
UNIVERSITY OF ALGARVE
 Faculty of Sea and Environmental Sciences
 MSc in Marine Biology
FISHERIES BIOLOGY
 (1st Year-1st Semester)

Exercises no. 5

2007 / 2008

LENGTH-WEIGHT RELATIONSHIP
AGE COMPOSITION
MEAN LENGTH AT AGE
MEAN AGE

Part 1 (Fictitious data)

Consider the catch length composition (in numbers) for unsexed fish (males and females combined) of a particular species (Table 1), the age-length key obtained by age reading of a particular calcified structure (e.g., otoliths) obtained by stratified random sampling of the catch (random samples of a fixed number by length class) (Table 2) and the following length-weight relationship estimated for the species: $W(g) = 0.005 * TL^3$.

Table 1		Table 2					
TL(cm)	Catch	TL(cm)	Age group (yr)				
			0	I	II	III	TOT
5-	1000	5-	20				20
10-	12000	10-	10	20			30
15-	2000	15-		12	28		40
20-	100	20-		3	10	7	20
Total	15100	Total	30	35	38	7	110

1. Convert the “age-length key (in number)” into its corresponding “age-length key (in proportion)” dividing, in each length class, the number of individuals recorded in each age by the total number of individuals in the length class;
2. Calculate the age composition of the catch, in number (abundance), multiplying the “age-length key in proportion”, obtained in 1, by the catch length composition (Table 1). The total number of individuals in each length class will be distributed by ages according to the proportions observed in the length class;
3. Calculate the age composition of the catch, in weight (biomass), using the mean weight at length estimated through the length-weight relationship;
4. Calculate the mean lengths at age in the catch;
5. Calculate the mean age in the catch.

Part 2 (Real data)

The data available for this exercise were collected by IPIMAR, the Portuguese Fisheries Institute, during an acoustic research survey, onboard R/V "Noruega", along the Portuguese coast in order to estimate the abundance and biomass of the stock of sardine (*Sardina pilchardus*) in November 1998. For the purpose of this exercise only data from the Algarve region (South coast) are presented.

The main aims of this exercise are (1) to build an "age-length key" (2) to estimate the age composition of the stock (in number – abundance and weight - biomass), (3) to calculate the mean lengths at age, mean weights at age and (4) mean age of sardine stock, in the Algarve region, in November 1998.

The length composition (total length, TL (cm)) of the stock, estimated by IPIMAR in the Algarve region in November 1998 (the length structure of the stock), is presented in Table 1 and available in digital format in file "BP0708_Ficha05_data.xls".

Table 1

TL (cm)	No.(thousand)	TL (cm)	No.(thousand)
12.5 -	5643	18.0 -	84913
13.0 -	6929	18.5 -	105509
13.5 -	5643	19.0 -	125042
14.0 -	23511	19.5 -	110134
14.5 -	81761	20.0 -	162287
15.0 -	172630	20.5 -	151650
15.5 -	290701	21.0 -	96602
16.0 -	279784	21.5 -	47376
16.5 -	120043	22.0 -	13955
17.0 -	84337	22.5 -	1588
17.5 -	48505		
TOTAL =	2018543		

The following length-weight relationship was estimated for sardine (unsexed fish) presented in the Algarve region in November 1998:

$$TW (g) = 0.00352 \times TL (cm)^{3.283}$$

Data on total weight (TW, g) and total length (TL, cm) was obtained from a sample of 1673 individuals with lengths ranging between 12.5 and 23.0 cm. The parameters of the relationship were estimated by linear regression analysis (least squares method) after logarithmic transformation of variables TW and TL.

A sample of 238 otoliths was collected along several fishing tows conducted by R/V "Noruega" in the Algarve, in November 1998. A stratified random sampling process was adopted with up to 16 individuals selected randomly by length class. Once cleaned and dried

each pair of whole otoliths was mounted in special black trays and covered with transparent resin.

The otoliths age reading performed onboard with a binocular microscope under reflected light. The results (age groups) are presented in Table 2 of file “BP0708_Ficha05_data.xls”.

I. Age-length key

a)-Build a table with the distribution by length classes (lines) and age groups (columns) of the individuals aged in the sample (age-length key, in number). Consider a “plus group” 7+ to include individuals with 7 yr old and older;

b)-Transform in proportion the numbers at age within each length class (total number of individuals in each length class will be 1, i.e., 100%).

II. Age composition of the stock

a)-Obtain the age composition in numbers of the sardine stock in the Algarve, in November 1998 (i.e., obtain the age structure of the stock abundance);

b)-Convert the age composition in numbers into the corresponding age composition in weight (i.e., obtain the age structure of the stock biomass) by using the estimated length weight relationship.

III. Mean lengths and mean weights at age

a)-Calculate the mean lengths at age of the sardine stock in the Algarve, in November 1998;

b)-Calculate the mean weights at age of the sardine stock in the Algarve, in November 1998 by using the corresponding mean weights obtained through the estimated length-weight relationship.

IV. Mean age

Calculate the individual mean age of sardine in the stock, available in the Algarve region in November 1998.

Recommended literature:

Holden, M. J. & D. F. S. Raitt, 1974 - Manuel de Science Halieutique. Deuxième partie - Méthodes de Recherches sur les Ressources et leur Application. Doc. Tech. FAO Pêches (115) Rev. 1: 223p. (**French version**). Available at the University library and *online*:
<http://www.fao.org/DOCREP/003/F0752F/F0752F00.HTM>

English version: Manual of Fisheries Science. Part 2 - Methods of Resource Investigation and their Application. Only available *online*:
<http://www.fao.org/DOCREP/003/F0752E/F0752E00.HTM>

Spanish version: Manual de Ciencia Pesquera. Parte 2 - Métodos para Investigar los Recursos y su Aplicación. Only available *online*:
<http://www.fao.org/DOCREP/003/F0752S/F0752S00.HTM>

King, M., 1995. Fisheries Biology, Assessment and Management. Blackwell Science, Oxford, pp: 103-107