Fourth Report
of the implementation of the FIP
Spanish crayfish, Procambarus clarkii, with fyke nets \& traps in
Andalusia and Extremadura

Montijo and Orellana La Vieja - Extremadura


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## 1 Executive Summary

FIP activities in Extremadura started in 2023 in May, when the fishing season started, with field work and data collection carried out in the Guadiana basin using traps. No sampling in Andalusia was carried out as this year there will be no rice field cultivation and therefore no catching season due to the drought that the area has been experiencing for nearly two years. Field work was carried out in May and June at Montijo and Orellana la Vieja, Guadiana Lakes in Extremadura. Results shows a slightly higher number of females in the traps catch sample, and a normal distribution of crayfish length frequencies. Total catch data in weight were provided by Alfocan, and were analysed and compared with the previous year. From this preliminary assessment there are several points that can be highlighted, namely the low proportion of bycatch of pumpkinseed juveniles at Guadiana Lake and the additional use of sardine as bait apart from the chicken and fruit analysed in previous reports. In order to fully assess the Spanish crayfish fishery, further work and additional data needs to be collected and provided, especially at the pods in Guadiana Basin, and a more effective stakeholder engagement, namely with administration and fishers.

## 2 Introduction

The following document represents the fourth report of the Spanish crayfish (Procambarus clarkia) FIP. In previous reports a description of the fishery, its socio-economic importance, but also biological and ecological aspects of crayfish were presented. The reports also included a summary of the current legislation in Andalusia and Extremadura regions. The present report focus on the fishing activities carried out in Extremadura region. Two site visits were planned and conducted in Extremadura and at least one more is planned for July before the fishery closes.

### 2.1 Crayfish fishery in Extremadura region.

The crayfish fishery in Extremadura is regulated and managed by Resolution of 25 of October $2016^{1}$ on the control plan for this region and supplies $25 \%$ of the national crayfish production. There are no fisher's association or other business organizations associated to the crayfish fishery, and the exact number of fishers operating in the area is still unknown.

Fishing activity in Extremadura is characterized by the use of traps (Fig. 1) that are set in Guadiana's Lake at Orellana La Vieja during a 24 hours period (Fig. 2) and also in small pods in the region, similar to the lake where the first 2023 site visit occurred (Fig. 3). Depending on amount of crayfish, the traps in these pods can fish for 48 hours. The bait used is fruits, raw chicken (last year) but this year also sardines bought from Vigo.

[^0]

Fig. 1 - Trap used to catch crayfish at Guadiana Lake in Extremadura region.


Fig. 2 - Fishing area in Guadiana's Basin at Orellana La Vieja, Extremadura region.


Fig. 3 - Fishing pod in Guadiana's Basin at Montijo, Extremadura region.

## 3 Work plan

The 2023 FIP activities started in May. The following planned FIP tasks were carried out:

Experimental planning (Started May 2023 - October 2023)

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

Data collection in situ (Started May 2023 - October 2023)

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

Data analyses (Started May 2023 - December 2023)

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


## Stakeholder mapping and engagement (Started May 2023 - December 2023)

- Fishers' engagement and participation in data collection.
- Municipalities' engagement in enabling historical data on crayfish captures.

Reporting and project management (Started May 2023 - December 2023)

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


## 4. Results

Two site visits to collect data were conducted in Extremadura, the first one on $31^{\text {st }}$ of May, and the second on $27^{\text {th }}$ of June, where traps catch data were collected by accompanying two fishers, the first one on board the fishing vessel and the second fisher side-by-side in another vessel, during their fishing activities. The following data were collected for each trap: crayfish size, sex, number of individuals, and existence of bycatch, bait used and GPS position.

### 4.1. Fisheries characterization in situ

The experimental design drafted included the collection of data from sets of traps of different fishers in order to have catch composition in the different fishing locations. However, it was only possible to follow one fisher at the time.

The number of traps displayed and the fishing time depends on the location fishers operate. The fisher accompanied in the first site visit had 20 traps set in the pod sampled. This fisher have other traps (a total of 100) distributed in several similar pods in the region that are collected every 48 hours, 15 out of 20 traps were sampled.

Fishers from Orellana Lake collect between 150 to 200 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 normal activity.

### 4.1.1. First Site Visit - 31/05

During the first visit one fisher was accompanied, and 15 of the 20 traps collected were sampled, corresponding to a total of 79 individuals measured. The total weight caught in the 20 traps was $6,805 \mathrm{~kg}$. Sampling in this site visit was carried out by one sampler, since the boat only had capacity for maximum two persons on board (the fisher and the biologist).

The ratio between male and female individuals are almost equal, with $51 \%$ of females and $49 \%$ of males, with 7 traps having a higher number of males, and 7 of females, with one trap registering equal number of both sexes. (Fig. 4).


Fig. 4 - Sex ratio for each trap sampled.

## ii) Catch per Unit of Effort - CPUE

The catch at each traps shows that there is a predominance of traps with approximately 5 individuals (Fig.5). Furthermore, knowing the number of fishers or traps operating in the area it is possible to estimate total crayfish catch for the Extremadura region.
a) CPUE in number

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

Total number of individuals sampled $=79$
Total number of traps sampled $=15$
CPUE $=5.27$


Fig. 5 - Number of individuals per trap.

Results shows that each trap harvest in average 5 individuals during the 48 hours fishing at the pod, with a peak in traps number 4 and 6 with 9 and 8 individuals caught, respectively.
b) CPUE in kg

$$
\text { CPUE }(\mathrm{Kg})=\frac{\text { Catches weight }}{\text { Number of Traps }}
$$

Catches weight $=6,805 \mathrm{~kg} \rightarrow 20$ traps

CPUE $(\mathrm{Kg})=6,805 / 20$
$C P U E(\mathrm{Kg})=0,34 \mathrm{Kg}$

Results shows that this fisher catches approximately 340 g of crayfish per trap operating 48 hours.

## iii) Length frequency

Catches were distributed between 22 and 42 mm , with the majority of the individuals around 28 and 38 mm , indicating that the catch was mainly composed of adult individuals, aged under 250 days.


Fig. 6 Crayfish length distribution per trap.

### 4.1.2. Second Site Visit - 27/06

During the second visit one fisher was accompanied (the same fisher accompanied in 2022) and 29 of the 200 traps collected were sampled, corresponding to a total 1853 individuals measured. This fisher collected a total of 524 kg from the 200 traps operating for 24 hours. In this site visit it was possible to have two biologists sampling at the same time.

Overall the number of crayfish female sampled are slightly higher than the number of males, with a total of $59 \%$ of female sampled ( 1102 individuals) and $41 \%$ males ( 751 individuals). When analysing each trap in detail, the proportion of males were higher in 8 traps, and in 6 of them the ratio grew up to $50 \%$ difference, traps $1,2,9,11,12$ and 13 . On the other hand the number of females where higher than $70 \%$ in four traps $(6,19,21$ and 24$)$ and in traps number 6 and 24 grew more than $80 \%$ (Fig. 7).


Fig. 7 - Sex ratio for each trap sampled.
i) Catch per Unit of Effort - CPUE

The catch at each traps shows that there is a predominance of traps with approximately 60 individuals (Fig.8).
a) CPUE in number

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

## fishfix

Total number of traps sampled $=29$
CPUE $=63,90$


Fig. 8 - Number of individuals per trap.

Results shows that each trap harvest in average 64 individuals during the 48 hours fishing at the lake, with a peak in traps number 19, 20 and 22 with more than 100 individuals per trap (111; 144 ; and 156 , respectively).
b) CPUE kgs

$$
\operatorname{CPUE}(\mathrm{Kg})=\frac{\text { Catches weight }}{\text { Number of Traps }}
$$

Catches weight $=524 \mathrm{~kg} \rightarrow 200$ traps

CPUE $(\mathrm{Kg})=524 / 200$

CPUE $(\mathrm{Kg})=2,62 \mathrm{Kg}$

Results shows that this fisherman catch approximately $2,600 \mathrm{~kg}$ of crayfish per trap operating 24 hours.

## ii) Length frequency

## fishfix

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Catches were distributed between 20 and 46 mm , with the majority of individuals with sizes between 25 and 35 mm , indicating that the catch was mainly composed of young adult individuals, aged under 250 days.


Fig. 9 a) Crayfish length distribution per trap: Trap 1-12.


Fig. 9 b) Crayfish length distribution per trap: Trap 13-29.

### 4.1.3. Bycatch characterization

Bycatch was identified and measured in just 1 out of the 43 total traps observed in both visits. Only a juvenile of pumpkinseed (Lepomis gibbosus) (Fig. 10), which is also an invasive species, was found in the first visit in the pod. In the second visit bycatch was not observed.


Fig. 10 - Pumpkinseed (Lepomis gibbosus). ${ }^{2}$
The pumpkinseed size was $8,5 \mathrm{~mm}$. The results are similar to the last season results, where only this species were registered as bycatch with 5 individuals caught. The results from this year corroborate what was seen in the previously season that bycatch is very low in the areas sampled.

### 4.1.4. Bait characterization

During 2022 season the bait used in Orellana lakes was mainly composed of raw chicken and fruits. However this season, 2023, the fisher accompanied is also using sardines (Sardina pilchardus)(Fig. 11), as bait.


Fig. 11 - European sardine (Sardina pilchardus). ${ }^{3}$

[^1]

The fisher from Orellana reported that he is using approximately 40 kg of frozen sardines per day, i.e. per 200 traps, bought in Vigo and caught in the Iberian Atlantic waters (Fig. 12). Nevertheless, it is not clear the quantity of sardines used and also if this is the only fisher using this species in the traps to caught crayfish. More data of the quantities of sardines used as bait is needed, and it is expected that more information will be collected during the next site visits this season.


Fig. 12 - Stock of frozen sardines used as bait.
European sardine has a wide distribution extending in the Northeast Atlantic from the Celtic Sea and North Sea in the north to Senegal in the south, with residual populations off the Azores, Madeira, and the Canary Islands. Sardine is also found in the Mediterranean and the Black Seas. As it is a short-lived species (generally living less than 10 years), the population level
depends strongly on the incoming year-class strength, which is highly variable and largely dependent on environmental factors and plankton community.
The sardine in ICES divisions $8 \mathrm{c} \& 9 \mathrm{a}$ is neighbour to the stock covering ICES subareas $7 \& 8 \mathrm{a}, \mathrm{b}$, d (Bay of Biscay), and extending to the south to the Strait of Gibraltar, but there is no indication of strong demographic connectivity between the two stocks. The sardine in subdivisions 8c \& 9a has been studied by a range of scientific institutions since 1978 in order to provide scientific advice for the management of its fisheries.

The stock assessment model results performed by ICES show that spawning-stock biomass is increasing but variable although stabilised in the last three years, and has been above Blim (196 334 tonnes) since 2019 and above $\mathrm{B}_{\mathrm{pa}}$ (252 523 tonnes) since 2020 (Fig. 13). The 2022 SSB is estimated at 432379 tonnes (between 290201 and 574557 tonnes), which is more than twice Blim, i.e. biomass under which recruitment is likely to be impaired. Fishing mortality has reduced since its historic peak in 2011, to be below FMSY ( 0.092 ) since 2018 but is increasing since and is in 2021 ( 0.098 ) above $\mathrm{F}_{\text {MSY }}$. ICES advises that when the MSY approach is applied, catches in 2023 should be no more than 43841 tonnes (ICES, 2022).


Fig. 13 - Sardine in divisions 8 c and 9 a . Summary of the stock assessment. The current reference points reflect the low productivity regime since 2006 (ICES, 2022) ${ }^{4}$.

[^2]
### 4.2. Production characterization

Total catch data was made available by Alfocan for the beginning of the 2023 season. Data from South Ocean was not available, but it will be included in the next FIP report for comparison. The data provided comprised the total catch weight received in each week (between week 17 and 27, May and June) from Orellana. Since the length measurements data were not available, the results presented shows only the weight distribution per week for Alfocan.

Results shows that the highest weights were registered between the weeks 24 and 27 (June), with a peak on the week 26 with a total of 18737 kg of crayfish collected from Orellana (Fig. 14).


Fig. 11 - Weight distribution per sampling day per week from Orellana, Extremadura region.

### 4.3. Stakeholder mapping and engagement

Stakeholder mapping and engagement activities were focused on contacting government representatives in Junta de Extremadura and Junta de Andalucía in order to be provided historical data on crayfish catches. It is expected to include these data in the next FIP report, once the data is made available by the municipalities.

## 5. Discussion

2023 FIP activities started in May, with two site visits to Guadiana basin. Field work and data collection was only possible at Extremadura's lakes fisheries with the use of traps in the Guadiana basin as there will be no catching this year in Andalucía due to the drought as previously commented. Data was collected in order to do an analysis of the catch composition and bycatch characterization of the fishery in Extremadura, and compared with the results for 2022 in the same region. Furthermore, more site visits to sample in Guadiana basin are planned to occur until the end of the season.

On the $31^{\text {st }}$ of May a first visit to one of the pods where fishing activities occur was made. Data collected from this location were very low comparing with all the site visits made until now. The area of the pod sampled was very small, determining the number of traps displayed. A total of 20 traps were placed around the pod. The CPUE (catch per unit of effort) was estimated for number and weight. CPUE in number was assessed for trap sampled and it was estimated in 5.27, which means that in average each trap caught 5 individuals during the 48 hours of fishing. The CPUE for total catch weight was estimated in 0.34 , meaning that in each trap caught in average 340 grams of crayfish in 48 hours. It is not possible to compare these results with previous since the fishing area was completely different from the other areas sampled so far. The pod correspond to a very small area, while the fisher reported that the catches were low, compared with previous years, and he associates the low catches with the water temperature being lower than expected for that time of the year. It would benefit the assessment to sample similar pods to allow for a comparison between them and also between other fishing areas like Orellana Lake.

CPUE estimated for each trap of the second site visit were much higher than the CPUE assessed in the pod visit, and also the CPUE assessed in the previous season; 63.9. Comparing with the data from the same area and period in 2022, there was an increase of 20 individuals in each trap. In the same way, the CPUE estimated for the total weight, 2.62, registered more than $50 \%$ increase comparing with the previous year ( 1 kg ). The fisher accompanied was the same in the year before, with the same amount of traps placed ( 200 traps), fishing during 24 hours. However there were two main differences compared with the same period the year before: the location in the Lake (see Fig. 2) and the bait used. Until now the bait used was mainly composed by raw chicken and fruits, however this year sardine replaced chicken as bait. The sardine bought in

Vigo seem to be from the Iberian southern sardine stock caught by the local Galiza purse seine fishery. However, the fishery and the stock still needs confirmation. Furthermore, it is unclear how many kg of sardine in total are used in the Orellana fishery. It is also premeditate to conclude what are the reasons behind the increase of the catches when comparing with the same period the year before. It is also important to have in mind that in 2022 fishers reported a year with very low catches.

Regarding the sex ratio of the crayfish sampled, the proportion of females were slightly higher than the males for both visits, but the size distribution were similar, showing that the population were mainly composed by adult individuals approximately 250 days of age.

Bycatch was assessed from 44 traps hauled during the two visits and it is very low. Only 1 individual of pumpkinseed, a prolific invasive species in the region, were found caught in one trap at the pod, which indicates high selectivity of the gear used.

The data provided by Alfocan included only total weight from the beginning of the operations until this date. Nevertheless, comparing the total catch data provided with the same period in the year before (2022), it is possible to observe that May and June represented the months where the highest volumes of crayfish were registered.

## 6. Conclusions and Recommendations

There are some points that can be highlighted, namely the lower proportion of bycatch. In order to fully assess the Spanish crayfish fishery, the following recommendations ought to be considered:

1. More data regarding fishers and fishing areas are required, particularly the fishing occurring in the pods in Extremadura region;
2. The engagement of fishers should be promoted to allow for fishery data to be collected;
3. The quantity and stock of sardine used as bait;
4. Historical data from government should be provided;
5. Data of crayfish collected from both companies, should be provided for comparison purposes.

[^0]:    ${ }^{1}$ http://doe.juntaex.es/pdfs/doe/2016/22000/16061720.pdf, downloaded 20/10/2021

[^1]:    2 https://www.flickr.com/photos/valter/5984861480, accessed 20/07/2022
    ${ }^{3}$ https://alchetron.com/European-pilchard, accessed 12/07/2023

[^2]:    4 ICES. 2022. Sardine (Sardina pilchardus) in divisions 8.c and 9.a (Cantabrian Sea and Atlantic Iberian waters). ICES 2022 Advice on fishing opportunities, catch, and effort. 16 December 2022.

