



Marine Stewardship Council fisheries assessments

Crayfish *Procambarus clarkii* fishery in continental Portugal



Pre-Assessment Report

Conformity Assessment Body (CAB)	FishFix
Fishery client	Alfocan and South Ocean
Assessment type	Pre-assessment
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Date	9 October 2024

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2 Glossary

CA	Consequence Analysis
CFP	Common Fisheries Policy
EC	European Commission
ETP	Endangered, Threatened or Protected species
EU	European Union
FAO	Food and Agriculture Organisation of the United Nations
HCR	Harvest Control Rules
ICES	International Council for the Exploration of the Sea
ICNF	Instituto da Conservação da Natureza e das Florestas
ISBF	Introduced Species Based Fisheries
IUU	Illegal, Unreported and Unregulated fishing
MCS	Monitoring, Control and Surveillance
MPA	Marine Protected Areas
MS	EU Member States
MSC	Marine Stewardship Council
MSY	Maximum Sustainable Yields
NGO	Non-Governmental Organisation
NAP	National Action Plan
PI	Performance Indicator
PRI	Point Recruitment is Impaired
PSA	Productivity Susceptibility Analysis
RBF	Risk Based Framework
SI	Scoring Issue
TAC	Total Allowable Catch
UoA	Unit of Assessment
UoC	Unit of Certification
VME	Vulnerable Marine Ecosystem

3 Executive summary

The Portuguese crayfish trap fishery pre-assessment was carried out with MSC Fisheries Standard 2.01, with Lisa Borges as expert for P1 and P3 and team leader, and Cláudia Correia as expert for P2. Interviews were carried out with active fishers and rice field owners, while contacts were made with the relevant authorities.

The main strengths of the crayfish trap fishery is its low environmental impact, with low number of bycatch species and no ETP species affected, while the impact on the bottom is low. There is also indication that the crayfish stock, an invasive species in the Portuguese continental region level, is in a healthy condition. In this context, there is a management plan to control the expansion of crayfish in continental Portugal.

Because crayfish is an invasive species, a modified assessment tree should be developed for Introduced Species Based Fisheries (ISBF) under Section SD, as all except one P1 PIs are considered to not be applicable. Nevertheless, all P1 PIs were scored and presented in the report.

Considering that all but one P1 PIs are not applicable, the fishery has automatically failed 7 PI (<SG60) in Principle 1, 2 and 3. There are additional 10 PIs that scored between SG60-79 and would therefore require conditions to improve. In addition, considering that are several PIs <SG80, the overall scoring of P1, P2 and P3 will likely be below SG80 which will result in an overall failure of the fishery. In summary, the fishery has several significant weaknesses and is therefore not consistent with the MSC Fisheries Standard.

4 Report details

4.1 Aims and constraints of the pre-assessment

The aim of this pre-assessment is to provide an analysis of the strength and weaknesses of the Portuguese crayfish trap fishery against the MSC Fisheries Standard 2.01. As with any other pre-assessment, there might be new or additional information that may have been missed that may change the scorings attributed at this time for the fishery.

4.2 Version details

Document	Version number
MSC Fisheries Certification Process	Version 2.1
MSC Fisheries Standard	Version 2.01
MSC General Certification Requirements	Version 2.3
MSC Pre-Assessment Reporting Template	Version 3.2

5 Unit(s) of Assessment

5.1 Unit(s) of Assessment

The Unit of Assessment is all trap fishing for crayfish in continental Portugal. The fishery was traditionally carried out in Mondego, Tagus, Sado and Guadiana basins, Lezírias with particularly importance in Castelo do Bode (Tagus) and Alqueva (Guadiana) reservoirs. Crayfish is particularly abundant in the central and southern regions of Portugal. Due to its invasive nature, the species has spread rapidly across many water bodies, often outcompeting native species and altering local ecosystems. The crayfish is harvested, for both domestic consumption and export, contributing to the local economy. It is caught with traps, usually small, baited devices made of wire or plastic mesh (Figure 1). Common types of traps used include pyramid traps, box traps and cylindrical traps, baited with fish, meat, or other organic materials.



Figure 1 – Example of traps used in continental Portugal.

In 2022, ICNF attributed 10 licences to 10 different areas in continental Portugal where control and transfer of crayfish specimens is permitted. A total of 100 fishers were also identified, catching a total of around 692 tonnes of crayfish caught in 17 municipalities in the Alentejo regions (Alcácer do Sal, Beja, Évora, Moura, Portel, Serpa), from the Center (Águeda, Aveiro, Cantanhede, Estarreja, Mira, Montemor-o-Velho), Lisbon and Tagus Valley (Almeirim, Azambuja, Benavente, Coruche, Palmela)¹.

Table II – Unit(s) of Assessment (UoA)

UoA 1	Description
Species	Crayfish, <i>Procambarus clarkii</i>
Stock	Stock considered at the Portuguese continental region.
Fishing gear type(s) and, if relevant, vessel type(s)	Traps
Client group	All fishers using trap fishing for crayfish in continental Portugal.
Other eligible fishers	
Geographical area	Portugal, ICES subdivision 9a
Justification for choosing the Unit of Assessment	At this stage one single UoA is considered, although UoAs per river basin should be considered in a posterior possible assessment.

¹ Plano de ação nacional para controlo do lagostim-vermelho-da-luisiana em Portugal continental. 2022 – 1º ano de implementação do plano. Poster 2 páginas.



Figure 2 – Portuguese basins highlighting where *P. clarkii* harvesting occur.

6 Traceability

6.1 Traceability within the fishery

Crayfish caught with traps are collected and transported live to Spain in trucks where they are landed live and sold at the processing factory. Individual fishers catch is identified at the landing site at the factory, but the catch is mixed with other fishers when processing starts at the size grading and posteriorly at the cooking phase. The process of how the crayfish is transported between Portugal and Spain is not clear. Private cars are usually used but the refrigeration method used is unclear.

Table III – Traceability within the fishery

Factor	Description
<p>Will the fishery use gears that are not part of the Unit of Certification (UoC)?</p> <p>If Yes, please describe: - If this may occur on the same trip, on the same vessels, or during the same season; - How any risks are mitigated.</p>	<p>No, the fishers fish exclusively with crayfish traps.</p>
<p>Will vessels in the UoC also fish outside the UoC geographic area?</p> <p>If Yes, please describe: - If this may occur on the same trip; - How any risks are mitigated.</p>	<p>All fishers and fishing areas are considered.</p>
<p>Do the fishery client members ever handle certified and non-certified products during any of the activities covered by the fishery certificate? This refers to both at-sea activities and on-land activities.</p> <ul style="list-style-type: none"> - Transport - Storage 	<p>Yes, landing, storage and processing is done at the factory and there can be a mixture for crayfish from continental Portugal from other areas of Spain.</p> <p>There must be mechanism in the factory so that there is no mixture of catch between Portugal and Spain. One</p>

<ul style="list-style-type: none"> - Processing - Landing - Auction <p>If Yes, please describe how any risks are mitigated.</p>	<p>possibility is to have specific days assigned to land from different regions.</p>
<p>Does transshipment occur within the fishery?</p> <p>If Yes, please describe:</p> <ul style="list-style-type: none"> - If transshipment takes place at-sea, in port, or both; - If the transshipment vessel may handle product from outside the UoC; - How any risks are mitigated. 	<p>No. The species is landed live and immediately transported to the depot or factory.</p>
<p>Are there any other risks of mixing or substitution between certified and non-certified fish?</p> <p>If Yes, please describe how any risks are mitigated.</p>	<p>Yes, as explained crayfish can be mixed at the factory with other crayfish from different regions.</p> <p>The risk may be mitigated for example by having different days assigned for landings of different regions.</p>

7 Pre-assessment results

7.1 Pre-assessment results overview

7.1.1 Overview

The crayfish trap fishery targets an invasive species that although is not assessed quantitatively, all known biological indicators points to a healthy stock. The fishery is quite selective with no major bycatch species or impacts in the ecosystem. However, control and enforcement is still in development while management measures are still being implemented.

Because crayfish is an invasive species, a modified assessment tree should be developed under Section SD, as all except one P1 PIs are considered to not be applicable. As an invasive species, the onus of the fisheries management, if the species cannot be extirpated, is to limit its abundance and spatial expansion, and not to protect the stock. In this context, the reasoning behind P1 scores are not applicable, except perhaps for P1.2.1 where a harvest strategy is needed but to maximise the fisheries impact on the species. Nevertheless, all P1 PIs based on the default assessment tree were scored and presented in the report.

Considering that all but one P1 PIs are not applicable, when analysing the crayfish trap fishery against the MSC Fisheries Standard 2.01, the fishery automatically failed 7 PI (<SG60) in Principle 1, 2 and 3. There are additional 10 PIs that scored between SG60-79 and would therefore require conditions to improve. In addition, considering that are several PIs <SG80, the overall scoring of P1, P2 and P3 will likely be below SG80 which will results in an overall failure of the fishery.

7.1.2 Recommendations

Based on the results summarised above, the following recommendations are made:

- A modified assessment tree should be developed for ISBF under Section SD (Introduced species)².
- Crayfish population monitoring needs to improve.
- UoA reporting and monitoring needs to improve, including:
 - Catch composition
 - Bycatch composition, including ETP species
 - Number of fishers, area of operation and intensity.
- Harvest strategy need to be clarified and implemented.
- Consultation and transparency of the management system needs to improve.
- Monitoring, Control and Surveillance measures need to be implemented, and compliance needs to improve.

7.2 Summary of potential conditions by Principle

Table IV – Summary of Performance Indicator level scores

Principle of the Fisheries Standard	Number of PIs with draft scoring ranges <60
Principle 1 – Stock status	1*
Principle 2 – Minimising environmental impacts	2
Principle 3 – Effective management	4

*two other PIs fail to reach SG60 but they are considered not applicable to invasive species.

7.3 Summary of Performance Indicator level scores

² https://www.msc.org/docs/default-source/default-document-library/for-business/program-documents/fisheries-program-documents/msc-fisheries-standard-v2-01.pdf?sfvrsn=8ecb3272_11#page=132

Table V – Summary of Performance Indicator level scores

Performance Indicator	Draft scoring range	Data deficient?
1.1.1 – Stock status	≥80	Yes
Rationale or key points		
RBF used to derive the score considering a low risk CA.		
1.1.2 – Stock rebuilding	NA	NA
Rationale or key points		
RBF was used to score P1.1.1		
1.2.1 – Harvest Strategy	<60	Yes
Rationale or key points		
There is a harvest strategy in the NAP but it is not clear how it is responsive to the state of the stock, while crayfish catches and abundance are not regularly monitored.		
1.2.2 – Harvest control rules and tools	<60	Yes
Rationale or key points		
There is no generally understood HCR or evidence that stock expansion is being limited.		
1.2.3 – Information and monitoring	<60	Yes
Rationale or key points		
UoA catch reporting is not available, while monitoring of stock abundance is lacking.		
1.2.4 – Assessment of stock status	≥80	Yes
Rationale or key points		
Default score as RBF was used to score PI 1.1.1.		
2.1.1 – Primary Outcome	≥80	Yes
Rationale or key points		
Based on interviews with Portuguese fishers and previous knowledge gathered from a similar fishery in Spain, the only primary species that could be considered is relating to the bait used in the crayfish traps. The bait normally used varies between fruit and chicken, but occasionally chub mackerel and sardines are also used. Sardine were considered the only primary species and minor as it is only sometimes used as bait and in very small quantities. According to the most recent ICES advice (2023), the sardine stock is in stable condition above B _{PA} and therefore highly likely to be above P _{RI} .		

2.1.2 – Primary Management	≥80	Yes
Rationale or key points		
The fishing strategy using traps can be considered as a partial strategy in itself, effectively functioning to prevent the capture of primary species. Research conducted in Spain with identically gears and interviews with Portuguese fishers show limited or no bycatch of primary species.		
2.1.3 – Primary Information	60 – 79	Yes
Rationale or key points		
Interviews with Portuguese fishers and the knowledge available from a similar Spanish fishery provided some qualitative information on bycatch estimates and species identification in relation to the UoA, showing that there are no main primary species in the UoA catches. However, quantitative information is needed from the UoA to assess that there are no main primary species and the UoA impact on minor species.		
2.2.1 – Secondary Outcome	≥80	Yes
Rationale or key points		
As no studies were found characterizing the bycatch of the crayfish fishery in Portugal, qualitative information on bycatch estimates and species identification in relation to the UoA was used. The information shows that there are no main secondary species, and only three minor secondary species: Atlantic chub mackerel (<i>Scomber colias</i>), pumpkin seed (<i>Lepomis gibbosus</i>) and common carp (<i>Cyprinus carpio</i>). Based on ICES, chub mackerel is not likely to be below PRI, while the two other minor secondary species are invasive exotic species.		
2.2.2 – Secondary Management	≥80	Yes
Rationale or key points		
The fishing strategy using traps can be considered as a partial strategy in itself, effectively functioning to prevent the capture of primary species. Research conducted in Spain with identically gears and interviews with Portuguese fishers show limited or no bycatch of secondary species.		
2.2.3 – Secondary Information	60 – 79	Yes
Rationale or key points		
Interviews with Portuguese fishers and the knowledge available from a similar Spanish fishery provided some qualitative information on bycatch estimates and species identification in relation to the UoA, showing that there are no main primary species in the UoA catches. However, quantitative information is needed from the UoA to assess that there are no main secondary species and the UoA impact on minor species.		
2.3.1 – ETP Outcome	<60	Yes
Rationale or key points		
The information available regarding a similar fishery in Spain, points to the possibility of amphibious species being caught in the crayfish traps. However, qualitative information gathered from interviews with fishers indicate that there are no ETP species that are actually caught by the fishery. However, as far as the team is aware, there is no information available if known direct effects of the UoA are likely to not hinder recovery of ETP species.		
2.3.2 – ETP Management	60 – 79	Yes
Rationale or key points		

<p>Although there is no information available on the survival rate of potential ETP species that may be caught accidentally, the deployment and retrieval of fishing gear, which limits interaction with ETP species and allows for the possibility of releasing unwanted catches can be considered as a management measure to ensure the UoA does not hinder the recovery of ETP species. However, more information and additional management measures are needed to ensure that these limited interactions do not impact ETP species.</p>		
2.3.3 – ETP Information	<60	Yes
Rationale or key points		
<p>Qualitative information gathered from interviews with Portuguese fishers and the knowledge available from a similar Spanish fishery indicate that there are no ETP species that are caught by the UoA. However, the team considers that this qualitative information is not adequate to estimate the UoA related mortality or manage its impact on ETP species.</p>		
2.4.1 – Habitats Outcome	≥80	Yes
Rationale or key points		
<p>According to the types habitats commonly found in the fishing grounds of the UoA consist of mud and sandy sediments. Pots and traps are lightweight and passive gears that rely on bait (or darkness) to attract target species and are generally considered to have low impact on the habitat.</p>		
2.4.2 – Habitats Management	60 – 79	Yes
Rationale or key points		
<p>There is the management plan for exotic species and the specific national plan for <i>P. clarkii</i>, which includes fishing as a means to control the impact of this species on the ecosystem. However, there is no information directly from the UoA on catches or number of fishers, to estimate if the fishery is being effective in at least preventing the species expansion in the region.</p>		
2.4.3 – Habitats Information	60 – 79	Yes
Rationale or key points		
<p>Although there are habitats that may be considered sensitive areas, such as wetlands and Natura 2000 network areas, the fishery mainly takes place in reservoirs/lakes and/or rice fields. The types and distribution of the main habitats are broadly understood and the information available is adequate to broadly understand the nature of the main impacts of gear use on the main habitats. However, there is no reliable information on the spatial extent of interaction and on the timing and location of use of the fishing gear, while there is at the moment no habitat monitoring in place.</p>		
2.5.1 – Ecosystems Outcome	60 – 79	Yes
Rationale or key points		
<p>The crayfish trap fishery, as described earlier, appear to have a limited impact on the ecosystem and habitat. Traps are highly selective and the fishery is likely to have only minor primary and secondary species bycaught, mainly associated to bait used and bycatch of invasive species, while the interaction with ETP species is likely minimal. On the other hand, the fishery, by removing invasive species with a high impact on the environment can improve the structure and function of an ecosystem. Nevertheless, there is no available information that can corroborate with a high degree of confidence regarding the ecosystem impact.</p>		
2.5.2 – Ecosystems Management	60 – 79	Yes
Rationale or key points		
<p>The crayfish trap fishery is regulated through the NAP. However, it is an invasive species, and therefore ecosystem management is based on the crayfish population control to mitigate the damage caused by the species. The team considers the NAP as a partial strategy in place to restrain impacts of, in this case, the crayfish on the ecosystem.</p>		

However, there is no information if the NAP is being implemented successfully, and there is no publicly available information on crayfish catches, number of licences given, number and area of traps deployment etc.		
2.5.3 – Ecosystems Information	60 – 79	Yes
Rationale or key points		
The information available, although mainly qualitative is adequate to identify the key elements of the ecosystem. Primary and secondary species are associated to either the bait species used or to invasive species. Potential ETP species have also been identified while the main habitats where the fishery operates are man-made. Also, being an invasive species, existing information on ecosystem impacts pertains to the species itself rather than fishing activity. However, the impact of invasive species in the Portuguese freshwater ecosystems are not well known and the impacts of crayfish specifically have not been investigated in detail.		
3.1.1 – Legal and customary framework	60 – 79	No
Rationale or key points		
European freshwater fisheries are managed through the European Union Environmental law. There is Regulation (EU) No 1143/2014 that addresses the prevention and management of the introduction and spread of invasive alien species. Portuguese Decree-Law No. 92/2019 that transposes the EU Regulation 1143/2014 into national legislation. The EU and the Portuguese management system exists within an appropriate legal and/or customary framework. However, it is unclear if the management system observes the legal rights of people dependent on fishing.		
3.1.2 – Consultation, roles and responsibilities	<60	Yes
Rationale or key points		
The major institutions involved in the management of the Portuguese crayfish trap fishery are well known and their functions and roles are generally understood. However, there is no information of any consultation process that involves crayfish fishers.		
3.1.3 – Long term objectives	60 – 79	No
Rationale or key points		
The EU environmental legislation, and its Regulation (EU) No 1143/2014 obliges MSs to have in place effective management measures for those invasive alien species of Union concern which the Member States have found to be widely spread on their territory, so that their impact on biodiversity, the related ecosystem services, and, where applicable, on human health or the economy are minimised. Therefore there are objectives of minimizing the impact of invasive species explicit in the management policy, but these are not necessarily clear.		
3.2.1 – Fishery specific objectives	≥80	No
Rationale or key points		
The crayfish trap fishery in continental Portugal is managed through a National Action Plan (NAP, Council of Ministers Resolution No. 133/2021, of September 7th) and has short and long term objectives.		
3.2.2 – Decision making processes	<60	No
Rationale or key points		
There are some decisions making process in place through the EU environmental legislation and its implementation in MSs, and uses the precautionary approach and is based on the best available scientific information. However, there is almost no publicly available information regarding catches of the crayfish trap fishery, number of licences given, number of fishers, area of operation, etc. It is also unclear if the NAP is being implemented. Furthermore, according to fishers interviews, crayfish catch is not always reported, the traps are not identified and there are many fishers with no licences.		

3.2.3 – Compliance and enforcement	<60	No
Rationale or key points		
<p>The overall requirements for Monitoring, Control and Surveillance (MCS) of freshwater fisheries in EU legislation Regulation (EU) No 1143/2014 is that MSs shall establish a surveillance system of invasive alien species of Union concern, or include it in their existing system. ICNF is responsible for monitoring, enforcement and inspection of freshwater fisheries in Portugal, but there is no information if they are actually implemented, let alone effective. Furthermore, there is no evidence that sanctions are applied evidence while there is systematic non-compliance with management measures.</p>		
3.2.4 – Management performance evaluation	<60	No
Rationale or key points		
<p>There are mechanisms in place to evaluate some parts of the fishery specific management system, namely reporting of catches and licences. However, it is unclear if any review of the management system of freshwater fisheries in Portugal, or of invasive species is subject to internal review.</p>		

7.4 Principle 1

7.4.1 Principle 1 background

The red crayfish *Procambarus clarkii* was originally distributed from northern Mexico to Florida, USA, and north to southern Illinois and Ohio (FAO, 2009). However, it was introduced in the early 1970's into water bodies of the Lower Guadalquivir Basin (southern Spain) (Alcorlo et al., 2008). In Portugal it appeared in 1979 and is spread across at least 11 river basins: Douro, Leça, Vouga, Mondego, Lis, Ribeiros do Oeste, Tagus, Sado, Mira, Ribeiros do Algarve and Guadiana³. In less than 20 years from the first introduction, new populations of *P. clarkii* have been reported in several countries of Europe, including Cyprus, England, France, Germany, Italy, Mallorca, The Netherlands, and Switzerland. (Barbaresi et al., 2007). Due to its broad ecological tolerance, rapid growth, high fecundity and resistance to diseases (several authors in a Alcorlo & Baltanás, 2013) constitutes a prolific invasive species.

It is typically found in marshes, rivers, reservoirs, irrigation systems, and rice fields (Barbaresi et al., 2007), mainly in lentic and lotic freshwater habitats: sluggish streams and lentic habitats, swamps, ditches, sloughs and ponds, especially in vegetation and leaf litter, avoiding high flow streams and ditches. Crayfish is highly territorial, it exhibits aggressive behaviour among its own species. Burrows during drought or cold periods, and it feeds on insects, larvae, and detritus with a preference for animal matter (FAO, 2009). Its life cycle, of approximately 5 years, is well suited to the annual spring flooding and summer dry season's common to large river systems and floodplains. However, in Spanish marshes and rice fields (Gutierrez et al., 1999), due to the fact that its reproductive period is dependent on both environmental and endogenous physiological factors, it can change between different regions (Anastacio & Marques, 1995).

The main breeding season of *P. clarkii* generally occurs from spring to autumn in native and exotic populations, except in the introduced tropical regions where year-round breeding occurs (several authors in Hamasaki et al., 2023). *P. clarkii* mating occur in open water, and the eggs remain attached to the female abdomen buried in the mud until it spawns in open waters. Burrowing activity for reproduction can occur throughout the year. Depending on size and condition of the female, the number of eggs laid varies between 200 and 500 per hatch. It is a fast-grower with 21 incubation days, growing up to 2 cm after one month and up to 8 cm length in three months, in a range of temperature that can vary between 10-22°C to >30°C (FAO, 2009). The size at sexual maturity probably varies according to the environmental conditions in each locality. For instance, sexually active males are considerably smaller in stressed environments with erratic water level fluctuations, high population densities, poor water quality, and limited food supply than in more favourable environments (several authors in Hamasaki et al., 2023).

In Portugal, crayfish from the lower Mondego River valley population structure was analysed and 7 cohorts were identified. The main recruitment period occurred from the second half of October to the end of November, but juveniles were found throughout the year. Tracking recognizable cohorts, along size-frequency distributions from successive sampling dates, allowed an estimation of growth parameters in order to calibrate a growth model incorporating seasonal adjustments. Average growth rate was estimated at 1.16 mm of total length per week. Production was estimated at 27.22 g m⁻² per year, the average biomass at 5.4 g m⁻², and the P/B ratio at 5.03. Females outnumbered males throughout the year and the average sex ratio was 0.24 (Anastácio & Marques, 1995).

Table VI - Species biological attributes for crayfish (Source <https://nas.er.usgs.gov/queries/factsheet.aspx?SpeciesID=217>,).

Species biological attributes			
Species	<i>Procambarus clarkii</i>	Average age maturity	2-3 months
Reproductive strategy	Brooders	Average maximum age	2-5 years
Length of larvae phase	2-3 months	Fecundity (No of eggs)	200 and 500 per hatch
Movement of adults	No significant migration pattern	Average size at maturity	18–29 mm for males and 25–34 mm for females postorbital carapace length
Sediment type	Muddy bottoms	Average maximum size	12-15 cm
Depth	0-20 m	Trophic level	2-3

Stock Identity

Barbaresi et al. (2007), in order to outline the history of the European *P. clarkii* invasion process throughout Europe, addressed the role of single versus multiple dispersal events through the comparison of the genetic structure of different populations. The first introduction of *P. clarkii* into Spain from Louisiana is well documented. On the other hand, the

³ https://www.cienciaviva.pt/planeta-agua/index.php?acao=showobj&id_obj=2829

events leading to subsequent expansion of the species are only partially known. Previous studies revealed high levels of genetic variability in five European populations, suggesting multiple introductions of individuals coming from different source locations. The high genetic diversity revealed by microsatellite markers in some introduced populations of *P. clarkii* could be the result of different types of introduction events, i.e. (1) multiple introduction events with individuals from different sources; (2) a single introduction of a large number of individuals from a genetically diverse source population; and (3) a combination of these events. The authors hypothesis that crayfish spread may involve both long-distance jump dispersal and natural dispersal at a microgeographical scale. The results confirm the model in which the colonization of Europe by this species derives from subsequent introductions of individuals coming from different source populations. This model is consistent with both the high genetic diversity observed (introduction of different sets of individuals) and the genetic differentiation of populations resulting from the casual bias of introductions.

In summary, there may be evidence between different European populations but not necessarily that there is a red shrimp population structure specific by river basin or even different in the continental Portugal area and adjacent areas in Spain. Nevertheless, the following P1 assessment is carried out at the continental Portugal area, considering that there is one *P. clarkii* stock.

Stock assessment & status

In the context of evaluating the status of an invasive species, stock status is *a priori* always favourable, and therefore it is the teams opinion that PI 1.1.1 Stock status, PI 1.1.2 Stock recovery (and also PI 1.2.3 Stock assessment) do not need to be scored. A modified assessment tree for P1 should therefore be developed for invasive species under Section SD. Nevertheless, and until a modified tree is developed, the team proceeded in scoring P1 using the default tree.

Since to the teams best knowledge there is no information on stock status for *Procambarus clarkii* in continental Portugal, nor reference points, a Risk-Based Framework Assessment was carried out to score PI 1.1.1 assuming a low risk in the Consequence Analysis (CA) for the sub-component geographical range. A Productivity Susceptibility Analysis (PSA) is designed to show the likely risk posed by the fishery to the population based on the biological characteristics of the stock and the likely susceptibility to capture. However, the results of this pre-assessment are provisional as in an MSC assessment PSA is a participatory analysis achieved by contributions by all stakeholders and it was not developed to cater for invasive species. When undertaking a PSA in MSC Principle 1, it is important to consider the combined contributions of all fishing gears fishing the target species over the range of the stock. However, crayfish in Portugal is fished with traps only.

Table VII - Crayfish PSA Productivity reasoning and scores (information gathered in the literature review).

Productivity	Rationale	Score
Average age at maturity	<5 years	1
Average maximum age	<10 years	1
Fecundity	100-20,000 eggs per year	2
Reproductive strategy	Live bearer	3
Trophic level	<2.75	1
Density dependence	No depensatory or compensatory dynamics demonstrated or likely	2
Total Productivity (average)		1.67

The productivity scores are fixed for the species, regardless of how the species is caught. By contrast the susceptibility scores will be different for each gear type catching the species within the stock area, in this case only traps. In scoring the susceptibility attributes for crayfish in continental Portugal the rationale for the area overlap was that fishing occurs in more than 50% of the stock area (considered at continental Portugal). As for encounterability and post capture mortality, were evaluated considering the default score for target species. Selectivity was based on information gathered with interview with fishers and based on the knowledge of the Spanish trap fishery that: around 3 cm are regularly caught while individuals of 1.5 cm can escape or avoid the traps.

Table VIII - Crayfish PSA Susceptibility reasoning and scores (information gathered at site visit).

Susceptibility	Rationale	Score
Area Overlap	The trap fishery operate in an area corresponding to between 10-30% of the stock area	2
Encounterability	High overlap with fishing gear - default score for target species.	3
Selectivity	Individuals < size at maturity are regularly caught and individuals < half the size at maturity can escape or avoid gear	2

Post capture mortality	Retained species default score.	3
Total Susceptibility (average)		1.88

The RBF analysis resulted in an overall MSC score for the PSA of 84 for trap fishing, which corresponds to an MSC total score of 92.

Harvest strategy

Both Portugal and the EU have jurisdiction over the crayfish fishery in Portugal. There is Regulation (EU) No 1143/2014 that addresses the prevention and management of the introduction and spread of invasive alien species (IAS). The equivalent in Portuguese legislation is Decree-Law No. 92/2019 that transposes the EU Regulation 1143/2014 into national legislation.

There is also a National Action Plan (NAP) for the management of the crayfish population in continental Portugal (Council of Ministers Resolution No. 133/2021, of September 7th), that includes promoting its commercial exploitation as a means of population control, as well as implementing biological and mechanical control methods. The conditions that the harvesting of the crustacean must comply with, both for personal consumption and for commercial activity, are also defined⁴. The NAP has four specific objectives:

- establish a system of control and containment of the species' population;
- identify sensitive areas for some species of native plants or animals where it will be necessary to reduce the abundance of crayfish;
- maintain the population at levels that minimize losses, but allow for its positive effects as prey in the diet of native fauna;
- implement a plan to capture specimens, as a method of control and containment.

According to the NAP, catches of crayfish can be carried out in two different ways: extraction for self-consumption or mass extraction. Crayfish catches that are only for self-consumption can only be transported dead. In this case fishing can be carried out by anyone but only with a shrimp net, scales (or ratel) or manually. For mass extraction, crayfish can be sold and transported alive, but fishing can only be carried out by holders of a professional fishing license, as long as they are registered as fishers in the service of companies/establishments licensed by the ICNF for the control and transfer and/or detention and treatment (purification, processing or destruction) of this species.

For companies/establishments, the NAP requirements are that they must hold a license issued by ICNF that allows it to exercise control, which includes the holding, transfer, purchase, sale, offer for sale and transport of live specimens to authorized establishments. They must provide fishers with a copy of this license. If the company/establishment, in addition to controlling and transferring captured specimens to an authorized establishment, also carries out the detention and treatment of this species, it must have permission to set up and operate an aquaculture establishment in inland waters or a related establishment, or permission that enables the processing of aquaculture products. The companies also have to maintain a record of the catches delivered by each fisher and, annually, send a report to the ICNF which must include the compilation of information relating to all shipments received from the fishers, using specific models.

Fishers must hold the applicable inland water fishing license(s), have professional fishing equipment (traps) identified and marked in accordance with the provisions of article 12 of Decree-Law no. 112/2017, of September 6, be in possession of a copy of the license of the company/establishment for which they carry out the fishing activity and, if necessary, a statement stating that they perform the functions of fisher for that company/establishment, deliver to the company/establishment, with each shipment of red crayfish, a catch declaration according to the model.

The species is also included in the National List of Invasive Species (annex II of Decree-Law n. 92/2019, of 10th July).

7.4.2 Catch profiles

There is no catch data made available publicly by the Portuguese authorities.

7.4.3 Total Allowable Catch (TAC) and catch data

Table IX – Total catch data

	Year	2023	Amount	n, unit
Total catch	Year	2023	Amount	n, unit
UoA share of total catch	Year	2023	Amount	n, unit
Total green weight catch by UoC	Year (most recent)	2023	Amount	n, unit

Commented [LB1]: Data needed from Alfocan and South Ocean. At least some level of how much you buy from Portugal?

⁴ <https://www.agroportal.pt/plano-de-acao-nacional-para-o-controlo-do-lagostim-vermelho-da-luisiana-em-portugal-continental/>

Total green weight catch by UoC	Year (second most recent)	2022	Amount	692 tonnes
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7.4.4 Principle 1 Performance Indicator scores and rationales

As stated before, because crayfish is an invasive species a modified assessment tree should be developed under Section SD, as all P1 PIs are considered to not be applicable, except perhaps PI1.2.1 where a harvest strategy is needed but to maximise the fisheries impact on the species. Nevertheless, all P1 PIs were tentatively scored and are presented below.

PI 1.1.1 – Stock status

Risk Based Framework was used to score this PI. Total score was 67. See section 7.3

PI 1.1.2 – Stock rebuilding

Not applicable as RBF was used to score PI1.1.1

PI 1.2.1 – Harvest strategy

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
Scoring Issue		SG 60	SG 80	SG 100
a	Harvest strategy design			
	Guide post	The harvest strategy is expected to achieve stock management objectives reflected in PI 1.1.1 SG80.	The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy work together towards achieving stock management objectives reflected in PI 1.1.1 SG80.	The harvest strategy is responsive to the state of the stock and is designed to achieve stock management objectives reflected in PI 1.1.1 SG80.
	Met?	Yes	No	No
Rationale				

Crayfish is managed by Portugal and the EU. There are several general regulations in place at EU level to manage invasive Alien species (its Regulation (EU) No 1143/2014) and national level (Portaria 27/2001, Despacho 127-A/2019, Portaria 1102-D/2000, Portaria 230/2012) that contain different management measures. The National Management Plan (Council of Ministers Resolution No. 133/2021) includes fishing licences and catch reporting requirement, while incentivising the commercial and recreational catch of the species. These elements of the HS are expected to limit to some level the abundance of red crayfish and therefore, SG60 is reached. It is unclear however how these elements of the harvest strategy are likely to work together, while it is not clear if the harvest strategy is responsive to the state of the stock and thus SG80 is not reached.

b	Harvest strategy evaluation			
	Guide post	The harvest strategy is likely to work based on prior experience or plausible argument.	The harvest strategy may not have been fully tested but evidence exists that it is achieving its objectives.	The performance of the harvest strategy has been fully evaluated and evidence exists to show that it is achieving its objectives including being clearly able to maintain stocks at target levels.
	Met?	Yes	No	No

Rationale

The NAP has several provisions to limit the expansion of the species, and these can work to limit the species expansion. So SG60 is reached. However, it is not clear if the strategy is actually working, if there is a diminishing abundance of the species and a decrease of its spatial distribution and as such SG80 is not reached.

Harvest strategy monitoring	
c	Monitoring is in place that is expected to determine whether the harvest strategy is working.
Guide post	
Met?	No
Rationale	

There is monitoring in place to collect data on catches but there is little information regarding number of fishers, traps or areas of operation, while there are almost no publicly available catch data. To the team's best knowledge there is also no regular monitoring to determine if the crayfish population is increasing abundance or expanding its geographical range, or increasing its wider ecosystem impact. Therefore there is no monitoring to determine whether the harvest strategy is working and SG60 is not met.

Harvest strategy review	
d	The harvest strategy is periodically reviewed and improved as necessary.
Guide post	
Met?	No
Rationale	

The NAP was just recently drafted and agreed, but there is no information if the NAP is review periodically and thus SG100 is not reached.

Shark finning			
e	It is likely that shark finning is not taking place.	It is highly likely that shark finning is not taking place.	There is a high degree of certainty that shark finning is not taking place.
Guide post			
Met?	NA	NA	NA
Rationale			

Not applicable to this pre-assessment as the target species is not a shark.

Review of alternative measures			
f	There has been a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock.	There is a regular review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock and they are implemented as appropriate.	There is a biennial review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock, and they are implemented, as appropriate.
Guide post			

Met?	NA	NA	NA
Rationale			

As the crayfish *P. clarkii* is an invasive alien species, where there are no objective to minimise UoA mortality of unwanted catch, the team considers that this is not applicable. In addition, there are very little discards from the trap fishery.

References

Information gathered through interviews with fishers.
 Regulation (EU) No 1143/2014 & Decree-Law No. 92/2019
 Council of Ministers Resolution No. 133/2021
 ICNF 2022 poster

Draft scoring range	<60
Information gap indicator	More information sought on the implementation of the NAP

PI 1.2.2 – Harvest control rules and tools

PI 1.2.2		There are well defined and effective harvest control rules (HCRs) in place		
Scoring Issue		SG 60	SG 80	SG 100
a	HCRs design and application			
	Guide post	Generally understood HCRs are in place or available that are expected to reduce the exploitation rate as the point of recruitment impairment (PRI) is approached.	Well defined HCRs are in place that ensure that the exploitation rate is reduced as the PRI is approached, are expected to keep the stock fluctuating around a target level consistent with (or above) MSY, or for key LTL species a level consistent with ecosystem needs.	The HCRs are expected to keep the stock fluctuating at or above a target level consistent with MSY, or another more appropriate level taking into account the ecological role of the stock, most of the time.
	Met?	No	No	No
Rationale				

There are no generally understood HCR available or in place that may limit stock abundance or spatial distribution. Therefore, SG60 is not reached.

b	HCRs robustness to uncertainty			
	Guide post		The HCRs are likely to be robust to the main uncertainties.	The HCRs take account of a wide range of uncertainties including the ecological role of the stock, and there is evidence that the HCRs are robust to the main uncertainties.
	Met?		No	No
Rationale				

There are no generally understood HCRs.

HCRs evaluation				
c	Guide post	There is some evidence that tools used or available to implement HCRs are appropriate and effective in controlling exploitation.	Available evidence indicates that the tools in use are appropriate and effective in achieving the exploitation levels required under the HCRs.	Evidence clearly shows that the tools in use are effective in achieving the exploitation levels required under the HCRs.
	Met?	No	No	No

Rationale

There is no information if crayfish catches are limiting in anyway the population abundance or its spatial distribution. Therefore SG60 is not reached.

References

Information gathered through interviews with fishers.
Regulation (EU) No 1143/2014 & Decree-Law No. 92/2019
Council of Ministers Resolution No. 133/2021

Draft scoring range	<60
Information gap indicator	More information sought on the implementation of the NPA

PI 1.2.3 – Information and monitoring

PI 1.2.3					Relevant information is collected to support the harvest strategy		
Scoring Issue		SG 60	SG 80	SG 100			
a	Range of information						
	Guide post	Some relevant information related to stock structure, stock productivity and fleet composition is available to support the harvest strategy.	Sufficient relevant information related to stock structure, stock productivity, fleet composition and other data are available to support the harvest strategy.	A comprehensive range of information (on stock structure, stock productivity, fleet composition, stock abundance, UoA removals and other information such as environmental information), including some that may not be directly related to the current harvest strategy, is available.			
	Met?	No	No	No			
Rationale							

There is no information regarding stock structure, catch, or even number of fishers and very little biological data from crayfish in all the river basins. Therefore SG60 is not reached.

b	Monitoring						
	Guide post	Stock abundance and UoA removals are monitored and at least one indicator is available and monitored with	Stock abundance and UoA removals are regularly monitored at a level of accuracy and coverage	All information required by the harvest control rule is monitored with high frequency and a high degree			

		sufficient frequency to support the harvest control rule.	consistent with the harvest control rule, and one or more indicators are available and monitored with sufficient frequency to support the harvest control rule.	of certainty, and there is a good understanding of inherent uncertainties in the information [data] and the robustness of assessment and management to this uncertainty.
	Met?	No	No	No
Rationale				

UoA removals have recently been obliged to be reported but no data is available publicly so there is no information if the monitoring and reporting of catches is actually occurring. There is also no indicator of stock abundance and therefore SG60 is not reached.

C	Comprehensiveness of information			
	Guide post		There is good information on all other fishery removals from the stock.	
	Met?		No	
Rationale				

Crayfish are taken also recreational for personal consumption. There is no information available on catch volumes. SG80 is not reached.

References

Information gathered through interviews with fishers.
Council of Ministers Resolution No. 133/2021

Draft scoring range	<60
Information gap indicator	More information sought on stock structure, productivity, spatial distribution but also on UoA composition and removals.
Data-deficient? (Risk-Based Framework needed)	Yes

PI 1.2.4 – Assessment of stock status

Default score of 80 as RBF was used to score PI1.1.1

7.5 Principle 2

7.5.1 Principle 2 background

According to the national action plan for the control of the red crayfish in mainland Portugal (Resolution of the Council of Ministers No. 133/2021), a report must be submitted annually to ICNF, which should include the compilation of information related to all shipments received by the collection centers. However, there is no monitoring and control system that allows for the recording of non-target catches. Therefore, the following scoring element table has been elaborated with public information gathered by different researchers on the subject, such as Pinto (2023), Aquiloni et al. (2006) Gutiérrez-Yurrita et al. (1999), and the National Action Plan (2021) which have identified geographic overlap of different species present in the catch of the crayfish trap fishery in Portugal mainland. MSC FS v2.01 SA 3.1.3-3.1.5 criteria has been used to classify them as main or minor, primary, secondary or ETP species.

Table X – Scoring elements

Component	Scoring elements	Designation	Data-deficient
Primary	Sardine (<i>Sardina pilchardus</i>)	Minor	No
Secondary	Atlantic chub mackerel (<i>Scomber colias</i>)	Minor	Yes
Secondary	Pumpekin seed (<i>Lepomis gibbosus</i>)	Minor	Yes
Secondary	Common carp (<i>Cyprinus carpio</i>)	Minor	Yes
ETP	European eel (<i>Anguilla anguilla</i>)	N/A	No
ETP*	White-clawed crayfish (<i>Austropotamobius pallipes</i>)	N/A	Yes
ETP*	Iberian midwife toad (<i>Alytes cisternasii</i>)	N/A	Yes
ETP*	Iberian frog (<i>Rana iberica</i>)	N/A	Yes
ETP*	Iberian newt (<i>Lissotriton boscai</i>)	N/A	Yes
ETP*	Fire salamander (<i>Salamandra salamandra</i>)	N/A	Yes

* Species listed based on geographical distribution, but based on Portuguese fishers' interviews and previous knowledge of a similar trap fishery in Spain, they are extremely unlikely to interact with the gear, and are not considered further individually.

Primary species

The fishing of *P. clarkii*, depending on the watercourse, can take place using small boats, for example in reservoirs and lagoons, or by setting traps on foot, for example in rice plantation channels. At present there is no official recording of species in the catch with no commercial value and there is no information on the survival rate after their release.

There is scarce information regarding the bycatch associated with this fishery. The information collected in this study is based on the overlap of habitats with species that may be accidentally caught, particularly amphibians. In the action plan, with the aim of minimizing the capture of amphibians in certain regions, it is mandatory to use a floating buoy that allows the trapped animals to breathe until they are released. In addition to this information, the data collected during sampling campaigns conducted in Orellana La Vieja and Andalucía trap fisheries, show that the bycatch mainly consists of common carp and pumpkinseed, both invasive species, and in a very small percentage (<5% of the total catch). In addition to the information collected on habitat overlap and the risk of accidental capture, there are no assessment studies of the fishery in which additional species have been identified.

Sardines and chub mackerel were reported, during interviews with the fishers, as species sometimes used as bait. According to stakeholder meeting with fishers, bait is mainly comprised by chicken and fruit, and occasionally Atlantic

chub mackerel (*Scomber colias*) and sardine (*Sardina pilchardus*). Since the quantities of mackerel and sardines used are not known and their use varies as an alternative to the availability of other cheaper bait, and since management measures only apply to sardine, sardine would be considered as a minor primary species and Atlantic chub mackerel as minor secondary species.

Sardine

ICES provides advice for the sardine stock (*Sardina pilchardus*) in Iberian waters. According to the 2023 ICES advice for sardine in divisions 8c and 9a (Cantabrian Sea and Atlantic Iberian waters), the biomass of age 1 and older fish has decreased since 2006 to an historical low in 2013. Biomass has since increased, being above B_{PA} since 2020, and is in 2024 almost 500,000 t. Recruitment has been below the long-term average since 2005 with 2014 estimated as the lowest in the time-series. However, in 2019 there was a high recruitment and 2023 again very low recruitment. Fishing mortality has been high and variable with three peaks, the latest in 2011, but decreasing since being below F_{MSY} since 2018. In 2019, F is the lowest in the time-series and in 2022 is 0.081

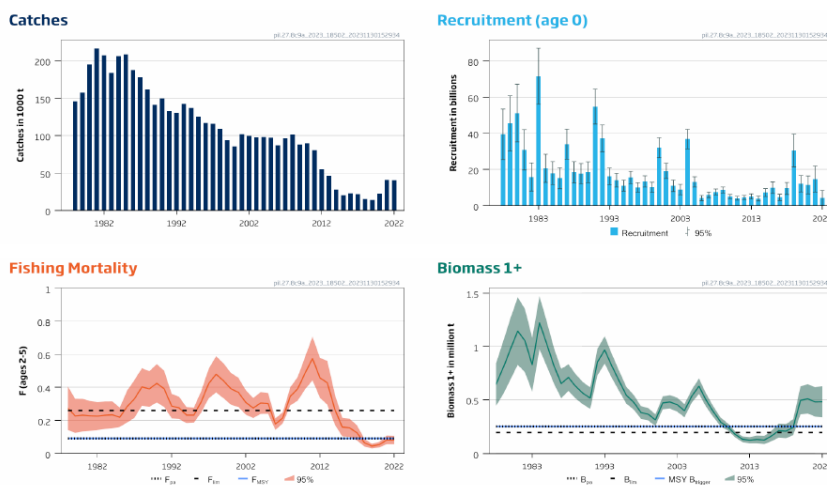


Figure 3 - Sardine in divisions 8c and 9a. Summary of the stock assessment. Fishing mortality and biomass have 95% confidence intervals. The current reference points reflect the low productivity regime since 2006 (ICES_SAR, 2023).

Secondary species

Atlantic chub mackerel

The following section is based on the compilation provided by ICES_WKCOLIAS2 (2021). The Atlantic chub mackerel (*Scomber colias*) is a middle-sized pelagic fish distributed in warm and temperate Atlantic waters (eastern and western coasts), and eastwards to the Mediterranean and southern Black Sea. In Atlantic European waters, landings mainly come from the Spanish and Portuguese purse seiner fisheries (from Bay of Biscay to Gulf of Cadiz), this fleet representing in recent years ~75% and up to 98% of the catches, in Portugal and Spain, respectively.

Chub mackerel seems to have a continuous distribution from Mauritania to Bay of Biscay, although the abundance in European waters is lower than that observed in Africa. Nevertheless, the strength of the 2016 year class has been above average in both African and European waters, suggesting an overall increase of the abundance throughout the distribution area. In both areas, chub mackerel appears to undertake migrations. From wintering areas, mainly located in Mauritanian waters, South Portugal and the inner part of the Bay of Biscay, chub mackerel spread towards northern waters in summer time and, in the case of the Bay of Biscay, also towards the western Iberian Peninsula.

Regarding length at first maturity, L_{50} , ranges from 18.71 to 30.8 cm in EU waters; from 16 to 31 cm in NW African waters; between 16.8 and 27.2 cm in Mediterranean waters; and ~27.4 in NW Atlantic. Considering sexes, a tendency to males maturing at larger sizes than females seems to occur, except for the Atlantic Iberian waters. Overall, a decrease of the L_{50} seems to occur from the Bay of Biscay to the Gulf of Cadiz, and an increase from North to South in NW African waters, with a transitional area which includes the northern Macaronesian islands. In the Mediterranean waters, a decreasing trend of the L_{50} seems to occur from West to East. A latitudinal variation of the period and duration of the

spawning activity seems to occur across Eastern Atlantic for chub mackerel, which spawns mostly in winter-spring in Iberian waters whereas, in NW Africa, the spawning period starts earlier, in autumn.

Finally, an attempt to assess several chub mackerel in European waters was conducted, considering an Iberian and a Portuguese stock, and using a surplus production model SPiCT. For the Portuguese stock, B/B_{MSY} shows an increasing trend from 1985 to 2009 and thereafter a decrease but was above 1 most of the period. F/F_{MSY} dropped in the early period and fluctuated at a low level until the late 2010s. F/F_{MSY} peaked in 2015 when the catches reached the historical maximum (45 000 t).

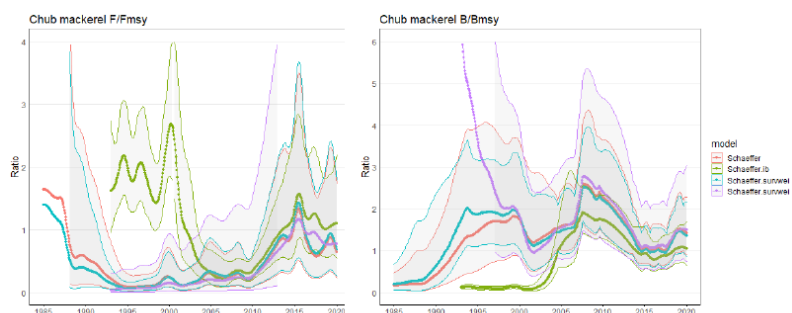


Figure 4 - Summary plots of the relative fishing mortality (F) (left panel) and biomass (B) (right panel) estimates for the four best SPiCT models fitted to chub mackerel in the Iberian (.ib) and Portuguese waters (ICES_WKCOLIAS2, 2021).

ETP species

Regarding the interaction of the fishery with ETP species, it is necessary to conduct on-site research to determine the impact of the fishery on these species. However, it is likely that European eel will be caught by the fishery.

European Eel

European eel (*Anguilla anguilla*) has been occasionally reported as bycatch in the fishing activities conducted in the rice channels of the Mondego basin and is classified by the IUCN in Europe as critically endangered. The population in Portugal, as in the rest of Europe, has experienced significant declines in abundance over the past several decades. Overfishing, habitat destruction, pollution, diseases and climate change are major factors contributing to the decline of eel populations. Globally, recruitment has dramatically decreased since the late 20th century. In Portugal, the decline mirrors the broader European trend, with recruitment levels significantly lower than historical levels (ICES_WGEEL, 2023). Studies in Minho River have shown distinct groups of eels with different development characteristics between tributaries and estuaries, indicating varied environmental conditions affecting their growth and survival (Moura et al., 2022). In the Mondego River, like in many European rivers, eel population is highly impacted by weirs and dams that obstruct migration. Efforts to improve connectivity, such as installing eel ladders, have been implemented but with limited success (Monteiro et al., 2023). Additionally, the prevalence of the swim bladder parasite *Anguillicola crassus* has been studied extensively. In the Minho River, infection rates increased from about 30.7% in the mid-1990s to around 67.9% in the late 2000s, slightly decreasing to 63.1% by 2021. This pattern indicates a significant impact on the eel population, similar to trends seen in other European regions (Unger et al., 2024). Efforts to conserve and manage European eel populations in Portugal include habitat restoration, improving river connectivity, and monitoring disease prevalence. The installation of eel ladders and other fish passes aims to facilitate upstream migration, although their effectiveness varies (Monteiro et al., 2023). Overall, the European eel remains critically endangered, and ongoing conservation efforts are crucial to stabilize and hopefully increase their populations in Portuguese rivers and coastal areas.

The eel fishery in Europe faces significant challenges due to the species' critically endangered status. Efforts to manage and conserve the species are complex due to the eel's complex life cycle, which includes migration between freshwater and marine environment. In Europe, eel management involves various conservation strategies (ICES_WGEEL, 2023). The EU has implemented regulations to reduce eel fishing, control illegal trade, and improve habitat conditions. However, illegal trafficking of glass eels to Asia continues to be a significant problem, driven by high demand in markets like Japan and China. The Commission Implementing Decision (EU) No 2019/909 (Data Collection Framework, DCF; EC, 2019) mandates that Member States make data collected through this framework available to end-users, including ICES.

According to ICES, the abundance of European eel across its various life stages has experienced significant declines (ICES_WGEEL, 2023):

- **Glass Eel (Juvenile Stage):** Recruitment of glass eels has drastically declined since the 1980s. For instance, in 2022, glass eel recruitment in the "North Sea" index area was only 0.5% of the levels observed from 1960 to 1979. In the "Elsewhere Europe" index series, recruitment was 9.7% in 2022 and 5.5% in 2021. Despite some fluctuations, recruitment levels have remained consistently low, indicating ongoing challenges for population recovery.
- **Yellow Eel (Growth Stage):** Abundance of yellow eels has also decreased significantly. In 2021, recruitment was at 19% of the levels seen from 1960 to 1979. Collecting comprehensive data on yellow eels is complex due to their wide distribution and various habitats.
- **Silver Eel (Mature Stage):** Biomass of silver eels, which represents the mature, migrating stage of the eel's life cycle, has decreased in parallel with declines in glass and yellow eel stages. The reduction in silver eel numbers is heavily influenced by overfishing, barriers to migration (such as dams and weirs), and habitat degradation.

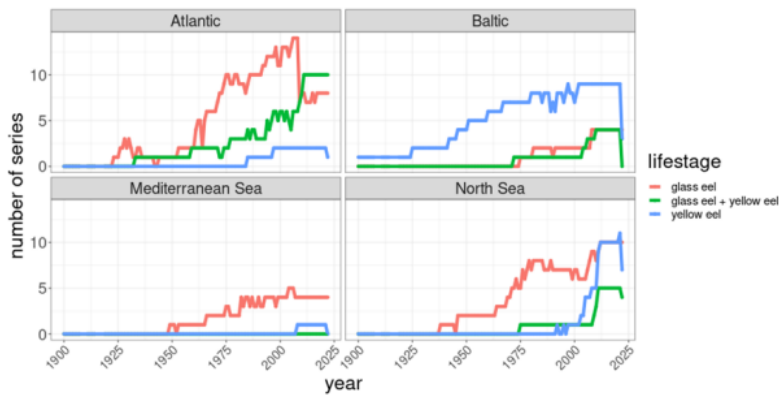


Figure 5 - Temporal trends in the number of series that have been kept to perform the recruitment analysis per stage and area. Note that the number of 2022 series is not final as the year has not yet ended and there are still series to be reported (ICES_WGEEL, 2023).

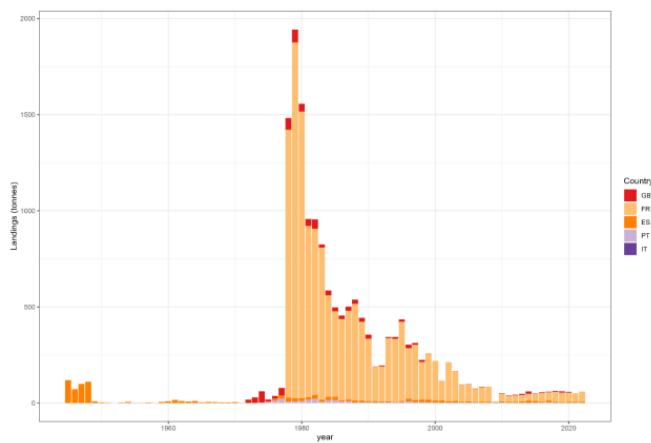


Figure 6 - Time-series of reported commercial glass eel fishery landings (tonnes), 1945-2022, by country. United Kingdom (GB), France (FR), Spain (ES), Portugal (PT) and Italy (IT) are included, combining information from the data call 2022 and the WGEEL database (ICES_WGEEL, 2023).

Habitats

The common habitats affected by the UoA are lotic water bodies, lentic water bodies, and natural wetland areas (such as rivers, lakes, ponds, and marshes), heavily modified habitats (such as reservoirs), and artificial environments (such as ditches, irrigation and drainage canals, and rice paddies). These habitats coincide with the distribution of the target species, but the number of existing fishers and the exact locations of the fishery are not clear.

Lotic water bodies are flowing water systems such as rivers and streams. These habitats are dynamic and characterized by continuous water flow, which influences their ecological characteristics. Lotic systems support a diverse range of species adapted to flowing water conditions, including various fish, invertebrates, and aquatic plant (Allan & Castillo, 2007). Lentic water bodies are still or standing water systems such as lakes and ponds. These habitats have different ecological dynamics compared to lotic systems. Lakes and ponds provide habitat for a variety of species, including fish, amphibians, and birds. The lack of flow leads to stratification and unique ecological zones. Recreational and commercial fishing in lakes can significantly impact fish populations and ecosystem health (Wetzel, 2011).

Natural wetland areas are areas where water saturates the soil, either permanently or seasonally. They include marshes, swamps, and bogs. Wetlands are among the most productive ecosystems, supporting a wide array of plants and animals. They provide critical habitat for fish, birds, and invertebrates. It can be important nursery grounds for fish, and overfishing in these areas can disrupt ecological balance and reduce biodiversity (Mitsch & Gosselink, 2015).

Finally, heavily modified habitats (reservoirs) are artificial lakes created by damming rivers. They are used for water storage, hydroelectric power, irrigation, and recreation. The creation of reservoirs alters natural flow regimes, impacting native species and ecosystems. They often create habitats for different species than those found in natural rivers. Reservoirs are commonly used for recreational fishing, which can lead to the introduction of non-native species and altered fish communities (Nilsson et al., 2005). Artificial environments (ditches, canals, rice paddies) are human-made environments designed for various purposes, including irrigation, drainage, and agriculture. These habitats often have lower biodiversity compared to natural systems but can still support a variety of species, especially those adapted to disturbed environments. In some regions, ditches and canals are important for local fisheries, providing habitat for certain fish species (Arthington, 2012).

Ecosystem

Procambarus clarkii is a key species in the function of aquatic ecosystems, as it physically alter its environment and changes the availability of resources for other species. By reducing the aquatic vegetation cover that favours the development of phytoplankton communities, it changes the ecological balance by increasing the turbidity of the water (Gutierrez et al., 1999). *P. clarkii* also poses a serious threat to the imperilled indigenous European crayfish, as it is a carrier of *Aphanomyces astaci*, the causative agent of the crayfish plague. *Aphanomyces astaci* is a parasitic oomycete native to North America and fatal for all European crayfish (Chucholl, 2011).

Crayfish as an omnivorous species that feeds on items of many trophic levels and is eaten by many others, it occupies a key trophic position within the invaded food webs. Its trophic role has important consequences for the management of the ecosystems where crayfish is present (Alcorlo & Baltanás, 2013). The same authors estimated the trophic position for crayfish to be low, suggesting the prevalence of omnivory and the occurrence of a trophic continuum rather than discrete levels. Crayfish occupies a predator position in the observed food webs, which is consistent with the predominance of animal food sources in the species' diet.

According to the NAP (Council of Ministers Resolution No. 133/2021), this species is currently an important food resource for native avifauna, forming an essential part of the trophic food chain for predator species in southwestern Spain. In some cases, it has been found in over 50% of diet samples collected. Additionally, the abundance of species that prey on the crayfish has significantly increased in these areas, contrasting with the abundance of herbivores and predator populations in other areas of Europe where these predators are considered threatened. Among the species benefiting the most are the glossy ibis (*Plegadis falcinellus*), black stork (*Ciconia nigra*), squacco heron (*Ardeola ralloides*), and Eurasian otter (*Lutra lutra*), among other bird species and small mammals.

7.5.2 Principle 2 Performance Indicator scores and rationales

PI 2.1.1 – Primary species outcome

PI 2.1.1		The UoA aims to maintain primary species above the point where recruitment would be impaired (PRI) and does not hinder recovery of primary species if they are below the PRI		
Scoring Issue		SG 60	SG 80	SG 100
a	Main primary species stock status			
	Guide post	Main primary species are likely to be above the PRI. OR If the species is below the PRI, the UoA has measures in place that are expected to ensure that the UoA does not hinder recovery and rebuilding.	Main primary species are highly likely to be above the PRI. OR If the species is below the PRI, there is either evidence of recovery or a demonstrably effective strategy in place between all MSC UoAs which categorise this species as main , to ensure that they collectively do not hinder recovery and rebuilding.	There is a high degree of certainty that main primary species are above the PRI and are fluctuating around a level consistent with MSY.
	Met?	Yes	Yes	Yes
Rationale				

To better understand the impact of the fishery on bycatch species, the assessment team considered information from a similar fishery in Spain and interviews with Portuguese fishers, as no specific studies were found regarding bycatch of the fishery in Portugal. However, these data provide qualitative information on bycatch estimates and species identification in relation to the UoA, showing that there are no main primary species to consider in the catches by the UoA. SG60, SG80, and SG100 are met by default.

b	Minor primary species stock status			
	Guide post			Minor primary species are highly likely to be above the PRI. OR If below the PRI, there is evidence that the UoA does not hinder the recovery and rebuilding of minor primary species.
	Met?			Yes
Rationale				

As stated above, based on Portuguese fishers interviews and previous knowledge gathered in a similar fishery in Spain, the only primary species that could be considered is relating to the traps bait. The bait normally used in the crayfish trap fishery varies between fruit and chicken, but occasionally chub mackerel and sardines are also used as bait. Both the scarcity of the species and its price would prevent fishers from using sardines as bait if other species are available. Therefore, the assessment team considered that the only primary species to consider is sardines and as minor, as it is only sometimes used as bait and in very small quantities. According to the most recent ICES advice (2023), the sardine stock is in stable condition above B_{PA} and therefore highly likely to be above PRI. SG100 is met.

References

Information gathered through interviews with fishers.
ICES_SAR (2023).
<https://fisheryprogress.org/fip-profile/spain-crayfish-crawfish-fyke-nets-traps>

Draft scoring range	≥80
Information gap indicator	More information sought on the quantities of sardine used as bait.
Data-deficient? (Risk-Based Framework needed)	No

PI 2.1.2 – Primary species management strategy

PI 2.1.2		There is a strategy in place that is designed to maintain or to not hinder rebuilding of primary species, and the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of unwanted catch		
Scoring Issue		SG 60	SG 80	SG 100
a	Management strategy in place			
	Guide post	There are measures in place for the UoA, if necessary, that are expected to maintain or to not hinder rebuilding of the main primary species at/to levels which are likely to be above the PRI.	There is a partial strategy in place for the UoA, if necessary, that is expected to maintain or to not hinder rebuilding of the main primary species at/to levels which are highly likely to be above the PRI.	There is a strategy in place for the UoA for managing main and minor primary species.
	Met?	Yes	Yes	No
Rationale				

The UoA has no main primary species, so no measures or partial strategy are deemed necessary. SG60 and SG80 are met by default. However, the team is unaware of any specific measures (beyond the fishing strategy itself) to manage minor primary species, namely sardines used as bait. Considering that a strategy represents a "cohesive and strategic arrangement that may include one or more measures, an understanding of how they work to achieve an outcome, and must be designed specifically to manage the impact on that component," and be appropriate to the scale, intensity, and cultural context of the fishery, the team concludes that SG100 is not met.

		Management strategy evaluation		
b	Guide post	The measures are considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/species).	There is some objective basis for confidence that the measures/partial strategy will work, based on some information directly about the fishery and/or species involved.	Testing supports high confidence that the partial strategy/strategy will work, based on information directly about the fishery and/or species involved.
	Met?	Yes	Yes	No
Rationale				

Since there are no main primary species, SG60 and SG80 are met by default. The fishing strategy using traps can be considered as a partial strategy in itself, effectively functioning to prevent the capture of primary species. Research conducted in Spain with identically gears and interviews with Portuguese fishers show limited or no bycatch of primary species. Therefore the team considers that there is some objective basis for confidence that the partial strategy to avoid

the capture of main primary species will work and SG80 is met. As the partial strategy has not been tested, SG100 is not met.

Management strategy implementation				
c	Guide post		There is some evidence that the measures/partial strategy is being implemented successfully .	There is clear evidence that the partial strategy/strategy is being implemented successfully and is achieving its overall objective as set out in scoring issue (a) .
	Met?		Yes	No
Rationale				

The fishing strategy using traps can be considered as a partial strategy in itself, effectively functioning to prevent the capture of primary species, while the fishery does not use other fishing gears. Therefore SG80 is met. But because there is not clear evidence SG100 is not met.

Shark finning				
d	Guide post	It is likely that shark finning is not taking place.	It is highly likely that shark finning is not taking place.	There is a high degree of certainty that shark finning is not taking place.
	Met?	NA	NA	NA
Rationale				

The fishery is an inland freshwater fishery and does not catch sharks. Scoring is not applicable.

Review of alternative measures				
e	Guide post	There is a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of main primary species.	There is a regular review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of main primary species and they are implemented as appropriate.	There is a biennial review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of all primary species, and they are implemented, as appropriate.
	Met?	Yes	Yes	No
Rationale				

There are no unintended catches of main primary species. SG80 is met by default. There are also no unintended catches of minor primary species; however, as far as the team is aware, there is no formal review of alternative measures to minimize mortality resulting from the UoA's (bait-related) activity on minor primary species, such as sardines. SG100 is not met.

References

Information gathered through interviews with fishers.
ICES_SAR (2023).
<https://fisheryprogress.org/fip-profile/spain-crayfish-crawfish-fyke-nets-traps>

Draft scoring range	≥80
Information gap indicator	More information sought on the quantities of sardine used as bait.

PI 2.1.3 – Primary species information

PI 2.1.3		Information on the nature and extent of primary species is adequate to determine the risk posed by the UoA and the effectiveness of the strategy to manage primary species		
Scoring Issue		SG 60	SG 80	SG 100
a	Information adequacy for assessment of impact on main primary species			
	Guide post	Qualitative information is adequate to estimate the impact of the UoA on the main primary species with respect to status. OR If RBF is used to score PI 2.1.1 for the UoA: Qualitative information is adequate to estimate productivity and susceptibility attributes for main primary species.	Some quantitative information is available and is adequate to assess the impact of the UoA on the main primary species with respect to status. OR If RBF is used to score PI 2.1.1 for the UoA: Some quantitative information is adequate to assess productivity and susceptibility attributes for main primary species.	Quantitative information is available and is adequate to assess with a high degree of certainty the impact of the UoA on main primary species with respect to status.
	Met?	Yes	No	No
Rationale				

Interviews with Portuguese fishers and the knowledge available from a similar Spanish fishery provided some qualitative information on bycatch estimates and species identification in relation to the UoA, showing that there are no main primary species in the UoA catches. SG60 is met. However, quantitative information is needed from the UoA to assess that there are no main primary species. SG80 and SG100 are not met.

b	Information adequacy for assessment of impact on minor primary species			
	Guide post			Some quantitative information is adequate to estimate the impact of the UoA on minor primary species with respect to status.
	Met?			No
Rationale				

As described above, there is only qualitative information on the possible impacts of the UoA on bycatch. This information shows that there are no interactions with main primary species. However, sardines are used as bait (albeit in low proportions) and are therefore considered here as a minor primary species. ICES has evaluated the sardine Iberian stock and the stock is above B_{PA}. Nevertheless, as the quantities of UoA bait use is uncertain and is solely based on qualitative information, SG100 is not met.

c	Information adequacy for management strategy			
	Guide post	Information is adequate to support measures to manage main primary species.	Information is adequate to support a partial strategy to manage main primary species.	Information is adequate to support a strategy to manage all primary species, and evaluate with a high degree of certainty whether the strategy is achieving its objective.

Met?	Yes	No	No
Rationale			

Interviews with Portuguese fishers and the knowledge available from a similar Spanish fishery provide some qualitative information on the expected catch composition by the UoA. This information shows that no main primary species are expected in the catch. The estimate of the quantities of sardines used as bait and the information on stock status provided by ICES are adequate to support measures to manage sardine if the quantities used are not minor. SG 60 is met but not SG80 and SG100.

References

Information gathered through interviews with fishers.
 ICES_SAR (2023).
<https://fisheryprogress.org/fip-profile/spain-crayfish-crawfish-fyke-nets-traps>

Draft scoring range	60-79
Information gap indicator	More information sought on the quantities of sardine used as bait.

PI 2.2.1 – Secondary species outcome

PI 2.2.1	The UoA aims to maintain secondary species above a biologically based limit and does not hinder recovery of secondary species if they are below a biological based limit			
Scoring Issue	SG 60	SG 80	SG 100	
a	Main secondary species stock status			
	Guide post	<p>Main secondary species are likely to be above biologically based limits.</p> <p>OR</p> <p>If below biologically based limits, there are measures in place expected to ensure that the UoA does not hinder recovery and rebuilding.</p>	<p>Main secondary species are highly likely to be above biologically based limits.</p> <p>OR</p> <p>If below biologically based limits, there is either evidence of recovery or a demonstrably effective partial strategy in place such that the UoA does not hinder recovery and rebuilding.</p> <p>AND</p> <p>Where catches of a main secondary species outside of biological limits are considerable, there is either evidence of recovery or a, demonstrably effective strategy in place between those MSC UoAs that have considerable catches of the species, to ensure that they collectively do not hinder recovery and rebuilding.</p>	<p>There is a high degree of certainty that main secondary species are above biologically based limits.</p>
	Met?	Yes	Yes	Yes
Rationale				

To better understand the impact of the fishery on bycatch species, the assessment team considered information from a similar fishery in Spain and interviews with Portuguese fishers, as no specific studies were found regarding bycatch of the fishery in Portugal. However, these data provide qualitative information on bycatch estimates and species identification in relation to the UoA, showing that there are no main secondary species to consider in the catches by the UoA. SG60, SG80, and SG100 are met by default.

Minor secondary species stock status		
b	Guide post	Minor secondary species are highly likely to be above biologically based limits. OR If below biologically based limits', there is evidence that the UoA does not hinder the recovery and rebuilding of secondary species
	Met?	Chub mackerel – Yes Pumpkin seed – Yes Common carp - Yes
Rationale		

As stated above, the information from a similar fishery in Spain and interviews with Portuguese fishers shows that there are only three minor secondary species: Atlantic chub mackerel (*Scomber colias*), pumpkin seed (*Lepomis gibbosus*) and common carp (*Cyprinus carpio*).

The bait normally used in the crayfish trap fishery varies between fruit and chicken, but occasionally sardines and chub mackerel are also used as bait. As fish is only sometimes used as bait and in very small quantities, chub mackerel is considered a minor secondary species. ICES in 2021 made a first attempt at assessing the stock in Portuguese waters. B/B_{MSY} showed an increasing trend from 1985 to 2009 and thereafter a decrease but was above 1 most of the period. Although the reference points were considered uncertain and the assessment was not used for advice, they clearly show the stock is highly likely to be above biologically based limits. Therefore SG100 is met.

Pumpkin seed and common carp are invasive species and as such they are highly likely to be above biological based limits and SG100 is met.

References

Information gathered through interviews with fishers.
ICES_WKCOLIAS2 (2021)
<https://fisheryprogress.org/fip-profile/spain-crayfish-crawfish-fyke-nets-traps>

Draft scoring range	≥80
Information gap indicator	More information on UoA chub mackerel used as bait and catch composition.
Data-deficient? (Risk-Based Framework needed)	Yes, more information sought on Atlantic chub mackerel stock status

PI 2.2.2 – Secondary species management strategy

PI 2.2.2	There is a strategy in place for managing secondary species that is designed to maintain or to not hinder rebuilding of secondary species and the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of unwanted catch		
Scoring Issue	SG 60	SG 80	SG 100
a	Management strategy in place		

	Guide post	There are measures in place, if necessary, which are expected to maintain or not hinder rebuilding of main secondary species at/to levels which are highly likely to be above biologically based limits or to ensure that the UoA does not hinder their recovery.	There is a partial strategy in place, if necessary, for the UoA that is expected to maintain or not hinder rebuilding of main secondary species at/to levels which are highly likely to be above biologically based limits or to ensure that the UoA does not hinder their recovery.	There is a strategy in place for the UoA for managing main and minor secondary species.
	Met?	Yes	Yes	No
Rationale				

There are no main secondary species to consider. SG60 and SG80 are met by default. The team considers that the use and retrieval of fishing gear, which allows for limited interaction with secondary species and the limited use of bait, can be considered only a partial strategy. Furthermore, the legislation regarding invasive species can also be considered a partial strategy. But as SG100 requires a strategy, it is not met.

	Management strategy evaluation			
b	Guide post	The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar UoAs/species).	There is some objective basis for confidence that the measures/partial strategy will work, based on some information directly about the UoA and/or species involved.	Testing supports high confidence that the partial strategy/strategy will work, based on information directly about the UoA and/or species involved.
	Met?	Yes	Yes	No
Rationale				

Since there are no main primary species, SG60 and SG80 are met by default. Again the fishing strategy using traps can be considered as a partial strategy in itself, effectively functioning to prevent the capture of secondary species. Research conducted in Spain with identically gears and interviews with Portuguese fishers show limited bycatch of secondary species. Furthermore, there is legislation specifically to tackle invasive species. Therefore, there is some objective basis for confidence that the partial strategy will work based on the information gathered through Portuguese fishers interviews. SG60 and SG80 is met. As the partial strategy has not been tested, SG100 is not met.

	Management strategy implementation			
c	Guide post		There is some evidence that the measures/partial strategy is being implemented successfully .	There is clear evidence that the partial strategy/strategy is being implemented successfully and is achieving its objective as set out in scoring issue (a) .
	Met?		Yes	No
Rationale				

As stated above, the use and retrieval of fishing gear, which allows for limited interaction with secondary species is considered a partial strategy. Therefore, based on Portuguese fishers interviews and the knowledge of similar fishery in Spain, there is only some evidence partial strategy is being implemented successfully and only SG80 is met.

	Shark finning			
d	Guide post	It is likely that shark finning is not taking place.	It is highly likely that shark finning is not taking place.	There is a high degree of certainty that shark finning is not taking place.

Met?	NA	NA	NA
Rationale			

The fishery is an inland freshwater fishery and does not catch sharks and therefore this SI does not apply.

Review of alternative measures to minimise mortality of unwanted catch				
e	Guide post	There is a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of main secondary species.	There is a regular review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of main secondary species and they are implemented as appropriate.	There is a biennial review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of all secondary species, and they are implemented, as appropriate.
	Met?	Yes	Yes	No
Rationale				

There are no main secondary species. SG60 and SG80 are met by default. There are also no unintended catches of mackerel as it is used as bait, while the other secondary species accidentally caught in a very low percentage are also invasive exotic species. However, as far as the team is aware, there is no formal review of alternative measures to monitor the mortality of minor secondary species resulting from the activity of the UoA. SG100 is not met.

References

Information gathered through interviews with fishers.
<https://fisheryprogress.org/fip-profile/spain-crayfish-crawfish-fyke-nets-traps>
 Decree-Law No. 92/2019

Draft scoring range	≥80
Information gap indicator	More information sought on chub mackerel used as bait and on UoA catch composition.

PI 2.2.3 – Secondary species information

PI 2.2.3	Information on the nature and amount of secondary species taken is adequate to determine the risk posed by the UoA and the effectiveness of the strategy to manage secondary species		
Scoring Issue	SG 60	SG 80	SG 100
a	Information adequacy for assessment of impacts on main secondary species		
	Guide post	Qualitative information is adequate to estimate the impact of the UoA on the main secondary species with respect to status.	Some quantitative information is available and adequate to assess the impact of the UoA on main secondary species with respect to status.
	OR	OR	
	If RBF is used to score PI 2.2.1 for the UoA:	If RBF is used to score PI 2.2.1 for the UoA:	
	Qualitative information is adequate to estimate productivity and susceptibility attributes for main secondary species.	Some quantitative information is adequate to assess productivity and susceptibility attributes for main secondary species.	

Met?	Yes	No	No
Rationale			

Interviews with Portuguese fishers and the knowledge available from a similar Spanish fishery provided some qualitative information on bycatch estimates and species identification in relation to the UoA, showing that there are no main secondary species in the UoA catches. SG60 is met. The species accidentally caught are in a very low percentage, and two are also invasive exotic species. However, quantitative information is needed from the UoA to assess that there are no main secondary species. SG80 and SG100 are not met.

Information adequacy for assessment of impacts on minor secondary species			
b	Guide post	Some quantitative information is adequate to estimate the impact of the UoA on minor secondary species with respect to status.	
	Met?		No
Rationale			

As described above, there is only qualitative information on the possible impacts of the UoA on bycatch. It shows that there are no catches of main secondary species. SG80 is met by default. However, mackerel is used as bait (albeit in low proportions) and are therefore considered here as a minor primary species. The two other minor secondary species are invasive species. Nevertheless, as the quantities of UoA bait use is uncertain and there is only qualitative data to characterise the UoA bycatch, SG100 is not met.

Information adequacy for management strategy				
c	Guide post	Information is adequate to support measures to manage main secondary species.	Information is adequate to support a partial strategy to manage main secondary species.	Information is adequate to support a strategy to manage all secondary species, and evaluate with a high degree of certainty whether the strategy is achieving its objective .
	Met?	Yes	No	No
Rationale				

Interviews with Portuguese fishers and the knowledge available from a similar Spanish fishery provide some qualitative information on the expected catch composition by the UoA. There are two species accidentally caught, in a very low percentage and are invasive exotic species. Chub mackerel is used occasionally as bait in the fishery. Therefore there is information to support measures if any of the minor species becomes main. SG60 is met. However the information is not adequate for a partial strategy and SG80 and SG100 are not met.

References

Information gathered through interviews with fishers.
<https://fisheryprogress.org/fip-profile/spain-crayfish-crawfish-fyke-nets-traps>
 Decree-Law No. 92/2019

Draft scoring range	60-79
Information gap indicator	More information sought on the UoA catch composition and chub mackerel used as bait.

PI 2.3.1 – ETP species outcome

PI 2.3.1	The UoA meets national and international requirements for the protection of ETP species The UoA does not hinder recovery of ETP species			
Scoring Issue	SG 60	SG 80	SG 100	
a	Effects of the UoA on population/stock within national or international limits, where applicable			
	Guide post	Where national and/or international requirements set limits for ETP species, the effects of the UoA on the population/ stock are known and likely to be within these limits.	Where national and/or international requirements set limits for ETP species, the combined effects of the MSC UoAs on the population /stock are known and highly likely to be within these limits.	Where national and/or international requirements set limits for ETP species, there is a high degree of certainty that the combined effects of the MSC UoAs are within these limits.
	Met?	NA	NA	NA
Rationale				

As far as the team is aware, there are no established limits for ETP species. This SI is not applicable.

b	Direct effects			
	Guide post	Known direct effects of the UoA are likely to not hinder recovery of ETP species.	Direct effects of the UoA are highly likely to not hinder recovery of ETP species.	There is a high degree of confidence that there are no significant detrimental direct effects of the UoA on ETP species.
	Met?	No	No	No
Rationale				

The information available regarding a similar fishery in Spain, points to the possibility of amphibious species being caught in the crayfish traps. However, as far as the team is aware, there is no information available if known direct effects of the UoA are likely to not hinder recovery of ETP species and SG60 is not met.

c	Indirect effects		
	Guide post	Indirect effects have been considered for the UoA and are thought to be highly likely to not create unacceptable impacts.	There is a high degree of confidence that there are no significant detrimental indirect effects of the UoA on ETP species.
	Met?	No	No
Rationale			

Studies show that the species *P. clarkii* can alter the ecosystem where it appears, reducing the number of prey and vegetation, which could lead to indirect impacts on ETP species, namely amphibians. However, there is little information available to conclude that these indirect effects are highly likely to not create unacceptable impacts. For this reason SG80 and SG100 are not met.

References

Silva (2022)
<https://fisheryprogress.org/fip-profile/spain-crayfish-crawfish-fyke-nets-traps>

Draft scoring range	<60
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Information gap indicator	More information sought on the UoA catch composition and its impact on ETP species.
Data-deficient? (Risk-Based Framework needed)	Yes

PI 2.3.2 – ETP species management strategy

PI 2.3.2	The UoA has in place precautionary management strategies designed to: <ul style="list-style-type: none"> - meet national and international requirements; - ensure the UoA does not hinder recovery of ETP species. Also, the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of ETP species			
	Scoring Issue	SG 60	SG 80	SG 100
a	Management strategy in place (national and international requirements)			
	Guide post	There are measures in place that minimise the UoA-related mortality of ETP species, and are expected to be highly likely to achieve national and international requirements for the protection of ETP species.	There is a strategy in place for managing the UoA's impact on ETP species, including measures to minimise mortality, which is designed to be highly likely to achieve national and international requirements for the protection of ETP species.	There is a comprehensive strategy in place for managing the UoA's impact on ETP species, including measures to minimise mortality, which is designed to achieve above national and international requirements for the protection of ETP species.
	Met?	NA	NA	NA
Rationale				

As far as the team is aware, there are no established limits for ETP species. This SI is not applicable.

b	Management strategy in place (alternative)			
	Guide post	There are measures in place that are expected to ensure the UoA does not hinder the recovery of ETP species.	There is a strategy in place that is expected to ensure the UoA does not hinder the recovery of ETP species.	There is a comprehensive strategy in place for managing ETP species, to ensure the UoA does not hinder the recovery of ETP species.
	Met?	Yes	No	No
Rationale				

The team is not aware of any specific management measures to ensure that the UoA is not affecting the recovery of ETP species. The only measure worth mentioning is the deployment and retrieval of fishing gear, which limits interaction with these species and allows for the possibility of releasing unwanted catches. SG60 is met. More information and additional management measures are needed to ensure that these limited interactions do not impact ETP species, in order to justify higher scores. SG80 and SG100 are not met.

c	Management strategy evaluation		
	Guide post	The measures are considered likely to work, based on plausible argument (e.g., general experience, theory or	There is an objective basis for confidence that the measures/strategy will work, based on information directly

		comparison with similar fisheries/species).	about the fishery and/or the species involved.	analysis supports high confidence that the strategy will work.
	Met?	Yes	No	No

Rationale

There is no information available on the survival rate of potential ETP species that may be caught accidentally, although qualitative information gathered from interviews with fishers and a similar fishery in Spain indicate that there are no ETP species that could be affected by the UoA. Therefore, the selective nature of the gear could be considered a measure and they are working and SG60 is met. Since there is no information directly from the fishery SG80 and SG100 are not met.

	Management strategy implementation			
d	Guide post		There is some evidence that the measures/strategy is being implemented successfully.	There is clear evidence that the strategy/comprehensive strategy is being implemented successfully and is achieving its objective as set out in scoring issue (a) or (b).
	Met?		Yes	No

Rationale

There is no information available on the survival rate of potential ETP species that may be caught accidentally, although qualitative information gathered from interviews with fishers and a similar fishery in Spain indicate that there are no ETP species that could be affected by the UoA. The fishing strategy using traps can be considered a management measure in itself, effectively functioning to prevent the capture of ETP species, therefore there is some evidence that the measures are being implemented effectively and SG80 is met. Since there is no clear evidence SG100 is not met.

	Review of alternative measures to minimize mortality of ETP species			
e	Guide post	There is a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of ETP species.	There is a regular review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of ETP species and they are implemented as appropriate.	There is a biennial review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality ETP species, and they are implemented, as appropriate.
	Met?	Yes	No	No

Rationale

There is no information available on the survival rate of potential ETP species that may be caught accidentally, although qualitative information gathered from interviews with fishers and a similar fishery in Spain indicate that there are no ETP species that could be affected by the UoA. Considering the highly selective nature of the crayfish trap, the teams considers there has been a review of alternative measures to minimise UoA-related mortality of ETP species and SG60 is met. As there is no information if the review occurs regularly SG80 is not met.

References

Information gathered through interviews with fishers.
<https://fisheryprogress.org/fip-profile/spain-crayfish-crawfish-fyke-nets-traps>

Draft scoring range	60-79
Information gap indicator	More information sought on UoA catch composition

PI 2.3.3 – ETP species information

PI 2.3.3	Relevant information is collected to support the management of UoA impacts on ETP species, including:			
	<ul style="list-style-type: none"> - Information for the development of the management strategy; - Information to assess the effectiveness of the management strategy; and - Information to determine the outcome status of ETP species 			
Scoring Issue	SG 60	SG 80	SG 100	
a	Information adequacy for assessment of impacts			
	Guide post	<p>Qualitative information is adequate to estimate the UoA related mortality on ETP species.</p> <p>OR</p> <p>If RBF is used to score PI 2.3.1 for the UoA: Qualitative information is adequate to estimate productivity and susceptibility attributes for ETP species.</p>	<p>Some quantitative information is adequate to assess the UoA related mortality and impact and to determine whether the UoA may be a threat to protection and recovery of the ETP species.</p> <p>OR</p> <p>If RBF is used to score PI 2.3.1 for the UoA: Some quantitative information is adequate to assess productivity and susceptibility attributes for ETP species.</p>	<p>Quantitative information is available to assess with a high degree of certainty the magnitude of UoA-related impacts, mortalities and injuries and the consequences for the status of ETP species.</p>
	Met?	No	No	No
Rationale				

Qualitative information gathered from interviews with Portuguese fishers and the knowledge available from a similar Spanish fishery indicate that there are no ETP species that could be affected by the UoA. However, the team considers that this qualitative information is not adequate to estimate the UoA related mortality on ETP species and SG60 is not met.

b	Information adequacy for management strategy			
	Guide post	<p>Information is adequate to support measures to manage the impacts on ETP species.</p>	<p>Information is adequate to measure trends and support a strategy to manage impacts on ETP species.</p>	<p>Information is adequate to support a comprehensive strategy to manage impacts, minimize mortality and injury of ETP species, and evaluate with a high degree of certainty whether a strategy is achieving its objectives.</p>
	Met?	No	No	No
Rationale				

Qualitative information gathered from interviews with Portuguese fishers and the knowledge available from a similar Spanish fishery indicate that there are no ETP species that could be affected by the UoA. However, the team considers that this qualitative information is also not adequate to support measures to manage the impacts on ETP species and SG60 is not met.

References

Information gathered through interviews with fishers.
<https://fisheryprogress.org/fip-profile/spain-crayfish-crawfish-fyke-nets-traps>

Draft scoring range	<60
Information gap indicator	More information sought on UoA interaction with ETP species

PI 2.4.1 – Habitats outcome

PI 2.4.1	The UoA does not cause serious or irreversible harm to habitat structure and function, considered on the basis of the area covered by the governance body(s) responsible for fisheries management in the area(s) where the UoA operates			
Scoring Issue	SG 60	SG 80	SG 100	
a	Commonly encountered habitat status			
	Guide post	The UoA is unlikely to reduce structure and function of the commonly encountered habitats to a point where there would be serious or irreversible harm.	The UoA is highly unlikely to reduce structure and function of the commonly encountered habitats to a point where there would be serious or irreversible harm.	There is evidence that the UoA is highly unlikely to reduce structure and function of the commonly encountered habitats to a point where there would be serious or irreversible harm.
	Met?	Yes	Yes	No
Rationale				

The habitats commonly found in the fishing grounds of the UoA consist of mud and sandy sediments. Traps are lightweight and passive gears that rely on bait (or darkness) to attract target species and are generally considered to have low impact on the habitat. For example, Eno et al. (2001) examined the effects of crustacean traps on benthic fauna in the UK through qualitative and quantitative experiments. This study focused on traps for lobsters and crabs on rocky substrates in southern England and found habitats and their communities to be relatively unaffected by trap fishing. Additionally, short-term effects of traps on supposedly sensitive benthic species in western Wales and Lyme Bay did not appear detrimental. On the other hand, since the UoA is actually removing an invasive species that has in itself the power to alter its habitat permanently, may actually prevent the reduction of structure and function of the commonly encountered habitats to a point where there would be serious or irreversible harm.

Given this, the team considers it highly unlikely that the UoA would reduce the structure and function of common habitats found to a point where serious or irreversible damage occurs. SG60 and SG80 are met. More information is needed on estimating the number of traps used throughout the UoA, along with a study on the impact of these gears, to achieve a higher score. Currently, SG100 is not met.

b	VME habitat status			
	Guide post	The UoA is unlikely to reduce structure and function of the VME habitats to a point where there would be serious or irreversible harm.	The UoA is highly unlikely to reduce structure and function of the VME habitats to a point where there would be serious or irreversible harm.	There is evidence that the UoA is highly unlikely to reduce structure and function of the VME habitats to a point where there would be serious or irreversible harm.
	Met?	Yes	Yes	No
Rationale				

The UoA is a freshwater fishery, therefore the issue of vulnerable marine habitats is non-existent. However, although there are habitats that may be considered sensitive areas, such as wetlands and Natura 2000 network areas, the fishery mainly takes place in reservoirs/lakes and/or rice field whose impact on the ecosystem appears to be minimal or non-existent. Therefore SG60 and SG80 are both reached. Higher score would require evidence that is not available. SG100 is not met.

Minor habitat status	
c	<p>Guide post</p> <p>There is evidence that the UoA is highly unlikely to reduce structure and function of the minor habitats to a point where there would be serious or irreversible harm.</p> <p>Met?</p> <p>No</p>
Rationale	

The minor habitats consist of mud and sandy areas. As mentioned above, scientific evidence would be required to support an SG100 score. Although it is highly unlikely that, due to the light weight of the gears, the UoA would reduce the structure and function of minor habitats to the point where serious or irreversible damage occurs, evidence is needed to meet SG100 requirements. Currently, SG100 is not met.

References

Eno et al. (2001)

Draft scoring range	≥80
Information gap indicator	Information sufficient to score PI
Data-deficient? (Risk-Based Framework needed)	No

PI 2.4.2 – Habitats management strategy

PI 2.4.2	There is a strategy in place that is designed to ensure the UoA does not pose a risk of serious or irreversible harm to the habitats		
Scoring Issue	SG 60	SG 80	SG 100
a	Management strategy in place		
Guide post	There are measures in place, if necessary, that are expected to achieve the Habitat Outcome 80 level of performance.	There is a partial strategy in place, if necessary, that is expected to achieve the Habitat Outcome 80 level of performance or above.	There is a strategy in place for managing the impact of all MSC UoAs/non-MSC fisheries on habitats.
Met?	Yes	Yes	No
Rationale			

There is the management plan for exotic species and the specific national plan for *P. clarkii*, which includes fishing as a means to control the impact of this species on the ecosystem. The team considers that the NAP constitutes a partial strategy that is expected to achieve the Habitat Outcome 80 level of performance or above and SG80 is met. Since it is not considered a strategy SG100 is not met.

Management strategy evaluation			
b	Guide post	The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar UoAs/habitats).	There is some objective basis for confidence that the measures/partial strategy will work, based on information directly about the UoA and/or habitats involved.
			Testing supports high confidence that the partial strategy/strategy will work, based on information directly about the UoA and/or habitats involved.

Met?	Yes	No	No
Rationale			

The management plan for exotic species and the specific NAP for crayfish which includes fishing as a means to control the impact of this species on the ecosystem is considered likely to work and SG60 is met. However, as there is no information directly from the UoA on catches or number of fishers, to estimate if the fishery is being effective in at least preventing the species expansion in the region, SG80 is not met.

Management strategy implementation			
C	Guide post	There is some quantitative evidence that the measures/partial strategy is being implemented successfully.	There is clear quantitative evidence that the partial strategy/strategy is being implemented successfully and is achieving its objective, as outlined in scoring issue (a).
	Met?	No	No
Rationale			

Again, as there is no information directly from the UoA on catches or number of fishers, to estimate if the fishery is being effective in at least preventing the species expansion in the region, SG80 is not met.

Compliance with management requirements and other MSC UoAs'/non-MSC fisheries' measures to protect VMEs				
d	Guide post	There is qualitative evidence that the UoA complies with its management requirements to protect VMEs.	There is some quantitative evidence that the UoA complies with both its management requirements and with protection measures afforded to VMEs by other MSC UoAs/non-MSC fisheries, where relevant.	There is clear quantitative evidence that the UoA complies with both its management requirements and with protection measures afforded to VMEs by other MSC UoAs/non-MSC fisheries, where relevant.
	Met?	NA	NA	NA
Rationale				

The crayfish trap fishery is a freshwater fishery therefore the issue of vulnerable marine habitats does not apply. However, although there are habitats that may be considered sensitive areas, such as wetlands and Natura 2000 network areas, the fishery mainly takes place in reservoirs/lakes and/or rice fields.

References

Draft scoring range	60-79
Information gap indicator	More information sought on the implementation of the NAP.

PI 2.4.3 – Habitats information

PI 2.4.3	Information is adequate to determine the risk posed to the habitat by the UoA and the effectiveness of the strategy to manage impacts on the habitat		
Scoring Issue	SG 60	SG 80	SG 100

Information quality				
a	Guide post	The types and distribution of the main habitats are broadly understood .	The nature, distribution and vulnerability of the main habitats in the UoA area are known at a level of detail relevant to the scale and intensity of the UoA.	The distribution of all habitats is known over their range, with particular attention to the occurrence of vulnerable habitats.
		OR If CSA is used to score PI 2.4.1 for the UoA: Qualitative information is adequate to estimate the types and distribution of the main habitats.	OR If CSA is used to score PI 2.4.1 for the UoA: Some quantitative information is available and is adequate to estimate the types and distribution of the main habitats.	
Met?	Yes	No	No	
Rationale				

Although there are habitats that may be considered sensitive areas, such as wetlands and Natura 2000 network areas, the fishery mainly takes place in reservoirs/lakes and/or rice fields. Therefore, the types and distribution of the main habitats are broadly understood and SG60 is met. However, more information on the spatial distribution of the fishery is needed for higher scores.

Information adequacy for assessment of impacts				
b	Guide post	Information is adequate to broadly understand the nature of the main impacts of gear use on the main habitats, including spatial overlap of habitat with fishing gear.	Information is adequate to allow for identification of the main impacts of the UoA on the main habitats, and there is reliable information on the spatial extent of interaction and on the timing and location of use of the fishing gear.	The physical impacts of the gear on all habitats have been quantified fully.
		OR If CSA is used to score PI 2.4.1 for the UoA: Qualitative information is adequate to estimate the consequence and spatial attributes of the main habitats.	OR If CSA is used to score PI 2.4.1 for the UoA: Some quantitative information is available and is adequate to estimate the consequence and spatial attributes of the main habitats.	
Met?	Yes	No	No	
Rationale				

As stated above, the fishery mainly takes place in reservoirs/lakes and/or rice fields. The traps used are also highly selective, and are lightweight and passive gears that rely on bait (or darkness) to attract target species and are generally considered to have low impact on the habitat. So it is the teams opinion that the information available is adequate to broadly understand the nature of the main impacts of gear use on the main habitats, including spatial overlap of habitat with fishing gear and SG60 is met. However, there is no reliable information on the spatial extent of interaction and on the timing and location of use of the fishing gear and SG80 and SG100 are not met.

c Monitoring				
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	Guide post		Adequate information continues to be collected to detect any increase in risk to the main habitats.	Changes in all habitat distributions over time are measured.
	Met?		No	No
Rationale				

To the team's best knowledge, there is at the moment no habitat monitoring in place and thus both SG80 and SG100 are not reached.

References

Draft scoring range

60-79

Information gap indicator

More information sought on the species impact and the effects of the UoA on the species.

PI 2.5.1 – Ecosystem outcome

PI 2.5.1		The UoA does not cause serious or irreversible harm to the key elements of ecosystem structure and function		
Scoring Issue		SG 60	SG 80	SG 100
a	Ecosystem status			
	Guide post	The UoA is unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.	The UoA is highly unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.	There is evidence that the UoA is highly unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.
	Met?	Yes	Partial	No
Rationale				

The crayfish trap fishery, as described earlier, appear to have a limited impact on the ecosystem and habitat. Traps are highly selective and the fishery is likely to have only minor primary and secondary species bycaught, mainly associated to bait used and bycatch of invasive species, while the interaction with ETP species is likely minimal. On the other hand, the fishery, by removing invasive species with a high impact on the environment can improve the structure and function of an ecosystem. Although as crayfish is an established invasive species, its complete removal could also impact species that have already adapted to its presence. Nevertheless, there is no available information that can corroborate with a high degree of confidence regarding the ecosystem impact. In Portugal, inland water systems lack information regarding the impact of fishing gear on ecosystems. For all these reasons, SG60 is met and only partially SG80.

References

Draft scoring range

60-79

Information gap indicator

More information sought on UoA broader ecosystem impacts

Data-deficient? (Risk-Based Framework needed) **No**

PI 2.5.2 – Ecosystem management strategy

PI 2.5.2		There are measures in place to ensure the UoA does not pose a risk of serious or irreversible harm to ecosystem structure and function		
Scoring Issue	SG 60	SG 80	SG 100	
a	Management strategy in place			
	Guide post	There are measures in place, if necessary which take into account the potential impacts of the UoA on key elements of the ecosystem.	There is a partial strategy in place, if necessary, which takes into account available information and is expected to restrain impacts of the UoA on the ecosystem so as to achieve the Ecosystem Outcome 80 level of performance.	There is a strategy that consists of a plan , in place which contains measures to address all main impacts of the UoA on the ecosystem, and at least some of these measures are in place.
	Met?	Yes	Yes	No
Rationale				

The crayfish trap fishery is regulated through the National Action Plan. Fishing is managed through a licensing scheme and catch data reporting. However, it is an invasive species, and therefore ecosystem management is based on the crayfish population control to mitigate the damage caused by the species to the ecosystem. The team considers the NAP as a partial strategy in place to restrain impacts of, in this case, of the crayfish on the ecosystem so as to achieve the Ecosystem Outcome 80 level of performance and SG80 is reached. As it is not a full strategy, SG100 is not met.

b	Management strategy evaluation			
	Guide post	The measures are considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar UoAs/ ecosystems).	There is some objective basis for confidence that the measures/ partial strategy will work, based on some information directly about the UoA and/or the ecosystem involved.	Testing supports high confidence that the partial strategy/ strategy will work, based on information directly about the UoA and/or ecosystem involved.
	Met?	Yes	No	No
Rationale				

The NAP is likely to work based on other invasive species fisheries and SG60 is met. However, as there is little information from the UoA SG80 is not reached.

c	Management strategy implementation			
	Guide post		There is some evidence that the measures/partial strategy is being implemented successfully .	There is clear evidence that the partial strategy/strategy is being implemented successfully and is achieving its objective as set out in scoring issue (a) .
	Met?		No	No
Rationale				

As far as the team is aware, there is no information if the NAP is being implemented successfully, and there is no publicly available information on crayfish catches, number of licences given, number and area of traps deployment etc. Thus SG80 is not met.

References

Draft scoring range	60-79
Information gap indicator	More information sought on the UoA broader ecosystem impacts

PI 2.5.3 – Ecosystem information

PI 2.5.3		There is adequate knowledge of the impacts of the UoA on the ecosystem		
Scoring Issue		SG 60	SG 80	SG 100
a	Information quality			
	Guide post	Information is adequate to identify the key elements of the ecosystem.	Information is adequate to broadly understand the key elements of the ecosystem.	
	Met?	Yes	No	
Rationale				

The information available, although mainly qualitative is adequate to identify the key elements of the ecosystem and SG60 is met. Primary and secondary species are associated to either the bait species used or to invasive species. Potential ETP species have also been identified while the main habitats where the fishery operates are man-made. Also, being an invasive species, existing information on ecosystem impacts pertains to the species itself rather than fishing activity. However, there is insufficient information on the impact of fishing on the ecosystem and therefore SG80 is not met.

b	Investigation of UoA impacts			
	Guide post	Main impacts of the UoA on these key ecosystem elements can be inferred from existing information, but have not been investigated in detail.	Main impacts of the UoA on these key ecosystem elements can be inferred from existing information, and some have been investigated in detail .	Main interactions between the UoA and these ecosystem elements can be inferred from existing information, and have been investigated in detail .
	Met?	Yes	No	No
Rationale				

As stated before, the information available, based on Portuguese fishers interviews and on previous knowledge of a similar Spanish trap fishery, although mainly qualitative is sufficient to infer the main impacts of the UoA in primary, secondary, ETP species and habitats and SG60 is met. However, as these impacts have not been investigated in detail SG80 is not reached.

c	Understanding of component functions		
	Guide post	The main functions of the components (i.e., P1 target species, primary, secondary and ETP species and Habitats) in the ecosystem are known .	The impacts of the UoA on P1 target species, primary, secondary and ETP species and Habitats are identified and the main functions of

			these components in the ecosystem are understood .
	Met?	No	No
Rationale			

Some of the main functions of the components in the ecosystem are known, such as primary and secondary species, and some of the impacts of crayfish as an invasive exotic species are also known. However, the impact of invasive species in the Portuguese freshwater ecosystems are not well known and for this reason SG80 is not met.

d	Information relevance		
	Guide post	Adequate information is available on the impacts of the UoA on these components to allow some of the main consequences for the ecosystem to be inferred.	Adequate information is available on the impacts of the UoA on the components and elements to allow the main consequences for the ecosystem to be inferred.
	Met?	No	No
Rationale			

e	Monitoring		
	Guide post	Adequate data continue to be collected to detect any increase in risk level.	Information is adequate to support the development of strategies to manage ecosystem impacts.
	Met?	No	No
Rationale			

As stated before, there is only qualitative information on the UoA possible catch composition, based on fishers interviews and similar fisheries in other areas. Although this information allowed for some of the UoA impacts to be inferred, the team considers that the available information is not adequate for some of the main consequences for the ecosystem to be inferred and SG80 is not met.

References

Draft scoring range	60-79
Information gap indicator	More information sought on the UoA broader ecosystem impacts

7.6 Principle 3

7.6.1 Principle 3 background

European Union

European freshwater fisheries are managed through the European Union Environmental law. There is Regulation (EU) No 1143/2014 that addresses the prevention and management of the introduction and spread of invasive alien species (IAS).

Other EU environmental legislation and international agreements that are applicable to habitats and species protection, but which are also relevant to fisheries activities are: the Bird and Habitat Directives on the conservation of natural habitats providing the basis for the Natura 2000 networks; CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora); and finally the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention).

National

At a national level, individual Member States are responsible for implementing EU legislation and agreements. EU environmental and other agreements are transposed by primary and secondary national legislation, enacted in accordance with the EU legislation. The main crayfish fisheries law in Portugal is the Decree-Law No. 92/2019 that transposes the EU Regulation 1143/2014 into national legislation.

A Member State may take measures to conserve and manage freshwater stocks, as well as maintain or improve the conservation status of freshwater ecosystems, as long as the EU has not adopted specific measures addressing conservation and management in that area or specifically addressing the problem identified by the Member State concerned. The Member State measures must be compatible with the objectives set out in EU environmental law and must be at least as stringent as the measures under Union law.

The crayfish trap fishery in continental Portugal is managed through a National Action Plan (NAP, Council of Ministers Resolution No. 133/2021, of September 7th), that includes promoting its commercial exploitation as a means of population control, as well as implementing biological and mechanical control methods. The NAP has four specific objectives:

- establish a system of control and containment of the species' population;
- identify sensitive areas for some species of native plants or animals where it will be necessary to reduce the abundance of crayfish;
- maintain the population at levels that minimize losses, but allow for its positive effects as prey in the diet of native fauna;
- implement a plan to capture specimens, as a method of control and containment.

Crayfish is also included in the National List of Invasive Species (Annex II of Decree-Law n. 92/2019, of 10th July).

Consultation, roles and responsibilities

The Ministry of the Environment and Energy, and its Secretariat of Environment are the main government department for the management of Portuguese freshwater fisheries and the implementation of the EU environmental law.

The main institutions involved in management of the crayfish trap fishery in continental Portugal are:

- European Commission DG ENV – responsible for drafting European legislation on the management of European freshwater fisheries in accordance with environmental law.
- Ministry of the Environment and Energy, and its Secretariat of Environment responsible for overall management of freshwater fisheries.
- Instituto da Conservação da Natureza e das Florestas (ICNF), responsible for regulating, monitoring, enforcement and inspection of freshwater fishing.
- International Council for the Exploration of the Sea, ICES – provides the forum for consolidation of scientific work undertaken by scientists in participating national institutions (through relevant Expert Groups), and the delivery of advice on how best to manage invasive species.
- University of Lisbon, U. of Trás-os-Montes e Alto Douro, U. of Minho, University of Évora and Instituto Politécnico de Bragança, national research organisations that study invasive species including crayfish.

All of these institutions have well established protocols covering their purpose, roles, operation, representation, consultation, and decision-making process, as well as for communicating policy, plans, decisions, and other information. However, their roles are not well understood and therefore interaction between them could work more effectively.

Long term and specific objectives for the fishery

The EU environmental legislation, and its Regulation (EU) No 1143/2014 obliges MSs to have in place effective management measures for those invasive alien species of Union concern which the Member States have found to be widely spread on their territory, so that their impact on biodiversity, the related ecosystem services, and, where applicable, on human health or the economy are minimised. The commercial use of already established invasive alien species may be temporarily allowed as part of the management measures aimed at their eradication, population control or containment.

Regarding the management of the crayfish trap fisheries (Principle 1) and its impact on ecosystem (Principle 2), the management system is in general less developed and less comprehensive when compared to marine crustacean stocks. However, based on NAP, there are four specific objectives for the crayfish trap fishery (mentioned above).

Control, enforcement, and compliance

The overall requirements for Monitoring, Control and Surveillance (MCS) of freshwater fisheries in EU legislation Regulation (EU) No 1143/2014 is that MSs shall establish a surveillance system of invasive alien species of Union concern, or include it in their existing system, which collects and records data on the occurrence in the environment of invasive alien species by survey, monitoring or other procedures to prevent the spread of invasive alien species into or within the Union. The specifications of the Portuguese MCS systems are not well developed or in place, and are not applied in a clear and transparent way. ICNF is responsible for monitoring, enforcement and inspection of freshwater fisheries but the catch reporting system is basic as it is based on excel spreadsheet that should be sent by fishers, but almost no data is available publicly (only 2022 catch data was published in a ICNF poster).

Overall there is a low degree of confidence in the enforcement system and there is significant evidence of systematic non-compliance in other freshwater fisheries in continental Portugal, leading the team to believe this may also be occurring in the crayfish fishery.

7.6.2 Principle 3 Performance Indicator scores and rationales

PI 3.1.1 – Legal and/or customary framework

PI 3.1.1		The management system exists within an appropriate legal and/or customary framework which ensures that it: <ul style="list-style-type: none"> - Is capable of delivering sustainability in the UoA(s); - Observes the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood; and - Incorporates an appropriate dispute resolution framework 		
Scoring Issue		SG 60	SG 80	SG 100
		Compatibility of laws or standards with effective management		
a	Guide post	There is an effective national legal system and a framework for cooperation with other parties, where necessary, to deliver management outcomes consistent with MSC Principles 1 and 2	There is an effective national legal system and organised and effective cooperation with other parties, where necessary, to deliver management outcomes consistent with MSC Principles 1 and 2.	There is an effective national legal system and binding procedures governing cooperation with other parties which delivers management outcomes consistent with MSC Principles 1 and 2.
	Met?	Yes	Yes	Yes
Rationale				

European freshwater fisheries are managed through the European Union Environmental law. There is Regulation (EU) No 1143/2014 that addresses the prevention and management of the introduction and spread of invasive alien species (IAS), and therefore has management outcomes consistent with MSC principles 1 and 2. Portuguese Decree-Law No. 92/2019 that transposes the EU Regulation 1143/2014 into national legislation. SG60 and SG80 is reached. Also, Portugal as part of the EU is under binding procedures governing cooperation with other Member States and other parties and thus SG100 is also met.

		Resolution of disputes		
b	Guide post	The management system incorporates or is subject by law to a mechanism for the resolution of legal disputes arising within the system.	The management system incorporates or is subject by law to a transparent mechanism for the resolution of legal disputes which is considered to be effective in dealing with most issues and that is appropriate to the context of the UoA.	The management system incorporates or is subject by law to a transparent mechanism for the resolution of legal disputes that is appropriate to the context of the fishery and has been tested and proven to be effective .
	Met?	Yes	Yes	No
Rationale				

Disputes between Member States and the European Commission are resolved in the Council of Ministers, while legal disputes between European Institutions and with EU governments can be taken to the Court of Justice of the European Union. Nationally, the resolution of legal disputes is made through the Portuguese judicial system. In the event of a fisheries infringement, the ICNF passes the details to the public prosecutor who will then decide the value of the fine. Fishers, or industry representatives, can appeal to the full judicial process. Therefore SG60 and SG80 are met. However, there is no information that the system has been tested and proven to be effective and thus SG100 is not met.

c	Respect for rights
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	Guide post	The management system has a mechanism to generally respect the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.	The management system has a mechanism to observe the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.	The management system has a mechanism to formally commit to the legal rights created explicitly or established by custom of people dependent on fishing for food and livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.
	Met?	Yes	No	No
Rationale				

In marine fisheries, the EU Common Fisheries Policy, and in national legislation Decreto-Lei 278/87, and its management system has a mechanism to formally commit to the legal rights of people depending their livelihoods from fishing. In its NAP, and in the attribution of fishing licences, it is expected that legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood will be respected and SG 60 is met. However, without further information, it is unclear if the management system observes the legal rights of people dependent on fishing and SG80 and SG100 are not met.

References

Regulation (EU) No 1143/2014 & Decree-Law No. 92/2019
Council of Ministers Resolution No. 133/2021

Draft scoring range	60-79
Information gap indicator	More information sought on the management system of freshwater fisheries.

PI 3.1.2 – Consultation, roles and responsibilities

PI 3.1.2	The management system has effective consultation processes that are open to interested and affected parties The roles and responsibilities of organisations and individuals who are involved in the management process are clear and understood by all relevant parties			
Scoring Issue	SG 60	SG 80	SG 100	
a	Roles and responsibilities			
	Guide post	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are generally understood .	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are explicitly defined and well understood for key areas of responsibility and interaction.	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are explicitly defined and well understood for all areas of responsibility and interaction.
	Met?	Yes	No	No
Rationale				

The major institutions involved in the management of the Portuguese crayfish trap fishery are well known and their functions and roles are generally understood and SG60 is met. However, there are doubts on roles and responsibilities on keys areas of responsibility and interaction, for example who should monitor the fishers catch reporting and therefore SG100 is not reached.

Consultation processes				
b	Guide post	The management system includes consultation processes that obtain relevant information from the main affected parties, including local knowledge, to inform the management system.	The management system includes consultation processes that regularly seek and accept relevant information, including local knowledge. The management system demonstrates consideration of the information obtained.	The management system includes consultation processes that regularly seek and accept relevant information, including local knowledge. The management system demonstrates consideration of the information and explains how it is used or not used .
	Met?	No	No	No
Rationale				

At European level there are several consultation processes that include local knowledge to inform management system, namely through different industry associations and environmental organisations. At national level, however, the teams has no information of any consultation process that involves crayfish fishers and thus SG 60 is not met.

Participation				
c	Guide post		The consultation process provides opportunity for all interested and affected parties to be involved.	The consultation process provides opportunity and encouragement for all interested and affected parties to be involved, and facilitates their effective engagement.
	Met?		No	No
Rationale				

As there is no consultation process, as far as the team is aware, SG80 is not met.

References

Regulation (EU) No 1143/2014 & Decree-Law No. 92/2019
Council of Ministers Resolution No. 133/2021

Draft scoring range	<60
Information gap indicator	More information sought on the management system of the crayfish trap fishery.

PI 3.1.3 – Long term objectives

PI 3.1.3 The management policy has clear long-term objectives to guide decision-making that are consistent with MSC Fisheries Standard, and incorporates the precautionary approach				
Scoring Issue	SG 60	SG 80	SG 100	
a	Objectives			
	Guide post	Long-term objectives to guide decision-making, consistent with the MSC Fisheries	Clear long-term objectives that guide decision-making, consistent with MSC	Clear long-term objectives that guide decision-making, consistent with MSC

	Standard and the precautionary approach, are implicit within management policy.	Fisheries Standard and the precautionary approach are explicit within management policy.	Fisheries Standard and the precautionary approach, are explicit within and required by management policy.
Met?	Yes	Partial	No
Rationale			

The EU environmental legislation, and its Regulation (EU) No 1143/2014 obliges MSs to have in place effective management measures for those invasive alien species of Union concern which the Member States have found to be widely spread on their territory, so that their impact on biodiversity, the related ecosystem services, and, where applicable, on human health or the economy are minimised. The commercial use of already established invasive alien species may be temporarily allowed as part of the management measures aimed at their eradication, population control or containment. Therefore there are objectives of minimizing the impact of invasive species explicit in the management policy, but these are not necessarily clear and for this reason SG80 is only partially met.

References

Regulation (EU) No 1143/2014 & Decree-Law No. 92/2019

Draft scoring range	60-79
Information gap indicator	More information sought on the management system of invasive species fisheries.

PI 3.2.1 – Fishery-specific objectives

PI 3.2.1	The fishery-specific management system has clear, specific objectives designed to achieve the outcomes expressed by MSC's Principles 1 and 2			
Scoring Issue	SG 60	SG 80	SG 100	
a	Objectives			
	Guide post	Objectives, which are broadly consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are implicit within the fishery-specific management system.	Short and long-term objectives, which are consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are explicit within the fishery-specific management system.	Well defined and measurable short and long-term objectives, which are demonstrably consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are explicit within the fishery-specific management system.
	Met?	Yes	Yes	No
Rationale				

The crayfish trap fishery in continental Portugal is managed through a National Action Plan (NAP, Council of Ministers Resolution No. 133/2021, of September 7th), that includes promoting its commercial exploitation as a means of population control, as well as implementing biological and mechanical control methods. Crayfish is also included in the National List of Invasive Species (Annex II of Decree-Law n. 92/2019, of 10th July). The NAP has four specific objectives:

- establish a system of control and containment of the species' population;
- identify sensitive areas for some species of native plants or animals where it will be necessary to reduce the abundance of crayfish;
- maintain the population at levels that minimize losses, but allow for its positive effects as prey in the diet of native fauna;
- implement a plan to capture specimens, as a method of control and containment.

As the NAP is to contain an invasive species, it has also wider ecosystem objectives, namely to mitigate the impacts of crayfish populations in line with P2 objectives. Therefore both SG60 and SG80 are reached. As the objectives are not well defined SG100 is not met.

References

Council of Ministers Resolution No. 133/2021

Draft scoring range	≥80
Information gap indicator	More information sought on the management system of the crayfish trap fishery.

PI 3.2.2 – Decision-making processes

PI 3.2.2		The fishery-specific management system includes effective decision-making processes that result in measures and strategies to achieve the objectives, and has an appropriate approach to actual disputes in the fishery		
Scoring Issue		SG 60	SG 80	SG 100
Decision-making processes				
a	Guide post	There are some decision-making processes in place that result in measures and strategies to achieve the fishery-specific objectives.	There are established decision-making processes that result in measures and strategies to achieve the fishery-specific objectives.	
	Met?	Yes	No	
Rationale				

There are some decisions making process in place through the EU environmental legislation and its implementation in MSs, and thus SG60 is met. However, while there is no consultation process in Portugal then it is the teams opinion that there are no established decision making processes for the UoA and SG80 is not reached

Responsiveness of decision-making processes				
b	Guide post	Decision-making processes respond to serious issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take some account of the wider implications of decisions.	Decision-making processes respond to serious and other important issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.	Decision-making processes respond to all issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.
	Met?	Yes	No	No
Rationale				

At EU there is a decision making process that responds to serious issues such as the detection of an invasive species. Although there is also a decision-making process nationally and SG60 is met, it does not respond to other important issues such is the case of non-compliance with the management measures in place for the crayfish trap fishery and SG80 is not met.

Use of precautionary approach			
c	Guide post	Decision-making processes use the precautionary approach and are based on best available information.	
	Met?		Yes
Rationale			

The decision-making process at EU level uses the precautionary approach, while the management at national law also use the precautionary approach and were based on the best available scientific information and thus SG80 is met.

Accountability and transparency of management system and decision-making process				
d	Guide post	Some information on the fishery's performance and management action is generally available on request to stakeholders.	Information on the fishery's performance and management action is available on request, and explanations are provided for any actions or lack of action associated with findings and relevant recommendations emerging from research, monitoring, evaluation and review activity.	Formal reporting to all interested stakeholders provides comprehensive information on the fishery's performance and management actions and describes how the management system responded to findings and relevant recommendations emerging from research, monitoring, evaluation and review activity.
	Met?	No	No	No
Rationale				

There is almost no publicly available information regarding catches of the crayfish trap fishery, number of licences given, number of fishers, area of operation etc. There is only catch data and number of fishers reported for 2022, the first year of the NAP implementation, in a ICNF poster. It is also unclear if the NAP continues to be implemented since. SG60 is not met.

Approach to disputes				
e	Guide post	Although the management authority or fishery may be subject to continuing court challenges, it is not indicating a disrespect or defiance of the law by repeatedly violating the same law or regulation necessary for the sustainability for the fishery.	The management system or fishery is attempting to comply in a timely fashion with judicial decisions arising from any legal challenges.	The management system or fishery acts proactively to avoid legal disputes or rapidly implements judicial decisions arising from legal challenges.
	Met?	No	No	No
Rationale				

According to fishers interview, crayfish catch is not always reported, the traps are not identified and there are many fishers with no licences, and thus SG60 is not met.

References

Information gathered through interviews with fishers.
Regulation (EU) No 1143/2014 & Decree-Law No. 92/2019

Draft scoring range	<60
Information gap indicator	More information sought on the management system of the crayfish trap fishery.

PI 3.2.3 – Compliance and enforcement

PI 3.2.3		Monitoring, control and surveillance mechanisms ensure the management measures in the fishery are enforced and complied with		
Scoring Issue		SG 60	SG 80	SG 100
a	MCS implementation			
	Guide post	Monitoring, control and surveillance mechanisms exist, and are implemented in the fishery and there is a reasonable expectation that they are effective.	A monitoring, control and surveillance system has been implemented in the fishery and has demonstrated an ability to enforce relevant management measures, strategies and/or rules.	A comprehensive monitoring, control and surveillance system has been implemented in the fishery and has demonstrated a consistent ability to enforce relevant management measures, strategies and/or rules.
	Met?	No	No	No
Rationale				

The overall requirements for Monitoring, Control and Surveillance (MCS) of freshwater fisheries in EU legislation Regulation (EU) No 1143/2014 is that MSs shall establish a surveillance system of invasive alien species of Union concern, or include it in their existing system, which collects and records data on the occurrence in the environment of invasive alien species by survey, monitoring or other procedures to prevent the spread of invasive alien species into or within the Union. ICNF is responsible for monitoring, enforcement and inspection of freshwater fisheries in Portugal, but there is no information if they are actually implemented, let alone effective and SG60 is therefore not met.

b	Sanctions			
	Guide post	Sanctions to deal with non-compliance exist and there is some evidence that they are applied.	Sanctions to deal with non-compliance exist, are consistently applied and thought to provide effective deterrence.	Sanctions to deal with non-compliance exist, are consistently applied and demonstrably provide effective deterrence.
	Met?	No	No	No
Rationale				

Again sanctions exist in the Portuguese law but there is no evidence that they are applied and thus SG60 is not met.

c	Compliance			
	Guide post	Fishers are generally thought to comply with the management system for the fishery under assessment, including, when required, providing information of importance to the effective management of the fishery.	Some evidence exists to demonstrate fishers comply with the management system under assessment, including, when required, providing information of importance to the effective management of the fishery.	There is a high degree of confidence that fishers comply with the management system under assessment, including, providing information of importance to the effective management of the fishery.

Met?	No	No	No
Rationale			

Fishers are not generally thought to comply with the management measures in place, namely the licences, catch reporting and traps identification. Therefore SG60 is not met.

d Systematic non-compliance			
Guide post	There is no evidence of systematic non-compliance.		
Met?		No	
Rationale			

To the team's best knowledge illegal activities are widespread in the crayfish fishery: seldom catch reporting, many unlicensed fishers and no identification of traps. Therefore there is evidence of systematic non-compliance and SG80 is not reached.

References

Information gathered through interviews with fishers.
Regulation (EU) No 1143/2014 & Decree-Law No. 92/2019
Council of Ministers Resolution No. 133/2021

Draft scoring range	<60
Information gap indicator	More information sought on the monitoring, control and surveillance of the crayfish trap fishery.

PI 3.2.4 – Monitoring and management performance evaluation

PI 3.2.4		There is a system of monitoring and evaluating the performance of the fishery-specific management system against its objectives There is effective and timely review of the fishery-specific management system		
Scoring Issue		SG 60	SG 80	SG 100
a	Evaluation coverage			
	Guide post	There are mechanisms in place to evaluate some parts of the fishery-specific management system.	There are mechanisms in place to evaluate key parts of the fishery-specific management system.	There are mechanisms in place to evaluate all parts of the fishery-specific management system.
	Met?	Yes	No	No
Rationale				

There are mechanisms in place to evaluate some parts of the fishery specific management system, namely reporting of catches and licences. SG 60 is met. However, it is unclear if are mechanisms in place to evaluate key parts of the fishery-specific management system and thus SG80 is not reached.

b	Internal and/or external review			
	Guide post	The fishery-specific management system is	The fishery-specific management system is subject to regular internal	The fishery-specific management system is

		subject to occasional internal review.	and occasional external review.	subject to regular internal and external review.
Met?	No	No	No	No

Rationale

The team is unaware of any review of the management system of freshwater fisheries in Portugal, or of invasive species has occurred or is subject to internal review. SG60 is not met.

References

Information gathered through interviews with fishers.
 Regulation (EU) No 1143/2014 & Decree-Law No. 92/2019
 Council of Ministers Resolution No. 133/2021

Draft scoring range	<60
Information gap indicator	More information sought on the management system of the crayfish trap fishery.

8 Appendices

8.1 Assessment information

8.1.1 Small-scale fisheries

Unit of Assessment (UoA)	Percentage of vessels with length <15m	Percentage of fishing activity completed within 12 nautical miles of shore
Crayfish trap fishery	NA (no vessels used)	100%

8.2 Evaluation processes and techniques

8.2.1 Site visits

The stakeholders contacts were carried out by Lisa Borges and Cláudia Correia between the June-July 2024, and included the following stakeholders:

- MSC Fisheries Certification Team, London
- Portuguese Fishers
- Sciaena

8.2.2 Recommendations for stakeholder participation in full assessment

All stakeholders contacted in this pre-assessment should participate in a full assessment, jointly with additional fishers and associations.

- Secretariat of Environment
- ICNF
- University of Évora, Évora
- University of Minho, Braga
- University of Trás-os-Montes e Alto Douro, Vila Real
- University of Lisbon.
- University of Algarve, Faro
- Fluviação de Moura
- PhD student, University of Aveiro.

8.3 Risk-Based Framework outputs

8.3.1 Consequence Analysis (CA)

	Scoring element	Consequence subcomponents	Consequence score
Principle 1: Stock status outcome	Crayfish	Population size	
		Reproductive capacity	
		Age/size/sex structure	

	Geographic range	100
Rationale for most vulnerable subcomponent	Considering that crayfish is an invasive species and that the objectives of the NAP is to limit, if not the abundance, the expansion of the species, then the impact of its geographic ranges is the most important subcomponent to follow.	
Rationale for consequence score	Although there isn't a lot of information available, it seems there has been no limitation of the geographical distribution and abundance of crayfish in Portugal. The NAP is incentivising commercial fishing to at least reduce crayfish abundance, but it is a new management plan, while its effective implementation is unclear.	

8.3.2 Productivity Susceptibility Analysis (PSA)

Table XI – PSA productivity and susceptibility attributes and scores		
Performance Indicator	1.1.1	
Productivity		
Scoring element (species)	Crayfish <i>Procambarus clarkii</i>	
Attribute	Rationale	Score
Average age at maturity	<5 years	1
Average maximum age	<10 years	1
Fecundity	100-20,000 eggs per year	2
Average maximum size Not scored for invertebrates		NA
Average size at maturity Not scored for invertebrates		NA
Reproductive strategy	Live bearer	3
Trophic level	<2.75	1
Density dependence Invertebrates only	No dependatory or compensatory dynamics demonstrated or likely	2
Susceptibility		
Fishery Only where the scoring element is scored cumulatively	Trap fishery	
Attribute	Rationale	Score
Areal Overlap	The trap fishery operate in an area corresponding to between 10-30% of the stock area.	2
Encounterability	High overlap with fishing gear - default score for target species.	3
Selectivity of gear type	Individuals < size at maturity are regularly caught and individuals < half the size at maturity can escape or avoid gear.	2

Post capture mortality	Retained species default score.	3
Catch (weight) Only where the scoring element is scored cumulatively		NA

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Template version control

Version	Date of publication	Description of amendment
1.0	15 August 2011	Date of first release
1.1	31 October 2013	Updated in line with changes to CR v1.3
2.0	08 October 2014	Confirmed background sections (Section 3) as optional (use of 'may' statements) Modified Table 6.3 to create a simplified scoring sheet to be completed in place of full evaluation tables Made amendments to PIs based on Fishery Standard Review changes (e.g. removed original PIs 1.1.2, 3.1.4 and 3.2.4).
2.1	9 October 2017	Inclusion of optional full evaluation tables
3.0	17 December 2018	Release alongside Fisheries Certification Process v2.1
3.1	29 March 2019	Minor document changes for usability
3.2	25 March 2020	Release alongside Fisheries Certification Process v2.2

A controlled document list of MSC program documents is available on the MSC website (msc.org).

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