



What changes 6 years after?

The fish community of Cávado Estuary (NW Portugal)

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INTRODUCTION

The Cávado estuary acts as a nursery for several fish species, some of them important as commercial species (e.g. eel and lamprey), and others as part of the food web ^(1,2). The knowledge of estuarine biodiversity and its dynamics is an important tool for the proper management of these resources and their habitat, which is included in the Natural Park of the North Coast and is a source of income for the local fisherman (Figure 1). The knowledge about this system is limited and regular monitoring programs should be implemented to follow evolution over time. Our team studied this estuary in 2003/2004 and in the absence of a proper monitorization, we decided to compare old data with new data.



Figure 1 – Cávado Estuary (NW Portugal).

AIM

- Find what changes in ichthyofauna abundance, biomass and diversity appeared (or not) after 6 years.

METHODS

The fish community of Cávado estuary was followed in one sampling station (Figure 2), in 2003/2004 and six years later, 2009/2010. The ichthyofauna was collected by a small beach seine, 10 mm mesh size. The sampling effort consists in 2 throw of the net, for a 10 meter path.



Figure 2 – Location of Sampling Station (SS) at Cávado Estuary (NW Portugal).

In laboratory the fishes were identified to the lowest taxonomic level. All the individuals were measured and weighted. Diversity indices and species richness have been determined with application of the software PRIMER 5 ⁽³⁾. Two-tailed t-test, assuming unequal variances (heteroscedastic), was used to evaluate abundance, biomass and diversity differences between sampling sets.

RESULTS AND DISCUSSION

In 2003/2004 we found 62 individuals per sampling effort distributed by 19 taxa and in 2009/2010 we found 139 individuals per sampling effort distributed by 17 taxa (Table 1). During the first sampling period *Pomatoschistus microps* dominated in abundance with 74% of total gathered followed by *Atherina boyeri* (8%) and *Liza aurata* (5%). In second sampling period *A. boyeri* dominated (45%), followed by *L. aurata* (25%) and *P. microps* (19%). In what respects the biomass, *P. microps* dominated (38%), followed by *A. boyeri* (18%) and *Gobius niger* (12%) in 2003/2004. Six years later *A. boyeri* dominated (39%) followed by *L. aurata* (31%) and *Platichthys flesus* (12%). After 6 years, the abundance per sampling effort for *A. boyeri* and *L. aurata* increased 9 – 63 and 6 – 34 respectively and for *Pomatoschistus microps* decreased 87 – 27 (Figure 3). Samples of 2003/2004 and 2009/2010 are not significantly different for the abundance per sampling effort or biomass per sampling effort (Table 2) considering all species together.

Table 1 – List of fish species identified for the Cávado estuary in each study period of and their abundances and biomass.

	Abundance		Biomass	
	(ind./samp. effort)		(g/samp. effort)	
<i>Anguilla anguilla</i> (Linnaeus, 1758)	03/04	09/10	03/04	09/10
<i>Atherina boyeri</i> (Risso, 1810)	1.0	0.7	0.100	0.026
<i>Atherina presbyter</i> (Cuvier, 1829)	9.3	63.4	0.930	2.263
<i>Callionymus lyra</i> (Linnaeus, 1758)	2.1	1.5	0.210	0.054
<i>Chelidonichthys lucerna</i> (Linnaeus, 1758)	0.1		0.010	
<i>Chelon labrosus</i> (Risso, 1827)	0.2		0.020	
<i>Ciliata mustela</i> (Linnaeus, 1758)		0.1		0.003
<i>Dicentrarchus labrax</i> (Linnaeus, 1758)		1.6		0.057
<i>Diplodus sargus</i> (Linnaeus, 1758)	0.3	0.8	0.030	0.027
<i>Diplodus vulgaris</i> (Geoffroy Saint-Hilaire, 1817)		0.3		0.010
<i>Engraulis encrasicolus</i> (Linnaeus, 1758)	1.2		0.120	
<i>Gobius niger</i> (Linnaeus, 1758)	0.8	0.1	0.080	0.004
<i>Gobius pagannellus</i> (Linnaeus, 1758)	1.0	1.5	0.100	0.055
<i>Labrus bergyllia</i> (Ascanius, 1767)		0.2		0.006
<i>Liza aurata</i> (Risso, 1810)	6.1	34.5	0.610	1.231
<i>Liza ramadei</i> (Risso, 1827)	0.1	6.8	0.010	0.242
<i>Nerophis ophidion</i> (Linnaeus, 1758)				
<i>Platichthys flesus</i> (Linnaeus, 1758)	0.1	0.3	0.010	0.009
<i>Pomatoschistus microps</i> (Kroyer, 1838)	86.5	26.6	8.650	0.950
<i>Pomatoschistus minutus</i> (Pallas, 1770)	3.9	0.8	0.390	0.027
<i>Sardina pilchardus</i> (Walbaum, 1792)	3.6		0.360	
<i>Solea solea</i> (Linnaeus, 1758)		0.0		0.001
<i>Syngnathus abaster</i> (Risso, 1827)	0.9		0.090	
<i>Syngnathus acus</i> (Linnaeus, 1758)	0.1	0.3	0.010	0.009

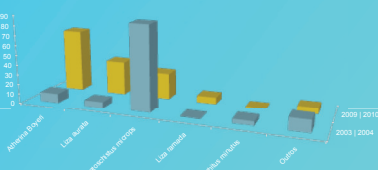


Figure 3 – Abundance per sampling effort of fish dominant species of Cávado estuary in each study period.

Grouping fish by their ecological characteristics we found an increase of abundance per sampling effort for migratory cyclical species (12 – 44) and a decrease of sedentary species (105 – 94). Migratory catadromous and occasional marine species are almost the same and occurs only in the warmer months (June to September) while the sedentary and cyclical migratory species inhabit the estuary throughout the year (Figure 4). Anadromous or occasional freshwater species were not registered during the study. 2003/2004 period is not significantly different from 2009/2010 period, in what respects to the abundance of different ecological groups (ind/sampling effort (Table 2).

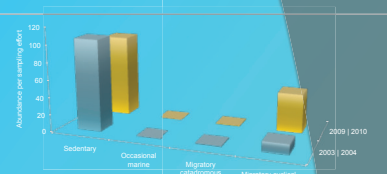


Figure 4 – Abundance per sampling effort of ecological fish groups of Cávado estuary in each study period.

The value of Shannon diversity index was 1.6 in 2003/2004 and 1.5 in 2009/2010. In the first sampling period the highest value of Shannon diversity index was recorded in June and lowest in January, 2.4 and 1.4 respectively. In the second sampling period the highest value was recorded in September, 1.8 and lowest in January, 0.5 (Figure 5). Samples of 2003/2004 and 2009/2010 are significantly different for the Shannon diversity index (Table 2).

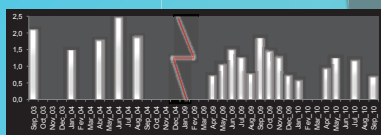


Figure 5 – Shannon diversity index per months of 2003/2004 and 2009/2010 of Cávado estuary.

Table 2 – Two-tailed t-test results of abundance per sampling effort, biomass per sampling effort, ecological groups abundance per sampling effort and Shannon diversity by sampling months.

	n	sample size	t value	t critical value (5%)	p-level	Degrees of freedom
Abundance per sampling effort	24; 24		0.193	2.014	0.848	45
Biomass per sampling effort	24; 24		1.437	2.056	0.163	26
Abundance per sampling effort by ecological groups	4; 4		0.162	2.447	0.877	6
Shannon diversity by sampling months	5; 14		4.391	2.365	0.003	7

CONCLUSION

- The fish community of Cávado estuary is stable, with minor fluctuations, that are normal in these dynamical systems.

- Atherina boyeri*, *Liza aurata* and *Pomatoschistus microps* are the dominant species.

- After 6 years, the abundance for *A. boyeri* and *L. aurata* increased and decreased for *P. microps*.

- Abundance of cyclical migratory species increased while of sedentary, migratory catadromous and occasional marine species are almost the same.

- The Shannon diversity index is almost the same six years after, despite the reduction in the number of species caught. Shannon diversity index is lower in Winter, increases in Spring and is higher in Summer.

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