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Modelling the variation in larval dispersal of estuarine and coastal ghost shrimp: *Upogebia* congeners in the Gulf of Cadiz

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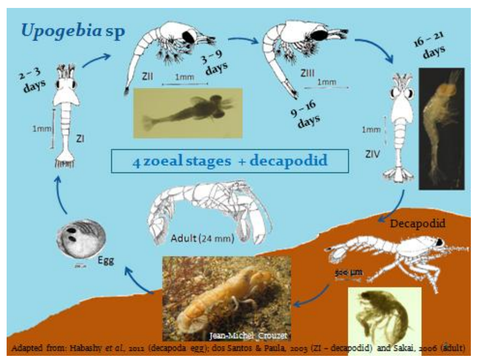
Introduction



Upogebia pusilla and *U. deltaura* (ghost shrimps), occupy different habitats in European coasts: estuaries and shelf areas, respectively. They present a short planktonic larval phase (3 weeks; 4 zoeal stages and 1 decapodid) and the adults construct burrows on sandy/muddy substrates.

Upogebia studies in the Gulf of Cadiz do not address the influence of oceanographic features on their dispersal and recruitment to parental populations.

Methods

Sampling was performed along the northwestern Gulf of Cadiz (August 2010) using Bongo nets and a LHPR sampler to study the vertical and spatial distribution of larvae.

Samples were preserved, biovolumes were determined and *Upogebia* larvae were identified and staged. The larval numbers were standardised to individuals per 10 m^3.

The modelling consisted on Lagrangian experiments conducted with Ichthyop running over a ROMS 3D realistic long term high resolution simulation for the Gulf of Cadiz-Alboran Sea sub-basin.

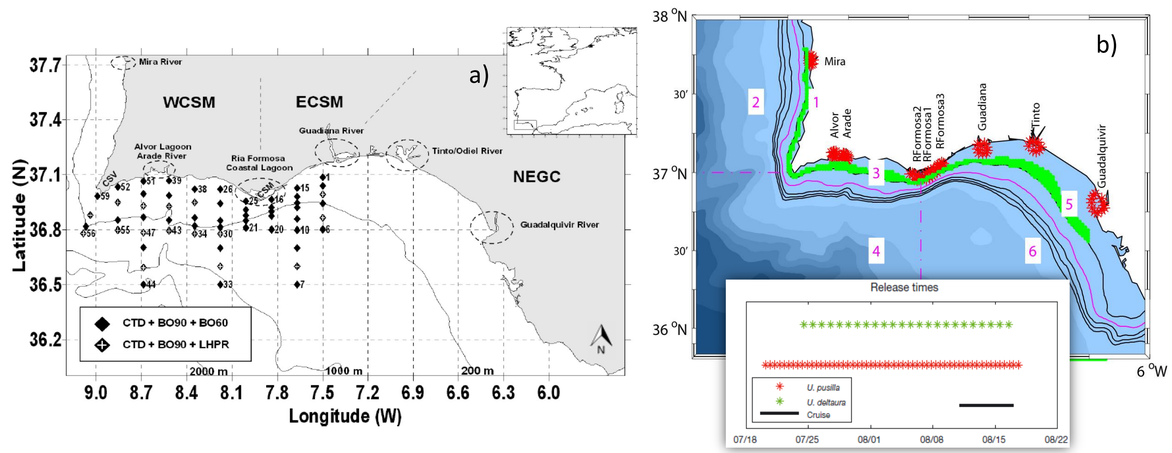


Fig. 1 –a) SW Coast of Portugal and Gulf of Cadiz showing the sampling sites. b) Release areas and timeline of particle release experiments (red – *Upogebia pusilla*, green – *U. deltaura*)

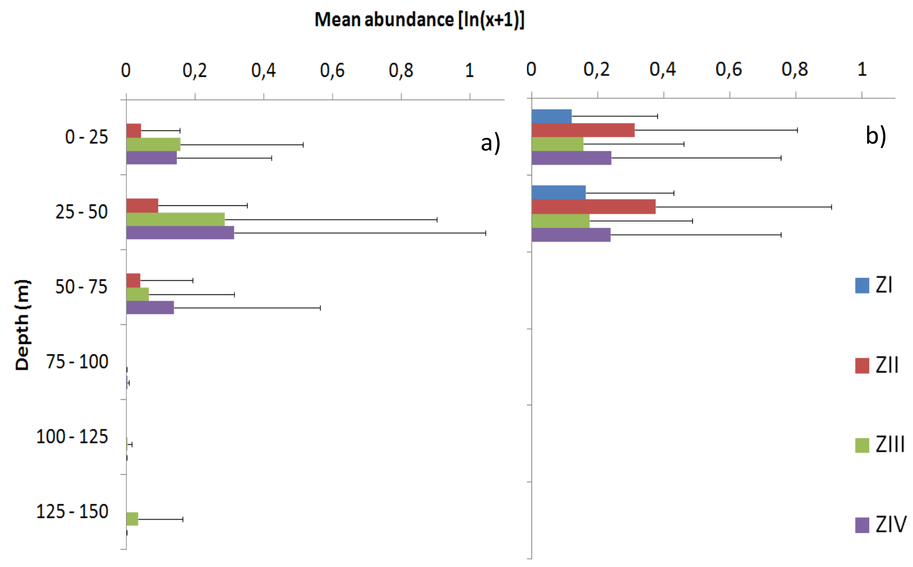


Fig. 2 – Mean± SD of vertical abundances (ln [x + 1] where x = ind. 10 m^3) of all zoeal stages of *U. pusilla* (a) and *U. deltaura* (b).

Results & Discussion

- Different strategies of larval exportation: *U. pusilla* exported from estuarine areas, *U. deltaura* highly dispersed in the innershelf in relation to the natal sites;
- Occurrence at deeper layers assure a nearshore retention → slower dispersal rates *(U. pusilla);*
- Occurrence at surface layers and distant from coast → higher cross-shore and alongshore dispersal (*U. deltaura*)*;*
- Reduction of cross-shore transport → alongshore drift and vertical migrations reduce cross-shore movements favouring a nearshore retention;
- The cyclonic circulation and a wider shelf promote a high cross-shore transport
- *U. deltaura* last zoeal stages probably swept off the shelf by upwelling events → higher offshore dispersal, establishment of barriers to the alongshore transport (e.g. CSV).

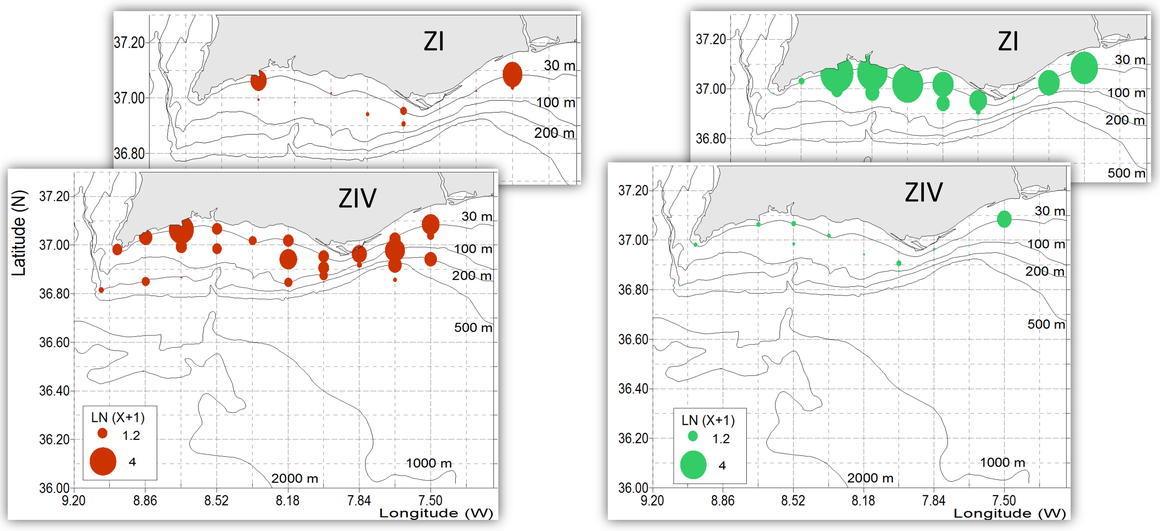


Fig. 3 – Bongo 60 data. Abundances (ln [x + 1] where x = ind. 10 m−3) of ZI and ZIV stages for *U. pusilla* (Red,) and *U. deltaura* (Green).

(a)	A1	A2	A3	A4	A5	A6
A1	92.7157	6.8558	0.0434	0.3742	0	0.0108
A2	X	X	X	X	X	X
A3	0.1097	0.0084	88.9373	1.3529	7.9011	1.6905
A4	X	X	X	X	X	X
A5	0	0	0.2102	0.0006	99.3731	0.4161
A6	X	X	X	X	X	X
(b)	A1	A2	A3	A4	A5	A6
A1	82.1100	14.5130	2.3584	1.0187	0	0
A2	X	X	X	X	X	X
A3	3.4051	0.0909	80.5482	7.4116	7.0130	1.5313
A4	X	X	X	X	X	X
A5	0	0	0.9423	0	93.2419	5.8158
A6	X	X	X	X	X	X

Fig. 4 – Connectivity between shelf areas (A1−A6) (% of particles emitted in one area that arrive at another or remain retained; X = areas where no particles were emitted) for (a) *U. pusilla* and (b) *U. deltaura*.

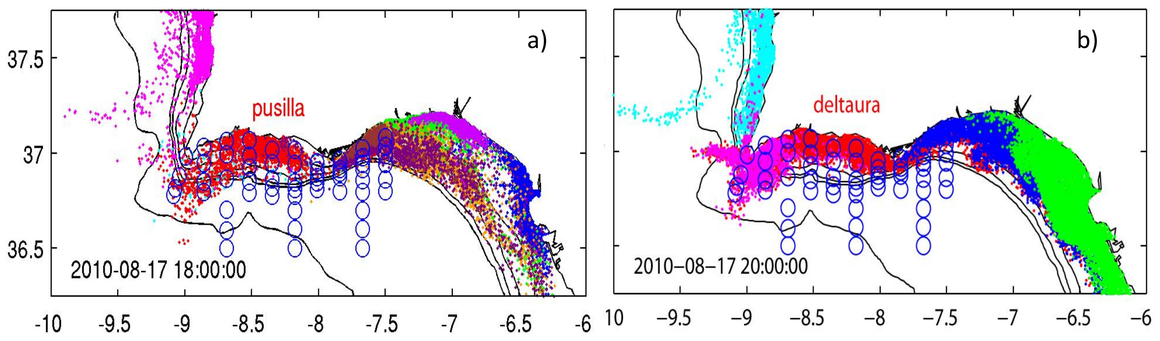


Fig. 5 – Snapshots of the simulated dispersal at the end of the survey for a) *Upogebia pusilla* and b) *Upogebia deltaura*.

Conclusion

- Simulations represent the main features of the observed distributions;
- Application to larvae of other marine invertebrate organisms of coastal areas with short planktonic life → dispersal prediction;
- Reference for future work about climatic change and the effects on larval dispersal and recruitment of coastal benthic populations.

References

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