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Diet of Silver scabbardfish *Lepidopus caudatus* (Euphrasen, 1788) in the Northern Aegean Sea

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Abstract: This study is based on the results of an extensive research carried out on silver scabbardfish *Lepidopus caudatus* from 2003 to 2005 in the Northern Aegean Sea (NAS). Data were collected from both commercial fisheries and research bottom trawl surveys. 264 specimens of silver scabbardfish, caught between 200 and 600 m depth, were processed for diet analysis. The silver scabbardfish diet covers different trophic levels, including euphausiids, decapods, fish and cephalopods. Overall, euphausiids were found to be the most important prey. Ontogenetically, the *L.caudatus* diet gradually changed from crustaceans, consumed by the smaller individuals to fish and cephalopods. During the sampling period, radical changes in the diet composition were observed: from euphausiids to fish between 2003 and 2004 and from fish to decapoda, euphausiids and cephalopods between 2004 and 2005. During 2004, feeding on high trophic level preys was attributed to lack of euphausiids. It was suggested that euphausiids play a crucial role in the energy transfer between lower and higher trophic levels in the deep demersal areas of the NAS.

Résumé : *Régime alimentaire du sabre* Lepidopus caudatus *(Euphrasen, 1788) en Mer Égée septentrionale*. La présente étude se fonde sur une vaste recherche sur le sabre *Lepidopus caudatus* réalisée de 2003 à 2005 en Mer Égée septentrionale. Les données ont été recueillies auprès de la pêche commerciale et expérimentale au chalut de fond. 264 échantillons de sabre pris entre 200 et 600 m de profondeur ont été traités pour l'analyse du régime alimentaire. Le sabre se nourrit à différents niveaux trophiques et son alimentation comprend des euphausiacés, des décapodes, des poissons et des céphalopodes. Dans l'ensemble, les euphausiacés étaient les proies les plus importantes. Le régime du sabre varie de façon ontogénique, des crustacés, consommés par les individus plus petits, aux poissons et aux céphalopodes. Au cours de la période d'échantillonnage, des changements radicaux dans la composition du régime alimentaire ont été observés : des euphausiacés aux poissons entre 2003 et 2004 et des poissons aux décapodes, euphausiacés et céphalopodes entre 2004 et 2005. En 2004, l'alimentation des proies de niveau trophique élevé a été attribuée au manque d'euphausiacés. Il a été suggéré que les euphausiacés jouent un rôle crucial dans le transfert d'énergie entre les niveaux trophiques inférieurs et supérieurs dans les zones démersales profondes de Mer Égée septentrionale.

Keywords: *Lepidopus caudatus* ● North Aegean Sea ● Diet ● Feeding behavior ● Trophic level

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Introduction

Silver scabbardfish *Lepidopus caudatus* (Euphrasen, 1788) is a benthopelagic species widely distributed throughout the temperate seas of the world. This fish inhabits the continental shelf and upper slope. During winter it is more abundant between 100 and 400 m depth while during summer it migrates to deeper waters (Demestre et al., 1993; Nakamura & Parin, 1993; D'Onghia et al., 2000). Silver scabbardfish may be occasionally found in inshore shallow waters (Demestre et al., 1993) or in superficial upwelled waters (Nakamura & Parin, 1993). It is a schooling species that lives close to the bottom during the day and migrates into midwater at night (Nakamura & Parin, 1993). It is a fast growing species that can reach total length (TL) of 70-80 cm in one year while its maximum TL can be reached at age of 13 years (Nakamura & Parin, 1993), measuring up to 205 cm (Nakamura & Parin, 1993). *L. caudatus* is a partial spawner and its spawning season takes place all year round without standard seasonality of reproductive peaks (Orsi-Relini et al., 1989; Demestre et al., 1993; Nakamura & Parin, 1993; D'Onghia et al., 2000; Tuset et al., 2006). Length at first maturity is 97 cm TL for males and 111 cm TL for females (Demestre et al., 1993). Silver scabbard fish is an apex predator that feeds principally on mesopelagic preys (Demestre et al., 1993). Biology of the Silver scabbard fish has been studied in the Canary Islands (Tuset et al., 2006), in Great Meteor Seamount (Klimpel et al., 2006), in the South Island west coast of New Zealand (Horn, 2013), in the northwest Mediterranean Sea (MacPherson, 1979; Orsi-Relini et al., 1989; Moli et al., 1990; Palandri & Orsi-Relini, 1992; Demestre et al., 1993) and in the Ionian Sea (D'Onghia et al., 2000; D'Onghia et al., 2011). In the Aegean Sea, scientific information on *L. caudatus* is limited to its distribution (Economidis, 1973; Torre et al., 2011).

The Silver scabbardfish is an important commercial fish species in the north-eastern Atlantic and off Namibia and New Zealand (Nakamura & Parin, 1993). In the Mediterranean Sea, the commercial exploitation of this species is limited to Italy, Spain, Albania and Tunisia (Fisher et al., 1987) where only larger specimens reach a considerable commercial value (Demestre et al., 1993; D'Onghia et al., 2000). According to FAO statistics, its fishery in the Mediterranean Sea and the Black Sea reached a peak of almost 5000 tons in 2011 and progressively declined. In 2015, the total fishery production accounted for 2964 tons and Italy was the first country, catching 52% of the total capture (http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do, consulted in October 4th, 2016). In Greece, the Silver scabbardfish is considered a low value species and it is discharged or locally consumed.

This is the first study on the diet of *L. caudatus*in the Aegean Sea and aims to improve our knowledge on a scarcely known species in this area. Ontogenetic shift of the feeding preferences, seasonal changes of feeding strategy, feeding behavior and position of *L. caudatus* within the food web of deep demersal areas of the Northern Aegean Sea are considered.

Materials and Methods

The diet of *L. caudatus* was studied using data from both commercial fisheries and research bottom trawl surveys between 2003 and 2005. In summer, samples were collected from the northern Aegean Sea during 65 hauls planned within the MEDITS (Mediterranean International Bottom Trawl Survey) trawl survey. Hauls were realized during daylight at the standard fishing speed of 3 knots on the ground, and the duration was 30 min at depths shallower than 200 m and 60 min at depths greater than 200 m. Trawl survey was done using a standard GOC 37 net having a cod-end mesh opening of 20 mm. During the MEDITS survey samples for diet analysis were collected in the area west the Lesvos Island between 240 and 370 m depth (Fig. 1: rounded area 2).

Data were also collected from commercial trawl fisheries in the area comprised between Samotraki, Thassos and Lesvos Islands (Fig.1: rounded area 1) at depth between 300 and 500 m. This area is intensively exploited for hake fishery. The vessels were equipped with nets with a stretched mesh size of 28 mm (knot to knot). Hauls lasted between 3 and 5 hours at an average speed of 2.5 knots.

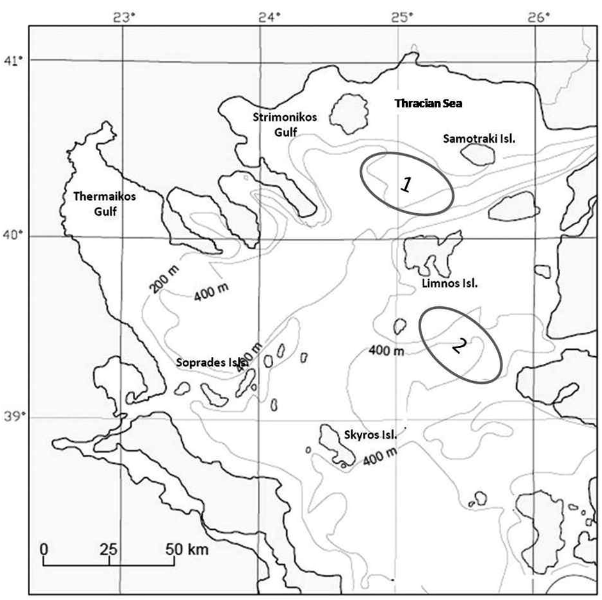

Figure 1. *Lepidotus caudatus.* Map of sampling areas (1: Commercial trawls. 2: MEDITS survey).

Samples for diet analysis were immediately frosted on board at -15° C and transferred to the laboratory for further analysis. Successively, samples were defrosted, measured (Total Length, TL) to nearest 1 mm and weighed (Total Weight, TW) to the nearest 0.01 g. Sex and maturity stage were documented by visual inspection (Nikolsky, 1963). Fish were dissected, weighed without viscera (Eviscerated Weight, EW) to the nearest 0.01 g and their stomach contents removed and weighed to the nearest 0.01 g. Stomach contents were successively transferred to a Petri dish and analyzed with a stereomicroscope. Prey items were identified to species or nearest possible taxonomic level, counted and weighed (to the nearest 0.01 g).

Feeding condition was determined by the fullness (F) and vacuity index (VI). Stomach fullness (F) was calculated using gut content weight (SW) as a percentage of fish body weight (eviscerated weight, EW). The proportions of empty and non-empty stomachs (vacuity index, VI) were estimated as a percentage of the total number of stomachs examined.

A Kolmogorov-Smirnov test was used in order to verify the normality of the values distribution divided by sample, sex and length class. Then a Levene test was used to test the homogeneity of variances between the grouped samples (200 mm size range). Once these assumptions were verified, one-way analysis of variance (ANOVA) was employed to test sex and size related differences in the feeding activity. When the assumption of data normality and homogeneity of variances was rejected, the non-parametric Mann-Whitney test was employed. The software Statistica 10 (Statsoft Inc., 2011) was used for all statistical analysis.

To estimate the contribution of the prey items to the fish diet, the Index of relative importance *IRI* (Pinkas et al., 1971 in Hyslop, 1980) was used:

$$IRI = (\%N + \%W) \times O \quad (1)$$

where:

$$\text{Numerical percentage}: \%N = 100 \times \frac{Total\ number\ of\ food\ item\ i}{Total\ number\ of\ all\ food\ items} \quad (2)$$

$$\text{Weight percentage}: \%W = 100 \times \frac{Total\ dry\ weight\ of\ food\ item\ i}{Total\ dry\ weight\ of\ all\ food\ items} \quad (3)$$

$$\text{Occurrence}: O = 100 \times \frac{Number\ of\ stomachs\ with\ food\ item\ i}{Number\ of\ not\ empty\ stomachs\ examined} \quad (4)$$

The *IRI* of each prey item wasexpressed as a ratio of the total sum of prey *IRI* contribution:

$$\%IRI = (IRI / \Sigma IRI) \quad (5)$$

To describe the seasonal and sexual variation of the diet, cluster analysis (group average linkage on Bray-Curtis similarity index) was performed on the weight values (W%).

The trophic level (TrL) of the species was estimated as follow (Pauly et al., 2000):

$$TrL_i = 1 + \sum_{j=1}^{G} DC_{ij} \times TrL_j \quad (6)$$

where TrL_j is the trophic level of the prey j, DC_{ij} is the proportion (weight fraction) of prey item j in the diet of stomach i and G is the total number of preys.

TrL values (± SE) were estimated using the routine for quantitative data of TrophLab (Pauly et al., 2000). When prey items were an identified fish, the Trophic levels values given by Fishbase (Froese et al., 2016) were utilized. In all other cases, the default values of TrophLab were used. Overall TrL value,TrL values for each sampling period separately and TrL values for all specimens grouped by size classes (200 mm size range) were computed.

Omnivory Index (OI, Pauly et al., 2000) was estimated as follows:

$$OI_i = \sum_{j=1}^{n} (TrL_j - (TrL_i - 1))^2 \times DC_{ij} \quad (7)$$

where TrL_j is the trophic level of prey j, TrL_i is the trophic level of the predator i and DC_{ij} is the fraction (weight proportion) of prey j in the diet of predator i.

When the value of OI is close to zero, the consumer is specialized on a trophic level. A large OI value indicates that the consumer feeds on many trophic levels. Overall OI value, OI values for each sampling period separately and OI values for all specimens grouped by size classes (200 mm size range) were computed.

Results

Overall 264 specimens (140 females and 124 males) of silver scabbardfish, with a mean total length of 572 mm, ranged between 82 and 1140 mm, were processed for diet analysis (Tables 1 & 2). Fullness index (FI) values did not differ significantly between specimens grouped by sex and size classes (200 mm size range, ANOVA; $p > 0.05$). Seasonally, F values ranged between 0.7 and 6.1 (Table 1 & Fig. 2). A remarkable decrease of the F values was observed considering only Summer samples. The maximum value of

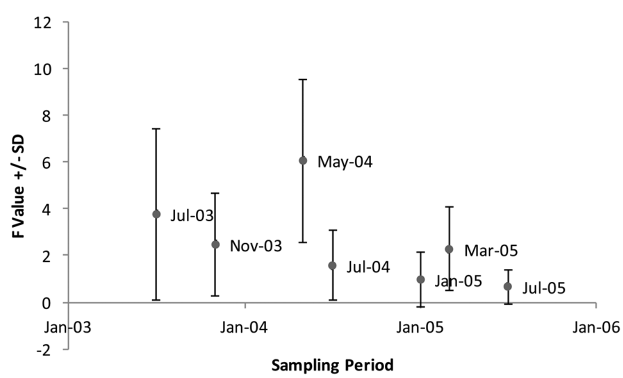

Figure 2. *Lepidotus caudatus.* Variation of Fullness Index F (mean +/- SD) by sampling period in the northern Aegean Sea.

Table 1. *Lepidotus caudatus.* Samples in Northern Aegean Sea considered for diet analysis. Number of individuals (N); Total length (TL, mm); Fullness index (F); Vacuity index (VI%).

	2003		2004		2005		
	Jun-Jul	Nov	May	Jun-Jul	Jan	March	Jun-Jul
N	39	37	47	46	67	19	9
TL min	324	493	467	293	526	82	705
TL max	1010	692	752	1122	762	213	1140
Mean	547.9	609.64	584.6	612.7	606.21	128.37	809.78
SD	157.86	165.23	113.5	236.86	38.58	35.45	129.12
F (Mean)	3.8	2.5	6.1	1.6	1	2.3	0.7
F (sd)	3.68	2.21	3.5	1.49	1.18	1.79	0.73
VI%	5.1	2.7	61.7	28.3	11.9	0	11.1

the vacuity index (VI%) was registered in May 2004 (61.7%).

Diet composition

Considering all the fish sampled during the research, the diet composition of *L. caudatus* was dominated by euphausiids (Table 3). However, considering the intra- and inter-annual diet variation, radical changes in the food preferences occurred. In summer 2003 (June-July) and November 2003 the diet was clearly dominated by euphausiids while, in 2004, by fish (*Merluccius merluccius* (Linnaeus, 1758) in May 2004 and *Lampanyctus crocodilus* (Risso, 1810)) in June-July 2004). Decapods were the main prey in Silver scabbardfish diet in January and March 2005 while euphausiids and the cephalopod *Abralia* sp. were the main prey items observed in summer 2005. Cluster analysis of prey ingested (W%) grouped by sampling period, confirmed the diet homogeneity in 2003 (Fig. 3) and the high inter-intra annual diet dissimilarities. Considering the sex partition of the feeding resources, cluster analysis on weight prey items (W%) showed a high diet similarity between males and females in each sample except for November 2003 when males ingested a significantly higher quantity of *Gadiculus argenteus* Guichenot, 1850 than was ingested by females (47% in males, 17% in females, Fig. 4). Cannibalism on juveniles was observed in May 2004 (in 5.5% of the individuals analysed) and June-July 2004 (18.1% of analysed individuals).

Figure 3. *Lepidotus caudatus.* Cluster analysis on weight % (W%) of prey items grouped by sampling period.

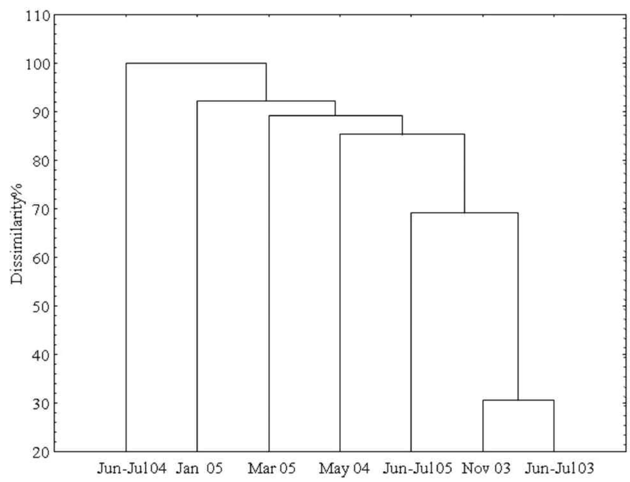

Table 2. *Lepidotus caudatus.* Number of individuals per length class (200 mm) of samples in northern Aegean Sea considered for diet analysis.

Size classes (mm)	2003		2004		2005			
	Jun-Jul	Nov	May	Jun-Jul	Jan	March	Jun-Jul	**Total**
0-200						19		19
200-400	13			11				24
400-600	19	24	40	16	66		1	166
600-800	5	13	7	13	1		5	44
800-1000	1			4			2	7
1000-1200	1			2			1	4
Total	39	37	47	46	67	19	9	264

Table 3. Lepidotus caudatus. Percentage composition by number (N%), weight (W%), occurrence (O%) and index of relative importance (IRI%) of the prey taxa. NI = Not Identified.

	All samples				June-July 2003				November 2003				May 2004			
	N %	W %	O %	IRI %	N %	W %	O %	IRI %	N %	W %	O %	IRI %	N %	W %	O %	IRI %
Fish																
Fish NI	2.75	3.25	24.76	3.39	0.65	2.29	13.51	0.28	3.37	8.98	38.89	4.68	1.56	0.24	5.56	0.19
Argentina sphyraena Linnaeus, 1758	0.05	0.1	0.48	< 0.01												
Argyropelecus hemigymnus Cocco, 1829	0.05	0.07	0.48	< 0.01					0.24	0.48	2.78	0.02				
Gadiculus argenteus	0.72	5.01	6.67	0.87	0.26	3.5	5.41	0.14	2.4	19.41	22.22	4.72	1.56	8.47	5.56	1.08
Chlorophthalmus agassizi Bonaparte, 1840	0.09	0.71	0.95	0.02					0.48	5.17	5.56	0.31				
Lampanyctus crocodilus	2.00	32.32	8.57	**6.71**	0.13	1.26	2.7	0.03	0.24	3.2	2.78	0.09	4.69	7.77	16.67	4.03
Lepidopus caudatus	0.61	7.48	4.76	0.88					0.24	0.75	2.78	0.03	1.56	18.99	5.56	2.22
Lobianchia dofleini (Zugmayer, 1911)	0.05	0.08	0.48	< 0.01									1.56	0.51	5.56	0.22
Micromesistius poutassous (Risso, 1827)	0.05	1.07	0.48	0.01									1.56	7.29	5.56	0.95
Maurolicus muelleri (Gmelin, 1789)	2.37	4.47	13.33	2.08	3.26	18.15	29.73	4.46	1.2	3.13	11.11	0.47	3.13	0.79	11.11	0.84
Merluccius merluccius	0.51	8.1	3.33	0.66									17.19	54.96	38.89	**54.43**
Myctophidae NI	0.75	0.36	3.33	0.08									1.56	0.07	5.56	0.18
Myctophum punctatum Rafinesque, 1810	0.05	0.29	0.48	< 0.01												
Paralepis sp.	0.05	0.5	0.48	0.01					0.24	3.66	2.78	0.11				
Cephalopods																
Cephalopods NI	0.09	0.86	0.95	0.02	0.26	6.23	5.41	0.25								
Abralia sp.	0.28	5.66	1.9	0.26												
Istioteutis sp.	0.09	0.29	0.95	0.01												
Sepiola sp.	0.19	0.44	1.43	0.02					0.24	1.00	2.78	0.03				
Crustaceans																
Decapoda																
Decapoda NI	3.21	0.02	7.62	0.56												
Parapenaeus longirostris (Lucas, 1846)	0.05	0.02	0.48	< 0.01					0.24	1.58	2.78	0.05				
Pasiphaea sp.	13.6	7.45	23.33	**11.2**	0.78	1.84	5.41	0.1								
Copepoda																
Euchaeta sp.	0.09	0.00	0.95	< 0.01												
Euphausiacea NI	72.31	21.24	34.29	**73.2**	94.65	66.72	83.78	**94.75**	91.11	52.62	63.89	**89.49**	65.63	0.91	27.78	**35.18**

Table 3. Continued

	June-July 2004				January 2005				March 2005				June-July 2005			
	N %	W %	O %	IRI %	N %	W %	O %	IRI %	N %	W %	O %	IRI %	N %	W %	O %	IRI %
Fish																
Fish NI	4.17	3.12	36.36	5.2	3.59	3.5	20.34	1.15	6.67	12.92	31.58	4.68	9.52	1.29	25.00	4.63
Argentina sphyraena					0.3	0.93	1.69	0.02								
Argyropelecus hemigymnus																
Gadiculus argenteus	0.34	0.78	6.06	0.13	0.3	2.96	1.69	0.04								
Chlorophthalmus agassizi																
Lampanyctus crocodilus	7.46	81.81	27.27	**47.77**	0.9	1.29	5.08	0.09					4.76	1.78	12.5	1.4
Lepidopus caudatus	1.76	9.4	18.18	3.98	0.9	9.79	3.39	0.29								
Lobianchia dofleini																
Micromesistius poutassous																
Maurolicus muelleri					5.69	12.76	18.64	2.75								
Merluccius merluccius																
Myctophidae NI					2.1	3.11	5.08	0.21	8.89	9.55	15.79	2.2				
Myctophum punctatum													4.76	3.00	12.5	1.66
Paralepis sp.																
Cephalopods																
Cephalopods NI																
Abralia sp.					0.6	1.51	3.39	0.06					19.05	57.35	25.00	32.74
Istioteutis sp.	0.44	0.79	6.06	0.15												
Sepiola sp.													14.29	3.13	25.00	7.46
Crustaceans																
Decapoda																
Decapoda NI									76.67	67.42	84.21	**91.7**				
Parapenaeus longirostris																
Pasiphaea sp.					85.63	64.15	79.66	**95.39**								
Copepoda																
Euchaeta sp.									2.22	0.56	10.53	0.22				
Euphausiacea NI	85.83	4.11	24.24	**42.78**					5.56	9.55	10.53	1.2	47.62	33.44	37.5	**52.1**

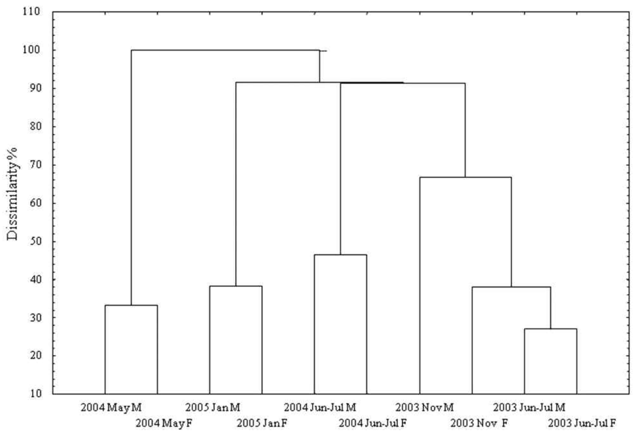

Figure 4. *Lepidotus caudatus.* Cluster analysis on weight% (W%) of prey items grouped by sex and sampling period.

Ontogenetically, crustaceans dominated the fish diet composition in small individuals and progressively decreased with fish growth (Fig. 5). Fish were the most abundant prey (W%) in individuals larger than 600 mm TL. Cephalopods had a minor presence on the diet and were ingested by individuals ranging between 500 and 1000 mm, with maximum values appearing in individuals between 600 and 800 mm.

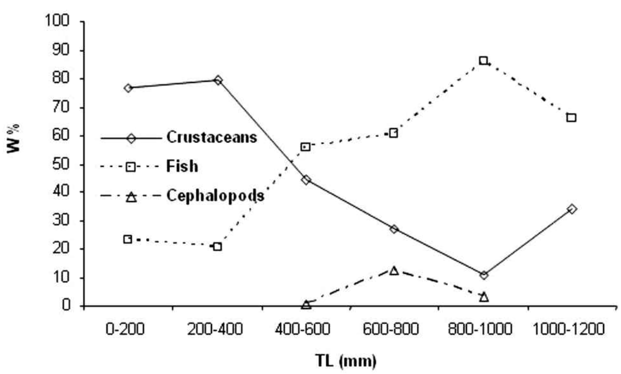

Figure 5. *Lepidotus caudatus.* Ontogenetic changes in the diet composition.

Grouping all the samples length classes (200 mm size range), trophic level (TrL) was 4.12 (± 0.68 SE) and increased significantly with increasing fish size ($R^2 = 0.69$, Fig. 6).

TrL values varied during the sampling period reaching a minimum value of 3.31 (± 0.24 SE) in summer 2003 and maximum of 5.11 (± 0.34 SE) in May 2004 (Fig. 7). Lower TrL values were associated with the high consumption of low trophic level preys such as Euphausiids (during 2003) and decapoda (January 2005 and March 2005) while higher TrL values were associated with the consumption of fish

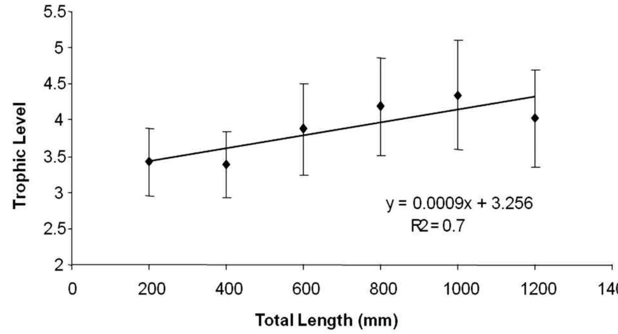

Figure 6. *Lepidotus caudatus.* Ontogenetic changes of mean trophic Level (mean ± SE).

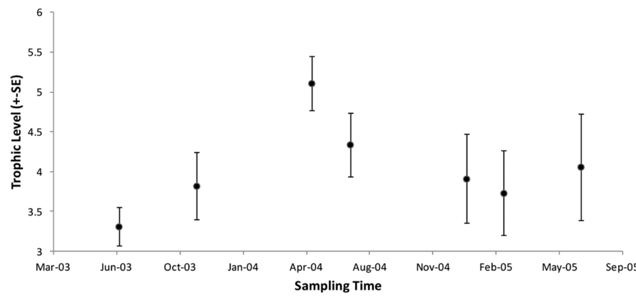

Figure 7. *Lepidotus caudatus.* Seasonal changes of trophic Level (mean ± SE).

(during 2004) and cephalopods (summer 2005). The high TrL value from May 2004 (5.11 ± 0.34 SE) was related with the consumption (54.96 W%) of hake (*Merluccius merluccius*).

High seasonal variability of omnivory index (OI, Fig. 8) was observed. In the beginning of the study period (summer 2003) OI values reached a maximum (0.53) and then decreased until summer 2004 (0.13) where the feeding preferences were limited to a few fish species. During 2005, OI ranged between 0.38 and 0.61 and minimum OI values (March 2005) coincided to a high contribution of decapoda (67.42 W%) in the diet.

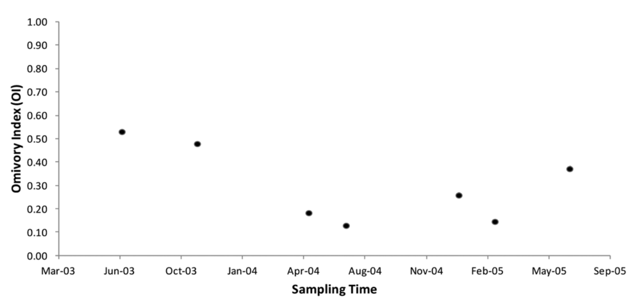

Figure 8. *Lepidotus caudatus.* Seasonal changes of Omnivory Index (OI).

Discussion

Silver scabbardfish in the Northern Aegean Sea (NAS) feeds in different trophic levels and its diet extends from Euphausiids and Decapods (lower trophic levels) to Fish and Cephalopods (higher trophic levels). These findings are in agreement to those of Demestre et al. (1993) in the Catalan Sea, MacPherson (1979) in the Western Mediterranean Sea and Klimpel et al. (2006) in the North Atlantic. The diet of Silver scabbardfish did not substantially change between males and females and was always dominated by a few preferred preys. This apparently selective feeding behavior may be a consequence of the shoaling behavior of *L. caudatus*: the information about the presence of a specific good food patch (e.g. a patch of Euphausiids), may be transferred by singular individuals to the entire school (Passive Information Transfer, PIT, Pitcher & Parrish, 1993).

In our study we found that Silver scabbard fish during its ontogenetic development gradually changes prey preferences from crustaceans to fish and cephalopods. Similar results were reported by Demestre et al. (1993) for this species in the Catalan Sea. However, MacPherson (1979) found an increase of decapods in its prey with increasing size, in the western Mediterranean Sea. D'Onghia et al. (2011), studying the distribution and behavior of deep sea fauna in the northern Ionian Sea, found that, during daylight, silver scabbardfish juveniles feed mostly in the sediment while adults have a more pelagic feeding behavior. These findings suggest that size-related differences in Silver scabbard fish feeding preferences, during daylight, are associated with vertical spatial segregation between juveniles and adults.

The presence of mesopelagic prey which undergo nychtimeral diel vertical migrations such as lantern fish (Mychtophidae) and Euphausiids crustaceans suggests that during the day *L. caudatus* feeds close to the bottom, in the deeper layers. During night, *L. caudatus* may migrate to surface for feeding, following the natural preys vertical migration, as confirmed by the occurrence of nocturnal catches of *L. caudatus* during surface line and drift long line fisheries (Torre, pers. comm.).

Silver scabbard fish exhibits high prey plasticity as demonstrated by the radical seasonal and annual changes in the diet composition. For example, during 2003 the diet was dominated by Euphausiids, while in 2004 it was dominated by two main fishes (Hake and *Lampanyctus crocodilus*). This ecological plasticity is also demonstrated by the seasonal and annual variations of OI. Remarkable is that the sharp decrease of OI from 2003 to 2004 was caused by predation on top predators such as Hake (*Merluccius merluccius*) and *L. caudatus*. Cannibalism and feeding on top predators demonstrates that Silver scabbardfish can reach the apex of the trophic pyramid. Similar feeding behavior was found also in Hake (Carpentieri et al., 2005) where cannibalism seems to be a relevant source of natural mortality. The reduced prey availability from lower trophic levels, as indicated by the noteworthy decrease of Euphausiids in the diet of fish sampled in 2004, may explain this behavioral change. The changes in feeding preferences from lower to top predator preys may be a result of a bottom-up control mechanism caused by the decrease of Euphausiids abundance. This bottom-up mechanism may cause the Silver scabbard fish predation shift on top predators and cannibalism and may results in a significant depletion of *L.caudatus* and other top trophic level species abundance. These suggestions may be extended to other species with similar feeding behavior like the commercially exploited Hake (Carpentieri et al., 2005). According to our results the role of Euphausiids and, to a lesser extent, of mesopelagic decapods (*Pasiphaea sp.*), seems to be of crucial importance in controlling the feeding behavior of *L. caudatus*. Euphasiids also play a key role in the diet of other marine fish, wales and sea birds (Kathman et al., 1986). Due to their ability of cover considerable nycthemeral vertical migrations euphausiids are very important in transferring energy from surface to deep waters and from low to high trophic levels (Brodeur & Pearcy, 1992). Same behavior is reported for the decapods of genus Pasiphae (Aguzzi et al., 2007). Despite the importance of euphausiids in the food web of open sea ecosystems (Katmann et al., 1986; Brodeur & Pearcy, 1992; Tarling et al., 1995; Gurney et al., 2001) their role in the food web of the Aegean Sea, remain, to date, scarcely known (Siokou–Frangou et al., 2010 & 2013; Tsagarakis et al., 2010). Papacostantinou et al. (1997) describes the mesopelagic fauna of the North Aegean Sea reporting that Euphausiids were, by far, the most abundant taxa between 200 and 1000 m, suggesting that their role should be taken in consideration within the food web of the NAS ecosystem. This is particularly true if we consider that in the NAS there are some deep demersal areas, highly productive as Limnos Basin (Torre et al., 2007), where a considerable portion of fish fauna such as *Trisopterus minutus* (Linnaeus, 1758), *Merluccius merluccius* and *Gadiculus argenteus* (Stergiou et al., 1997; Kallianiotis et al., 2004; Torre et al., 2011) feed, mainly, on Euphasiids (Stergiou & Karpouzi, 2002). These areas are also important fishing grounds for trawl fisheries due to the exploitation of Hake and other important commercial species.

In conclusion, *L. caudatus*, is an opportunistic voracious predator, which preys on available organisms. Food items are mainly Euphausiids and teleost fish, although cephalopods also appear in the diet of young and adults. We point out that the availability of Euphausiids may play a crucial role in the feeding behavior and to a greater extent in the population dynamic of this species. As for Capelin *Mallotus villosus* (Müller, 1776) in the Newfoundland and Labrador Shelf, Euphausiids abundance may act as a bottom-up force that limits the population recovery (Obradovich et al., 2014).

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