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NOTE

Preliminary biological data on the northeast Mediterranean conger eel *Conger conger* L., 1758

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ABSTRACT

Specimens of conger eel *Conger conger* L., 1758 from spring Medits (Mediterranean International Trawl Survey, spring 2002) and autumn Grund (National Group for Demersal Resource Evaluation, autumn 2001 and 2002) trawl surveys in the Adriatic (northeast Mediterranean) at depths of between 0 and 400 m, were found to measure in length from 21 to 130 cm, with greater frequency in the 30 to 50 cm range. Age determined on the basis of ring count and the length of the greater otolith axis was found to be between 3 and 8 years, with the majority of specimens in the 4- to 5-year range. Histological gonad analysis only revealed immature ovaries. The specimens were found to feed chiefly on Osteichthyes, Crustacea and Mollusca, which are most abundant in autumn.

Keywords: *Conger conger*, growth, reproduction, diet.

RESUMEN

Relación de crecimiento, reproducción y hábitos alimentarios de congrio* Conger conger *L., 1758 en el Mediterráneo nororiental

Los ejemplares de congrio Conger conger *L., 1758 provenientes de las campañas de primavera Medits (Mediterranean International Trawl Survey, primavera de 2002) y de otoño Grund (National Group for Demersal Resource Evaluation, otoño de 2001 y 2002) en el mar Adriático (Mediterráneo nororiental), entre 0 y 400 m de profundidad, tienen una longitud que oscila entre 21 y 130 cm y, con mayor frecuencia, entre 30 y 50 cm. La edad, determinada mediante la cuenta de los anillos y la medición del eje mayor de los estatolitos, se estima entre 3 y 8 años, con predominio de ejemplares de 4 y 5 años. El análisis histológico de las gónadas ha permitido identificar solo óvulos inmaduros. La dieta, más abundante en otoño, se constituye principalmente a base de Osteichthyes, Crustacea y Mollusca.*

Palabras clave: Conger conger*, crecimiento, reproducción, dieta.*

INTRODUCTION

The European conger eel *Conger conger* L., 1758 is distributed in the eastern Atlantic Ocean, from Norway to Senegal. It is also present in the Mediterranean and in the western part of the Black Sea. The species is an important benthic fish and represents a valuable fishery resource (Figueiredo, Figueiredo and Correia, 1996; Relini, Bertrand and Zamboni, 1999). A reliable assessment of this resource, however, still calls for close examination of the biological aspects involved (Relini, Bertrand and Zamboni, 1999; Correia *et al.*, 2006). Total world *C. conger* catch reported to the FAO for 2001 was 14 238 t; the countries with the largest catches were France (5 225 t) and Portugal (3 311 t) (FAO-FIGIS, 2001). Conger eel spawning is assumed to occur at great depths (3 000-4 000 m) in the Atlantic (between Gibraltar and the Azores archipelago) once a year in summer. In the Mediterranean Sea, the only currently known spawning ground is in the waters south of the island of Sardinia at depths of between 600 and 800 m (Cau and Manconi, 1983). Actual spawning grounds and migration pathways of the species to European and North African coasts may only be properly determined by studying geographic distribution, growth and reproduction patterns, and genetic structure (Sbaihi *et al.*, 2001; Sánchez, Blanco and Gancedo, 2002; Correia *et al.*, 2006; Vallisneri *et al.*, 2006).

MATERIALS AND METHODS

A hundred and seventy conger eels were caught in the Adriatic with a tartan-type trawl at depths of between 0 and 400 m at over 3 miles from the coast as part of the Medits (Mediterranean International Trawl Survey, spring 2002) and Grund (National Group for Demersal Resource Evaluation, autumn 2001 and 2002) research projects (figure 1). More complete information about these programmes can be found in Relini and Piccinetti (1996). Overall length (TL in cm) of all specimens was measured, and the age of 37 specimens from all frequency classes was determined. More precisely, age was determined by measuring the longer axis of the otoliths (otolith diameter in mm) using a Leica Qween computer-assisted image analyser and counting the rings using a stereomicroscope after lengthwise cutting, smoothing and clarification in ethyl alcohol. Sex identification was attempted using a microscope to examine the gonads of the full sample, and confirmed by histological analysis of sub-samples from all age classes. For this purpose, the gonads were fixed in Bouin solution, dehydrated in ethyl alcohol, embedded in Paraplast plus, sectioned to 7 µm, and stained with Mayer hemalum and yellow eosin. Diet was determined on the full sample by examining stomach contents on a 4-level scale (empty, semi-empty, semi-full, full) and the quality and quantity of the ingested preys.

RESULTS

Length was found to range from 21 to 130 cm (table I), and modes from 31 to 40 cm for the Medits spring trawl survey and from 41 to 50 cm for the Grund autumn trawl surveys. Age was assessed at from between 3 and 8 years, with greater frequency at between 4 and 5 years. Greater otolith axis length was found to rise in an almost linear way with the increase of length and age (table II).

In all specimens, gonads appeared to be in the form of two long flat ribbons wrinkled along the edges, whitish, and poorly vascularised. Histological

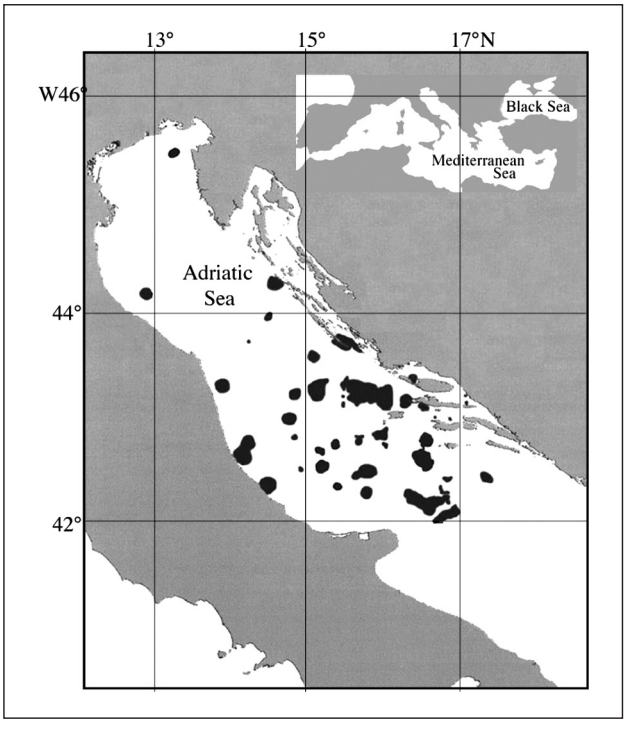

Figure 1. *Conger conger* sampling area in the Mediterranean

Table I. Size distribution frequency (%) for the *Conger conger* trawl surveys

Length class (cm)	% GRUND 2001	% GRUND 2002	% MEDITS 2002
21-30	5	16	14
31-40	19	12	51
41-50	66	54	9
51-60	4	4	14
61-70	3	7	9
71-80	1	8	1
81-90	1	0	1
121-130	1	0	1

Table II. *Conger conger* age (years) distribution frequency (%) and measurements of greater otolith axis in relation to size

Age (years)	Range otholit diameter (mm)	Range TL (cm)	Frequency (%)
3	3.7-5	21-30	12
4	4.2-6	31-40	27
5	5-7.2	41-50	43
6	7-9	51-80	16
7	10-10.5	81-90	1
8	13	121-130	1

examination revealed these gonads to be immature ovaries consisting of numerous lamellae with oocytes surrounded by a large adipose matrix. The oocytes, arranged along the edges of the lamellae, were in the pre- or initial vitellogenesis stage and featured lipidic vesicles in the cytoplasm.

Table III shows stomach content level of all specimens examined. The percent of full stomachs was greater in autumn than in spring. Quality-wise, the diet was seen to consist of Osteichthyes, Crustacea and Mollusca Cephalopoda (table IV). Quantity-wise, Osteichthyes and Crustacea were found to prevail in percent terms compared to Mollusca Cephalopoda (table IV).

DISCUSSION

Findings on the conger eel are still at a preliminary stage and, given the lack of literature on the subject, comparisons are difficult to make (Correia *et al.*, 2006). Nevertheless, growth may be observed to differ depending on geographic area. In fact, in the Adriatic, a narrow inner sea of the Mediterranean, growth was seen to be less than that observed in Brittany, whose coastline is along the Atlantic Ocean (Campillo, 1992).

Findings as to reproductive biology are also few (Relini, Bertrand and Zamboni, 1999; Sbaihi *et al.*, 2001). Little is yet known on the spawning period, most likely summer (Relini, Bertrand and Zamboni, 1999); spawning areas (Correia *et al.*, 2006); spawning depth, which seems to range between 600 and 800 m (Cau and Manconi, 1984); and sexual maturity onset age, which seems to range between 5 and 15 years (Whitehead *et al.*, 1986). The conger eels examined in the present study were caught on neritic sea beds at a depth of between 0 and 400 m, and were all females with immature gonads. These findings are in agreement with those reported by Cau and Manconi (1983) for Sardinian catches. According to these authors, *sex ratio* depends on depth, ranging from 0:1 down to depths of 400 m because of the complete absence of males, 0.5:1 for depths from 400 to 800 m, and to 1:1 from 400 to 1 000 m. The fact that only females were found on neritic sea beds seems to suggest a possible influence of the environment on gonad differentiation (Relini, Bertrand and Zamboni, 1999). The macroscopic appearance of the gonad with a plate-like lamellar structure and its histological characteristic with a large adipocyte matrix are both in agreement with the findings of Fannon, Fahy and O'Reilly (1990) and with Robinet *et al.* (2003) for other eel species.

The conger eel may be said to be a voracious predator, as the percent of specimens with a full stomach was found to be high both in spring and autumn catches. Unlike Cau and Manconi (1984), only a small percentage of specimens in our sample were found to have an empty stomach at the time of gamete spawning. This may be explained by the fact that, as borne out by histological data, the specimens examined by us were not proximate to spawning. Quality-wise, the diet of our specimens was seen to be essentially in line with the literature (Macpherson, 1979; Mori, 1982; Cau and Manconi, 1984; Morato *et al.*, 1999). Depth-related differences (Cau and Manconi, 1984) were not observed,

Table III. Stomach content level in *Conger conger*

Empty stomachs (%)	Autumn	Spring
Empty	17.1	29.2
Semy-empty	27.8	37.5
Semy-full	19.9	20.8
Full	36.2	12.5

Table IV. Diet composition in *Conger conger*

Osteichthyes 49 %	Crustacea 48 %	Mollusca 3 %
Callionymus sp.	*Goneplax* sp.	*Illex coindetii* (Vérany, 1839)
Gobius niger (L., 1758)	*Munida* sp.	Sepiolidae
Arnoglossus sp.	*Nephrops norvegicus* (L., 1758)	
Coelorhinchus sp.	*Squilla mantis* (L., 1758)	
Boops boops (L., 1758)	*Squilla desmaresti* (Risso, 1816)	
Engraulis encrasicolus (L., 1758)		
Phycis blennoides (Brünnich, 1768)		
Lophius sp.		
Spicara sp.		
Coelorhinchus coelorhinchus (Risso, 1810)		

probably because our specimens were retrieved from relatively shallow deep-waters, 400 m at most.

In conclusion, it may be said that our knowledge of the conger eel's biology is still quite poor, probably owing to its complex life cycle. In fact, it goes through great changes, starting from its initial leptocephalic stage (Tortonese, 1970; Correia *et al.*, 2002), and also migrates to very great depths (Cau and Manconi, 1984). A more thorough knowledge of this species is hence called for, especially given its importance as a fishery resource.

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