

Actas

Proceedings

**1º Simpósio Interdisciplinar sobre Processos
Estuarinos**

SIPRES

**1st Interdisciplinary Symposium on Estuarine
Processes**



Universidade do Algarve

**Faro
1998**

Resumos das comunicações apresentadas durante

**1º Simpósio Interdisciplinar sobre Processos
Estuarinos**

Faro, 15 - 17 de Junho de 1998

SIPRES

Abstracts of posters presented during

**1st Interdisciplinary Symposium on Estuarine
Processes**

Faro, 15 - 17 June, 1998

ÍNDICE

TEMA 1 - PROCESSOS BIOLÓGICOS / BIOLOGICAL PROCESSES

Dynamics Of Green Algae And Its Associated Fauna In The Ria Formosa: Is Herbivory Important? J. Aníbal & M. Sprung.....	1
Relationship Between Bacterio- And Phytoplankton During Spring Bloom And Post Bloom Conditions In The Guadiana Estuary A. Barbosa, H. Galvão, J. Kuparinen, C. Rocha & M. P. Reis.....	3
Reponses Biologiques Du Mesozooplancton Au Potentiel Nutritif Des Particules En Milieu Estuarien : Cas D' <i>Acartia bifilosa</i> . D. Burdloff, S. Gasparini, F. Villate, H. Etcheber et J. Castel.....	6
A 7 Years Record Of Primary Productivity In Tall And Short Populations Of <i>Spartina maritima</i> E. M. Castellanos, C. J. Luque, J. M. Castillo, J. J. Nieva & M. E. Figueroa.....	10
<i>Spartina maritima</i> Contribution To The Nitrogen Cycle In The Mondego Estuary (Portugal) P. Castro & M. H. Freitas.....	11
Primeros Datos Sobre La Interacción Hombre-Aves En Áreas Intermareales Estuarinas Del Suroeste De La Península Ibérica. D. Cuenca & F. Hortas.....	12
Diel Variation Of Fish Eggs And Larvae Abundance In Two Portuguese Estuaries (Rivers Mira And Guadiana) E. Esteves, M. L. Coelho, T. Pina & J. P. Andrade.....	16
Produção Da Macrofauna Bentónica De Reservatórios De Água De Salinas E De Uma Piscicultura Da Ria Formosa (Portugal) S. Gamito, K. Lock & A. Pires.....	20
Evolución De La Salinidad-Temperatura En La Ria Carreras (Huelva-España) C. Jiménez, J.A. López, M. Pacheco & J.L. Vicente.....	21
Dados Preliminares Da Produtividade Primária E Variabilidade Espacial Da Biomassa Microfitobêntica Na Zona Intertidal Do Sector Inferior Do Estuário Do Rio Douro. C. Magalhães, A. A. Bordalo. & W. Wiebe	23
Longitudinal Distribution Of Plankton Community In The Guadiana Estuary During Late-Spring. C. Miguel, I. Gouveia, M ^o H. Marques, M ^a A. Chícharo & L. M Chícharo.....	26
Dinâmica Zoobentónica No Estuário Do Rio Douro - Relação Com Gradientes De Contaminação A. P. Mucha, A. A. Bordalo & T. V. Vasconcelos	30
Potential Fecundity Of Twaité Shad <i>Alosa fallax fallax</i> (Pisces: Clupeidae) From The Upper Estuary Of River Mira (Sw Portugal): Preliminary Results T. Pina, M. L. Coelho, E. Esteves & J. P. Andrade.....	33
Aspectos Da Relação Na ⁺ /K ⁺ Em <i>Salicornia ramosissima</i> Da Ria De Aveiro M ^a H. Silva, M ^a H Freitas & G. Caldeira.....	37
Seasonal Dynamics Of The Shore Crab <i>Carcinus maenas</i> In The Ria Formosa M. Sprung.....	40
Abundância De Vírus Na Ria De Aveiro: Factores De Variação M ^a A. Almeida, M ^a A. Cunha & F. Alcântara.....	43

DIEL VARIATION OF FISH EGGS AND LARVAE ABUNDANCE IN TWO PORTUGUESE ESTUARIES (RIVERS MIRA AND GUADIANA)

Esteves, E.; Coelho, M.L.; Pina, T. & Andrade, J.P.
UCTRA - Universidade Algarve, Campus de Gambelas, 8000 Faro, Portugal

Key Words: diel variation, relative abundance, fish larvae, eggs, river Mira, river Guadiana

The importance of estuaries as fish nursery areas has been well documented. Several studies have indicated that a variety of factors, both abiotic and biotic, influence the distribution of fish species in an estuary (Robinson & Bain, 1989). In addition, it is generally accepted that a combination of larval behaviour and oceanography is critical either for the retention or the transport of young invertebrates and fish out of and back into these areas.

In the Guadiana river this subject has been addressed by Chicharo (1988) and Chicharo *et al.* (1998). The former author examined the abundance, occurrence and distribution, both spatial and daily, of ichthyoplankton, and stressed the importance of the Guadiana estuary as a nursery ground for *Engraulis encrasicolus* larvae. The latter studied the differences between the diel variation of mesozooplanktonic organisms in two sites, one at the mouth of the estuary and the other near the estuarine turbidity maximum. In river Mira, Ré & Gonçalves (1993) studied the temporal variation of *E. encrasicolus* larvae over a period of eight years (1985-1992). Paula (1993) investigated the ecology of larval decapods in the estuary. Recently, Costa *et al.* (1994) discussed the potential as a nursery area for fish species.

In this paper, the relative abundance and diel patterns in the distribution of fish eggs and larvae, and their relation to other mesozooplankters, were examined and compared in the estuaries of rivers Mira (SW Portuguese coast) and Guadiana (SE Portugal).

A total of 13 samples were taken every two hours in each estuary (Vila Nova Milfontes, river Mira, July 17, 1997, and Vila Real Sto. António, river Guadiana, June 30, 1997) with a conical 0.5 mm mesh zooplankton net (0.37 m x 1.60 m), equipped with a flowmeter. Plankton hauls were made 1 m below the surface for 10 min. at low speed (≤ 3 knots). Samples were fixed and stored in buffered 4% formalin solution. Temperature, salinity and Secchi-disk depth (during daylight) were determined.

In the laboratory, fish eggs, larvae, and zooplankters were identified, counted and their abundance ($\text{ind.}100\text{m}^{-3}$) calculated. Data concerning fish larvae was analysed at the family level to reduce inaccuracy from misidentifications and to accommodate poor representation of some species. Fish eggs were not identified further. Other zooplankters were identified to the lowest *taxon* possible. Excessively abundant samples were sub-sampled using a Folsom-splitter. Diversity and similarity were assessed by using Shannon-Wiener's index (H') and Morisita's similarity index ($C\lambda$), respectively (Omori & Ikeda, 1992). Abundance distributions of fish eggs and larvae were compared with other zooplankter's (>1% total abundance) using Spearman Rank Correlation Coefficients (Zar, 1996). Diel abundance

distributions (of fish eggs and larvae, and other relevant zooplankters) were compared between estuaries using Chi-square Tests (Zar, 1996).

Mean abiotic parameters were slightly different between the two estuaries. Lower values for both salinity and turbidity were found in river Mira, whilst higher values were obtained for temperature. The total abundance of zooplankters was much higher in river Mira (156848 ind.100m⁻³) than in river Guadiana (24461 ind.100m⁻³). Decapods (nauplii and zoea) were very abundant in both rivers (>26.5% and 39.5%, in river Mira and Guadiana respectively), followed by cladocerans (12.6%) and fish eggs (47.2%) in river Guadiana, and copepods (20.1%) and taliaceans (14.1%) in river Mira. Isopods, amphipods, mysids, larvaceans and siphonophors represented less than 10% of zooplankters total abundance. Fish larvae represented less than 2% and 0.4% in river Guadiana and river Mira, respectively. Gobiidae were the most abundant fish larvae in both rivers (57.0% and 33.8% of total larvae in river Guadiana and Mira respectively) followed by clupeids (9.2%) and atherinids (7.4%) in river Guadiana, and clupeids (18.0%), labrids (17.0%) and sparids (10.2%) in river Mira. (Figure 1). Those differences were reflected in the diversity indexes as well as in the comparison between estuaries. Higher value for the Shannon-Wiener index was calculated from samples taken in river Mira (H'=1.88) than in river Guadiana (H'=1.72). Zooplankton communities were relatively dissimilar (Cλ=0.355) between estuaries.

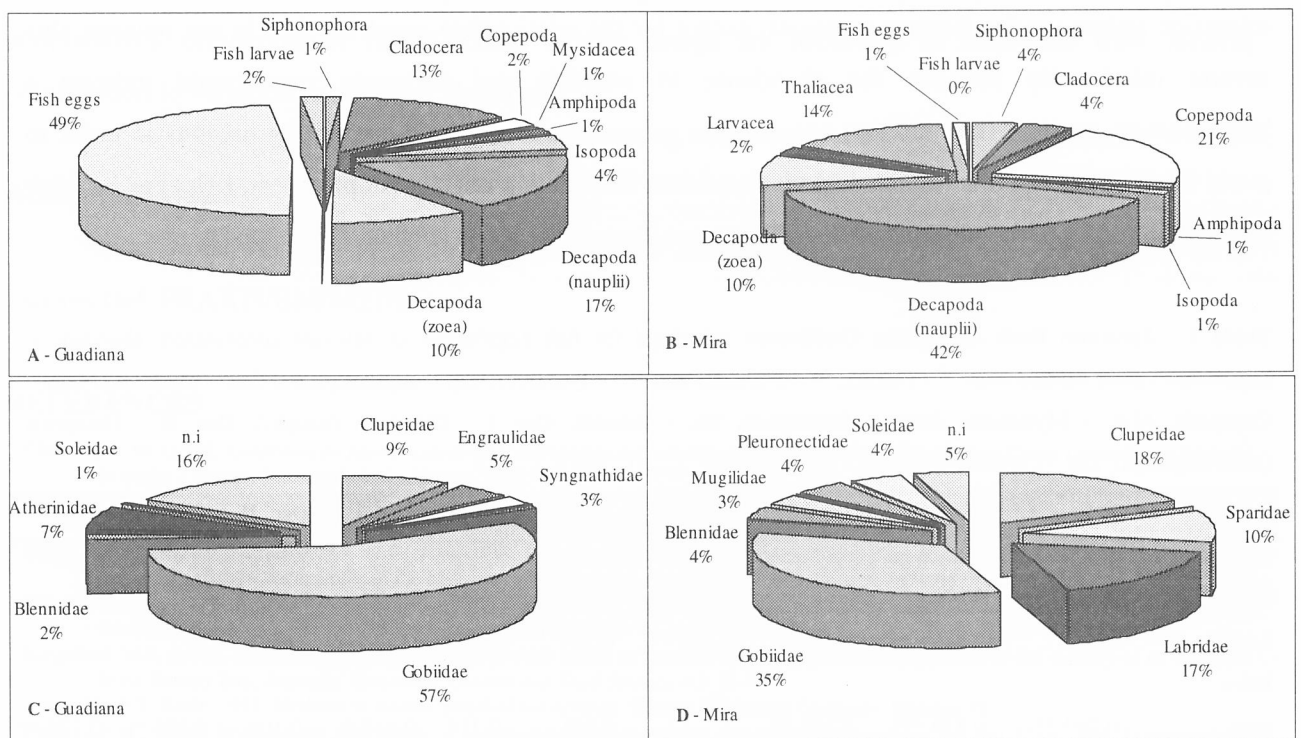


Figure 1 - Relative abundance of zooplankters in rivers Guadiana (A, C) and Mira (B, D) estuaries (A and B refer to total zooplankters; C and D refer to fish larvae alone).

In river Guadiana, relevant zooplankters and fish eggs/larvae were more abundant during ebb-tide, whereas in river Mira the opposite occurred. Moreover, in river Mira fish eggs/larvae abundance

decreased during ebb-tide and increased during flood-tide. A related trend, although displaced in time, could be depicted in the copepods, nauplii and thaliaceans distributions. The zooplankters distribution in river Guadiana was irregular and no consistent pattern could be distinguished. This tide-related trend in ichthyoplankton abundance is not uncommon and has been considered as an important factor in determining species composition and relative abundance in estuaries (Kingsford & Suthers 1994, 1996). Abundance of zooplankters was higher during the night in both estuaries (plus 31% and 43% in rivers Guadiana and Mira, respectively). This results might be related to lower gear avoidance and/or light-driven vertical migrations.

Abundance distributions of fish eggs seem associated with siphonophors, cladocerans and copepods in both rivers. In addition, fish eggs are associated with nauplii, larvaceans and thaliaceans in river Mira. Abundance of pooled fish larvae was significantly correlated with mysids in river Guadiana while in river Mira it was associated with siphonophors, copepods, amphipods and larvaceans (Table 1). At the family level, these correlations were significant between gobiids/mysids ($R=0.701$, $P<0.05$) and zoea/clupeids ($R=-0.653$, $P<0.05$) in the river Guadiana. In river Mira, significant correlations were also found between clupeids/copepods ($R=0.592$, $P<0.05$), gobiids/copepods ($R=0.667$, $P<0.05$), gobiids/amphipods ($R=0.784$, $P<0.01$), soleids/copepods ($R=0.691$, $P<0.01$) and sparids/amphipods ($R=0.718$, $P<0.01$). Generally, these associations might be related to a particular pattern of vertical migration and/or similar feeding strategies, except for the relationship zoea/clupeids. In our opinion, this inverse relationship between the abundance of clupeids and decapods *zoea* might indicate a 'displacement strategy', i.e. this two zooplankton groups search for non-conflicting habitats in order to avoid (feeding) competition. In conclusion, abundance distribution of total zooplankters, fish eggs and fish larvae were different between estuaries (Chi-square Tests, $P<0.0001$) (Figure 2).

Table 1 - Spearman Rank Correlation Coefficients calculated for fish eggs/larvae vs. relevant zooplankters abundances. Significant values marked with: * - $P<0.05$; ** - $P<0.001$; and *** - $P<0.0001$. Sip. - Siphonophora, Cla. - Cladocera, Cop. - Copepoda, Mys. - Mysidacea, Amp. - Amphipoda, Iso. - Isopoda, Dec. I - Decapoda (nauplii), Dec. II - Decapoda (zoea/megalopa), Lar. - Larvacea, and Tha. - Thaliacea; $n_{(Guadiana)}=12$ and $n_{(Mira)}=13$.

	Sip.	Cla.	Cop.	Mys.	Amp.	Iso.	Dec. I	Dec. II	Lar.	Tha.
Guadiana										
Eggs	0.928 ***	0.874 ***	0.683 *	0.276	0.190	0.193	0.486	0.594		
Larvae	-0.021	0.289	0.155	0.708 **	0.147	0.191	0.546	-0.261		
Mira										
eggs	0.769 **	0.829 ***	0.687 **		0.201	-0.214	0.648 *	-0.109	0.676 *	0.775 **
larvae	0.465 **	0.603	0.688 *		0.645 *	0.140	0.509	-0.159	0.597 *	0.537

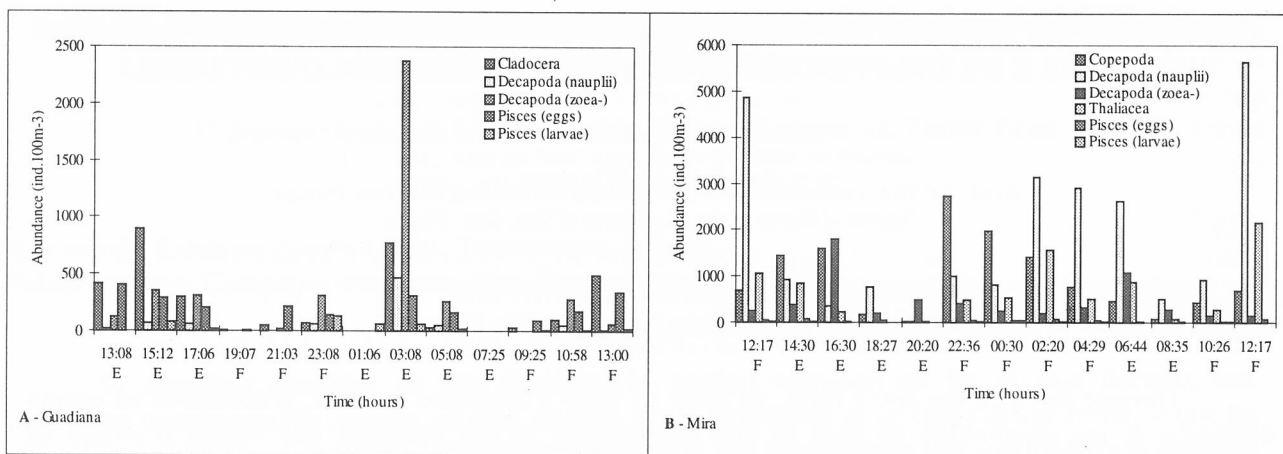


Figure 2 - Abundance distribution of relevant zooplankters, fish eggs and larvae, over 24h. periods in rivers Guadiana (A) and Mira (B) estuaries (E - ebb-tide, F - flood-tide).

Differences in the abundance of ichthyoplankton abundance and species composition were found between estuaries. Physical differences between estuaries might explain our findings. The higher abundance of fish larvae during the night may be influenced by the vertical distribution of their preferred prey, or a combination of factors associated with light avoidance.

Because of the multiple, physical and biological factors that influence patterns of ichthy- and zooplankters, orthogonal or mixed model sample design are necessary to determine their relative contribution to variation in plankton abundance.

Acknowledgements

This work was funded by Programa PRAXIS XXI (ref. 3/3.2/CA/1981/95) and a grant to E. Esteves (ref. PRAXIS/BM/8427/96).

REFERENCES

- Chicharo, L.M. (1988) *Contribuição para o estudo do ichtioplâncton no estuário do Guadiana*. Relatório Estágio Curso Licenciatura Biologia Marinha e Pescas, Universidade do Algarve, Faro, 75 p.
- Chicharo, L.M.; Chicharo, M.A.; Marques, H.; Gouveia, I.; Barros, P.; Esteves, E.; Barbosa, A. & H. Galvão, 1998. Diel and tidal variation of mesozooplankton in the Guadiana estuary (South Portugal). *Eos, Transactions, American Geophysical Union*, 59(1), Suppl.: OS24
- Costa, M.J.; Costa, J.L.; Almeida, P.R. & C. Assis, 1994. Do eel grass beds and salt marsh borders act as preferential nurseries and spawning grounds for fish? - An example of the Mira estuary in Portugal. *Ecological Engineering*, 3: 187-195
- Kingsford, M.J. & I.M. Suthers, 1994. Dynamic estuarine plumes and fronts: importance to small fish and plankton in coastal waters of NSW, Australia. *Estuarine, Coastal and Shelf Science*, 14: 655-672
- Kingsford, M.J. & I.M. Suthers, 1996. The influence of tidal phase on patterns of ichthyoplankton abundance in the vicinity of an estuarine front, Botany Bay, Australia. *Estuarine, Coastal and Shelf Science*, 43: 33-54
- Omori M. & T. Ikeda, 1992. *Methods in marine zooplankton ecology*. Krieger Publishing Company, Malabar FL.
- Paula, J.P.M., 1993. *Ecologia da fase larvar e recrutamento de crustáceos decápodes no estuários do Rio Mira*. Tese Doutorado, Faculdade Ciências Universidade Lisboa, Lisboa, 282 p.
- Ré, P. & E. Gonçalves, 1993. Ecologia da fase planctónica da anchova (*Engraulis encrasicolus*) no estuário do Rio Mira. Resultados de 8 anos de estudo. *Boletim UCA*, 1: 527-542
- Robinson, C.L. & M.B. Bain, 1989. Determinants of estuarine nursery habitat for fish. Pp. 997-1010 In Magoon, O.T.; Converse, H.; Miner, D.; Tobin, L.T. & D. Clark (eds.) Coastal Zone '89. Volume 2. *Proceedings of the Sixth Symposium on Coastal and Ocean Management*, Charleston SC, 4978 p.
- Zar, J.H., 1996. *Biostatistical analysis*. Third edition, Prentice Hall International Inc., U.S.A., 662 p.