

Actas

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**1º Simpósio Interdisciplinar sobre Processos
Estuarinos**

SIPRES

**1st Interdisciplinary Symposium on Estuarine
Processes**



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Resumos das comunicações apresentadas durante

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POTENTIAL FECUNDITY OF TWAITE SHAD *Alosa fallax fallax* (Pisces: Clupeidae) FROM THE UPPER ESTUARY OF RIVER MIRA (SW PORTUGAL): PRELIMINARY RESULTS

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Key words: Potential fecundity; stereological method; twaite shad; upper estuary; river Mira.

The great majority of European anadromous fishes are threatened species (Lelek, 1980). Despite the existing legal protection for migratory fishes, these are vulnerable and particularly threatened by anthropogenic impact, by physical obstacles for migrating fish and by physical impacts on spawning and nursery areas

Twaite shad, *Alosa fallax fallax* (Lacepède, 1803), is an anadromous species, and is a typical inhabitant of the Northeast Atlantic, and adjacent waters (Quignard & Douchement, 1991). It is distributed from Christiana Fjord, southwards to the Iberian Peninsula and Morocco (Quignard & Douchement, 1991).

The twaite shad, although rare or even extinct in most European river basins, still migrates into river Mira to spawn. Thus, it is important to develop conservation and management programmes that are endeavouring to halt further declines and improve their conservation status (e.g. detailed studies on the bioecology of the population, the protection of some known spawning areas)

Fecundity and sexual maturity information is a basic aspect of fish biology and population dynamics (Koslow *et al.*, 1995; Cuellar *et al.*, 1996) and is a critical parameter for management of any fishery (Hunter *et al.*, 1992).

This study presents some preliminary results on the potential fecundity of twaite shad. Comparisons were made between these fecundity estimates and those available in the literature for *Alosa* spp. These results were also related to gonad weight and body size (length and weight). The role of the upper estuary of river Mira was discussed in light of the results.

The potential fecundity of the twaite shad was estimated on 14 mature females caught with trammel nets, during April and May 1997, in the upper estuary of River Mira (Odemira, Southwest Portugal). A sample of the middle portion of the ovary was fixed in San Felice solution (36h). After dehydration in ethanol, the samples were embedded in paraffin, sectioned at 6-8 µm and stained with Masson's Trichome (Martoja & Martoja-Pierson, 1967). After staining, the slices were enclosed in DPX mounting medium, after which they were examined. The maximum diameter of each oocyte was measured, to the nearest 0.01µm, by image analysis (Image Pro Plus 3.0). An oocyte size frequency distribution (class interval: 0.05µm) was produced for the ovaries caught in each month.

The use of a stereological method for estimating fish fecundity provides numerous advantages over the volumetric, gravimetric and automated particle counter methods (Emerson *et al.*, 1990). In this study was decided to adapt the stereological method of Laird & Priede (1986) to estimate potential

fecundity of twaite shad. The relation between fecundity and gonad weight, body weight and length were estimated using simple linear regression (Zar, 1996).

The oocyte size frequency distributions showed that cell diameter ranged from 39.5 to 210 μm in pre-vitellogenic oocytes; from 240 to 900 μm in vitellogenic oocytes and from 920 to 1300 μm in mature oocytes (Fig. 1). These results indicated that oocyte development is asynchronous. Previtellogenic oocytes are present in the ovary of females caught in April and May. The asynchrony of oocyte growth suggests that females spawn more than once during a season, as described to *Alosa fallax fallax* by Hass (1968) and Le Clerc (1941).

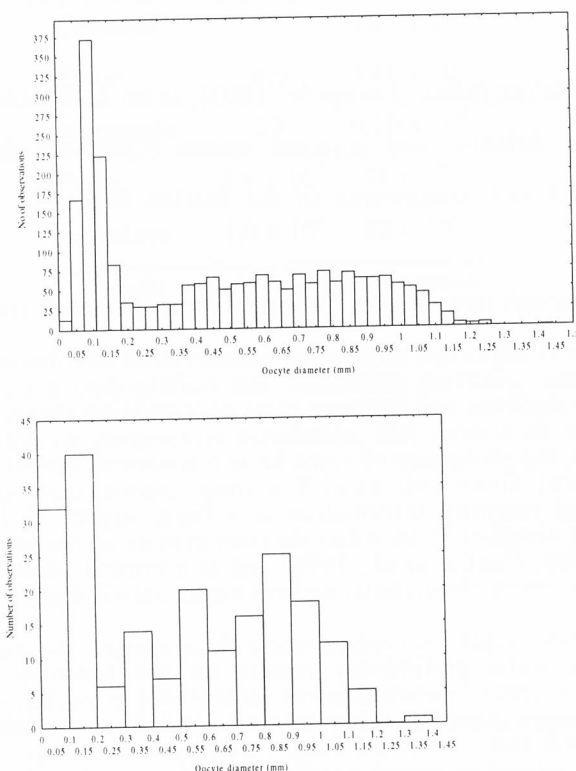


Fig. 1. Size frequency distributions of oocytes in the ovaries: a) in April (n=13); b) in May (n=1)

Fecundity estimates varied between 82746 and 263284 for twaite shads ranging in weight from 412.5 g to 584.3 g. These results were similar or slightly higher than those referred to in other studies (Manyukas, 1989; Quignard & Douchement, 1991) (Table I).

Table I - Fecundity estimates obtained for *Alosa* spp.

Species	Source	Fecundity
<i>Alosa fallax fallax</i>	this study	82746 - 263284
	Manyukas, 1989	204000 - 256000
	Quignard & Douchement, 1991	50000 - 200000
<i>Alosa fallax rhodanensis</i>	Quignard & Douchement, 1991	ca.150000
<i>Alosa fallax lacustris</i>	Quignard & Douchement, 1991	15000 - 20000
<i>Alosa fallax nilotica</i>	Quignard & Douchement, 1991	30000 - 340000
<i>Alosa sapidissima</i>	Walburg, 1960	277000-659000
	Nichols & Massmann, 1963	169000 - 436000
<i>Alosa pseudoharengus</i>	Jessop, 1993	ca.150000
<i>Alosa aestivalis</i>	Jessop, 1993	ca.180000

Fecundity was positively correlated with gonad weight ($Y= 1073.36 + 4057.55X$; $r^2 = 0.84$; $p<0.05$) (Fig. 2.). However there was no significant correlation between fecundity and both body weight or length ($p>0.05$) (Fig. 3.). This could have been due to the reduced number of females sampled. Nevertheless, these results agree with Vukovic (1961 in Quignard & Douchement, 1991), who stated that, in *Alosa fallax nilotica*, fecundity is independent of the weight of the female. On the other hand, Walburg (1960) and Nichols & Massmann (1963) found positive correlations between fecundity and both body weight or length, for *Alosa sapidissima*.

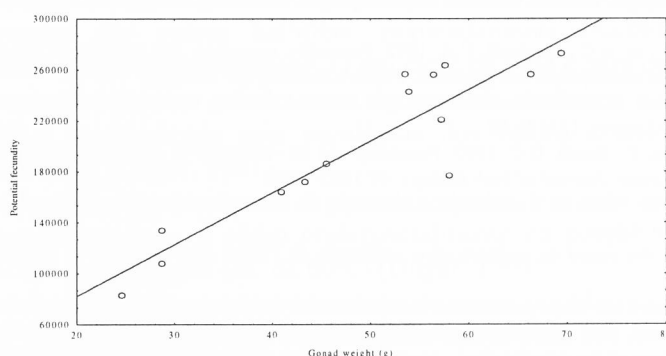


Fig. 2. Relation between potential fecundity and gonad weight ($Y=1073.36 + 4057.55X$; $r^2 = 0.84$; $p<0.05$).

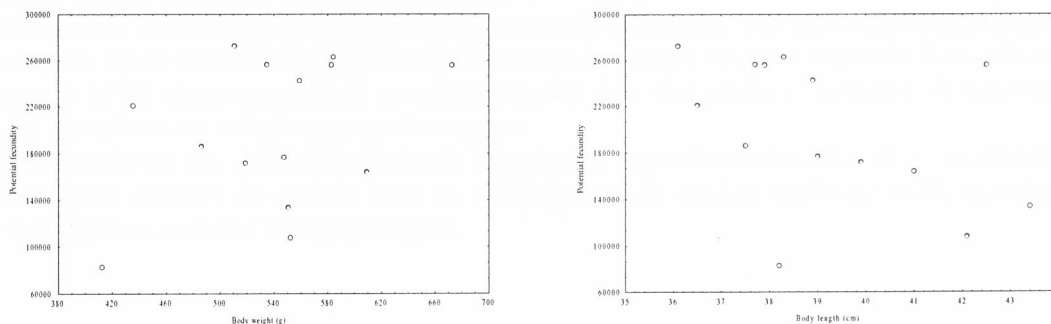


Fig. 3. Relation between potential fecundity and both body weight and length.

This study showed that the upper estuary of river Mira is a spawning area for *A. fallax fallax*. Considering the threatened status of this species, special care must be taken with this ecosystem. Thus, anthropogenic action that is direct cause of mortality of both adult and larvae (pollution, dredging, dams,

artificial embankments, extraction of gravel or block stones from the river bed, modifications in water flow) should be controlled.

At the species biology level, more information on the number of batches spawned is essential to understand the spawning dynamics. Our future research will address a special attention to this problem, since the delineation of spawning frequency is essential to accurate fecundity estimates. More representative samples will clarify some the relationships referred to in this study. Walburg (1960) and Manyukas (1989) found a significant relationship between age and fecundity. This will be a key subject in our short term research. It may then be possible to group and classify twaite shad populations according to their fecundity, because this and the number of female spawners are ultimately the most important factors determining recruitment to a population.

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