

A PRELIMINARY STUDY ON FEEDING PREFERENCE OF THE MUSKY OCTOPUS, *Eledone moschata*, (Cephalopoda: Octopodidae) IN IZMIR BAY, AEGEAN SEA

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Abstract: The aim of the preliminary study was to determine the feeding preference of the musky octopus (*Eledone moschata*) from its natural habitats. A total of 471 specimens were measured and their fully or partially full stomachs were fixed in 6% formaldehyde, and then analyzed in the laboratory. The degree of stomach fullness was estimated from 471 individuals, their capture times were precisely known (369 stomachs at 09:00 in morning; 102 stomachs at 12:00 in mid-day). Stomach contents were examined microscopically and prey categories could be identified in higher taxonomic level. Analysis of stomach contents showed that the musky octopus fed principally on crustaceans.

Keywords: Feeding, stomach, musky octopus, *Eledone moschata*, Izmir Bay, Aegean Sea

Özet: **İzmir Körfezi'nde (Ege Denizi) mis ahtapotun, *Eledone moschata*, (Cephalopoda: Octopodidae) beslenme tercihi üzerine bir ön çalışma**

Bu ön çalışmanın amacı, doğal yaşam alanlarından alınan mis ahtapotların (*Eledone moschata*) besin tercihini belirlemektir. Toplam 471 birey ölçülmüş ve dolu veya kısmi dolu mideleri %6'lık formaldehitte saklanmıştır ve daha sonra laboratuarda incelenmiştir. Mide doluluk derecesi yakalanma zamanı bilinen 471 bireyden (369 mide sabah saat 09.00'da; 102 mide öğlen saat 12:00'de) tahmin edilmiştir. Mide içerikleri mikroskobik olarak incelenmiş ve yem kategorileri en yüksek taksonomik seviyede tanımlanabilmiştir. Mide içeriği analizleri mis ahtapotun başlıca krustaselerle beslendiğini göstermiştir.

Anahtar Kelimeler: Beslenme, mide, mis ahtapot, *Eledone moschata*, İzmir Körfezi, Ege Denizi

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Introduction

The musky octopus, *Eledone moschata*, belongs to the medium size octopus of Octopodidae and is a commercially important species in coastal countries of Mediterranean Region (FAO, 2003). This species inhabits muddy bottoms at depths between 8-400 m throughout the Mediterranean Sea as well as the Sea of Marmara, Aegean and Adriatic Seas and the Gulf of Cadiz (Digby, 1949; Mangold-Wirz, 1963; Roper et al., 1984; Katağan and Kocataş, 1990; D'Onghia et al., 1991; Tursi and D'Onghia, 1992; Salman et al., 1997; Akyol and Metin, 2001; Salman et al., 2002; Silva et al., 2004; Akyol et al., 2007; Akyol and Şen, 2008). Musky octopuses are usually discarded by the Turkish bottom-trawlers because of its low commercial values.

There are scarce studies on the diet and feeding activities of *E. moschata*. Boletzky (1975) stated that juveniles of *E. moschata* consume the small pieces of shrimp (*Leander spp.*) and crab (*Carcinus maenas*) or live crabs (*C. maenas*, *Philocheras spp.*), while molluscs (bivalves and gastropods) and fishes are generally rejected. On the soft sandy and muddy bottoms where *E. moschata* lives, crustaceans are various and abundant; it seems likely, therefore, that they are the main food items as in the related species *E. cirrhosa* (Mangold, 1987). Şen (2007) reported that the musky octopuses showed significant preferences amongst food items in this order: crustacean > molluscs > fish. Also, there is only one study on diet of *E. moschata* in the natural environment (Krstulović Šifner and Vrgoč, 2009). They notified that in nature *E. moschata* fed mainly with crustaceans (65%), fish (37.8%) and cephalopods (21.8%) according to their stomach contents. However, there is no study on diet and feeding of the musky octopus in the Aegean Sea. The aim of the present study is to determine the feeding of the musky octopus from its natural habitats.

Materials and Methods

Monthly samples of *Eledone moschata* from bottom trawl net (18 mm stretched mesh) catches at depths between 30–78 m during one hour survey. The survey was done using R/V 'Egesuf' (27 m length and 500 hp engine) from December 2004 to November 2005, except in February, July and October in the Bay of Izmir, northeastern Aegean. A total of 471 specimens were measured and fully or partially full stomachs were fixed in

6% formaldehyde, and analyzed in the laboratory. The degree of stomach fullness was estimated from 471 individuals whose capture times were precisely known (369 stomachs at 09:00 in morning; 102 stomachs at 12:00 in midday). The following Zuev et al. (1985)'s scale of the stomach fullness was used: 0, empty; 1, traces of food; 2, filled less than half; 3, filled more than half; 4, full; 5, exclusively crammed, its walls distended (Laptikhovsky, 2002). The importance of stomach fullness according to the two diurnal times was evaluated calculating the index of stomach fullness (ISF = total stomach contents weight / total octopus body weight * 100) (Hyslop, 1980). Chi-square test (χ^2) was used for comparisons of stomach fullness between morning and midday periods.

A total of 53 out of 210 stomachs (fully or partially full) were examined. Stomach contents were examined microscopically and prey categories were identified in higher taxonomic level. Crustaceans were recognized by diagnostic exoskeleton fragments, extremities and eyes. Bony fishes were determined by otoliths.

Total body weights (BW) and dorsal mantle lengths (ML) of *Eledone moschata* were measured in fresh animals to the nearest ± 1 mm and ± 0.01 g, respectively. The averages were given with standard errors (\pm SE).

Results and Discussion

In this study, 267 females and 204 males of *Eledone moschata* were between 2.7 cm ML (3.4 g of body weight) and 15 cm ML (651 g of body weight) with an average of 7.9 ± 0.09 cm ML (121.9 ± 4.5 g of average body weight) in both sexes. A total of 369 and 102 stomachs were obtained from morning and midday samples, respectively. The stomach fullness category (5) was not observed, while the stomach fullness category (1) was only detected in the morning group. Although, the empty stomachs (0) in the morning and in the midday were found as 53.7% and 61.8%, respectively, the full stomachs (4) were estimated as 3.3% and 1% for the same times (Figure 1). Indexes of the stomach fullness (ISF) for morning and midday were calculated as 0.187 and 0.161, respectively. There were significant differences between morning and midday stomach contents ($P < 0.05$).

Analysis of stomach contents showed that the musky octopus fed principally on crustaceans and the others were found with crustacean remnants (Table 1.). Surprisingly, multifilament net yarn

(Figure 2) and spine of sea urchin were found for the first time in a stomach of *E. moschata*.

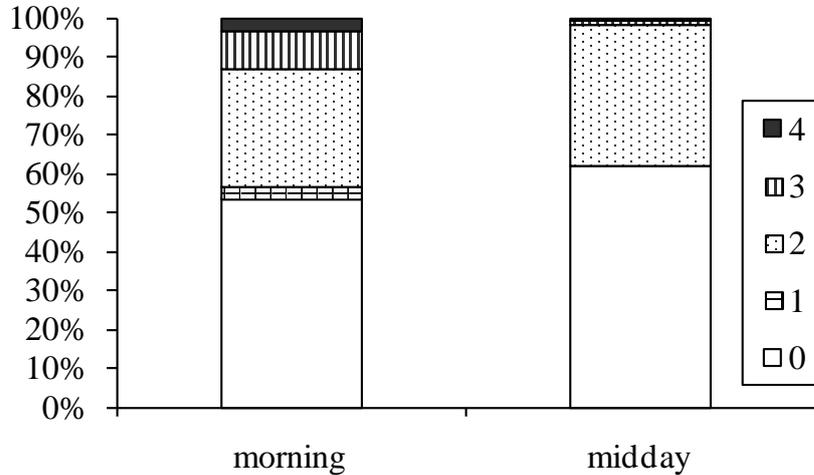


Figure 1. Occurrence of stomach fullness categories in *E. moschata*

Table 1. Food composition of *E. moschata*

Prey item	%
Crustaceans	100
Fish	13
Bivalve	8
Gastropods	8
Number of stomach	53

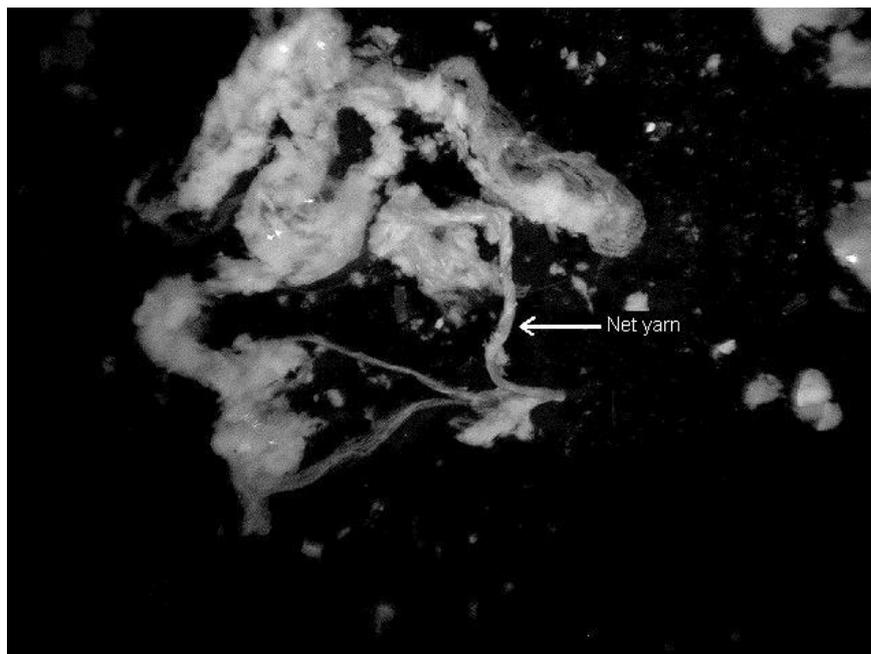


Figure 2. Multifilament net yarn in stomach content of *E. moschata*

Despite the limited number of samples examined, results indicated that *E. moschata* fed almost exclusively on crustaceans, fish, gastropods and bivalves. The diet of *E. moschata*, reported in the current study, is similar to the previous studies of this species (Şen 2007; Krstulovic´ Šifner and Vrgoč, 2009). There were differences in stomach fullness of *E. moschata* between the morning and the midday periods.

Krstulovic´ Šifner and Vrgoč (2009) reported that important prey categories of the larger specimens were crustaceans, fish and cephalopods, and also they observed cannibalism. Although, in this study crustaceans and fish were major preys, neither cephalopods nor cannibalism were observed.

In the present study, especially small crustaceans were eaten completely; these findings are parallel to results of Krstulovic´ Šifner and Vrgoč (2009). On the contrary, Şen (2007) reported that the musky octopus eat soft parts of the crustaceans and discharged exoskeletons in controlled conditions. However, it's known that many octopus species change their feeding behavior depending on the size and life conditions (Guerra, 1978; Boucher-Rodoni et al., 1987; Nixon, 1987; Hanlon and Messenger, 1996). Additionally, the finding of multifilament net yarn in the stomach is the evidence of the opportunistic behavior of *E. moschata*, eaten the fish entangled to the commercial gill net.

Conclusions

In conclusion, according to the present results, *E. moschata* fed almost exclusively on crustaceans, fish, gastropods and bivalves. There were differences in stomach fullness of *E. moschata* between the morning and the midday periods. It seems that these animals feed probably at dusk as there were many empty stomachs of *E. moschata*. They are opportunistic animals able to change their feeding behaviors. So, the further and more detailed studies on diurnal and seasonal feeding habits of *E. moschata* in the Aegean Sea with determination of prey at lower taxonomic levels are needed.

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