Fisheries Research 106 (2010) 321–328

Contents lists available at ScienceDirect

Fisheries Research

journal homepage: www.elsevier.com/locate/fishres

Macroparasites as biological tags for stock identification of the bluemouth, *Helicolenus dactylopterus* (Delaroche, 1809) in Portuguese waters

Vera Sequeira[a,b,*], Leonel Serrano Gordo[a,b], Ana Neves[a,b], Rafaela B. Paiva[a,b], Henrique N. Cabral[b], Joana F. Marques[b]

[a] *Universidade de Lisboa, Faculdade de Ciências, Departamento de Biologia Animal, 1749-016 Lisboa, Portugal*
[b] *Universidade de Lisboa, Faculdade de Ciências, Centro de Oceanografia, 1749-016 Lisboa, Portugal*

ARTICLE INFO

Article history:
Received 20 April 2010
Received in revised form 6 July 2010
Accepted 30 August 2010

Keywords:
Helicolenus dactylopterus
Macroparasites
Anisakis spp.
RFLP
Stock identification

ABSTRACT

In the present study, the macroparasite assemblage infecting *Helicolenus dactylopterus* (Delaroche, 1809) in three different areas off the Portuguese coast was evaluated in order to assess their use as biological tags in stock identification. Fish were obtained from commercial landings in Azores, Madeira and mainland Portugal (Peniche), and were examined for macroparasites infections according to standard procedures. Parasite assemblage composition and the prevalence and mean abundance of each macroparasite taxa within each area were calculated. Amongst the 20 taxa found, 13 were selected as good biological tags, presenting statistically different infection levels between areas. Anisakidae larvae, which presented different prevalence and mean abundance levels between the three areas, were further identified according to the restriction fragment length polymorphism (RFLP) pattern on *Taq*I, *Hinf*I and *Hha*I. The multivariate discriminant analysis applied to the macroparasites species present in more than one area and showing prevalence higher than 10% revealed a high differentiation among the three sampled areas suggesting at least three different bluemouth stocks in Portuguese waters.

1. Introduction

The biology and ecology of many commercially important species were not subject to study before they began to be exploited and managers recognize that there is little option but to institute short-term reactive measures (Pawson and Jennings, 1996). Moreover, knowledge of stock structure and degree of mixing among populations is important for the rational management of marine resources (Moles et al., 1998) especially when dealing with commercially important marine fish species such as the bluemouth *Helicolenus dactylopterus* (Delaroche, 1809). This is a benthic deepwater (200–1000 m) scorpaenoid belonging to the family Sebastidae, as other commercial important rockfishes. It is widely distributed in the eastern Atlantic Ocean, from Norway to South Africa, including the Azores, Madeira and Canary islands (Hureau and Litvinenko, 1986), and in the Mediterranean Sea. Although several studies have been published on *H. dactylopterus*, namely on age and growth (White et al., 1998; Kelly et al., 1999; Massutí et al., 2001; Abecasis et al., 2006) and reproduction (Muñoz and Casadevall, 2002; Sequeira et al., 2003; Mendonça et al., 2006) the available biological information on bluemouth population structure is still contradictory. Furthermore, the few studies conducted on the NE Atlantic population structure using genetic markers (Aboim et al., 2005), otolith microchemistry (Swan et al., 2006) and age and growth data (Sequeira et al., 2009) suggest some discrimination between the populations from Azores and mainland Portugal. Nevertheless, and although this is the most important scorpaenoid captured on the continental Portuguese slope (2500 t landed annually in the last decade (DGPA, 2010)), its stock structure in Portuguese waters still needs clarification.

Little is known about the stock structure of *H. dactylopterus* although Eschemeyer (1969) divided the species into two subspecies on the basis of morphological characteristics: *Helicolenus dactylopterus lahillei* and *Helicolenus dactylopterus dactylopterus*. Based on *H. d. dactylopterus* geographical distribution, Eschemeyer (1969) considered four different populations: the South Africa, the Gulf of Guinea, the northeast (NE) Atlantic (from Norway to North Africa and Mediterranean) and the northwest (NW) Atlantic (Nova Scotia to Venezuela). Barsukov (1980) proposed the further subdivision of the species into six subspecies also based on morphological measurements and geographical distribution: *H. d. dactylopterus*, *H. d. maderensis*, *H. d. maculatus*, *H. d. gouphensis*, *H. d. angolensis* and *H. d. lahillei*.

The Portuguese coast lies in a confluence of three important biogeographic areas (the cold temperate Atlantic, the warm temperate Atlantic and the Mediterranean) characterized by different

* Corresponding author at: Universidade de Lisboa, Faculdade de Ciências, Departamento de Biologia Animal, 1749-016 Lisboa, Portugal. Tel.: +351 217 500 824; fax: +351 217 500 028.
E-mail address: vlsequeira@fc.ul.pt (V. Sequeira).

0165-7836/$ – see front matter © 2010 Elsevier B.V. All rights reserved.
doi:10.1016/j.fishres.2010.08.014

Table 1
Prevalence (%), and mean abundance and its standard deviation (between brackets) of each macroparasite taxon infecting *H. dactylopterus* in three areas from Portuguese waters. Host sex, sample size, average total length (TL) and its standard deviation (s.d.), macroparasite life-stage and site of infection are also indicated.

	Stage	Site	Azores	Madeira	Mainland Portugal
Sample size [T (F + M)]			30 (9 + 21)	30 (5 + 25)	31 (22 + 9)
Average TL ± s.d. (mm)			271 ± 3.8	267 ± 2.2	275 ± 1.8
Min.–Max. Age (years)			8–21	10–22	11–22
Taxon					
Acanthocephala					
Acanthocephala A	A	L, M	46.7 (1.9 ± 3.0)	16.7 (0.2)	
Nematoda					
Anisakis spp.	L3	D, Go, L, M	96.7 (11.7 ± 15.5)	90.0 (4.9 ± 5.1)	96.8 (21.2 ± 12.6)
Cestoda					
Trypanorhyncha					
Hepatoxylon trichiuri	A	Go			3.2 (0.0)
Trypanorhyncha A	EP	D, L, M	100.0 (172.5 ± 301.4)		
Trypanorhyncha B	EP	D, G, L, M		53.3 (1.7 ± 2.7)	
Digenea					
Accacoeliidae					
Odhrenium sp.	A	M	3.3 (0.0)		
Hemiuridae					
Lecithochiriinae A	A	G			3.2 (0.0)
Hypohepaticola sp.	A	D			3.2 (0.0)
Lecithocladium sp.	A	D			6.5 (0.1 ± 0)
Hirudinellidae					
Hirudinella ventricosa	A	Go		3.3 (0.0)	
Isopoda					
Gnathia sp.	Pr	G, S		10.0 (0.1)	93.5 (72.8 ± 112.6)
Unidentified cysts		D, L, M	50.0 (3.0 ± 9.4)		

Sex: F, female; M, male; T, total. Stage: A, adult; L3, third-stage larvae; M, metacercariae; EP, encysted pleurocercoid; Pr, praniza. Site: D, digestive tract; G, gills; Go, gonads; L, liver; M, mesenteries; S, skin.

geomorphological characteristics and different current patterns. The influence of these water masses is expected to be reflected in population differentiation, especially in sedentary species like the bluemouth (Uiblein et al., 2003) that seems to dwell mostly around submarine mountains in the neighborhood of deep canyons (Figueiredo et al., 1995).

Parasites have been frequently employed to discriminate fish host populations and to study migratory movements of fish, either alone (MacKenzie, 2002) or in conjunction with other methodologies (Marques et al., 2006b; Abaunza et al., 2008; Gordo et al., 2009). As fish only become infected when conditions are suitable for the transmission of the parasite (MacKenzie and Abaunza, 2005),

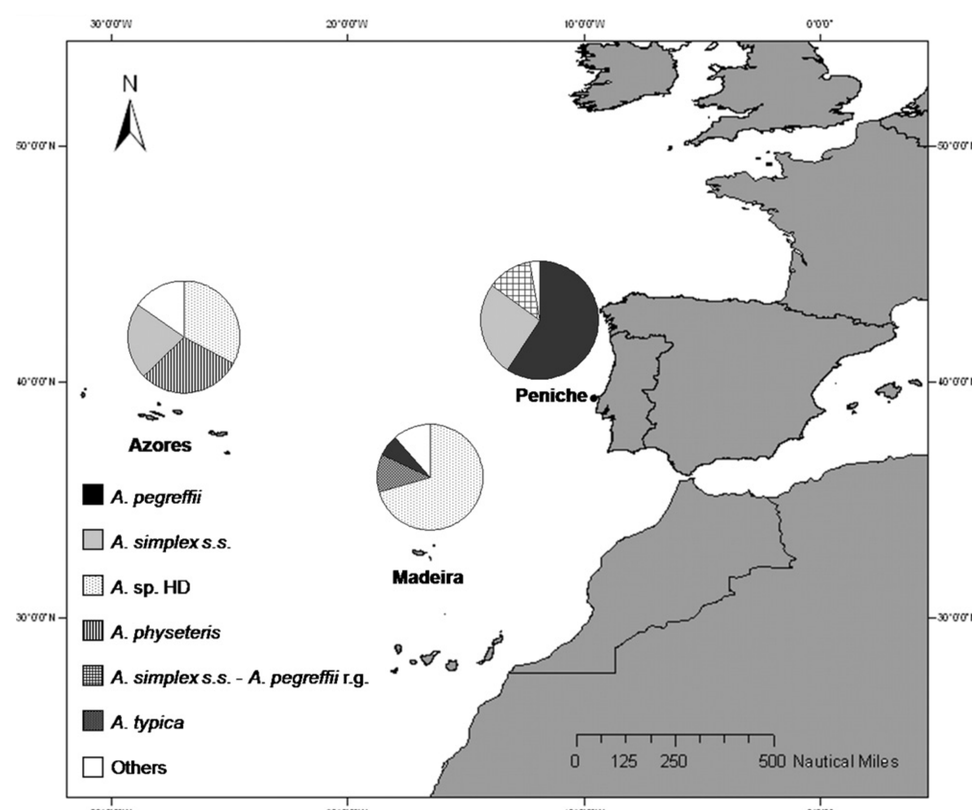

Fig. 1. Sampling location and the distribution of the most common *Anisakis* spp. identified by PCR-RFLP in *H. dactylopterus* from each sampled area from Portuguese waters.