

Short communication

Site fidelity and movements of gilthead sea bream (*Sparus aurata*) in a coastal lagoon (Ria Formosa, Portugal)

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ABSTRACT

Short-time site fidelity and movements of gilthead sea bream (*Sparus aurata*) in a coastal lagoon were determined using passive acoustic telemetry. Nine fish, ranging from 20.1 to 32.5 cm total length, were surgically implanted with acoustic transmitters and monitored for up to 179 days. Minimum convex polygon areas ranged from 18,698.6 m² to 352,711.9 m². Home range sizes were small, with individuals using core areas on a daily basis. However, these core areas shifted within the study site over time towards the opening to the sea. Two different diel behaviors were recorded, with some individuals more active at night and others during day time. Some individuals also demonstrated homing abilities, returning to the capture site after being released more than 4 km away.

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1. Introduction

The gilthead sea bream, *Sparus aurata*, is an inshore species which inhabits sea grass beds as well as sand and rocky bottoms (Bauchot and Hureau, 1986). During its first months of life, this species is known to enter coastal lagoons and estuaries in early spring, seeking shelter and food (Arias, 1976, 1980; Suau and Lopez, 1976). Although most juveniles leave the nursery before reaching 1-year-old, some individuals may stay for a second year (Arias, 1980). Although a number of studies have been published on *S. aurata*, the vast majority of them focus on aquaculture issues and only a few researches were published on wild *S. aurata* age, growth, reproduction and feeding habits (e.g. Arias, 1976, 1980; Suau and Lopez, 1976; Pita et al., 2002; Chaoui et al., 2006).

The Ria Formosa coastal lagoon (Southern Portugal) is used by *S. aurata* as a nursery ground, with juveniles arriving in the spring and usually leaving before the end of the winter (Erzini, pers. comm.), feeding mainly on gastropods and bivalves (Pita et al., 2002).

Previous studies on the ichthyofauna of the Ria Formosa coastal lagoon focused largely on temporal and spatial changes in species composition (Monteiro et al., 1990; Ribeiro et al., 2006, 2008). As one of the most important commercial and recreational species, information on movements and habitat use of *S. aurata* is of considerable importance for management and conservation. This study, the first on wild *S. aurata* using acoustic telemetry, aims to

improve our knowledge of *S. aurata* site fidelity and movement patterns inside a coastal lagoon through the use of passive acoustic telemetry.

2. Material and methods

2.1. Study area

The Ria Formosa coastal lagoon, classified as a natural park in 1987, is relatively shallow, with tidal elevations ranging between 1.3 and 2.8 m for neap and spring tides, respectively. This lagoon consists in large part of salt marsh and shallow channels where much of the intertidal zone consists of sandy or muddy bottom. A variety of different habitats can be identified based on substrate type (ranging from sand, gravel, to fine mud), depth, vegetation, and distance from the sea. The study area was limited to one channel, between the bridge that connects the mainland to one of the barrier islands and the end of this same channel to the SE (Fig. 1). Bottom types consisted mainly of sand, mud and sea grass beds of *Zostera noltii*, *Zostera marina* and *Cymodocea nodosa*.

2.2. Tagging

Fish were captured using a beach seine net as described in (Abecasis et al., 2006). Nine gilthead sea bream, ranging from 20.1 to 32.5 cm total length, was captured and surgically implanted with a V7-4L-R04K Vemco Ltd. (Canada) acoustic transmitter. Transmitters were coded with a unique pulse randomly emitted between 30 and 90 s and have an estimated lifetime of 160 days. For surgery,

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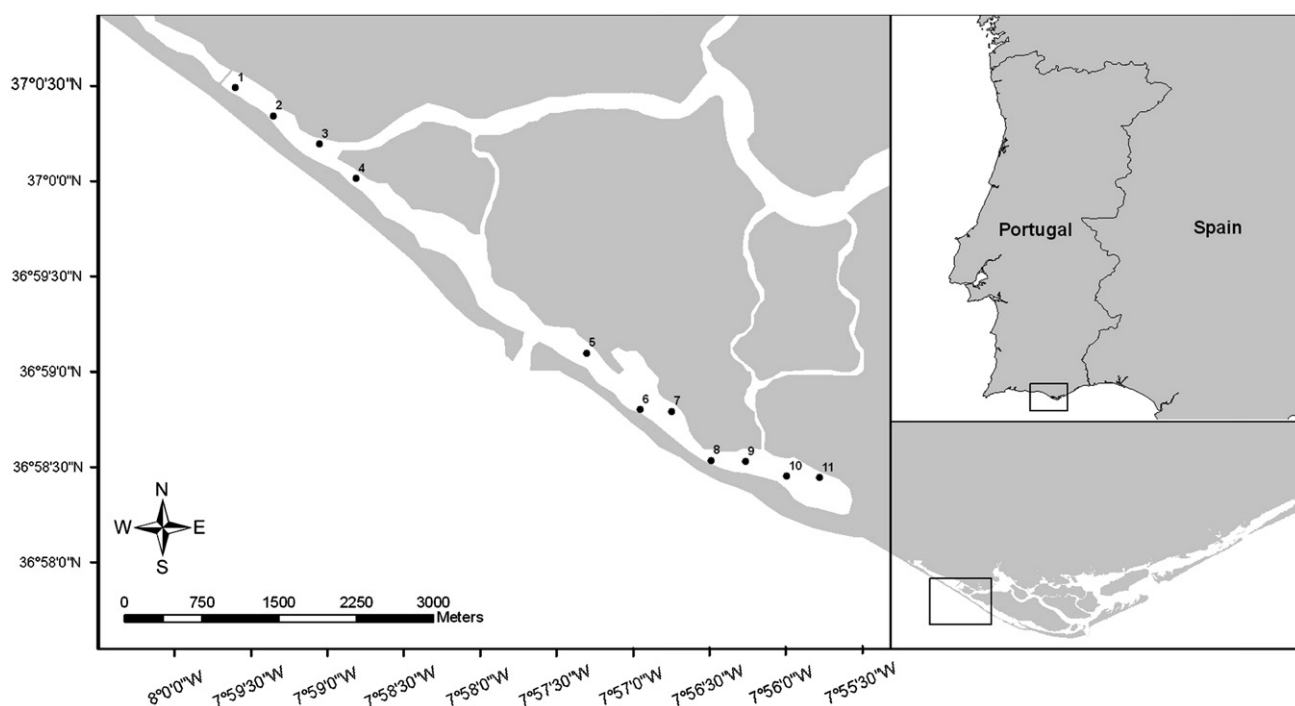


Fig. 1. Map of the study area with the location of the VR2 receivers.

Table 1

Minimum convex polygon (MCP) areas and residency index (I_R) for all *Sparus aurata* tagged for each of the receivers. Italicized values indicate location of release. *denotes place of capture. –no detections. Note: no I_R values for fish two and three are presented as only a few detections occurred. MCP areas were not estimated for individuals released in places other than the capture position (ID 1–3) neither for ID 4 as it was only detected by one receiver

ID	Release date	Days monitored	TL (cm)	MCP area (m ²)	I_R (total)	I_R 1	I_R 2	I_R 3	I_R 4	I_R 5	I_R 6	I_R 7	I_R 8	I_R 9	I_R 10	I_R 11
1	17-11-2006	13	20.1	–	0.92	0.15	0.15	0.08	0.08	0.77*	–	–	–	–	–	–
2	06-12-2006	1	21.6	–	–	–	–	–	–	–	–	–*	–	–	–	–
3	07-12-2006	1	21.5	–	–	–	–	–	–	–	–	–*	–	–	–	–
4	03-09-2007	179	32.5	–	0.82	–	–	–	–	–	–	–	–	–	0.82*	–
5	03-09-2007	99	29	18,698.6	0.41	–	–	–	–	–	–	–	0.01	0.06	0.35*	0.05
6	03-09-2007	27	27.3	213,349.2	0.85	–	–	–	–	–	–	0.11	–	0.81	0.78*	0.22
7	14-09-2007	67	31.5	39,074.1	0.18	–	–	–	–	–	0.01	–	0.13	0.16	0.15*	0.07
8	14-09-2007	4	27.5	213,349.2	1.00	–	–	–	–	–	0.15	–	0.33	0.50	1.00*	1.00
9	16-10-2007	51	24	352,711.9	1.00	–	–	–	–	0.02	0.02	–	0.29	0.82	0.90*	0.39

fish were placed in a V-shape support and an incision (<1 cm) was made on the mid ventral line between the insertion of the pelvic fins and the anus. The transmitter was coated with a povidone-iodine antiseptic solution before introduction and the incision was closed with tissue adhesive (Vetseal, B. Braun Medical, Sempach, Switzerland). Fish were also tagged with external T-tags (Floy Tags

Inc.) to guarantee visual identification of the acoustically tagged fish in case they were captured. The entire procedure took less than 2 min and after full recovery (about 20 min) fish were released. With the exception of three fish (#1, #2 and #3) released approximately 4 km away from the capture position all other fish were released at the capture site. Detections were made through an array of 11 VR2 receivers (Vemco Ltd., Canada), deployed on the lagoon floor (Fig. 1). The distance between receivers varied between 300 and 500 m with the exception of receivers 4 and 5 which were

Table 2

Characteristics of the area monitored by each receiver and total number of detections per receiver

Receiver	Bottom	Distance to outlet (m)	Number of detections
1	Sand	3750	152
2	Sand	3250	99
3	Sand/sea grass	2750	51
4	Sand/sea grass	2250	65
5	Sea grass	600	2116
6	Sand	1300	53
7	Sea grass	1550	12
8	Sand	2150	516
9	Sand/sea grass	2450	42013
10	Sea grass	2850	19003
11	Sea grass	3150	5935

Table 3

Results of the χ^2 test by time of day for *Sparus aurata* tagged in Ria Formosa

ID	χ^2	p	Time of day with highest number of detections
1	780.31	<0.01	Day
4	572.45	<0.01	Night
5	37.23	<0.01	Day
6	9.87	<0.01	Night
7	6.69	<0.01	Night
8	9.42	<0.01	Day
9	146.27	<0.01	Night

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