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Focus

Parasite communities in *Boops boops* (L.) (Sparidae) after the *Prestige* oil-spill: Detectable alterations

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Abstract

Environmental pollution affects parasite populations and communities, both directly and through effects on intermediate and final hosts. In this work, we present a comparative study on the structure and composition of metazoan parasite communities in the bogue, *Boops boops*, from two localities (Galician coast, Spain) affected by the *Prestige* oil-spill (POS). We focus on the distribution of both individual parasite species and larger functional groupings by using both univariate and multivariate analyses. Our results indicate directional trends in community composition that might be related to the *Prestige* oil-spill disturbance of the natural coastal communities off Galicia. Endoparasite communities in *B. boops* reflected a notable change in the composition and abundance of the benthic fauna in the localities studied post-spill probably due to organic enrichment after the POS.

Keywords: Parasite communities; *Boops boops*; *Prestige* oil-spill; Galician coast; Cantabrian sea

1. Introduction

The *Prestige* oil-spill (POS) started on 13th November 2002 when this oil tanker carrying crude oil began leaking, broke in two and sank over the Galician Bank, *c.* 103 miles off the Spanish coast. The release of 60,000 tons of crude oil into the sea contaminated, to some degree, a large coastal area of the Cantabrian Sea. Because of its huge geographical spread, the spill reached virtually all types of marine habitat (Albaigés and Morales-Nin, 2006).

Previous experience has shown that the recovery of impacted marine ecosystems may take from as little as 2 years to over a decade following an oil-spill. Thus, a recent study examining changes in the benthic macrofauna after the 1992 *Aegean Sea* spill in Galician waters (off A Coruña) over a four-year period compared with pre-spill data, found that, during the first 12 months, most of the species sensitive to crude oil disappeared or declined to be replaced by opportunistic species (mostly polychaetes). This sudden decrease in biodiversity and biodensity was followed by a three-year low, until the original communities begin to re-emerge (Gómez Gesteira and Dauvin, 2005).

Environmental pollution affects parasite populations and communities, both directly and through effects on intermediate and final hosts. Previous studies support the view that ectoparasites increase and endoparasites decrease in prevalence and abundance in fish after chronic exposure to xenobiotics and polycyclic aromatic hydrocarbons (PAHs), in particular (MacKenzie, 1999; Khan, 2003). Immunosuppression has been suggested as one of the main causes contributing to an increase of ectoparasites. On the other hand, the decrease of endoparasites might be associated with both direct (low survival of larval forms) and indirect (a decline in intermediate hosts) effects of pollutants (see Khan, 2003 and references therein). Recently, the ratio between single-host (monoxenous) and multiple-host (heteroxenous) parasite species, which basically reflects the above findings, has been used in analyses of impacted coastal marine ecosystems (Broeg et al., 1999; Diamant et al., 1999; Dzikovski et al., 2003).

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One of the drawbacks of follow-up studies of catastrophic events, such as the POS, is the absence of predisturbance data. On the other hand, whereas a wealth of studies on the effects of the POS on marine communities concerns the coastal areas (intertidal and subtidal habitats) directly oiled by the spill (http://otvm.uvigo.es/vertimar2005) the information on possible effects offshore, in shelf communities is still scarce (e.g. Martínez-Gómez et al., 2005, 2006; Serrano et al., 2005, 2006) and reflects the difficulties to identify major physical (e.g. sediment contamination) and toxicological (e.g. PAH bioaccumulation) impacts in the continental shelf.

In the course of a pilot study, using parasite communities as predictors of harvest location of fish (Power et al., 2005), a large sample of bogue, *Boops boops* (L.), was collected in 2001 from the NE Atlantic coasts of Spain. Two of the localities originally sampled were re-sampled after the POS. Here, we present the results from a comparative study on the structure and composition of metazoan parasite communities in this fish species, using matched samples from two impacted localities on the Galician coast of Spain. We focus on the distribution of both individual parasite species and larger functional groupings which detect directional trends in community composition that might be related to the POS disturbance of the natural coastal communities off Galicia.

2. Materials and methods

2.1. Model fish species

The bogue, *B. boops* is a demersal to semipelagic, non-migratory species which is common in the NE Atlantic (from the Bay of Biscay to Gibraltar). It is gregarious, found on the shelf or coastal pelagic on various bottoms at a depth range 0–350 m, ascending to the surface mainly at night. *B. boops* is omnivorous (trophic level 2.97), feeding mainly on benthic copepods (which make up to about 59.6% of the diet) and plants (40.4%) but is also planktonophagous (copepods) (Jukic, 1972; Froese and Pauly, 2005). *B. boops* hosts a relatively large number of metazoan parasites (67 species) among which a group of common species, which are consistently present in both the Mediterranean and the NE Atlantic fish can be identified (Pérez-del Olmo et al., 2007; see also Renaud et al., 1980; Anato et al., 1991; Power et al., 2005). The above characteristics, combined with the site fidelity of the host, indicate that parasite communities are likely to reflect local food-web structure, as well as levels of infection and other characteristics of the localities of sampling (e.g. oil-spill impact) at a finer geographical scale.

2.2. Fish and parasite samples

A total of 165 fish was studied comprising five samples. Three pre-spill samples collected in 2001 from Galicia [off Malpica (November, $n = 30$) and Vigo (May, $n = 30$)]

Fig. 1. Map indicating the affected areas (in black) along the NE Atlantic coasts of Spain and the sampling localities.

and the Basque Country [Ondarroa (June, $n = 30$)] provided comparative data on the variations in parasite community structure in *B. boops* populations from NE Atlantic. The two post-spill samples were collected from an oil contaminated area (Galician coasts of Spain) two (off Malpica, June 2004; $n = 30$) and three (off Vigo, May 2005; $n = 45$) years after the *Prestige* grounded on the Galician Bank (see map in Fig. 1). Fish transferred on ice to laboratory were measured [length (SL, cm), weight (W, g)], labelled and packed individually and frozen. The condition factor (K) was calculated as $K = (W/L^3) * 100$. A sub-sample of fresh fish was examined from both post-spill samples to obtain live parasite material for a precise identification. Fish were examined for both ecto- and endoparasites. Parasites were recovered according to a standardised protocol by the present authors. All metazoan parasites were identified and counted.

Worms were fixed and stored in 70% alcohol. Trematodes, monogeneans and acanthocephalans were stained with iron acetocarmine (Georgiev et al., 1986) and examined as permanent mounts in Canada balsam. Nematode larvae were identified on temporary mounts in saline solution or glycerine. Voucher material is deposited at The Natural History Museum, London [BMNH 2006.3.14.6-8; 2006.3.14.11; 2006.3.14.10] and the Cavanilles Institute of Biodiversity and Evolutionary Biology, University of Valencia, Spain.

2.3. Statistical analyses

Ecological terms are used according to Bush et al. (1997). Species with prevalence higher than 30% in any of the samples will further be referred to as common. Due to the overall aggregated distribution of parasites, Spearman rank correlations (rs) and non-parametric tests