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The diet of the peacock wrasse, *Symphodus (Crenilabrus) tinca* (Labridae), in the southern coast of Tunisia

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The feeding habits of the peacock wrasse, Symphodus (Crenilabrus) tinca *(Linnaeus, 1758), from the southern coast of Tunisia were investigated with respect to fish size and season. Stomach contents of 1334 specimens, 8.1-23.1 cm total length, were analyzed. Of the total, 1166 were empty (87.4%). This percentage varied over the year, with a maximum during the spawning period (May-July) and minimum in February and August. Crustaceans and mollusks constituted the main prey in both the small and large size classes. As fish grew, the proportion of isopods in the stomachs decreased and the proportion of shrimps and benthic organisms increased. Diet composition varied seasonally, with crustaceans the most important prey item in all seasons especially summer and autumn. Higher feeding activity in winter may be related to the reproductive cycle of the wrasse and the abundance of benthic organisms. Results indicate that the peacock wrasse feeds on a wide range of prey items and is an opportunistic predator.*

Key words: Labridae, *Symphodus (Crenilabrus) tinca*, Mediterranean Sea, southern coast of Tunisia, feeding habits

INTRODUCTION

The peacock wrasse, *Symphodus (Crenilabrus) tinca* (Linnaeus, 1758) is a common fish in the Mediterranean and the eastern Atlantic from Spain to Morocco (QUIGNARD & PRAS, 1986). In Tunisia, it is usually found around rocks and seaweed in coastal areas at depths down to 50 m (AZOUZ, 1971; BEN OTHMAN, 1971). It is the most abundant species among the twelve Labridae fishes inventoried in the southern coast of Tunisia (BRADAI, 2000; OUANNES-GHORBEL, 2003).

Very little is known about the feeding ecology of the peacock wrasse. It is an obligatory carnivorous feeder preying on sea urchins, ophiuroides, mollusks, copepods, crabs, and worms (QUIGNARD & PRAS, 1986; BUDAEV & ZWORYKIN, 1998). However, little is known about how the diet of the peacock wrasse is affected

by factors such as fish size, sex, and season. QUIGNARD (1966) presented a list of prey of the peacock wrasse in French Mediterranean coastal waters and showed that sea urchins, ophiuroides, and mollusks are its main food. A few brief studies described the peacock wrasse diet in the Black Sea, where mollusks and copepods are its main prey (BUDAEV & ZWORYKIN, 1998).

MATERIALS AND METHODS

The peacock wrasses used in this study were taken from different localities along the southern coast of Tunisia. They were captured by artisan fishing gears in sheltered seaweed areas close to the shore, generally in depths of 1-6 m. The study included 1334 individuals (736 females and 598 males). Sampling was conducted monthly from commercial landings. For each fish, the sex was recorded, and total length (TL) and eviscerated weight were measured to the nearest 1 mm and 1 g, respectively. In the laboratory, the gut was weighed (wet weight) and its content identified to the lowest possible taxonomic level. Species abundance and wet weight to the nearest 0.001 g were recorded.

The total length of the fish ranged 81-231 mm. To assess for possible differences in diet with respect to size, fish were divided into two size classes: small (TL<133 mm) and large (TL>133 mm). Indices for quantitatively expressing the relative importance of different prey items in fish diets have been described by BERG (1979), HYSLOP (1980), and TIRASIN & JORGENSEN (1999). In this study, we used vacuity index (VI%), i.e., the number of empty stomachs divided by the total number of stomachs multiplied by 100; percent frequency of occurrence (%F), based on the number of stomachs in which a food item was found, expressed as a percentage of the total number of non-empty stomachs; percent numerical abundance (%Cn), i.e., the number of each prey item in all non-empty stomachs, expressed as a percentage of the total number of food items in all stomachs; and percent gravimetric composition (%Cw), the wet weight of each kind of prey, expressed as a percentage of the total weight of the stomach contents.

Main food items were identified using the index of relative importance (IRI) of PINKAS *et al* (1971), modified by HACUNDA (1981), IRI = %F x (%Cn + %Cw). This index has been expressed as %IRI = (IRI/Σ IRI) x 100. Prey were sorted in decreasing order according to their IRI and the cumulative %IRI was calculated.

RESULTS

Feeding intensity

Of the total 1334 stomachs examined, 1166 were empty (VI% = 87.4). VI% reached its maximum of 100% during May-July and minimum of 71.2% in February and August (Fig. 1). VI did not differ between males

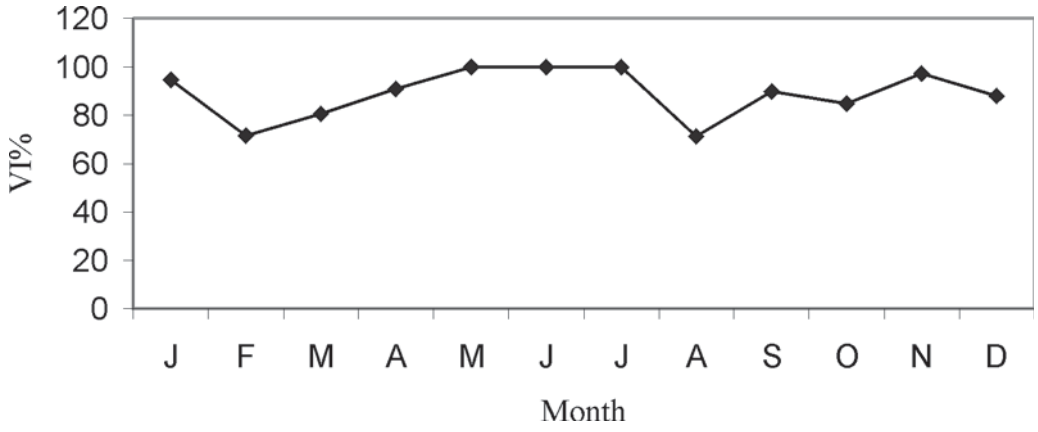

Fig. 1. Monthly vacuity index (VI%) of Symphodus (Crenilabrus) tinca

(87%) and females (87.9%) throughout the year and was higher in young specimens (93.7%) than in adults (87.4%).

Diet composition

Thirteen prey species belonging to 11 embranchments were identified (Table 1). Table 2 shows their frequency of occurrence, numerical and biomass composition, and IRI. Crustaceans were the most important ingested prey, constituting 59.4% of the total IRI. Among the crustaceans, Macroura (shrimps) were the most important contribution to the diet (%IRI = 24.9). Isopoda and Mollusca were frequently eaten but in smaller amounts. Other prey groups were comparatively low and of less importance.

Diet in relation to fish size

Crustaceans and mollusks were the only prey eaten by young fish and the most important prey ingested by adults (Table 3). Among the crustaceans, isopods were the most important contribution to the diet for young fish; shrimps were most important for adults. Other prey groups in the adult stomach contents were of comparatively low and lesser importance.

Table 1. List of prey recorded in the stomach contents of the peacock wrasse, Symphodus (Crenilabrus) tinca

Embranchment	Superclass/Class	Order/Suborder	Group/Family	Genus species
Annelida	Polychaeta	Errantia	Nereidae	*Nereis hombergi* *Nereis* sp. *Nereis*
Mollusca	Cephalopoda	Decapoda	Sepiidae	*Sepia officinalis*
	Bivalvia	Anisomyaria	Pteriidae	*Pinctada radiata*
	Gastropoda	Mesogastropoda	Turbinidae	-
			Turritellidae	*Turritella* sp.
		Archeogastropoda	Phasionellidae	*Phasionella tenuis*
			Trochidae	-
			Patellidae	-
Arthropoda	Crustacea	-	-	-
	Eucarida	Decapoda	-	-
		Brachyura	Portinidae	*Portinus mediterraneus*
		Macrura	Caridideae	*Penaeus kerathurus*
	Peracurida	Amphipoda	Gammaridae	-
		Copepoda	-	-
		Isopoda	Sphaeromidae	*Sphaeroma* sp.
	Cirripedia	-	-	-
Echinoidea	Echinida	Regularia	Echinidae	*Paracentrotus lividis*
Cnidaria	Anthozoa	-	-	-
Bryozoa	-	-	-	-
Foraminifera	-	-	-	-
Chrysophyta	Diatomeae	-	-	-
Angiospermae	Monocotyledoneae	Potamogetonaceae	-	*Posidonia oceanica*
Pheophycophytes	Pheophyceae	Fucales	Cystoseireae	*Cystoseira* sp.
Vertebreta	Osteichtyes	-	-	-
	Teleostei	Perciformes	-	-

Table 2.Frequency of occurrence (%F), numerical composition (%Cn), biomass composition (%Cw), and index of relative importance (IRI) of dietary groups of the peacock wrasse

Prey	%F	%Cn	%Cw	IRI	%IRI
Annelida	6.0	3.1	7.7	64.8	0.4
Mollusca	17.5	32.6	8.2	714.0	4.3
Bivalvia	3.6	2.1	1	11.2	0.1
Gastropoda	13.9	29.1	4.4	465.7	2.8
Cephalopoda	0.6	0.21	0.2	0.2	0.1
Crustacea	89.2	43.9	66.1	9812.0	59.4
Brachyura	2.41	1	1.2	5.3	0.1
Macrura	64.5	22.6	41.1	4108.7	24.9
Amphipoda	1.8	0.6	1.1	3.1	0.1
Isopoda	22.3	17.8	20.6	856.3	5.2
Cirripedia	3.6	1.3	1	8.3	0.1
Antozoa	0.6	0.2	0.1	0.2	0.1
Bryozoa	19.9	6.9	7.1	278.6	1.7
Foraminifera	3.6	7.1	0.4	27	0.2
Diatomeae	0.6	0.21	0.1	0.2	0.1
Algae	15.7	5.4	3.7	142.9	0.9
Teleostei	1.2	0.5	6.7	2.8	2.8

Table 3. Frequency of occurrence (%F), numerical composition (%Cn), biomass composition (%Cw), and index of relative importance (%IRI) of dietary groups for small and large peacock wrasse

	Small (TL = 81-133 mm)				Large (TL = 134-231 mm)			
Prey	%F	%Cn	%Cw	%IRI	%F	%Cn	%Cw	%IRI
Mollusca	12.5	26.9	9.5	2.7	18	33	8.12	6.9
Crustacea	100	73.1	90.5	27.3	88	42.3	65	88.1
Antozoa	-	-	-	-	0.7	0.2	0.1	0.1
Bryozoa	-	-	-	-	22	7.3	7.4	3.1
Foraminifera	-	-	-	-	4	7.5	0.5	0.3
Diatomeae	-	-	-	-	0.7	0.2	0.1	0.1
Alguae	-	-	-	-	17.3	5.8	3.8	1.6
Teleostei	-	-	-	-	1.3	0.4	7	10.1

Seasonal variation

Crustaceans were the dominant prey in all seasons, especially in summer and autumn (%Cn>84.2; Fig. 2). In summer, small quantities of Mollusca and Bryosoa were also eaten whereas crustaceans were the only prey eaten in autumn, together with a small amount of accidentally ingested algae. Other prey groups were present in the winter and spring diets, in which Mollusca constituted the most frequently ingested prey.

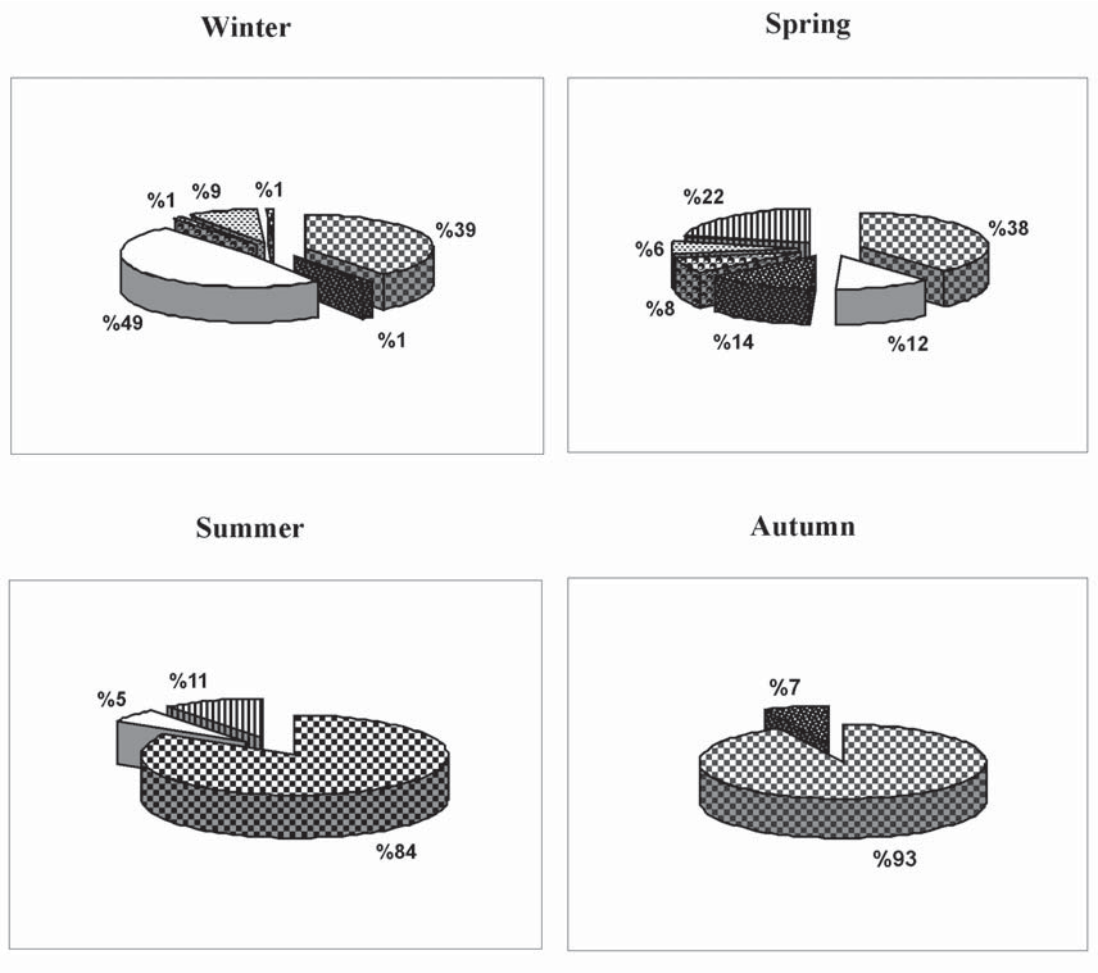

Fig. 2. Seasonal variation of Symphodus (Crenilabrus) tinca *diet based on %Cn values of the major prey groups*

DISCUSSION

In general, the diversity of ingested prey groups and species indicates that peacock wrasse is an opportunistic predator, feeding especially on the benthic organisms of shallow meadows of posidonia beds, with a wide range of prey size and morphology. Young and adult peacock wrasse on the southern coast of Tunisia fed principally on crustaceans (isopods and shrimps) and mollusks (gastropoda) (OUANNES-GHORBEL, 2003) which are well represented in the benthic fauna of Gabes Gulf (BRADAI, 2000). All other prey (Polychaeta, Algae, Amphipoda, Antozoa, Bivalvia, Bryozoa, Brachyura, Cephalopoda, Cirripedia, Diatoma, Foraminifera, and Teleostei) were eaten only by adults, but in much smaller amounts and especially in winter. The intensified feeding of adults throughout winter can be attributed to the development of sexual maturity (OUANNES-GHORBEL *et al.,* 2002); adults feed at high intensity in winter to optimize energy for gonad development (OUANNES-GHORBEL *et al.,* 2002). Since benthic fauna was well represented in their stomachs, we suppose that adults change their behavior and relationship in the bottom biocenoses. QUIGNARD (1966), reporting on the food composition of peacock wrasse (6.0-35.0 cm TL) from the southern coast of France, confirmed its opportunistic behavior. In his study, stomach contents were dominated by the benthic organisms Ophuiora (three species), Mollusca (three species of Gastropoda, eight of Bivalvia), Crustacea (two species of

Decapoda, one species of Amphipoda), Annelida (one species), Amphineura (one species), and Foraminifera (one species), the same main prey species found in our study. Differences in food composition between the southern coast of France and the southern coast of Tunisia are due mainly to different distribution, abundance, density, and availability of prey (QUIGNARD, 1966; OUANNES-GHORBEL, 2003).

With growth, the proportion of small crustacean isopods diminished while the proportion of larger prey (shrimps) increased. In this respect, trophic ontogeny in peacock wrasse can be explained in terms of fish morphology. The width and mouth gape are linearly related to fish size (ROSS, 1978; STONER, 1980) and larger body and mouth sizes permit fish to capture a broader range of prey sizes (WARE, 1972; ROSS, 1977; STONER & LINGVISTON, 1984).

The monthly vacuity indices (IV%) did not show a clear difference between males and females. The low IV% in February and August can be contributed to spawning; in the southern coast of Tunisia, peacock wrasse spawns during April and June (OUANNES-GHORBEL *et al.,* 2002). The animal's feeding intensity increased before and after this period.

In conclusion, peacock wrasse is an opportunistic predator of many benthic animal groups in the Gabes Gulf shallow meadow bed. Crustaceans and mollusks were the major prey, although many benthic organisms (Polychaeta, Algae, Amphipoda, Antozoa, Bivalvia, Bryozoa, Brachyura, Cephalopoda, Cirripedia, Diatoma, Foraminifera, and Teleostei) were found in analyzed guts, particularly in adult specimens.

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Sastav hrane i intenzitet ishrane lumbraka, *Symphodus (Crenilabrus) tinca* (Labridae), na južnim oblama Tunisa

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SAŽETAK

Istraživan je sastav hrane i intenzitet ishrane lumraka, *Symphodus (Crenilabrus) tinca* (Linnaeus, 1758) sakupljenog na južnim obalama Tunisa. Analiziran je sadržaj želuca kod 1334 primjerka ukupne veličine 8.1-23.1 centimetara, od kojih je 1166 (87.4%) primjeraka imalo prazan želudac. Intenzitet ishrane kolebao je tijekom godine od maksimuma za vrijeme sezone mriješćenja (svibanj-srpanj) do minimuma u veljači i kolovozu. U hrani su prevladavali rakovi i mekušci svih veličina. Shodno veličini ustanovljeno je da je kod većih primjeraka zastupljenost izopoda u ishrani manja, dok su rakovi i bentički organizmi više zastupljeni. Intenzitet ishrane kolebao je prema godišnjem dobu, iako su rakovi bili najvažniji plijen tijekom cijele godine, a posebno u ljeto i jesen.

Viši intenzitet hranjenja u zimskom razdoblju može se pripisati periodu mrijesta lumbraka i povećanoj prisutnosti bentičkih organizama. Rezultati ukazuju da se lumbrak hrani širokim rasponom plijena, te je oportunistički predator.

Ključne riječi: Labridae, *Symphodus (Crenilabrus) tinca*, južna obala Tunisa, hranidbene navike, rakovi, mekušci