PA 02175/18

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

ENVIRONMENTAL IMPACT ASSESSMENT REPORT
VOLUME 2: ENVIRONMENTAL RISK ASSESSMENT

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Quality Assurance

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Environmental Impact Assessment Report: Vol. 2 - Risk Assessment
July 2018

Report for: **AJD Tuna Ltd**

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1. ENVIRONMENTAL RISK ASSESSMENT

INTRODUCTION

1.1. Volume 2 of the EIA Report presents an environmental risk assessment for the Scheme.

Terms of Reference

1.2. The Terms of Reference (ToR) for the environmental risk assessment, issued by the Environment and Resources Authority (ERA), are reproduced in **Technical Appendix 1:** ***Terms of Reference and Method Statements***):

ASSESSMENT METHODOLOGY

Scheme Phases

1.3. The Scheme will involve three phases, as follows:

- Construction (deployment of moorings and cages);
- Operation; and
- Decommissioning (once the North Aquaculture Zone is set up).

Deployment (Construction) Phase

1.4. The construction phase is described in **Chapter 3** of the EIA Report (Volume 1). It is not foreseen that construction will present significant environmental risk, given that the materials making up the farm (mooring blocks, ropes, chains, cage collars, and nets), will be inert / non-hazardous in nature and the cage deployment phase follows standard marine placement methods. The only environmental risks would be related to:

- Operational discharges of fuels and lubes from deployment vessels (tug boats, barges, etc.); and
- Erroneous placement of mooring blocks on sensitive habitats instead of the planned location.

1.5. Operational losses of oils and fuels from the smaller craft are possible, as with all marine craft; however, as long as the craft are maintained in good condition and good working practices are adopted, these impacts are expected to be not significant (see also **Chapter 5**), especially when taking into account the fact that the Scheme site is located adjacent to the largest bunkering zone in the Maltese Islands that is regularly used for such operations by larger vessels. Furthermore, the deployment craft will only be on site for a short period of time, and in the unlikely event of a spill, the extent of coastline that may be exposed to such risks is very small. Furthermore, the farm operator has a contractual agreement with a spill response company in the event of accidental release of oils.

1.6. Nonetheless, it is important that good operational practice and proper project management is adhered to in order to minimise the potential for such operational releases of diesels/lubricants.

1.7. Therefore it is considered that the environmental risk from this phase does not need to be further assessed.

Decommissioning Phase

1.8. The Scheme is currently operating under a temporary development permit arrangement and has a condition for the farm to be relocated once the North Aquaculture Zone (currently the subject of a separate Environmental Impact Assessment) is set up. The current proposal for the Scheme is, likewise, a temporary arrangement[1].

1.9. If the farm is to be removed or relocated, its decommissioning will take place in a reverse order to the deployment, with the nets removed first, followed by the cage collars, ropes, chains, and mooring blocks. The entire farm can be decommissioned in approximately four weeks. If it is to be relocated, the cages will be towed to the new site and anchored while the mooring blocks, ropes and other tackle at the Scheme site will be recovered from the seabed. If required, a Decommissioning Plan will be provided. Since the Scheme does not involve the use or storage of any hazardous materials, the decommissioning would not generate any wastes other than generated by normal operation, and considering that the procedures that would apply in decommissioning of the farm are identical to the procedures applied each year in undertaking maintenance on the cages, no significant risks are expected from this process and the environmental risk from this phase does not need further assessment.

Objectives

1.10. This Report, therefore presents a detailed environmental risk assessment of the Scheme operations by:

- Describing and evaluating the risks to the environment associated with the Scheme operations (including risks associated with potential accidents / extreme events); and
- Describing the measures which will be undertaken to mitigate such risks, and evaluating the residual risk levels.

Methodology

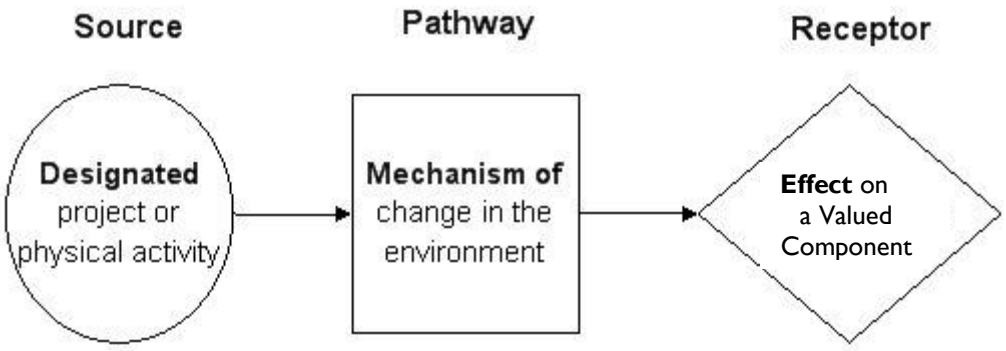
1.11. The methodology used for the environmental risk assessment is based on IEC/ISO 31010: *Risk management: Risk assessment techniques*.

[1] Unless the North Aquaculture Zone is established at the same site as the Scheme.

1.12. An environmental risk occurs when there is a means by which a hazard can result in a deleterious impact on the surrounding environment, that is, receptors. The presence of a hazard alone does not constitute a risk. A risk is only present if there is a pathway which links the source (hazard) to the receptor. This is known as the source-pathway-receptor linkage.[2]

1.13. Environmental risk assessment is the process by which source-pathway-receptor linkages are identified and evaluated. If any of the three elements are absent then there is no complete linkage, and thus no unacceptable risk. To illustrate this, **Figure 1** shows a basic source-pathway-receptor model.

Figure 1: Source-pathway-receptor Model



Source: Environment Canada[3]

Risk Assessment Criteria

1.14. If a source-pathway-receptor linkage is found, the magnitude of a risk is a function of the potential consequences arising from the particular activity and the likelihood that this consequence will occur. The combination of consequence and likelihood produces an estimate of the risk associated with a particular issue.

1.15. Since the farming operation already exists and the Scheme is intended to increase the number of cages without adding to the approved biomass, the main aim of the risk assessment is to determine if current management is sufficient, and therefore the current management strategies need to be considered when determining the consequence and likelihood levels (de Jong & Tanner, 2004[4]).

1.16. The risk criteria applied in this assessment is based on a matrix consistent with ISO 31010: *Risk management: Risk assessment techniques*.

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[2] Defra (2002) *Groundwater Protection Code: Petrol Stations and other Fuel Dispensing Facilities involving Underground Storage Tanks*.
[3] Technical Guidance for Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012
[4] De Jong, S. And Tanner, J.E. (2004). Environmental Risk Assessment of Marine Finfish Aquaculture in South Australia. SARDI Aquatic Sciences Publication No. RD03/0044-4. SARDI Aquatic Sciences, Adelaide.

1.17. **Table 1** presents the criteria used for assessing environmental consequences; **Table 2** presents the criteria used for assessing the likelihood of the event occurring. The overall risk level is then determined by combining the two factors, using the matrix in **Table 3**.

Table 1: Criteria for Assessing Environmental Consequences

Severity Level	Effects on Natural Environment
1: Negligible	Very insignificant impacts. Unlikely to be even measurable at the scale of the stock/ecosystem/community against the natural background variability.
2: Minor	Minor effects on biological or physical environment. Possibly detectable but minimal impact on structure/function or dynamics.
3: Moderate	Moderate effects on biological or physical environment (e.g. air, water) but not affecting ecosystem function. Maximum appropriate/acceptable level of impact (e.g. full assimilation rate of nutrients).
4: Major	Serious environmental effects with some impairment of ecosystem function. Relatively widespread medium-long term impacts. Relatively long timeframe likely to be needed to restore to acceptable level.
5: Catastrophic	Very serious environmental effects with impairment of ecosystem function. Long term, widespread effects on significant environment (e.g. national park). Unlikely to be ever fixed (e.g. extinctions).

Table 2: Measure of Likelihood

Level	Descriptor	Description	Guideline Frequency
A	Almost Certain	Consequence is expected to occur in most circumstances	Occurs more than once per month
B	Likely	Consequence will probably occur in most circumstances	Occurs once every 1 month - 1 year
C	Occasional	Consequence should occur at some time	Occurs once every 1 year - 10 years
D	Unlikely	Consequence could occur at some time	Occurs once every 10 years - 100 years
E	Rare	Consequence may only occur in exceptional circumstances	Occurs less than once every 100 years

Table 3: Risk Matrix

Likelihood	Environmental Consequence					No Pollutant Linkage
	1: Negligible	2: Minor	3: Moderate	4: Major	5: Catastrophic	
A: Almost Certain	Low	Moderate	Extreme	Extreme	Extreme	None
B: Likely	Low	Moderate	High	Extreme	Extreme	
C: Occasional	Very low	Moderate	High	High	Extreme	
D: Unlikely	Very low	Low	Moderate	High	High	
E: Rare	Very low	Low	Moderate	Moderate	High	

Overview

1.18. The Scheme will involve the rearing of wild-capture bluefin tuna in 50 m diameter cages anchored at the Scheme site some 5 km off the northeast coast of Malta. As described in the EIA Report (Volume 1), the rearing of the tuna will involve feeding using baitfish, assimilation of feed in the fattened tuna and excretion by the fish, harvesting of tuna, and disposal of offal.

1.19. Potential pollution sources are summarized in **Table 4**, which also identifies the respective pathway to the relevant receptor. The table also describes the mitigation measures that will be adopted to mitigate such risks, distinguishing between elements incorporated into the Scheme by design and operational / procedural mitigation measures. It is to be noted that all the mitigation measures in the table will be implemented as part of the Scheme and several of these are a requirement of the extant environmental permits for the tuna farming operation as issued by the ERA.

1.20. **Table 5** identifies source-pathway-receptor linkages for extreme events / major accident scenarios, such as oil spills, mass mortality, disease, or natural disasters.

Table 4: Pollution Pathway Identification and Mitigation Measures

Source	Pathway	Receptor	Mitigation Measures	
			Mitigation Measures Designed into the Scheme	Operational Mitigation Measures
Feeding of tuna: release of fish oils	Direct release into the marine environment; migration through water currents	• Sea • Coast, including bathing areas	• Permanent deployment of oil booms inside each cage	• Ensure permanent oil boom is present and in good condition inside each cage (when tuna are present) • Deploy skimmers in each cage to collect the oil while still inside the cage • Deploy third party oil spill response vessels in the event of a larger release of fish oil • Spill kit available on site • Training of personnel in basic oil spill response
Feeding of tuna: settlement of uneaten feed	Through water column down to seabed	• Seabed • Benthic habitats	• NIL	• Good feed management (including monitoring by divers to control amount of baitfish given to tuna and training of personnel) • Monitoring of seabed and feeding practices • Prompt action to rectify over-feeding or loss of baitfish
Feeding of tuna: excretion of fish waste (organic loading)	Direct contamination	• Water column	• NIL	• Avoid large stocking densities in cages

Source	Pathway	Receptor	Mitigation Measures	
			Mitigation Measures Designed into the Scheme	Operational Mitigation Measures
Tuna harvesting: release of blood	Direct release into the marine environment	• Sea	• NIL	• Quick slaughtering required to keep body temperature down so as not to compromise meat quality; • Immediate transfer to processing vessel and collection of blood mixed with waste water
Tuna harvesting and processing: offshore disposal of offal (12 nautical miles from shore)	Direct release into the marine environment; settlement through water column; water currents	• Sea • Seabed • Benthic habitats • Inshore waters • Coast, including bathing areas	• NIL	• Collection of all offal on board vessels • Disposal at different locations beyond the 12 nautical mile limit so as not to overload one area • Vessel monitoring system to ensure correct disposal
Operational discharges / spills (oil, bilge water) from farm support vessels	Direct release into the marine environment	• Sea • Marine species (turtles, cetaceans, seabirds)	• NIL	• Regular and appropriate maintenance of all vessels • Spill kits available on board • Training of personnel in correct operation and spill management
Operational discharges / spills (oil, bilge water, process wastewater, sewage) from processing vessels	Direct release into the marine environment	• Sea • Marine species (turtles, cetaceans, seabirds) • Coast, including bathing areas	• Vessel equipped with adequate holding tanks	• Regular and appropriate maintenance of all vessels • Adherence to MARPOL Regulations • Use of Port Reception Facilities for waste • Spill kits available on board • Training of personnel in correct operation and spill management

Source	Pathway	Receptor	Mitigation Measures	
			Mitigation Measures Designed into the Scheme	Operational Mitigation Measures
Loss of items overboard (marine litter) from vessels	Direct release into the marine environment; settlement through water column	• Sea • Sea bottom (including important habitats) • Marine species (turtles, cetaceans, seabirds)	• Screen vessel scuppers to reduce chances of items falling overboard	• Use of flat form cartons as packaging material and ensure proper disposal of wastes at shore-side facilities • Immediate recovery of any items that may accidentally end up in the sea (whether floating or deposited on the seabed) • Good practices aboard ships to minimise littering, including training of personnel

Table 5: Pollution Pathway Identification and Mitigation Measures for Extreme Events / Major Accident Scenarios

Scenario	Source	Pathway	Receptor	Mitigation Measures	
				Mitigation Measures Designed into the Scheme	Operational Mitigation Measures
Severe storm causing mass mortality of farmed fish	Dead fish	Through water column down to seabed	• Sea • Seabed	• Appropriate mooring of cages	• Optimise stocking density • Nets kept taut to eliminate billowing • Regular checking and maintenance on mooring system (including blocks, ropes, chains, etc). • Thorough equipment check after major storms • Preparation of contingency plan for large-scale mortalities
Ship collision with the Scheme causing mass mortality of farmed fish	Dead fish	Through water column down to seabed	• Sea • Seabed	• Appropriate mooring of cages • Appropriate navigational marker buoys and lights	• Regular checking and maintenance on mooring system (including blocks, ropes, chains, etc. • Ensuring lights are always functioning and in line with navigational safety requirements • Charting of tuna farm on navigational charts • Preparation of contingency plan for large-scale mortalities

Scenario	Source	Pathway	Receptor	Mitigation Measures	
				Mitigation Measures Designed into the Scheme	Operational Mitigation Measures
Oil spill from external vessels / bunkering zone causing mass mortality of farmed fish	Dead fish	Through water column down to seabed	• Sea • Seabed	• Permanent deployment of oil booms inside each cage (to prevent intake of oil into the cage)	• Ensure permanent oil boom is present and in good condition inside each cage (when tuna are present) • Training of personnel in Tier One Oil Spill Response • Contractual arrangements for third party oil response service up to Tier Three • Deployment of oil booms in direction of spill to safeguard farm • Towing away of cages • Preparation of contingency plan for large-scale mortalities
Disease causing mass mortality of farmed fish	Dead fish	Marine environment	• Sea • Seabed • Wild fish stocks	• NIL	• Keep farm away from sources of contamination • Control source of baitfish to ensure good quality • Appropriate storage of baitfish in accordance with food safety legislation • Monitoring of farmed tuna for signs of stress or disease • Optimise stocking density • Culling of stressed / diseased individuals and removal from cages • Ensure source of good quality baitfish • Preparation of contingency plan for large-scale mortalities

Scenario	Source	Pathway	Receptor	Mitigation Measures	
				Mitigation Measures Designed into the Scheme	Operational Mitigation Measures
Failure of moorings leading to net collapse	Dead fish	Through water column down to seabed	• Seabed	• Appropriate mooring of cages	• Nets kept taut to eliminate billowing • Regular checking and maintenance on mooring system (including blocks, ropes, chains, etc). • Thorough equipment check after major storms • Preparation of contingency plan for large-scale mortalities

Identification of Potential Releases

1.21. The main potential emissions from the Scheme under normal operation, as described, relate to the feeding of the tuna. This results in the release of fish oils from the baitfish, fish wastes excreted by the fish, and settlement of uneaten baitfish on the seabed, which can lead to organic loading. A number of mitigation measures will be in place on site to minimise emissions associated with the Scheme operations, as described below, and in **Table 4** and **Table 5**. Most mitigation measures are operational in nature, and already regulated by the environmental permit for the current cages present on site.

1.22. The feeding process requires proper and effective management to ensure against overfeeding of the tuna and hence minimise the loss of uneaten feed, which settles on the seabed. The amount of baitfish given to the tuna will be controlled and the feeding itself supervised by divers. Prompt action will also be taken to rectify over-feeding or loss of baitfish.

1.23. Controlling the amount of fish stocked in each cage will also help reduce the organic loading per cage at the Scheme site by distributing the fish among more cages and hence over a larger volume.

1.24. Without mitigation, the Scheme will also potentially release contaminants in the form of oils and bilge water from operational vessels, and also sewage and process wastewater from the processing vessels. The former would be restricted to the rearing period (c. 5 – 6 months), while the latter would be restricted to the harvesting period (c. 2 months).

1.25. However, vessels to be used at the Scheme site or to service the Scheme will have the necessary certification and will be regularly maintained to minimise the potential for operational discharges of oil and bilge water. Likewise, the processing vessels will follow the relevant MARPOL regulations with regards to discharges at sea (including availability of holding tanks or sewage treatment plants on board, and, where appropriate, make use of port reception facilities.

1.26. The vessel scuppers will be appropriately screened (but not blocked) to minimise the possibility of items falling overboard and into the sea. Personnel will be instructed not to leave litter lying around on the deck, to immediately recover any material lost overboard, as well as to collect any floating marine litter that reaches the farm. Training in correct operational practice and in spill management (to Tier One) will also be provided to staff.

1.27. Other discharges relate to the fish harvesting and processing activities. These activities release blood into the marine environment, which easily disperses and does not generate environmental risks. The release of blood during harvesting cannot be mitigated as this process has to take place in a very short time to ensure the quality of the meat. The only mitigation would be the immediate transfer of the culled tuna to the processing vessel where any additional blood drained from the fish would be collected with the process waste water in holding tanks on board.

1.28. Fish processing generates offal (entrails, fins and heads), which at the moment are collected and dumped at sea beyond the 12 nautical mile limit. In order not to overload one area, this organic waste is discharged in different locations. The option of macerating the offal prior to discharge should be actively investigated to minimise the possibility of entrails floating inshore with the currents. The Applicant should also consider alternative (non-marine) disposal options in consultation with the Veterinary authorities.

1.29. Extreme events / major accident scenarios are of two types: "external" events or "internal" events. "External" events are events such as oil spills, ship collisions, disease (from wild fish or external sources of contamination), or natural disasters (e.g. storms) that may affect the farm itself potentially leading to the death of the tuna, which in turn could affect the environment at the Scheme site. "Internal" events, including failure of moorings that could lead to net collapse, lack of navigational signage that could lead to ship collisions, or tuna deaths from disease from stress or bad farming conditions. All these events ultimately lead to mass mortality of the tuna. Measures will be taken to reduce the likelihood and severity of an incident, as described in **Table 5**.

1.30. To reduce the risk of damage to the farm, which can lead to mass mortality of the tuna, the mooring layout and technology for the farm will be properly assessed to ensure against dragging or drifting. Once deployed, the farm area will be marked with appropriate navigational markers and lights in conformity with navigational safety requirements, as requested by Transport Malta. The farm will also be officially charted on the navigational charts. The mooring system will also be regularly checked and any maintenance required undertaken without delay to safeguard the cages. The entire system will also be thoroughly checked after each major storm.

1.31. The tuna will also be regularly monitored for any signs of disease or stress. Any stressed or diseased individuals will be culled and removed from the farm to reduce the risk of mass mortality events.

1.32. Additionally, the operators are required by their Environmental Permit to prepare contingency plans in case of large scale mortalities. It is understood that the contingency plans will include measures for immediate removal of dead fish to avoid contamination of the seabed and the marine environment.

Identification of Migration Pathways

Without Mitigation

1.33. In view of the nature of the Scheme, the main pathway is the marine environment, with currents and the water column playing an important role, and with some of the releases settling down to the seabed.

1.34. Most pathways involve a direct release into the marine environment, for example, fish excreta released into the water column, fish oils released from the cages and operational discharges from vessels dispersed by surface currents, uneaten baitfish falling through the cages and settling on the seabed, and offal discharged directly into

the sea and settling to the bottom (or floating and carried by surface currents).

With Mitigation

1.35. In order to counteract the release of fish oils and to minimise nuisance to other coastal users, permanent oil booms will be deployed in each cage to contain any released oils. The oil will then be collected by means of surface skimmers and transferred to IBCs, from where the water phase will be decanted on land and the oil phase sold to waste recycling contractors. Deployment of additional oil booms at the farm perimeter to collect any oils that manage to escape from the individual cages can also be considered, together with the deployment of oil spill response contractors and the use of spill kits by trained personnel.

1.36. Any marine litter that accidentally falls overboard from the Scheme vessels will also be recovered immediately. The vessel scuppers will be screened to minimise the potential for items to fall off the deck, while staff will be trained on the importance of eliminating marine litter and to keep the decks free from rubbish and unnecessary items.

1.37. Offal will be collected on board the processing vessels and transferred to service vessels for offshore disposal, as per instructions from the Veterinary authorities. The offal is dumped beyond the 12 nautical mile limit in areas characterised by muddy sandy bottoms. In order not to overload one area, the offal is disposed of in different locations. Operators should remain vigilant in the case of any offal becoming buoyant and floating to the surface, which may result in beaching, including on popular bathing areas. Such items should be collected and macerated prior to dumping.

Identification of Potential Receptors

1.38. Due to the nature of the Scheme the main environmental receptor is the marine environment. The first interaction will always be with the water column; fish oils and operational discharges of fuels from vessels will float and mainly impact the surface waters. In the unmitigated scenario, these oils will leave the farm and be dispersed by surface currents; the extent of the area affected will depend on the direction and strength of currents and waves. Fish excreta will be released within the water column, affecting a wider volume (rather than just surface waters), but they will be readily dispersed and their effect restricted to the vicinity of the cages. The release of fish excreta cannot be mitigated.

1.39. Uneaten baitfish and marine litter have the potential to sink to the bottom of the sea, where they can negatively affect the benthic habitats, some of which are protected and have a high nature value. In the unmitigated scenario, approximately 28 kg of baitfish per cage per day fall through the cage and settle on the seabed. The impact is mainly restricted to the area directly beneath the cages and reduces to insignificant with distance from the cages. The settlement of uneaten feed is a chronic impact with additional amounts settling each day, which can lead to overloading of the benthic ecosystem. The location of the cages on a predominantly coarse sand with minimal live rhodolith cover helps to minimise the impact, but additional mitigation in

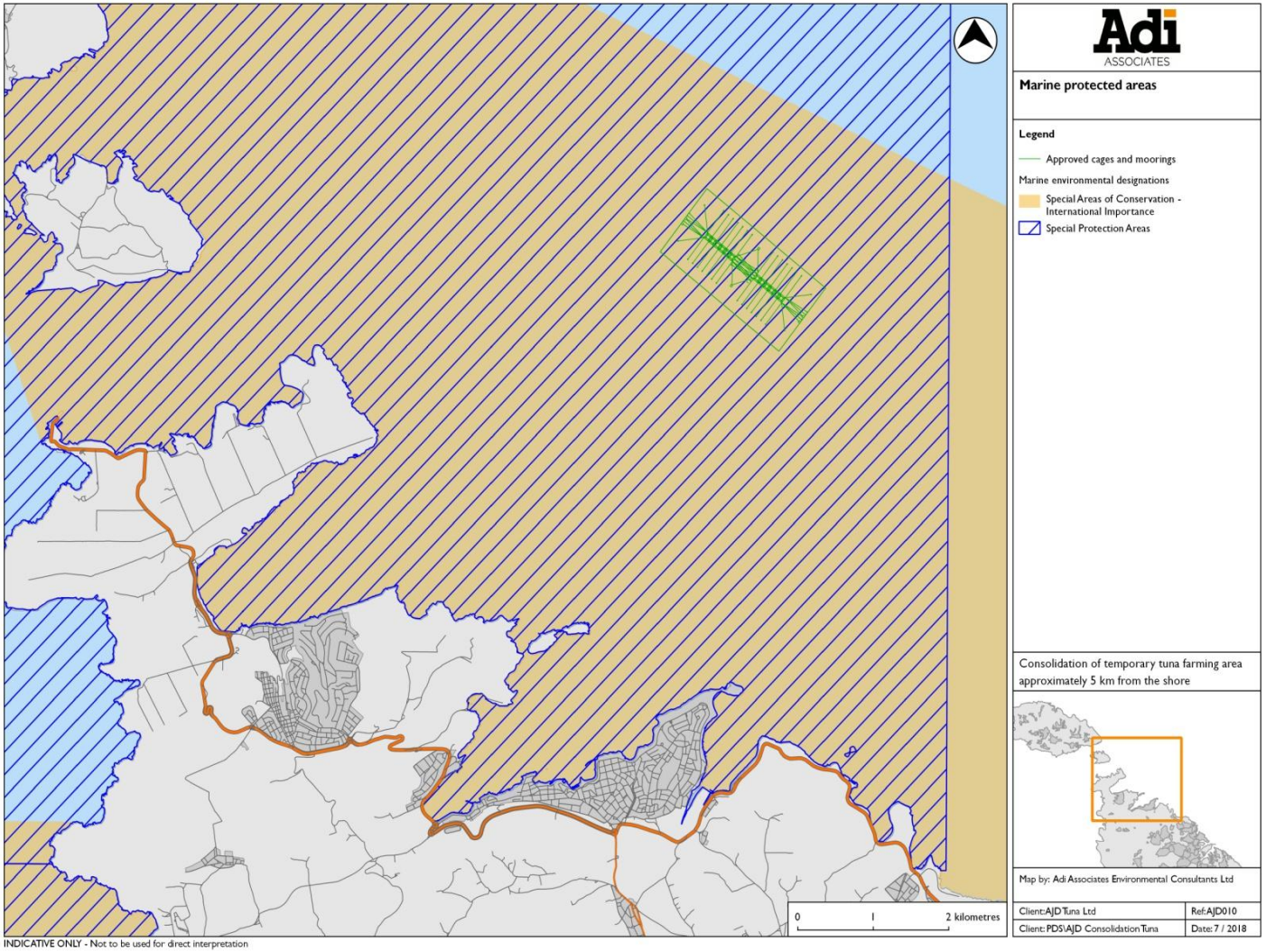
the form of a strict feed management regime to minimise losses will be important.

1.40. Litter can float and be dispersed over wide areas, potentially affecting coastal areas (including bathing sites) much removed from the Scheme site or even marine species (cetaceans, turtles, and seabirds) that ingest such items thinking them food. Other litter and various anthropogenic items can rapidly settle to the bottom, littering the seabed and physically impacting the benthic habitats.

1.41. The Scheme is located within two protected areas: Special Area of Conservation: Żona fil-Baħar fil-Grigal ta' Malta, and Specially Protected Area: Il-Baħar ta' madwar Għawdex (see **Figure 2**).

1.42. Though located well offshore, the Scheme is still located in front of important coastal bathing areas, including Mellieha Bay, St Paul's Bay, and Bugibba. The dispersal of fish oils under the action of surface currents can affect an even wider area of coast, as shown in **Chapter 5** of the EIA Report (Volume 1).

Figure 2: Protected areas within which the Scheme lies



Risk Evaluation

1.43. The various risks on the environment have been assessed using the evaluation criteria described above (**Table1** to **Table 3**). The risks associated with both the unmitigated and mitigated scenarios are evaluated. However, it should be noted that the Scheme envisages including all of the mitigation measures described in **Table 4** and **Table 5**.

Without Mitigation

1.44. **Table 6** presents risk levels for each source without the implementation of any mitigation measures.

Table 6: Environmental Risk Levels Without Mitigation

Source	Environmental Consequences	Likelihood of Consequence	Resultant Risk Level
Feeding of tuna: release of fish oils	Minor	Almost certain	Moderate
Feeding of tuna: settlement of uneaten feed (beneath cages)	Major	Almost certain	Extreme
Feeding of tuna: settlement of uneaten feed (away from cages)	Minor to Negligible	Occasional	Moderate
Feeding of tuna: excretion of fish waste (organic loading)	Minor	Almost certain	Moderate
Tuna harvesting: release of blood	Negligible	Likely[5]	Low
Tuna harvesting and processing: offshore disposal of offal	Moderate	Likely[6]	High
Operational discharges / spills (oil, bilge water) from farm support vessels	Minor	Likely	Moderate
Operational discharges / spills (oil, bilge water, process wastewater, sewage) from processing vessels	Moderate	Likely[7]	High
Loss of items overboard (marine litter) from vessels	Moderate	Likely	High
Severe storm causing mass mortality of farmed fish	Major	Occasional	High
Ship collision causing mass mortality of farmed fish	Moderate	Occasional	High

[5] Likelihood of consequence is "Likely" not "Almost certain" in view that harvesting takes place over a 2 month period and not throughout the year.
[6] Ditto
[7] Likelihood of consequence is "Likely" not "Almost certain" in view that the processing vessel is only present during harvesting, which takes place over a 2 month period and not throughout the year.

Source	Environmental Consequences	Likelihood of Consequence	Resultant Risk Level
Third-party oil spill causing mass mortality of farmed fish	Major	Unlikely	High
Disease causing mass mortality of farmed fish	Moderate	Unlikely	Moderate
Failure of moorings leading to net collapse and death of tuna	Moderate	Unlikely	Moderate

1.45. The release of fish oils from the baitfish has a minor impact on the natural environment as the oils themselves are not hydrocarbon based but natural fish oils. Without mitigation, this impact will routinely arise and the likelihood has therefore been classified as almost certain.

1.46. Impacts from the settlement of uneaten feed and impacts from fish wastes (excretion) are likewise classified as almost certain. Risks from the settlement of uneaten feed are considered to be moderate; whereas those from the fish wastes are classified as minor since the modelling shows that the impacts would be quite limited and localised.

1.47. During harvesting, blood and offal are released. The release of blood has a negligible impact as it is a natural material and readily disperse and biodegrades. The impact form the dumping of offal at sea is considered to be moderate in view of the amounts potentially dumped in a single area over a short period of time. Though these impacts will definitely take place during harvesting, the likelihood of these impacts occurring is classified as "Likely" and not "Almost certain" in view that the harvesting takes place over a two-month period and not throughout the year.

1.48. The risk of operational discharges from vessels servicing the farm without any mitigation has been considered as potentially having a minor adverse impact on the marine environment. The likelihood has been classified as likely, since such wastes are regularly generated from vessels and without appropriate mitigation would be discharged to sea.

1.49. Unmitigated operational discharges from the larger processing vessels would have the same effect, though potentially a bigger extent, and thus has been designated as a moderate impact. As in the case of the blood and offal (see above) the likelihood has been classified as "likely".

1.50. The loss of items overboard, which contributes to marine litter, is being classified as a moderate but likely impact, since such losses are fairly common.

1.51. Natural disasters, such as a major storm that could impact the farm, are considered to be an occasional event; nonetheless, the environmental consequences could be major in the unmitigated scenario due to the potential for damage to the farm and potential loss of tuna leading to mass mortality and consequent impacts on the seabed.

1.52. The possibility of a ship collision is also considered occasional without mitigation; nevertheless, the environmental consequences would be moderate since it is unlikely that the incident would result in death of all the tuna reared at the Scheme.

1.53. The possibility of an oil spill reaching the farm and causing mass mortality, though unlikely would be an event of major consequence as a result of mass mortality at the Scheme[8]. Though not generated by the Scheme itself, this effect is considered in view of the location of the farm next to a bunkering zone and the possibility of a spill happening through interaction / collision with the farm is a possibility.

1.54. Like an oil spill, a disease outbreak leading to a mass mortality event are considered to be unlikely scenarios; however, the environmental consequences, if these were to occur, would be moderate in the unmitigated scenario.

1.55. The failure of the moorings leading to net collapse and tuna mortality are likewise considered to be unlikely events of moderate consequence.

With Mitigation

1.56. **Table 7** presents risk levels for each source with the implementation of the proposed mitigation measures.

Table 7: Risk Levels With Mitigation

Source	Environmental Consequences	Likelihood of Consequence	Resultant Risk Level
Feeding of tuna: release of fish oils	Negligible	Occasional	Very Low
Feeding of tuna: settlement of uneaten feed (beneath cages)	Minor	Almost certain	Moderate
Feeding of tuna: settlement of uneaten feed (away from cages)	Negligible	Rare	Very Low
Feeding of tuna: excretion of fish waste (organic loading)	Minor	Almost certain	Moderate
Tuna harvesting: release of blood	Negligible	Likely	Low
Tuna harvesting and processing: offshore disposal of offal	Minor	Likely	Moderate
Operational discharges/ spills (oil, bilge water) from farm support vessels	Minor	Occasional	Moderate
Operational discharges / spills (oil, bilge water, process	Minor	Occasional	Moderate

[8] The environmental consequences of the oil spill itself are outside the scope of this assessment as the Scheme would not be the source of the spill.

Source	Environmental Consequences	Likelihood of Consequence	Resultant Risk Level
wastewater, sewage) from processing vessels			
Loss of items overboard (marine litter) from vessels	Negligible	Occasional	Very Low
Severe storm causing mass mortality of farmed fish	Minor	Unlikely	Low
Ship collision causing mass mortality of farmed fish	Minor	Rare	Low
Third-party oil spill causing mass mortality of farmed fish	Minor	Unlikely	Low
Disease causing mass mortality of farmed fish	Minor	Unlikely	Low
Failure of moorings leading to net collapse and death of tuna	Minor	Unlikely	Low

1.57. The effects from tuna rearing, especially feeding, are the main source of environmental concern and there is much scope for improving current operational procedures. The mitigation measures incorporated in the Scheme design and, especially, the operational mitigation measures proposed are expected to significantly reduce the environmental risk from these activities. Regular monitoring, supervision, and reporting on activities, and training of personnel will be crucial to ensure that the operational measures remain in place throughout the tuna fattening period.

1.58. The deployment of permanent oil booms inside each cage and the collection of the contained fish oils by means of proprietary oil skimmers, coupled with the collection of any escaped oils through the deployment of additional booms and collection by oil spill contractors and training of personnel, will reduce the impact to negligible under normal operating conditions as all the oil will be contained. Even in the event of a breach of the oil mitigation system (such as failure of the oil booms or delay in spill response), only minor environmental effects are expected as most of the spill would still be collected; such a scenario is expected only occasionally. The resultant environmental risk is deemed to be very low.

1.59. The settlement of uneaten feed is another of the major sources of contamination. The fact that the feeding is supervised by divers and the expense of the baitfish militates against over-feeding. The further training of personnel will further reduce the risk by ensuring that the uneaten feed is kept to a minimum. The environmental risk is considered to be minor under the cages and reducing to negligible with distance from the cages. The likelihood is almost certain for the impact under the cages since this release is routinely generated, and rare for areas away from the cages. The resultant environmental risk is moderate under the cages and very low away from the cages.

1.60. The reduction in the stocking density of each cage as a result of a greater number of cages will help to reduce the impact from fish wastes (excreta) at each cage location

by distributing the fish in a larger volume of sea. This will help disperse the excreta more effectively such that the environmental consequences will be reduced to minor from the unmitigated scenario. However, the likelihood is almost certain since this release is routinely generated and cannot be eliminated from this type of activity. The resultant environmental risk is classified as moderate.

1.61. As explained, the release of blood cannot be mitigated for food quality reasons. Hence the environmental risk for this impact remains the same as the unmitigated risk. However, since the blood disperses quickly and is biodegradable, and considering that the harvesting activity is restricted to approximately two months, the risk is deemed to be low.

1.62. The proposal to macerate the offal prior to disposal will reduce the environmental consequences at the Scheme site to minor but likely such that the environmental risk would be moderate. However, if an alternative disposal route is finally agreed, and the offal is landed for use as a by-product, then the pathway linkage would be eliminated.

1.63. In view of the nature of marine vessels, the impact from operational discharges, even with the implementation of the mitigation measures, will still result in minor environmental consequences from occasional accidental releases, resulting in a moderate risk to the environment. The operational discharges from the processing vessels are more easily contained due to the installation of holding tanks and/or sewage treatment plants on board; therefore the environmental consequences of any accidental releases are also classified as minor; the probability of such events occurring is also considered to be occasional.

1.64. As regards the control of marine litter, the proposed mitigation measures will go a long way in mitigating these impacts such that the environmental consequence can be reduced to negligible even in the event of an occasional release. The mitigated risk is deemed to be very low.

1.65. While the probability of major storms affecting the Scheme remains occasional, the mitigation incorporated in the farm through better mooring layouts and redundancy in equipment, will reduce the likelihood of damage to the farm and mass mortality to unlikely. The environmental consequences of mass mortality events are also reduced to minor following the implementation of the Scheme's contingency plan, which it is understood will include provision for immediate collection and removal of dead fish. The environmental risk is therefore deemed to be low.

1.66. The probability of a mass mortality event from ship collision is reduced to rare in view of the various mitigation measures employed, including with the official charting of the farm's locationon navigational charts, and the deployment of appropriate special marker buoys and navigational lights on site. The environmental consequences would still be minor since the probability of such a collision impacting the entire farm or several cages is not high. The environmental risk is deemed to be low.

1.67. The likelihood of an external oil spill causing mass mortality is reduced (though remaining unlikely) with the mitigation in place. Nevertheless, as mentioned the environmental consequences of mass mortality would be reduced to minor.

1.68. Based on past experience which includes the proposed mitigation including the daily presence of personnel on the farm and the supervision of the tuna, the probability of disease outbreaks is also considered to be unlikely. Similar to the previous scenario, the environmental consequences of mass mortality are minor. The environmental risk is low.

1.69. Considering the additional mitigation, including improved moorings, regular maintenance and checking of equipment, the possibility of moorings failing, leading to the collapse of nets and the death of the tuna is also considered to be unlikely and leading to a minor impact. The environmental risk is low.

1.70. In conclusion, as a result of the mitigation measures envisaged to be implemented, environmental risks from the Scheme are considered to have been reduced to low or very low, and some moderate risk related to operational discharges from vessels (including litter), impacts from the disposal of offal at sea, and impacts from uneaten feed settling on the seabed and fish excreta.