



Scientific Note

Record of coastal colonization of the Lepadid goose barnacle *Lepas anatifera* Linnaeus, 1758 (Crustacea: Cirripedia) at Arraial do Cabo, RJ

LUIS FELIPE SKINNER¹ & DANIELLE FERNANDES BARBOZA^{1,2}

¹Universidade do Estado do Rio de Janeiro (UERJ), Laboratório de Ecologia e Dinâmica Bêntica Marinha, São Gonçalo, Rio de Janeiro. Rua Francisco Portela 1470, Patronato, São Gonçalo, RJ. 24435-005.

²Bolsista PROATEC, UERJ. E-mail: Lskinner@uerj.br

Abstract. In this note we record the occurrence of *Lepas anatifera* (Cirripedia) on the hull of a coastal supply boat that operates only in restricted inshore waters of Arraial do Cabo. This species is usually found on tropical and subtropical oceanic waters and, at region, could be classified as transient species.

Key words: marine fouling, barnacle, recruitment, inshore transport, species distribution, Cabo Frio upwelling

Resumo. Registro de colonização costeira da craca pedunculada *Lepas anatifera* Linnaeus, 1758 (Crustacea: Cirripedia) na costa de Arraial do Cabo, RJ. Nesta nota nós registramos a ocorrência de *Lepas anatifera* (Cirripedia) no casco de uma pequena embarcação que opera exclusivamente em águas costeiras de Arraial do Cabo. Esta espécie é típica de águas oceânicas de regiões tropicais e subtropicais e pode ser classificada como transiente na região.

Palavras chave: incrustação marinha, craca, recrutamento, transporte costeiro, distribuição de espécies, ressurgência de Cabo Frio

Lepas anatifera Linnaeus, 1758 (Fig. 1) is a pedunculate goose barnacle with cosmopolitan distribution (Young 1990, 1998). They are found mainly on oceanic waters from tropical and subtropical regions attached to many kinds of natural substrates like algae (Hobday 2000, Hinojosa *et al.* 2006), driftwood (O'Riordan 1967, Cowles 2005), marine vertebrates like sea turtles, crocodile and fishes (Frick *et al.* 2003, Barreiros & Teves 2005, Cupul-Magaña *et al.* 2011) and on artificial substrates like ships and platforms (Ferreira *et al.* 2006, Farrapeira 2010) or on floating debris like wood, plastics, glass, aluminum, among others (Farrapeira 2011). In many places, is usual that inshore currents transport them to coastal areas (Farrapeira 2010, Young 1990, Hinojosa *et al.* 2011, Whitehead *et al.* 2011). Whitehead *et al.* (2011) investigated the specificity of substrate selection by *L. anatifera* and found higher attachment to plastic debris but related to its prevalence on marine waters

and not by larval preference.

At Cabo Frio region is frequent to find many individuals that arrived to the coast on floating debris. This happens mainly during the prevalence of S-SW inshore winds and inshore currents (L. F. Skinner pers. obs). However, its continuous presence on fixed (rocky shore, pillars, breakwater) or floating coastal structures (navigation buoys, boats and shell farm buoys) was never been recorded. Records on region include structures moved inshore like platforms and large vessels (Ferreira *et al.* 2006).

The aim of this note is to report the record of one individual of *L. anatifera* found attached on the hull of a supply boat from Brazilian navy that operates exclusively inside Anjos bay (22°58'40.35"S/ 41°59'56.75"W). The operational range of the boat is inside Anjos Bay, mainly from fisherman marina to Cabo Frio Island, circa 4.0 km distant. This means that *L. anatifera* larvae have

settled inshore.

This record was performed in November 08 2012 and the only one individual of *L. anatifera* was removed manually from the boat hull and fixed in 95% alcohol. It was identified based on the description by Young (1990) and Hinojosa *et al.* (2011). The specimen collected was deposited in the Marine Invertebrate Collection of Departamento de Ciências of the Universidade do Estado do Rio de Janeiro (UERJ). The individual collected (Fig. 1) is 39mm long. Pedunculum size is 13 mm length by 7mm wide; capitulum size is 26mm long and 17mm wide. De Wolf (2008) had recorded a very large individual at Dutch coast, reaching capitulum length of 72mm, the higher described size for this species.



Figure 1. The goose barnacle *Lepa anatifera* collected at Arraial do Cabo, Rio de Janeiro

The hydrological conditions at Cabo Frio region are strongly influenced by winds that determine the distribution of water masses. During

the prevalence of winds from ENE quadrant, the upwelling of the South Atlantic Central Water (SACW) can be registered (Valentin *et al.* 1987). But during the influence of S-SW winds, tropical waters from Brazilian Current Water (BCW) moves inshore (Valentin *et al.* 1987). Tropical waters are characterized by temperatures higher than 20°C and salinities higher than 36. Mix of tropical and coastal waters is characterized by salinities lower than 36 and higher than 35.4 (Pereira *et al.* 2009).

Lepas anatifera individuals usually settle gregariously on the less illuminated portions of floating structures, preferring rougher surfaces (Newman & Abbott 1980). This species is hermaphroditic with cross-fertilization. Gonads develop from 15 up to 30°C and egg and embryos development time is strongly affected by temperature (Patel 1959). Larvae are brooded on mantle cavity and are released as nauplii. There is no information about time from larval release to settlement. Hoffman (1988) indicates the opportunistic characteristic of this species based on high growth rates and short life cycle. Also, the generalistic settlement preferences indicates opportunistic characteristic (Whitehead *et al.* 2011).

Despite the several records of this species attached to many kinds of substrates (Frick *et al.* 2003, Barreiros & Teves 2005, Ferreira *et al.* 2006, Yan *et al.* 2006, Farrapeira 2010, Cupul-Magaña *et al.* 2011, Farrapeira 2011), none of them included the presence of the species at coastal region related exclusively to local recruitment. The presence of *L. anatifera* attached to ship hulls and artifacts reported by Farrapeira (2010) is related to oceanic operation. Also, records at Fernando de Noronha and São Pedro e São Paulo Archipelago are related to oceanic waters (Macedo *et al.* 2009).

The beaching of debris and other floating materials with the presence of *L. anatifera* indicates oceanic influence on coastal waters, as reported by Hinojosa *et al.* (2011) to Chile and Whitehead *et al.* (2011) to South Africa. On Brazil, at Rio de Janeiro coast, it means the proximity of the Brazilian Current near the coast (Fernandes *et al.* 2009). Other organisms are usually recorded during the prevalence of these conditions, like the floating barnacle *Dosima fascicularis* Ellis & Solander, 1786, the floating gastropod *Janthina globosa* Swainson, 1822, and hydrozoans like *Physalia physalis* (Linnaeus, 1758), *Velevella velevella* (Linnaeus, 1758) and *Porpita porpita* (Linnaeus, 1758) (L.F.Skinner pers. obs.)

During these inshore transportation events, fertile animals could release larvae and if larvae found suitable conditions, they could develop into

cyprid, colonize available substrates and develop into adults. Other possibility is the larval transportation itself, and local recruitment. However, we could not discharge other possibility, that is the release of larvae that arrived attached on ships hull, as this region is under intense maritime traffic. Although any of the above three possibilities is plausible, this record reinforces the fact that *L. anatifera* have recruited inside the bay, in coastal area, since the supply boat do not operates outside Anjos bay.

As stated by Pereira *et al.* (2009), at Cabo Frio region we can find the prevalence of three waters masses (SACW, BCW and coastal) and a combination of them depending of wind prevalence. Under favorable water conditions, individuals of *L. anatifera* could settle, develop into adults and grow, but is unexpected to establish a permanent population, despite the continuous arriving of individuals through time.

Under these conditions, *Lepas anatifera* could be classified in the region as a transient species, *i.e.*, a species that could be present for sometime on region but do not could live permanently due to the absence of suitable conditions (Zullo 1979). The presence of *L. anatifera* could be used as indicator of influence of oceanic waters close to the shore and the prevalence of these conditions during time.

Acknowledgements

We would like to thank Instituto de Estudos do Mar Almirante Paulo Moreira (IEAPM) for logistic support; team from Laboratório de Ecologia e Dinâmica Bêntica Marinha (DCIEN/UERJ) for helping in the field work. Instituto Chico Mendes de Conservação da Natureza (ICMBio) collection permission #36194-1. Financial support by FAPERJ (Proc. E-26/111.454/2011). Thanks also to referees for suggestions and the Editor, Pablo Muniz, for the assistance during the evaluation process.

References

- Barreiros J. P. & M. Teves 2005. The sunfish *Mola mola* as an attachment surface for the Lepadid Cirriped *Lepas anatifera* – a previously unreported association. **Aqua, Journal of Ichthyology and Aquatic Biology**, 10: 1-4.
- Cowles, D. 2005. *Lepas anatifera* Linnaeus, 1758. Available from http://www.wallawalla.edu/academics/departments/biology/rosario/inverts/Arthropoda/Crustacea/Maxillopoda/Cirripedia/Lepas_anatifera.html. (Accessed 09 Nov 2012).
- De Wolf, P. 2008. Very large goose-barnacles, *Lepas anatifera* L., 1758 (Cirripedia, Thoracica). **Crustaceana**, 81(5): 637-639.
- Farrapeira, C. M. R. 2010. Records of goose barnacles (Cirripedia, Lepadidae) in the Northeast Brazilian Region. **Revista Nordestina de Zoologia**, 4: 5-23.
- Farrapeira, C. M. R. 2011. Macro-benthic invertebrates found in Brazilian coast transported on abiogenic solid floating debris. **Journal of Integrated Coastal Zone Management**, 11 (1): 85-96.
- Fernandes, A. M. , Silveira, I. C. A. , Calado, L. , Campos, E. J. D. & Paiva, A. M. 2009. A two-layer approximation to the Brazil Current Intermediate Western Boundary Current System between 20 S and 28 S. **Ocean Modelling** (Oxford), 29: 154-158.
- Ferreira C. E. L., J. E. A. Gonçalves & R. Coutinho 2006. Ship hulls and oil platforms as potential vectors to marine species introduction. **Journal of Coastal Research**, 39: 1341–1346.
- Frick, M. G., Ross, A., Williams, K. L., Bolten, A. B., Bjorndal, K. A. & Martins, H.R. 2003. Epibiotic Associates of Oceanic-Stage Loggerhead Turtles from the Southeastern North Atlantic. **Marine Turtle Newsletter**, 101: 18-20.
- Hinojosa, I., Boltaña, S., Lancellotti, D., Macaya, E., Ugalde, P., Valdivia, N., Vásquez, N., Newman, W. A. & Thiel, M. 2006. Geographic distribution and description of four pelagic barnacles along the south east Pacific coast of Chile - a zoogeographical approximation. **Revista Chilena de Historia Natural**, 79: 13-27.
- Hobday, A. J. 2000. Persistence and transport of fauna on drifting kelp (*Macrocystis pyrifera* (L.) C. Agardh) rafts in the Southern California Bight. **Journal of Experimental Marine Biology and Ecology**, 253: 75–96.
- Hoffman, D. L 1988. Settlement and Growth of the Pedunculate Barnacle *Pollicipes polymerus* Sowerby in an Intake Seawater System at the Scripps Institution of Oceanography, La Jolla, California. **Pacific Science**, 42(3-4): 154 – 159.
- Macedo, S. J., Montes, M. J. F. & Costa, K. M. P. 2009. A água. In: Viana, D. L., Hazin, F. H. V. & Souza, M. A. C. Orgs. (2009). **O arquipélago de São Pedro e São Paulo: 10 anos de Estação Científica**. -- SECIRM, 2009, Brasília, DF. 348p
- Newman, W. A. & Abbott, D. P. 1980. Cirripeda: The barnacles. Pages 504-535. In R. H.

- Morris, D. P. Abbott, and E. C. Haderlie, eds. **Intertidal invertebrates of California**. Stanford Univ. Press, Stanford, Ca.
- O'Riordan, C. E. 1967. Cirripedes in Ireland (Irish cirripedes in the collections of the National Museum of Ireland and in the literature). **Proceedings of the Royal Irish Academy B**, 65: 285-296.
- Patel, B. 1959. The influence of temperature on the reproduction and moulting of *Lepas anatifera* L. under laboratory conditions. **Journal of the Marine Biological Association of the United Kingdom**, 38(3): 589-597.
- Pereira, G. C., Granato, A., Figueiredo, A. R. & Ebecken, N. F. F. 2009. Virioplankton abundance in trophic gradients of an upwelling field. **Brazilian Journal of Microbiology**, 40: 857-865.
- Valentin, J. L., André, D. L. & Jacob, S. A. Hydrobiology in the Cabo Frio (Brazil) upwelling: two-dimensional structure and variability during a wind cycle. **Continental Shelf Research**, v. 7, p. 77-88, 1987.
- Whitehead, T. O., Biccard, A. & Griffiths, C. L. 2011. South African pelagic goose barnacles (Cirripedia, Thoracica): substratum preferences and influence of plastic debris on abundance and distribution. **Crustaceana**, 84(5-6): 635-649.
- Yan, T., Yan, W., Dong, Y., Wang, H., Yan, Y. & Liang, G. 2006. Marine fouling of offshore installations in the northern Beibu Gulf of China. **International Biodeterioration & Biodegradation**, 58: 99-105.
- Young, P. S. 1990. Lepadomorph cirripeds from The Brazilian coast. I.-Families Lepadidae, Poecilasmatidae and Heteralepadidae. **Bulletin of Marine Science**, 47(3): 641-655.
- Young, P. S. 1998. **Catalogue of Crustacea of Brazil**. Serie Livros; n.6, Museu Nacional do Rio de Janeiro, 717p.
- Zullo, V. A. 1979. Marine Flora and Fauna of the Northeastern United States. Arthropoda: Cirripedia. **NOAA Technical Report NMFS Circular 425**.

Received June 2013

Accepted December 2013

Published online May 2014