

Homing behaviour of *Parablennius parvicornis* (Pisces: Blenniidae).

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ABSTRACT

The homing ability of the rockpool fish *Parablennius parvicornis* was studied at the rocky shore of Gran Canaria (Canary Islands, Spain). Fish were displaced from the original rockpool during low tide to another pool 74 metres away. The return of the first blenny occurs directly after the first tide while one week later 40% of the blennies had returned to the original pool. This paper discusses the homing behaviour of this species.

Keywords: Homing behaviour, fish, intertidal, rockpool, blenny.

RESUMEN

Se estudian las habilidades de retorno (homing) de la barriguda *Parablennius parvicornis* en una región de la costa rocosa de la isla de Gran Canaria (Islas Canarias, España). Los peces fueron desplazados desde su charco original, durante la bajamar, a otro charco que distase 74 metros. El retorno de la primera barriguda ocurrió después de la primera marea, mientras que tras una semana habían regresado el 40% de los peces originalmente desplazados. En este artículo se discute el comportamiento de retorno de esta especie.

Palabras clave: comportamiento de retorno, peces, intermareal, charco, blénidos

INTRODUCTION

Homing behaviour has been studied in several fish species. A lot of studies concern the homing ability in intertidal zones or in coral reefs (Gibson, 1967; Thompson, 1983; Polivka & Chotkowski, 1998; Griffiths *et al.*, 2003; Odling-Smee & Braithwaite, 2003; Burt de Perera & Guilford, 2008; Mitamura *et al.*, 2009). These studies try to answer different questions.

Some studies are based on observation and experimentation in the natural habitat. These generally consist of analyses of the fish's movement (Gibson, 1967; Thompson, 1983; Mitamura *et al.*, 2009), the recolonization of an area (Griffiths *et al.*, 2004) or the role of the habitat's complexity (Griffiths *et al.*, 2006). In addition, Carson *et al.* (cited by Olding-Smee & Braithwaite, 2003) revealed that some species returned home from as far away as 22.5 km or after 6 months in captivity. Little is known about the activity of intertidal fish during the high-tide because of the difficulties encountered when attempting to study them in this particular physical condition. Unfortunately, most fishes are less active during low-tide (Almada & Faria, 2005) and many of the most interesting events in the ecology of this assemblage do not occur during these periods.

Few others studies (Odling-Smee & Braithwaite, 2003; Burt de Perera & Guilford, 2008), often made in laboratories, attempt to understand how fish return to their pool. What is their motivation? What is the role of learning in their orientation? (Odling-Smee & Braithwaite, 2003). Do they have a long term memory which allows them to recognize the landmarks leading to their home or do they end up in their pool by chance? (Odling-Smee & Braithwaite, 2003; Burt de Perera & Guilford, 2008). What kind of clues do they use? At these questions, several studies propose some

ideas and try to prove them. For example, Gibson (1967) proved that the temperature has a significant role, which seems to be correlated with the changing in fish assemblages in the pools throughout the seasons. It seems that fish can also memorize the relief and the water movements occurring between stationary objects in the environment and they own bodies. Others possibilities are the use of the sun, the stars or the magnetism to navigate. And finally, the use of senses like olfactory, well studied for the orientation of salmons (Odling-Smee & Braithwaite, 2003).

Understanding these homing and site fidelity behaviours can contribute towards solving many of the riddles of animal behaviour (e.g., orientation, navigation, and the underlying sensory mechanism).

The rockpool blenny (*Parablennius parvicornis*) is an intertidal fish living in rockpools during the low-tide. We consider intertidal fish as a fish that, after the larval stage, lives permanently in the rocky intertidal habitat and spawns there (Almada & Serrano-Santos, 1995).

Parablennius parvicornis occurs along the East African coast, from Senegal to the Zaire, including the archipelagos of Azores, Madeira, Canaries and Cape Verde (Zander, 1986; Domingues *et al.*, 2008). According to Cody (1993), this species is one of the most abundant fish of the intertidal pools of the Canary Islands.

This fish is a relatively long-lived species, reaching ages of more than 6 years (Ros *et al.*, 2006). Young males of one year have a body length of approximately 10 cm, while old males can reach 14 cm (Miranda *et al.*, 2003). Like many other intertidal species, the rockpool blenny spends a lot of time in shelters under rocks to protect them from predators or to guard their nests during the breeding season (Espino *et al.*, 2006).

Like other species of blennies, it exhibits male parental care (Cody, 1993; Orlando-Bonaca *et al.*, 2008).

The aim of this paper is to prove the homing behaviour of *P. parvicornis*. The choice of the specie is related to its great abundance in the Canaries rockpools. Moreover, saying that each individual always stay in a same rockpool means that in each rockpool lives a specific community, or in other words, that each rockpool is a little ecosystem. In this way, the area of our study can be represented as a multitude of ecosystems. But what happens if one of the rock pools is disturbed? What happens if several rockpools are disturbed? What happens concerning the fish communities? The study of the homing behaviour of *P. parvicornis*, one of the most abundant fish in the Canaries rocky-shore, proves the importance to the rockpools, as essential elements of the shore. It should be an argument for the preservation of areas such as the Confital.

MATERIALS AND METHODS

This study was realized on a rocky coast at the north-east of Gran Canaria Island (Spain). It is characterized by a large intertidal zone made up of several rockpools. Three pools (A, B, C) were studied between December 15th, 2009 and December 20th, 2009. The distance between pools A and B was 32 m. and the one between pools B and C was 42 m (Fig. 1). The rockpools A was 0.91 m², with a maximal depth of 0.55 m, while the rockpool B and C 1.76 m² and 6.38 m² respectively with a maximal depth of 0.4 and 0.25 m. Each rockpools comported connections with others neighbour rockpools (Fig. 1) in both seaward and coastward directions. The maximum difference between low and high tide during the study period was approximately 0.8 m.

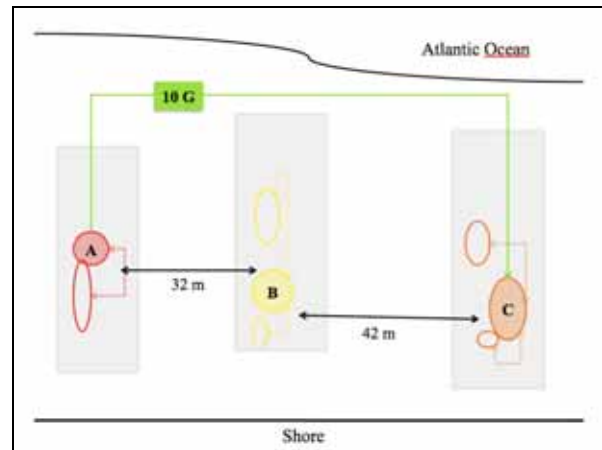


Figure 1: Disposition of the rockpools A, B and C during the low-tide. (10G = 10 green-marked fish displaced to the pool C)

During low-tide, in each of these pools were caught 10 rockpool blennies using a hand net. Specimens were marked one by one with a visible implant fluorescent elastomer (VIFE) tag. The fish from the pools A, B and C were tagged respectively in red, yellow and orange. Immediately after the marking, fish were released back in their respective place of capture. In the pool A, 10 additional fish were tagged in green. These last 10 fish were displaced from their original pool (A) to the pool (C), 60 m away (Fig. 1). Green-marked fishes were 10.15 cm of total length in average (SD=1.13)

The three rockpools were visited daily during low-tide in order to count the marked fish. Each rockpool was observed for about 20 minutes a day. For a better census, observations were done during after nightfall, using an UV light (Griffiths, 2002). In order to facilitate the census and due to the fact that fish try to stay into their refuges (under stones or crevices), fish were previously attracted using pieces of bread. To avoid counting several times the same fish, it was also recorded the differences between the shape and body position of the marks. Stones and rocks of the pools were not move during census to avoid frightening the fish and making them definitively leave their pool.

RESULTS

The 40% of rockpool blenny returned to their original pools, showing homing abilities.

After the first tide, only two green-marked fish (marked in the pool A and displaced to the pool C) were encountered out of pool C: one in the rockpool A, and the other in the rockpool C. So the first green-marked fish returned to its original pool from 74 m distance. Four red-marked and four yellow-marked fish were still in their original pool (respectively pool A and B) while only three orange-marked fish were encountered in the pool C.

The second day, after 35 hours, four green-marked fish were recorded in their original pool (A) whereas no green-marked fish was observed in pool C. From this moment onward, we never found green-marked blennies in a pool other than their original one (A). In the same way, the other groups of marked fish were encountered only in their original rockpool. On the second day, 4 reds fish were found in the pool A, 3 yellows ones in B and 3 oranges blennies in C (Fig. 2).

During the following days of observation, the number of blennies censured for the four groups was approximately the same as the previous day, with a minimum of three fish in their original pool and a maximum of five. The last observations were made 6 weeks after, on the January 30th and the February 3rd of 2010, during which we still observed similar results.

It is important to note that observations were also done in the adjacent rockpools distant between 1 and 6 m) where sometimes one or two marked-fish were censured.

The body position and shape of the marks allowed the identification of individual fish in each pools. Due to this, there is certainty that two red-marked fish

were constantly in their pool (A) throughout the experiment. The same was noted with the yellow-marked fish from the pool B and with the orange-marked fish from the pool C. The two or three other fish seemed to move during the days. Nevertheless, despite the efforts made for the recognition of the fish, we can't conclude that an effective number of fish went back to their original pool due to the great similarity between the marks and because fish were not recaptured observations should be done from several meters of distance

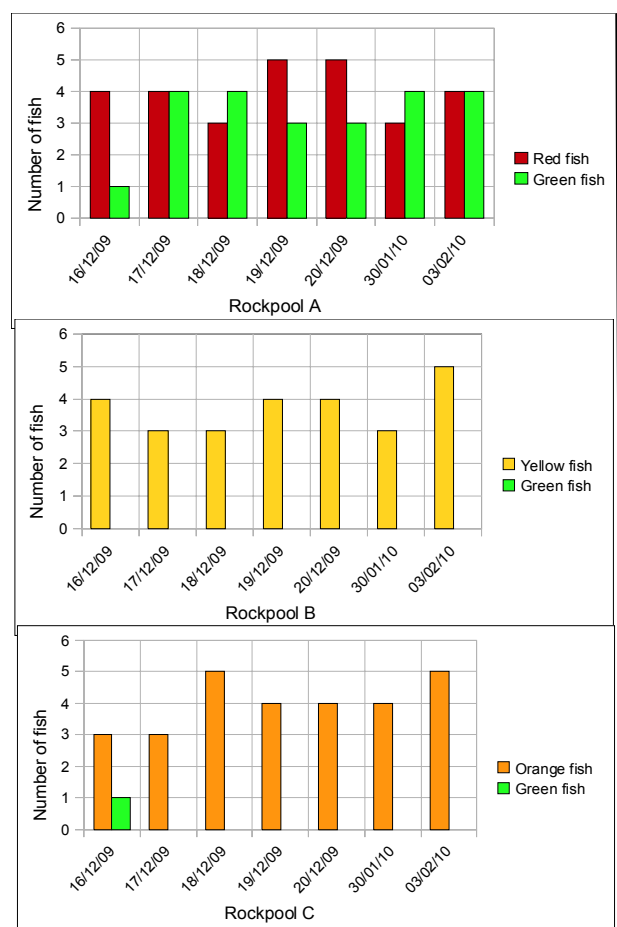


Figure 2. Numbers of fish encountered in each rockpool during the experiment (from December 2009 to February 2010).

DISCUSSION

Despite the lack of data, the experiment suggests that rockpool blenny *Parablennius parvicornis* shows homing behaviour. The fact that the first blenny

return to its pool from 74 m. away after only four hours seems to be a good proof of this phenomena. Moreover, the majority of the marked-blennies remained in the same pools during the five days of observation, despite these pools were connected to several adjacent ones, showing a marked site fidelity. As an example, in the smallest pool (A), eight marked-blennies were seen from the second day until the end of the experiment (red and green-marked fish). This is not an insignificant number considering the size of the rockpool, the relatively small number of fish which it contained and the possibilities for the fish to move to adjacent pools during low-tide.

On the other hand, it is highly probable that some of the marked-fish were not recorded because: (i) perhaps some fish stayed hidden in a shelter during the 20 minutes of observation, and time of observation in the neighbouring rockpools could be also scarce, and sometimes the weather did not allowed us to make a more accurate observation; and (ii), in addition to that, the stress caused by the capture and tagging could have disturbed the fish behaviour in a significant way. Moreover, in this study, the censuses were done at nightfall and it is known that fish behaviour can change according to the lighting (Helfman, 1992; Mitamura *et al.*, 2009). It would be interesting to observe the rockpools during daylight hours.

During the experiment, it was not noted that each fish occupied any specific place under rocks or crevices, despite that *Parablennius parvicornis* is a territorial fish (Cody, 1994; Triay-Portella, 2009). This aspect, together with the high predation risk of the intertidal area by marine birds, may produce that *P. parvicornis* looks for an adequate shelter for it and its spawn, and to know in detail the location of available refuges in the pool should be an important advantage for this fish. These two facts could be an evolutionary argument for the homing abilities of this blenny.

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