COMPARISON OF FEEDING HABITS OF SARDINE *SARDINA PILCHARDUS* (WALB., 1792) AND ANCHOVY *ENGRAULIS ENCRASICOLUS* (L.,1758) FROM THE EASTERN ADRIATIC SEA

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Abstract
In total 207 stomachs of small pelagic fish (sardine and anchovy) from Eastern Adriatic Sea were analysed from June 2014 to October 2015. Total lengths varied from 10.5 to 17.0 cm for sardine and from 13.0 to 17.5 cm for anchovy. Feeding habits of 130 sardines and 77 anchovies reviled 17 different taxa belonging to 10 prey groups.
Average prey numbers in the stomach was similar for both species: 15±47 (sardine) and 16±48 (anchovy). The main prey items for sardine were copepods. For anchovy, bigger prey occurred in the diet, as decapod larvae, amphipods, euphausids and adult copepods.

Keywords: Diet, Fishes, Food webs, Zooplankton , Central Adriatic Sea

Introduction Small pelagic species, as sardine and anchovy, are most abundant and the most important target species in the fisheries of the Eastern Adriatic Sea. Both species are mostly caught by purse seines and they represent 80% of the total fish landing in Croatia. The importance of low trophic levels, such as sardine and anchovy, is also in the functioning of the ecosystem due to their role in capturing energy and making it available to the higher trophic levels [1]. Environmental changes, especially changes in sea water temperature can influence the composition of plankton, which is the main food source of small pelagic fish [2]. Considering close relationship between the environment and small pelagic population dynamics, it is very important to expand the knowledge on feeding behaviour of such species. In this study we compared feeding habits of adult sardines and anchovy in the Eastern Adriatic Sea.

Material and methods
Feeding habits of 130 sardines and 77 anchovies were analysed from June 2014 to October 2015. All the samples were obtained from the commercial purse seine catches of the Eastern Adriatic Sea and measured to the nearest mm and weighed to the nearest g. The entire stomach from each specimen was removed and fixed with ethanol (95%). Identification of food particles in the stomach was performed under the stereomicroscope to the lowest taxon possible. Feeding incidence (FI) was calculated as the percentage of the total number of fish examined having at least one prey in the guts.

Results and discussion
A total length (LT) of 130 sardines varied from 10.5 to 17.0 cm, with an average value 14.22±1.24 cm. Total weight (W) was from 6.78 to 37.17 g. Total length (LT) of 77 anchovies was from 13.0 to 17.5 cm, average value was 14.83±1.15 cm, while total weight (W) varied from 11.11 to 33.32 g. In total 207 stomachs of sardines and anchovies were analysed and 17 different taxa were identified belonging to 10 prey groups (Table 1).

Tab. 1. Percentages of prey categories per fish stomach in terms of numbers (%n) of the sardine and anchovy in the Eastern Adriatic Sea

Prey main group	Prey taxon	Sardine	Anchovy
Bivalvia	Bivalvia larvae	0.10	0
Gastropoda	Pteropoda	0.10	0
Cladocera	-	0.13	0
	Evadne spp.	1.29	0.11
Copepoda	Unidentified calanoid adult	32.55	13.33
	Temora stylifera	3.54	0.82
	Clausocalanus spp.	1.32	0
	Macrosetella gracilis	0	0.04
	Goniopsyllus rostratus	0	0.11
	Centropages spp.	0	0.07
	Pareuchaeta spp.	0	0.07
	Oncaea spp.	0.65	0
	Corycaeus spp.	0	0.25
	Unidentified postnauplii	4.09	0.42
	Copepod eggs	20.15	1.87
Amphipoda	Hyperiidae	2.56	17.54
Isopoda	-	6.48	1.10
Euphausidae	-	0.73	14.69
Decapoda	Decapoda larvae	18.95	36.03
	Decapoda megalopa	0.44	8.60
Fish larvae	-	0.09	1.89
Fish egg	-	5.01	3.07

Average prey numbers in the stomach was similar for both species: 15±47 (sardine) and 16±48 (anchovy). However, the percentage of fish with food in the stomach (FI) was higher in anchovy (79.2%) than in sardine (65.4%). Sardines fed mainly on copepods and copepod developmental stages (>62%) with the main prey species being *Temora stylifera, Clausocalanus spp*. and *Oncaea spp*. On the contrary, bigger prey occurred in the diet of anchovy: amphipods, eupahusids and adult copepods, with decapod larvae dominating.
Analyses of composition of the diet and prey selectivity considered only adult specimens with total length from 10.5 to 17.0 cm for sardine and from 13.0 to 17.5 cm for anchovy. Previous records of sardine nutrition in the middle-eastern Adriatic where its diet was composed mostly of copepods (30.1%) and decapoda larvae (22.8%) are quite consistent with our results [3]. Anchovy diet was similar between juveniles and adults in the Adriatic Sea with preference for a few copepod species of small sizes [1]. On contrary, an ontogenetic shift from copepods towards decapods and amphipods as fish increased in size was recorded in Algeria, which is also confirmed with our findings of the adult specimens [4]. Although both co-occurring species consumed similar types of food, our results confirmed that sardine generally consumed smaller prey than anchovy. However, sardine specimens in this study were in general smaller than those of anchovies. Differences in feeding habits are a consequence of different feeding apparatus and feeding behaviour between sardines and anchovies [5]. Furthermore, knowledge of prey availability is essential in order to understand the relative importance of food categories and to assess prey selectivity which will also allow assessing possible competition between those two species for zooplankton.

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