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Bareh Bahgat HABASHI, Andrzej KOMPOWSKI, Jan WOJCIECHOWSKI

FOOD AND FEEDING OF CHUB MACKEREL, *SCOMBER JAPONICUS* HOUTTUYN, 1782 IN THE NORTH-WEST AFRICAN SHELF

POKARM I ODŻYWIANIE SIĘ MAKRELI JAPOŃSKIEJ, *SCOMBER JAPONICUS* HOUTTUYN. 1782, W WODACH SZELFU PÓŁNOCNO-ZACHODNIEJ AFRYKI

Institute of Fisheries Oceanography
and Protection of Sea,
Szczecin

Food of the chub mackerel is very diverse; it consists of both plankton (mainly calanoids, euphausiids, and tunicates) and nekton (cephalopods and fish). The food composition varies considerably from month to month, Feeding intensity, generally rather high, devreases somewhat during spawning.

INTRODUCTION

The chub mackerel, *Scomber japonicus*, is a pelagic species occurring over the continental shelf and inhabiting tropical, subtropical, and partly moderate latitudes of all the three oceans. In the central-eastern Atlantic it occurs as a subspecies, *S.japonicus colias* Gmelin, 1789. In spite of a noteworthy commercial importance of the species, its catches making up recently about 100% of the total catch within the central-eastern Atlantic (FAO subarea 34), it was dealt with in a few studies only.

The objective of the present work is to broaden the knowledge on food and feeding of the species in the North-West African shelf.

MATERIALS AND METHODS

The individuals examined were obtained from catches of Polish B-23 trawlers operating within 1971–1973 in the North-West African shelf. Owing to the large extent of the area under study, it was divided into two sub-regions (Fig. 1): sub-region 1, extending from 18°00′N to 22°59′N, and sub-region 2, extending from 23°00′N to 28°59′N.

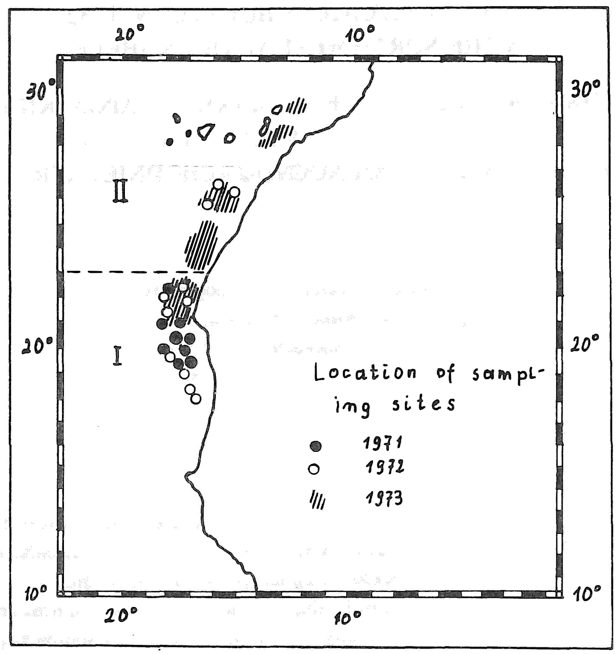

Fig. 1. Collection sites and division of the area under study into sub-regions

Most individuals were examined on board the "Barbata", a B-23 trawler; part of the material was collected in the harbour, from frozen catches landed by other trawlers.

The total length of each fish was measured to 1 cm, rounding up to the nearest integer such that, for example, the 25 cm length class covered the fish length interval of 24.1–25 cm. Gonad maturity stage was determined according to the 8-stage Maier scale. Stomach fullness was determined according to a 5-stage scale scoring from 0 to 4 (Fortunatova, 1955). Stomachs for content analysis were preserved in formalin. During the analysis, stomach contents were sorted into various items, each one being subsequently weighed. Table 1 summarises the analyses performed.

Table 1

Measurements and analyses performed

Sub-region	Year	Month	Measurements and analyses: Fish length (no. of fish)	Gonad maturity (no. of fish)	Stomach fullness (no. of fish)	Food composition (no.of fish)
I	1971	IX	1316	1316	1316	–
		X	1707	1707	1707	–
		XI	1943	1943	1943	–
		XII	451	451	451	–
	1972	I	156	156	156	–
		II	45	45	45	–
		III	106	106	106	–
		IV	72	72	72	–
		V	56	56	56	56
		VI	140	140	140	35
		XII*	204	204	204	30
	1973	I*	125	125	125	17
		II*	1180	1180	1180	75
		III*	400	400	400	52
	Total		7901	7901	7901	265
II	1972	XII*	24	24	24	10
	1973	II*	700	700	700	49
		III*	361	361	361	23
		IV*	550	550	550	23
	Total		1635	1635	1635	105
Grand total sub-regions 1+2)			9536	9536	9536	370

* Materials collected during a cruise of MT "Barbata"

RESULTS

1. Frequency of various items

As seen from Tables 2 and 3, the chub mackerel food is very diverse. It contains various crustaceans and their larvae, tunicates, cephalopods, fish, polychaetes, priapulids, and Branchiostoma Sp. Calonoid copepods are the most frequent food item. In the sub-region 1, they occured in 34.6–76.5% of full stomachs, depending on month, while in the sub-region 2 they were found in 17.4–89,8% of stomachs (Tables 2 and 3). The *Salpa* tunicates were very frequent, too, particularly in sub-region 1 (28.6 – 69.3% of stomachs). In subregion 2, the frequency of salps in food changed considerably from month to month: in December 1972 salps were found in 80% of the stomachs examined, while in April 1972 they were absent. Other frequent items were the *Euphausiacea*, cephalopods, and fish.

Apart from the food being very diverse, the analysis of frequency of occurrence of various food items showed the food to vary in composition from month, the variations having usually no clear-cut trend. The food composition in sub-regions 1 and 2 was very similar. Therefore data from both sub-regions are pooled in a table (Table 4) constructed to follow fish length dependent changes in frequencies of various items. As shown by the table, if 41–45 and 46–50 cm classes are disregarded as non-representative due to low numbers of individuals examined, no clear-dut patterns in fish length dependent changes in frequency of different items can be detected.

2. Food composition as expressed in per cent stomach content weight

Weight analysis of food composition (Table 5) showed the *CEphalopoda, Tunicata* and *Euphausiacea* to contribute most to the stomach content weights in sub-region 1. Cephalopods were most abundant in December (40.1%) and January (32.5%), their percentage contributions being much lower in the remaining months. On the other hand, the euphausiids increased their contribution from almost negligible (below 0.1%) in December to 23.7% in March and 29.0% in May. Tunicate percentage varies from month to month in an unpredictable manner, which was also the case in malacostracan larvae and fish.

The dominant prey organisms in sub-regions 1 and 2 were the *Calanoida, Tunicata, Branchiostoma sp.*, and fish, cephalopods and euphausiids playing a less important role (Table 6). The month-tomonth changes in proportions of the food items mentioned showed nodistinct trend except for fish, increasing in importance from December until April.

The food composition as expressed in per cent stomach content weight showed a well-marked relation to fish length (Table 7). Proportions of euphausiids, calanoids, and malacostracan larvae decreased gradually with increasing fish length, which was accompanied by the growing importance of tunicates. The remaining prey showed no consistent pattern of changes.

Table 2

Frequency of occurrence (%) of different food items in *S.japonicus* stomachs by month. Sub-region 1.

Food item	December 1972	January 1973	February 1973	March 1973	May 1973	June 1972
Polychaeta	–	–	4.0	1.9	10.5	17.1
Priapulida	3.3	5.9	13.3	15.4	–	–
Euphausiacea	3.3	11.8	68.0	46.2	70.2	40.0
Calanoida	63.3	76.5	36.0	34.6	42.1	62.9
Isopoda	–	–	18.7	7.7	12.3	28.6
Amphipoda	3.3	–	6.7	–	–	8.6
Decapoda:						
Macrura natantia	–	–	1.3	11.5	–	–
Anomura	–	–	1.3	–	–	–
Brachyura	–	–	1.3	–	–	–
Malacostraca larvae:						
megalopa	10.0	11.8	17.3	26.9	35.1	57.1
phyllosoma	16.7	–	58.7	3.9	14.0	22.9
Stomatopoda larvae:	6.7	29.4	4.0	5.8	–	–
larvae "cypris"	–	–	–	1.9	–	–
Cephalopoda:						
Teuthoidea	23.3	17.7	36.0	17.3	38.6	34.3
Loliginidae	26.7	11.8	–	–	–	–
Sepioidea	–	–	6.7	3.9	–	17.1
Gastropoda:	–	–	1.3	–	–	–
Chaetognatha	6.7	–	6.7	–	–	–
Tunicata:						
Salpa sp.	60.0	29.4	69.3	51.9	38.6	28.6
Pyrosoma sp.	3.3	–	1.3	5.8	–	11.4
Other	6.7	–	4.0	1.9	–	–
Branchiostoma sp.	3.3	–	10.7	13.7	28.07	22.7
Pisces:	3.3	5.9	38.7*	25.0	24.56	28.6
Myctophidae	–	52.9	–	–	–	–
Fish eggs	6.7	–	4.0	–	–	–
No. of fish examined	30	17	75	52	57	35

* *Echelidae, Lophiidae, Myctophidae*

Table 3

Frequency of occurrence (%) of different food items in *S. japonicus* stomachs by month. Sub-region 2

Food item	December 1972	February 1973	March 1973	April 1973
Polychaeta	40.0	20.4	56.5	–
Priapulida	–	12.2	–	–
Euphausiacea	30.0	22.5	34.8	34.8
Calanoida	50.0	89.8	17.4	30.4
Isopoda	–	–	4.4	82.6
Amphipoda	10.0	4.1	–	4.4
Mysidacea	–	4.1	–	–
Decapoda:				
Macrura natantia	–	2.0	13.0	–
Anomura	–	2.0	–	–
Malacostraca larvae:				
megalopa	30.0	59.2	–	8.7
mysis	–	–	–	8.7
zoea	–	–	–	4.4
phyllosoma	–	–	52.2	–
Stomatopoda larvae	–	12.2	–	–
Cephalopoda:				
Teuthoidea	20.0	20.4	8.7	8.7
Sepioidea	2.0	–	–	–
Other	–	–	34.8	–
Chaetognatha	70.0	–	–	–
Tunicata:				
Salpa sp.	80.0	46.9	47.8	–
Pyrosoma sp.	–	–	4.4	–
Other	–	2.0	4.4	–
Branchiostoma sp.	50.0	14.3	–	17.4
Pisces	10.0	6.1	30.4*	30.4
Fish eggs	10.0	–	4.4	–
No. of fish examined	10	49	23	23

* *Carangidae, Myctophidae, Ophichthyidae, Clupeidae, Syngnathiformes,* othes

Table 4

Fish length dependent frequency (%) of different food items in *S. japonicus* stomachs. Subregions 1 and 2

Food item	Fish length (cm)					
	20–25	26–30	31–35	36–40	41-45	46–50
Polychaeta	6.3	10.2	15.2	10.7	10.0	–
Priapulida	9.4	10.2	5.1	–	40.0	50.0
Euphausiacea	37.5	40.6	46.8	14.3	20.0	50.0
Copepoda	–	–	–	–	10.0	–
Calanoida	65.6	59.4	34.0	21.4	30.0	50.0
Isopoda	18.8	10.9	17.7	7.1	10.0	–
Amphipoda	6.3	13.3	2.5	–	20.0	–
Decapoda:						
Macrura natantia	–	4.7	2.5	–	–	–
Anomura	–	0.8	1.3	–	–	–
Brachyura	–	0.8	–	–	–	–
Malacostraca larvae:						
megalopa	34.4	30.5	19.0	7.1	–	–
phyllosoma	21.9	22.7	25.3	21.4	20.0	–
zoëa	–	–	1.3	–	–	–
mysis	–	1.6	2.5	–	–	–
Stomatopoda larvae	6.3	8.6	7.6	–	–	–
Larvae „cypris"	–	0.8	–	–	–	–
Cephalopoda:						
Teuthoidea	12.5	23.4	19.0	32.1	20.0	50.0
Loliginidae	3.1	1.6	2.5	21.4	–	–
Sepoioidea	6.3	0.8	1.3	3.6	10.0	
Other	–	0.8	10.1	7.1	10.0	–
Gastropoda	–	1.6	1.3	–	–	–
Chaetognatha	6.3	9.4	10.1	–	–	–
Tunicata:						
Salpa sp.	28.1	50.8	54.4	53.6	100.0	100.0
Pyrosoma sp.	3.1	0.8	2.5	3.6	–	–
Other	9.4	1.6	–	–	–	–
Branchiostoma sp.	6.3	11.7	15.2	–	10.0	–
Pisces	31.3	15.6*	21.5	42.9**	50.0	–
Fish eggs	3.1	3.1	2.5	–	–	–
No. of fish examined	32	128	79	28	10	2

** *Echelidae, Lophiidae, Muraneidae, Myctophidae.*
* *Capros aper, Echelidae, Myctophidae, Ophichthyidae, Lophiidae*

Table 5

Scomber japonicus food composition in different months as expressed in per cent stomach content weight. Sub-region 1

Food item	December 1972	January 1973	February 1973	March 1973	May 1973	June 1972
Polychaeta	–	–	0.0	0.0	0.5	0.3
Priapulida	0.0	0.1	0.4	0.2	–	–
Euphausiacea	0.0	2.0	14.6	23.7	29.0	13.4
Calanoida	10.6	18.0	2.9	8.8	6.2	20.1
Isopoda	–	–	1.5	0.1	2.0	3.7
Amphipoda	0.5	–	0.2	–	–	0.5
Decapoda:						
Macrura natantia	–	–	0.1	12.5	–	–
Anomura	–	–	0.1	–	–	–
Brachyura	–	–	0.1	–	–	–
Malacostraca larvae:						
megalopa	0.7	0.3	1.7	2.2	7.2	7.6
phyllosoma	4.0	–	25.2	0.9	2.4	3.4
Stomatopoda larvae	0.6	2.0	0.1	0.8	–	–
larvae *cypris*	–	–	–	0.2	–	–
Cephalopoda:						
Teuthoidea	'2.5	2.1	6.9	5.0	18.4	8.2
Loliginidae	37.6	30.4	–	–	–	–
Sepioidea	–	–	1.3	1.2	–	–
Gastropoda	–	–	0.0	–	–	–
Chaetognatha	0.1	–	1.4	–	–	–
Tunicata:						
Salpa sp.	34.0	6.6	21.1	26.2	11.2	6.5
Pyrosoma sp.	0.9	–	0.3	0.5	–	2.3
Other	2.5	–	1.0	0.3	–	–
Branchiostoma sp.	0.2	–	2.0	0.6	6.8	9.1
Pisces:	0.1	1.9	10.0	5.2	11.5	19.6
Myctophidae	–	35.6	–	–	–	–
Fish eggs	0.0	–	0.0	–	–	–
Mucus and epithelium	5.7	1.0	9.1	11.6	4.8	3.7
Total	100.0	100.0	100.0	100.0	100.0	100.0
Total food weight (g)	153.10	123.66	506.45	281.71	702.90	345.04
No. of fish examined	30	17	75	52	57	34

Table 6

Fish length dependent frequency (%) of different food items as expressed in per cent stomach content weight. Sub-region 2

Food item	December 1972	February 1973	March 1973	April 1973
Polychaeta	2.8	1.0	5.8	–
Priapulida	–	0.1	–	–
Euphausiacea	4.5	2.3	6.9	9.8
Calanoida	6.4	43.3	4.1	15.4
Isopoda	–	–	0.3	16.5
Amphipoda	1.0	0.3	–	0.0
Mysidacea	–	0.1	–	–
Decapoda:				
Macrura natantia	–	1.8	2.6	–
Anomura	–	0.1	–	–
Malacostraca larvae:				
megalopa	2.6	7.7	–	0.1
mysis	–	–	–	0.4
zoea	–	–	–	0.4
phyllosoma	–	–	18.6	–
Stomatopoda larvae	–	3.4	–	–
Cephalopoda:				
Teuthoidea	5.5	5.5	1.4	1.4
Sepioidea	–	0.1	–	–
Other	–	–	16.4	–
Chaetognatha	20.3	7.1	–	–
Tunicata:				
Salpa sp.	28.7	10.4	21.2	–
Pyrosoma sp.	–	–	0.5	–
Other	–	0.2	3.1	–
Branchiostoma sp.	9.6	3.3	–	28.6
Pisces	0.7	2.0	13.8	24.9
Fish eggs	0.1	0.0	–	–
Mucus and epithelium	17.8	11.3	5.3	2.5
Total	100.0	100.0	100.0	100.0
Total food weight (g)	31.96	152.87	177.97	96.74
No. of fish examined	10	49	23	23

Table 7

Fish length dependent food composition as expressed in per cent stomach content weight. Sub-regions 1 and 2

Food item	Fish length (cm)					
	20–25	26–30	31–35	36–40	41–45	46–50
Polychaeta	*0.1*	0.5	1.6	0.5	1.3	–
Priapulida	0.3	0.1	0.1	–	0.7	–
Euphausiacea	8.4	17.0	14.0	0.8	1.7	3.0
Copepoda	–	–	–	–	0.1	–
Calanoida	14.3	16.1	11.4	3.6	1.5	3.0
Isopoda	1.9	1.2	2.3	0.2	1.8	–
Amphipoda	0.4	0.8	0.1	–	0.3	–
Decapoda:						
Macrura natantia	–	3.3	0.8	2.7	12.4	–
Anomura	–	0.0	0.1	–	–	–
Brachyura	–	0.1	–	–	–	–
Malacostraca larvae:						
megalopa	3.2	3.5	1.5	0.3	–	–
phyllosoma	9.2	17.1	10.5	6.3	2.8	–
zoea	–	–	0.1	–	–	–
mysis	–	0.0	0.1	–	–	–
Stomatopoda larvae	0.4	1.2	0.9	–	–	–
larvae *cypris*	–	0.1	–	–	–	–
Cephalopoda:						
Teuthoidea	2.3	4.3	2.8	9.0	2.6	3.9
Loliginidae	13.7	0.2	7.2	17.0	–	–
Sepioidea	1.1	0.0	0.1	1.0	1.3	–
Other	–	0.3	4.3	2.6	10.3	–
Gastropoda	–	0.0	0.0	–	–	–
Chaetognatha	0.6	2.6	2.2	–	–	–
Tunicata:						
Salpa sp.	8.7	14.6	16.1	21.5	49.6	87.0
Pyrosoma sp.	0.3	0.3	0.5	0.3	–	–
Other	3.0	0.5	–	1.1	–	–
Branchiostoma sp.	3.6	2.9	6.4	–	0.1	–
Pisces	14.5	5.7	6.5	27.6	8.9	–
Fish eggs	0.0	0.0	0.0	–	–	–
Mucus and epithelium	14.0	7.6	10.4	5.5	4.6	–
Total	100.0	100.0	100.0	100.0	100.0	100.0
Total food weight (g)	104.23	539.93	457.42	279.92	112.31	30.04
No. of fish examined	32	128	79	28	10	2

Table 8

Fish length dependent stomach fullness. Sub-region 1

Fish length (cm)	% of fish given fullness					Mean stomach fullness	No. of fish examined
	0	1	2	3	4		
15–20	–	–	29.4	59.6	11.0	2.82	146
21–25	–	1.1	13.1	15.1	70.7	3.55	451
26–30	1.4	3.3	17.4	23.1	54.8	3.27	2500
31–35	1.3	4.4	13.4	30.0	50.9	3.25	2077
36–40	1.8	4.4	20.3	32.3	41.2	3.07	2080
41–45	0.5	3.6	19.9	27.3	48.7	3.20	607
46–50	–	–	7.5	17.5	75.0	3.68	40
						Total	7901

Table 9

Fish length dependent stomach fullness. Sub-region 2

Fish length (cm)	% of fish with given fullness					Mean stomach fullness	No. of fish examined
	0	1	2	3	4		
21–25	–	29.8	28.2	37.4	4.6	2.17	131
26–30	2.5	15.8	21.8	18.6	41.3	2.80	671
31–35	1.6	2.4	14.0	15.8	66.2	3.43	577
36–40	–	7.2	17.4	20.3	55.1	3.23	236
41–45	–	–	–	52.9	47.1	3.47	17
46–50	–	–	–	33.3	66.7	3.67	3
						Total	1635

Table 10

Gonad maturity dependent stomach fullness. Sub-region 1

Gonad maturity stage, Maier scale	% of fish with given stomach fullness					Mean stomach fullness	No. of fish examined
	0	1	2	3	4		
II	1.3	4.0	20.9	33.0	40.8	3.08	2989
III	0.9	1.2	7.6	17.9	72.4	3.59	1548
IV	0.2	1.4	6.8	17.2	74.4	3.64	1375
V	2.6	1.2	14.2	31.3	50.7	3.26	654
VI	4.1	14.6	46.2	27.1	8.0	2.20	487
VII	0.8	7.7	25.0	37.2	29.3	2.86	376
VIII	1.1	5.7	25.0	47.2	21.0	2.81	472
						Total	7902

Table 11

Gonad maturity dependent stomach fullness. Sub-region 2

Gonad maturity stage Maier scale	% of fish with given stomach fullness					Mean stomach fullness	No. of fish examined
	0	1	2	3	4		
II	1.5	22.3	21.0	21.0	34.2	2.64	272
III	–	–	19.5	–	80.5	3.61	41
IV	–	4.8	21.2	26.9	47.1	3.16	104
V	1.0	5.5	20.9	11.9	60.7	3.26	201
VI	2.7	11.3	17.5	25.0	43.5	2.95	655
VII	0.6	4.5	17.5	11.9	65.5	3.37	310
VIII	–	21.0	15.4	25.0	38.6	2.81	52
						Total	1635

3. Feeding intensity

Stomach fullness is a measure of fish feeding intensity. As shown by data in Tables 8 and 9, feeding intensity was fairly high over the period of study, individuals with empty stomachs being very rare.

In both sub-regions, feeding intensity clearly grew with the chub mackerel length.

That part of the year when the observations reported were made (September – June) spans the spawning season of *S.japonicus*, the peak spawning taking place from November until February. As shown by data in Tables 10 and 11, the fish did not cease feeding. The development of gonads resulted only in some reduction in the amount of food consumed. Those individuals with gonads at stage 6, 7, 8, and 2 Maier scale were feeding with the lowest intensity, the highest feeding intensity being shown in the individuals with gonads at stages 3 and 4. Even the spawners had their stomachs almost packed with food.

DISCUSSION

The chub mackerel is a species of a very wide food spectrum. This is demonstrated not only by the results reported here, but also by other authors, for example Schaefer (1980) who extensively reviewed studies on food and feeding of the species. Angelescu (1979) found *S.japonicus* off the Argentine coasts to feed on two different neritic communities, plankton and nekton. According to Angelescu, the chub mackerel belongs to the mixed feeding type: the fish use both their gill rakers to screen off zooplankton and actively catch their prey as visual predators do, to feed on nekton (other fish and squids).

The food composition of this widely distributed species is similar in various areas of its geographical range. Sokołowski (in Siewierski, 1984) found representatives of the following taxa in stomachs of *S.japonicus* caught in NW Pacific: *Coelenterata, Ostracoda, Copepoda, Amphipoda, Euphausiacea, Cephalopoda, Tunicata, Chaetognatha*, and *Pisces*. The same taxa occur in food of the chub mackerel from other areas (Fry in Schaefer, 1980; Angelescu, 1979). The similarity of food is confirmed also by the results presented in this paper. It is interesting to find *Branchiostoma sp.* among the food items of *S.japonicus* in the NW African shelf. Adult *Branchiostoma* is a typical benthic dweller; during the winter, however, it presumably stays in the water column, which may be associated with its reproduction (Kompowski, 1976). In that season, *Branchiostoma* is found in food of other fish species, too, e.g., the horse mackerel and sea bream (Kompowski, 1976; Lê-trông Phań and Kompowski, 1972 a, b).

The season during which the materials for the present work were collected is a period of intensive spawning (Novoženin and Staroselskaja, 1964; Wysokiński and Porębski 1972; Habashi, 1975). In spite of advanced gonad development, the chub mackerel did not cease feeding, although this activity proceeded at somewhat slower pace in the pre-spawning and spent individuals. In spite of overlapping feeding and spawning grounds, no fact of adult preying on the species' juveniles was observed. Cannibalism, however, may occur in larvae and juveniles. Schaefer (1980) quotes Hunter and Kimbrell who observed behaviour of laboratory-hatched chub mackerel larvae kept in aquaria. The 8 mm long larvae exhibited fierce cannibalism, the activity stopping with metamorphosis. Larval cannibalism in *S.japonicus* occurs under natural conditions as well, as observed by Lipskaja (1982) in SE Pacific. According to her account, larval cannibalism is enhaced by prolonged spawning, as both the newly hatched larvae and juveniles co-occur within a spawning ground.

The wide food spectrum of *S.japonicus* is a cause of food overlap with other species. Competition is possible, too. Kompowski (1976) showed the overlap to occur in the NW African shelf between *S.japonicus* and *Trachurus trachurus, T.trecae, T.picturatus*, and Caranx rhonchus. Copepods, euphausiids, Branchiostoma sp., and myctophids are important food items for all those species. On the other hand, tunicates are abundant in the chub mackerel food and scarce in the horse mackerel diet. Schaefer (1980) quotes Kramer who found competition for food to exist between S.japonicus and Trachurus symmetricus. Moreover, he refers to McCall et al. who suggested Sarda chilensis as a food competitor for *S.japonicus*.

The chub mackerel food composition does not vary throughout the whole NW African shelf studied, as evidenced by similar stomach contents. In sub-region 1, tunicates, cephalopods, calanoids, and euphausiids made up a slightly higher percentage. Proportions between various prey organisms changed with season. In sub-region 1, caphalopods prevailed in December and January, their contribution decreasing in favour of euphausiids in the spring. In sub-region 2, the fish contribution increased from December until April. Seasonal changes in *S.japonicus* food composition were recorded also by Hatanaka et al. and by Takahashi (all in Schaefer, 1980) and by Angelescu (1979).

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Translated: dr. T. Radziejewska

Bareh Bahgat Habashi, Andrzej Kompowski, Jan Wojciechowski

POKARM I ODŻYWIANIE SIĘ MAKRELI JAPOŃSKIEJ, *SCOMBER JAPONICUS* HOUTTUYN, 1782, W WODACH SZELFU PÓŁNOCNO-ZACHODNIEJ AFRYKI

STRESZCZENIE

Ryby do badań pobrano z połowów polskich trawlerów typu B-23 w latach 1971–1973 (rys. 1, tab. 1).

Pokarm *S.japonicus* jest bardzo zróżnicowany. W skład jego wchodzą różne skorupiaki (*Calanoida, Euphausiacea, Isopoda, Amphipoda, Decapoda* i inne oraz ich larwy), *Tunicata, Cephalopoda, Pisces, Branchiostoma sp., Polychaeta, Priapulida* i *Chaetognatha* (tab. 2 i 3). Skład pokarmu w obydwóch badanych podrejonach (I – 18°00′N – 22°59′N i II – 23°00′N – 28°59′N) był podobny. Częstość występowania poszczególnych składników zmieniała się w znacznym stopniu z miesiąca na miesiąc (tab. 2 i 3), jak również w zależności od długości badanych ryb (tab. 4), przy czym, w zmianach tych brak wyraźnie ukierunkowanych tendencji. Analiza przeprowadzona metodą wagową (tab. 5 i 6) wykazała, że w podrejonie I w treści pokarmowej dominowały *Cephalopoda, Tunicata* i *Euphausiacea. Cephalopoda* przeważały w grudniu i styczniu, podczas gdy *Euphausiacea* w marcu i maju. W podkrejonie II *Cephalopoda* i *Euphausiacea* odgrywały mniejszą rolę, zaś dominantami były *Calanoida, Tunicata, Brachiostoma sp.* i ryby. Proporcja ryb w pokarmie makreli z rejonu II wyraźnie rosła od grudnia do kwietnia. Ze wzrostem długości ryb wzrasta porporcja *Tunicata* w pokarmie, maleje zaś stopniowo znaczenie *Crustacea* (tab. 7).

Intensywność żerowania badanych ryb była stosunkowo duża (tab. 8 i 9) i zwiększała się wyraźnie ze wzrostem długości badanych ryb. Makrela nie zaprzestaje żerowania nawet podczas tarła (tab. 9 i 11).

Z przeprowadzonej dyskusji wynika, że na szelfie północno-zachodniej Afryki występuje częściowa zbieżność pokarmowa *S.japonicus* z *Trachurus trachurus, Tr. trecae, Tr. picturatus, Caranx rhonchus, Pagellus acarne* i *Pagellus coupei.*

Authors: addresses:

Dr Bahgat B. Habashi
Superintendent
MARINE POLLUTION UNIT
P.O. Box 46972
Fahaheel – Kuwait

Doc. dr hab. Andrzej Kompowski
Dr. Jan Wojciechowski
Faculty of Sea Fisheries and Food Technology
ul. Kazimierza Królewicza 4
SZCZECIN 71–550
POLSKA (Poland)