

**6th Report of the implementation of the FIP Spanish  
crayfish (*Procambarus clarkia*) with fyke nets & traps in  
Andalusia and Extremadura**

**- Orellana la Vieja, Extremadura -**



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## Table of Contents

1. Executive Summary .....	3
2. Introduction .....	3
3. Work plan May-October 2024 .....	6
4. Crayfish fishery in Orellana la Vieja Lake.....	6
5. Production characterization .....	13
6. Discussion .....	13
7. Final remarks .....	15

## 1. Executive Summary

The 2024 FIP activities began in July in Extremadura. Fieldwork and data collection were carried out following the Guadiana basin fishery, using traps. This fieldwork took place in July at Orellana la Vieja, a lake in Extremadura within the Guadiana basin, on two different dates. No sampling was conducted in Andalusia in 2024 due to the absence of fishing, which was caused by the prolonged drought that has affected the region over the past two years, and no sampling in other Extremadura pounds were made. Notably, there was no bycatch at Orellana, and in addition to chicken and fruit, sardines were also used as bait, as noted in previous reports. The results further show a balanced number of females and males in the trap catch sample and a normal distribution of crayfish length frequencies, and a lower number of crayfish individuals comparing with the previous seasons (2022 and 2023), presumably due to lower water temperature. Moreover, data from catches reported in the control plans for Andalusia and Extremadura were provide by the client. Several important points emerged regarding difficulty in accessing catch data and a Risk Based Framework analysis is proposed and also the division of the FIP in Unit of Assessment, on order to advance in the FIP.

## 2. Introduction

This document is the sixth report of the Spanish crayfish (*Procambarus clarkii*) FIP. Earlier reports provided an overview of the fishery, its socio-economic significance, and the biological and ecological characteristics of the crayfish. In this report, the MSC Risk-Based Framework (RBF) is proposed, given that the species in question is an invasive non-native and the bycatch rates are very low, primarily involving other invasive species. This report focuses on the 2024 FIP activities, which were limited to Orellana Lake. This report is organised into several chapters: an introduction with a brief overview of fishing (Chapter 2) one for the work plan (Chapter 3), one covering Orellana Lake (Chapter 4), another for data provided by the client (Chapter 5), and the final two chapters for key observations and conclusions (Chapters 6 and 7). It is also important to highlight that this report refers to the data and the fishers provided by Alfocan S.A., to the moment of the writing of this report any data was provided by South Ocean.

### 2.1. Fishery Overview

The Louisiana crayfish (*Procambarus clarkii*) is an invasive species in Spain, originally native to the south-eastern United States and northern Mexico. It was introduced to Spain in the 1970s for aquaculture purposes but quickly spread throughout wetlands, rivers, and rice fields across the country. Despite favouring some species from higher levels on the trophic chain, namely

otters (*Lutra lutra*) and the black stork (*Ciconia nigra*), its ecological impact has been significant, as it competes with native species for resources, alters aquatic ecosystems, and contributes to the decline of native crayfish and amphibian populations. Additionally, it affects water quality by increasing turbidity and can damage crops, particularly in rice fields, due to its burrowing behaviour.

The crayfish fishery in Extremadura is regulated and managed by a Management Plan of Resolution of 25 of October 2016. This Plan establishes management measures for *Procambarus clarkii* and *Pacifastacus leniusculus* within the Autonomous Community of Extremadura, in accordance with the provisions of Regulation (EU) No. 1143/2014, of the European Parliament and of the Council, of October 22, 2014, the Law 42/2007, of December 13, on cultural heritage and biodiversity, and the Royal Decree 630/2013, of August 2, which regulates the Spanish Catalog of invasive exotic species.

The establishment of a control plan for this species, in a very geographical area, previously took place in Extremadura with the approval of the Governing Plan for Use and Management of Orellana, approved by Order of December 28, 2012 by which approves the Master Plan for the Use and Management of the ZIR "Orellana and Sierra de Pela Reservoir". This provides in point 7.4.3 within the management guidelines that the General Directorate of the Environment will carry out the necessary actions for the elimination of invasive exotic species considered as such in the Spanish catalog of exotic species invasive in accordance with Royal Decree 1628/2011, of November 14, without prejudice to the specific regulations that are developed for the regulation of industrial uses of the crayfish (*Procambarus clarkii*). Point 7.4.3 also foresees that the access roads for fishing to the reservoir will be directed to non-priority areas for birds, so that fish farming activity and wildlife conservation do not come into conflict.

Fishing is a key strategy outlined in the Spanish management plan to control the population of the Louisiana crayfish. By promoting crayfish harvesting, authorities aim to reduce its numbers and limit its ecological impact on native species and ecosystems. This method not only helps to control the invasive species but also provides socio-economic benefits, particularly in rural areas where crayfish fishing has become an important local activity. The plan recognizes that, while eradication may be unrealistic, managing the population through regulated fishing is essential for mitigating its negative effects. Rules apply to the number of fishing licences and gears allowed per licence. Additionally, the type of fishing gears allowed and its mode of operation is regulated in order to cause the minimum impact on the ecosystem and reduce the number of rejections and bycatch. This includes the number of hours each trap can fish.

## 2.2. Application of the Risk-Based Framework (RBF)

The client and the consultant agreed that the application of the RBF could be used to assess the environmental risk due to the lack of quantitative data on the impacts of crayfish fishing, and considering the regulation described above. This approach allows for the evaluation of qualitative and contextual risks, providing a structured way to analyze potential environmental effects even in the absence of detailed data, ensuring a more comprehensive understanding of the fishery's sustainability.

The RBF involves two approaches: the Productivity-Susceptibility Analysis (PSA) and the Consequence Analysis (CA). The RBF focuses on environmental impact and species productivity. The PSA assesses risk based on two components: Productivity: the species' ability to regenerate/populate; and Susceptibility: the degree of exposure to fishing activity. Productivity for the Louisiana crayfish is high, as it is an invasive and highly resilient species with rapid fecundity and growth rates. The use of selective trap fishing reduces susceptibility for other species (low bycatch). Nevertheless, using sardines as bait may raise concerns about the status of the sardine population, however the sardine used comes from Galicia corresponding to the Iberian stock that is very well known and highly regulated. In order to define productivity and susceptibility parameters it is necessary to assign a score (high, medium, low) to each factor, such as fecundity, natural mortality, and fishing gear selectivity and analyse the susceptibility of both the crayfish and the sardines used as bait. Furthermore, the Consequence Analysis (CA) is used to assess the consequences of environmental impact when data is insufficient. This part focuses on: (i) Habitat impact: trap fishing generally has a low impact on the environment, but it's important to assess if there are disturbances to the lake floor or other sensitive areas; (ii) Impact on non-target species (bycatch): as it has been mentioned that bycatch is not significant, this would be a positive point to highlight; (iii) Impact of using sardines as bait: sardines are a species that may be under pressure. Assess the impact on the marine ecosystem (sardine populations) and consider more sustainable alternatives (artificial baits or certified catch). To the moment of the writing of the present report several factors have been collected to draft the RBF analysis and a few more factors needed to be collected and addressed, namely the willingness of the fishers to change the sardine as bait and if it has impact on the catch. Thus, it is intended to present a full RBF analysis in the annual FIP report (April 2025).

### 3. Work plan May-October 2024

#### **Experimental planning (Started May 2024 – July 2024)**

- Defining sampling areas, methodology and adapt methods
- Preparing sampling material

#### **Data collection *in situ* (July 2024)**

- Collecting crayfish biological data (size, total weight, sex, behavior, habitat, geographic position) and crayfish trap fishery bycatch

#### **Data analyses (Started July 2024 – October 2024)**

- Biological data compilation and analysis
- Review of sampling planning
- Bycatch identification and characterization.

#### **Stakeholder mapping and engagement (Started May 2024 – October 2024)**

- Fishers' engagement and participation in data collection.

#### **Reporting and project management (Started May 2024 – October 2024)**

- Drafting report
- Managing activities
- FIP reporting (July, October)

### 4. Crayfish fishery in Orellana la Vieja Lake

According to the management plan, there are two authorized centers for crayfish collection, one of which exclusively supplies catches to Alfocan. Two visits were conducted to Orellana, where capture data were gathered, and the expedition center was also visited. Based on data provided by the client, a total of 28 licenses have been authorized in Orellana, each allowed to operate with up to 200 traps, resulting in a total of 5,600 traps. It is unknown how many fishers provides exclusively for this expedition center and the total catch volume in the Orellana Lake, considering the other expedition center. Furthermore, not all licenses are in place each season. As it is a seasonal fishery, fishers engage in other occupations, choosing one activity over the other depending on its profitability. While the species is resilient, its abundance is closely linked to environmental factors, particularly temperature and water levels. During the 2024 season, lake temperatures in Orellana were recorded as lower than in previous years due to the dam's

opening and resulting inflow of colder waters, resulting in a reduced crayfish activity, which remained mostly inactive due to the lower temperatures, and decreasing catch numbers.

Fishing activity primarily involves the use of traps deployed in Guadiana's lake at Orellana la Vieja over a 24-hour period (refer to Fig. 1). Depending on crayfish abundance, the traps may remain in the water for up to 48 hours, which happened during 2024 season, due to the low water temperature, as described earlier.

Regarding bait, fruits and raw chicken were commonly used in Orellana la Vieja, and sardines purchased from Vigo.



**Fig. 1** – Fishing area in Guadiana's Basin at Orellana La Vieja, Extremadura region.

#### 4.1. Orellana Lake site visit results

Two site visits were conducted in Orellana la Vieja, the first one on 7<sup>th</sup> of July and a second on 23<sup>th</sup> of July, where traps catch data were collected by accompanying two fishers during their fishing activities side-by-side in another vessel. The following data were collected for each trap: crayfish size, sex, number of individuals, bycatch number and size if present, bait used and GPS position.

The experimental design drafted included the collection of data from sets of traps of different fishers in order to have catch composition in different fishing locations. However, it was only possible to follow one fisher at the time, in a total of two fishers in the 2024 season, which for Orellana, considering the previous site visits is enough to understand catch composition.

Fishers from Orellana lake collect between 100 to 150 traps per fishing day, but it was only possible to sample around 10% of traps due to the time required to measure each crayfish, while trying to minimise interference in the fisher's normal activity.

#### 4.1.1 First Site Visit – 07 July 2024

During the first visit one new fisher was accompanied and 9 of the 150 traps collected were sampled, corresponding to a total 442 individuals measured. The total weight of the catch was 75 kg. This season, due to the crayfish abundance, the number of traps fishing in Orellana Lake was lower. The fisher accompanied during the first site visit had less 50 gears operating comparing with the previous seasons

##### i) Sex Ratio

Overall the number of crayfish female sampled are slightly higher than the number of males, with a total of 54% of female sampled and 46% males (Fig. 3).

When analysing each trap in detail, the proportion of males and females were balanced indicating a good sex distribution of the species.

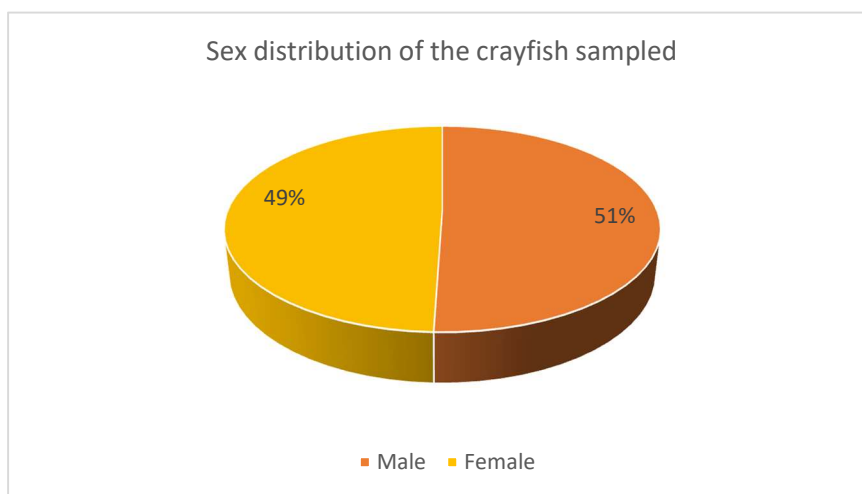


Fig. 3 – Overall sex ratio sampled.

##### ii) Catch per Unit of Effort – CPUE

CPUE was only possible to calculate in number, since the total weight of the catch and the average weight of the traps were not available. The catch at each traps shows that there is a predominance of traps with approximately 40 individuals, except for traps number five and six which caught 14 and 23 individuals, respectively and trap number 4 with 83 (Fig.4).

a) CPUE in number

$$CPUE(\text{number}) = \frac{\text{total number of individuals}}{\text{total number of traps}}$$

Total number of individuals sampled = 425

Total number of traps sampled = 9

CPUE = 47,2

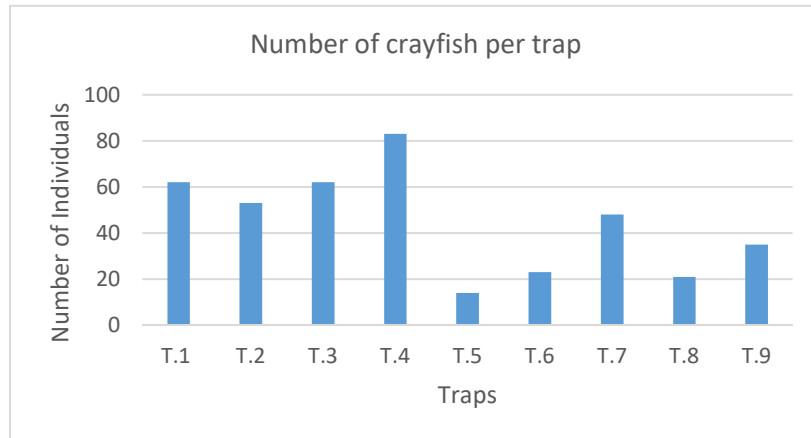


Fig. 4 – Number of individuals per trap

Results shows that each trap harvest in average 40 individuals during the 48 hours fishing at the lake, with a higher peak in trap number 4 with 87 individuals, and a lower in trap number 5 with 14 individuals. Traps sampled presented a homogenous number of crayfish between 40 and 50 individuals per trap (Fig.4).

b) CPUE in weight

$$CPUE(\text{weight}) = \frac{\text{total catch}}{\text{total number of traps}}$$

Total weight of the catch = 75 kg

Total number of traps = 150

CPUE = 0,5

Results shows that in average, each trap caught 0.5 kg of crayfish within the 48 hours of fishing, these results are rather different from the previous season with a CPUE of 2.62. This decreasing in catches can be explained by the low water temperature and the low metabolic rates of the crayfish. The trap with the highest catch (Trap 4) was displayed in a water branch where the temperatures were higher.

iii) Length frequency

Catches were distributed between 25 and 43 mm, with the majority of individuals with sizes between 28 and 39 mm, indicating that the catch was mainly composed of young adult individuals, aged under 250 days.

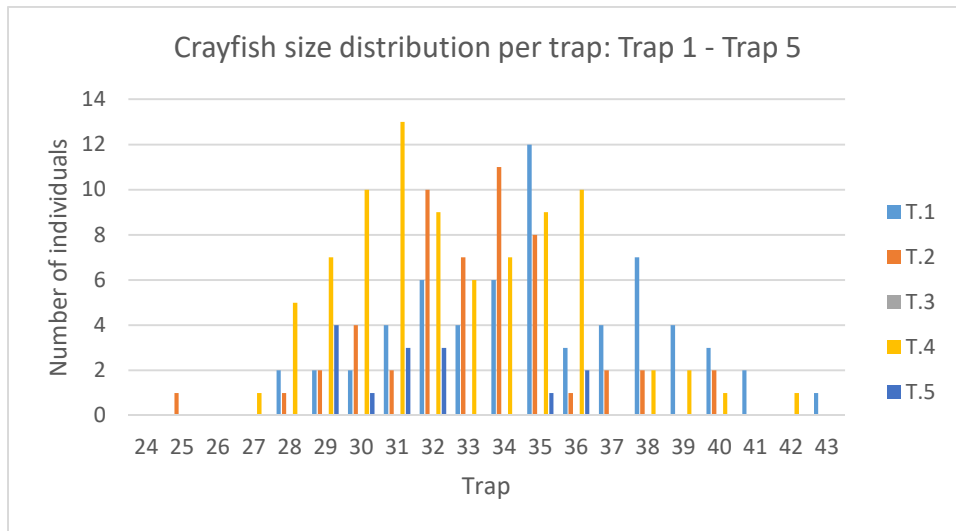


Fig. 5 a) Crayfish length distribution per trap: Trap 1 – 5.

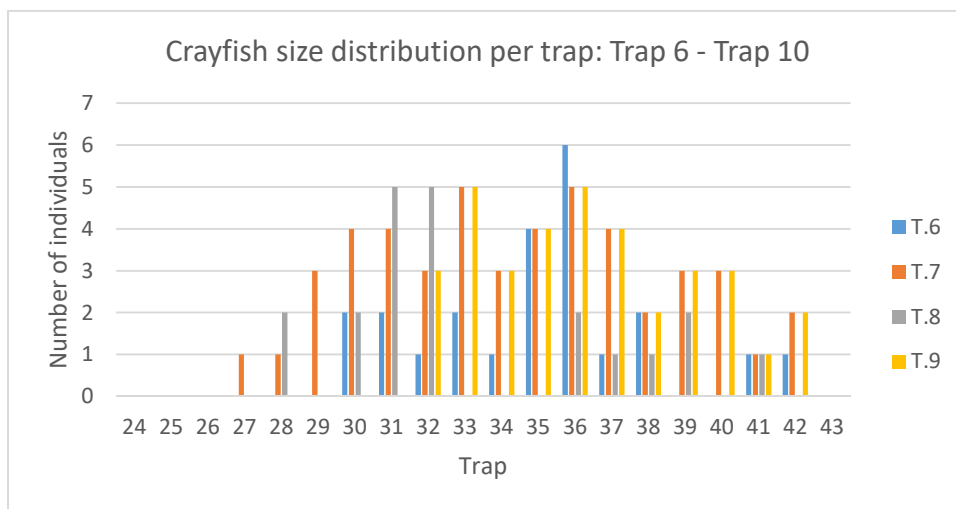


Fig. 5 b) Crayfish length distribution per trap: Trap 6 – 9.

4.1.2 Second Site Visit – 23 July 2024

A second visit was conducted approximately two weeks later, on July 23, with a different fisher. This fisher was using only 100 of the 200 authorized traps. He also reported lower temperatures compared to previous years, attributing this to the dam gates being open, allowing a constant

inflow of colder water. Six traps were sampled, corresponding a total of 215 individuals measured.

i) Sex Ratio

The number of crayfish male sampled are slightly higher than the number of females, with a total of 51% of female sampled and 49% males (Fig. 6).

When analysing each trap in detail, the proportion of males and females were balanced indicating a good sex distribution of the species, in accordance with the previous results.

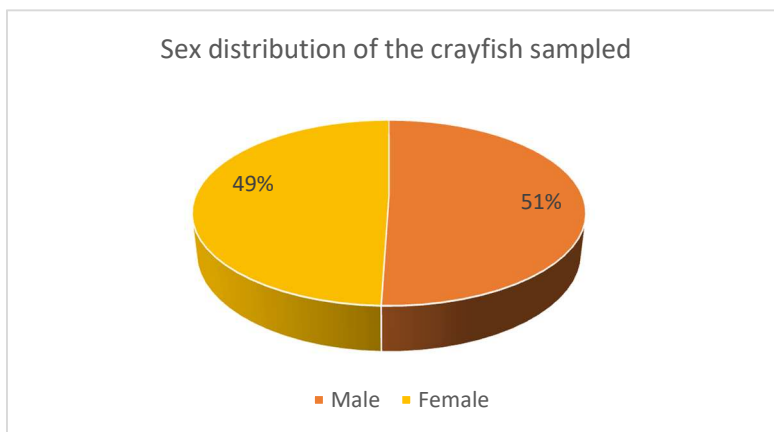


Fig. 6 – Overall sex ratio sampled.

ii) Catch per Unit of Effort – CPUE

CPUE was only possible to calculate in number, since the total weight of the catch and the average weight of the traps were not available. The catch at each traps shows that there is a predominance of traps with approximately 40 individuals, except for traps number five and six which caught 14 and 23 individuals, respectively and trap number 4 with 83 (Fig.7).

a) *CPUE in number*

$$CPUE(number) = \frac{\text{total number of individuals}}{\text{total number of traps}}$$

*Total number of individuals sampled = 215*

*Total number of traps sampled = 6*

*CPUE = 35,83*

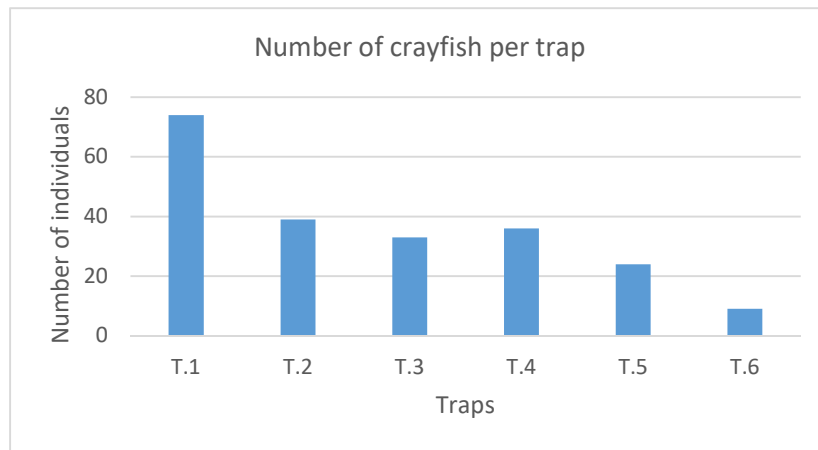


Fig. 7 – Number of individuals per trap.

Results shows that each trap harvest in average 35.83 individuals during the 48 hours fishing at the lake, with a higher peak in trap number 1 with 74 individuals, and a lower in trap number 6 with 9 individuals. Traps sampled presented a homogenous number of crayfish between 30 and 40 individuals per trap (Fig.7).

iii) Length frequency

Catches were distributed between 20 and 41 mm, with the majority of individuals with sizes between 28 and 39 mm, indicating that the catch was mainly composed of young adult individuals, aged under 250 days. Trap number 1 displayed the higher number of individuals with 27 mm, 18 of the 74 individuals caught.

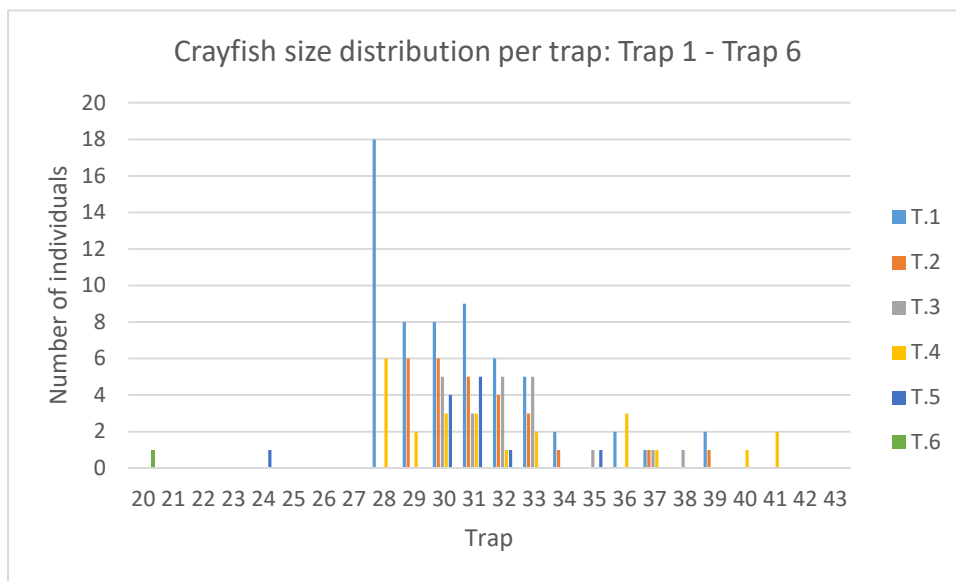


Fig. 8 – Crayfish length distribution per trap: Trap 1 – 6.

#### 4.1.3 Bycatch characterization

No bycatch was observed in either the sample traps or reported by the fishers in Orellana Lake.

#### 4.1.4 Bait characterization

In the 2022 season, the bait consisted mainly of raw chicken and fruits in Orellana lakes. However, during the 2023 season, fishers used sardines (*Sardina pilchardus*) as bait, as previously noted in the 4th report, and is still in use amongst Orellana fishers. This development has prompted the re-opening of Action 4 under Principle 2. It was not possible to assess the amount of sardines used amongst fishers in Orellana Lake. The fishers reported using around 40 kg of frozen sardines daily in roughly 200 traps. These sardines are sourced from Vigo and harvested from Iberian Atlantic waters.

### 5. Production characterization

The client, Alfocan S.A., provided aggregate data as reported in the control plans for Andalusia, Extremadura, and Orellana for the years 2022 and 2023 (Tab.1). Data for 2024 is not yet available. Weekly measurement data for this client was deemed unnecessary, as these measurements reflect the length of individuals within a 2 kg sample, which has remained stable over time and appears unaffected by capture volumes. Although measurement data is not required and the total capture volume for each region has been provided, it was not possible to determine the percentage specifically attributable to the client. Data for the entire season from South Ocean was not provided. It is critical to the successful completion of the work planned that data from the producers are provided on a timely manner.

Table 1 - Catches reported in the control plans for Andalusia and Extremadura

<i>Region</i>	<i>2022</i>	<i>2023</i>
<i>Andalusia</i>	126079	0
<i>Extremadura</i>	181654	139564
<i>Orellana</i>	89545	85475

### 6. Discussion

FIP activities for the year 2024 started in July, involving two site visits to the Orellana Lake, Orellana la Vieja, Extremadura region. Fieldwork and data collection were exclusively conducted at Extremadura's lake fisheries, utilizing traps within the Guadiana basin, as there were no fishing activities in Andalucía in 2024 due to the aforementioned drought. The data collected

provided the basis for an analysis of the catch composition and characterization the bycatch of the fishery in Extremadura, allowing for a comparison with the results from the previous years, 2022 and 2023, in the same region.

On July 9<sup>th</sup>, the first visit to Orellana was conducted. Data collected from this site showed significantly lower numbers of crayfish caught compared to the previous seasons. The CPUE (catch per unit of effort) was estimated at 47.2, indicating an average of 47 individuals caught during the 48-hour fishing period.

CPUE calculated for the 2nd site visit in Orellana lake (July 23<sup>th</sup> 2024) were lower than the previous site visit two weeks earlier in Orellana, with a CPUE calculated in 35.83. CPUE from the site visit in 2022, was assessed to be 40.2, and in 2023 of 63.9. The results are difficult to compare since crustaceans populations are known to quickly change their abundance in response to environment variations, as already described for Andalusia region in the 3<sup>rd</sup> FIP report, due the lack of water, and earlier in this report regarding the temperature of the water. Additionally, the second visit in 2024 in Orellana was conducted with a (new) different fisher than the previous site visits in 2024, 2023 and 2022, as described in 2<sup>nd</sup> and 4<sup>th</sup> FIP reports.

Two main differences between three were also observed, namely in the fishing location within the lake (refer to Fig. 2) and the bait used, compared to the same period the previous year. In 2022, the bait primarily consisted of raw chicken and fruits, whereas this year, sardines replaced chicken as the bait of choice. The sardines purchased in Vigo appear to originate from the Iberian southern sardine stock caught by the local Galiza purse seine fishery. However, both the fishery and the stock require further confirmation. Additionally, the total quantity of sardines used in the Orellana fishery remains unclear, as also reported in the previous reports. Additionally fishing activity in 2023 and 2024 occurred closer to Orellana and closer to each other.

Regarding the sex ratio of the crayfish sampled are in balance, and the size distribution were similar, showing that the population were mainly composed by adult individuals approximately 250 days of age, with slightly decrease of size at the second visit, where bigger individuals were not found (max. found was 41mm).

Bycatch was not registered in the total of 15 traps sampled during the visits at Orellana. Bycatch had already been considered very low in previous years, only composed by pumpkinseed fish, a prolific invasive species in the region.

The crayfish fishery in Orellana Lake through the years seems to have similar crayfish catch composition in terms of sex ratio and length profiles within areas, and overall low bycatch of non-native species. However, stakeholder engagement and the involvement of government agencies in the fishery management process, as well as fishers' organization, are compromising the successful achievement of crucial actions in Principle 1 and 3, and impacting also Principle 2. As stated in the previous reports, stakeholders' engagement are crucial to understand the extent of the fishery and its impact.

Finally, the data from South Ocean was not available since 2022 season.

## 7. Final remarks

Based on the results obtained over three years of sampling in Orellana, and as discussed in the introduction of this report regarding the challenges in accessing quantitative catch data and the fact that this is an invasive exotic species listed in the invasive species catalogue, it is proposed to reassess the FIP to integrate the possibility of using RBF analysis to address the challenges of this fishery. It is also important to highlight that, from an environmental perspective (P2), concerning ecosystem impact, the results show that bycatch is virtually non-existent. Additionally, the management plan specifies the use of equipment and fishing zones designed to minimize habitat impact.

Furthermore, it is recommended to separate UoAs by region in the FIP, as constraints imposed on Andalusia and the difficulty of accessing small lakes in Extremadura—where more than 50% of the region's catches occur—pose challenges for advancing areas with greater data availability and greater potential to achieve certification, such as Orellana Lake.

In light of the above, the next steps include a review of the work plan to incorporate the results obtained thus far and the new proposals for revising the FIP.