

PRELIMINARY RESULTS ON THE BIOLOGICAL MONITORING OF THE EUROPEAN EEL *ANGUILLA ANGUILLA* IN THE FRESHWATERS OF THE SEGURA RIVER BASIN (SOUTHEASTERN IBERIAN PENINSULA)

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INTRODUCTION

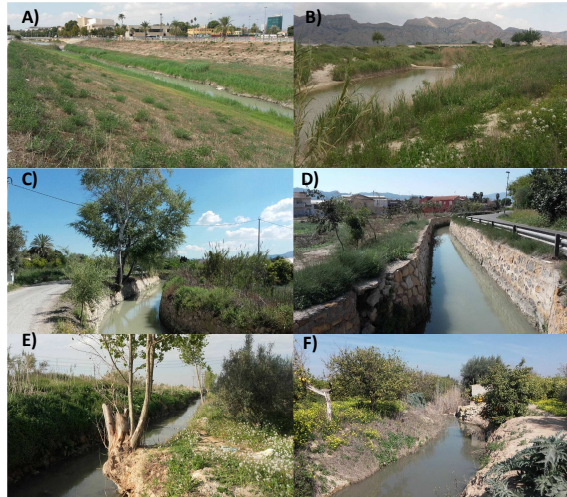
The European eel *Anguilla anguilla* is listed as *Critically Endangered* by IUCN because its populations have suffered a dramatic decline during the last decades. The critical situation of this species in Europe has forced the European Union to require its member states to develop specific management plans for the eel in each of its river basins.

In the Segura river and the irrigation network of the middle and lower basin there are historical records of the species. The eel was a very abundant species in these environments. However, due to the heavy water pollution and habitat degradation during the last decades of the XX century the eel almost completely disappeared from the basin, being located only in the lower stretches near the river mouth and in the Mar Menor coastal lagoon. The recovery of water quality parameters in recent years has allowed the eel to recolonize the main channel of the Segura as well as the irrigation channels of the Murcia orchard.

However, there is a lack of updated information regarding the distribution and population status of the species in this area, so there is an urgent need to carry out specific studies to assess their conservation status and the subsequent development of management proposals for this threatened species.

Therefore, the objective of this work is to provide updated information on the distribution and population status of the European eel in the Segura river and the irrigation network of the Murcia orchard.

STUDY AREA AND METHODOLOGY



The study area comprises a river section of the Segura river and the irrigation network of the Murcia orchard. The sampling was developed during a complete annual cycle between October 2016 and September 2017 by using fyke nets.

Three habitat types were sampled: the Segura river channel (images A & B), the irrigation channels that provide water to crop fields called *acequias* (images C & D) and the drainage channels that return water back to the river called *azarbes* (images E & F). We sampled three sampling sites per habitat type and season. We used 12-18 fyke nets per sampling site.

Captured eels were measured (± 1 cm) and weighed (± 1 g), and then returned to their habitat. In addition, the development phase (yellow or silver eel) was distinguished.



RESULTS AND CONCLUSIONS

A total of 22 sampling sites were surveyed throughout the study period, distributed as follows: 5 in the Segura river, 8 in the acequia and 9 in the azarbes habitat types. All these locations were sampled at least once. Eel was detected in 11 sampling sites (50%). In the Segura river it has been detected in 100% of the localities, while in the azarbes this percentage reaches 45% and in the acequias 38%. The maximum density value for the species was 3.6 individuals/1000 m² (acequia Aljufía).

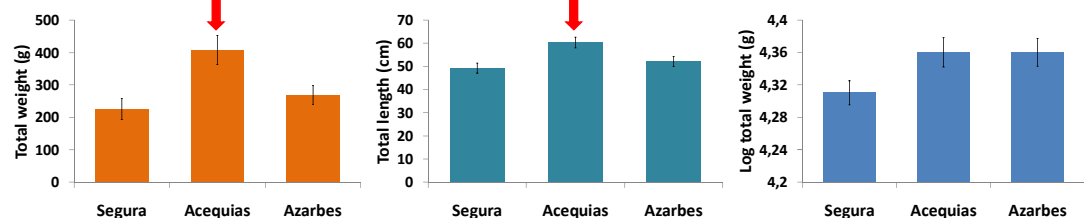
Sampling site	Habitat type	UTM X	UTM Y	Eel presence
Segura river (Gardamar)	River	705102	4218763	YES
Segura river (Beniel)	River	675224	4213911	YES
Segura river (La Fica)	River	667736	4206329	YES
Segura river (Arboleja)	River	661246	4205743	YES
Segura river (Contraparada)	River	656513	4206801	NO
Acequia Aljufía (Los Canalaos)	Acequia	659725	4206137	YES
Acequia Aljufía (Arboleja)	Acequia	668349	4208159	YES
Acequia Barreras (Héro)	Acequia	657580	4204577	NO
Acequia Barreras (Aljucer)	Acequia	661853	4202681	NO
Acequia Barreras (Toma del Junco)	Acequia	663094	4203764	YES
Acequia Arboleja (El Verdecillo)	Acequia	661883	4205513	NO
Acequia Alguazas (El Progreso)	Acequia	664805	4203128	NO
Acequia Alfatego (Guadalupe)	Acequia	659636	4206222	NO
Azarbe Mayor (Casillas)	Azarbe	668349	4208159	YES
Azarbe Mayor (Zarandona)	Azarbe	666145	4208373	YES
Azarbe Montegudo (Montegudo)	Azarbe	666430	4209301	YES
Azarbe Bollo del Norte (Alquerías)	Azarbe	672099	4208012	YES
Azarbe de Beniel (Alquerías)	Azarbe	671190	4206917	NO
Azarbe Merancho (Santomera)	Azarbe	673408	4213712	NO
Azarbe de la Sierpe (Los Dolores)	Azarbe	667696	4205402	NO
Azarbe de los Pérez (Santomera)	Azarbe	671112	4213052	NO
Azarbe Mayor (Beniel)	Azarbe	676440	4211290	NO

- Although the eel has recovered part of its original distribution area, the density of the species continues to be extremely low, so the eel population in the study area can be considered as critical conservation status

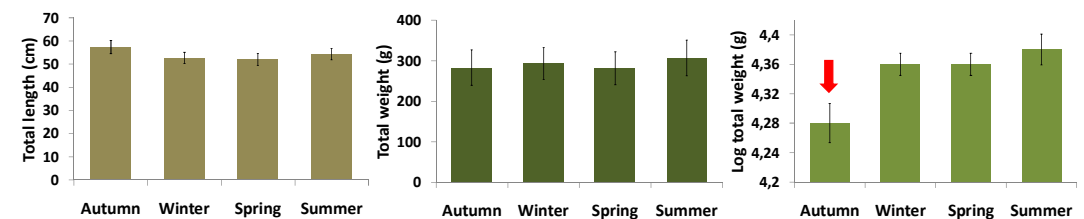
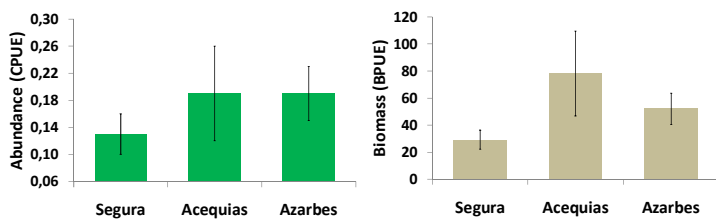
- The larger size of the eels captured in the acequias could be related to the presence of large pools that maintain water throughout the year, acting as refuge and feeding areas for the species in periods of zero or low flows

- Results suggest that the three habitat types provide similar environmental conditions for the species

- Seasonal pattern of somatic condition was similar to other Iberian freshwater populations, and was probably related to the reproductive migration that usually occurs on winter and early spring



Total weight (TW) and total length (TL) were higher in acequias than in the other two habitat types (ANOVA TW: $F = 6.85$, $P < 0.01$; ANOVA TL: $F = 6.32$, $P < 0.01$), but somatic condition did not show significant differences among habitat types (ANCOVA: $F = 2.98$, $P = 0.056$). There were no significant differences in the relative abundance and biomass among the three habitat types (ANOVA In (CPUE+1): $F = 0.34$, $P = 0.712$; ANOVA In (BPUE + 1): $F = 0.97$, $P = 0.386$).



The average total weight (TW) and total length (TL) did not show significant differences among seasons (ANOVA TW: $F = 0.06$, $P = 0.980$; ANOVA TL: $F = 0.50$, $P = 0.686$). Somatic condition was lower during autumn and reached maximum values during summer (ANCOVA: $F = 3.25$, $P < 0.05$). There were no significant differences in the relative abundance and biomass among seasons (ANOVA In (CPUE+1): $F = 1.66$, $P = 0.185$; ANOVA In (BPUE + 1): $F = 0.76$, $P = 0.523$).

