Marine Policy 45 (2014) 194–203

Contents lists available at ScienceDirect

Marine Policy

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

Developing self-guided scuba dive routes in the Algarve (Portugal) and analysing visitors' perceptions

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ARTICLE INFO

Article history:
Received 11 August 2013
Received in revised form
23 October 2013
Accepted 23 October 2013
Available online 21 November 2013

Keywords:
Underwater routes
Scuba diving
Environmental awareness
Coastal tourism
Dive tourism
Ecotourism

ABSTRACT

Scuba diving allows for underwater visitation of cultural and natural resources. Underwater routes can be used as a tool for guided and supervised underwater visits. Two scuba diving routes were implemented in the Algarve (South of Portugal), the "B24" and "Poço" diving sites. The perceptions of scuba divers regarding several aspects of the routes and the existing support infrastructures were studied following a survey carried out through face-to-face interviews from 2008 to 2012. Divers profile and their perceptions were analysed using 246 valid questionnaires. Divers were mainly Portuguese, over 30 years old and with more than 12 years of formal education. Some of the support infrastructures did not achieve a "good" or "acceptable" grade. This should be carefully considered by diving operators and managers, because perceptions tend to circulate throughout the diving tourists. All features of interpretative slates were graded as highly satisfactory. Overall, diver satisfaction increased slightly after route implementation, with an average ranking of "good". These findings support the implementation of underwater routes as a way to promote diving activity, and to increase divers' environmental education and awareness.

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1. Introduction

Large scale coastal tourism began in the 19th century, with increased prosperity and mass transports, and consequent affordability of tourism activities [1]. Currently, coastal tourism represents the fastest growing industry in the world [2], triggering the development of a wide variety of marine recreational activities [3,4].

Diving allows visitation of subaquatic cultural and natural resources. In fact greater underwater autonomy, along with higher cultural and ecotourism demand, have encouraged *in situ* preservation of underwater sites with archaeological features, promoting the development of underwater tourism, either through media virtual tours, snorkelling, scuba diving or glass-bottom boat tours, thereby increasing the popularity of the diving activity *per se* [5,6]. Scuba diving and snorkelling are also increasingly important touristic components of multiple-use Marine Protected Areas (MPAs) [7,8]. The use of underwater routes (or trails), mostly by scuba divers, but also by snorkelers [8] allows divers to carry out guided and supervised underwater visits of the natural and/or cultural patrimony, and have been in use for some time now [5,9–11]. The use of trails is also important because it restricts divers' access to defined areas, and serves to enhance their knowledge of the marine environment [12–14]. The latter issue is particularly important since the broadening of divers' knowledge, especially with regard to (potential negative) impacts and diving skills, enhances environmentally responsible behaviour [15].

In the Mediterranean, MPAs managers are increasingly interested in reducing the environmental effects of underwater recreational activities using self-guide trails, and there are several examples of routes established for this purpose, such as in the Port Cros National Marine Park, the Bouches de Bonifacio Marine Reserve and the Cerbère-Banyuls Natural Marine Reserve, all located in France [16–18].

In Brazil the interpretative trail located at Anchieta Island Park (southeast Brazil) represents an important example (probably the sole example for this country) of a scientifically-based underwater route that aims to promote environmental education for snorkelers and scuba divers [19]. In Mexico, at Isabel Island National Park, six underwater trails were implemented to concentrate scuba diving within established routes and define carrying capacity of recreational diving in this popular island [20]. In the Nordic and

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http://dx.doi.org/10.1016/j.marpol.2013.10.011

the Baltic Sea Regions, Tikkanen [11] presents two innovative projects for the regulation of visits of underwater cultural heritage sites: the Nordic Blue Parks Project that enhances recreation through underwater trails at wreck sites; and the Vrouw Maria Underwater Project, that provides underwater visits to the Vrouw Maria Dutch snow ship using virtual simulation, because of the "Natura 2000" protected area in which the wreck is located. In Portugal, three underwater snorkelling routes have been developed, in 2008, as a way to promote environmental knowledge at a popular summer season beach, the Marinha Beach (Algarve) [10].

Independently of the method used, carefully planned briefings are essential for reducing divers' underwater impact [14,21]. However, in order to be effective, briefings must be "environmentally friendly" [22], site and target specific, and be provided immediately prior to the dive [23]. If properly delivered, *in situ* interpretation and education can contribute to increase environmental awareness. Furthermore, these methods increase divers' satisfaction and their perception about the surrounding environment [23].

A number of studies have been conducted on scuba diver visits [e.g. 10,13,24–26], with most research focusing on divers' impacts on the environment, especially on coral reefs, an issue of increasing concern amongst the scientific community [23,27,28]. Some studies have analysed divers' perceptions about their impacts on the system or their satisfaction regarding different aspects of the dive, support facilities and infrastructures. Analysis of divers' perceptions about this recreational activity is rare and mainly relate to specific crowded and popular diving sites, explicit concerns of managers, divers' satisfactions and motivations, or environmental education procedures. Musa [29,30] studied Sipadan (Malaysia) diving site in order to examine overall divers' satisfaction, define divers' profile and understand their impact on the tourism development of the island. O'Neill et al. [31] Atilgan et al. [32] and MacCarthy et al. [33] analysed operators performances by investigating divers perceptions. Reef management preferences of sport divers, in offshore Texas, were studied by Ditton et al. [34]. Demographic characteristics of divers in the Medes Island (Spain) were analysed by Mundet and Ribera [35]. Musa et al. [36] analysed the influence of scuba divers' personality, experience and demography on their underwater behaviour. Divers' environmental perception and its implications for the management of the activity were studied by Brotto et al. [37] for the coastal area of Rio de Janeiro (Brazil).

Specific scientific research on underwater routes use is even rarer. In Brazil, Berchez et al. [38] and Pedrini et al. [19], worked on improving environmental education for Anchieta Island's Park underwater routes, reporting the absence of research data for comparison purposes. Hannak [13] analysed visitor characteristics and their perceptions about the management tools used for the implementation of a snorkelling underwater route in Dahab (South Sinai, Egypt). In Portugal, Rangel et al. [10] analysed visitors' satisfaction and overall perceptions about three underwater snorkelling routes implemented at Marinha Beach (Algarve). The general lack of knowledge in this area conflicts with the increasing use of interpretative trails as management measures all around the world.

Two underwater scuba dive routes were implemented in the Algarve (South of Portugal), allowing visitors to engage with natural underwater biodiversity, landscape, and historical heritage in the area. The objectives of this paper are to gauge divers' perceptions about these routes and their role in enhancing underwater tourism, the diving service provided and the supporting infrastructures. Plus the paper investigates their motivations and defines divers' demographic profiles.

2. Methods

2.1. Mapping, characterization and selection of dive sites for routes' implementation

Diving spots were selected based on defined features: high biodiversity, existence of charismatic (e.g. *Muraena helena*) and protected species (e.g. *Eunicella verrucosa*), appealing landscape (e.g. rocky outcrops), geological features, existence of key biotope species (e.g. *Dyctiota dichotoma*), existence of wrecks, accessibility and supporting infrastructures. Motivating features for diving visitation such as presence of fish and other dynamic aquatic life, site popularity, underwater adventure, natural and unpolluted surroundings [34] were also considered.

All dives were undertaken with local operators to allow customary dive procedures within each company and to enable immediate surveys of the tourists after diving. When choosing the study areas, all dive operators of the Algarve were considered for taking part in the study. Of the 13 dive clubs that existed in 2007 in the Algarve, Dive Spot (Armação de Pêra) and Hidroespaço (Faro) were chosen due to the interest and willingness they showed in taking part in the research and to the fact that both clubs are owned and managed by marine biologists who were receptive to collaborating in a scientific study. Initially, in 2007 and 2008, five well known diving spots were analysed for possible route implementation: "Anzol", "B24" and "Cavalos do Mar", operated by Hidroespaço, and "Poço" and "Nudis", by Dive Spot.

Marine underwater communities were assessed (to characterize local fauna and flora, identify characteristics and/or protected species, localize interesting landscape features and locate conspicuous species) in all five dive spots using the RenSub projects visual census methodology for characterization of the marine communities of the Central Algarve Underwater Ecological Reserve.

In 2008 two diving spots, "B24" and "Poço" (Fig. 1), were chosen for the implementation of routes. Selection was first based on RenSub field research team choice of most appealing and feasible underwater spots for route development. Accessibility, possible dangers and routes' drawings, support infrastructures, as well as motivating features for diving visitation, as identified by Ditton et al. [34], were later considered for the final selection of areas for the routes. The chosen spots were considered the most consensual for all described features.

Both study areas are part of the National Underwater Ecological Reserve *Reserva Ecológica Nacional* (REN; DL no. 321/83, of 5th of July), consisting of areas under special protection, from the shore to the 30 m bathymetric mark (Minister Council Resolution no. 81/2012), due to their ecological sensitivity, exposure and susceptibility to natural impacts.

2.2. Route sites

2.2.1. "B24" – Faro

The "B24 Liberator" (Fig. 1) is the wreck of the U.S. B-24 Liberator bomber PB4Y that sank in 1943 off Faro (coordinates: N36 59.235; W008 00.251). The historical aspect of the spot, along with its rich biological assemblages and its popularity amongst divers were the main reasons for its selection. Nowadays it is possible to identify the structure of two complete wings (34 m long) in inverted position, the motors and the cavities for the landing gear storage bay. Unfortunately, the fuselage has disappeared, but two of the propellers, a motor rotor and one vertical rudder are located quite near the main structures and can be seen during the same dive.

2.2.2. "Poço" – Armação de Pêra

The diving spot "Poço", located off Armação de Pêra (coordinates: N37 03.103; W008 21.197) (Fig. 1), consists of an underwater

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