of the N2 night scope for this and other nocturnal studies. R. Spaar, P. Kerlinger, K. Bildstein, and an anonymous reviewer improved an earlier version of the manuscript.

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NESTING DISTRIBUTION, FOOD HABITS, AND CONSERVATION OF OSPREY ON BOAVISTA ISLAND (ARCHIPELAGO OF CAPE VERDE)

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KEY WORDS: *Osprey*; Pandion haliaetus; *Boavista*; *conservation*; *diet*; *distribution.*

The Osprey (*Pandion haliaetus*) is widely distributed around the world and it has suffered heavily from several human impacts such as persecution, disturbances, and fishery practices (Saurola and Koivu 1987). This raptor eats live fish almost exclusively (Häkkinen 1977, 1978, Saurola and Koivu 1987) and therefore its distribution is restricted to the vicinity of favorable fishing waters; e.g., rivers, lakes, and sea coasts (Poole 1989).

In ideal conditions Osprey nests are located close to

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the shoreline. However, timber extraction and shoreline development have reduced the availability of suitable nesting sites, likely causing population declines (Ewins 1997). Because Ospreys are generally wary in areas disturbed by human activities, they may locate their nest several kilometers from foraging areas (Saurola 1997). Nevertheless, in many areas, Ospreys have adapted to intensive human activity by nesting on powerline poles, windmills, bridges, and other structures (Cramp and Simmons 1980, Ewins 1997, Saurola 1997).

Naurois (1969) estimated 50 pairs of Osprey inhabited the Cape Verde Islands during the 1960s. Through the years, this population has remained about the same size, with 3–8 pairs on each island and 1–2 pairs on the islets (Hazevoet 1995). However, Ferreira and Palma (2000) described a general decline of this population due to persecution and human pressure, which has caused abandonment of several accessible nests (only 31–38 breeding pairs reported in 1998). Apart from this information, there is a study on Ospreys in Cape Verde (Naurois 1987); but the diet, nesting distribution, and specific conservation problems of the population on the island of Boavista have never been analyzed. Traditionally, this Osprey population has remained stable because this island was unknown to travelers (Naurois 1969, Hazevoet 1995). Also, Boavista has been only sparsely populated by humans for centuries. However, the plans for the future tourist expansion will increase human disturbances and may threaten the species. In this paper, I examine the population, nesting distribution, characteristics of the nests, food habits, and the possible influence of tourist activities in the Osprey population on Boavista Island.

STUDY AREA AND METHODS

The Cape Verde Islands are situated in the eastern Atlantic between 14°48′–17°22′N and 22°44′–25°22′W, 460–830 km west of Senegal (Fig. 1). There are 10 islands and several islets. Boavista Island is the third largest island of the archipelago, 620 km^2 in area with a perimeter of 116 km. The topography is generally flat, the highest elevation (Monte Estância) being only 387 m, and very dry (mean annual rainfall for Boavista is 91 mm [Kasper 1987]). Because the moderating influence of the surrounding ocean temperatures are relatively constant, the amplitude of mean temperatures in different months is seldom more than 6°C. Large areas are covered with sand, forming mobile dunes and barren stony plains, but in the interior there are oases with palms (Sena-Martins et al. 1986).

For this study, I gathered preliminary data on the Boavista Osprey population from island people and naturalists. Because Osprey breeding sites are usually close to water (Ewins 1997, Saurola 1997), I conducted transects by vehicle and on foot close to the shoreline during 1999 (total transect length = 121.2 km). Each time I detected an Osprey, I stopped the vehicle and searched by foot for nests and perches.

To analyze the Osprey diet in July 1999, I collected prey remains and pellets from nests and perches (Häkkinen 1978) used by five different pairs. All pellets and 95.4% of the remains were collected near perches, and the rest of the prey remains came from nests. The prey items were identified to the species level (when possible) by comparing them with a local reference collection and fish-identification guides (Muus and Dahlstrøm 1971, Rojo 1988, Muus et al. 1999). Finally, I contacted with the Cape Verde Authorities and the Cape Verde Nature 2000 project coordinator, for information on current and planned tourism development and research projects for Boavista Island.

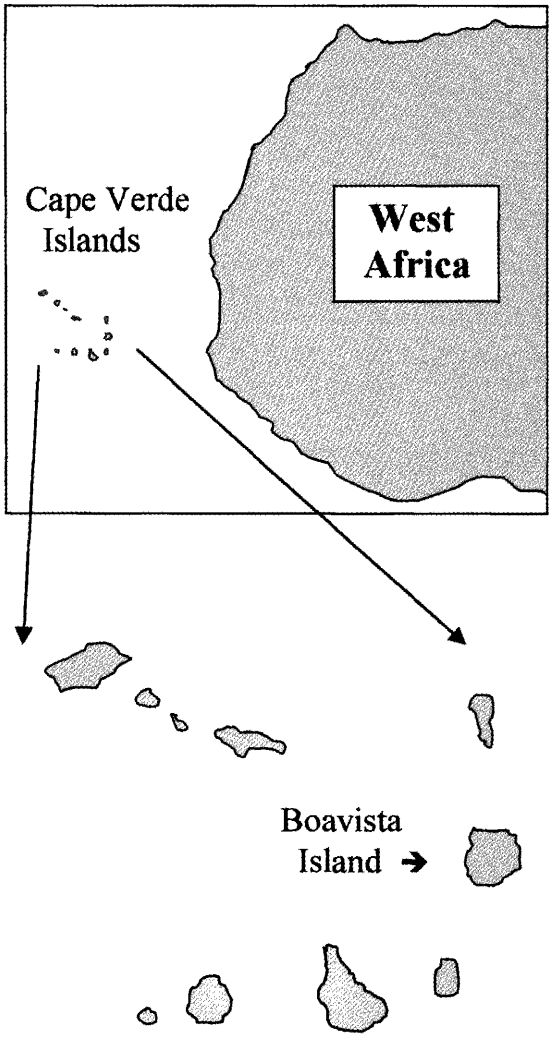

Figure 1. Map of Cape Verde Islands, and their position relative to West Africa.

RESULTS AND DISCUSSION

The Osprey population of Boavista is composed of at least eight pairs that are distributed regularly along the

Table 1. Diet of the Osprey on Boavista Island (Cape Verde).

PREY	FREQUENCY OF PREY	PERCENT FREQUENCY
Parrotfish	127	89.4
Salemas	2	1.4
Bennett's flying fish	2	1.4
Dentex	5	3.5
Trachichthydae	1	0.1
Unidentified fish	5	3.5
Total	142	

shoreline. The mean distance between nests was 12.6 ± 2.1 km (range = 10.5–16.5 km; distance between pairs measured as km of coast from the nests of neighboring pairs). On Boavista Island, trees are practically non-existent and, thus, Ospreys normally occupy other nest sites. I found nests on small cliffs ($N = 7$), on the mast of a beached boat ($N = 1$), on the ground ($N = 2$), on the ground on a small islet ($N = 1$), and one nest on a palm-tree (*Phoenix* sp.).

The occupied Osprey breeding sites in Boavista Island are close to the shoreline, at a mean distance of 134.8 ± 306.7 m from the water (range = 0–950 m; $N = 8$). This location minimizes energy expenditure (Garber 1972, Henny et al. 1978, Ewins 1997) for Ospreys, which generally forage on the coastline.

The availability of suitable nest sites may be limiting local breeding populations (Newton 1979, Ewins 1997) as I found few structures suitable for supporting nests during my survey. The number of Ospreys in Boavista probably has remained stable during the last few years, but increased tourism on this island may eventually cause a population decline (Ferreira and Palma 2000). I found that the two nests on the ground, which were vulnerable to disturbance, did not have prey remains indicating no recent use. Therefore, the scarcity of alternative nesting cliffs and the human disturbance of some existing nest sites may be a threat to the future of this population.

As Ospreys clean and tear the fish before eating them (Moll 1962), only 11 pellets were found in the study area. These pellets corresponded to 11 prey, and the rest of information on food habits came from collected remains. Six different types of prey were identified among the 142 prey items found in the study area (Table 1). The abundance of *Sparisoma* sp. in the diet of this raptor on Boavista Island is notable. This genus is the most abundant among the medium-size fish around this island, thriving in water up to 2 m deep (Ontiveros unpubl. data), near the surface, where Osprey usually catch their prey (Poole 1989). This agrees with the fact that Osprey takes the most abundant available prey in each moment (Edwards 1988, Poole 1994). However, my data were in opposition to Bannerman and Bannerman (1968), who described the Osprey as having a wide choice of prey in the sea around the Cape Verde Islands and specified that *Serranus cabrilla* was the most important prey in this archipelago.

In the past, Ospreys were killed in Europe as a competitive consumer of fish (Dennis 1991, Saurola 1997). However, in Boavista the fishing is based on large fish species not consumed by Ospreys, such as tuna (*Thunnus thynnus*); thus, this raptor has not been considered as a competitor by the people, the bird being traditionally respected. Nevertheless, Osprey eggs and nestlings are consumed by people as food on some Cape Verde islands (Ferreira and Palma 2000).

The conservation needs of island fauna, and especially of raptors, are generally more urgent than those of continental species, except where limited distributions on continents mimic an island situation (Virani 1995, Virani and Watson 1998). The Cape Verde Osprey population has recently been estimated at 31–38 pairs (Ferreira and Palma 2000) and, as on Boavista Island, tourism projects on many islands of the archipelago represent a threat to the entire island population. The Cape Verde government is promoting projects to boost tourism in the country in two ways: (1) building tourist centers in undisturbed coastal habitats and (2) favoring such activities as watching marine turtles, especially the loggerhead sea turtle (*Caretta caretta*), the most abundant turtle in the sea surrounding Boavista Island (López-Jurado et al 1999).

The Osprey is easily detected on the shoreline of the island and can also be a tourist attraction in the area Nevertheless, the current increasing human population threatens the Osprey population on the island and probably on other islands of Cape Verde. In other places in the world, the stabilization of Osprey breeding habitats has been due largely to intensive management, including nest-site protection (Poole 1989, Spitzer 1989, Houghton and Rymon 1997), which has been proposed for Ospreys on the Cape Verde Islands (Ferreira and Palma 2000). If Ospreys are not persecuted, they tolerate human activities quite well (Houghton and Rymon 1997, Saurola 1997). A growing number of adventure lovers and ecotourists are expected to visit this desertic island in the next years; maintaining a buffer area surrounding nests free of human disturbances during the breeding period (especially for the most accessible nests), could help to conserve the Osprey population while permitting the tourist activities in the archipelago. Efforts in this direction can serve to make the conservation of Boavista wildlife compatible with economic expansion on the island

RESUMEN.—La distribución y dieta del Águila Pescadora (*Pandion haliaetus*) fue estudiada en la Isla de Boavista (archipiélago de Cabo Verde) durante 1999 a través de transectos lineales en vehículo y a pie, así como las amenazas existentes sobre la población. Se localizó una población uniformemente distribuida a través del perímetro de la isla, con una distancia media entre las 8 parejas

encontradas de 12.6 ± 2.1 km. Debido a la escasez de vegetación de la isla y la exigua población humana, el Águila Pescadora nidificó en lugares tan variados como roquedos, islotes, el mástil de un barco encallado, una palmera, y el propio suelo. Los nidos se ubicaron invariablemente cerca de la orilla del mar, con una distancia media entre el nido y el agua de 134.8 ± 306.7 m, minimizando de esta forma el gasto energético de las aves en sus desplazamientos. El 89.4% de las presas capturadas fue *Sparisoma* sp., uno de los géneros de peces más abundantes en aguas somera. Para evitar la influencia del turismo creciente, es conveniente diseñar un plan de protección para la isla que lo haga compatible con la conservación de la especie.

[Traducción de César Márquez]

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