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The Age, Growth, Changes of Weight Proportions and
Chemical Composition of Eel during its Life in Polish
Waters

by

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The material examined was collected from the commercial catches. It contained:-

550 specimens of yellow eel from: Vistula River, Gdańsk Bay near Sopot, Firth of Vistula and Mazurian Lakes near Ruciane.

67 specimens of silver eel from Gdańsk Bay near Jastarnia.

All the eels were measured in centimetres and weighted in grammes. The separation of the sexes was done by the examination of the gonads. All material was divided into three groups:-

1. Males - 72 specimens - fishes with lobed organs.
2. Females - 483 specimens - fishes with ^{wide} crenulated gonads with ribbon-like structure, in which often it was possible to see eggs.
3. Indefinite group - 42 specimens - fishes with gonads too small for determination (mainly less than 30 cm long).

Fat contents was determined by Soxhlet method, protein - Kjeldahl, ash - by the method of complete combustion, and water by drying in the electric drier at 105°C up to constant weight. The age of the eels was determined from the otoliths and expressed in age-groups. The otoliths were picked from the auditory capsules after cutting and lifting the top of the skull and removing the brain. On the basis of Wundsch's (1916), Hornyhold's (1922) and Frost's (1945) methods, a modified method of preparing the otoliths for reading was elaborated. The otoliths were collected and kept for a few days in envelopes, then washed in absolute alcohol and the convex surface rubbed on a fine carborundum stone until the growth rings were to be seen at their best. The reading was done by reflected light against dark ground under the binocular. The otoliths were placed on the special plates, sinked in Canada balsam.

The interpretation of the light and dark concentric zones was as follows:- in the middle there was a central dark area, which represented the first year of life; then there were usually slightly distinguished three light and dark pairs of narrow zones, referring to three years of life in the sea. Around them was the first wide, light zone - first summer in fresh or brackish waters, then the first dark - first winter in these waters, second light - second summer, and so on.

The age of eels was determined in age-groups. To the group 0 were classified the eels, their otoliths having formed the first summer ring in fresh or brackish waters, to the group I those with one summer and one winter ring, formed in fresh or brackish waters, and so on.

Length, weight and age of the eels caught in different Polish waters are presented in Table 1 (page 2).

The mean yearly length increment of eel is about 5 cm, but in some cases older specimens, after XV age-group, have an increase of about 10 cm. The weight increment increases according to the age.

Table 1. Length, weight and age of eels in Polish waters

	Place of catch	Sex	Length (cm)	Weight (g)	Age-group	Mean age years
Yellow eel	Gdańsk Bay and Vistula Mouth	♂	27-39 (32,8)	41-120 (63,5)	III-VIII (V)	4,2
		♀	20-47 (34,6)	20-120 (58,3)	III-IX (V)	5,2
		♂	11-25 (17)	15-25 (11)	I-II	2
Yellow eel	Firth of Vistula	♀	18-88 (42,3)	25-780 (163)	III-XIV (VIII)	7
Yellow eel	Mazurian Lakes	♀	50-115 (65,9)	210-2750 (696)	IX-XX (XIII)	12,7
Silver eel	Gdańsk Bay	♂	34-49 (38,6)	65-220 (97)	V-XII (VIII)	7,3
		♀	48-76 (64,5)	170-1400 (524)	VIII-XVI (XIII)	12,3

() = mean values.

In the VI age-group and the length of 37 cm the rate of growth of eels in all Polish waters is the same. Beginning from this point, the growth of males decreases. The growth of females increases to XII age-group and a length of 60 cm, and then the rate of growth begins to decrease. The data collected show that during the life of eel there are three critical points: in age groups VIII, XII, and XV. In the first interval (age-groups VIII to XII) the weight/length relationship of silver eels is smaller than that of the yellow eels, in the second interval (XII to XV) bigger, and above age-group XV again smaller. The mean length for those groups are 48, 73, and 90 cm, respectively.

On the whole, the rate of growth is various for the different waters. The most intensive growth was observed in females from the Firth of Vistula. The females from the Gdańsk Bay has a smaller growth than that of the yellow eels from the Mazurian Lakes and that of the smaller silver males. The individual parts of the eel body do not grow, during its lifetime, in the same rates. Most intensively is the increase in percentage of weight of the gonads (up to 2,4%) and of the muscles. The highest weight of flesh is found in the silver females. The percentage of weight of the separate parts of the eel body are presented in Table 2 (page 3).

During the life of eel, spent in Polish waters, changes are observed in the percentage of the main components of flesh. In particular the fat contents increases from 2% till about 30%, while protein and water on the contrary decrease. The percentage of ash is the whole time almost at the same level - about 1%. The chemical composition of the flesh of eel is presented in Table 3.

Table 2. The weights of the separate parts of the eel body (in %)

	Place of catch	Sex	Viscera	Liver	Bones	Skin	Flesh	Heads
Yellow eel	Gdańsk Bay	♂	8,5-15 (11,5)	-	-	-	-	8,5-15 (10,5)
		♀	7-9,5 (8,5)	-	-	-	-	4,5-8 (6)
		♀	17-27 (21)	-	-	-	-	7-16 (8,5)
Yellow eel	Firth of Vistula	♀	3,3-12 (6,5)	0,8-3,1 (1,6)	13,6-28,8 (22,3)	7,2-18,5 (13,4)	39-62 (53,6)	3,2-13,2 (5)
Yellow eel	Mazurian Lakes	♀	2,5-13,2 (5,9)	1-2,8 (1,9)	9,5-25 (19,8)	8-16 (11,9)	43-76 (59)	2,4-6 (4,2)
Silver eel	Gdańsk Bay	♂	4-11,4 (7,2)	1,2-4,5 (3)	10,5-20 (13,5)	7,1-15,8 (11,4)	43-72 (60)	5,6-16,8 (9,5)
		♀	4-9,2 (6,3)	1,7-3,3 (2,3)	10-19 (11,9)	8,8-15 (10,8)	54-72 (66)	3,8-8,3 (5,4)

() = mean values

Table 3. Chemical composition of eel flesh

() = mean values

Place of catch	Sex	Protein	Water	Fat	Ash
montee Boulogne	-	20.4	74.6	2.7	1.6
Yellow eel Gdańsk Bay	♂	17.9-20.8 (18.8)	61.2-72.2 (66.3)	8.5-19.1 (12.1)	0.9-1.2 (1.1)
	♀	16.8-20.5 (18.2)	64.5-73 (69)	5.4-14.1 (9.3)	0.9-1.2 (1.1)
	♀	16.8-20.7 (18.3)	72.1-77.5 (74.4)	2.6-8.6 (5.1)	0.9-1.3 (1.0)
Yellow eel Firth of Vistula	♀	14.2-20.1 (16.9)	55.4-76.2 (65.2)	3.4-24.1 (15.7)	0.7-1.2 (1.0)
Yellow eel Mazurian Lakes	♀	12.5-20.9 (18.4)	53-66.5 (59.5)	12.2-30.2 (22.2)	0.8-1.2 (1.0)
Silver eel Gdańsk Bay	♂	13.9-17.2 (15.1)	52.5-60.2 (55.2)	20.2-33.2 (28.6)	1.1-1.4 (1.2)
	♀	12.1-19.1 (15.3)	50.9-67.2 (57.2)	13.1-32.1 (25.4)	0.9-1.2 (1.0)

Wide-head eels

Narrow-head eels

Length and weight at XV age-group

74 cm, 630 g

82 cm, 1065 g

Mean fat contents

15%

24%

Mean water contents

63%

58%

Mean protein contents

18,5%

14,5%

Relation between: distance from the eye to the end of mouth to the width of mouth

1 : less than 1

1 = more than 1