Available online at www.sciencedirect.com
ScienceDirect
Estuarine, Coastal and Shelf Science 70 (2006) 27–38
ESTUARINE COASTAL AND SHELF SCIENCE
www.elsevier.com/locate/ecss

Structure and temporal variations of fish assemblages of the Castro Marim salt marsh, southern Portugal

Pedro Veiga*, Lina Vieira, Constança Bexiga, Rita Sá, Karim Erzini

Centro de Ciências do Mar (CCMAR), Universidade do Algarve, 8005-139 Faro, Portugal

Received 13 February 2005; accepted 19 September 2005
Available online 8 August 2006

Abstract

We studied the ichthyofauna of the Castro Marim salt marsh based on monthly sampling surveys at five sites between September 2000 and August 2001. Sampling took place at night during rising neap tides using a 40-m long beach seine. We sampled a total of 7955 fish specimens (37 995.7 g), comprising 34 species and 17 families. The occurrence of most species was occasional, with *Pomatoschistus microps* (51.9%) and *Atherina* spp. (10.3%) being the most abundant species, accounting for 62.2% of the total fish captured. Biomass was dominated by the marine species *Liza ramado* (15.9%), *Mullus surmuletus* (13.5%), and *Liza aurata* (13.4%). Temperature and salinity showed a seasonal pattern, with minimums during the winter months and maximums during the summer months. In contrast, river flow peaked in winter and was lowest during summer. This pattern in river flow appears to be correlated with variations in the fish assemblages, which present two distinct compositions during the two periods. A few species characterise the winter fish assemblage, with dominance by residents and the presence of freshwater species, while the summer assemblage is characterised by the presence of many marine visitors that use the salt marsh in their first months/years of life. Temporal variations in total abundance and biomass reflect fluctuations in the dominant species. Resident species presented the highest abundance values, while marine adventitious species and marine species that use the salt marsh as a nursery ground contributed most to community species richness. Castro Marim salt marsh constitutes an important ecosystem for fishes, providing habitat for many species, especially juveniles, which find conditions within the salt marsh suitable for their development.

Keywords: fish assemblage; salt marsh; Castro Marim; beach seine

1. Introduction

Salt marshes are one of the highest-elevation intertidal habitats within estuaries, commonly forming the buffer between the land and the sea. Vegetation within salt marshes consists of grasses, herbs, and low shrubs (Connolly, 1999). These ecosystems are distributed around the medium and high latitudes of the world, being replaced by mangroves in the tropical latitudes (Boaden and Seed, 1985). Because of permanent exposure to the effects of the tides, salt marshes are extremely rigorous ecosystems, with highly variable physical (temperature, salinity, oxygen) and biological (predation and competition) conditions (Haedrich, 1983; Kneib, 1997). Consequently, these ecosystems are known as sites of low diversity, with dramatic seasonal and diurnal shifts in the composition of nekton assemblages, where only a few species are permanently resident (Kneib, 1997). Despite this perceived low diversity, it has long been argued that salt marshes are important as nurseries because their high productivity and structural complexity provide both enhanced foraging opportunities and sites of refuge from predators for juvenile fishes (Boesch and Turner, 1984; Kneib, 1997; Thomas and Connolly, 2001). In addition, these ecosystems are an important source of nutrients for estuaries and nearshore coastal areas (Lefeuvre et al., 1999), although this theory is controversial (Costa et al., 2001). For example, Wolanski et al. (2004) suggested that the major export path of nutrients from the salt marsh area occurs via the growth of fishes rather than by dissolved or particulate components.

* Corresponding author.
E-mail address: pveiga@ualg.pt (P. Veiga).

0272-7714/$ - see front matter © 2006 Elsevier Ltd. All rights reserved.
doi:10.1016/j.ecss.2006.05.037

Due to their innate richness, salt marshes have been extensively used for many anthropogenic activities over the centuries, including aquaculture, fisheries, recreational activities, and salt production (Adam, 1990). Consequently, areas of salt marsh have been reduced dramatically over the last century as human activities and coastal development have reclaimed this habitat (Connolly, 1999; Thomas and Connolly, 2001), particularly in Europe (Kneib, 1997). Studies of fish communities are thus particularly important for the conservation and sustainable management of these ecosystems, as such studies are frequently used to assess quality and to monitor environmental changes in estuarine environments (Rebelo, 1992; Mathieson et al., 2000; Methven et al., 2001; Lobry et al., 2003). Such studies also provide important information for fisheries assessment purposes, as salt marshes are known to provide habitats for many juveniles of commercially valuable species (Morton et al., 1987; Thomas and Connolly, 2001; Lazzari et al., 2003).

European salt marshes are generally poorly studied (Kneib, 1997; Connolly, 1999), and few published data are available to describe marsh nekton assemblages (Drake and Arias, 1991a,b; Cattrijsse et al., 1994; Laffaille et al., 2000; Mathieson et al., 2000). In Portugal (Costa et al., 1994; Gonçalves and Beldade, 2000; Mathieson et al., 2000; Costa et al., 2001), and particularly in the Castro Marim salt marsh (Machado, 1978; Gonçalves and Beldade, 2000), information about salt marsh fish is scarce. With the construction of the Alqueva Dam on the Guadiana River upstream of the Castro Marim salt marsh, a baseline study of the fish communities of this ecosystem is important to evaluate the future impact of the dam. The present study aims primarily to study the ichthyofaunal composition of the Castro Marim salt marsh, particularly its temporal variation, and secondly to relate this composition to environmental parameters.

2. Materials and methods

2.1. Study area

The Castro Marim salt marsh is a 1222 ha wetland zone located in the southeastern part of the Algarve (latitude 37°12′N, longitude 7°26′W), near the mouth of the Guadiana River (Fig. 1). The salt marsh was assigned Natural Reserve status in 1975, mainly due to its importance as a breeding area for many species of birds. Nevertheless, the richness of biotopes contributes to a great diversity of other aquatic and terrestrial organisms. Aquatic habitats include tidal flats, intertidal creeks, salinas, tidal pools, and two major subtidal creeks (Lezíria and Carrasqueira Creeks) that cross the entire salt marsh and into which the seawater flows every high tide. The two main creeks also have freshwater inflow that is greatest in winter.

This ecosystem is characterized by semi-diurnal mesotides (tidal range 1.22 to 2.82 m) (Morales, 1997). Unlike salt

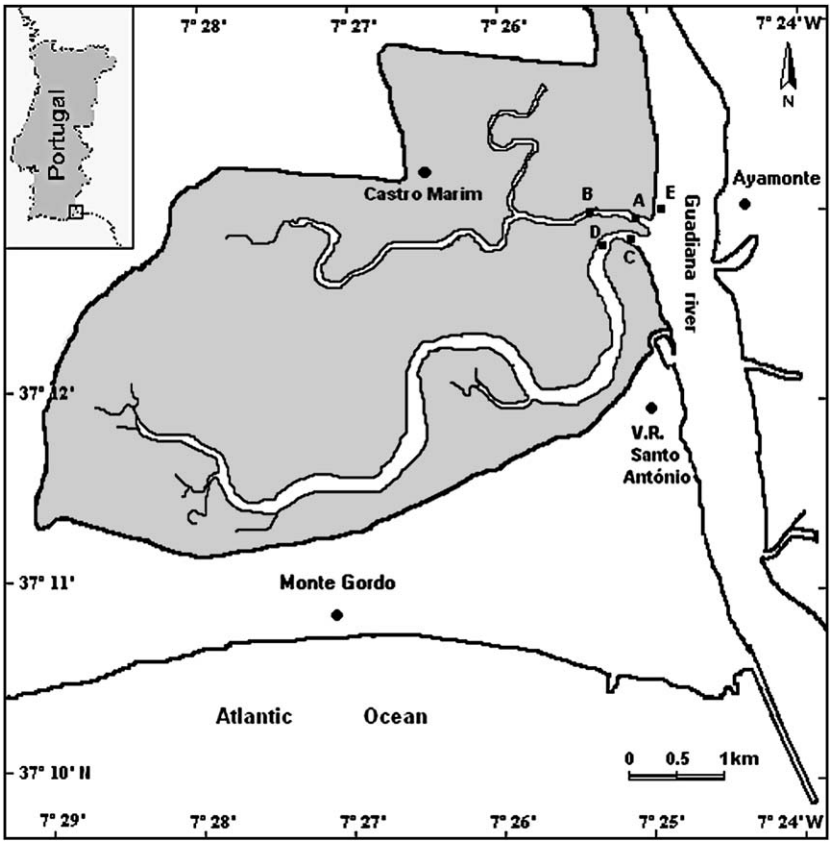

Fig. 1. Map of the study area and locations of sampling sites within Lezíria subtidal creek (A and B), Carrasqueira creek (C and D), and mouth of the salt marsh creeks (E). Shaded area indicates the extent of the Natural Reserve.