rhodoliths but **not significant** for other benthic assemblages. | | |
| Damage or disturbance to habitats and species from increased human presence | 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.<br><br>Some disturbance to pelagic fauna present in the general area of the farm, mainly through the generation of underwater noise.<br><br>Introduction of 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.<br><br>surveys made below tuna cages at local tuna penning sites have indicated that, in places, a | Monitor human activities on site; implement environmental management system through the environmental permit conditions.<br><br>Regular monitoring of seabed condition and retrieve any lost items deposited on the seabed<br><br>Prohibit / strictly control fishing activities in the vicinity of tuna farms. | Environmental management system formulated – may require mor regular auditing to ensure proper implementation.<br><br>Annual monitoring of the seabed using video cameras – reports provided to farm operators, ERA and DFA<br><br>Fishing around tuna farms remains a regular occurrence as the farms attract wild fish. |

| Impact description | Impact analysis (original EIA Report) | Mitigation Measures proposed in original EIA Report | Have Mitigation Measures been implemented? |
|---|---|---|---|
| | 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.<br><br>**Impact:**<br>• Increased human activity at the Scheme site is not expected to result in a material change to habitat quality or extent and are therefore **not significant**.<br>• Impact on pelagic fauna is expected to be temporary in nature and **not significant to minor**.<br>• Impacts from operational / accidental spills is expected to be **not significant to minor** and of a temporary or very short duration.<br>• 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 | | |
| Impacts from the potential introduction of alien species and disease-causing organisms | The introduction of alien species or disease-causing organisms with the baitfish is an issue that is rarely considered in the debate on tuna farm development. 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 | Monitor for evidence of introductions and act accordingly | Yes - No such evidence to date |

| Impact description | Impact analysis (original EIA Report) | Mitigation Measures proposed in original EIA Report | Have Mitigation Measures been implemented? |
|---|---|---|---|
| | to be a remote possibility, it cannot be discounted.<br><br>**Impact:**<br>• Should such an event occur, the significance of this impact could be **major** or it could be **insignificant.** | | |

## ANALYSIS OF BENTHIC DATA FROM ENVIRONMENTAL MONITORING REPORTS

3.22. The tuna penning operation undertaken by AJD Tuna Ltd[23] at the Scheme site is subject to environmental monitoring that is undertaken by an independent monitoring firm. Monitoring has been undertaken regularly in line with an approved monitoring programme as part of the farms' environmental permits, ever since the farms were relocated to the Scheme site. The farming operations at the previous locations were likewise subject to environmental monitoring.

3.23. Since 2019, Ecoserv Ltd has undertaken monitoring at this site. The environmental monitoring programme approved by ERA requires the following:

- Water Quality:
    - *in situ* measurement of dissolved oxygen (DO), salinity, temperature and turbidity, at four (4) monitoring stations using a multi-parameter meter.
    - measurement of current speed and direction.
    - collection of water samples from the same four (4) monitoring stations from a depth of approximately 0.5 - 1 m for analysis of pH, Total Nitrogen, Total Phosphorous, Chlorophyll *a*, total organic carbon (TOC) and total suspended solids (TSS).
    - two water quality sessions will be undertaken per year; one in spring during the fallow period, and the other in autumn towards the end of the tuna farming season.
- Benthic survey:
    - a video survey using a remotely operated vehicle (ROV) that will be undertaken below a select number of fish cages to assess for the following:
        - Level of uneaten feed accumulating on the seabed;
        - Species diversity and abundance of megafauna;
        - Marine litter; and
        - Overall impacts from the farm activities on the physical and biological characteristics of the seabed.
    - The video survey will be undertaken using a remotely operated vehicle (ROV) that will be navigated below, as much as possible, a select number of tuna cages at AJD Tuna Ltd's and Malta Mariculture Ltd's tuna penning site; the video footage will later be analysed in the laboratory.

3.24. The video footage of the seabed is collected in the vicinity of eight cages; four cages

[23] The entire operation is carried out under two aquaculture permits – one for AJD Tuna Ltd and one for Malta Mariculture Limited, both owned by Messers Azzopardi.

at each of AJD Tuna Ltd's and Malta Mariculture Ltd's tuna penning sites. The cages selected for such monitoring are chosen at random in the field by the scientists on the day of monitoring, with the selected cages being as distant from each other as possible to allow for representative assessment.

3.25. Video footage of the seabed is also collected from four other stations located at a distance from the tuna penning site, where the bottom supports a habitat of high ecological importance; namely soft bottom / maerl habitat located west, north and east of the site, as well as at 'Is-Sikka l-Bajda' located south of the site.

### Monitoring data

3.26. As agreed with ERA, this EIA update assessed the findings from a five-year monitoring exercise (2019-2023) at the Scheme site rather than undertaking a one-time survey specifically for the EIA update. **Table 3.2** indicates the monitoring dates for each year and the type of monitoring undertaken at each session.

**Table 3.2: Monitoring at tuna penning site operated by AJD Tuna Ltd & MML**

| Year | Monitoring | Monitoring sessions |
|---|---|---|
| 2019 | Water Quality | March & September |
| | Benthos | May/June & September |
| 2020 | Water Quality | May & October |
| | Benthos | April & September |
| 2021 | Water Quality | May & September |
| | Benthos | May & October |
| 2022 | Water Quality | August & October |
| | Benthos | July & October |
| 2023 | Water Quality | June & November |
| | Sediments* | June & September |
| | Benthos | June & November |

*Since 2023, the ERA requested an expansion of the monitoring programme to also include sediment sampling

3.27. The environmental monitors devised an 'uneaten food index' to enable comparison of the relative amounts of dead fish present under the pens (see Holmer *et al*, 2008[24]). The index, which ranges between 0 and 4, is described in **Table 3.3**.

[24] Holmer M., Hansen P. K., Karakassis I., Borg J. A. & Schembri P. J., 2008. Monitoring of Environmental Impacts of Marine Aquaculture. In: Holmer M., Black K., Duarte C., Marba N., & Karakassis I. (editors) Aquaculture in the Ecosystem; pp. 47-85. Heidelberg, Germany: Springer; 326pp.

**Table 3.3: "Uneaten Food Index"**

| Index Value | Description |
|---|---|
| 0 | No uneaten fish present |
| 1 | <1 uneaten fish present per $m^2$ of seabed |
| 2 | >1 uneaten fish present per $m^2$ of seabed, but the fish do not form a continuous layer covering the seabed |
| 3 | >1 uneaten fish present per $m^2$ of seabed. Fish form a single, uninterrupted layer within at least a $1m^2$ area on the seabed |
| 4 | >1 uneaten fish present per $m^2$ of seabed. Fish form two or more uninterrupted layers on top of each other within at least a $1m^2$ area on the seabed |

## Monitoring results

3.28. Analysis of the findings of the monitoring data for the benthos, undertaken through video surveys of the seabed have been reviewed and assessed against the baseline conditions reported in the original EIA. **Table 3.4** provides a summary of the findings of the seabed monitoring.

3.29. Analysis of the water quality and seabed sediment monitoring are provided in **Chapter 4**.

**Table 3.4: Summary of findings of benthic monitoring (2019-2023)**

| Monitoring session | Summary of Findings |
|---|---|
| May/June 20194 | Video footage was recorded from below a total of seven tuna pens - three cages belonging to AJD Tuna Ltd (AJD Cage 3, AJD Cage 13, and AJD Cage 18) and four belonging to Malta Mariculture Ltd (MML Cage 7, MML Cage 8, MML Cage 9 and MML Cage 12), and at three reference sites (NE reference, SE reference and Sikka l-Bajda reference). Although the plan was to collect video footage of the seabed from below a fourth tuna cage (belonging to AJD Tuna Ltd) and fourth reference site (northwest reference), adverse sea conditions and time constraints precluded this.<br><br>During this survey, MML Cage 7 and MML Cage 9 held tuna.<br><br>The bottom below the seven tuna pens and at two of the reference sites (NE reference and SE reference) consisted predominantly of coarse sand. The surface of the mobile sediment had conspicuous crests and troughs. The troughs of soft sediment had sparse accumulations of rhodoliths (0 - 20% cover). Very small patches of bedrock appeared to be present below MML Cage 9.<br><br>At the Sikka l-Bajda reference site, the bottom comprised a mosaic with patches of seagrass *Posidonia oceanica* growing on soft sediment and photophilic algae growing on bedrock that characterises this reef area. The seagrass *Posidonia oceanica* appeared to be in a good state.<br><br>The underwater visibility was good and ranged around 20 m – 25 m.<br><br>A few anthropogenic items were recorded on the seabed; these mainly consisted of an unidentified item, a building brick, short lengths of rope, small concrete weights with ropes attached, unidentified strips of what looked like PVC, metal and an abandoned fish trap. It is assumed that the short lengths of rope and small concrete weights with ropes attached originate from the tuna farming activities.<br><br>No fish bones or remains of tuna were recorded from below the seven tuna pens and at the three reference sites. However, a single bone (vertebra) which may have originated from a tuna individual |

| Monitoring session | Summary of Findings |
|---|---|
| | was recorded from below MML Cage 9. A few uneaten feed-fish (around four individuals were counted in all) were present on the seabed below MML Cage 8, but none were present on the seabed below the other cages or at the reference sites.<br><br>Megafauna recorded from beneath the cages mainly comprised a high density of the irregular sea urchin *Spatangus purpureus*. Individuals of the seastar *Lurida ciliaris* and of the urchin *Stylocidaris affinis* were present in places.<br><br>Demersal fishes, namely Comber *Serranus cabrilla*, Weever Fish *Trachinus* sp., and Stingray *Dasyatis pastinaca* were recorded below some of the tuna pens. The pelagic fish fauna recorded in the vicinity of the tuna pens included very large shoals of Bogue *Boops boops* and Shad *Alosa* sp. |
| September 2019 | Video footage of the seabed was recorded from below a total of eight tuna pens - three cages belonging to AJD Tuna Ltd (AJD Cage 1, AJD Cage 5, AJD Cage 14 and AJD Cage 16) and four belonging to Malta Mariculture Ltd (MML Cage 7, MML Cage 11, MML Cage 20 and MML Cage 22), and at four reference sites (NW reference, NE reference, SE reference and SW reference).<br><br>During this survey, all of AJD Tuna Ltd's and MML's tuna pens held tuna.<br><br>The bottom below the eight tuna pens and three of the reference sites consisted predominantly of coarse sand, which in many places had small accumulations of rhodoliths or sparse rhodoliths (percentage cover 1 – 20%). while at the Sikka l-Bajda reference site the bottom comprised a mosaic with patches of seagrass *Posidonia oceanica* growing on soft sediment and photophilic algae growing on bedrock that characterises this reef area. The seagrass *Posidonia oceanica* appeared to be in a good state and unimpacted by the tuna penning activities.<br><br>The underwater visibility was good and ranged around 20 m – 25 m.<br><br>A few anthropogenic items were recorded on the seabed below the tuna pens, some of which, namely the large sheet of fabric (or possibly a sack used to hold feed fish), short lengths of rope and |

| Monitoring session | Summary of Findings |
|---|---|
| | small concrete weights with ropes attached, appear to have originated from the tuna farming activities.<br><br>A tuna carcass was recorded on the seabed below MML's Cage 7; Ecoserv's consultants immediately contacted the site manager who took due action such that the carcass was retrieved by SCUBA divers. Otherwise, no fish bones or remains of tuna were recorded from below the remaining tuna pens and at the three reference sites. Some of the tuna pens had small amounts (uneaten food index value = 1) of uneaten feed fish on the seabed below them, while an appreciable amount of uneaten feed fish (uneaten food index value = 1 - 2) was present on the seabed below AJD Tuna Ltd's Cage 14. Communication with the site manager re the latter observation indicated that the appreciable amount of uneaten feed fish resulted from accidental rupture of the feed net present on the surface in the tuna cage, and release of an inordinate amount of feed fish. The site manager was advised to make arrangements so that as much as possible of the feed fish are retrieved.<br><br>Megafauna recorded from this assemblage type was rather impoverished compared to that recorded during the previous survey made in March 2019 and mainly comprised occasional individuals of the irregular sea urchin *Spatangus purpureus*. However, this observation held true for the seabed under the tuna pens, as well as for that at the NE, NW and SW reference sites which had the same benthic habitat type. This would seem to indicate that the observation of impoverished megafauna is not related to the effects of the tuna penning activities.<br><br>The demersal fish fauna and pelagic fish fauna swimming close to the tuna cages were typical of that which occurs in local offshore coastal waters but were present in a much higher abundance in the vicinity of the tuna cages; this is to be expected given that offshore cages used for aquaculture and fish ranching attract large shoals of wild fishes. |
| April 2020 | Video footage was recorded from below a total of eight tuna pens – four cages belonging to AJD Tuna Ltd (AJD Cage 3, AJD Cage 5, AJD Cage 15 and AJD Cage 18) and four belonging to Malta Mariculture Ltd (MML Cage 7, MML Cage 10, MML Cage 20 and MML Cage 23), as well as at four |

| Monitoring session | Summary of Findings |
|---|---|
| | reference sites (NW reference, NE reference, SE reference and SW reference).<br><br>During the survey, only AJD Tuna Ltd's Cages 3 and 5 held tuna, while none of MML's cages held tuna.<br><br>The bottom below the eight tuna pens and three of the reference sites (NE reference, NW reference and SE reference) consisted predominantly of coarse sand and rhodoliths with a percentage cover of 0-20%, while at the Sikka l-Bajda reference site, the bottom comprised a mosaic with patches of seagrass *Posidonia oceanica* growing on soft sediment and photophilic algae growing on bedrock that characterises this reef area. The *Posidonia oceanica* appeared to be in a good state and unimpacted by the tuna penning activities.<br><br>The underwater visibility was good and ranged around 20 – 25 m.<br><br>A number of anthropogenic items were recorded on the seabed below the tuna pens, some of which, namely short lengths of rope and small concrete weights with ropes attached appear to have originated from the tuna farming activities.<br><br>No remains of tuna or feed fish were recorded from below the tuna pens or at the four reference sites.<br><br>Megafauna recorded from beneath the cages comprised the Heart Urchin *Spatangus purpureus*, the Long Spined Urchin *Centrostephanus longispinus* and the Red Lance Urchin *Stylocidaris affinis*, all of which were present in a high density in places. The recorded high density of these megafaunal species was attributed to organic enrichment of the seabed underneath the tuna pens as a result of input of waste from the tuna penning activities. The organic matter serves as food for macro- and megafaunal species, supporting a high density of the organisms.<br><br>The demersal fish fauna and pelagic fish fauna swimming close to the tuna cages were typical of that which occurs in local offshore coastal waters and mainly comprised individuals of Comber *Serranus* |

| Monitoring session | Summary of Findings |
|---|---|
| | *cabrilla* and Rainbow Wrasse *Coris julis*. Large shoals of Bogue *Boops boops* were recorded below some of the tuna pens. |
| September 2020 | Video footage of the seabed was again recorded from below a total of eight tuna pens - four cages belonging to AJD Tuna Ltd (AJD Cage 2, AJD Cage 6, AJD Cage 13 and AJD Cage 17) and four belonging to Malta Mariculture Ltd (MML Cage 7, MML Cage 10, MML Cage 20 and MML Cage 22), as well as at four reference sites (N reference, E reference, S reference and W reference).<br><br>During the survey, most of AJD Tuna Ltd's and Mariculture Ltd's cages held tuna.<br><br>The bottom below the eight tuna pens and at three of the reference sites (N reference, E reference and S reference) consisted predominantly of coarse mobile sediments, namely coarse sand and rhodoliths, having a percentage cover of 0-20% , while at the Sikka l-Bajda reference site (W reference) the bottom comprised a mosaic with patches of seagrass *Posidonia oceanica* growing on soft sediment and photophilic algae growing on bedrock that characterises this reef area.<br><br>The underwater visibility was good and ranged around 25 – 30 m.<br><br>The presence of feed fish, albeit not in large quantities, under some of the tuna pens, particularly below those at MML's tuna penning site, as well as the presence of white patches that in most places were associated with what appeared to be the remains of fish in a very advanced stage of decomposition, indicated some alteration of the physical characteristics of the seabed below some of the tuna pens. Two tuna carcasses (one of which appeared to be in a very advanced state of decomposition) were recorded on the seabed below AJD Tuna Ltd's Tuna Pen 2, and another carcass was present below Tuna Pen 13 at the same (AJD Tuna Ltd's) site. However, this finding was reported to the site manager who took immediate action by having SCUBA divers retrieve one of the carcasses from below Tuna Pen 2 and that present below Tuna Pen 13. Feed fish, in different states of decomposition, were recorded in places below some of the tuna pens, however, no feed fish were recorded at any of the four reference sites. |

| Monitoring session | Summary of Findings |
|---|---|
| | Several anthropogenic items were recorded on the seabed; these included ones (such as short lengths of rope and small concrete weights with ropes attached) that seem to have originated from the tuna farming activities.<br><br>Megafauna recorded from beneath the cages comprised the Heart Urchin *Spatangus purpureus*, the Long Spined Urchin *Centrostephanus longispinus*, the Red Lance Urchin *Stylocidaris affinis* and the crinoid *Antedon mediterranea*. Of these, the Long Spined Urchin *Centrostephanus longispinus* was present in a high density in places. Other megafauna recorded during the survey included the seastar *Echinaster sepositus* and the sea slug *Aplysia fasciata*.<br><br>The demersal fish and pelagic fish fauna swimming close to the seabed and in the vicinity of the tuna cages, respectively, were typical of those that occur in local offshore coastal waters and mainly comprised numerous individuals of an unidentified Goby *Gobiidae* sp., individuals of the Comber *Serranus cabrilla*, of Bream *Diplodus* spp. and of the Rainbow Wrasse *Coris julis*, as well as large shoals of Bogue *Boops boops* and of Blotched Picarel *Spicara maena*, and shoals of Amberjack *Seriola dumerilii*. Individuals of the Common Stingray *Dasyatis pastinaca* were recorded swimming close to the seabed under some of the tuna cages; some of the individuals were noted consuming feed fish. This species was therefore evidently scavenging on the seabed for uneaten feed fish, while the numerous individuals of the unidentified Goby would also be scavenging pieces originating from the feed fish. Several individuals of Atlantic Blue Fin Tuna *Thunnus thynnus* were recorded swimming in the vicinity of AJD Tuna Ltd's Tuna Pen 6. It would seem that these wild tuna are attracted to the tuna pens by the presence of individuals of the same species held in the pens and by the uneaten feed fish that pass through the tuna cage mesh and are carried away from the pens by sea currents. |
| May 2021 | Video footage was collected from the four reference sites (Northwest Reference, Northeast Reference, Southeast Reference and Southwest Reference) and from below the following cages: - AJD Tuna Ltd Cage 1, Cage 3, Cage 4 and Cage 16; - Malta Mariculture Ltd Cage 8, Cage 9, Cage 10 and Cage 22. |

| Monitoring session | Summary of Findings |
|---|---|
| | During this survey, four cages between the two farms held tuna.<br><br>The bottom below the eight tuna pens and at three of the reference sites (Northwest Reference, Northeast reference and Southeast reference) predominantly consisted of coarse sand. In places, the surface of the mobile sediment had conspicuous crests and troughs, with the troughs having accumulations of rhodoliths with a percentage cover of 0-20%. At the SW Sikka l-Bajda reference site, the bottom comprised a mosaic with patches of seagrass *Posidonia oceanica* growing on soft sediment and photophilic algae growing on the bedrock that characterise this reef area. The seagrass *Posidonia oceanica* appeared to be in a good state and unimpacted by the tuna penning activities.<br><br>The underwater visibility was around 20 – 25 m.<br><br>Several anthropogenic items were recorded on the seabed, some of which (such as short lengths of rope with attached concrete weights, lengths of rope and of heavy chain), appeared to have originated from the tuna farming activities.<br><br>Two tuna carcasses were recorded on the seabed below Cage 8 at MML's site, and one tuna carcass was recorded below AJD Tuna Ltd's Cage 16. What appeared to be the skeleton of a tuna was recorded from below MML's Cage 8, and large bones that probably originated from dead tuna were recorded under some of the cages. These findings were reported to the site manager so that action will be taken retrieve to retrieve the tuna carcasses that were not yet in an advanced state of decomposition.<br><br>Feed fish (uneaten feed index = 1) were only recorded underneath AJD Tuna Ltd's Cage 16. No feed fish or remains of dead tuna were recorded at any of the four reference sites<br><br>In places, the alien alga *Caulerpa cylindracea* was present on the soft sediment surface.<br><br>The most abundant megafauna recorded beneath the cages were the crinoid *Antedon mediterranea*, |

| Monitoring session | Summary of Findings |
|---|---|
| | the Long-spined Urchin *Centrostephanus longispinus*, and the Red Lance Urchin *Stylocidaris affinis*.<br><br>The demersal fish fauna and pelagic fish fauna swimming close to the tuna cages were typical of that occurring in local offshore coastal waters and included Comber *Serranus cabrilla*, Rainbow Wrasse *Coris julis*, Two-Banded Bream *Diplodus vulgaris*, and unidentified Gobidae and Blennidae. Large shoals of Bogue *Boops boops*, were recorded below some of the tuna pens. |
| October 2021 | Video footage was collected from the four reference sites (Northwest Reference, Northeast Reference, Southeast Reference and Southwest Reference) and from below the following cages: - AJD Tuna Ltd Cage 3, Cage 6, Cage 14 and Cage 17; - Malta Mariculture Ltd Cage 7, Cage 8, Cage 9 and Cage 19.<br><br>During this survey, all of AJD Tuna Ltd's and Malta Mariculture Ltd's cages held tuna.<br><br>The bottom below the eight tuna pens and at three of the reference sites (Northwest Reference, Northeast reference and Southeast reference) predominantly consisted of coarse sand. In places, the surface of the mobile sediment had conspicuous crests and troughs, with the troughs having accumulations of rhodoliths with a percentage cover of 0-20%. At the SW Sikka l-Bajda reference site, the bottom comprised a mosaic with patches of seagrass *Posidonia oceanica* growing on soft sediment and photophilic algae growing on the bedrock that characterise this reef area.<br><br>The underwater visibility was around 20 m.<br><br>Several anthropogenic items were recorded on the seabed, some of which (such as short lengths of rope with attached concrete weights, lengths of rope and of heavy chain), appeared to have originated from the tuna farming activities.<br><br>Three tuna carcasses in various stages of decomposition were recorded below AJD Tuna Ltd's Cage 17, two tuna carcasses (one of which was in an advanced stage of decomposition) and a tuna skeleton were recorded below MML's Cage 9; and two tuna carcasses were recorded below MML's |

| Monitoring session | Summary of Findings |
|---|---|
| | Cage 19. In places, bones (e.g. vertebrae) that probably originated from dead tuna were present on the seabed underneath some of the cages. These findings were reported to the site manager so that action will be taken retrieve to retrieve the tuna carcasses that were not yet in an advanced state of decomposition.<br><br>Feed fish were present below cages as follows:<br><br>- A patch with variable density of feed fish (uneaten feed index = 1–2) recorded below AJD Cage 3;<br><br>- Patches with variable density of feed fish (uneaten feed index = 1–2) recorded below AJD Cage 6;<br><br>- A patch with feed fish (uneaten feed index = 1) recorded below AJD Cage 14;<br><br>- Sparse, partly decomposed feed fish (uneaten feed index = 0-1) recorded below AJD Cage 17;<br><br>- Patches with variable density of feed fish (uneaten feed index = 1–2) recorded below MML Cage 7;<br><br>- Sparse feed fish (uneaten feed index = 0-1) recorded below MML Cage 8;<br><br>- Sparse, partly decomposed feed fish (uneaten feed index = 3) recorded below MML Cage 19.<br><br>No feed fish were present at any of the four reference sites but a recently deposited tuna carcass was recorded at the northeast reference site.<br><br>Patches with what appeared to be *Beggiatoa* were present under some of the cages; presumably their presence is attributed to organic enrichment of the sediment surface following decomposition of feed fish deposited on the seabed.<br><br>In places, the alien alga *Caulerpa cylindracea* was present on the soft sediment surface.<br><br>The most abundant megafauna recorded beneath the cages were the crinoid *Antedon mediterranea*, |

| Monitoring session | Summary of Findings |
|---|---|
| | the Long-spined Urchin *Centrostephanus longispinus*, and the Red Lance Urchin *Stylocidaris affinis*.<br><br>Several individuals of the Common Stingray *Dasyatis pastinaca* and of the Bull Ray *Aetomylaeus bovinus* were recorded swimming close to the seabed under most of the tuna cages; individuals of these were noted feeding on the feed fish that had been deposited on the seabed. At the southeast reference site, shoals of Damselfish *Chromis chromis* and of Rainbow Wrasse *Coris julis*, were recorded swimming in the vicinity of the *P. oceanica* meadows present at the site. |
| July 2022 | Video footage was collected from the four reference sites (Northwest Reference, Northeast Reference, Southeast Reference and Southwest Reference) and from below the following cages: AJD Tuna Ltd: AJDT Cage 4, AJDT Cage 5, AJDT Cage 16, and AJDT Cage 17; and Malta Mariculture Ltd: MML Cage 7, MML Cage 9, MML Cage 20, and MML Cage 23.<br><br>During the survey, most of the cages belonging to the two farms held tuna.<br><br>The recorded natural physical characteristics of the seabed at the tuna penning site were the same as those noted during previous video surveys and were also typical of the bottom present off the northeastern coast of Malta within the 50 m – 80 m depth range, and at is-Sikka l-Bajda. However, in terms of anthropogenic influence, the presence of: (i) anthropogenic items originating from the tuna penning activities; (ii) tuna carcasses and skeletal remains, and (iii) patches with uneaten feed fish; indicate some alteration of the physical characteristics of the seabed. Such interpretations are similar to those from previous monitoring sessions.<br><br>Some tuna carcasses and skeletal remains, and a few patches with uneaten feed fish, were recorded underneath the cages; however, the amounts were less than those recorded in the previous year (2021), indicating an improvement in farm operations.<br><br>Notwithstanding, the overall state of the seabed appeared good, and the recorded benthic biota included megafauna (e.g. the urchin *Spatangus purpureus*) that were typical of the habitat. However, the authors noted a high density of some megafauna, which almost certainly resulted from the |

| Monitoring session | Summary of Findings |
|---|---|
| | presence of elevated levels of organic matter on the seabed originating from uneaten feed fish and other waste generated by the tuna farms. A high abundance of rays was also recorded below several of the tuna cages; these fish would have been attracted by the presence of uneaten feed fish, which they consume.<br><br>At the is-Sikka l-Bajda reference site, the *Posidonia oceanica* meadows appeared to be in a very good state and seemed unaffected by the tuna penning activities.<br><br>The demersal and pelagic fish fauna present in the vicinity of the tuna cages comprised species that are typical of local coastal areas but were present in high densities as a result of being attracted to food and waste originating from the tuna farms.<br><br>Therefore, in this regard, one may contend some alteration to the biological characteristics of the seabed in some places below the tuna cages at AJD Tuna Ltd's and Malta Mariculture Ltd's tuna penning sites.<br><br>The tuna penning fallow period between January and March / April helps to mitigate the effects of deposition of uneaten feed fish and / or tuna carcasses on the seabed. |
| October 2022 | Video footage was collected from the four reference sites (Northwest Reference, Northeast Reference, Southeast Reference and Southwest Reference) and from below the following cages: AJD Tuna Ltd: AJDT Cage 3, AJDT Cage 6, AJDT Cage 14, and AJDT Cage 17; and Malta Mariculture Ltd: MML Cage 9, MML Cage 12, MML Cage 19, and MML Cage 23.<br><br>During the survey, most of the cages belonging to the two farms held tuna.<br><br>The recorded natural physical characteristics of the seabed at Malta Mariculture Ltd's and AJD Tuna Ltd's tuna penning site were the same as those recorded during previous video surveys and are also typical of the bottom present off the northeastern coast of Malta within the 50 m – 80 m depth |

| Monitoring session | Summary of Findings |
|---|---|
| | range, and at is-Sikka l-Bajda.<br><br>In terms of anthropogenic influence, the presence of some items originating from the tuna penning activities, a few tuna carcasses and skeletal remains, a few patches with uneaten feed fish, and some patches with *Beggiatoa* indicate some alteration of the physical characteristics of the seabed at the tuna penning site. Such interpretations are like those from previous monitoring sessions.<br><br>During this survey, some tuna carcasses and skeletal remains, a few patches with uneaten feed fish, and some patches with *Beggiatoa*, were recorded underneath the cages. However, an appreciable decrease in the number of tuna carcasses present on the seabed underneath the cages was recorded in October 2022 when compared to the findings from the previous July 2022 session and surveys made in previous years, which is viewed as an improvement on previous years. The recorded presence of patches with *Beggiatoa* on the seabed below some of the cages results from nutrient enrichment of the bottom sediments and is a common occurrence at fish farm cage sites worldwide, particularly in places that are characterised by a low energy regime.<br><br>Several megabenthic biota (e.g. the urchin *Spatangus purpureus* and the crinoid *Antedon mediterranea*) recorded during the survey were typical of the habitat types present but some species were present in very high densities. As for the July 2022 session, the authors noted that this probably resulted from the presence of elevated levels of organic matter originating from uneaten feed fish that attract the megafauna. Likewise, the high abundance of rays recorded below several of the tuna cages evidently results attraction to uneaten feed fish, which they consume.<br><br>At the is-Sikka l-Bajda reference site, the *Posidonia oceanica* meadows appeared to be in a very good state and seemed unaffected by the tuna penning activities.<br><br>The demersal and pelagic fish fauna present in the vicinity of the tuna cages comprised species that are typical of local coastal areas but were present in high densities as a result of being attracted to food and waste originating from the tuna farms. |

| Monitoring session | Summary of Findings |
|---|---|
| | Therefore, in this regard, one may contend some alteration to the biological characteristics of the seabed in some places below the tuna cages at AJD Tuna Ltd's and Malta Mariculture Ltd's tuna penning sites.<br><br>The tuna penning fallow period between January and March / April helps to mitigate the effects of deposition of uneaten feed fish and / or tuna carcasses on the seabed. |
| June 2023 | Video footage was collected from the four reference sites (Northwest Reference, Northeast Reference, Southeast Reference and Southwest Reference) and from below the following cages:<br><br>AJD Tuna Ltd: Cage 2, Cage 4, Cage 14, Cage 17; and<br><br>Malta Mariculture Ltd: Cage 7, Cage 10, Cage 19, Cage 20.<br><br>During this survey, all or most of the cages were empty.<br><br>The seabed habitat type below the eight tuna pens and at three of the reference sites (Northwest reference, Northeast reference and Southwest reference) were similar to those recorded during previous surveys and mainly supported coarse sands and fine gravels. Accumulations of rhodoliths were mostly present in the troughs of seabed current ripples.<br><br>The most abundant megafaunal species recorded during the surveys were ones that are typical of the habitat type recorded under the cages and at the three aforementioned reference sites. The seabed at the southwest (Sikka l-Bajda) reference site mainly supported a biocenosis of *Posidonia oceanica* meadows, a biocoenosis of infralittoral algae, and patches with sublittoral sediment, which together formed a mosaic. The *Posidonia oceanica* appeared to be in a very good state.<br><br>The demersal fish fauna was also typical of the respective habitat types from where they were recorded during the surveys. |

| Monitoring session | Summary of Findings |
|---|---|
| | Some anthropogenic items (some of which appear to have originated from the tuna farms) were recorded on the seabed.<br><br>Two tuna carcasses (one each under MML Cage 19 and MML Cage 20), skeletal remains of tuna, and a high density of hermit crabs *Pagurus* sp. (the latter recorded under MML Cage 7) were recorded during this survey. Excluding MML Cage 7, where fish bones originating from uneaten feed fish were present, no uneaten feed fish were recorded under the cages and the seabed below the eight tuna pens surveyed appears to have retained similar physical and biological characteristics.<br><br>No anoxic conditions or other indications of an adverse state of the seabed habitats and species were detected; |
| September 2023 | Video footage was collected from the four reference sites (Northwest Reference, Northeast Reference, Southeast Reference and Southwest Reference) and from below the following cages:<br><br>AJD Tuna Ltd: Cage 2, Cage 5, Cage 13, Cage 16; and<br><br>Malta Mariculture Ltd: Cage 8, Cage 11, Cage 21, Cage 24.<br><br>During this survey, most of the cages belonging to the two farms held tuna.<br><br>The seabed area under the cages and at the reference sites supports benthic habitat types that are similar to those identified in the baseline studies undertaken prior to initiation of tuna penning activities.<br><br>Input of organic waste from the tuna farm and the anthropogenic items (several of which originate from the tuna penning activities) present on the bottom under some of the tuna cages have led to some alteration of the physical and biological characteristics of the benthic environment; this is mainly manifested by an increase in the abundance of benthic and demersal megafaunal scavengers that have been attracted to the area by the presence of organic matter (such as that originating from |

| Monitoring session | Summary of Findings |
|---|---|
| | uneaten feed fish), while the particulate matter and anthropogenic items contribute to some modification of the physical environment.<br><br>With regard to anthropogenic items that appear to have originated from the tuna farming activities; while the number of ropes is similar when comparing observations from the previous (June 2023) session with the present one, the number of weights appears to have increased, and the two very long tubes that may have served as supporting ring for the cage at the surface were not recorded in June 2023.<br><br>No anoxic conditions or other indications of an adverse state of the seabed habitats and species were detected.<br><br>The abundance of some indicator species such as of the Heart Urchin *Spatangus purpureus* appeared to be lower under the cages compared to the reference sites. On the other hand, other species that are typical of a pristine seabed, such as the Red Lance Urchin *Stylocidaris affinis* and the crinoid *Antedon mediterranea*, were present on the bottom under the cages, indicating an overall good state of the seabed. The seagrass *Posidonia oceanica* present within the 'Sikka l-Bajda' area appeared to be in a very good state and not influenced by the tuna farming activities |

## CONCLUSIONS

3.30. In conclusion, when one considers the findings of the environmental monitoring of the seabed over the five-year period from 2019 to 2023, it is evident that while the tuna penning activities have resulted in some alterations to the physical and biological characteristics of the seabed, the impact overall from fish wastes, uneaten feed fish, and tuna carcasses, is deemed to be insignificant to minor. These alterations are not large and are reversible, as has been confirmed when comparing data from the activity tuna penning season against that from the following fallowing period. Also, no anoxic conditions or other indications of an adverse state of the seabed habitats and species were detected to date. However, it is important for the tuna farm operators to remain vigilant and to ensure good practices throughout the operations on the farm to minimise adverse impacts.

3.31. The main effect seems to be an increase in the abundance of the scavenger / detritivore community beneath the cages, with benthic and demersal megafaunal scavengers attracted to the area by the presence of organic matter (e.g. uneaten feed fish)

3.32. The presence of anthropogenic litter on the seabed, mostly from the tuna penning activities, is of concern. From season to season, this litter seems to be increasing, and a greater effort needs to be made for this material to be collected and disposed of ashore.

# 4. MARINE ENVIRONMENT (WATER & SEDIMENT QUALITY)

4.1. This chapter focuses on a description of the quality of the marine environment at the Scheme site, in particular the water and sediment quality and how these are affected, if at all, by the tuna penning activities.

4.2. This Chapter is based on the information in the original baseline studies undertaken for the EIA, namely: the fieldwork in relation to the water and sediment quality undertaken on 4th April 2018 and reported in **Technical Appendix 2:** ***Marine Ecology Baseline Report***), and on the monitoring data collected by Ecoserv Ltd on behalf of AJD Tuna Ltd and Malta Mariculture Ltd for the period 2019 – 2023 (see **Technical Appendix 3:** ***Environmental Monitoring – Integrated assessment reports (2019-2023)***.

4.3. The potential key issues of the Scheme on the marine environment (water & sediment quality) 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**
- **Increased pollution risks (oils, fuels, sewage, litter) as a result of increased maritime traffic**
- **Possible marine littering from items lost overboard**

## TERMS OF REFERENCE & METHODOLOGY

4.4. As explained in **Chapter 3**, when requesting an EIA Update Report for the current proposal, the ERA requested an update to baseline studies in order to assess the long-term impacts that can potentially occur as a result of the proposed conversion of the current tuna penning operation from a temporary to a permanent one. Among the studies requested is the impact on seabed habitats and on the water quality from nutrient loads and other pollutants.

4.5. As for the methodology, in the same way as for the marine benthos aspects, in view that the Scheme site is the subject of a long-term monitoring programme, it was decided that the data from the monitoring programme would provide a better overview of the impacts on the water column from the tuna farming operations than

any new survey, which would provide a snapshot of the situation today. Therefore, this analysis is based on the data collected over the entire operational phase of the tuna penning operation at the Scheme site to date.

## BASELINE INFORMATION

4.6. The baseline information for the original EIA included sampling at six stations – four stations at the Scheme site (A – D) and two reference stations (R1 and R2). The location of the stations is shown in **Figure 4.1**, and their geographical coordinates and water depths are reproduced in **Table 4.1**.

**Table 4.1: 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 |

4.7. **Table 4.2** 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. 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 4.2: 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 | µg/l |

| Parameter | Method | Units |
|---|---|---|
| | Man 29 2003 | |
| 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 |

4.8. 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.

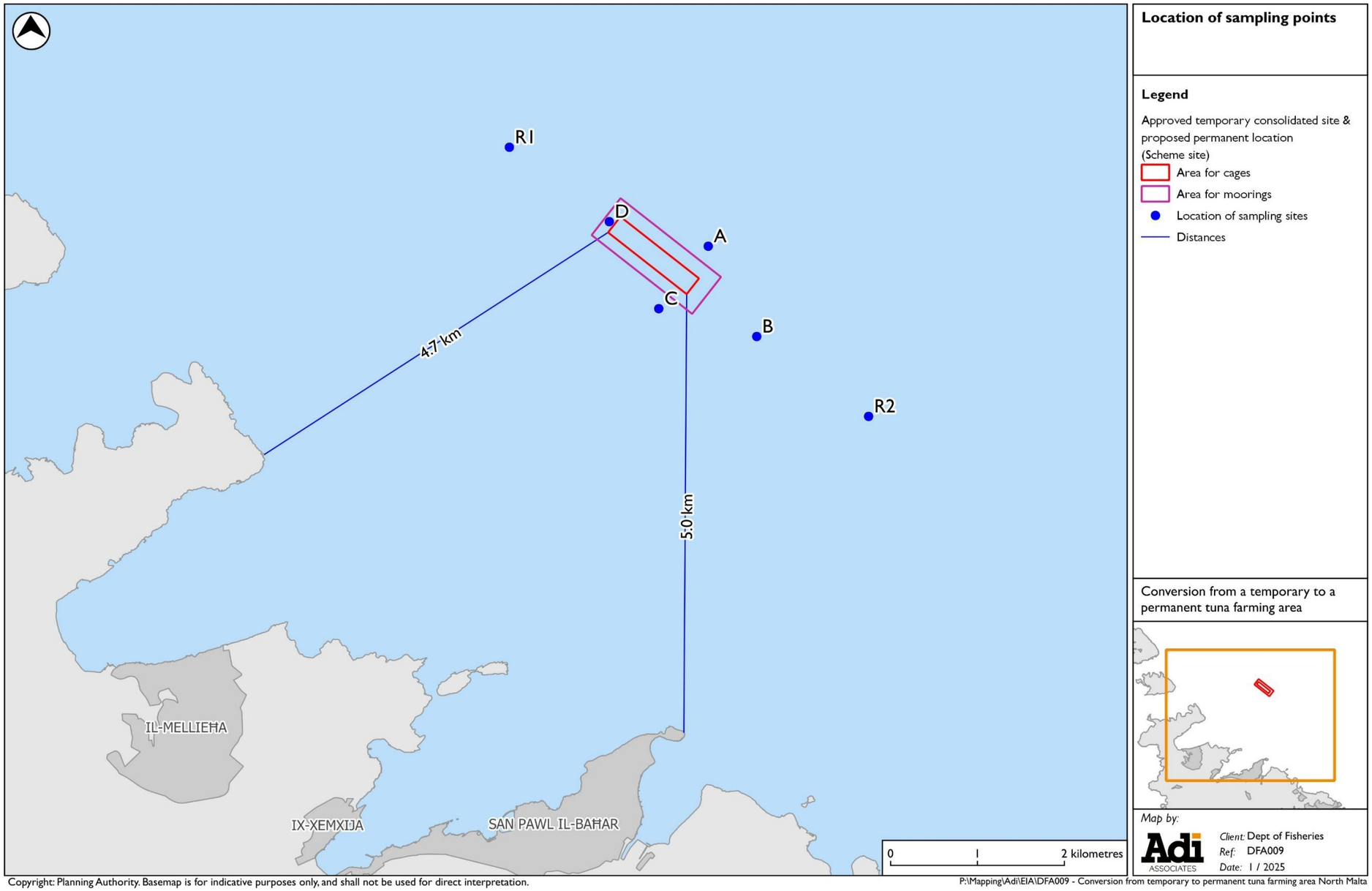
4.9. As regards sediment quality, samples were collected using a 0.1 $m^2$ Van Veen grab that was deployed from a 12 m vessel equipped with hoisting jib and winch. Two replicate grab samples were collected from each of the six stations. Samples were tested for chemical composition and granulometry. **Table 4.3** lists the physico-chemical attributes that were included in the sediment quality survey.

**Table 4.3: 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 |

4.10. The results of *in situ* measurement of physico-chemical parameters of the water column for the baseline studies of the original EIA indicated 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 and 29 m.

**Figure 4.1: Location of sampling stations**




Copyright: Planning Authority. Basemap is for indicative purposes only, and shall not be used for direct interpretation.

P:\Mapping\Adi\EIA\DFA009 - Conversion from temporary to permanent tuna farming area North Malta

4.11. 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.

4.12. 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.

4.13. 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.

4.14. The full set of results for the water and sediment quality analysis are available in **Technical Appendix 2: *Marine Ecology Baseline Report***.

## IMPACT ASSESSMENT

4.15. The original EIA Report identified the following impacts as relevant to the water quality at the Scheme site:

**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;

### Prediction and significance of impacts

4.16. 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.

4.17. 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[25] 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.

4.18. 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.

### Impact Assessment in original EIA Report

4.19. **Table 4.4** outlines the impact assessment on the marine environment as described in the original EIA Report. The Table lists the relevant impacts and describes the assessment and the mitigation measures proposed. A review of the mitigation measures proposed at EIA stage and whether these have since been implemented is also provided.

4.20. In **Chapter 5**, the impacts as originally assessed are analysed against the new water quality and sediment data collected through the environmental monitoring reports and an assessment of the long-term impacts on the water and sediment quality from the farming operation if the tuna farm is converted to a permanent installation is provided.

[25] "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).

## Table 4.4: Summary of Impacts on the marine environment as assessed in original EIA

| Impact description | Impact analysis (original EIA Report) | Mitigation Measures proposed in original EIA Report | Have Mitigation Measures been implemented? |
|---|---|---|---|
| **During Deployment** | | | |
| Increased potential for oil pollution due to increased maritime traffic (deployment craft) in area | Cages are towed to site by means of tugboats 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.<br><br>**Impact:**<br>• The 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**. | Good operational practices;<br><br>Ensure craft is in good working order;<br><br>Availability of oil spill response capabilities | Yes – Vessels used in deployment of cages and mooring blocks were in good working order and licensed for such work. |
| Reduction in bottom water transparency due to re-suspension of sediment particulates by mooring blocks | Cages are anchored on site by means of mooring blocks. The placement of these structures on the seabed results in the re-suspension of sediment particulates and entrapped nutrients, leading to a temporary reduction in water transparency and potentially increased productivity.<br><br>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.<br><br>**Impact:**<br>• The impact is considered to be **not significant**. | Impact not significant – no mitigation measures proposed | |

| Impact description | Impact analysis (original EIA Report) | Mitigation Measures proposed in original EIA Report | Have Mitigation Measures been implemented? |
|---|---|---|---|
| **During Operations** | | | |
| Reduction in water quality of surface waters due to release of fish oils and mucus from baitfish during feeding | Tuna farming operations release considerable amounts of natural fish oils and mucus 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.<br><br>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. 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 the EIA shows that the winds and currents at the Scheme site vary and any uncontained oil released from the farm would reach the coastline.<br><br>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. 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. | Deployment of oil booms and collection of fish oils using skimmers from inside the cages to minimise release outside of farm area | Yes. Oil booms deployed inside each cage<br><br>Use of diver-operated skimmers to collect fish oil generated during the feeding.<br><br>Deployment of service vessels to patrol the waters around the farm and collect any fish oil that escapes<br><br>Contract with Aquaculture Resources Ltd for the deployment of additional craft to patrol a wider stretch of coastline and collect oils / slime reported to the authorities.<br><br>Partial thawing of the feed fish on land prior to transfer to the farm (thaw water collected in IBCs and disposed of by licensed waste contractor).<br><br>Surveillance and liaison with authorities to counteract the formation of slime and its collection.<br><br>Annual training of farm staff by environmental consultants. |

| Impact description | Impact analysis (original EIA Report) | Mitigation Measures proposed in original EIA Report | Have Mitigation Measures been implemented? |
|---|---|---|---|
| | **Impact:**<br>• Impacts are considered to be temporary (for as long as the tuna are present on site) and judged to be **minor to not significant** in terms of water quality impacts | | |
| Deterioration in water quality due to increased nutrient loads from fish excreta and uneaten feed | 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.<br><br>Data from past monitoring programmes at operational tuna farm sites show that nutrient levels within the water column at all stations exhibit wide fluctuations, 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 the EIA 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. | Optimise stocking density in cages not to overload the water column<br><br>Strict feed management;<br><br>Monitoring of tuna feeding (possibly using new technologies),<br><br>Greater liaison with regulators,<br><br>Prompt action by farmers to collect sinking baitfish,<br><br>Lengthening of statutory fallowing period | Stocking density controlled through license / ICCAT quota and number of cages.<br><br>Tuna feeding monitored and controlled by divers to limit wastage and loss of fish to the seabed.<br><br>Tuna farm operators and Aquaculture Resources Ltd in regular contact with ERA.<br><br>Twice yearly environmental monitoring at the farm by independent monitors. Findings include any evidence of uneaten baitfish accumulation on the seabed or tuna carcasses.<br><br>Collection of baitfish from seabed.<br><br>Overwintering not practiced in recent years allowing for a longer fallowing period. |

| Impact description | Impact analysis (original EIA Report) | Mitigation Measures proposed in original EIA Report | Have Mitigation Measures been implemented? |
|---|---|---|---|
| | 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 seabed 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.<br><br>**Impact:**<br>• The impact is 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 | 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. | Collection, handling and management of offal to be in line with the provisions of EC Regulations on handling of fishery products and animal by-products;<br><br>Monitoring and supervision to ensure disposal beyond 12 nautical miles; | Offal is no longer being disposed of at sea. Instead, it is now being collected and transferred to a rendering plant on land for the production of fish meal and fish oils.<br><br>Tuna carcasses are either transferred to the rendering plant (if still in good condition), or landed for |

| Impact description | Impact analysis (original EIA Report) | Mitigation Measures proposed in original EIA Report | Have Mitigation Measures been implemented? |
|---|---|---|---|
| | 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.<br><br>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.<br><br>**Impacts:**<br>• Impacts from the release of blood from the culling process is judged to be **minor to not significant**.<br>• Impacts from the production of offal are deemed to be **minor to not significant** if disposal is controlled and carried out over a | Maceration of offal prior to disposal<br><br>Prohibit disposal of tuna carcasses at sea and manage in line with the provisions of Regulation (EC) No 1069 of 2009;<br><br>Farm operators to ensure recovery of carcasses in the event of accidents / mass mortality during storms.<br><br>Prohibit / strictly control fishing activities in the vicinity of tuna farms | incineration at the abattoir, or disposed of beyond the 12 nm limit.<br><br>Twice yearly environmental monitoring at the farm by independent monitors. Findings include any evidence of uneaten baitfish accumulation on the seabed or tuna carcasses.<br><br>Collection of some tuna carcasses from seabed has taken place (especially when the carcasses are still fresh).<br><br>Fishing within the area occupied by the tuna farm is not allowed; however, fishermen still congregate outside this area and a considerable activity takes place there as the farms are good attractors of wild fish, including tuna. |

| Impact description | Impact analysis (original EIA Report) | Mitigation Measures proposed in original EIA Report | Have Mitigation Measures been implemented? |
|---|---|---|---|
| | wide area to avoid overloading.<br>• The impact from tuna mortalities is uncertain but considered to be **major to minor** depending on the scale of the deaths and the effectiveness of the response. | | |
| Pollution from operational release of petroleum hydrocarbons and bilge waters, and from litter and sewage from vessels associated with the Scheme | Operational losses of oils and fuels from the smaller craft used on the farm 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<br><br>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 15$m^3$ of oily bilge water per year, which bilge water could contain up to 5% by volume, lubricating oils and other petroleum products.<br><br>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 sewage effluents within 4 nautical miles from land, unless it is equipped with an approved sewage treatment plant.<br><br>Following processing on board the factory vessels, the tuna are packed in purpose made carton | Good operational practices;<br><br>Adherence to MARPOL Regulations (oil content, prohibition of discharge, holding tanks, etc);<br><br>Ensure craft is in good working order;<br><br>Availability of oil spill response capabilities<br><br>Use of flat-pack cartons for packaging;<br><br>Collection of marine litter<br><br>Immediate collection of any items lost overboard (whether floating or on the seabed);<br><br>Monitoring of seabed condition | All service vessels and processing vessels follow MARPOL Regulations and are appropriately licensed and certified as required.<br><br>Packaging boxes are the flat-packed type.<br><br>Collection of marine litter is practiced although a greater effort is required to retrieve items lost overboard and accumulating on the seabed.<br><br>Twice yearly environmental monitoring at the farm by independent monitors. Findings include any evidence of anthropogenic items and litter on the seabed. |

| Impact description | Impact analysis (original EIA Report) | Mitigation Measures proposed in original EIA Report | Have Mitigation Measures been implemented? |
|---|---|---|---|
| | 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. 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.<br><br>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.<br><br>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 | | |

| Impact description | Impact analysis (original EIA Report) | Mitigation Measures proposed in original EIA Report | Have Mitigation Measures been implemented? |
|---|---|---|---|
| | farm.<br><br>**Impact:**<br>• Impacts from bilge waters are considered to be **not significant to minor** in the case of small craft and **minor to major** in the case of an accidental large spill. As regards the large processing vessels, the impacts are deemed to be **minor to major**.<br>• Impacts from sewage are considered to be **minor to major** depending 9on the measures available on the vessels.<br>• Impacts from packaging waste are deemed to be **not significant to minor**.<br>• Impacts from galley litter are considered to be of **minor** significance or of **minor to major** significance with regards to other litter and anthropogenic items lost overboard. | | |

# ANALYSIS OF WATER QUALITY AND SEDIMENT DATA FROM ENVIRONMENTAL MONITORING REPORTS

4.21. The tuna penning operation undertaken by AJD Tuna Ltd[26] at the Scheme site is subject to environmental monitoring that is undertaken by an independent monitoring firm. Monitoring has been undertaken regularly in line with an approved monitoring programme as part of the farms' environmental permits, ever since the farms were relocated to the Scheme site. The farming operations at the previous locations were likewise subject to environmental monitoring.

## Monitoring programme

4.22. Details of the monitoring programme were described in **Chapter 3** above. Water Quality monitoring at the Scheme site has been undertaken twice yearly since 2019. Water quality monitoring included aerial photography sessions coupled with water quality surveys. The aim of the aerial photographs is to detect any potential oil slicks and their extent in the vicinity of the tuna farms, given that this was the main issue that resulted in the relocation of the tuna farms. The aerial reconnaissance is undertaken at the same time as the *in-situ* measurement of water quality attributes and collection of marine water samples for later analysis in the laboratory.

4.23. *In-situ* measurements (two replicates) and collection of seawater samples (two replicates) are made at a water depth of 1 m (subsurface) at four stations located within the Scheme site: an up-current station, two stations located at the centre of the site, and a down-current station. Furthermore, two replicate samples of seawater are taken at the surface from the same four stations for potential analysis of oils. The latter analysis is, however, only undertaken if the aerial photographs show evidence of the presence of an oil slick. At each station, observations on the following are also made: presence of floating material; surface oil slicks; tarry residues; surface foam/bubbles; or odours. Water samples for laboratory analyses are transferred to pre-treated glass or plastic bottles, as appropriate and depending on the analysis concerned. Samples are maintained at a temperature of 4-8°C during transport to the lab. Analysis for the parameters is undertaken using standard methods. The parameters that require laboratory analysis are analysed at a laboratory that is accredited according to the ISO 17025:2005 standard.

4.24. In 2021, the water quality monitoring programme was amended to include two additional sampling stations – one "up-current" and one "down-current". These additional stations were to be located some 500 m from the tuna penning site. These additional stations (see **Figure 4.2**) should help the interpretation of potential elevated levels of one or more of the monitored parameters.

4.25. A further change to the monitoring programme was made in 2023, when ERA requested the addition of seabed sediment sampling and analysis for granulometry,

[26] The entire operation is carried out under two aquaculture permits – one for AJD Tuna Ltd and one for Malta Mariculture Limited, both owned by Messers Azzopardi.

Total Organic Carbon, Redox Potential, sulphide, pH, Total Nitrogen, and Total Phosphorus. A total of eight stations are monitored – four aligned along a northwest-southeast imaginary line through the Scheme site and two stations adjacent to two cages from each farm (AJD Tuna Ltd and MML), which stations are chosen at random during each monitoring session (see **Figure 4.3**).

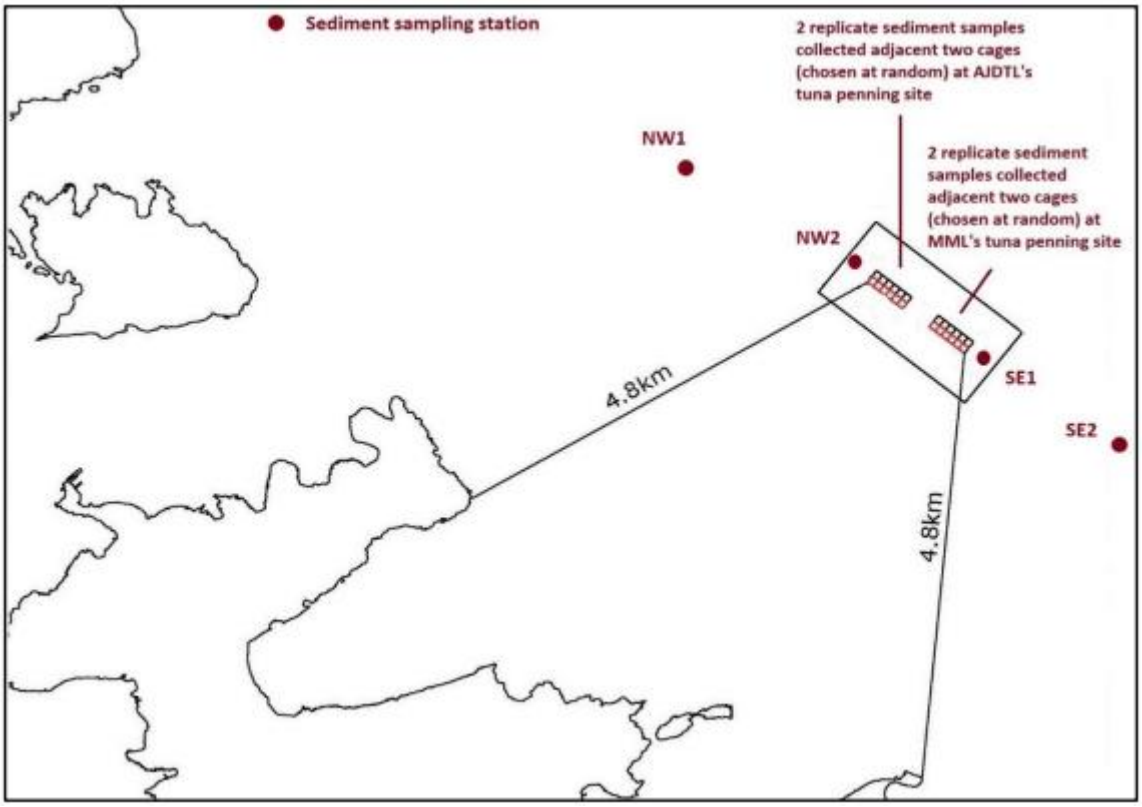
### Monitoring results

4.26. Analysis of the findings of the monitoring data for water quality (2019 – 2023) and seabed sediments (2023) have been reviewed and assessed against the baseline conditions reported in the original EIA. **Tables 4.5** and **4.6** provide a summary of the findings of the water quality and sediment monitoring, respectively.

**Figure 4.2: Aerial image showing the locations of water quality monitoring stations A - F.**


Source: Ecoserv Ltd, 2023; Map Source: Google Earth™

**Figure 4.3: Map showing location of sediment sampling stations.**




Source: Ecoserv Ltd, 2023

**Table 4.5: Summary of findings of water quality monitoring (2019-2023)**

| Monitoring session | Summary of Findings |
|---|---|
| March 2019 | Values of temperature, salinity, dissolved oxygen, turbidity and Secchi Disc depth recorded from the four water quality monitoring stations were similar, overall, during both spring and summer 2019 sessions.<br><br>No floating material, surface oil slicks, tarry residue, surface foam/bubbles or odours were detected on the sea surface during this survey. This was corroborated by aerial photographs of the survey area.<br><br>Of the 8 cages used by AJD Tuna Ltd, two cages had a net and appeared to hold tuna; likewise, of the 8 cages used by Malta Mariculture Ltd, two cages had a net and appeared to hold tuna.<br><br>Mean values of pH, Total Nitrogen, Total Phosphorous, Chlorophyll a, total organic carbon (TOC) and total suspended solids (TSS) in seawater recorded from the four stations were similar, overall, during both spring and summer 2019 sessions.<br><br>The findings of the present water quality monitoring session indicate that AJD's and MML's tuna farming activities have not resulted in appreciable alteration of water quality in terms of the monitored attributes. |
| September 2019 | Values of temperature, salinity, dissolved oxygen, turbidity and Secchi Disc depth recorded from the four water quality monitoring stations were similar, overall, during both spring and summer 2019 sessions.<br><br>Some oil slicks and foam were observed on the surface during fieldwork. Such patches were dispersed and recorded close to the boundary line of the tuna farms, in the vicinity of the western station.<br><br>No floating material, surface oil slicks, tarry residue, surface foam/bubbles or odours were detected |

| Monitoring session | Summary of Findings |
|---|---|
| | on the surface in the rest of the study area during this survey. This was corroborated by aerial photographs of the survey area, which however, indicated patches with a dispersed oily substance on the sea surface in the vicinity of the western station.<br><br>Of the 12 cages used by AJD Tuna Ltd and Malta Mariculture Ltd appeared to hold tuna during this survey.<br><br>Mean values of pH, Total Nitrogen, Total Phosphorous, Chlorophyll a, total organic carbon (TOC) and total suspended solids (TSS) in seawater recorded from the four stations were similar, overall, during both spring and summer 2019 sessions.<br><br>The findings of the present water quality monitoring session indicate that AJD's and MML's tuna farming activities have not resulted in appreciable alteration of water quality in terms of the monitored attributes. |
| May 2020 | No floating material, surface oil slicks, tarry residue, surface foam/bubbles or odours were detected on the surface in the study area during this monitoring session. Aerial photography was not possible during this session due to the restrictions during the COVID-19 pandemic.<br><br>Differences in temperature, salinity, dissolved oxygen, turbidity levels and Secchi Depth amongst the four stations were small and, overall, levels of these attributes are considered typical for offshore waters during spring.<br><br>Results for TOC and TSS indicated low levels of these attributes at all four stations. Mean values of TSS varied between 2.90 mg/L at station A and 4.00 mg/L at Station B. Mean values for TOC ranged from 0.92 mg/l at Station C and 1.00 mg/L at Station B. In comparison to the previous session held in September 2019, TSS levels recorded from the May 2020 survey were slightly higher, overall, whereas levels of TOC were slightly lower.<br><br>Values of pH recorded from the four stations were between 8.27 at Stations C and D, and 8.29 at |

| Monitoring session | Summary of Findings |
|---|---|
| | Stations A and B; such values are within the typical range for offshore waters.<br><br>Chlorophyll a was not recorded above the detection limit of 0.3 µg/L at any of the four stations.<br><br>The recorded levels of total nitrogen were lower compared to the previous session (September 2019), when values for total nitrogen ranged between 16.80 µg/l at Station D and 12.50 µg/l at Station A. During this monitoring session, the recorded levels of total nitrogen were between 0.60 µg/L at Station C, and 1.20 µg/L at Station A.<br><br>Levels of total phosphorous recorded during the previous (September 2019) session ranged between 3.05 µg/l at station A and 2.58 µg/l at Station C. Levels of total phosphorous recorded during this monitoring session were higher, ranging between 36.85 µg/l at Station D and 44.60 µg/l at Station A. However, a trend of decreasing total phosphorous levels from Station A to Station D was noted, which ran counter to the recorded current direction on the day and indicated that the observed high levels were probably not due to the tuna farming activities. |
| October 2020 | No floating material, surface oil slicks, tarry residue, surface foam/bubbles or odours were detected on the surface in the study area during this monitoring session. This was corroborated by aerial photographs of the survey area.<br><br>All of AJD Tuna Ltd's and MML's cages held tuna at the time of this survey.<br><br>Differences in temperature, salinity, dissolved oxygen, turbidity levels and Secchi Depth amongst the four stations were small and, overall, levels of these attributes are considered typical for offshore waters during summer.<br><br>During this monitoring session, mean values for TSS varied between 2.50 mg/L at stations B and C and 3.80 mg/L at Station A, while mean values for TOC ranged from 0.83 mg/l at Station C and 0.85 mg/L at Stations A and D. These values indicated that differences in levels of these two attributes amongst the monitoring stations were not appreciable, while the recorded levels were similar or |

| Monitoring session | Summary of Findings |
|---|---|
| | lower compared to those recorded from the previous (May 2020) survey.<br><br>Values of pH recorded from the four stations were between 8.18 at Station A and 8.22 at Stations B and C; such values were deemed to be within the typical range for offshore waters.<br><br>Chlorophyll a was recorded at low levels of between 0.2 µg/L at Stations A and B, and 0.39 µg/L at Station C.<br><br>The recorded levels for total nitrogen were 0.90 µg/L at all four stations, which is similar to the levels reported from the previous (May 2020) session, where the recorded levels were between 0.60 µg/L and 1.20 µg/L.<br><br>Levels of total phosphorous recorded during this monitoring session ranged between 1.25 µg/L at Station D, and 4.05 µg/L at Station B. These levels were lower than those recorded from the previous (May 2020) session, when values ranged between 36.85 µg/L and 44.60 µg/L. |
| May 2021 | No floating material, surface oil slicks, tarry residue, surface foam/bubbles or odours were detected on the surface in the study area during both this monitoring session. These observations were corroborated by the aerial photographs, which indicated the absence of appreciable amounts of floating material, including floating oily substances (commonly referred to as 'sea slime').<br><br>Values of pH, temperature, salinity, dissolved oxygen, turbidity levels and Secchi Depth amongst the four sampling stations were similar, and levels of these attributes were considered typical for offshore waters during this season.<br><br>Mean values for TSS varied between 0.45 mg/L at Station A, and 0.60 mg/L at Station F.<br><br>Mean values for TOC ranged from 1.00 mg/l at Stations B and D and 1.25 mg/L at Station F.<br><br>Chlorophyll a was not recorded above the method detection limit of 0.05 µg/L at stations A to D |

| Monitoring session | Summary of Findings |
|---|---|
| | located in the immediate vicinity of the cages. At Stations E and F, located > 2 Km away northwest and southeast of the cages respectively, chlorophyll a was detected at low levels of 0.24 µg/L (Station E) and 0.35 µg/L (Station F).<br><br>The recorded levels for total nitrogen and total phosphorous did not exceed the respective method detection limits of 1.40 µg/L and 0.30 µg/L at any of the six stations.<br><br>The recorded differences in values of the considered parameters amongst the six stations were deemed not appreciable and typical of coastal offshore waters during spring. |
| September 2021 | No floating material, surface oil slicks, tarry residue, surface foam/bubbles or odours were detected on the surface in the study area during both this monitoring session. These observations were corroborated by the aerial photographs, which indicated the absence of appreciable amounts of floating material, including floating oily substances (commonly referred to as 'sea slime').<br><br>Values of pH, temperature, salinity, dissolved oxygen, turbidity levels and Secchi Depth amongst the four sampling stations were similar, and levels of these attributes were considered typical for offshore waters during this season.<br><br>Mean values for TSS varied between 0.40 mg/L at Stations A and B, and 0.60 mg/L at Stations E and E.<br><br>Mean values for TOC ranged from 0.72 mg/l at Station F and 0.99 mg/L at Station D.<br><br>Chlorophyll a was recorded at levels between 0.89 µg/L at Station F and 0.52 µg/L at Station A.<br><br>The recorded levels for total nitrogen and total phosphorous did not exceed the respective method detection limits of 1.40 µg/L and 0.30 µg/L at any of the six stations. |

| Monitoring session | Summary of Findings |
|---|---|
| | The recorded differences in values of the considered parameters amongst the six stations were deemed not appreciable and typical of coastal offshore waters during spring.<br><br>With regard to the slightly elevated levels of Chlorophyll a; both reference stations E and F , which are located at a considerable distance from the farm sites, had the highest levels. Therefore, it was concluded that the recorded levels should not be attributed to the tuna penning activities but possibly to higher phytoplankton abundance in local coastal waters during summer. |
| August 2022 | The results of this monitoring session indicated, overall, that levels of the monitored attributes at the NAS were within a range that is expected for local coastal offshore waters in summer; no appreciable differences in levels of the monitored attributes were noted amongst the six stations including the 'down-current' station, and the 'up-current' station. However, some patches with a white oily slick and foam having a fishy odour were present in the vicinity of the tuna penning sites, although no large amounts of the floating substance were present. |
| October 2022 | The results of this monitoring session indicated that levels of the monitored attributes at the NAS were within a range that is expected for local coastal offshore waters in autumn; no overall appreciable differences in levels of the monitored attributes were noted amongst the six stations, including the 'down-current' station.<br><br>Values for TOC were marginally higher in the vicinity of the cages when compared to the reference stations, and one station (Station C) had a significantly higher value for total nitrogen but this was considered to be anomalous.<br><br>A fishy odour was detected in the vicinity of the cages |
| June 2023 | The results of this monitoring session indicated that levels of the monitored attributes at the NAS were mostly within a range that is expected for local coastal offshore waters in summer, although TOC, TSS and total phosphorous were slightly elevated. However, no appreciable differences in |

| Monitoring session | Summary of Findings |
|---|---|
| | levels of the monitored attributes were noted amongst the six stations including the 'down-current' station, and the 'up-current' station, indicating that the elevated readings were unlikely to have originated from the tuna farming activities.<br><br>During this monitoring session, most of the cages were empty. |
| November2023 | The results of this monitoring session indicated that levels of the monitored attributes at the NAS were within a range that is expected for local coastal offshore waters in winter; no overall appreciable differences in levels of the monitored attributes were noted amongst the six stations, including the 'down-current' station.<br><br>Values for TSS were somewhat high, especially in the vicinity of the cages, but this was also the case at the reference stations. However, turbidity and Secchi depth readings indicated a high level of water transparency, while these did not vary appreciably amongst stations.<br><br>During this monitoring session, most of the cages were either full or the tuna had been recently harvested. |

**Table 4.6: Summary of findings of seabed sediment monitoring (2023)**

| Monitoring session | Summary of Findings |
|---|---|
| June 2023 | The results of this monitoring session indicated that the sediment within and around the NAS is mostly coarse sand.<br><br>Results of chemical analysis indicated that levels of monitored parameters were as expected of background conditions, while statistical analysis showed no significant difference between levels of most the parameters in sediment below the fish cages, and at the reference sites. The only exception was phosphorous, which was found to be higher at the cage sites compared to the reference sites |

| Monitoring session | Summary of Findings |
|---|---|
| | noting, however, that the elevated levels were recorded from within the 'zone of allowable effect' (AZE), and therefore were expected to be higher than background values |
| November2023 | This monitoring session indicated that grain size was coarser than in June and was mostly classified as very coarse sand.<br><br>Levels of most parameters recorded during this monitoring session were very similar to those recorded from the previous (June) session, and only phosphorous was found to be present at significantly higher levels at the cage sites in comparison to the reference sites. Nitrogen on the other hand, was lower at the cage sites, when compared to the reference sites. |

## CONCLUSIONS

4.27. In conclusion, when one considers the findings of the environmental monitoring on water quality and sediments over the five-year period from 2019 to 2023, it is evident that while the tuna penning activities have occasionally resulted in localised impacts from foam, or oil slicks, the values of the water quality monitored attributes were generally within a range that would be expected of local pristine offshore waters for each of the monitored years. Furthermore, no appreciable differences in the levels of the monitored physico-chemical parameters were noted amongst the monitoring stations, including the 'up-current' station and the 'down-current' station. Accordingly, it can be concluded that the tuna farming activities at the Scheme site have not resulted in appreciable alteration of water quality in terms of the monitored attributes. Nonetheless, increased vigilance during operations, and improved operational management practices are advisable to ensure against unmitigated impacts.

4.28. As regards sediments, which have only been monitored since 2023, it was concluded that the results of the two sediment quality monitoring sessions made at the Scheme site in 2023 were in line with what one would expect for sediments below fish farms. Furthermore, it was encouraging to note that with respect to the monitored parameters, there were no appreciable differences in levels between sediments below the cages and those at reference sites located approximately two kilometres away from the Scheme site, nor were there appreciable differences between the results of chemical analyses of sediments when comparing the start of tuna penning operations, to those recorded in 2023. Overall, the recorded results indicated that the effects of tuna farming on the sediments below the farms, and the immediate surroundings are limited, and where present, appear to be mostly confined to the general footprint of the Scheme site and where elevated levels were recorded, these were deemed normal of what one would expect from an area located directly below the farm cages and hence under an 'allowable zone of effect'; sediments below farm cages are subject to organic enrichment, which will alter the sediment characteristics to some degree.

# 5. CONCLUSIONS AND RECOMMENDATIONS

5.1. This final chapter provides a re-assessment of the impacts considered in the original EIA undertaken for PA/02175/18 in the light of the findings of the environmental monitoring undertaken at the Scheme site since 2019. It also considers the effects on the Conservation Objectives of the Natura 2000 sites. Conclusions and recommendations, especially with regards to mitigation measures are also provided.

5.2. As requested by the ERA, the analysis was restricted to the impacts on seabed habitats from fish waste and uneaten feed, impacts on water quality from nutrient loads and other pollutants, consideration of the extent of the area affected by the operations and its recovery potential, and effects on the conservation objectives of Natura 2000 marine sites.

## SUMMARY OF KEY IMPACTS

5.3. In the EIA Report for PA/02175/18, the unmitigated major impacts identified related 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.

5.4. Other impacts were identified as being of possible major significance under certain circumstances, though a degree of uncertainty or a range of possible conditions did not allow the impact to be conclusively defined at the time. These included:

- 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;

5.5. Other uncertain effects related to impacts on birds (disturbance from light pollution, predation on seabirds, and impacts from ingestion of marine debris), marine archaeology (potential damage to unknown or buried artefacts), and effects on humans (including impact on the AFM's firing practice area, impacts on navigation, deterioration of inshore waters and impacts on recreation and tourism).

# PREDICTED VS ACTUAL IMPACTS

5.6. The following section identifies the impacts of potential major significance identified in the original EIA Report and assesses whether these impacts did materialise following five years of tuna penning activity, in the light of the findings from the ongoing environmental monitoring at the Scheme site. While the main emphasis is on benthic ecology and water quality, as requested by ERA, a commentary on other impacts identified in the EIA is also provided.

## Benthic Ecology

| Predicted Impacts | Actual Impacts |
|---|---|
| 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 | The placement of moorings would have definitely impacted the benthic habitats within their footprint and a distance from the moorings in view of sediment movement or scour.<br><br>**Impact confirmed** |
| Benthic habitats were also deemed to be 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. | The findings of the environmental monitoring of the seabed over the five-year period from 2019 to 2023 indicate that while the tuna penning activities have resulted in some alterations to the physical and biological characteristics of the seabed, the impact overall from fish wastes, uneaten feed fish, and tuna carcasses, is deemed to be minor to not significant.<br>These alterations are not large and are reversible, as has been confirmed when comparing data from the active tuna penning season against that from the following fallowing period.<br>This impact is definitely related to the farm management and in particular to good feed management.<br><br>**Impact: minor to not significant as long as good farm management practices are in place** |

## Water Quality

| Predicted Impacts | Actual Impacts |
|---|---|
| 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. | The water quality and sediment monitoring results have not indicated any such deterioration. Values of the monitored attributes were generally within a range that would be expected of local offshore waters, and no appreciable differences in values were noted amongst the four sampling stations, including the 'up-current' and 'down-current' stations.<br><br>It was hence concluded that the tuna farming |

| Predicted Impacts | Actual Impacts |
|---|---|
| | activities at the Scheme site have not resulted in appreciable alteration of water quality in terms of the monitored attributes.<br><br>**Impact: minor to not significant as long as feed management is strictly enforced, and any tuna carcasses or excessive uneaten feed fish are collected immediately so as not to overload the scavenger system on the seabed.** |
| 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. | The limited impacts identified are a strong indicator of the importance of good farm management practices.<br><br>No instances of bilge water or sewage discharges have been reported to date.<br><br>A different matter is the loss of anthropogenic material and other litter on the seabed. This seems to be on the increase with little of this material being retrieved (unlike tuna carcasses, which have often been collected for disposal on land.<br><br>A clean up of the seabed would go a long way to mitigating this matter together with more regular training and stricter enforcement of measures against littering on the farm.<br><br>**Impact: Not significant with regards to sewage, bilge waters, oil spills.**<br>**Minor to major significance with regards to anthropogenic litter** |

## Avifauna

| Predicted Impacts | Actual Impacts |
|---|---|
| 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. number 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. | Impacts identified have not been monitored so the uncertainty remains. Birdlife Malta reports that the number of seabirds frequenting fish farms (including the ones in the south) seems to be increasing, with fish farms being a favourite destination for bird watchers (especially for terns, gulls and petrels).<br><br>Birdlife also reports various and increasing instances of seabirds oiled with fish slime (see **Appendix 2**).<br><br>**Impact: Uncertainty remains. While light pollution does not appear to be a major consideration with regards to the farms, the attraction to the farms and the oiling of the birds requires further studying.** |

## Archaeology

| Predicted Impacts | Actual Impacts |
|---|---|
| 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. | No effects on archaeology have been reported over the past years and the likelihood of buried items being disturbed is low.<br><br>**Impact: minor significance but uncertain** |

## Effects on Human Populations

| Predicted Impacts | Actual Impacts |
|---|---|
| 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 | It has since transpired that the farm was not actually shifted and hence the issue remains. The AFM is still objecting to the location of the farm and insisting that it should move outside of the firing arc. The DFA has issued written instructions to the farm operator to shift the farm to its permitted location by 31 March 2025.<br><br>**Impact: major significance** |
| As regards navigational safety, this can be mitigated though normal navigational safety practices, including proper charting and on site marking of the farm. | The situation remains the same. The farm has been charted and no additional navigational issues are reported. Transport Malta has maintained its no objection to the Scheme subject to adherence to conditions.<br><br>**No change in impacts** |
| 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. | The release of fish oils remains a problem for as long as the tuna are fed feed fish. The deployment of additional patrolling and oil collection measures are a positive step and increased surveillance is important. The possibility of using other technologies to develop an early warning system should be considered further. As should the possibility of changing the feed to the new artificial feed being developed specifically for tuna.<br><br>Instances such as what happened at Ħondoq ir-Rummien in August 2024 must be avoided at all costs in the interests of recreation, tourism, and the environment<br><br>**Impacts confirmed** |

### Conclusion

5.7. The above has evaluated the impacts resulting from the proposal to convert the tuna farming zone operated by AJD Tuna Limited from a temporary to a permanent facility.

5.8. Evidence from the environmental monitoring programme undertaken over the past years show that as long as the management of the farm and the monitoring of the feed follow good operational practices, the impacts on the seabed and on the water quality are contained and the residual impact is less than what was originally predicted.

5.9. Although surveillance and oil collection measures have been stepped up, the impacts from fish slime when this manages to escape the farm precincts and reaches the inshore areas, is still of major significance especially with regards to nuisance on other marine and coastal uses. Greater attention to this issue must be had, for as long as the tuna keep on being fed bait fish.

5.10. The availability on the market of artificial feed specifically designed for bluefin tuna (see for example: https://www.skretting.com/) could be a game changer and local tuna farmers are encouraged to explore this new product with a view to eliminate or reduce baitfish feeding.

5.11. Except for the above, the rest of the impacts are not individually expected to differ from those assessed as a result of the Scheme proposal to convert the current temporary tuna farm operation into a permanent installation, except that they would no longer be short term or temporary but become long-term and/or permanent, which could, in the long run, lead to chronic effects on environmental resources. This situation should, therefore, be continually monitored to counteract any sudden or unanticipated effects. The following recommendations are also to be considered as eventual permit conditions if the proposal is approved.

## RECOMMENDATIONS

5.12. While impacts from the tuna penning activities on the marine environment appear to be contained, certain measures can still be taken to mitigate or minimise further these effects. Such measures include:

- Ensuring that as long as the tuna continue to be fed baitfish, the feeding is carefully monitored and feeding stopped as soon as the fish appear satiated so as to avoid the loss of uneaten fish and its deposition on the seabed beneath the cages.

- The tuna farm operator should consider testing the new artificial feed that has been developed specifically for tuna with a view to assess its suitability and financial feasibility in the hope that this could be a game changer that would eliminate the possibility of uneaten feed fish ending up on the seabed. It would be advisable for the farm operator to be requested to provide a report on viability of this (or similar) feed.

- Issuing strict instructions to farm operations against discarding of material into the marine environment. In the eventuality that anthropogenic items end up on the seabed by accident, every attempt should be made to retrieve and dispose of them in an appropriate manner (given the water depth of around 50 m this should be possible). ERA should also consider imposing fines if the monitoring reports report an increase in such items, as has been happening recently.

- Avoiding having tuna carcasses or the remains of dead tuna ending up on the seabed below the cages and in their vicinity, even if this is not the direct result of action by the tuna farm operators; in this respect tuna carcasses and / or remains of dead tuna should be retrieved by divers (given the depths), as long as these have not started to decompose.

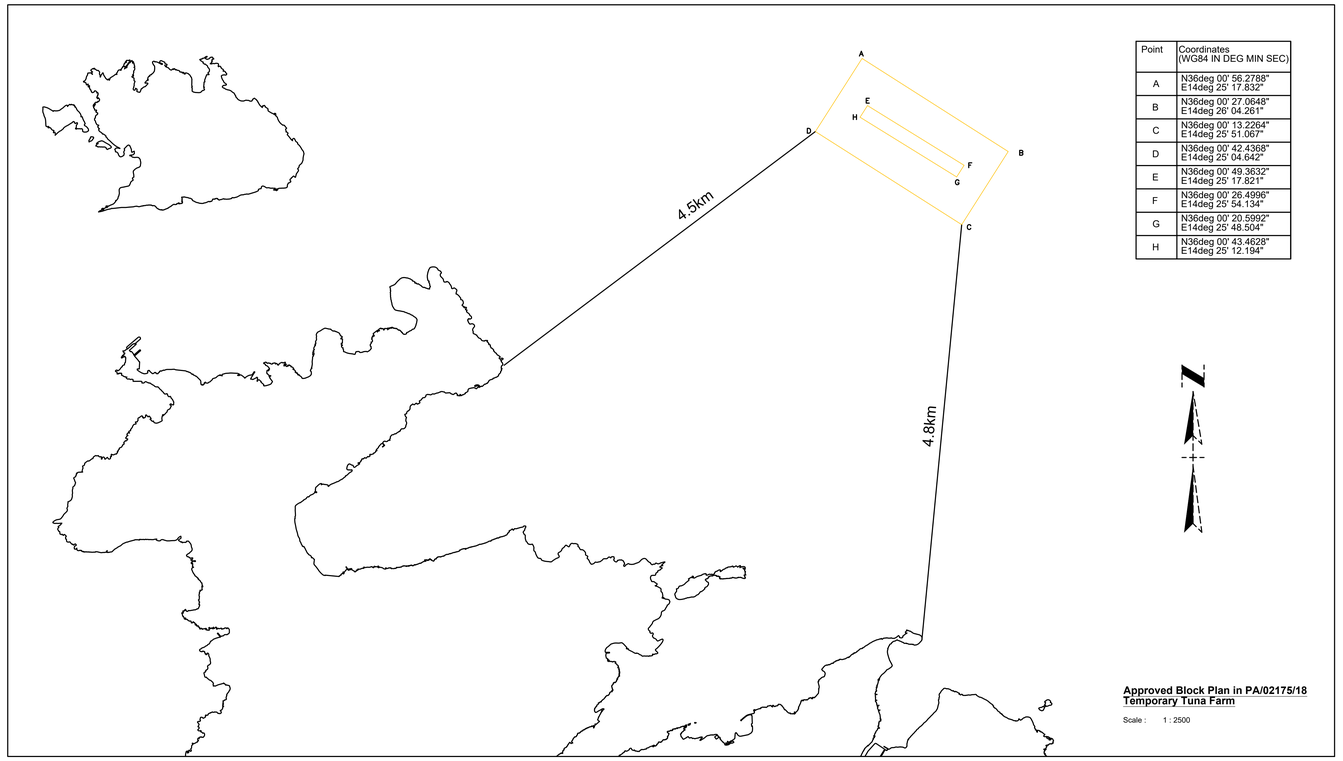
- Undertake a consolidated study to assess the effects of the fish farms on the seabird populations in the Maltese Islands and including: the farms as a source of food, impacts from fish slime oiling, impacts from marine litter, and predator-prey interactions.

- The patrolling of the shores and collection of fish slime and oils is to be improved to eliminate the possibility of this material reaching the inshore areas.

- Explore the possibility of using technology to establish an early warning surveillance system for oil slicks and fish slime.

- Tuna farms to be encouraged to properly implement the environmental management systems they devised as part of their environmental permits and to regularly train their staff on environmental matters. Annual audits of the EMS should be considered to ensure implementation.

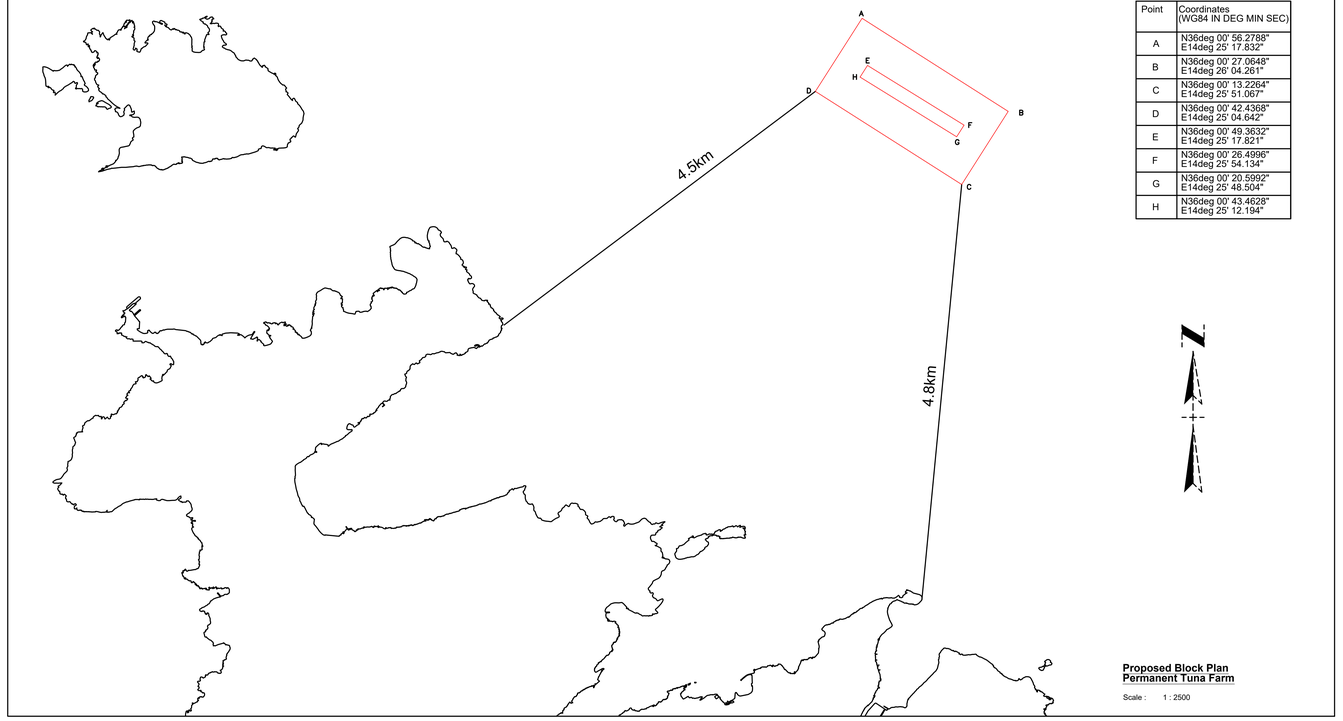
# Appendix 1: Scheme Plans




| Point | Coordinates (WGS84 IN DEG MIN SEC) |
|---|---|
| A | N36deg 00' 56.2788" E14deg 25' 17.832" |
| B | N36deg 00' 27.0648" E14deg 26' 04.261" |
| C | N36deg 00' 13.2264" E14deg 25' 51.067" |
| D | N36deg 00' 42.4368" E14deg 25' 04.642" |
| E | N36deg 00' 49.3632" E14deg 25' 17.821" |
| F | N36deg 00' 26.4996" E14deg 25' 54.134" |
| G | N36deg 00' 20.5992" E14deg 25' 48.504" |
| H | N36deg 00' 43.4628" E14deg 25' 12.194" |

**Approved Block Plan in PA/02175/18**
**Temporary Tuna Farm**

Scale : 1 : 2500




| Point | Coordinates (WGS84 IN DEG MIN SEC) |
|---|---|
| A | N36deg 00' 56.2788" E14deg 25' 17.832" |
| B | N36deg 00' 27.0648" E14deg 26' 04.261" |
| C | N36deg 00' 13.2264" E14deg 25' 51.067" |
| D | N36deg 00' 42.4368" E14deg 25' 04.642" |
| E | N36deg 00' 49.3632" E14deg 25' 17.821" |
| F | N36deg 00' 26.4996" E14deg 25' 54.134" |
| G | N36deg 00' 20.5992" E14deg 25' 48.504" |
| H | N36deg 00' 43.4628" E14deg 25' 12.194" |

**Proposed Block Plan**
**Permanent Tuna Farm**

Scale : 1 : 2500

METRES 0 500 1000 2000 5000
SCALE 1:25,000

**Legend**

- Construction Proposed
- Demolition Proposed
- As Constructed - To Sanction
- Approved but not Constructed

**Notes**

-Do not scale from this drawing.
-This drawing is to be read in conjunction with other architectural, structural and services drawings or other consultant's documentation, permit conditions etc as may be applicable.
-Information as supplied by the current operator. Any discrepancies and inaccuracies in the drawing shall be brought to the attention of the architect in charge within 7 days of receipt.

RAY SAMMUT & ASSOCIATES
ARCHITECTS & CIVIL ENGINEERS

ARCHITECT
RAY SAMMUT & Associates
ARCHITECTS & CIVIL ENGINEERS
B.E.& A.(Hons), A. & C.E.
No. 4, Ta' Xbiex Wharf, Ta' Xbiex, Malta
Mob.(356)99814788 (356)99994542
E. raysammut27@gmail.com
E. sammutnat@gmail.com
www.raysammut.com

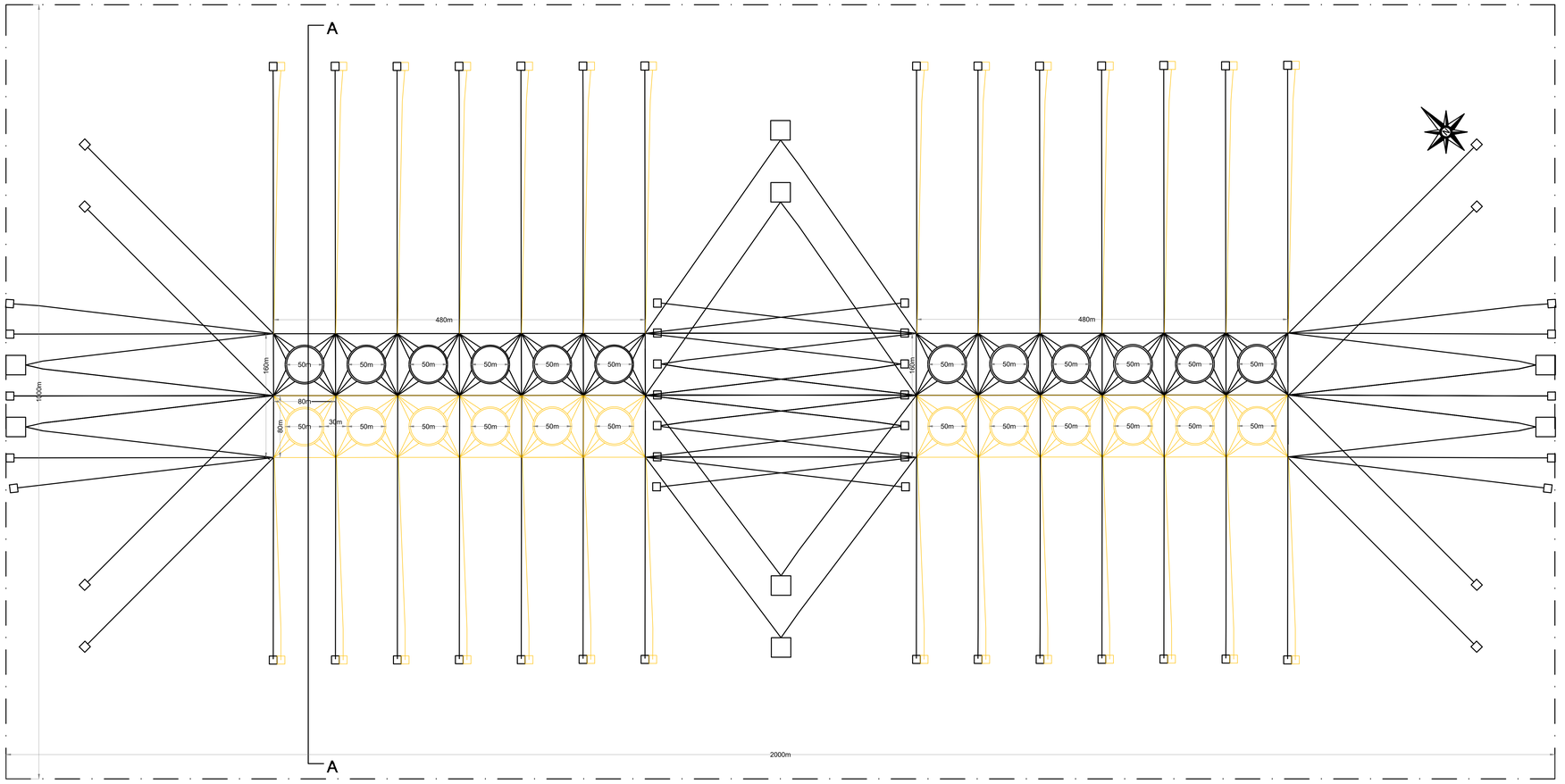
JOB TITLE
TUNA FARM OFF ST PAUL'S BAY

DRAWING TITLE
PLANS

CLIENT
D.G.Bjorn Callus obo
D.H.Ministry for Agriculture, Fisheries, Food
D.I. & Animal rights

LOCATION
Site off Sikka l-Bajda,
Sikka l-Bajda, San Pawl il-Bahar

| DATE | |
|---|---|
| 15.07.2022 | |
| REF No. | |
| AFD423-004 | |
| SCALE | SIZE |
| 1:25,000 | A0 |
| DRAWN | APPROVED |
| N.S. | N.S. |
| DRAWING No. | REVISION No. |
| 110 | 00 |




**Approved Plan in PA/02175/18 - Temporary Tuna Farm**
Scale : 1 : 2500

METRES 0 50 100 200 300 500
SCALE 1:2500

**Legend**

- Construction Proposed
- Demolition Proposed
- As Constructed - To Sanction
- Approved but not Constructed

**Notes**

-Do not scale from this drawing.
-This drawing is to be read in conjunction with other architectural, structural and services drawings or other consultant's documentation, permit conditions etc as may be applicable.
-Information as supplied by the current operator. Any discrepancies and inaccuracies in the drawing shall be brought to the attention of the architect in charge within 7 days of receipt.

ARCHITECT

RAY SAMMUT & Associates
ARCHITECTS & CIVIL ENGINEERS
B.E.& A.(Hons), A. & C.E.
No. 4, Ta' Xbiex Wharf, Ta' Xbiex, Malta
Mob.(356)99814788 (356)99994542
E. raysammut27@gmail.com
E. sammutnat@gmail.com
www.raysammut.com

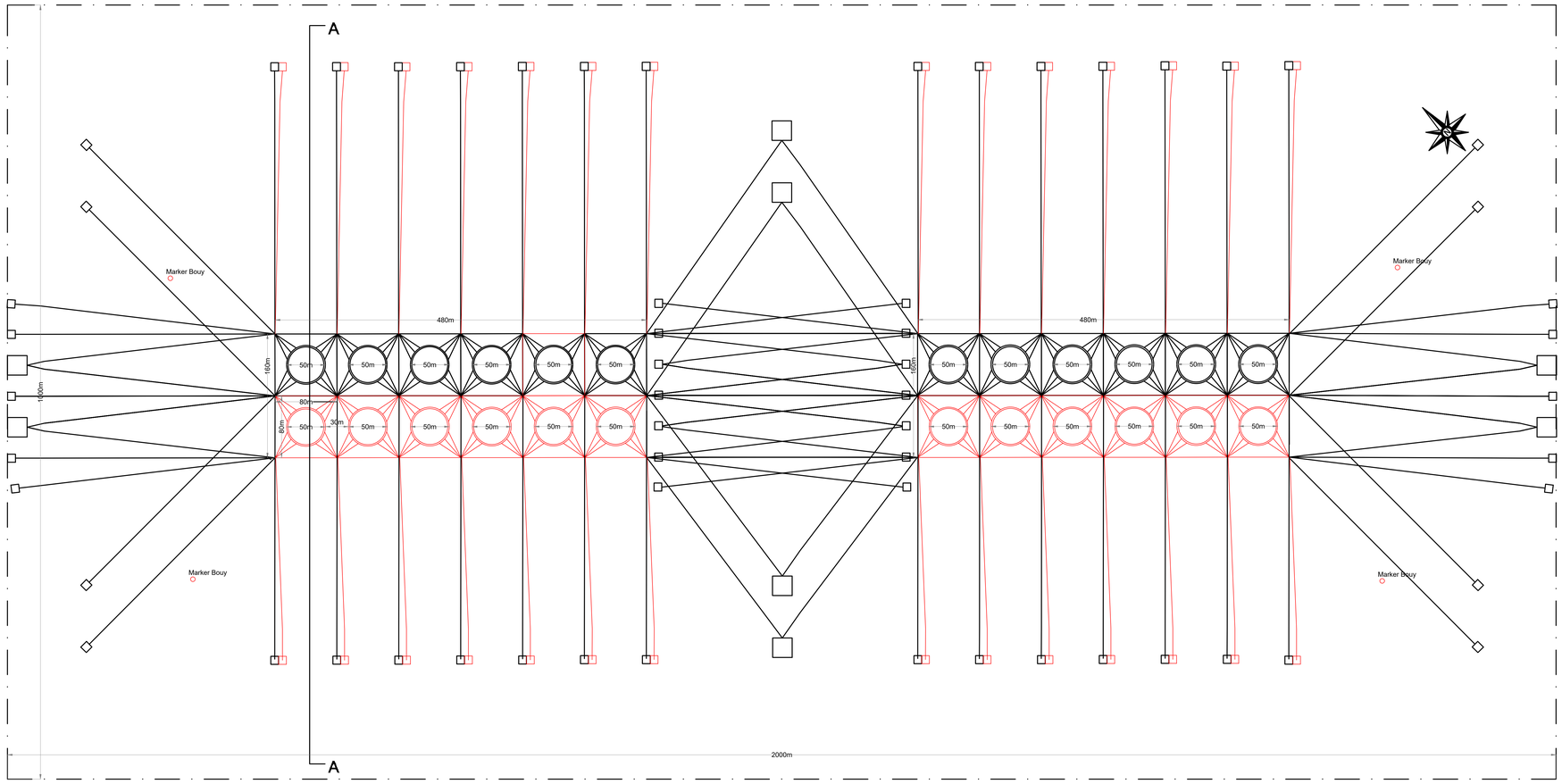
JOB TITLE
TUNA FARM OFF ST PAUL'S BAY

DRAWING TITLE
PLANS

CLIENT
D.G.Bjorn Callus obo
D.H. Ministry for Agriculture, Fisheries, Food
D.I. & Animal rights

LOCATION
Site off Sikka l-Bajda,
Sikka l-Bajda, San Pawl il-Bahar

| DATE | |
|---|---|
| 15.07.2022 | |
| JOB NO. | |
| AFD423-004 | |
| SCALE | SIZE |
| 1:2500 | A0 |
| DRAWN | APPROVED |
| N.S. | N.S. |
| DRAWING No. | REVISION No. |
| 100 | 00 |




**Proposed Plan - Permanent Tuna Farm**
Scale : 1 : 2500

METRES 0 50 100 200 300 500
SCALE 1:2500

**Legend**

- Construction Proposed
- Demolition Proposed
- As Constructed - To Sanction
- Approved but not Constructed

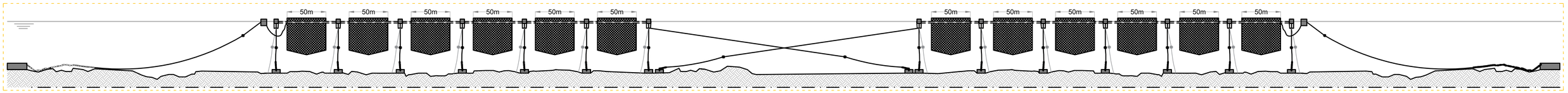
**Notes**

-Do not scale from this drawing.
-This drawing is to be read in conjunction with other architectural, structural and services drawings or other consultant's documentation, permit conditions etc as may be applicable.
-Information as supplied by the current operator. Any discrepancies and inaccuracies in the drawing shall be brought to the attention of the architect in charge within 7 days of receipt.

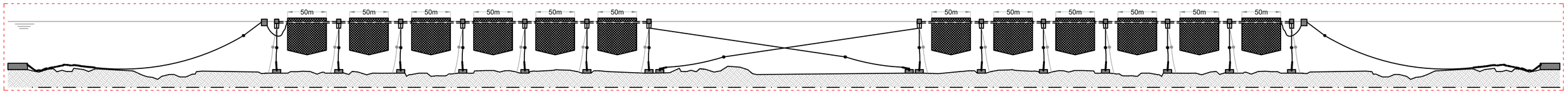
ARCHITECT

RAY SAMMUT & Associates
ARCHITECTS & CIVIL ENGINEERS
B.E.& A.(Hons), A. & C.E.
No. 4, Ta' Xbiex Wharf, Ta' Xbiex, Malta
Mob.(356)99814788 (356)99994542
E. raysammut27@gmail.com
E. sammutnat@gmail.com
www.raysammut.com

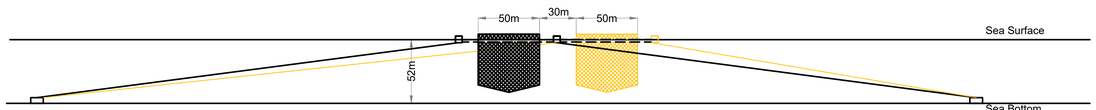
JOB TITLE: TUNA FARM OFF ST PAUL'S BAY
DATE: 15.07.2022
DRAWING TITLE: PLANS
REF. No.: AFD423-004
CLIENT: D.G.Bjorn Callus obo D.H.Ministry for Agriculture, Fisheries, Food D.I. & Animal rights
SCALE: 1:2500
SIZE: A0
DRAWN: N.S.
APPROVED: N.S.
LOCATION: Site off Sikka l-Bajda, Sikka l-Bajda, San Pawl il-Bahar
DRAWING No.: 110
REVISION No.: 00



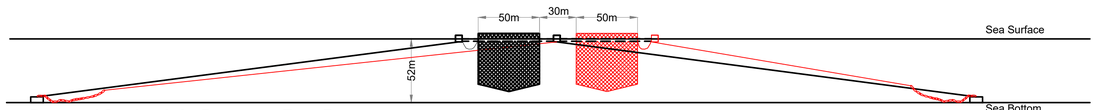

**Approved Anchoring Detail in PA/02175/18 - Temporary Tuna Farm**
Scale : 1 : 2500




**Proposed Anchoring Detail in PA/02175/18 - Permanent Tuna Farm**
Scale : 1 : 2500




**Approved Section A-A in PA/02175/18 - Temporary Tuna Farm**
Scale : 1 : 2500




**Proposed Section A-A - Permanent Tuna Farm**
Scale : 1 : 2500


**Legend**

- Construction Proposed
- Demolition Proposed
- As Constructed - To Sanction
- Approved but not Constructed

**Notes**

-Do not scale from this drawing.
-This drawing is to be read in conjunction with other architectural, structural and services drawings or other consultant's documentation, permit conditions etc as may be applicable.
-Information as supplied by the current operator. Any discrepancies and inaccuracies in the drawing shall be brought to the attention of the architect in charge within 7 days of receipt.

RAY SAMMUT & ASSOCIATES
ARCHITECTS & CIVIL ENGINEERS

ARCHITECT

RAY SAMMUT & Associates
ARCHITECTS & CIVIL ENGINEERS
B.E.& A.(Hons), A. & C.E.
No. 4, Ta' Xbiex Wharf, Ta' Xbiex, Malta
Mob.(356)99814788 (356)99994542
E. raysammut27@gmail.com
E. sammutnat@gmail.com
www.raysammut.com

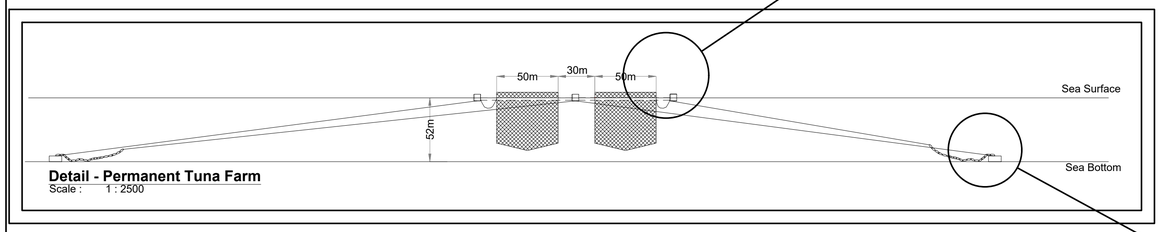
JOB TITLE
TUNA FARM OFF ST PAUL'S BAY

DRAWING TITLE
SECTIONS

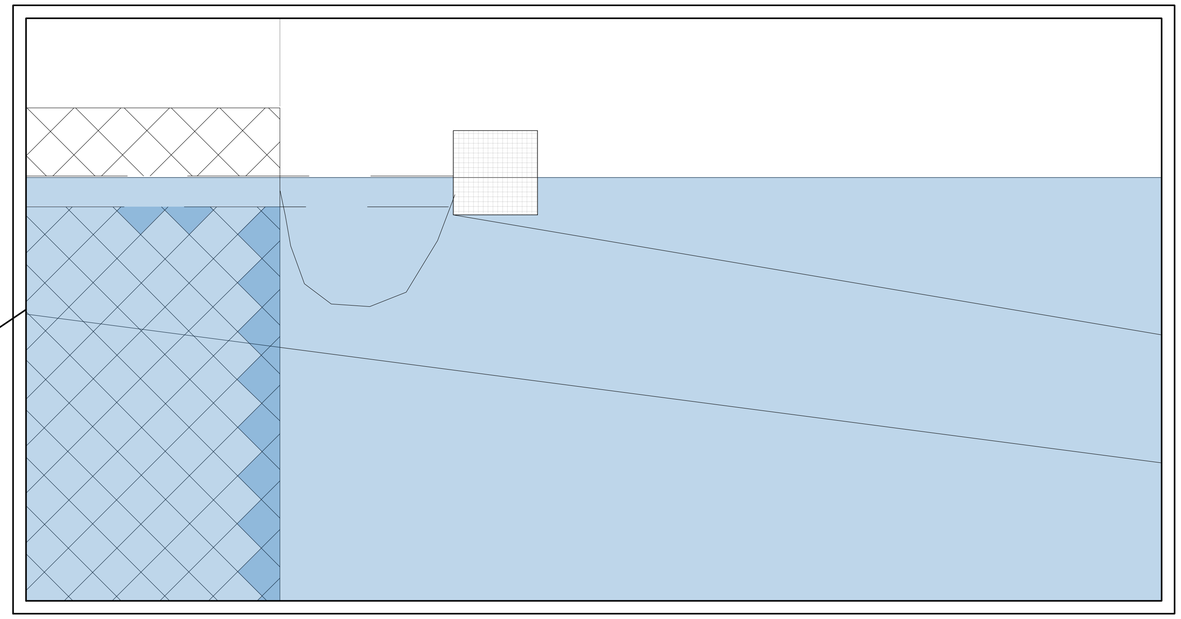
CLIENT
D.G.Bjorn Callus obo
D.H. Ministry for Agriculture, Fisheries, Food
D.I. & Animal rights

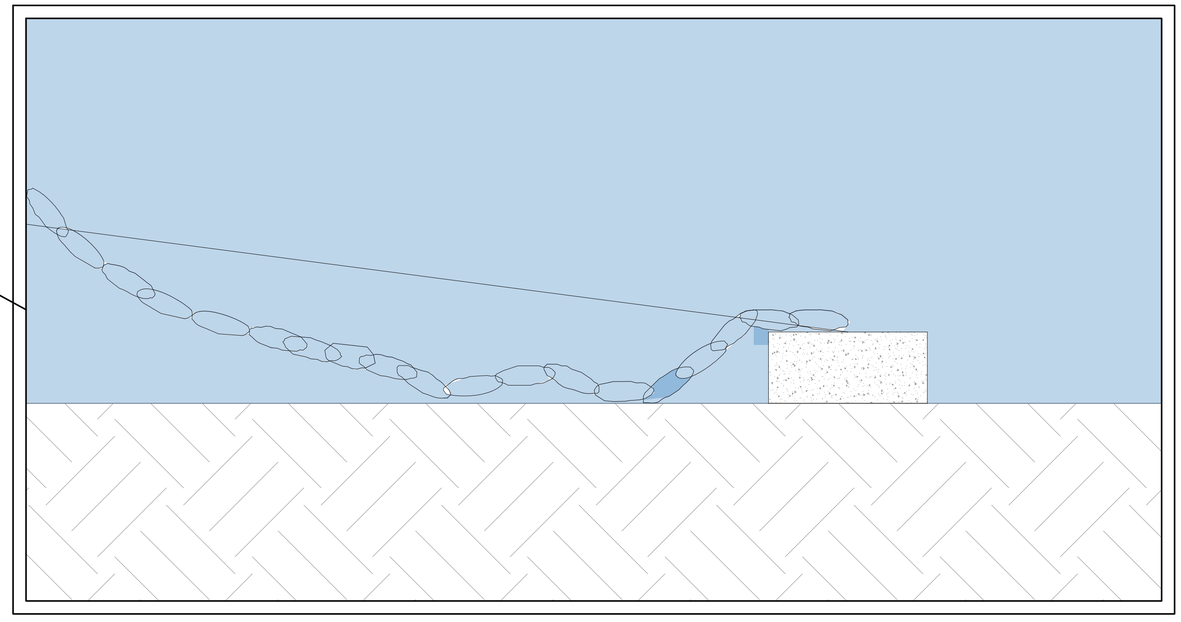
LOCATION
Site off Sikka l-Bajda,
Sikka l-Bajda, San Pawl il-Bahar

| | |
|---|---|
| DATE | 15.07.2022 |
| REF No. | AFD423-004 |
| SCALE | 1:2500 |
| SIZE | A1 |
| DRAWN | N.S. |
| APPROVED | N.S. |
| DRAWING No. | 120 |
| REVESION No. | 00 |




**Detail - Permanent Tuna Farm**
Scale : 1 : 2500





**Approved in PA/02175/18 - Temporary Tuna Farm**

METRES 0 50 100 200 300 500
SCALE 1:2500

**Legend**
- Construction Proposed
- Demolition Proposed
- As Constructed - To Sanction
- Approved but not Constructed

**Notes**
-Do not scale from this drawing.
-This drawing is to be read in conjunction with other architectural, structural and services drawings or other consultant's documentation, permit conditions etc as may be applicable.
-Information as supplied by the current operator. Any discrepancies and inaccuracies in the drawing shall be brought to the attention of the architect in charge within 7 days of receipt.

RAY SAMMUT & ASSOCIATES
ARCHITECTS & CIVIL ENGINEERS

ARCHITECT
RAY SAMMUT & Associates
ARCHITECTS & CIVIL ENGINEERS
B.E.& A.(Hons), A. & C.E.
No. 4, Ta' Xbiex Wharf, Ta' Xbiex, Malta
Mob.(356)99814788 (356)99994542
E. raysammut27@gmail.com
E. sammutnat@gmail.com
www.raysammut.com

JOB TITLE
TUNA FARM OFF ST PAUL'S BAY

DRAWING TITLE
Detail

CLIENT
D.G.Bjorn Callus obo
D.H. Ministry for Agriculture, Fisheries, Food
D.I. & Animal rights

LOCATION
Site off Sikka l-Bajda,
Sikka l-Bajda, San Pawl il-Bahar

| | |
|---|---|
| DATE | 15.07.2022 |
| REF. No. | AFD423-004 |
| SCALE | 1:2500 |
| SIZE | A1 |
| DRAWN | N.S. |
| APPROVED | N.S. |
| DRAWING No. | 120 |
| REVESION No. | 00 |

# Appendix 2: Note from Birdlife (Malta) on incidences of oiling of seabirds

**Rising cases of birds rescued at sea with compromised waterproofing: Investigating potential links to Aquaculture expansion**

17th February 2025

## The Expansion of Tuna Farming in Malta

Globally, aquaculture is experiencing significant growth. In Malta, according to the latest publication by the National Statistics Office (NSO), 91% of aquaculture production is dominated by tuna farming. The quantity of farmed tuna has increased substantially in recent years, with a 10% rise in farmed tuna production between 2021 and 2022, followed by an additional 15.4% increase between 2022 and 2023. This expansion in tuna farming corresponds to a higher demand for fish feed (Figure 1)[1].

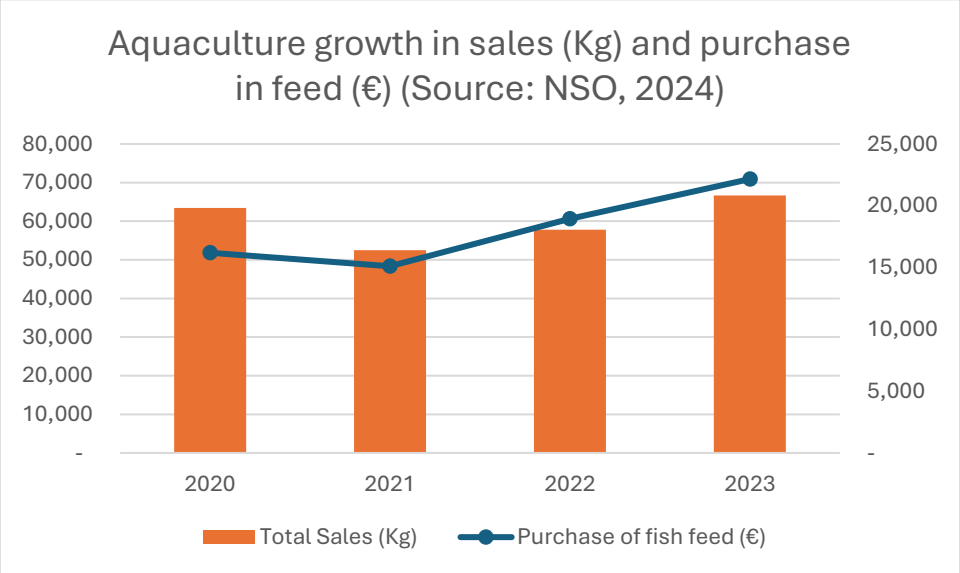



*Figure 1: Aquaculture growth in sales (Kg) and purchase in feed (€) in Malta*

## The Issue of Oil-Slicks and Birds' Risk of Exposure to the Oil

The Environmental Impact Assessment for the proposed aquaculture zone in northern Malta (GF00250/07) highlights that operations in local tuna farms release considerable amounts of natural fish oils and mucus from frozen baitfish. These oils disperse into the marine environment when fed to tuna and, unless contained, rapidly spread over the sea

[1] NSO (2024). Aquaculture: 2023. https://nso.gov.mt/aquaculture-2023/.

surface, forming an oily film. Such slicks can drift towards coastal areas, coating marine life, divers, and bathers[2].

Oily residues from stock and feed will form dense oil-slicks which was noted to attract seabirds, particularly olfactory foragers such as shearwaters and storm-petrels, as well as gulls and terns which are attracted to shoals of juvenile fish typically attracted to pens[3,4]. Attraction to these oil-slicks puts seabirds at risk of exposure to the oil. When birds are exposed to oil, their waterproofing ability and thermoregulation is impaired as a result of damage to the insulative properties of their feathers. If an oiled bird is unable to maintain thermal homeostasis, hypothermia and death can follow rapidly. A small amount of oil on seabirds is sufficient to break down the feather barrier that is necessary to prevent water penetration and hypothermia. In a study in Britain, it resulted that seabird feathers exposed to the thinnest fish oil resulted in measurable feather weight gain (from oil and water uptake) and significant feather microstructure disruption. Both feather weight gain and microstructure disruption increased with increasing fish oil thickness. In addition, interviews conducted with wildlife rehabilitation professionals with experience rehabilitating sea birds after edible oil exposure indicated that physical contact with fish and other 'edible oils' in the marine environment is at least as harmful to seabirds as petroleum oils[5].

**The Increase in Incidents of Birds Covered in Oily Residues**

In recent years, BirdLife Malta has recorded an increase in birds reported with (a) compromised waterproofing and/or (b) covered in oily residues and with compromised waterproofing. Between 2020 and 2024, a total of 50 affected birds with compromised waterproofing were recovered from coastal and offshore areas (Figure 2). Despite rehabilitation efforts, only 42% survived.

[2] Adi Associates. (2018). GF00250/07: PROPOSAL FOR A NEW AQUACULTURE ZONE IN THE NORTH OF MALTA, ZONE OFFSHORE MALTA. ENVIRONMENTAL IMPACT ASSESSMENT REPORT.
[3] Morandin, L. A., & O'Hara, P. D. (2014). Fish oil disrupts seabird feather microstructure and waterproofing. *Science of the Total Environment*, *496*, 257-263.
[4] Borg, J. J. (2012). Tuna farms - A seasonal supplementary food source for storm petrels *Hydrobates pelagicus melitensis*. Avocetta 36: 91-94.
[5] Tuarze, P., Stephenson, M., Mazzocco, P., & Knopper, L. (2021). A Physiologically Based Oiling Model (PBOM) to Predict Thermoregulatory Response in Birds. *Environmental Toxicology and Chemistry*, *40*(1), 251-260.

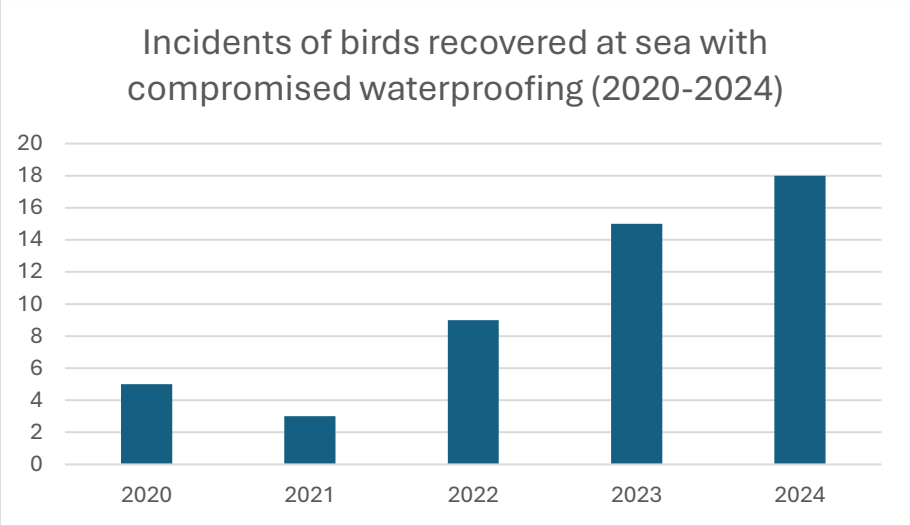



*Figure 2: Incidents of birds recovered at sea with compromised waterproofing between 2020 and 2024*

Among these collected birds, 36% were Mediterranean Storm-Petrels (*Hydrobates pelagicus melitensis*), 18% Scopoli's Shearwaters (*Calonectris diomedea*), and 26% Yelkouan Shearwaters (*Puffinus yelkouan*), all of which rely on olfactory foraging and are known to be attracted to fisheries (Figure 3).

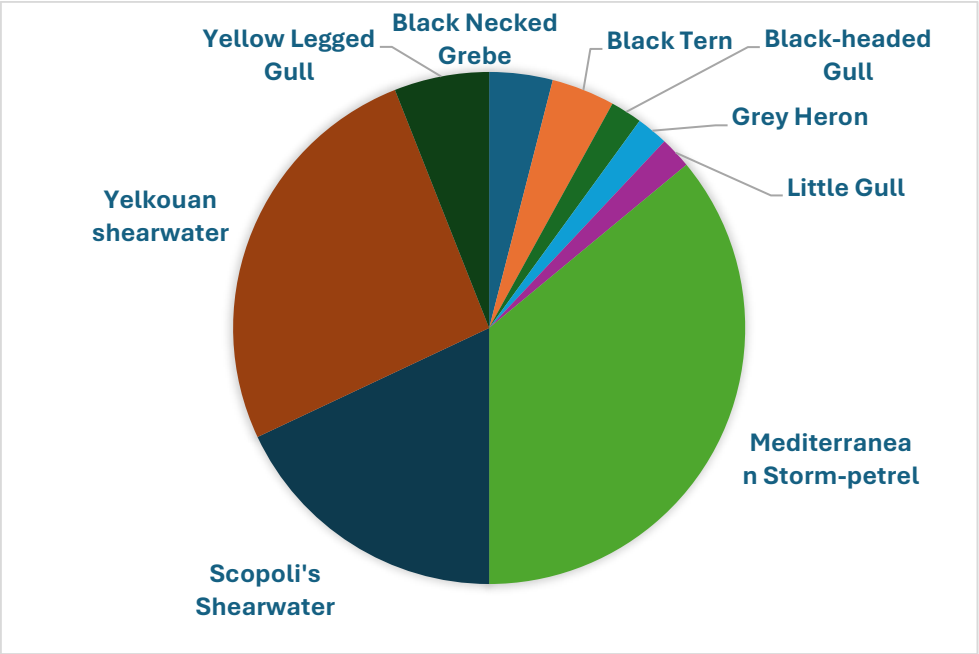



*Figure 3: Species composition of affected birds*

The majority of affected birds were collected between June and November, with July and August showing the highest numbers between 2020 and 2024 (Figure 4). These months coincide with the fattening phase of the tuna farming cycle, during which caged tuna are fed intensively before being harvested and sold.

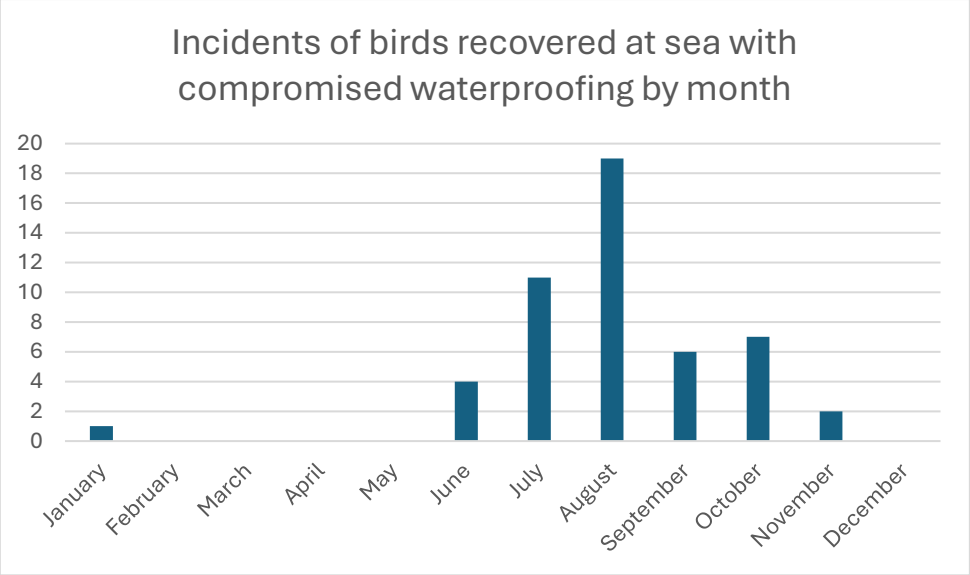



*Figure 4: Incidents of birds recovered at sea with compromised waterproofing by month*

All birds were retrieved at sea from offshore waters or near the coastline. Any birds rescued on land are not included in such an analysis. Figure 5 below highlights the localities associated with these recoveries, indicating where oiled seabirds were found. A significant number were collected from the waters off San Pawl il-Baħar and Marsaskala, areas that also coincide with the locations of offshore fish farm cages.

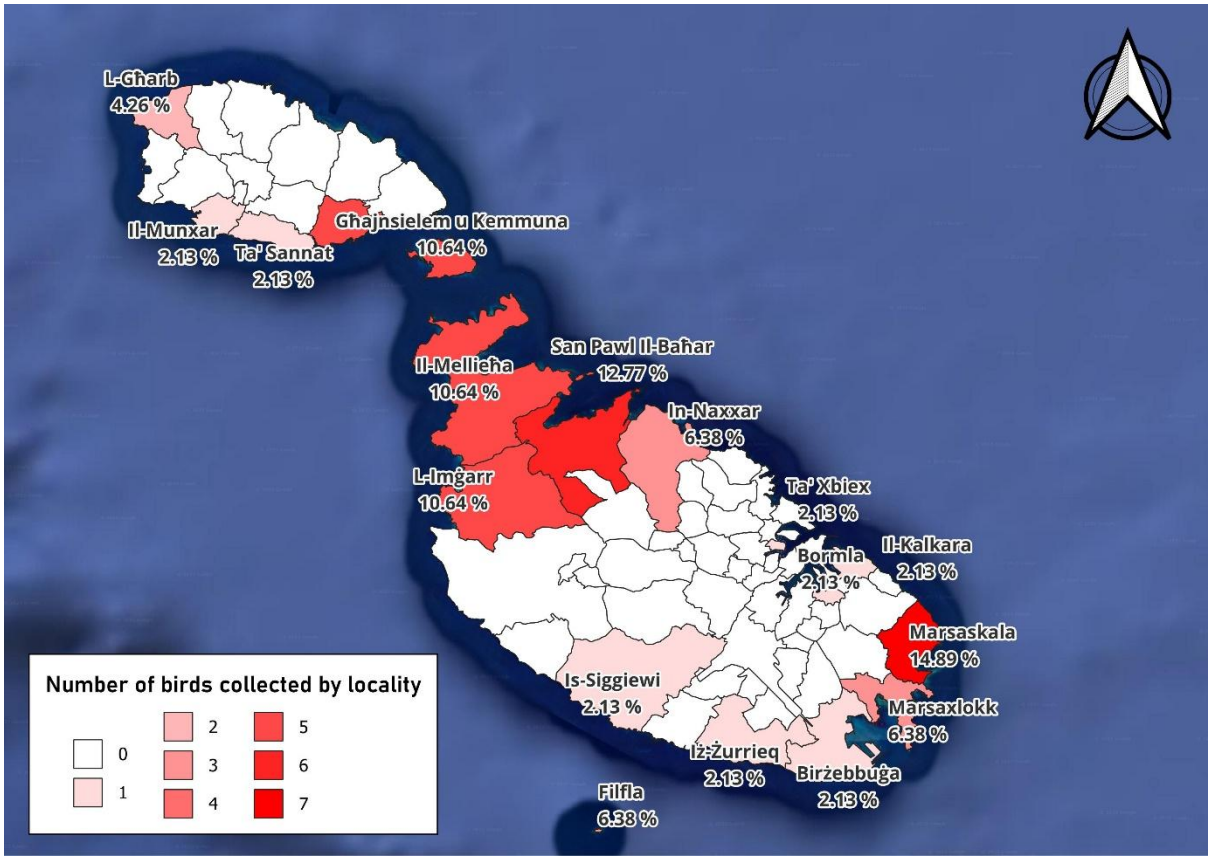



*Figure 5: Number of birds collected by locality between 2020 and 2024*

**Further assessments to understand the Implications of Tuna Farming on Malta's Seabirds Populations**

The seasonal overlap between seabird oiling incidents and tuna farm operations, the geographical correlation between bird collection sites and fish farms, and the rising trends in both tuna farming and reported oiled seabirds suggest a potential causal relationship. Given the risks posed by oil-slicks accumulating around tuna farms, further assessments are required to determine the extent of seabird exposure to oil-slicks and fish farm oil-related mortality. BirdLife Malta has begun collecting feather samples from affected birds for potential future chemical analysis to determine whether the oil originates from fish farm operations. Quantifying this risk is essential, as large-scale oiling events could compromise entire seabird rafts. Ultimately, further assessments are required to better understand the implications of tuna farming on Malta's seabird populations, as should the industry keep expanding its operations, and especially if these are close or coincidental with seabird rafting areas, it is possible that we will see an increase in numbers of compromised seabirds with an increased mortality on various protected species.