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A new method for classifying the prey of fish

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Analysis of stomach contents is commonly used in studies of fish diet. Once prey are identified, food preferences can be assessed by calculating the relative proportions of each major prey category in terms of percent number, percent weight, or frequency of occurrence. These methods and others, with their advantages and disadvantages, are the subject of many papers like that of Berg (1979). In addition to this direct approach various indices of dietary preference have been developed which combine two or three of these measures. Some authors have proposed to classify the major prey categories of fish, in terms of preference, with regard to their dietary index value. In the present study three dietary indices and prey classification methods are applied to two sparid fish (*Diplodus sargus* and *Pagellus erythrinus*) stomach data.

$$MFI = \frac{(N + F) \times W}{2} \quad \text{(Zander, 1982)} \qquad Q = N \times P \quad \text{(Hureau, 1970)} \qquad IA = \frac{F \times P}{100} \quad \text{(Lauzanne, 1975)}$$

where $N = 100 \times \frac{\text{Number of Individuals of Prey i}}{\text{Total Number of Prey}}$ $\quad W = 100 \times \frac{\text{Weight of Prey i}}{\text{Total Weight of Prey}}$

$F = 100 \quad \frac{\text{Number of Stomachs containing Prey i}}{\text{Total Number of Stomachs Containing Food}}$

With the MFI and IA indices all prey appear to have almost the same importance and major prey cannot be distinguished (Table 1). These indices do not discriminate enough prey categories, especially when these are numerous. Hureau's (1970) classification of categories can be applied successfully to sparid fish since all prey are distributed in the three proposed categories. These methods of classifying dietary items were adapted to the species studied by their proposing authors, but the categories and their limits are empirical and cannot be applied to all predators. A more reliable distinction between prey categories may be required, for example when comparing two fish species or several classes within one fish species.

The following method is proposed : Stomach content data are first analyzed by any dietary index (N,F,Q,MFI, etc) and the total index value of all prey categories is calculated. Each individual value is then expressed as a percentage of the total value. As a result all indices are transformed to the same scale and comparisons (between fish species or classes within a species) become simpler. Prey categories are ranked by decreasing order, with regard to their index value. From prey of rank 1 to prey of rank n, the transformed index values of each prey are summed until 50% is reached. It is suggested that these prey are termed PREFERENTIAL. The values of the following prey are added up to 75% of the total index and it is proposed to call these prey SECONDARY. The remaining prey in the list are considered as ACCESSORY.

There are situations, however, where one has to be cautious when applying this method. When the index values of prey are very close it can be impossible to separate them between preferential and secondary. 1st ex. : 50%, 49%, 1%. 2nd ex. : 40%, 10%, 9%, 3%. When the combined percent values of the first and second prey represent almost 50% but the third prey has a very low value, it is unacceptable to include it in the group of Preferential prey. Ex. : 30%, 19%, 4%.

As a example the proposed method has been applied to *Diplodus sargus* stomach data (Table 2). Whatever index is considered (IA, MFI, or Q) a distinction is made between preferential prey and others, which was not always the case with the other methods. The present method always provides a prey ranking, for every kind of predator. It can be used to compare several fish diets even if the original data were not analyzed using the same index. In traditional classifications key values are fixed *a priori*, or based on data obtained with a given species. Prey are distributed individually in each category according to their index value. With our proposed classification it is not only the individual index value which is taken into account, but also the cumulative index values of all prey.

INDICES		PREY	*Diplodus sargus*	*Pagellus erythrinus*
IA	50-100	Main	-	-
	25- 50	Essential	-	Annelids
	10- 25	Not negligeable	-	-
	0- 10	Secondary	All Prey	Other Prey
MFI	> 75	Main	-	-
	51- 75	Principal	-	-
	25- 50	Secondary	-	Annelids
	< 26	Accessory	All Prey	Other Prey
Q	> 200	Preferential	Molluscs	Annelids Decapods
	20-200	Secondary	Fish Decapods Annelids Echinoderms	Molluscs Echinoderms Amphipods -
	< 20	Accidental	Other Prey	Other Prey

Table 1 : Classifications proposed by 3 authors with regard to the dietary indices. Application to two sparid species.

	%IA	%MFI	%Q
PREFERENTIAL PREY	Fish......... 33 Molluscs..... 22	Molluscs..... 19 Fish......... 19 Decapods..... 13 Annelids..... 13	Molluscs..... 45 Fish......... 18
SECONDARY PREY	Decapods..... 15 Annelids..... 13	Echinoderms.. 9 Plant remains 8	Decapods..... 10 Annelids..... 11
ACCESSORY PREY	Echinoderms.. 6 Plant remains 6	Amphipods.... 5	Echinoderms.. 5 Amphipods.... 4

Table 2 : New prey classification, example of *Diplodus sargus*.

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Food items of Saurida undosquamis in the Northern Cilician Basin (Eastern Mediterranean)

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Lizard fish is known as a carnivorous fish (RAO, 1981). This species emigrated into the eastern Mediterranean Sea and beame commercially important along the coastline of the Levantine Basin in the mid fifties (BEN-YAMI and GLASER, 1973). In 1952 this species was not found in the Gulf of Mersin and its neighbouring waters (GOTTLIEB and BEN-TUVIA, 1953, in BEN-YAMI and GLASER, 1973). In the same years AKYUZ (1957) had not included Lizard fish in the species list of Indo-Pacific emigrants. This fish is now commercial species in the inshore region of the eastern Mediterranean coast of Turkey (BINGEL, 1981, 1987).

Nevertheless, very little is known about the feeding habit of Lizard fish in the Levantine Basin.

Material collected in two stations are approximately 17 nautical miles apart from each other. Samples were taken before noon, iced on board and kept frozen in the laboratory.

Food specimens in the stomachs of Lizard fish were tried to be identified at species level. Totally 5223 individuals from both stations were collected monthly between July 1980-September 1981 and examined.

It is found that Lizard fish fed mainly on fish (97.3 %). The significant food items consisted of MULLIDAE 40.1 %, SPARIDAE 13.5 %, LEIOGNATHIDAE 12.4 % and SYNODONTIDAE 7.4 %

Table 1: Food composition of S. undosquamis in the northern Cilician Basin.

Food organisms	Number of identified specimens July 1980 - September 1981 Numbers	%
M. barbatus	134	36.8
L. klunzingeri	45	12.4
S. undosquamis	27	7.4
Diplodus sp.	36	9.9
M. chryselis	23	6.3
Sardine sp.	17	4.7
U. moluccensis	12	3.3
Gobius sp.	10	2.7
Pagellus sp.	10	2.7
B. boops	8	2.2
T. trachurus	7	1.9
E. encrasiccolus	5	1.4
S. aurata	5	1.4
Trigla sp.	3	0.8
P. saltator	3	0.8
Trachinus sp.	3	0.8
A. laterna	2	0.5
C. linguatula	1	0.3
Sphyraena sp.	1	0.3
Siganus sp.	1	0.3
M. merluccius	1	0.3
Loligo & Sepia sp.	6	1.6
Penaeidae	3	0.8
Others	1	0.3
Total	364	100.0

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