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Meat Yield of the Deep-Sea Crab, *Chaceon affinis*, from an Exploratory Fishery off Madeira Island (Portugal - Eastern Central Atlantic)

by

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Abstract

The geryonid crab *Chaceon affinis* was subjected to an exploratory fishery off Madeira Island (Portugal - Eastern Central Atlantic). The apparent abundance of this alternative fishing resource and the short distance to the fishing grounds suggested the possibility of implementing a local small-scale fishery targeted to this deep-sea crab species. The main purpose of the present study was to quantify the meat yield of *Chaceon affinis* specimens caught in this exploratory fishery. A total of 40 crabs were separated into three different parts: legs, chelae and whole carapace (cephalothorax). The relationships between meat yields (% fresh weight) of legs and chelae and several morphometric parameters of the specimens (total, carapace, legs and chelae weightings and measurements) were determined by means of linear regression analysis (on original data). Both total meat yield (legs + chelae) (17% of total weight) and meat yields from legs and chelae were relatively high (47% and 53% of legs and chelae weight, respectively), being similar to meat yields reported for several commercial crab species (namely for some geryonid crab species). The carapace, mainly due to its relative weight (60% of total weight), seem to have an interesting potential as raw material for conversion in a by-product that allows the complete utilisation of this deep-sea crab species by the seafood industry. The linear regressions established indicate that several morphometric parameters are valuable for the indirect estimation of the specimens potential meat yield. In this particular, the relationships between meat yields and specimens weightings (total, legs and chelae weight) invariably presented statistically significant linear regressions ($P<0.05$). On the contrary, among measurements (carapace and chelae length and width), only the relationships between chelae meat yield and the respective length and width presented statistically significant linear regressions ($P<0.05$).

Key Words: Meat yield, Deep-sea crab, *Chaceon affinis*, Geryonidae, Madeira Island, Portugal.

Introduction

Because of the over-exploitation of traditional fishing resources there is an increasing interest in alternative fishing resources potentially exploitable, namely the deep-sea crabs.

Some deep-sea crab species support targeted fisheries of high economical value. In some cases crabs are marketed alive, but generally they are send to seafood processing industries, where they are separated into their constituent parts, namely legs, chelae and whole carapace.

The deep-sea crab *Chaceon affinis* was subjected to an exploratory fishery off Madeira Island (Portugal - Eastern Central Atlantic). The apparent abundance of this alternative fishing resource and the short distance to the fishing grounds suggested the possibility of implementing a local small-scale fishery towards this geryonid species.

The main purpose of this study was to quantify the meat yield of the *Chaceon affinis* specimens caught in this exploratory fishery.

Materials and Methods

A total of 40 crabs were separated into three different parts: whole carapace (C), legs (L), and chelae (CH), and due to sexual dimorphism, chelae were processed separately (right chelae - RCH and left chelae - LCH).

Subsequently, the relationships between meat yields (% fresh weight) of legs (Lw) and chelae (CHw) and several weightings (total weight - TW, legs weight - LW, and chelae weight - CHW) and measurements of the specimens (carapace length - CLg, carapace width - CWd, chelae length - CHLg and chelae width - CHWd) (Figure 1), were determined by means of linear regression analysis (on original data).

Results

The results obtained in the legs and chelae meat yield estimations, and the relationships established between these meat yields and the crabs morphometric parameters are represented in Figures 2 a), b) and c).

Discussion

The comparisons between the meat yields obtained in the legs, chelae and legs+chelae of *Chaceon affinis* and the meat yields reported for other commercially important crab species are presented in Tables 1a), b) and c).

Both total meat yield (legs + chelae = 17% of total weight) (Figure 2b) and meat yields from legs and chelae were relatively high (47% and 53% of legs and chelae weight, respectively) (Figure 2c), being similar to meat yields reported for several commercial crab species (namely for some geryonid crab species) (Tables 1a,b,c). The carapace, mainly due to its relative weight (60% of total weight) (Figure 2a), seem to have an interesting potential as raw material for conversion in a by-product that allows the complete utilisation of this deep-sea crab species by the seafood industry.

The linear regressions established indicate that several morphometric parameters are valuable for the indirect estimation of the specimens potential meat yield (Figures 2a,b,c). In this particular, the relationships between meat yields and specimens weightings (total, legs and chelae weight) invariably presented statistically significant linear regressions ($P<0.05$). On the contrary, among measurements (carapace and chelae length and width) only the relationships between chelae meat yield and the respective length and width presented statistically significant linear regressions ($P<0.05$).

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References

1) - CAYRE, P., P. LE LOEUFF, and A. INTES. 1979. *Geryon quinquedens* le crab rouge profond. Biologie, pêche, conditionnement, potentialités d'exploitation. *Pêche Marit.*, No. 1210, pp. 8.
2) - EDWARDS, E. and J. C. EARLY. 1987. Catching, handling and processing crabs. *Torry Advisory Note*, No. 26, 16 p.
3) - ERDMAN, R. B., and N. J. BLAKE. 1988. The golden crab (*Geryon fenneri*) fishery of the Southeast Florida. *Proc. 12th Ann. Conf. Trop. Subtrop. Fish. Technol. Soc. Americas*, pp. 95-106.
4) - GAERTNER, D. 1985. Evaluation de la richesse en crabes rouges des profondeurs (*Geryon* spp.) de la pente continentale Sénégalaise au moyen de casiers. *Pêche Marit.*, Mars 1985: 163-171.
5) - GALUS, H. S. 1973. Red crab, once ugly, has become delicacy overnight. *Natl. Fisherman*, **54**: 20-27.

6) - GATES, W. K., and A. H. PARKER. 1992. Characterization of minced meat extracted from blue crab picking plant by-products. *J. Food Sci*., **57**: 267-270.
7) - GEORGE, C., and K. GOPAKUMAR. 1987. Biochemical studies on crab *Scylla serrata*. *Fish. Technol*., **24**: 57-61.
8) - KRZECZKOWSKI, R. A., and F. E. STONE. 1974. Amino acid, fatty acid and proximate composition of snow crab (*Chionoecetes opilio*). *J. Food Sci*., **39**: 386-388.
9) - KRZECZKOWSKI, R. A., R. D. TENNEY, and C. KELLEY. 1971. Alaska king crab: fatty acid composition, carotenoid index and proximate analysis. *J. Food Sci*., **36**: 604-606.
10) - LEE, E., S. P. MEYERS, and J. S. GODBER. 1993. Minced meat crabcake from blue crab processing by-products - Development and sensory evaluation. *J. Food Sci*., **58**: 99-103.
11) - McRAE, E. D. Jr. 1961. Red crab explorations off the northeastern coast of the United States. *Comm. Fish. Rev*., **23**: 5-10.
12) - NOWAK, W. S. W. 1970. *The Marketing of Shellfish*. Fishing News (Books) Ltd, London, 263 p.
13) - OTWELL, W. S., J. J. BELLAIRS, and D. SWEAT. 1984a. Initial development of a deep-sea crab fishery in the Gull of Mexico. *Florida Sea Grant Coll. Rep*., No. 61, 29 p.
14) - OTWELL, W. S., SWEAT, D. E., and J. J. BELLAIRS. 1984b. Exploratory fishing for deep-sea crabs (*Geryon*) in the Gulf of Mexico. Abstracts of technical papers. National Shellfisheries Association Annual Meeting. Hilton Head, South Carolina, 6-9 June 1983. *J. Shellfish Res*., **4**: 97-98.
15) - SHAHIDI, F., and J. SYNOWIECKI. 1991. Nutrient and chemical compositions of Atlantic snow crab offals. *Proc. 15th Ann. Conf. Trop. Subtrop. Fish. Technol. Soc. Americas*, pp. 334-339.
16) - VOIGT, M. N. 1986. A study of the use of cod, cod by-products and crustacean by-products for surimi and surimi based products: Parts III - Shellfish flavour extraction studies. *Can. Ind. Rep. Fish. Aquat. Sci*., 42 p.
17) - VOIGT, M. N., OSBORNE, R., and D. E. HALL. 1989. Profile of taste active components in crab products / by-products and in cod surimi. *Pap. 34th Atl. Fish. Technol. Conf. Seafood Biotechnol. Workshop*, pp. 453-468.
18) - WARD, D. R. 1990. Processing Crustaceans. ***In**: The Seafood Industry*. Martin R. E. and J. F. Flick (Eds.). Van Nostrand Reinhold, New York, pp. 174-181.

Table 1a). Comparison of legs meat yields between *Chaceon affinis* and other commercially exploited crab species.

Family / Species	**Legs Meat Yield (%)**	**Type of Meat Extraction**	**References**
Family Geryonidae:			
Chaceon affinis	**8%** (LGw/TW)	Manual	**Present Study**
Chaceon affinis	**47%** (LGw/LGW)	Manual	**Present Study**
Chaceon fenneri	5.8% (LGw/TW)	Unknown	13
Other Commercial Crabs:			
Chionoecetes bairdi	15.8% (LGw/TW)	Manual	8
Paralithodes camtschatica	48% (LGw/LGW)	Manual	12
Paralithodes camtschatica	9%-13% (LGw/TW)	Manual	9

Table 1b). Comparison of chelae meat yields between *Chaceon affinis* and other commercially exploited crab species.

Family / Species	Chelae Meat Yield (%)	Type of Meat Extraction	References
Family Geryonidae:			
Chaceon affinis	**9%** (CHw/TW)	Manual	**Present Study**
Chaceon affinis	**53%** (CHw/CLW)	Manual	**Present Study**
Chaceon fenneri	8.9% (CHw/TW)	Manual	13
Other Commercial Crabs:			
Callinectes sapidus	2%-3% (CHw/TW)	Manual	13
Callinectes sapidus	49% (CHw/CLW)	Manual	10
Chionoecetes bairdi	6% (CHw/TW)	Manual	8
Paralithodes camtschatica	2%-3% (CHw/TW)	Manual	9
Scylla serrata	42%-47%(CHw/CLW)	Manual	7

Table 1c). Comparison of total meat yields between *Chaceon affinis* and other commercially exploited crab species.

Family / Species	Total Meat Yield (%)	Type of Meat Extraction	References
Family Geryonidae:			
Chaceon affinis	**17%** (legs+chelae)	Manual	**Present Study**
Chaceon fenneri	16%-20%	Mechanical	13
Chaceon fenneri	23%	Manual	13
Chaceon fenneri	17%-23%	Manual	3
Chaceon maritae	11%-20%	Manual	4
Chaceon quinquedens	36.5 %	Manual	11
Chaceon quinquedens	10%	Mechanical	5
Chaceon quindedens	18%-22%	Manual	13
Chaceon quinquedens	10%	Mechanical	1
Chaceon quinquedens	20%-22%	Manual	1
Geryon sp.	23%	Manual	14
Other Commercial Crabs:			
Callinectes sapidus	12%	Manual	12
Callinectes sapidus	11%-14%	Unknown	13
Callinectes sapidus	10%	Unknown	18
Callinectes sapidus	10%	Manual	6
Callinectes sapidus	11%	Manual	10
Cancer magister	20%-25%	Unknown	13
Cancer pagurus	30%	Unknown	2
Chionoecetes bairdi	33.7%	Manual	8
Chionoecetes opilio	30%	Unknown	16
Chionoecetes opilio	30%	Unknown	17
Chionoecetes opilio	20%-30%	Unknown	15
Paralithodes camtschatica	18%-26%	Manual	9
Scylla serrata	21.9%	Manual	7

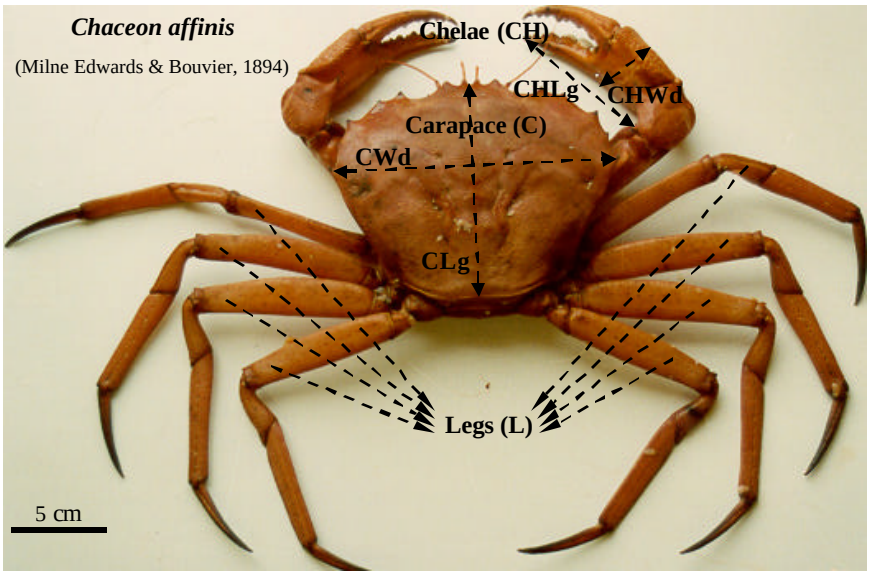
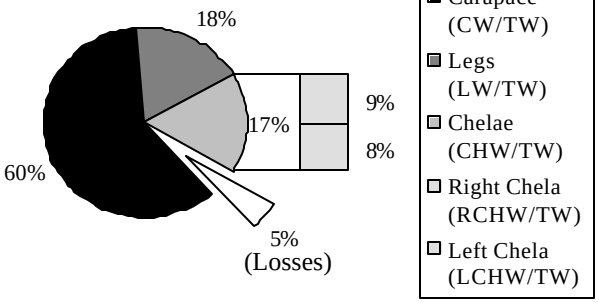
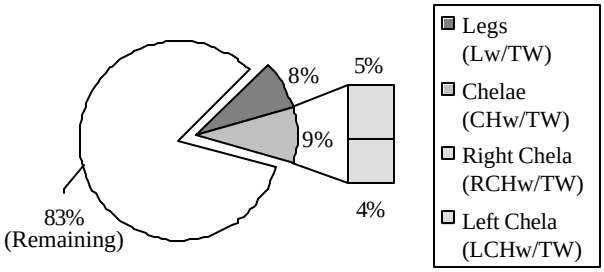


Fig. 1. Schematic representation of the body parts separation and measurements made on *Chaceon affinis* specimens.



	TW	CLg	CWd
TW	-	r^2 = 0.884 **(P<0.05)**	r^2 = 0.910 **(P<0.05)**
CW	r^2 = 0.936 **(P<0.05)**	r^2 = 0.902 **(P<0.05)**	r^2 = 0.901 **(P<0.05)**
LW	r^2 = 0.891 **(P<0.05)**	r^2 = 0.703 (n.s.)	r^2 = 0.745 (n.s.)
CHW	r^2 = 0.929 **(P<0.05)**	r^2 = 0.745 (n.s.)	r^2 = 0.746 (n.s.)
RCHW	r^2 = 0.895 **(P<0.05)**	r^2 = 0.692 (n.s.)	r^2 = 0.688 (n.s.)
LCHW	r^2 = 0.917 **(P<0.05)**	r^2 = 0.751 (n.s.)	r^2 = 0.753 (n.s.)

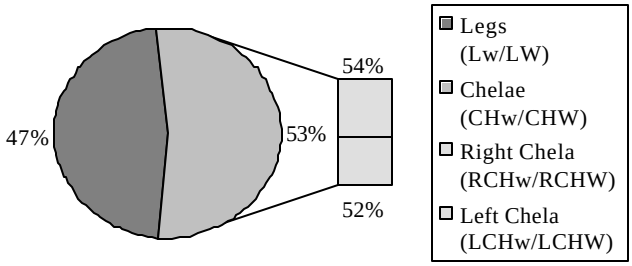
Fig. 2a). Meat yield estimations and morphometric relationships: parts weight / total we ight.



	TW	CLg	CWd	LW
Lw	r^2 = 0.880 **(P<0.05)**	r^2 = 0.687 (n.s.)	r^2 = 0.755 (n.s.)	r^2 = 0.988 **(P<0.05)**

	TW	CLg	CWd	CHW
CHw	r^2 = 0.925 **(P<0.05)**	r^2 = 0.746 (n.s.)	r^2 = 0.750 (n.s.)	r^2 = 0.991 **(P<0.05)**

Fig. 2b). Meat yield estimations and morphometric relationships: parts meat yield / total weight.



	TW	CLg	CWd	RCHLg	RCHWd	RCHW
RCHw	r^2 = 0.897 **(P<0.05)**	r^2 = 0.694 (n.s.)	r^2 = 0.692 (n.s.)	r^2 = 0.924 **(P<0.05)**	r^2 = 0.917 **(P<0.05)**	r^2 = 0.990 **(P<0.05)**

	TW	CLg	CWd	LCHLg	LCHWd	LCHW
LCHw	r^2 = 0.902 **(P<0.05)**	r^2 = 0.751 (n.s.)	r^2 = 0.756 (n.s.)	r^2 = 0.939 **(P<0.05)**	r^2 = 0.941 **(P<0.05)**	r^2 = 0.989 **(P<0.05)**

Fig. 2c). Meat yield estimations and morphometric relationships: parts meat yield / parts weight.