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Stomach contents of three deep-diving toothed whale species stranded in Greece, eastern Mediterranean

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Abstract

Understanding trophic ecology is essential for assessing the role of top predators in marine food webs. In the Mediterranean Sea, toothed whales are key components of megafauna and for this reason, we investigated the diets of nine deep-diving odontocetes stranded along the Greek coastline: five Risso's dolphins (*Grampus griseus*), three goose-beaked whales (*Ziphius cavirostris*) and one sperm whale (*Physeter macrocephalus*). A total of 17 cephalopod species were identified and quantified via percentage by number (%N) and by weight (%W). For Risso's dolphins, *Histioteuthis reversa* was the most important prey item (%N=24.7, %W=27.3), while *Histioteuthis bonnellii* dominated the diets of goose-beaked whales (%N=32.3, %W=34.1) and the sperm whale (%N=86.8, %W=99.8). We report, for the first time for *G. griseus* in the eastern Mediterranean, *Illex coindetii* as a rather important prey and the beltfish *Trichiurus lepturus* as an unusual prey. Our findings underscore the ecological importance of the *Histioteuthis* genus in the diets of deep-diving toothed whales in the Mediterranean. Risso's dolphins exhibited the most diverse diet, indicative of a generalist foraging strategy, whereas goose-beaked whales and the single sperm whale displayed more specialized feeding habits focusing on mesopelagic and bathypelagic prey. The finding of macroplastics in the sperm whale highlights a widespread threat to this species in the region. Despite the small sample size and the opportunistic nature of stranding events, our findings align with previous evidence of species-specific dietary patterns and emphasize the importance of conserving deep-sea foraging habitats in the eastern Mediterranean.

Keywords: cephalopod; diet; odontocetes; teuthophagous; trophic ecology; plastic debris.

Introduction

Marine top predators such as large fish, seabirds, seals and cetaceans play a crucial role in regulating ecosystems through top-down control of prey populations and nutrient cycling (Curry *et al.*, 2011; Lynam *et al.*, 2017; Aarts *et al.*, 2019; Rupil *et al.*, 2022). Understanding their trophic ecology is therefore essential for interpreting predator-prey dynamics, identifying critical habitats, and assessing the potential impacts of human activities on these species (Harkonen *et al.*, 2012; Maxwell *et al.*, 2013; Roff *et al.*, 2018).

Several species of marine top predators inhabit both basins of the Mediterranean Sea. In the eastern basin, the narrow continental shelf and steep deep-sea trenches form important habitats for deep-diving toothed whales (Frantzis *et al.*, 2003; Frantzis, 2009; Frantzis *et al.*, 2014). These geomorphological features act as biological hotspots by concentrating prey, such as deep-sea cephalopods and fish, along slope-associated fronts, thereby facilitating efficient foraging during prolonged, breath-hold dives (Aïssi *et al.*, 2012).

Three deep-diving odontocete species are regularly observed in the eastern Mediterranean: sperm whales (*Physeter macrocephalus* Linnaeus, 1758), goose-beaked whales (*Ziphius cavirostris* Cuvier, 1823), and Risso's dolphins [*Grampus griseus* (G. Cuvier, 1812)]. These species inhabit both pelagic and slope-associated habitats (Frantzis *et al.*, 2003; Frantzis, 2009; Frantzis *et al.*, 2014). According to the IUCN Red List of Threatened Species, the Mediterranean subpopulations of sperm whales and Risso's dolphins are currently classified as Endangered (EN) (Lanfredi *et al.*, 2021; Pirotta *et al.*, 2021), while goose-beaked whales are listed as Vulnerable (VU) (Cañadas & Notarbartolo Di Sciara, 2018). Although the ecology of these three species has been studied in other regions (Clarke *et al.*, 1993; West *et al.*, 2017; Bloch *et al.*, 2012), caution must be exercised when extrapolating such findings to the isolated Mediterranean subpopulations, which are genetically distinct from their Atlantic counterparts (Dalebout *et al.*, 2005; Gaspari *et al.*, 2007; Violi *et al.*, 2023).

Stomach content analysis of stranded animals has long served as a valuable tool for investigating the trophic ecology of deep-diving toothed whales, whose elusive behaviour makes direct observation of feeding nearly impossible (Clarke, 1980). This method allows for accurate species-level identification of prey remains and estimation of prey size, enabling a quantitative assessment of each prey's relative importance in the predator's diet (Pierce & Boyle, 1991). However, because it relies on opportunistic samples, stomach content analysis may disproportionately reflect the most recent feeding events of stranded individuals, which might not be representative of the broader population.

Analyses of stomach contents from Mediterranean sperm whales, goose-beaked whales and Risso's dolphins have revealed an almost exclusive reliance on mesopelagic and bathypelagic squids as their primary prey (Tables S1, S2 and S3). Although deep-sea squids are important prey for these predators, their biological and ecological characteristics remain poorly understood due to limitations of standard sampling methods (Hoving *et al.*, 2014). For sperm whales, the deep-sea squid *Histioteuthis bonnellii* (A. Férussac, 1834) has been consistently identified as the most important prey species in their diet (Roberts, 2003; Garibaldi & Podesta, 2014; Mazzariol *et al*., 2018; Foskolos *et al.*, 2020a; Tonay *et al.*, 2021). In contrast, goose-beaked whales and Risso's dolphins appear to have broader dietary niches. The diet of *Z. cavirostris* includes a range of deep-sea squid species from the families Chiroteuthidae, Cranchiidae, Histioteuthidae, and Octopoteuthidae (Blanco & Raga, 2000; Kovačić *et al.*, 2011; Pedà *et al.*, 2015; Tonay *et al*., 2025). *G. griseus*, on the other hand, preys on squids from the families Histioteuthidae, Ommastrephidae, and Onychoteuthidae (Würtz *et al.*, 1992; Bello & Bentivegna, 1996; Blanco *et al.*, 2006; Öztürk *et al.*, 2007; Pedà *et al.*, 2015; Milani *et al.*, 2018; Luna *et al.*, 2021).

Across the Mediterranean, stomach content analyses have been conducted on 28 individuals of *G. griseus* and 14 individuals of *Z. cavirostris*, with only three and eight individuals, respectively, originating from the eastern basin (Würtz *et al.*, 1992; Bello & Bentivegna, 1996; Blanco & Raga, 2000; Orsi Relini & Garibaldi, 2005; Blanco *et al*., 2006; Öztürk *et al*., 2007; Kovačić *et al*., 2011; Pedà *et al.*, 2015; Milani *et al*., 2017; Luna *et al.*, 2021; Tonay *et al.*, 2025). In contrast, 11 of the 12 *P. macrocephalus* individuals examined to date were stranded in the eastern Mediterranean (Roberts, 2003; Foskolos *et al.*, 2020a; Tonay *et al.*, 2021). Despite these efforts, the total number of stomachs analysed for all three species remains too limited to support robust assessments of spatial, interspecific, or intraspecific variations in their diet.

To expand the limited dataset for the eastern Mediterranean basin, we analysed the stomach contents of nine individuals stranded along the Greek coastline: five Risso's dolphins, three goose-beaked whales, and one sperm whale. Although the sample size is small, our results indicate that squids of the genus *Histioteuthis* represent a key dietary component for all three species. These findings therefore offer valuable insights into the trophic ecology of these elusive deep-diving cetaceans across a region increasingly affected by anthropogenic pressures.

Materials and Methods

Sample collection

Stomach contents of five Risso's dolphins and three goose-beaked whales stranded along the Greek coastline were collected by the Pelagos Cetacean Research Institute (PCRI) between 1994 and 2012 (Table 1, Fig. 1). In addition, we included the stomach contents of a single sperm whale stranded in 2019 (Table 1, Fig. 1). Stomach contents from other sperm whales stranded in Greece between 2005 and 2014 were excluded, as they have been already reported in a previous study (Foskolos *et al.*, 2020a). For each individual, the length, sex and -when possible- the cause of death were recorded (Table 1).

Stomach contents were carefully extracted *in situ* from all toothed whales. For one Risso's dolphin (Gg1 in Table 1), the stomach contents were only photographed while for all other specimens, prey remains were preserved in 70% ethanol. As most of these stomach contents had already been analysed for debris items in a previous study (Alexiadou *et al.*, 2019), we only washed and dried the debris found in specimen Pm11 (Table 1) for further analysis.

Analysis of stomach contents

Cephalopod beaks, eye lenses and musculoskeletal remains, fish bones and other invertebrate remains were sorted from each sample. Beaks served as the primary diagnostic morphological structures and were categorized into lower and upper. Cephalopods were primarily identified to the species level using lower beaks, following the identification guide by Pedà *et al.* (2022). Damaged lower beaks were identified to the lowest possible taxonomic level and were used solely to estimate the total number of prey. Fish and crustacean remains were identified using published references (Dalyan & Eryılmaz, 2008; Fischer *et al.*, 1987; Nakamura & Parin, 1993). Abundance was then estimated based on the number of dentary bones for fish and telsons for crustaceans. Similarly, cephalopod abundance was estimated by counting lower beaks. However, since upper beaks of certain species -such as *Octopoteuthis sicula* Rüppell, 1844 and *Argonauta argo* Linnaeus, 1758- can also be diagnostic, the estimated number of cephalopods was revised whenever upper beaks outnumbered lower ones.

Standard measurements of undamaged cephalopod lower beaks were taken using a digital Vernier calliper (±0.02 mm accuracy). For each individual cephalopod, total wet weight (W) and mantle length (ML) were

Table 1. Details of the stranded Risso's dolphins (*Gg*), goose-beaked whales (*Zc*) and the single sperm whale (*Pm*) included in this study. "L" and "U" refer to lower and upper cephalopod beaks, respectively. The identification codes for the sperm whales follow the numbering system used by Foskolos *et al*. (2020a). All stomach contents, except for that of *Pm11*, were previously analysed for debris items in Alexiadou *et al*. (2019).

Identification code	Stranding date	Stranding location	Total length (m)	Sex	Cause of death	Number of cephalopod beaks (L/U)	Number of cephalopod species	Presence of non-cephalopod prey remains	Presence of debris items
Gg1	08/01/1994	Gythio, Laconia	2.95	F	Deliberate killing	3/7	1	+	-
Gg2	29/04/2006	Megas Gialos, Siros	3.15	M	Unknown	1/0	1	-	-
Gg3	07/06/2008	Gira, Lefkada	2.91	F	Ingestion of macroplastics	464/405	9	-	+
Gg4	04/04/2011	Tsoukalia, Paros	3.06	M	Unknown	2/7	3	-	-
Gg5	18/10/2012	Zacharo, Ilia	3.13	F	Unknown	169/94	8	-	-
Zc1	12/05/1996	Kartelas, Messinia	4.50	M	Military sonar	180/162	7	+	-
Zc2	30/11/2011	Arillas, Kerkyra	4.88	M	Military sonar	126/167	6	+	-
Zc3	01/12/2011	Kontogialos, Kerkyra	4.33	M	Military sonar	134/134	7	-	-
Pm11	27/10/2019	Keratea, Attica	12.1	M	Ship strike	1300/332	6	-	+

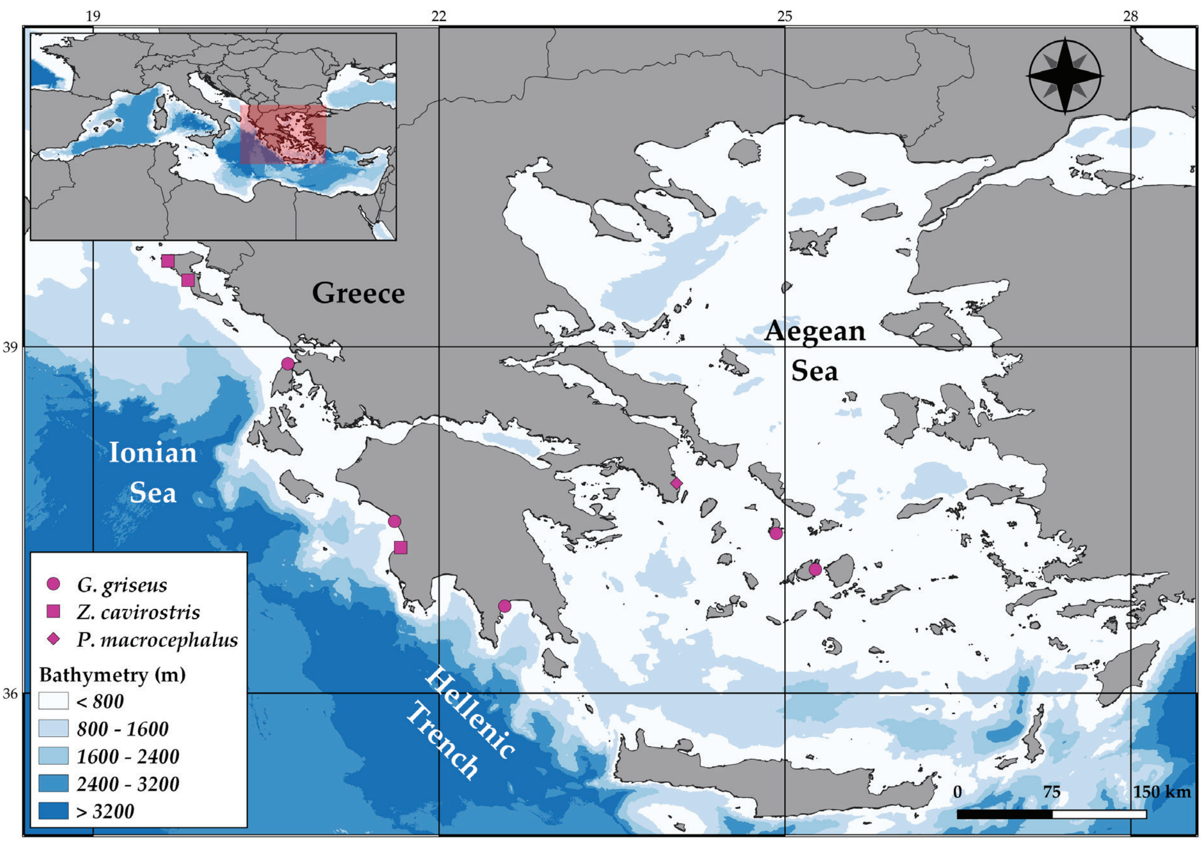

Fig. 1: Stranding locations of deep-diving toothed whales whose stomach contents were analysed for this study (Table 1). The map was created using QGIS (https://www.qgis.org), with data sourced from the following: coastline (https://www.eea.europa.eu/data-and-maps/data/eea-coastline-for-analysis-2/gis-data/eea-coastline-polygon), country borders (https://gadm.org), and bathymetry (https://www.emodnet-bathymetry.eu/).

estimated using established regression equations (Table S4); these equations relate body size and weight to either the lower beak rostral length (LRL) of squids or lower beak hood length (LHL) for octopodids. We obtained these regressions from the literature, with preference given to studies based on Mediterranean populations when available (Table S4). Beaks for which the estimated ML and W were not within the range of values used in the selected regressions were not included in the analysis. The total biomass represented by the beaks of a given cephalopod species was estimated by dividing the summed estimated weights of the measured beaks by the proportion of individuals measured, following the method of Santos *et al.* (2001).

To describe the diet composition of each toothed whale species, we used three indices: frequency of occurrence, average percentage abundance, and prey-specific abundance (Amundsen *et al.*, 1996). These indices were calculated as follows:

Frequency of occurrence: $FO_i = \frac{n_i}{n}$,

Average percentage abundance ($\%N_i$, $\%W_i$): &

$$\%A_i = \frac{\sum_{j=1}^{n} \%A_{ij}}{n}$$

Prey-specific abundance ($\%PN_i$, $\%PW_i$):

$$\%PA_i = \frac{\sum_{j=1}^{n} \%A_{ij}}{n_i}$$

Here, n_i represents the number of stomachs containing prey *i*, and *n* is the total number of stomachs analysed. A_{ij} denotes the abundance (by number or weight) of prey *i* in stomach *j*. *%PN* refers to the prey-specific percentage by number, and *%PW* to the prey-specific percentage by weight. To assess the overall dietary importance of each prey species, we calculated the prey-specific index of relative importance (PSIRI; Brown *et al.*, 2012) as follows:

$$PSIRI_i = FO_i \cdot (\%PN_i + \%PW_i)$$

We did not calculate PSIRI for two fish species (*Chauliodus sloani* Bloch & Schneider, 1801 and *Trichiurus lepturus* Linnaeus, 1758) and one crustacean species [*Aristaeomorpha foliacea* (Risso, 1827)] for which weight could not be estimated. All values are expressed as %PSIRI, calculated by dividing the PSIRI for prey item *i* by the sum of PSIRI values for all prey items, then multiplying by 100. Prey species with %PSIRI>5 were considered important dietary components (Harvey *et al.*, 2014). Stomach contents from three Risso's dolphins (Gg1, Gg2 and Gg4, Tables 1 and S5) contained only a few prey items and were therefore excluded from all dietary index calculations.

Each debris item found in the stomach of Pm11 was labelled, weighed, photographed and measured using a measuring tape. All debris consisted of plastic, particularly user plastics -non-industrial remnants of plastic products-. These were classified into five main categories proposed by Provencher *et al.* (2017) and into commonly used size categories (Barnes *et al.*, 2009): megaplastics (>100 mm), macroplastics (>20-100 mm), mesoplastics (5-20 mm) and microplastics (<5 mm). We also categorized plastic items into eight broad colour groups based on Verlis *et al.* (2013).

Results

With the exception of Gg2, Gg4 and Pm11 (Table 1), all toothed whales had stranded alive. The identified prey items consisted almost exclusively of cephalopod beaks: 2379 lower beaks and 1308 upper beaks (Table 1), along with 341 rostral tips from either upper or lower beaks. Cephalopod eye lenses were present in most stomachs (i.e., Gg1, Gg3, Gg5, Zc1, Zc2, Zc3 and Pm11), whereas cephalopod gladii were only found in Gg1 and Zc1. Cephalopod flesh remains were even rarer, limited to Gg1, which contained three mantles, two buccal masses and four crowns of arms. Fish remains were infrequent and included a complete skeleton of *T. lepturus* (total length 81 cm) in Gg1 and a dentary bone of *C. sloani* in Zc1. Crustacean remains were also rare, represented by an abdomen of *A. foliacea* in Zc1. A few nematodes were recovered from Zc2 and Zc3. Macroplastic debris was found in Pm11 as well as in Gg3 (see Alexiadou *et al*., 2019).

A total of 2162 intact lower beaks were identified, corresponding to 17 cephalopod species across 12 different families. These included 14 species in Risso's dolphins, 10 species in goose-beaked whales, and six species in the single sperm whale respectively (Tables 2, 3, 4). In Risso's dolphins, the most frequently occurring cephalopod families were (in descending order): Chiroteuthidae, Histioteuthidae, Octopoteuthidae, Ommastrephidae, Onychoteuthidae, Ancistrocheiridae, Argonautidae, Brachioteuthidae, Chtenopterygidae, Cranchiidae, and Loliginidae. For goose-beaked whales, the dominant families were: Histioteuthidae, Octopoteuthidae, Ancistrocheiridae, Chiroteuthidae, Cranchiidae, Onychoteuthidae, Chtenopterygidae and Ommastrephidae (Table 3). The most numerically abundant prey species were *Histioteuthis reversa* (A.E. Verrill, 1880) for Risso's dolphins (24.7%), and *Histioteuthis bonnellii* for goose-beaked whales (32.3%) and the single sperm whale (86.8%) (Tables 2, 3, 4). These species contributed the largest proportion of total reconstructed biomass for each predator species, accounting for 27.3% (Risso's dolphins), 34.1% (goose-beaked whales) and 99.8% (sperm whale), respectively (Tables 2, 3 and 4). Based on the %PSIRI index, the most important prey species (%PSIRI>5) were the following (Tables 2, 3, 4): *H. reversa* (27%), *Illex coindetii* (Vérany, 1839) (22.6%), *Argonauta argo* Linnaeus, 1758 (11.5%), *Todarodes sagittatus* (Lamarck, 1798) (8.2%), *Onychoteuthis banksii* (Leach, 1817) (5.4%), and *Octopoteuthis sicula* Rüppell, 1844 (5.1%) for Risso's dolphins; *H. bonnellii* (33.3%), *Galiteuthis armata* Joubin, 1898 (22.3%), *H. reversa* (16.9%), *O. sicula* (12.9%), and *Chiroteuthis veranii* (A. Férussac, 1835) (7.8%) for goose-beaked whales; and *H. bonnellii* (99.4%) for the sperm whale. The combined stomach contents yielded an estimated in-

Table 2. Diet composition of stranded Risso's dolphins (*Gg3* & *Gg5*), presented as percentage frequency of occurrence (%FO), percentage prey-specific number (%PN), percentage number (%N), percentage prey-specific weight (%PW), percentage weight (%W), and the prey-specific index of relative importance (%PSIRI). For each prey species, the mean and standard deviation (sd) of lower rostral length (LRL) or lower hood length (LHL) in millimeters (mm), as well as the mean and maximum mantle length (ML, mm) and total weight (g), are also reported. Prey species with %PSIRI>5 are marked with **bold** since they were considered important dietary components (Harvey *et al*., 2014). The total number of prey items are presented in Table S5.

Class	Order	Family	Species	%FO	%PN	%N	%PW	%W	%PSIRI	LRL/LHL (mm)		ML (mm)		Total weight (g)
										Mean	sd	Mean	Max	
Cephalopoda	Bathyteuthida	Chtenopterygidae	*Chtenopteryx sicula*	50	2.7	1.4	1	0.5	1	1.2	0.2	50	67	154
	Myopsida	Loliginidae	*Loligo vulgaris*	50	4.6	2.3	12.6	6.3	4.4	3.1	0.2	262	291	$3{\cdot}10^3$
	Oegopsida	Ancistrocheiridae	*Ancistrocheirus alessan-drinii*	50	1	0.5	9.8	4.9	2.8	5	1.2	162	206	$1.5{\cdot}10^3$
		Brachioteuthidae	*Brachioteuthis riisei*	50	2.3	1.2	0.2	0.1	0.6	1.2	0.2	34	45	23
		Chiroteuthidae	*Chiroteuthis veranii*	100	6.2	6.2	3.4	3.4	5	3.4	0.8	94	157	$1.1{\cdot}10^3$
		Cranchiidae	*Galiteuthis armata*	50	0.6	0.3	0.9	0.4	0.4	3.9	1	338	407	135
		Histioteuthidae	***Histioteuthis reversa***	**100**	**24.7**	**24.7**	**27.3**	**27.3**	**27**	**2.5**	**0.7**	**68**	**105**	**$1.2{\cdot}10^4$**
		Octopoteuthidae	***Octopoteuthis sicula***	**100**	**4.1**	**4.1**	**5.8**	**5.8**	**5.1**	**5.7**	**1.4**	**120**	**150**	**$2.1{\cdot}10^3$**
		Ommastrephidae	***Illex coindetii***	**100**	**21.3**	**21.3**	**22**	**22**	**22.6**	**3.6**	**0.6**	**162**	**207**	**$5.7{\cdot}10^3$**
			Todaropsis eblanae	50	10.3	5.2	8.7	4.3	4.9	3.8	0.5	132	176	$2.1{\cdot}10^3$
			Todarodes sagittatus	**50**	**5.2**	**2.6**	**26.4**	**13.2**	**8.2**	**7.7**	**0.9**	**287**	**326**	**$6.4{\cdot}10^3$**
		Onychoteuthidae	*Ancistroteuthis lichten-steinii*	50	3.8	1.9	-	-	1	-	-	-	-	-
			Onychoteuthis banksii	**100**	**4.6**	**4.6**	**5.7**	**5.7**	**5.4**	**2.4**	**0.1**	**117**	**129**	**$1.8{\cdot}10^3$**
	Octopoda	Argonautidae	***Argonauta argo***	**50**	**32.8**	**16.4**	**11.5**	**5.8**	**11.5**	**3**	**0.7**	**41**	**82**	**$1.7{\cdot}10^3$**
	Broken beaks	-	-	100	7.3	7.3	-	-	-	-	-	-	-	-

Table 3. Diet composition of stranded goose-beaked whales (*Zc1-3*), expressed as percentage frequency of occurrence (%FO), percentage prey-specific number (%PN), percentage number (%N), percentage prey-specific weight (%PW), percentage weight (%W), and the prey-specific index of relative importance (%PSIRI). For each prey species, the mean and standard deviation (sd) of lower rostral length (LRL) in millimeters (mm), as well as the mean and maximum mantle length (ML, mm) and total weight (g), are also reported. Prey species with %PSIRI>5 are marked with **bold** since they were considered important dietary components (Harvey *et al*., 2014). The total number of prey items are presented in Table S5.

Class	Order	Family	Species	%FO	%PN	%N	%PW	%W	%PSIRI	LRL (mm)		ML (mm)		Total weight (g)
										Mean	sd	Mean	Max	
Cephalopoda	Bathyteuthida	Chtenopterygidae	*Chtenopteryx sicula*	33.3	8.9	3	2.8	0.9	2	1.4	0.2	58	70	290
	Oegopsida	Ancistrocheiridae	*Ancistrocheirus alessandrinii*	66.6	1.1	0.7	2.1	1.4	1.1	6.3	0.3	214	225	$2.3 \cdot 10^3$
		Chiroteuthidae	***Chiroteuthis veranii***	**66.6**	**12.9**	**8.6**	**10.4**	**6.9**	**7.8**	**5.1**	**0.7**	**135**	**164**	$\mathbf{2.2 \cdot 10^3}$
		Cranchiidae	***Galiteuthis armata***	**66.6**	**45**	**30**	**21.9**	**14.6**	**22.3**	**3.5**	**0.8**	**313**	**461**	$\mathbf{4.1 \cdot 10^3}$
		Histioteuthidae	***Histioteuthis bonnellii***	**100**	**32.3**	**32.3**	**34.1**	**34.1**	**33.3**	**4.5**	**1.5**	**81**	**191**	$\mathbf{4.8 \cdot 10^4}$
			Histioteuthis reversa	**100**	**15.1**	**15.1**	**18.7**	**18.7**	**16.9**	**2.8**	**0.6**	**77**	**105**	$\mathbf{5.9 \cdot 10^3}$
		Octopoteuthidae	***Octopoteuthis sicula***	**100**	**5.3**	**5.3**	**20.5**	**20.5**	**12.9**	**8.2**	**1.6**	**157**	**205**	$\mathbf{8.5 \cdot 10^3}$
		Ommastrephidae	*Ommastrephes caroli*	33.3	0.5	0.2	5.7	1.9	1.1	10	-	447	447	$3.1 \cdot 10^3$
			Todarodes sagittatus	33.3	1.1	0.4	-	-	0.2	-	-	-	-	-
		Onychoteuthidae	*Ancistroteuthis lichtensteinii*	66.6	6.1	4	1.6	1	2.5	3.3	0.4	106	114	497
Malacostraca	Decapoda	Aristeidae	*Aristaeomorpha foliacea*	33.3	-	-	-	-	-	-	-	-	-	-
Actinopterygii	Stomiiformes	Stomiidae	*Chauliodus sloani*	33.3	-	-	-	-	-	-	-	-	-	-

Table 4. Diet composition of the stranded sperm whale (*Pm11*), expressed as percentage frequency of occurrence (%FO), percentage prey-specific number (%PN), percentage prey-specific weight (%PW), and the prey-specific index of relative importance (%PSIRI). For each prey species, the mean and standard deviation (sd) of lower rostral length (LRL) in millimeters (mm), as well as the mean and maximum mantle length (ML, mm) and total weight (g), are also reported. Prey species with %PSIRI>5 are marked with **bold** since they were considered important dietary components (Harvey *et al.*, 2014). The total number of prey items are presented in Table S5. Percentage number (%N) and percentage weight (%W) are not reported since they are equal to %PN and % PW respectively.

Class	Order	Family	Species	%FO	%PN	%PW	%PSIRI	LRL (mm)		ML (mm)		Total weight (g)
								Mean	sd	Mean	Max	
Cephalopoda	Oegopsida	Brachioteuthidae	*Brachioteuthis riisei*	100	0.1	-	0	1.5	-	41.1	41.1	3
		Chiroteuthidae	*Chiroteuthis veranii*	100	0.1	-	0	3.9	-	106.1	106.1	30
		Enoploteuthidae	*Abralia veranyi*	100	0.1	-	0	-	-	-	-	-
		Histioteuthidae	***Histioteuthis bonnellii***	**100**	**86.8**	**99.8**	**99.4**	**6.8**	**1.2**	**126.5**	**195.5**	**$9.1 \cdot 10^5$**
			Histioteuthis reversa	100	0.5	0.1	0.3	3.3	0.3	93.1	106.3	921
		Octopoteuthidae	*Octopoteuthis sicula*	100	0.2	0.1	0.2	6.7	5.3	135	190.4	$1.2 \cdot 10^3$
	Broken beaks	-	-	100	12.2	-	-	-	-	-	-	-

gested biomass of 34 kg for Risso's dolphins, 75 kg for goose-beaked whales, and 912 kg for the sperm whale (Tables 2, 3, 4, S5). The measurable beaks from which we could reliably estimate ML (n=1329) gave estimates that ranged from 24 mm for *A. argo* to 461 mm for *G. armata* (mean=129 mm, median=119 mm, sd=71 mm). ML estimates for *H. reversa* and *H. bonnellii* in each predator species are presented in Figure 2, while estimates for other key prey species are shown in Figure S1.

All 50 debris items found in Pm11 were plastic, the majority of which were sheet plastics (43 items), including 38 plastic bags (Table 5). The total weight of the debris was 3.7 kg, with a combined surface area of 23.1 m^2 (Table 5, Fig. 3). Most items were classified as megaplastics (95.4%), while only 4.6% were macroplastics. Although 58.8% of the items appeared blackened due to squid ink staining, their original colour was predominantly off/white-clear (76.5%). The remaining items were originally blue-purple (8.8%), grey-silver (5.9%), black (5.9%), or orange-brown (2.9%).

Discussion

Despite recent scientific advances, the inaccessibility of deep-sea habitats continues to make stomach content analysis a valuable tool for investigating the diets of deep-diving predators and the ecosystems they inhabit. In this study, we analysed the stomach contents of nine stranded individuals from three deep-diving toothed whale species to identify key prey taxa and contribute new dietary data for the eastern Mediterranean, a region where such information remains scarce. However, given the limited sample size, our findings should be interpreted with caution when making inferences about population-level dietary patterns.

The individuals included in this analysis stranded across a broad geographic area, over different seasons and years, introducing potential confounding factors related to prey availability. Nevertheless, the diet of all three species was consistently dominated by cephalopods, supporting previous studies that characterise them as teuthophagous (Clarke, 1996). In particular, our results underscore the central role of *Histioteuthis* spp. in the diets of deep-diving odontocetes in the Mediterranean Sea (Bello, 2000), with *H. reversa* identified as the primary prey of Risso's dolphins, and *H. bonnellii* predominating the diets of both goose-beaked whales and the sperm whale. This prevalence of deep-sea cephalopods in the diets of all three whale species highlights the ecological significance of poorly studied deep-sea habitats, such as submarine canyons, and underscores the need to prioritize these areas in future conservation efforts targeting deep-diving toothed whales. In these habitats -especially in extensive regions like the Hellenic Trench- seismic exploration for oil and gas is both ongoing and planned. In addition to the direct acoustic impact on cetaceans (Duarte *et al.*, 2021), evidence indicates that anthropogenic noise from such activities may also significantly disrupt cephalopod populations (Solé *et al.*, 2017). This disrup-

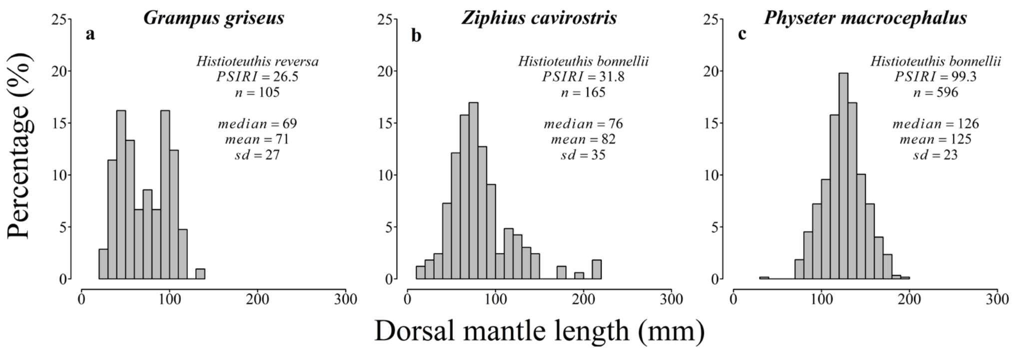

Fig. 2: Histograms of estimated mantle length for the prey species with the highest prey-specific index of relative importance (PSIRI) in the diet of the three toothed whale species. *n*: number of measured lower beaks, *sd*: standard deviation. This figure was created using RStudio (https://posit.co/download/rstudio-desktop/).

Table 5. Data on debris items found in the stomach of the stranded sperm whale *Pm11*. sd: standard deviation, se: standard error. Plastic debris was categorized into sheet plastics (including bags, sacks and other), threads (including rope) and miscellaneous items, following the classification system of Provencher *et al.* (2017).

Debris items			Number	Weight (g)			Total weight (g)	Total surface area (m²)
				Mean (sd/se)	Median	Range		
all plastics	sheets	bags	38	62 (76/13)	27	5-350	2355	20.1
		sacks	4	239 (53/26)	247	160-300	955	3
		other	1	25 (0/0)	25	-	25	-
	threads	rope	4	42 (0/0)	42	-	170	-
	miscellaneous	-	3	87 (98/56)	20	15-225	260	-

Fig. 3: Plastic debris recovered from the stomach of the stranded sperm whale Pm11. (a-e) Plastic sheets (bags and sacks) as well as threads (b) appeared blackened due to staining from squid ink. (f) Unusual plastic items, from left to right: a fragment of a bucket, pot or similar item; a spray can cap; and a thick tube. Scale bar: 10 cm.

tion could reduce prey availability, thereby indirectly threatening the survival of these teuthophagous predators.

Risso's dolphins exhibited the most diverse diet among the three species analysed, with 14 cephalopod species identified across 11 families. The most important prey, in decreasing order of importance, were *H. reversa*, *I. coindetii*, *A. argo*, *T. sagittatus*, *O. banksii* and *O. sicula*. Notably, the broadtail shortfin squid (*I. coindetii*) is reported here for the first time in the diet of *G. griseus* in the eastern Mediterranean. Additionally, this study provides the first record of the largehead hairtail (*T. lepturus*) in the stomach contents of Risso's dolphins in the Mediterranean Sea. The dominance of the reverse jewel squid (*H. reversa*) in the diet aligns with previous findings from the western Mediterranean (Würtz *et al.*, 1992), suggesting that this species is a key prey resource throughout the basin. The presence of vertically migrating species (e.g., *O. banksii*), the epipelagic *A. argo* and more strictly bathypelagic taxa (e.g., *C. veranii*) indicates that Risso's dolphins forage across a range of depths, reflecting a broad trophic niche and an opportunistic foraging strategy. Taken together, these results suggest that *G. griseus* in the eastern Mediterranean functions as a generalist predator that primarily consumes deep-sea cephalopods, while maintaining the flexibility to exploit a diverse array of prey. Strandings like those of the three Risso's dolphins with stomachs that contained only a few prey items are rarely documented in the literature and may indicate compromised feeding, underscoring the need for caution when interpreting dietary data from stranded individuals.

Goose-beaked whales had a more selective diet than Risso's dolphins, with ten cephalopod species identified, largely dominated by deep-water taxa. The umbrella squid (*H. bonnellii*) was the most important prey species, followed by *G. armata*, *H. reversa*, *O. sicula*, and *C. veranii*, all characteristic of mesopelagic and bathypelagic habitats. This prey composition indicates a clear foraging preference for deep-sea cephalopods, aligning with the extreme diving behaviour of *Z. cavirostris*, known to exceed depths of 1000 meters (Schorr *et al.*, 2014). These findings are therefore consistent with previous studies in the Mediterranean (Pedà *et al.*, 2015; Blanco & Raga, 2000; Tonay *et al.*, 2025), while also providing new dietary data for the eastern basin, where empirical evidence on the species' feeding ecology remains limited. Although the giant red shrimp (*A. foliacea*) and Sloane's viperfish (*C. sloani*) are reported for the first time in the stomachs of goose-beaked whales in the Mediterranean, their presence likely reflects secondary ingestion, as their small size and low abundance suggest they were consumed by the whales' cephalopod prey rather than directly targeted.

The single sperm whale examined in this study displayed a highly specialized diet, with a marked predominance of *H. bonnellii.* This finding is consistent with previous research from both the western and eastern Mediterranean (Roberts, 2003; Mazzariol *et al.*, 2011; Foskolos *et al.*, 2020a; Tonay *et al.*, 2021). The near exclusivity of *H. bonnellii* in the stomach contents of this apex predator suggests a strong prey specialization, likely driven by the energetic efficiency of targeting relatively small, neutrally buoyant, slow-swimming cephalopods in deep waters -species that are not subject to commercial exploitation. Other prey species found in this individual were negligible in biomass and occurred at very low abundancies, further supporting the conclusion that sperm whales in the eastern Mediterranean exhibit a narrow trophic niche, relying heavily on a small number of key prey species (Foskolos *et al.*, 2020a). Additionally, the presence of debris in this individual provides further evidence that sperm whales in Greece regularly ingest macroplastics, often with fatal consequences (Alexiadou *et al*., 2019; Foskolos *et al*., 2020b).

Despite the limited sample size, our results are consistent with recent findings, suggesting that dietary niche segregation among deep-diving odontocetes is influenced not only by prey taxonomic composition but also by differences in prey size and, by extension, ontogenetic stage (Visser *et al.*, 2021). Although Risso's dolphins, goose-beaked whales and the sperm whale all consumed cephalopods from the same families, the dominance of different prey species and size classes likely reflects variation in prey selection and foraging depth. These differences are, in turn, shaped by species-specific physiological constraints, such as diving capacity and biosonar characteristics. Notably, *H. bonnellii*, a dominant prey species for both goose-beaked whales and sperm whales, was not detected in the diet of Risso's dolphins. While this prey species has been reported in previous dietary studies of Risso's dolphins in the Mediterranean (Würtz *et al.*, 1992; Blanco *et al.*, 2006; Öztürk *et al.*, 2007; Pedà *et al.*, 2015; Milani *et al.*, 2017; Luna *et al.*, 2021), its absence here may reflect regional or/and seasonal variation in foraging behaviour and prey availability.

While this study provides valuable insights into the trophic ecology of deep-diving cetaceans in the eastern Mediterranean, it also underscores the urgent need for the analysis of additional stomach contents from these predators. Due to the opportunistic nature of data derived from strandings, only a larger sample size can support population-level generalizations and enable meaningful inter-basin comparisons across species. As anthropogenic pressures on the marine environment continue to intensify, addressing these data gaps is essential for understanding how deep-diving cetaceans interact with their prey, and how their ecological roles may shift in a rapidly changing sea.

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References

Aarts, G., Brasseur, J.J., Poos, J., Schop, R., Kirkwood, T. *et al.*, 2019. Top-down pressure on a coastal ecosystem by harbor seals. *Ecosphere*, 10 (1), e02538.

Aïssi, M., Fiori, C., Alessi, J., 2012. Mediterranean submarine canyons as stepping stones for pelagic top predators: The case of sperm whale. p. 99-103. In: *Mediterranean Submarine Canyons Ecology and governance*. M. Würtz (Ed.). IUCN, Gland, Switzerland and Málaga, Spain.

Alexiadou, P., Foskolos, I., Frantzis, A., 2019. Ingestion of macroplastics by odontocetes of the Greek Seas, eastern Mediterranean: Often deadly! *Marine Pollution Bulletin*, 146, 67-75.

Amundsen, P.A., Gabler, H.M., Staldvik, F.J., 1996. A new approach to graphical analysis of feeding strategy from stomach contents data-modification of the Costello (1990) method. *Journal of Fish Biology*, 48, 607-614.

Barnes, K.A.D., Galgani, F., Thompson C.R., Barlaz M., 2009. Accumulation and fragmentation of plastic debris in global environments. *Philosophical Transactions of the Royal Society B*, 364, 1985-1998.

Bello, G., 2000. How rare is *Histioeuthis bonnellii* (Cephalopoda: Histioteuthidae) in the eastern Mediterranean Sea*? Journal of Molluscan Studies*, 66, 575-577.

Bello, G., Bentivegna, F., 1996. Cephalopod remains from the stomach of a Risso's dolphin, *Grampus griseus* (Cetacea: Delphinidae), stranded along the eastern Tyrrhenian coast. *Atti della Società Italiana di Scienze Naturali e del Museo Civico di Storia Naturale in Milano*, 135 (2), 467-469.

Blanco, C., Raduán M.Á., Raga, J.A., 2006. Diet of Risso's dolphin (*Grampus griseus*) in the western Mediterranean Sea. *Scientia Marina*, 70 (3), 407-411.

Blanco, C., Raga, J., 2000. Cephalopod prey of two *Ziphius cavirostris* (Cetacea) stranded on the western Mediterranean coast. *Journal of the Marine Biological Association of the UK*, 80, 381 - 382.

Bloch, D., Desportes, D., Harvey, P., Lockyer, C., Mikkelsen, B., 2012. Life History of Risso's Dolphin (*Grampus griseus*) in the Faroe Islands. *Aquatic Mammals*, 38 (3), 250-266.

Brown, S.C., Bizzarro, J.J., Cailliet, G.M., Ebert, D.A., 2012. Breaking with tradition: redefining measures for diet description with a case study of the Aleutian skate *Bathyraja aleutica* (Gilbert 1896). *Environmental Biology of Fishes*, 95, 3-20.

Cañadas, A., Notarbartolo di Sciara, G., 2018. *Ziphius cavirostris* (Mediterranean subpopulation) (errata version published in 2021). The IUCN Red List of Threatened Species 2018: e.T16381144A199549199.

Clarke M.R., 1996. Cephalopods as prey. III. Cetaceans. *Philosophical Transactions of Royal Society of London*, 351 (1343), 1053-1065.

Clarke M.R., Martins H.R., Pascoe P., 1993. The diet of sperm whales (*Physeter macrocephalus* Linnaeus 1758) off the Azores. *Philosophical Transactions of Royal Society of London*, 339 (1287), 67-82.

Clarke, M.R., 1980. *Cephalopoda in the diet of sperm whales of the southern hemisphere and their bearing on sperm whale biology*, *Discovery Reports*. Institute of Oceanographic Sciences, Great Britain, 324 pp.

Cury, P.M., Boyd, I.L., Bonhommeau, S., Anker-Nilssen, T., Crawford, R.J.M. *et al.*, 2011. Global seabird response to forage fish depletion—one-third for the birds. *Science*, 334 (6063), 1703-1706.

Dalebout, M.L., Robertson, K.M., Frantzis, A., Engelhaupt, D., Mignucci-Giannoni, A.A. *et al.*, 2005. Worldwide structure of mtDNA diversity among Cuvier's beaked whales (*Ziphius cavirostris*): Implications for threatened populations. *Molecular Ecology*, 14, 3353-3371.

Dalyan, C., Eryılmaz, L., 2008. A new deepwater fish, *Chauliodus sloani* Bloch & Schneider, 1801 (Osteichthyes: Stomiidae), from the Turkish waters of Levant Sea (eastern Mediterranean). *Journal of Black Sea / Mediterranean Environment*, 14, 33-37.

Duarte, C., Chapuis, L., Collin, S., Costa, D., Devassy, R. *et al.*, 2021. The soundscape of the Anthropocene ocean. *Science*, 371, eaba4658.

Fischer, W., Bauchot, M.L., Schneider M. (Eds), 1987. *Fiches FAO d'identification des espèces pour les besoins de la pêche. (Révision 1). Méditerranée et mer Noire. Zone de pêche 37. Volume I. Végétaux et Invertébrés. Publication préparée par la FAO, résultat d'un accord entre la FAO et la Commission des Communautés Européennes (Projet GCP/INT/422/EEC) financée conjointement par ces deux organisations*. Organisation Des Nations Unies Pour L'alimentation et L'agriculture, Rome, 267-268 pp.

Foskolos, I., Koutouzi, N., Polychronidis, L., Alexiadou, P., Frantzis, A., 2020a. A taste for squid: the diet of sperm whales stranded in Greece, Eastern Mediterranean. *Deep Sea Research Part I: Oceanographic Research Papers*, 155, 103164.

Foskolos, I., Gkikopoulou, K., Frantzis, A., 2020b. Current State of Knowledge and Conservation Perspectives on the Cetaceans of the Aegean Sea. p. 1-28. In: *The Aegean Sea Environment: The Natural System*. Anagnostou, C.L., Kostianoy, G.A., Mariolakos, D.I., Panayotidis, P., Soilemezidou, M., Tsaltas G. (Eds). Springer Nature, Berlin, Heidelberg.

Frantzis, A., 2009. *Cetaceans in Greece: present status of knowledge*. Technical Report Initiative for the Conservation of Cetaceans in Greece, 94 pp.

Frantzis, A., Alexiadou, P., Gkikopoulou, K.C., 2014. Sperm whale occurrence, site fidelity and population structure along the Hellenic Trench (Greece, Mediterranean Sea). *Aquatic Conservation: Marine and Freshwater Ecosystems*, 24, 83-102.

Frantzis, A., Alexiadou, P., Paximadis, G., Politi, E., Gannier, A. *et al.*, 2003. Current knowledge of the cetacean fauna of the Greek Seas. *Journal of Cetacean Research and Management*, 5, 219-232.

Garibaldi, F., Podestà, M., 2014. Stomach contents of a sperm whale (*Physeter macrocephalus*) stranded in Italy (Ligurian Sea, north-western Mediterranean). *Journal of the Marine Biological Association of the United Kingdom*, 94 (6), 1087-1091.

Gaspari, S., Airoldi, S., Hoelzel, A.R., 2007. Risso's dolphins (*Grampus griseus*) in UK waters are differentiated from a population in the Mediterranean Sea and genetically less diverse. *Conservation Genetics*, 8 (3), 727-732.

Harkonen, T., Harding, K., Wilson, S., Baimukanov, M., Dmitrieva, L. *et al.*, 2012. Collapse of a Marine Mammal Species Driven by Human Impacts. *PloS one*, 7 (9), e43130.

Harvey, J.T., Friend, T., McHuron, E.A., 2014. Cephalopod remains from stomachs of sperm whales (*Physeter macrocephalus*) that mass-stranded along the Oregon coast. *Marine Mammal Science*, 30, 609-625.

Hoving, H.J.T., Perez, J.A.A., Bolstad, K.S., Braid, H.E., Evans, A.B. *et al.*, 2014. The study of deep-sea cephalopods. p. 235-359. In: *Advances in Cephalopod Science: Biology, Ecology, Cultivation and Fisheries*. Vidal, A.G.E. (Ed.). Academic Press, London.

Kovačić, I., Đuras, M., Gomerčić, H., Lucić, H., Gomerčić, T., 2011. Stomach contents of two Cuvier's beaked whales (*Ziphius cavirostris*) stranded in the Adriatic Sea. *Marine Biodiversity Records*, 3, e19.

Lanfredi, C., Arcangeli, A., David, L., Holcer, D., Rosso, M. *et al.*, 2021. *Grampus griseus* (Mediterranean subpopulation). The IUCN Red List of Threatened Species 2021: e. T16378423A190737150.

Luna, A., Sánchez, P., Chicote, C., Gazo, M., 2021. Cephalopods in the diet of Risso's dolphin (*Grampus griseus*) from the Mediterranean Sea: A review. *Marine Mammal Science*, 38 (2), 725-741.

Lynam, C., Llope, M., Möllmann, C., Helaouet, P., Bayliss-Brown, G. *et al.*, 2017. Interaction between top-down and bottom-up control in marine food webs. *Proceedings of the National Academy of Sciences*, 114 (8), 1952-1957.

Maxwell, S., Hazen, E., Bograd, S., Halpern, B., Breed, G.A. *et al.*, 2013. Cumulative human impacts on marine predators. *Nature communications*, 4, 2688.

Mazzariol, S., Centelleghe, C., Cozzi, B., Povinelli, M., Marcer F. *et al.*, 2018. Multidisciplinary studies on a sick-leader syndrome-associated mass stranding of sperm whales (*Physeter macrocephalus*) along the Adriatic coast of Italy. *Scientific Reports*, 8, 11577.

Mazzariol, S., Di Guardo, G., Petrella, A., Marsili, L., Fossi, M.C. *et al.*, 2011. Sometimes sperm whales (*Physeter macrocephalus*) cannot find their way back to the high seas: a multidisciplinary study on a mass stranding. *PLoS One*, 6, e19417.

Milani, C.B., Vella, A., Vidoris, P., Christidis, A., Koutrakis, E. *et al.*, 2018. Cetacean stranding and diet analyses in the North Aegean Sea (Greece). *Journal of the Marine Biological Association of the United Kingdom*, 98 (5), 1011-1028.

Nakamura, I., Parin, N.V., 1993. *Snake mackerels and cutlassfishes of the world (families Gempylidae and Trichiuridae). An annotated and illustrated catalogue of the snake mackerels, snoeks, escolar, gemfishes, sackfishes, domine, oilfish, cutlassfishes, scabbardfishes, hair-tails and frostfishes known to date.* FAO species catalogue. Vol. 15. Food and Agriculture Organization of the United Nations, Rome, 136 pp.

Orsi Relini, L., Garibaldi, F., 2005. Mesopelagic Cephalopods biodiversity in the Cetacean Sanctuary as a result of direct sampling and observations on the diet of the Cuvier's beaked whale, *Ziphius cavirostris*. *Biologia Marina Mediterranea*, 12 (1), 106-115.

Öztürk, B., Salman, A., Öztürk, A.A., Tonay, A., 2007. Cephalopod remains in the diet of striped dolphins (*Stenella coeruleoalba*) and Risso's dolphins (*Grampus griseus*) in the eastern Mediterranean Sea. *Vie et Milieu / Life & Environment*, 57, 53-59.

Pedà C., Battaglia P., Scuderi A., Voliani A., Mancusi C. *et al.*, 2015. Cephalopod prey in the stomach contents of odontocete cetaceans stranded in the western Mediterranean Sea. *Marine Biology Research*, 11 (6), 593-602.

Pedà, C., Battaglia, P., Romeo, T., Stipa, M.G., Longo, F. *et al.*, 2022. *Photographic atlas of cephalopod beaks from the Mediterranean Sea*. EtaBeta EBS Print, Italy, 120 pp.

Pierce, G.J., Boyle, P.R., 1991. A review of methods for diet analysis in piscivorous marine mammals. *Oceanography and Marine Biology*, 29, 409-486.

Pirotta, E., Carpinelli, E., Frantzis, A., Gauffier, P., Lanfredi, C. *et al.*, 2021. *Physeter macrocephalus* (Mediterranean subpopulation). The IUCN Red List of Threatened Species 2021: e.T16370739A50285671.

Provencher, J.F., Bond, A.L., Avery-Gomm, S. *et al.*, 2017. Quantifying ingested debris in marine megafauna: a review and recommendations for standardization. *Analytical Methods*, 9, 1454-1469.

Roberts, S.M., 2003. Examination of the stomach contents from a Mediterranean sperm whale found south of Crete, Greece. *Journal of the Marine Biological Association of the United Kingdom*, 83, 667-670.

Roff, G., Brown C.J., Priest, M.A., Mumby, P.J., 2018. Decline of coastal apex shark populations over the past half century. *Communications Biology*, 1, 223.

Rupil, G., Angelini, R., Rodrigues-Filho, J.L., Roman, J., Daura-Jorge, F.G., 2022. The role of mammals as key predators in marine ecosystems. *Marine Ecology Progress Series.* 684, 211-222.

Santos, M.B., Pierce, G.J., Smeenk, C., Addink, M.J., Kinze, C.C. *et al.*, 2001. Stomach contents of northern bottlenose whales *Hyperoodon ampullatus* stranded in the North Sea. *Journal of the Marine Biological Association of the United Kingdom*, 81, 143-150.

Schorr, G.S., Falcone, E.A., Moretti, D.J., Andrews, R.D., 2014. First Long-Term Behavioral Records from Cuvier's Beaked Whales (*Ziphius cavirostris*) Reveal Record-Breaking Dives. *Plos One*, 9 (3), e92633.

Solé, M., Sigray, P., Lenoir, M., Van der Schaar, M., Lalander, E. *et al.*, 2017. Offshore exposure experiments on cuttlefish indicate received sound pressure and particle motion levels associated with acoustic trauma. *Scientific Rep*orts, 7, 45899.

Tonay, A., Öztürk, A., Salman, A., Dede, A., Aytemiz Danyer, I. *et al.*, 2021. Stranding records of sperm whale (*Physeter macrocephalus*) on the Turkish coast in 2019- 2020 with a note on the opportunistic sampling of stomach content. *Journal of the Black Sea / Mediterranean Environment*, 27 (3), 281-293.

Tonay, A., Salman, A., Taşkaya, İ., Danyer, E., Dede A. *et al.*, 2025. Stomach Contents of Stranded Goose-Beaked Whales in the Levantine Basin and Aegean Sea. *Marine Mammal Science*, e7007.

Verlis, K.M., Campbell, M.L., Wilson, S.P., 2013. Ingestion of marine debris plastic by the wedge-tailed shearwater *Ardenna pacifica* in the Great Barrier Reef, Australia. *Marine Pollution Bulletin*, 72 (1), 244-249.

Violi, B., De Jong, M., Frantzis, A., Alexiadou, P., Tardy, C.

et al., 2023. Genomics reveals the role of admixture in the evolution of structure among sperm whale populations within the Mediterranean Sea. *Molecular Ecology*, 32 (11), 2715-2731.
West, K.L., Walker, W., Baird, R., Mead, J.G., Collins, P.W., 2017. Diet of Cuvier's beaked whales *Ziphius cavirostris* from the North Pacific and a comparison with their diet world-wide. *Marine Ecology Progress Series*, 574, 227-242.
Würtz, M., Poggi, R., Clarke, M.R., 1992. Cephalopods from the stomachs of a Risso's dolphin (*Grampus griseus*) from the Mediterranean. *Journal of the Marine Biological Association of the United Kingdom*, 72, 861-867.

Supplementary Data

The following supplementary information is available online for the article:

Fig. S1: Histograms of estimated mantle length for the prey species with the highest prey-specific index of relative importance (PSIRI) in the diets of Risso's dolphins (a-e) and goose-beaked whales (f-i). *n*: number of measured lower beaks, *sd*: standard deviation. This figure was created using RStudio (https://posit.co/download/rstudio-desktop/).

Table S1. Prey species identified in the stomachs of Risso's dolphins from the Mediterranean Sea, along with ecological information obtained from the literature. Data sources include Guerra *et al*. (2014), FAO (2016), Jereb & Roper (2005, 2010), and the online databases FishBase (www.fishbase.se) and SeaLifeBase (www.sealifebase.se), accessed in May 2025. Reported depth ranges are indicative and may be updated as new data become available.

Table S2. Prey species identified in the stomachs of goose-beaked whales from the Mediterranean Sea, along with ecological information obtained from the literature. Data sources include Guerra *et al*. (2014), FAO (2016), Jereb & Roper (2005, 2010), and the online databases FishBase (www.fishbase.se) and SeaLifeBase (www.sealifebase.se), accessed in May 2025. Reported depth ranges are indicative and may be updated as new data become available.

Table S3. Prey species identified in the stomachs of sperm whales from the Mediterranean Sea, along with ecological information obtained from the literature. Data sources include Guerra *et al*. (2014), FAO (2016), Jereb & Roper (2005, 2010), and the online database FishBase (www.fishbase.se), accessed in May 2025. Reported depth ranges are indicative and may be updated as new data become available.

Table S4. Regression equations used to estimate cephalopod mantle length and weight based on standard measurements of their beaks. Length and weight are reported in millimeters (mm) and grams (g), respectively. Abbreviations: LHL - lower hood length; LRL - lower rostrum length; ML - mantle length; TW - total (wet) weight.

Table S5. Number of prey items (N) and total weight (W, in g) for each prey species identified in the stomach contents of individual whales. Weight estimation was not possible for the prey species found in individuals Gg1 and Gg2. See Table 1 for whale identification codes.