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OSPREY DIET ALONG THE EASTERN SIDE OF THE GULF OF CALIFORNIA, MEXICO

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Key words: Osprey, *Pandion haliaetus*, Gulf of California, diet, *Mugil cephalus*, *Tylosurus*, *Strongylura*.

A large resident population of Ospreys (*Pandion haliaetus*) has been documented in the Gulf of California and Baja California region of Mexico (Henny and Anderson 1979, Reitherman and Storrer 1981, 1982, Judge 1983, Danemann and Guzmán Poo 1992, Castellanos and Ortega-Rubio 1995, Cartron 2000). However, Osprey diet in this region has been reported only for the Bahía de Los Angeles Islands (Judge 1981). To date, no published information on diet exists for Ospreys nesting along the coast of Sonora on the eastern side of the Gulf of California. The Bahía de Los Angeles Islands are small, rocky islands, whereas the coast of Sonora is characterized by extensive sandy beaches, shallow bays, and estuaries (Molles 1978, Alvarez-Borrego 1983, Alvarez-Borrego and Lara-Lara 1991, Thomson et al. 2000). Because the Osprey is an opportunistic rather than selective fish-eating species (Poole 1989), its prey base is likely to differ between these 2 geographic areas.

In 1995 and 1996 we studied the diet of 39 and 40 Osprey pairs, respectively, nesting along the eastern side of the Gulf of California. Our study focused on 3 locations: Bahía Sargento, Mancha Blanca, and El Desemboque (Fig. 1). Each location provided distinctive foraging environments and therefore potentially different prey bases for Ospreys. Bahía Sargento ($n = 22$ occupied Osprey nests, 1995; $n = 23$, 1996) is a wide, shallow bay dotted with scattered rocky patch reefs. Except toward its northern end, it is bordered by extensive beaches of fine sand. Along the south-facing side of the bay, a large negative estuary lined by mangrove encroaches upon the land. To the north of Bahía Sargento, Mancha Blanca ($n = 7$, 1995 and 1996) is characterized by a steeply

sloping pebble beach near the rocky headland, Punta Tepopa. At the northern end of our study area, the 4-km stretch of coast north of El Desemboque ($n = 10$, 1995 and 1996) is located just south of the mouth of the intermittent Río San Ignacio.

The breeding season of Ospreys in the Gulf of California is characterized by a high degree of asynchrony among pairs (Judge 1983, Cartron 2000). The onset of egg laying typically ranges from early January to early March, with fledging occurring from April to early June (Judge 1983). In 1995 prey remains were collected twice, mid-March and late May; in 1996 they were collected monthly from January through May.

We collected prey remains under nests and at the base of cardon (*Pachycereus pringlei*) cacti used by Ospreys for feeding. Nest disturbance was minimal (see Cartron 2000). A large number of collected prey items were sufficiently intact for easy identification using Thomson and McKibbin's (1976) guide to Gulf of California fish; they were subsequently used as references to identify other remains. Some prey species were tallied using specific bones (e.g., jaw bones for needlefish [*Tylosurus* and *Strongylura* spp.] or *Calamus brachysomus*, opercula for *Mugil cephalus*). Other prey species (e.g., *Balistes polylepis*), which were found in the form of (nearly) complete skeletons with attached skin, were simply counted. Scavenging of some prey remains by coyotes (*Canis latrans*) occurred in the study area but appeared to be fairly consistent through time.

During the study period we recorded 1385 prey at the 3 sites; these prey represented at least 19 species from 18 families (Table 1). At

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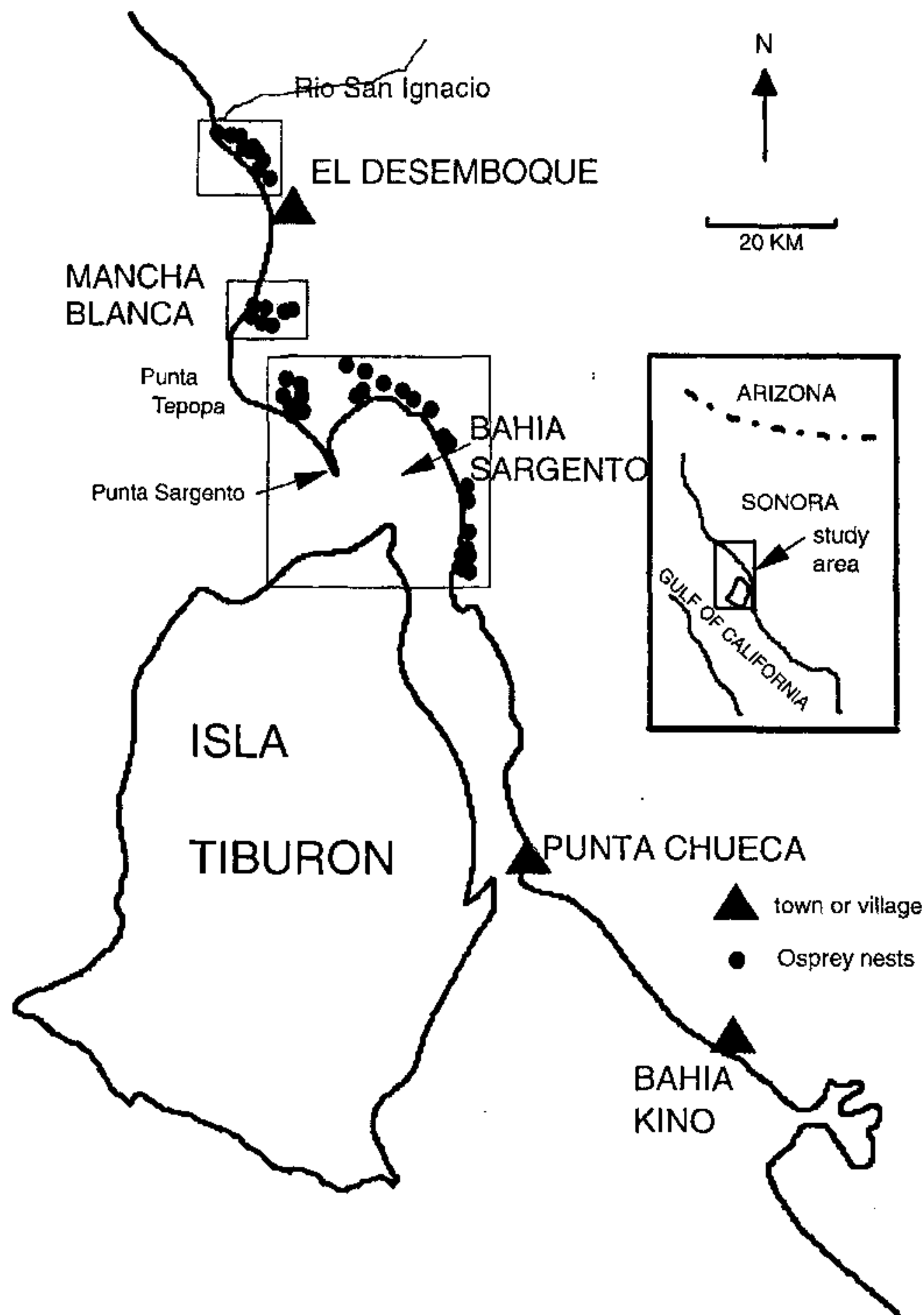


Fig. 1. Location of the study area on the eastern side of the Gulf of California. The 3 study sites (Bahia Sargento, Mancha Blanca, and El Desemboque) and all Osprey occupied nests are marked.

all 3 locations bullseye puffers (*Sphoeroides annulatus*) were occasionally found on the ground next to Osprey prey remains, but these poisonous fish never appeared to have been consumed. Based on prey remains, the fish most frequently consumed by Ospreys at El Desemboque appeared to be needlefish, followed respectively by striped mullet (*Mugil cephalus*), finescale triggerfish (*Balistes polylepis*), and Pacific porgy (*Calamus brachysomus*; Table 1). In 1995 and 1996 these fish represented 83–87% of prey remains at that location. At the other 2 sites striped mullet

followed by needlefish seemingly represented the bulk of the Osprey diet, with Pacific porgy and finescale triggerfish amounting to $\leq 5\%$ of the diet (Table 1).

There was no significant ($\chi^2 = 5.23$, $df = 3$, $P > 0.05$) difference between 1995 and 1996 in the proportion of the 4 main species (needlefish, striped mullet, finescale triggerfish, and Pacific porgy) recorded among prey remains at El Desemboque. Similarly, no significant ($\chi^2 = 0.18$, $df = 1$, $P > 0.05$) difference was noted in the proportion of the 2 main fish species (striped mullet and needlefish) among prey

TABLE 1. Number (%) of Osprey prey found at the 3 study sites during the 1995 and 1996 nesting seasons.

Family	Common family		Bahia Sargento		Mancha Blanca		El Desemboque	
	name	Species name	1995	1996	1995	1996	1995	1996
Rhinobatidae	Guitarfishes	<i>Rhinobatos productus</i>	0	0	1 (1)	0	1	0
Clupeidae	Herrings	Unidentified	0	0	1 (1)	0	0	0
Ariidae	Sea catfishes	<i>Bagre panamensis</i>	1	0	0	0	3 (3)	0
Synodontidae	Lizardfishes	<i>Synodus scituliceps</i>	0	0	0	0	1	0
Belonidae	Needlefishes	<i>Tylosurus</i> and <i>Strongylura</i> spp.	78 (28)	85 (28)	20 (22)	45 (39)	45 (39)	183 (38)
Fistulariidae	Cornetfishes	<i>Fistularia commersonii</i>	0	0	0	0	0	1
Scorpaenidae	Rockfishes	<i>Scorpaena mystes</i>	0	0	0	0	4 (3)	0
Triglidae	Searobins	<i>Prionotus ruscarius</i>	0	0	0	0	0	1
Serranidae	Sea basses	<i>Paralabrax</i> <i>maculofasciatus</i>	1	0	0	0	0	0
		Unidentified ^a	0	1	0	3 (3)	6 (5)	39 (8)
Carangidae	Jacks	<i>Seriola lalandi</i>	0	0	1 (1)	0	0	1
Haemulidae	Grunts	Unidentified	0	0	1 (1)	0	0	0
Sparidae	Porgies	<i>Calamus brachysomus</i>	10 (4)	7 (2)	0	2 (2)	7 (6)	50 (10)
Kyphosidae	Seachubs	<i>Girella simplicidens</i>	1	0	0	0	0	0
Mugilidae	Mullet	<i>Mugil cephalus</i>	177 (63)	209 (69)	60 (66)	63 (55)	33 (29)	110 (23)
Labridae	Wrasses	Unidentified	0	0	0	0	0	6 (1)
Scombridae	Mackerels and tunas	<i>Scomberomorus sierra</i>	4 (1)	0	0	0	2 (2)	3
Pleuronectidae	Righteye flounders	Unidentified	0	0	0	0	1	0
Balistidae	Triggerfishes	<i>Balistes polylepsis</i>	2	3	5 (5)	2 (2)	11 (10)	73 (15)
	Unidentified		5	2	2 (1)	0	1	11 (2)
TOTAL			279 (100)	307 (100)	91 (100)	115 (100)	115 (100)	478 (100)

^aIncludes at least one other serranid species besides *Paralabrax maculofasciatus*.

remains at Bahia Sargento. At Mancha Blanca there was a significant ($\chi^2 = 5.64$, $df = 1$, $P \leq 0.05$) difference in the proportion of striped mullet and needlefish between 1995 and 1996. Yet, this pattern may have been the result of missing data for the month of February at that location (prey remains were collected that month but were lost before they were analyzed). Minor differences between 1995 and 1996 were noted at El Desemboque: stone scorpionfish (*Scorpaena mystes*) and chihuil (*Bagre panamensis*), which seemingly represented 6% of the prey base of Ospreys at that location in 1995, were not found among prey remains in 1996.

Differences in diet among pairs were not analyzed due to small sample size for nests along Bahia Sargento or at Mancha Blanca. At El Desemboque the high density of nests typically prevented us from identifying with certainty the pair that had fed on a fish whose remains we found. One exception was a pair at the northern end of the study site. Between mid-March and mid-April 1996, Pacific porgy seemingly comprised 29% of its diet. During that same period the diet of all other pairs at

El Desemboque appeared to consist of <5% porgy. Overall, however, mullet or needlefish was always the primary prey species at any time in any collection of prey remains.

In 1995 and 1996 the proportion of needlefish and mullet in the diet of Ospreys appeared to vary through time. In 1995 the relative proportion of these 2 prey was significantly different between the 1st (March) and 2nd (May) samples we collected at El Desemboque ($\chi^2 = 4.8$, $df = 1$, $P \leq 0.05$), Mancha Blanca ($\chi^2 = 14.29$, $df = 1$, $P \leq 0.05$), and Bahia Sargento ($\chi^2 = 12.88$, $df = 1$, $P \leq 0.05$). In 1996 the relative decrease in striped mullet and increase in needlefish was apparent as early as February and continued through April (Fig. 2).

Our results suggest that the diet of Ospreys along the eastern side of the Gulf of California is substantially different from that of Ospreys on islands of the Gulf. Ospreys nesting on islands in Bahia de Los Angeles rely most consistently on Gulf opaleye (*Girella simplicidens*) and sand basses and sea basses (*Paralabrax* and *Epinephalis* spp.; Judge 1981). In contrast, the diet of Ospreys in our study area appeared to include chiefly striped mullet and needlefish.

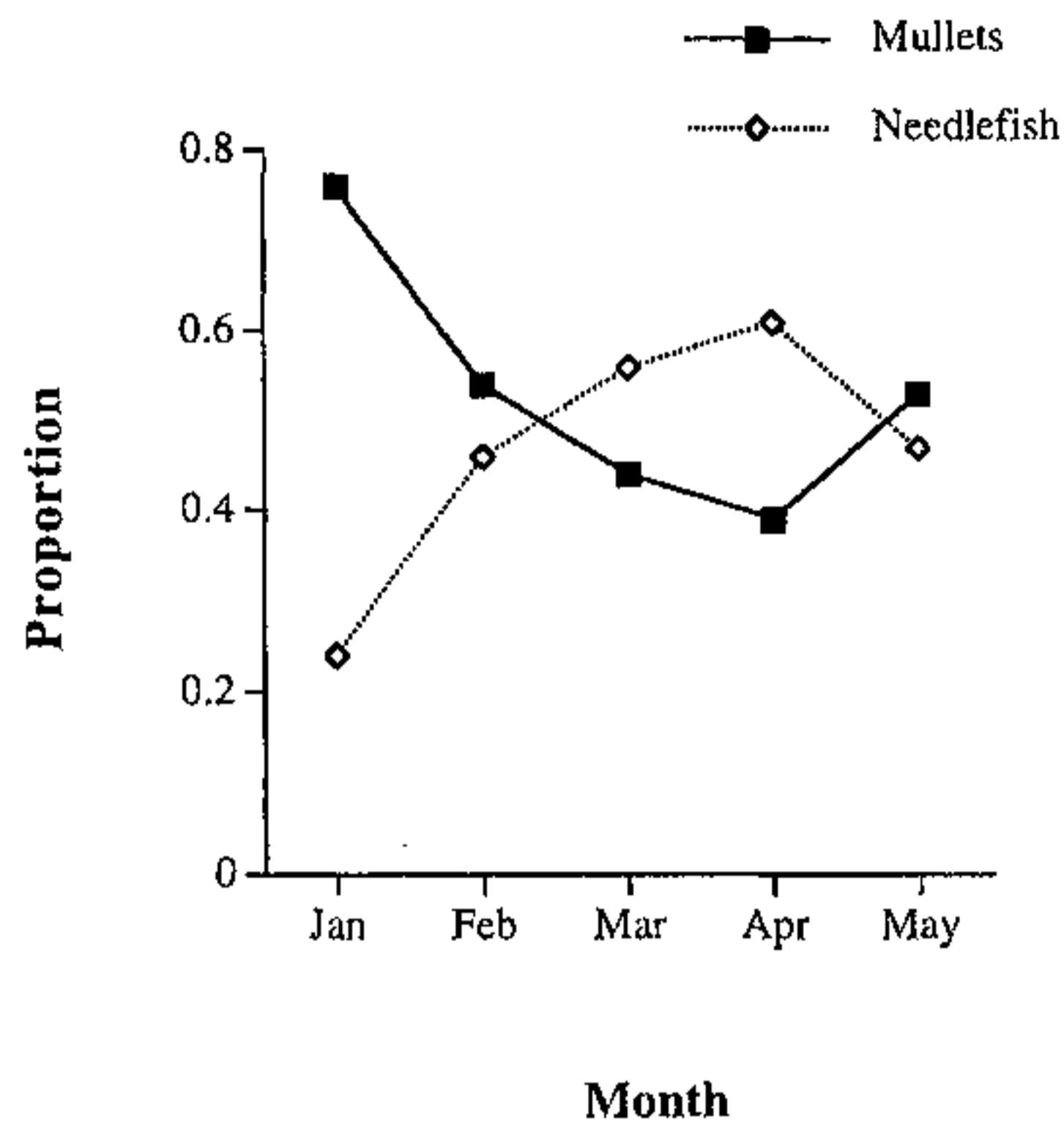


Fig. 2. Monthly variation in the proportion of needlefish vs. striped mullet in the diet of Ospreys at all 3 sites combined, January–May 1996. Sample size is only 2 (Bahia Sargento and El Desemboque) in February. Although declines in mullet relative to needlefish are observed at Bahia Sargento, Mancha Blanca, and El Desemboque, their timing or magnitude varies somewhat among these locations.

Locally, species such as the Pacific porgy or the finescale triggerfish became additional important prey species.

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