

RELATIONSHIPS OF *KATSUWONUS PELAMIS* LINNAEUS, 1758, CAUGHT IN THE SOUTH AND
SOUTHEAST OF BRAZIL: LENGTH-WEIGHT AND GILLED/GUTTED WEIGHT-WEIGHT

A. F. de Amorim, S. A. Antunes, and C. A. Arfelli

SUMMARY

The skipjack, *Katsuwonus pelamis*, Linnaeus, 1758, was studied by the Marine Fishery Division of the Fishery Institute¹ and Fish Technology Area of Oceanographic Institution, University of São Paulo², through specimens caught in the south and south-east of Brazil (20° to 33°S), from October 1978 to June 1980. Data obtained included length-weight $W = 6.79 \times 10^{-6} L^{3.28}$ and gilled/gutted weight-weight $W_1 = 0.87 W$ relationships. These equations must be applied just to the studied area and considered amplitude.

¹"Divisão de Pesca Marítima do Instituto de Pesca - DPM-IP"

²"Instituto Oceanográfico da Universidade de São Paulo - IOUSP"

RESUME

Le listao, *Katsuwonus pelamis* Linnaeus 1758, a été étudié par la "Divisão de Pesca Marítima do Instituto de Pesca" et l'Institut océanographique de l'université de São Paulo, à partir de spécimens capturés dans le sud-est et sud du Brésil (20° à 30°S) d'octobre 1978 à juillet 1980. On a obtenu les relations longueur/poids $W = 6,79.10^{-6} L^{3.28}$ et poids éviscéré/poids vif $W_1 = 0.87 W$. L'utilisation de ces équations doit uniquement être appliquée à la zone étudiée et au nombre de spécimens échantillonnés.

RESUMEN

El listado, (*Katsuwonus Pelamis-Linnaeus, 1758*), fué estudiado en la "Divisão de Pesca Marítima do Instituto de Pesca" y "Area de Tecnología do Pescado do Instituto Oceanográfico da Universidade de São Paulo", a partir de ejemplares capturados en el Sudeste y Sur de Brasil (20° a 33° S.), de Octubre de 1978 a Julio de 1980. Fueron obtenidas las relaciones talla/peso : $W = 6,79.10^{-6} L^{3,28}$ y peso eviscerado/peso vivo : $W_1 = 0,87 W$. La utilización de estas ecuaciones deberá restringirse al área estudiada y amplitud de los ejemplares muestreados.

INTRODUCTION

The skipjack, *Katsuwonus pelamis*, is sporadically caught in small quantities by long-liners operating along the South and Southeast coasts of Brazil (ZAVALA-CAMIN, 1974). Baitboats have been fishing large quantities off Rio de Janeiro State coast since November 1978. The product has been exported frozen and canned by employment of local technology (ANTUNES et alii in press).

This work was begun in November 1978 and developed in cooperation between members of the Marine Fishery Division of the Fishery Institute and the Fish Technology Area of the Oceanographic Institution.

The length-weight and gilled/gutted weight-weight relationships were calculated in order to contribute to the biological knowledge of the specie in this region.

METHODOLOGY

The samples were obtained from Brazilian and Korean long-liners, and Brazilian baitboats, operating between the 20° to 33°S parallels and 40° to 50°W meridians.

From October 1978 to June 1980 were obtained 99 specimens, which were transported to the laboratory, weighed (10 g precision) and measured based on the Field Manual of ICCAT (MIYAKE & HAYASI, 1972).

The length-weight relationship was determined with 70 fishes, individually computed, in order to obtain the following type of mathematical expression:

$$W = a L^b$$

and submitted to the chi-square method (linear regression) to the logarithmic transformation:

$$\ln W = \ln a + b \ln L$$

were:

$$W = \text{total weight in kilograms}$$

L = length (tip of upper jaw to fork of tail) in centimeters

a and b = constants

In order to establish the gilled/gutted weight-weight relationship, data of 44 specimens were collected, which computed individually (Fig. 2), show that the relationship is linear and results in an expression as follows:

$$W_1 = b W$$

were:

W = total weight in kilograms

W_1 = gilled and gutted weight in kilograms

b = constant

The constant b was estimated by the chi-square method. The curvilinear relationship between length and weight, was graphically compared with others found in related publications, after data standardization.

RESULTS AND DISCUSSION

The data used are presented in Table 1, and their relationships are:

- length-weight (Fig. 1)

$$W = 6.79 \times 10^{-6} L^{3.28}$$

The variation amplitudes of samples lengths and weights were 48.3 to 83.0 cm and 2.22 to 14.10 kg.

- gilled/gutted weight-weight (Fig. 2)

$$W_1 = 0.87 W$$

it was observed that this straight line crosses the origin of Cartesian Coordinates. The variation amplitudes of gilled / gutted weight-weight relationship were 1.91 to 9.40 and 2.22 to 10.54 kg, respectively.

By analysis of the length-weight relationship obtained, under the conditions of the present work, a close coefficient of correlation ($r^2 = 0.9930$) and linearity, with a little deviation, was verified upon application of the ln/ln transformation.

Comparing the length-weight curve of the present work with those of others already established in the Pacific Ocean by CHATWIN (1959) and HENNEMUTH (1959 b), and in the Atlantic by SUAREZ-CAABRO & DUARTE-BELLO (1961), a proximity in general trend was ascertained within the considered interval. The same was verified with the data obtained by BONHAM (1946) in the Pacific (Fig. 3). Nevertheless, according to the works of CHATWIN (1959) and HENNEMUTH (1959 a and b) there exist significant differences in the regression coefficients of the length-weight relationships for different areas, and therefore the present equation should be considered as restricted to the area studied.

The gilled/gutted weight-weight relationship has local application because of the Brazilian conditions of preservation and unloading.

CONCLUSION

On the conditions of the present paper, it was observed that:

- The length-weight relationship is represented by the equation:

$$W = 6.73 \times 10^{-6} L^{3.28}$$

- The gilled/gutted weight-weight relationship can be expressed by the equation:

$$W_1 = 0.87 W$$

- The relationships must be applied just to the studied area and considered amplitude.

ACKNOWLEDGMENTS

The authors wish to especially thank the Professor Edson P. dos Santos; Dr. Shitiro Tanji; and also thank the local fisheries industry and all those who have assisted us in this research.

LITERATURE CITED

- ANTUNES, S.A.; A. RADASEWSKY; F. MANCUSO FILHO & C.G. PALMA, *Pro cessamento de bonitos e atuns: Enlatamento*. SUDEPE, Brasília-71p., 5 tab., 10 fig. (in press).
- BONHAM, K. 1946 Measurements of some pelagic commercial fishes of Hawaii. *Copeia*, (2): 81-84.
- CHATWIN, B.M. 1959 The relationships between length and weight of yellowfin tuna (*Neothunnus macropterus*) and skipjack (*Katsuwonus pelamis*) from the Eastern Tropical Pacific Ocean. *Bull. Inter-American Tropical Tuna Comm.*, La Jolla, 3(7): 305-352.
- HENNEMUTH, R.C. 1959a Morphometric comparison of skipjack from the Central and Eastern Pacific Ocean. *Bull. Inter-American Tropical Tuna Comm.*, La Jolla, 3(8): 241-304.
- _____. 1959b Additional information on the length-weight relationship of skipjack tuna from the Eastern Tropical Pacific Ocean. *Bull. Inter-American Tropical Tuna Comm.*, La Jolla, 4(2): 25-37.
- MIYAKE, P.M. & S. HAYASI 1972 Manual de operaciones para las estadísticas y el muestreo de tunidos y especies afines en el Océano Atlántico. ICCAT, Madrid.
- SUAREZ-CAABRO, J.A. & P.P. DUARTE-BELLO 1961 Biología pesquera del bonito (*Katsuwonus pelamis*) y la albacora (*Thunnus atlanticus*) en Cuba. I. Serie de estudios sobre trabajos de investigación (15). Instituto Cubano de Investigaciones Tecnológicas (ICIT), La Habana, 151p.
- ZAVALA-CAMIN, L.A. 1974 Ocorrência de atuns no Sudeste e Sul do Brasil. *Bol. Instituto de Pesca*, Santos, 3(3): 37-52.

Table 1 - Length, sex and weights of Katsuwonus pelamis Linnaeus, caught in 1978/80 in the South and Southeast of Brazil.

| Sampling data | | | Fish gear | Sex | Total length (cm) | Weight (kg) | |
|---------------|-----|------|-----------|-----|-------------------|-------------|-----------------|
| Month | Day | Year | | | | Total | gilled / gutted |
| 10 | 10 | 78 | long-line | M | 48.3 | 2.54 | 2.09 |
| 10 | 10 | 78 | " | F | 48.4 | 2.49 | 2.05 |
| 10 | 24 | 78 | " | F | 59.5 | 3.11 | - |
| 11 | 13 | 78 | " | - | 79.7 | 11.95 | - |
| 11 | 13 | 78 | " | - | 59.5 | 7.79 | - |
| 11 | 20 | 78 | " | - | 79.0 | 11.49 | - |
| 11 | 29 | 78 | " | - | 81.2 | 12.90 | - |
| 12 | 06 | 78 | " | M | 78.0 | 11.32 | - |
| 01 | 03 | 79 | " | M | 81.9 | 13.12 | - |
| 01 | 17 | 79 | " | M | 82.6 | 13.59 | - |
| 01 | 17 | 79 | " | F | 75.3 | 10.25 | - |
| 01 | 17 | 79 | " | F | 73.0 | 10.00 | - |
| 01 | 17 | 79 | " | F | 78.6 | 11.40 | - |
| 01 | 17 | 79 | " | F | 74.5 | 9.80 | - |
| 01 | 17 | 79 | " | M | 77.0 | 11.40 | - |
| 01 | 17 | 79 | " | M | 70.5 | 7.60 | - |
| 01 | 17 | 79 | " | F | 74.1 | 9.60 | - |
| 01 | 17 | 79 | " | M | 80.4 | 12.65 | - |
| 01 | 17 | 79 | " | F | 76.5 | 9.80 | - |
| 01 | 17 | 79 | " | M | 80.0 | 11.20 | - |
| 01 | 17 | 79 | " | M | 66.4 | 6.40 | - |
| 01 | 17 | 79 | " | M | 73.7 | 9.00 | - |
| 01 | 17 | 79 | " | F | 76.6 | 11.70 | - |
| 01 | 17 | 79 | " | M | 74.9 | 9.20 | - |
| 01 | 18 | 79 | " | M | 83.0 | 14.10 | - |
| 01 | 18 | 79 | " | F | 70.3 | 7.50 | - |
| 01 | 18 | 79 | " | M | 75.8 | 9.30 | - |
| 01 | 18 | 79 | " | F | 71.9 | 8.30 | - |
| 08 | 02 | 79 | " | - | 77.0 | 10.54 | 9.40 |
| 09 | 06 | 79 | " | M | 70.0 | 8.95 | 6.29 |
| 09 | 06 | 79 | " | M | 65.2 | 6.14 | 5.32 |

Table 1 - Length, sex and weights of Katsuwonus pelamis Linnaeus, caught in 1978/80 in the South and Southeast of Brazil.

(CONTINUATION)

| Sampling data | | | Fish gear | Sex | Total length (cm) | Weight (kg) | |
|---------------|-----|------|-----------|-----|-------------------|-------------|-----------------|
| Month | Day | Year | | | | Total | gilled / gutted |
| 03 | 05 | 79 | long-line | F | 57.1 | 3.57 | 3.05 |
| 03 | 05 | 79 | " | M | 56.7 | 3.33 | 3.29 |
| 12 | 05 | 79 | live-bait | F | 60.5 | 4.73 | 4.10 |
| 12 | 05 | 79 | " | M | 69.8 | 7.30 | 5.48 |
| 12 | 05 | 79 | " | M | 71.1 | 6.99 | 6.00 |
| 12 | 05 | 79 | " | M | 63.1 | 5.45 | 4.74 |
| 12 | 05 | 79 | " | M | 64.2 | 5.32 | 4.58 |
| 12 | 05 | 79 | " | M | 64.0 | 5.59 | 4.85 |
| 12 | 05 | 79 | " | F | 65.3 | 6.57 | 5.40 |
| 12 | 05 | 79 | " | F | 67.8 | 7.14 | 6.11 |
| 12 | 05 | 79 | " | M | 61.8 | 5.43 | 4.77 |
| 12 | 05 | 79 | " | F | 68.7 | 6.92 | 5.98 |
| 12 | 05 | 79 | " | M | 49.3 | 2.22 | 1.91 |
| 12 | 05 | 79 | " | F | 59.8 | 4.53 | 3.90 |
| 12 | 05 | 79 | " | F | 67.3 | 6.85 | 5.93 |
| 12 | 05 | 79 | " | M | 52.6 | 3.02 | 2.64 |
| 12 | 05 | 79 | " | F | 59.2 | 4.39 | 3.84 |
| 12 | 05 | 79 | " | M | 51.5 | 2.84 | 2.45 |
| 12 | 05 | 79 | " | F | 55.3 | 3.55 | 3.06 |
| 12 | 05 | 79 | " | F | 63.6 | 5.88 | 5.13 |
| 12 | 05 | 79 | " | F | 55.2 | 3.70 | 3.07 |
| 12 | 05 | 79 | " | F | 68.7 | 4.42 | 3.85 |
| 12 | 05 | 79 | " | M | 62.7 | 5.52 | 4.88 |
| 12 | 05 | 79 | " | F | 67.0 | 6.48 | 5.68 |
| 12 | 05 | 79 | " | M | 66.6 | 6.68 | 5.65 |
| 12 | 05 | 79 | " | M | 67.7 | 6.72 | 5.90 |
| 12 | 05 | 79 | " | F | 63.3 | 5.77 | 5.04 |
| 12 | 05 | 79 | " | F | 64.8 | 6.13 | 5.40 |
| 12 | 05 | 79 | " | F | 64.9 | 3.68 | 3.13 |
| 12 | 05 | 79 | " | M | 67.8 | 7.35 | 6.45 |
| 12 | 05 | 79 | " | M | 53.1 | 3.06 | 2.75 |

Tabela 1 - Length, sex and weights of Katsuwonus pelamis Linnaeus, caught in 1978/80 in the South and Southeast of Brazil.

(CONTINUATION)

| Sampling data | | | Fish gear | Sex | Total length (cm) | Weight (kg) | |
|---------------|-----|------|-----------|-----|-------------------|-------------|-----------------|
| Month | Day | Year | | | | Total | gilled / gutted |
| 12 | 05 | 79 | live-bait | F | 63.4 | 5.75 | 5.02 |
| 12 | 05 | 79 | " | F | 57.1 | 4.30 | 3.75 |
| 05 | 08 | 80 | " | - | 58.5 | 3.79 | 3.27 |
| 05 | 08 | 80 | " | M | 61.3 | 4.51 | 3.84 |
| 05 | 08 | 80 | " | - | 58.4 | 4.18 | 3.61 |
| 05 | 08 | 80 | " | F | 65.4 | 6.43 | 5.57 |
| 05 | 08 | 80 | " | F | 59.8 | 3.98 | 3.44 |
| 06 | 24 | 80 | " | F | 67.1 | 6.31 | 5.51 |

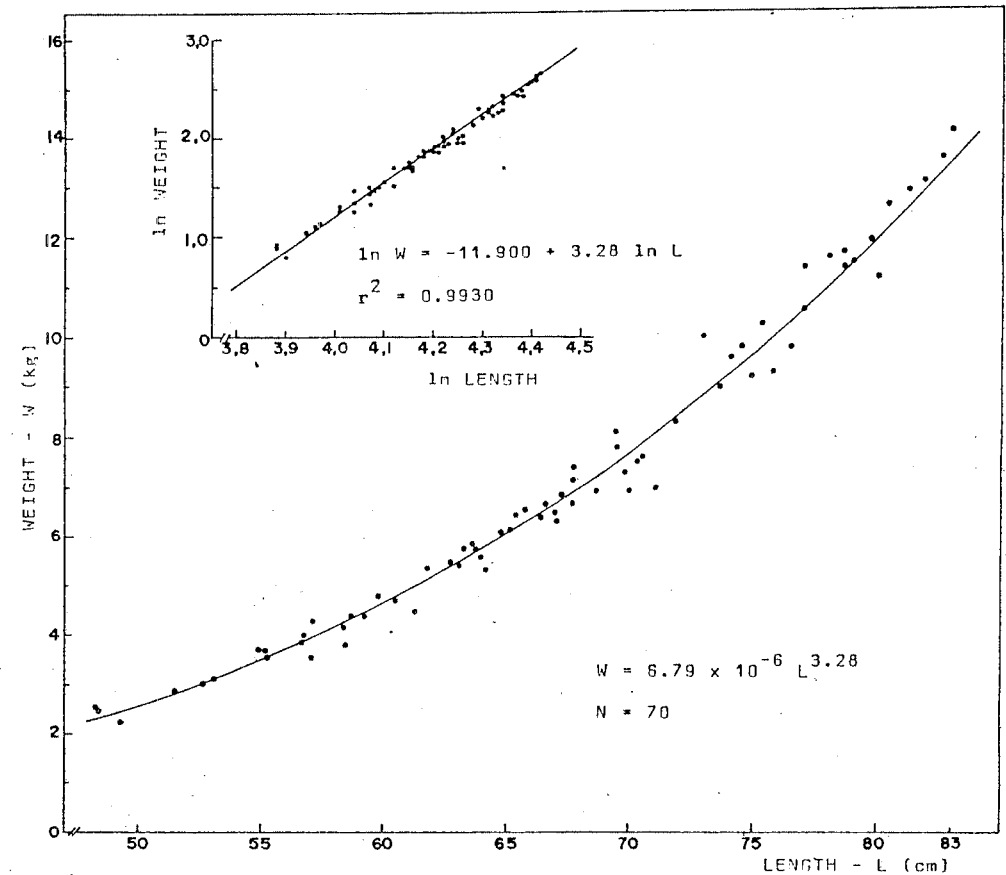


Fig. 1 - Length-weight relationship of Katsuwonus pelamis Linnaeus, caught in 1978/80 in the South and Southeast of Brazil.

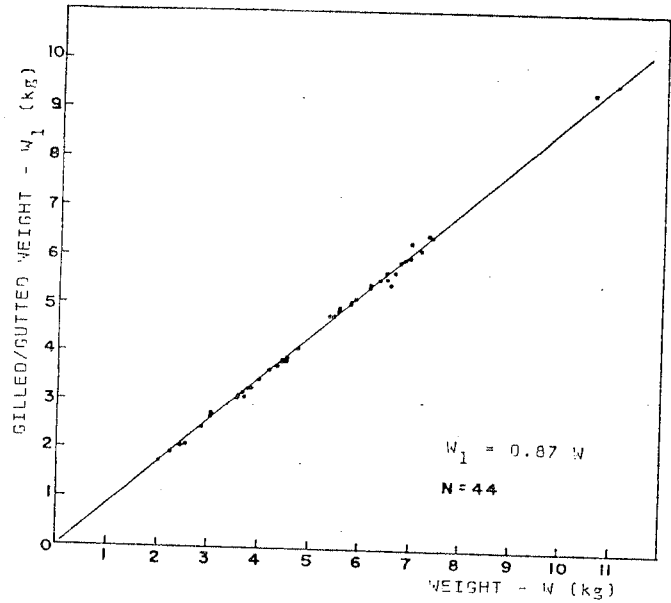


Fig. 2 - Gilled/gutted weight-weight relationship of *Katsuwonus pelamis* Linnaeus, caught in 1978/80 in the South and Southeast of Brazil.

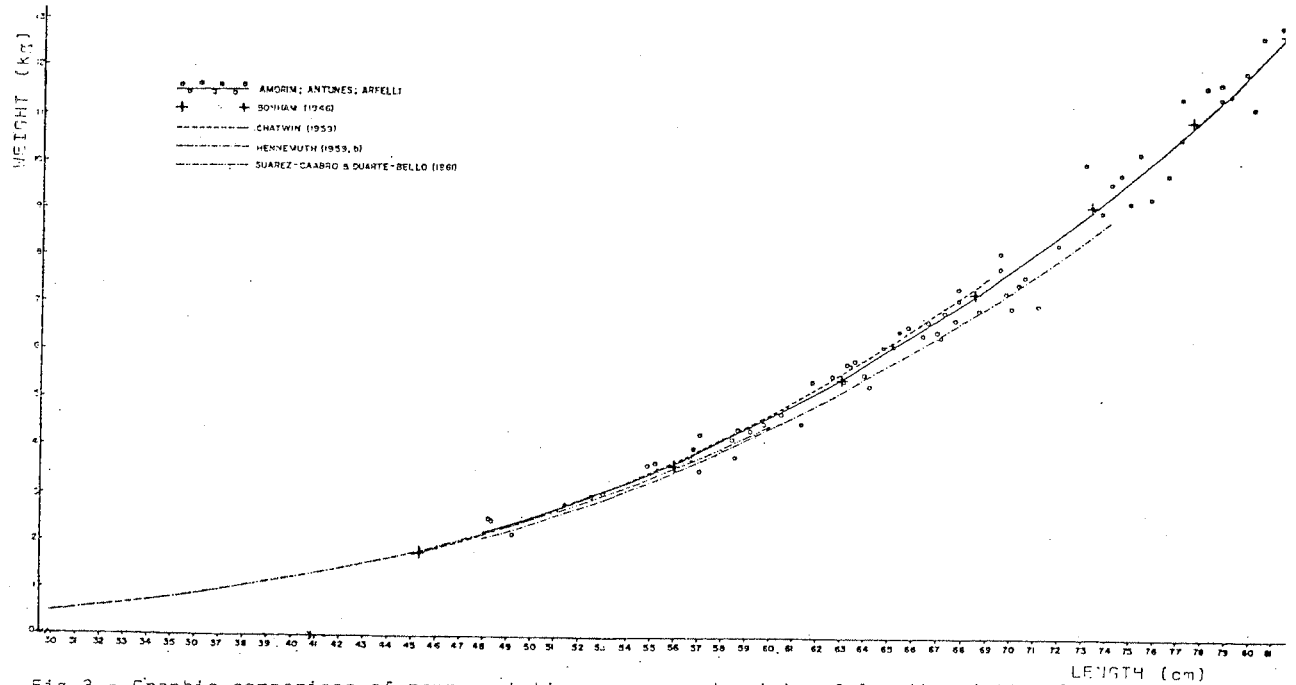


Fig. 3 - Graphic comparison of representative curves and points of length-weight relationships of *Katsuwonus pelamis* Linnaeus in the Atlantic and Pacific Oceans by several authors.