ISSN: 0001-5113
AADRAY

ACTA ADRIAT.,
55(1): 75 - 84, 2014

ORIGINAL RESEARCH PAPER

Diet and feeding habits of *Spicara maena* and *S. smaris* (Pisces, Osteichthyes, Centracanthidae) in the North Aegean Sea

Paraskevi K. KARACHLE[1] and Konstantinos I. STERGIOU[1, 2]

[1]Hellenic Centre for Marine Research, 46.7 km Athens Sounio ave., P.O. Box 712, 19013 Anavyssos Attiki, Greece

[2]Aristotle University of Thessaloniki, School of Biology, Department of Zoology, Laboratory of Ichthyology, Box 134, 54124, Thessaloniki, Greece

Corresponding author, e-mail: pkarachle@hcmr.gr

In the present paper we studied the diet of two centracanthid species, Spicara maena *and* S. smaris, *in the N Aegean Sea. Overall, 282 and 118 individuals were examined, respectively. Both species preyed upon zooplankton, notably Copepoda (54.3 and 63.5%, respectively).* S. maena *included in its diet a wider variety of food items (36 taxa) compared to* S. smaris *(12 taxa). The individual trophic levels for both species ranged from 3.00 to 4.50 (mean values ± strandard error: 3.21±0.058 for* S. maena *and 3.05±0.068 for* S. smaris*). Given their trophic position and local abundance, they play a crucial role in the flux of energy from low to high trophic levels of the Aegean benthic and pelagic food webs.*

Key words: alimentary tract, diet, trophic levels, North Aegean Sea, Centracanthidae, Greece

INTRODUCTION

The family Centracanthidae includes 2 genera (*Centracanthus* and *Spicara*) and 7 species (FishBase: www.fishbase.org; FROESE & PAULY, 2012). The genus *Spicara* is represented in the Mediterranean by two species, *S. maena* and *S. smaris*, which are of small to medium size (www.fishbase.org) and economic value (SUMAILA *et al*., 2007; STERGIOU *et al*., 2011). According to FishBase and ESCHMEYER (2012), *S. flexuosa* is considered a synonym of *S. maena*, yet there is genetic evidence that they are two separate species (e.g. TURAN, 2011; MINOS *et al*., 2013). Their global fisheries production originates mostly from Greece, where they are mainly fished in the waters surrounding Cyclades Islands and their populations are fully exploited (STERGIOU *et al*., 2011), but it also plays important role in Croatian coastal fisheries and as traditional food (e.g. DULČIĆ *et al*., 2000, 2003; MATIĆ-SKOKO *et al*., 2011).

The biology of both species has been studied in the Mediterranean (e.g., *S. maena*: MYTILINEOU, 1987; DULČIĆ *et al.*, 2000; MATIĆ-SKOKO *et al*., 2004; SOYKAN *et al*., 2010; *S. smaris*: TSANGRIDIS & FILIPPOUSIS, 1991; VIDALIS, 1994; ISMEN, 1995; DULČIĆ *et al*., 2003). With respect to the feeding habits of *S. maena,* they have been studied in various areas of the western (Gulf of Lions: KHOURY, 1984; Algerian coasts: HARCHOUCHE *et al*., 2009) and central Mediterranean Sea (Patraikos Gulf: MYTILINEOU, 1987), whereas no such information exists for the eastern Mediterranean. The diet of *S. smaris* has been studied in the Gulf of Marseille (BELL & HARMELIN-VIVIEN, 1983), the Cretan Sea (VIDALIS, 1994) and the South Evvoikos Gulf (PETRAKIS *et al*., 1993).

In this paper we (a) describe the feeding habits of these two species, by sex and season, in the North Aegean Sea, Greece; and (b) estimate fractional trophic levels (τ) for describing the position of these species in the Mediterranean food webs.

MATERIALS AND METHODS

Samples were collected in the North Aegean Sea, on a seasonal basis from June 2001 to January 2006, using professional fishing vessels (i.e. purse seiners, trawlers and small-scale gill netters). Specimens caught were preserved in 10% formalin. In the laboratory, all specimens were measured (total length (TL), 0.1 cm), the digestive tract was removed and the stomachs were isolated. Sex was also determined, by visual examination of the gonads. Consequently, the vacuity coefficient (VC) was estimated as the percentage of empty stomachs and the stomach contents were examined, by identification of food items to the lowest possible taxonomic level. Subsequently, each food category was weighed (0.001 g) and expressed as a percentage of the total stomach content (W%; HYSLOP, 1980). Additionally, the frequency of occurrence of each prey

(FO= $100 \times \frac{\text{number of stomachs where prey item i was observed}}{\text{number of stomachs containing food}}$)

was estimated. Using the FO and W% values, the Costello graph (COSTELLO, 1990) was constructed, in order to define the importance of each prey item in the diet of the two species and the feeding strategy (i.e. generalised preference or specialisation) of the two studied species towards prey items. More details regarding samplings and stomach content analysis is presented in KARACHLE & STERGIOU (2008). Based on the W% values, τ per individual per species was estimated using TrophLab (PAULY *et al*., 2000) and, subsequently, the mean individual τ-values between the two species were tested for differences using t-test (ZAR, 1999).

RESULTS AND DISCUSSION

Overall, 282 individuals of *S. maena* and 118 individuals of *S. smaris* were examined (Table 1). For *S. maena*, the highest VC was recorded in autumn (65.1%) and the lowest one in summer (3.6%) whereas for *S. smaris*, the highest value was observed in summer (87.9%) and the lowest one in spring (47.1%) (Table 1).

Thirty six taxa were identified in the stomach contents of *S. maena* as opposed to only 12 taxa in *S. smaris* (Table 1). Copepoda was the most important food item, in terms of weight contribution, for both species (Table 1, Fig. 1), and was the dominant and preferred prey for both species (Fig. 1). However, *S. smaris* also exhibited a specialization preying upon fish larvae, with the later being a rare prey (Fig. 1). Indeed, large quantities of fish larvae (32.1%) were recorded (Table 1, Fig. 1) in the stomach content of only one female individual in spring. The higher diversity of taxa observed in the stomach contents of *S. maena*, combined with the presence of fish larvae in the stomachs of *S. smaris*, indicate that, despite the overlap of prey items, the two species may use the resources differently. Indeed, it has also been observed in small pelagic fishes, such as *Engraulis encrasicolus*, *Sardina pilchardus* and *Sardinella aurita*, preying upon the same food items, that they use resources differently in order to avoid competition and meet with the energetic demands of reproduction (KARACHLE & STERGIOU, 2014). Yet, in the case of the species studied here, this hypothesis needs further investigation.

For both species, diet in spring differed from that in the remaining seasons, with stomach content including high percentages of Mysidacea for *S. maena*, and fish larvae for *S. smaris*. In *S. maena*, in almost half of the individuals (32 out of 67 specimens) the percentage of Mysidacea in the diet was >75%, possibly reflecting high

Table 1. Food items, expressed as % weight contribution, totally, per season and sex, for Spicara maena *and* S. smaris *in the N Aegean Sea, June 2000-January 2006. SP: spring; SU: summer; AU: autumn; WI: winter; ♀: female; ♂: male; n.i.: not identified; N: number of individuals; TL: total length; SE: standard error; VC: vacuity coefficient; τ : trophic level (values from* KARACHLE & STERGIOU, 2006; 2008

Table 1. Food items, expressed as % weight contribution, totally, per season and sex, for *Spicara maena* and *S. smaris* in the N Aegean Sea, June 2000-January 2006. SP: spring; SU: summer; AU: autumn; WI: winter; ♀: female; ♂: male; n.i.: not identified; N: number of individuals; TL: total length; SE: standard error; VC: vacuity coefficient; τ : trophic level (values from KARACHLE & STERGIOU, 2006; 2008).

Prey item	***Spicara maena***							***Spicara smaris***						
	Total	**SP**	**SU**	**AU**	**WI**	♀	♂	**Total**	**SP**	**SU**	**AU**	**WI**	♀	♂
Polychaeta														
Errantia	0.1		28.0			0.1								
larvae	*		0.1			*								
n.i.	1.7	1.1		*	9.7	2.0	0.9	1.6		33.2			1.7	
Mollusca														
Heteropoda	0.1			0.2		0.2	*							
Gastropoda														
Opisthobranchia														
Nudibranchia	0.2			0.4		0.3								
Bivalvia														
larvae								*		0.2			*	
Cephalopoda	0.7			1.2		1.0								
Crustacea														
Cladocera														
Evadne spp.	*	*	0.1		*	*	*							
Penilia spp.	0.1	0.1			0.2	*	0.1							
Podon spp.	*				*	*								
Ostracoda	*		0.1	*		*	*	*	*				*	
Copepoda														
Acartia spp.	1.1	5.0	0.1	*	*	0.6	2.6	19.3	20.8				19.8	
Candacia spp.	*	*	0.1	*	*	*	*	*	*				*	
Centropages spp.	0.1	0.4	0.1			*	0.3							
Corycaeus	*	*	0.1	*		*	*							

spp.														
Corycella spp.	*			*	*	*	*	*	*				*	
Oncaea spp.	*	*	0.3	*	*	*	*	6.1	6.5				6.2	
Sapphirina spp.	*				*	*								
n.i.	53.1	7.0	28.1	78.8	16.4	54.6	49.2	38.1	35.5	66.5	100.0	83.3	37.2	71.4
Euphasiacea														
larvae	0.1			0.1	0.2	*	0.2							
Decapoda														
Brachyura														
Portunus puber														
Zoa	*			*	*	*								
Metazoa	0.3	0.1			1.9	0.4	0.1							
Other larvae	0.1	0.3		*		*	0.2							
Mysidacea	13.6	59.4				14.3	11.7	0.8	0.9					28.6
larvae	*	0.1					0.1							
Amphipoda	0.2	0.3	14.1	0.1		0.1	0.3	0.4				16.7	0.4	
Isopoda	0.1	0.1	28.1			0.1	*	1.6	1.7	0.2			1.7	
n.i. Crustacea	5.3	17.8	0.1	0.3	6.9	1.7	14.1							
Chaetognatha	3.2			1.7	14.5	3.6	2.1							
Chordata –Urochordata														
Appendicularia	9.4	*	0.1	12.0	12.8	8.1	12.4							
Thaliacea	0.5				3.1	0.7								
Chordata –Vertebrata														
Pisces														
eggs	0.1		0.1	0.1	0.2	0.1	0. 2							
larvae	7.8	6.8		2.1	33.8	10.2	1.9	32.1	34.6				33.0	
n.i.	1.1	1.6		1.2		1.0	1.5							
N.i.														
eggs	1.1			1.7	0.2	0.7	2.0							

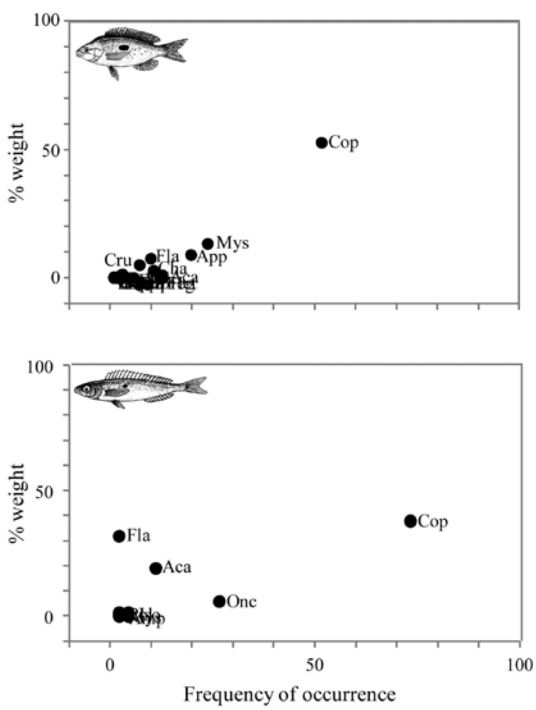

Figure 1. Costello graphs (COSTELLO, 1990) using weight percentage (W%) and frequency of occurrence for *Spicara maena* (top) and *Spicara smaris* (bottom) from the N-NW Aegean Sea, Greece, spring 2001- winter 2006. Aca: *Acartia* spp.; Amp: Amphipoda; App: Appendicularia; BFU: unidentified bony fish; Cen: *Centropages* spp.; Cep: Cephalopoda; Cha: Chaetognatha; Cop: Copepoda; Cru: digested Crustacea; Dla: Decapoda larvae; Egg: eggs; Ela: Euphaciacea larvae; Err: Errantia; Feg: fish eggs; Fla: fish larvae; Het: Heteropoda; Iso: Isopoda; Mpp: metazoan larvae of *Portunus puber*; Mys: Mysidacea; Nud: Nudibranchia; Onc: *Oncea* spp.; Oth: others; Pen: *Penillia* spp.; Pol: Polychaeta; Tha: Thaliacea. Fish drawings are taken from FAO (www.fao.org).

abundances of this taxon in the environment. In *S. smaris*, on the other hand, this seasonal differentiation is attributed to the presence of large quantities of fish larvae (32.1%) in one individual. However, such a difference should be considered with caution because of the relatively low sample size for autumn, winter and summer (<33 individuals) and the large VC in those three seasons (ranging from 67 to 88%) (Table 1).

With respect to the differentiation of feeding with sex, no differences were found in *S. maena*. In contrast, female *S. smaris* included large amounts of fish larvae (33.0%, Table 1), which was not observed in the stomach contents of males. The latter included large quantities of Mysidacea (28.6%, Table 1), a prey item that was not consumed by females. Again, such a difference is greatly affected by the strongly uneven sample size with sex (108 females and only 7 males) (Table 1).

The mean (±standard error) individual τ was 3.21±0.058 (range: 3.00-4.50) and 3.05±0.068 (range: 3.00-4.50) for *S. maena* and *S. smaris*, respectively (Fig. 2). For *S. maena*, the majority (91.7%) of τ values ranged between 3.00 and 3.50, with only 11 values (8.2%) being higher than 3.45 (Fig. 2). Accordingly, for *S. smaris* 97.8% of τ values ranged between 3.00 and 3.20, with only one value (2.2%) being equal to 4.50 (Fig. 2). In the case of *S. maena*, the maximum value of 4.50 was recorded for 7 individuals, which consumed unidentified bony fish (Table 1). In two more cases τ values were notably high: the first one (τ = 4.20±0.33) was a female that included large quantities of cephalopods (77.4%) in its diet, and the second one (τ = 3.87±0.62) was a male that preyed on almost equal quantities of fishes (42.4%) and other invertebrates (57.6%). Correspondingly, for *S. smaris*, as mentioned above, only the female which consumed fish larvae scored the highest τ-value. The mean individual τ differed significantly ($p < 0.01$) between the two species. Mean individual τ-values (Fig. 2) and overall τ (taken from KARACHLE & STERGIOU, 2006, 2008; Table 1) did not differ in the case of *S. maena*. However, there was a difference of 0.45 τ-units in the case of *S. smaris* (Table 1, Fig. 2), which is attributed to the high contribution of fish larvae by one individual.

STERGIOU & KARPOUZI (2002), in their review of feeding and trophic levels of Mediterranean fish, present five studies on the diet and estimate τ for the two study species (*S. maena*: 3.00±0.00 (PINNEGAR & POLUNIN, 2000), 3.16±0.27 (KHOURY, 1984), and 3.30±0.39 (MYTILINEOU, 1987); *S. smaris*: 3.00±0.04 (BELL & HARMELIN-VIVIEN, 1983), and 3.10±0.35 (PETRAKIS *et al.*, 1993). Two more studies were found since the study of STERGIOU & KARPOUZI (2002) (Table 2). Thus, from all these 7 studies, the estimated τ ranged from 3.00±0.00 to 3.30 ± 0.39 for *S.*

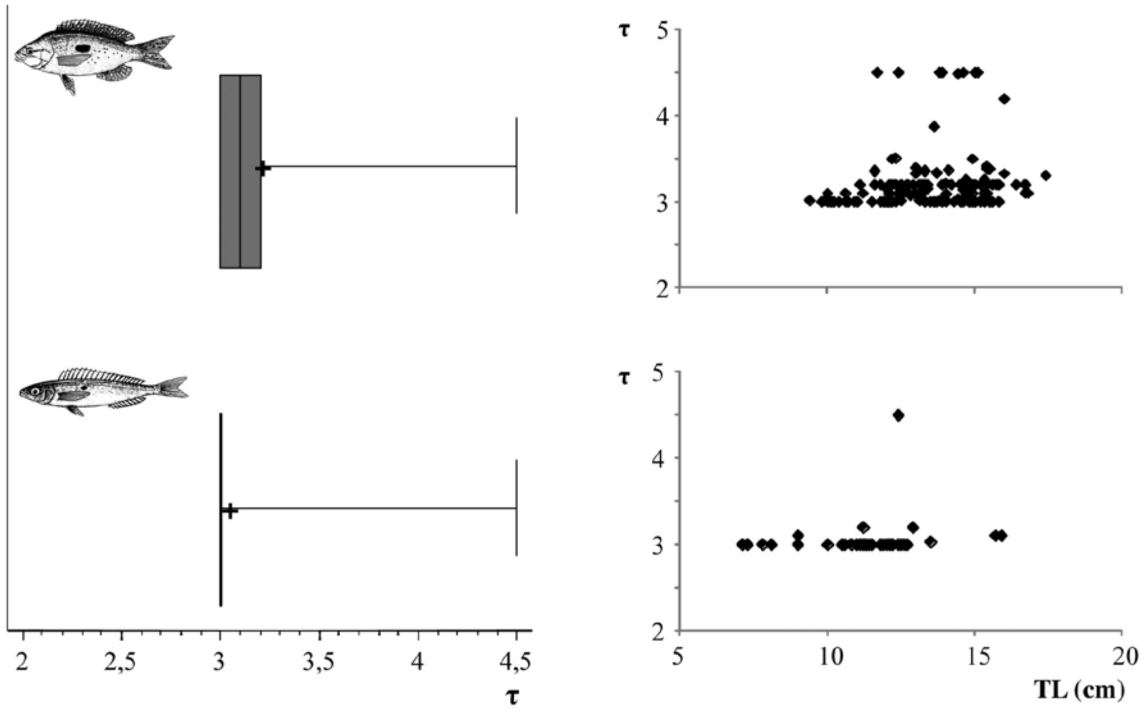

Figure 2. **left:** Box-whisker plots for fractional trophic level (τ), as they were estimated for each individual separately, for *Spicara maena* (top) and *Spicara smaris* (bottom) from the N-NW Aegean Sea, Greece, spring 2001- winter 2006. The central box indicates the range of values representing the 50% of cases around the median (vertical lines), the whiskers (horizontal lines) show the range of the values, and the cross (+) indicates the mean value. **Right**: relation of estimated individual fractional trophic level (τ) with individual total length (TL). Fish drawings are taken from FAO (www.fao.org).

maena, and 2.87 ± 0.31 to 3.50 ± 0.48 for *S. smaris* (Table 2). Both species can be classified as omnivores with preference to animal material in all cases, with one exception for *S. smaris* (overall diet; classified as omnivore with preference to plant material) (Table 2). This difference must be attributed to the fact that VIDALIS (1994) reports significant quantities of detritus and plants in the overall diet of *S. smaris* and, hence, the estimated τ was lower than that of other cases.

The two studied benthopelagic species are zooplanktivorous having τ ranging around 3.00-3.50. They are preyed by larger demersal/benthopelgic (e.g. *Conger conger, Merluccius merluccius*, *Muraena helena, Phycis phycis, Scorpaena scrofa*, *Squalus acanthias, Uranoscopus scaber*, *Zeus faber*) and pelagic fishes (*Sarda sarda*) (DULČIĆ *et al.*, 2000, 2003; FROESE & PAULY, 2012; and references therein) all of which generally have τ>4 (STERGIOU *et al.*, 2011). Thus, given the relatively high abundance of *Spicara* spp. in Greek waters (i.e. their landings amounting to around 15,000 t in late 2000s: STERGIOU *et al.*, 2011), they play a crucial role in the flux of energy from low to high trophic levels of the Aegean benthic and pelagic food webs.

Table 2. Literature-derived information on the diet and feeding habits of *Spicara maena* and *S. smaris*: SP = sampling period, LT = length type, LR = length range, TL = total body length, τ ± SE = fractional trophic level ± standard error (estimated in the present study using TrophLab (PAULY *et al*., 2000)), FTG = functional trophic group according to STERGIOU & KARPOUZI (2002), OV = omnivore with preference to plant material, OA = omnivore with preference to animal material, F = frequency of occurrence, N= numerical percentage, W = percentage by weight, V = percentage by volume, VC = vacuity coefficient, IRI=index of relative importance.

Area	SP	LT	LR	N_i	Main prey	Method	τ±SE	FTG	Reference
Spicara maena									
Algerian coasts	1999-2003	TL		284	Copepods, chaetognaths, polychaets	F, N, VC	3.10±0.18	OA	HARCHOUCHE *et al*., 2009
				126	(males) Copepods, chaetognaths		3.10±0.14	OA	
				145	(females) Copepods, polychaets, chaetognaths		3.10±0.16	OA	
				89	(autumn) Copepods, mysids		3.10±0.08	OA	
				83	(winter) Copepods, chaetognaths, amphipods		3.10±0.16	OA	
				92	(spring) Copepods, polychaets, chaetognaths, mysids		3.10±0.22	OA	
				20	(summer) Copepods, amphipods		3.10±0.16	OA	
Spicara smaris									
Cretan Sea	1988-1990			1349	Copepods, detritus, plants, ostracods, other crustaceans	F, N, W, VC, IRI	2.87±0.31	OV	VIDALIS, 1994
					(males) Copepods, other crustaceans, fish eggs & larvae		3.38±0.47	OA	
					(females) Copepods, ostracods, fish eggs & larvae		3.24±0.38	OA	
					(immature) Copepods, fish eggs & larvae		3.50±0.48	OA	
					(winter) Copepods, fish eggs & larvae, detritus		3.21±0.38	OA	
					(spring) Copepods, fish eggs & larvae, ostracods		3.14±0.29	OA	
					(summer) Copepods, other crustaceans, fish eggs & larvae		3.48±0.52	OA	

REFERENCES

BELL, J.D. & M.L. HARMELIN-VIVIEN. 1983. Fish fauna of French Mediterranean *Posidonia oceanica* seagrass meadows. 2. Feeding habits. Tethys, 11: 1-14.

COSTELLO, M. 1990. Predator feeding strategy and prey importance: a new graphical analysis. J. Fish Biol., 36: 261-263.

DULČIĆ, J., M. KRALJEVIĆ, B. GRBEC & P. CETINIĆ. 2000. Age, growth and mortality of blotched picarel *Spicara maena* L. (Pisces: Centracanthidae) in the eastern central Adriatic. Fish. Res., 48: 69-78.

DULČIĆ, J., A. PALLAORO, P. CETINIĆ, M. KRALJEVIĆ, A. SOLDO & I. JARDAS. 2003. Age, growth and mortality of picarel, *Spicara smaris* L. (Pisces: Centracanthidae), from the eastern Adriatic (Croatian coast). J. Appl. Ichthyol., 19: 10-14.

ESCHMEYER, W.N. 2012. Catalog of Fishes. California Academy of Sciences Available at http://research.calacademy.org/research/ichthyology/catalog/fishcatmain.asp. Electronic version accessed 22/11/2012.

FROESE, R. & D. PAULY. 2012. FishBase. World Wide Web electronic publication. Available at http//:www.fishbase.org [version 10/2012]. Accessed 22/11/2012.

HARCHOUCHE, K., C. MAURIN & F. ZEROUALI–KHODJA. 2009. Régime alimentaire de *Spicara maena* (Centracanthidae) des eaux Algériennes. Bull. Soc. Zool. Fr., 134(1-2): 123-141.

HYSLOP, E.J. 1980. Stomach contents analysis - a review of methods and their application. J. Fish Biol., 17: 411-429.

ISMEN, A. 1995. Growth, mortality and yield per recruit model of picarel (*Spicara smaris* L.) on the eastern Turkish Black Sea coast. Fish. Res., 22(3-4): 299-308.

KARACHLE, P.K. & K.I. STERGIOU. 2006. Trophic levels of north Aegean Sea fishes and comparisons with those from FishBase. In: M.L.D. PALOMARES, K.I. STERGIOU & D. PAULY (Editors). Fishes in Databases and Ecosystems. Fisheries Centre Research Reports, 14(4): 22-26.

KARACHLE, P.K. & K.I. STERGIOU. 2008. The effect of season and sex on trophic levels of marine fishes. J. Fish Biol., 72: 1463-1487.

KARACHLE, P.K. & K.I. STERGIOU. 2014. Feeding and ecomorphology of three clupeoids in the N Aegean Sea. Medit. Mar. Sci., 15(1): 9-26.

KHOURY, C. 1984. Ethologies alimentaires de quelques espèces de poisons de l' herbier de Posidonies du Parc National de Port-Cros. In: C.F. BOUDOURESQUE, A. JEUDY DE GRISSAC & J. OLIVIER (Editors). International Workshop *Posidonia oceanica* Beds, 12-15 October 1983, Vol. 1. GIS Posidonie Publications, Porquerolles, France, pp. 335-347.

MATIĆ-SKOKO, S., M. KRALJEVIĆ & J. DULČIĆ. 2004. Fecundity of blotched picarel, *Spicara maena* L. (Teleostei: Centracanthidae), in the eastern central Adriatic Sea. Acta Adriat., 45(2): 155-162.

MATIĆ-SKOKO, S., N. STAGLIČIĆ, M. KRALJEVIĆ, A. PALLAORO, P. TUTMAN, B. DRAGIČEVIĆ, R. GRGIČEVIĆ & J. DULČIĆ. 2011. Croatian artisanal fisheries and the state of littoral resources on the doorstep of entering the EU: effectiveness of conventional management and perspectives for the future. Acta Adriat., 52(1): 87-100.

MINOS, G., A. IMSIRIDOU & G. KATSELIS. 2013. Use of morphological differences for the identification of two picarel species *Spicara flexuosa* and *Spicara maena* (Pisces: Centracanthidae). Medit. Mar. Sci., 14/3: 26-31.

MYTILINEOU, C. 1987. Contribution to the Biology of picarel *Spicara flexuosa* (Raf. 1810), in the Patraikos Gulf (Greece) (in Greek). Ph.D. Thesis, University of Athens, 152 pp.

PAULY, D., R. FROESE, P. SA-A, M.L. PALOMARES, V. CHRISTENSEN & J. RIUS. 2000. Trophlab manual. ICLARM, Manila, Philippines, 6 pp.

PETRAKIS, G., K.I. STERGIOU, E. CHRISTOU, C.-Y. POLITOU, M. KARKANI, N. SIMBOURA, & P. KOUYOUFAS. 1993. Small Scale Fishery in the South Euboikos Gulf (in Greek). Final Report, Contract No XIV-1/MED-91/007. National Centre for Marine Research, Athens, Greece.

SOYKAN, O., A.T. İLKYAZ, G. METİN & H.T. KINACIGİL. 2010. Growth and reproduction of blotched picarel (*Spicara maena* Linnaeus, 1758) in the central Aegean Sea, Turkey. Turk. J. Zool., 34: 453-459.

STERGIOU, K.I., P.K. KARACHLE, A.C. TSIKLIRAS & E. MAMALAKIS. 2011. Shouting fishes: fishes from the Greek Seas – Biology, fisheries and management (in Greek). Patakis Publishers, Athens, Greece, 358 pp.

STERGIOU, K.I. & V.S. KARPOUZI. 2002. Feeding habits and trophic levels of Mediterranean fish. Rev. Fish Biol. Fish., 11: 217-254.

SUMAILA, U.R., A.D. MARSDEN, R. WATSON & D. PAULY. 2007. A global ex-vessel fish price database: construction and applications J. Bioecon., 9: 39-51.

TSANGRIDIS, A. & N. FILIPPOUSIS. 1991. Use of length-frequency data in the estimation of growth parameters of three Mediterranean fish species: bogue (*Boops boops* L.), picarel (*Spicara smaris* L.) and horse mackerel (*Trachurus trachurus* L.). Fish. Res., 12(4): 283-297.

TURAN, C. 2011. The systematic status of the Mediterranean *Spicara* species (Centracanthidae) inferred from mitochondrial 16s rdna sequence and morphological data. J. Black Sea/Medit. Environ., 17(1): 14-31,

VIDALIS, K.L. 1994. Biology and population dynamics of the pickerel (*Spicara smaris*, L., 1759) on the Cretan continental shelf (in Greek). Ph.D. Thesis, University of Crete. 248 pp.

ZAR, J.H. 1999. Biostatistical analysis. 4th Edition. Prentice Hall, New Jersey. 663 pp.

Received: 27 November 2012
Accepted: 14 April 2014

Prehrana i hranilišta traglja *Spicara maena* i gire *S. smaris* (Pisces, Osteichthyes, Centracanthidae) u sjevernom dijelu Egejskog mora

Paraskevi K. KARACHLE[1,*] i Konstantinos I. STERGIOU[1, 2]

[1]Helenski centar za istraživanje mora, 46.7 km Athens Sounio ave., P.O. Box 712, 19013 Anavyssos Attiki, Grčka

[2]Aristotelovo Sveučilište u Solunu, Fakultet biologije, Odjel za zoologiju, Laboratorij za ihtiologiju, Box 134, 54124, Solun, Grčka

Kontakt adresa, e-mail: pkarachle@hcmr.gr

SAŽETAK

U ovom radu prikazani su rezultati istraživanja prehrane dviju vrsta iz porodice girovki, traglja *Spicara maena* i gire *S. smaris* , sa sjevernog područja Egejskog mora. Istraženo je 282 jedinki traglja te 118 jedinki gire. Obje vrste u svojoj prehrani koriste zooplankto, osobito veslonošce Copepoda (54.3% tragalj, 63.5% gira). Tragalj u svojoj prehrani koristi znatno širi raspon organizama (36 svojti) dok gira znatno manje (12 svojti). Pojedinačna trofička razina za obje vrste se kreće od 3.00 do 4.50 (srednja vrijednost±standardna pogreška: 3.21±0.058 za traglja i 3.05±0.068 za giru). Glede njihove trofičke razine i lokalne brojnosti, obje vrste igraju značajnu ulogu u protoku energije od najnižih do najviših trofičkih razina u Egejskom moru u okviru pelagijskog i bentoskog lanca prehrane.

Ključne riječi: probavni sustav, prehrana, trofička razina, sjeverni dio Egejskog mora Centracanthidae, Grčka