ORIGINAL RESEARCH

Nutritional characterization of *Trachurus lathami* discarded by the Argentine fishing industry: first step towards the sustainable valorization of the species

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ABSTRACT. In the Argentine Continental Shelf pelagic fisheries, rough scad (*Trachurus lathami*) is incidentally caught, being discarded by the commercial fleet despite its high abundances. With the aim of promoting the sustainable use of this species, the nutritional characterization of *T. lathami* is reported here for the first time. High protein (16%) and lipid (5.4%) content in whole individuals indicated that this is a moderately fat species. In the edible portion, within total lipids (4.8%), the n-3 polyunsaturated fraction was represented by docosahexaenoic (16.8%) and eicosapentaenoic (5.6%) acids. Results encourage potential strategies towards the developing of restructured products for human consumption.

Key words: Fish discards valorization, nutritional quality, fatty acids, DHA, EPA.

Caracterización nutricional de *Trachurus lathami* descartada por la industria pesquera argentina: primer paso hacia la valorización sustentable de la especie

RESUMEN. En las pesquerías pelágicas del Talud Continental Argentino, el jurel (*Trachurus lathami*) es capturado incidentalmente, siendo descartado por la flota comercial a pesar de sus altas abundancias. Con el objetivo de promover el uso sostenible de esta especie, se reporta aquí por primera vez la caracterización nutricional de *T. lathami*. El alto contenido de proteínas (16%) y lípidos (5.4%) en individuos enteros indicó que esta es una especie moderadamente grasa. En la porción comestible, dentro de los lípidos totales (4.8%), la fracción poliinsaturada n-3 estuvo representada por los ácidos docosahexaenoico (16.8%) y eicosapentaenoico (5.6%). Los resultados alientan estrategias potenciales hacia el desarrollo de productos reestructurados para consumo humano.

Palabras clave: Valorización del descarte de peces, calidad nutricional, ácidos grasos, DHA, EPA.

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INTRODUCTION

Historically, the fishing industry in the Argentinean Continental Shelf (SWAO) has been based on the commercialization of a limited group of marine species such as Argentine hake (*Merluccius hubbsi*), red shrimp (*Pleoticus muelleri*), Argentine squid (*Illex argentinus*) and anchovy (*Engraulis anchoita*) among the most important, with total annual landings between 700,000 and 800,000 t (Subsecretaría de Pesca y Acuicultura Argentina 2023). In this context, the use of species without commercial value caught by different fishing fleets and discarded on board could become an important initiative for the growth of the sector. In this sense, Blanco et al. (2018) described three reasons why discarding occurs: (a) fish species of low commercial value, (b) fish under minimum reference sizes for conservation of the species, and (c) fish catches above the allowed quota. However, most of those discarded specimens possess good nutritional value (high-quality proteins, fats and minerals, among others) and significant amounts of bioactive compounds.

One of the most challenging aspects is the need to develop different alternatives for valorization of those discarded species. In recent years, a new generation of seafoods called 'restructured products' has been developed. Restructured seafood products are made from minced and/or chopped muscle, used with or without additional ingredients or additives, to make other products with a new appearance, texture or flavor (Moreno et al. 2014). The raw material used for the elaboration of restructured products must be of high quality and preserved in optimal conditions throughout the reconstitution process. Fish are extremely perishable food, subject to multifaceted spoilage processes. These processes include physical, chemical and microbiological mechanisms, which are related to color changes, texture collapse, protein deterioration, lipid oxidation and microbial spoilage (Moreno et al. 2014).

Chemical spoilage also plays an important role in indicating fish freshness degree. The value of total volatile basic nitrogen (TVB-N) is one of the most important chemical indicators commonly used for evaluation of fish protein degradation during cold storage (Castro et al. 2006). Other indicators of fish quality include thiobarbituric acid reactive substances (TBARS) index, normally used to determine the secondary oxidative products for interpreting further lipid oxidation degree and malondialdehyde (MDA), mostly used as an indicator of oxidative damage in biological samples and muscle foods (Wu et al. 2022).

Not only the quality of fish but also its nutritional composition has gained relevance in recent years, since fishery products can meet the protein needs of consumers. A particular attraction of seafood products is their fatty acids composition, which varies greatly according to the species, the total fat content, the geographical location of waters they inhabit, environmental conditions and the composition of their food. Marine fish species are usually characterized by high levels of polyunsaturated fatty acids (PUFAs), especially eicosapentaenoic (EPA, 20:5n-3) and docosahexaenoic (DHA, 22:6n-3) acids, which make them a promising source for the supplementation of these nutrients (Zhang et al. 2020). In this sense, EPA and DHA play important roles in the prevention of cardiovascular, inflammatory and autoimmune diseases as well as other diseases (Chen et al. 2022; Sugasini et al. 2023).

Trachurus lathami is a pelagic-coastal species that is distributed in Atlantic waters from 43° N (United States) to 41° S (Argentina), including the Caribbean Sea and the Gulf of Mexico, at depths between 50 and 100 m (Cousseau and Perrota 2013). This species is caught as bycatch mainly during the spring in Buenos Aires coastal waters (34° S-42° S, 62° W-52° W), together with pelagic species of important commercial value, such as *E. anchoita* and the Atlantic chub mackerel, *Scomber colias* (Flaminio et al. 2017; Riestra and Ruarte 2017; Orlando et al. 2018; Garciarena 2022). Although specimens are discarded when collected in significant quantities, they could be landed with the target species (Orlando et al. 2018). In terms of commercial exploitation, only a small-scale activity occurs upon rough scad mainly in Brazil (Ruas and Vaz-dos-Santos 2017), while in Chile and Peru, species of the genus (*T. murphyi*) are commercialized on a large scale as raw material for the canning industry, as well as fillet or smoked (Bórquez et al. 1994). *Trachurus lathami* is currently underutilized by the Argentine fishing industry, despite recent studies showing sustained increases in its abundances since the mid-1990s (Orlando et al. 2018). Therefore, the study of the nutritional composition of whole individuals, edible portion (trunk) and waste generated during evisceration (head and viscera), is crucial to explore the potential development of new products from this species.

Despite the relevance of characterizing underexploited fishing species for their potential incorporation into the human diet in the form of canning, smoking and restructured products, to date nutritional information about rough scad is scarce. In this context, the main objectives of this work were to (a) determine the proximal composition and fatty acids composition of whole specimens, trunk, and residue of *T. lathami*, and (b) evaluate quality parameters of the species. It is expected that results will contribute with novel information for the potential development of innovative seafood products from rough scad, species currently discarded by the Argentine fleet.

MATERIALS AND METHODS

Sample collection

Rough scad specimens were captured during a research cruise from the Instituto Nacional de Investigación y Desarrollo Pesquero (INIDEP), carried out onboard of the RV 'Victor Angelescu' in October 2018, operating off the Buenos Aires Province coast (34° S-42° S, 62° W-52° W), until 100 m depth. Specifically, fishes were collected as part of stock assessment surveys carried out by INIDEP, using a bottom trawling net. Fish died during the capture. Fish were stored in vacuum sealed plastic bags at -18 °C until laboratory analyses.

Morphometric parameters

For each specimen (n = 15), total length (from the front end of the snout to the end of the tail fin; cm) was measured with an ichthyometer, while total weight (g) was recorded with a Mettler PK electric scale 4,800 (precision 0.01 g). Then, dissection of the head and viscera (residues) was carried out, and its total weight (g) was determined. Finally, trunk length (from gill opening to tail fin –cm) and weight (g) were registered. This is mainly made up of muscle and vertebral column. The ratio of trunk weight/total weight × 100 was used as an indicator of the yield of the portion intended for human consumption (edible portion).

Proximal and fatty acid analyses

Analyses were made on whole specimens, trunk and residue (n = 3 in each case) in duplicate following AOAC (1995). To determine humidity, 10 g of sample were dried in a vacuum oven at 105 ± 5 °C until reaching a constant weight. Ashes were determined using 2 g of sample that were weighed in porcelain capsules and charred on a lighter to burn all the organic matter in a controlled way. Then, they were calcined in a muffle at 550 °C until obtaining gray-white ashes. The ash content was expressed as a percentage (g of ash in 100 g of product). Proteins were determined by the Kjeldahl method. Samples were mineralized in a digesting equipment (DK20, Velp, Italy) coupled to a scrubber-neutralizer (SMS Scrubber, Velp, Italy), using 6.25 as nitrogen-to-protein conversion factor. Results were expressed as a percentage (g of total protein in 100 g of product). Lipids were determined according to Bligh and Dyer (1959) and their content was expressed as a percentage (g of total lipids in 100 g of product).

The fatty acid profile was determined from the extracted lipids, only for the trunk (edible portion). Previously, methylation was performed according to ISO 12966-2 (ISO 2017) with slight modifications. Briefly, fatty acid methyl esters were separated and identified on a gas chromatograph (Shimadzu® GC-2010) equipped with an automatic injector (Shimadzu® AOC-20i) in split mode (T° = 250 °C; split rate = 5.0), a Omegawax Supelco® 320 fused silica capillary column

(30 m long, 0.32 mm internal diameter, 0.25 μm thick stationary phase film), and a flame ionization detector (T° = 250 °C). To identify fatty acids, commercial standards (AccuStandard® FAMQ-005 + Supelco® PUFA 1 Marine Source) were used. Chromatograms resulting from each run were analyzed with the GC-solution software. Results were expressed qualitatively as a percentage of the area of each peak in the chromatogram in relation to the sum of areas of all the fatty acids detected.

Total volatile basic nitrogen and lipids oxidation

Total volatile basic nitrogen (TVB-N) was determined through the EC reference method (EU 1995). The lipid oxidation was evaluated through the thiobarbituric acid reactive substances (TBARS) methodology (Tironi et al. 2007). Results were expressed as mg of malonaldehyde (MDA) per kg of sample.

Statistical analysis

Data analyses were performed using Infostat Software Package (Infostat 2008). One-way analysis of variance (ANOVA) was carried out to compare percentages of humidity, ash, proteins and lipids, as well as TVB-N and MDA levels between whole specimens, trunk and residue. *Post-hoc* differences between pairs of means were evaluated by the Tukey test using a 95% confidence interval.

RESULTS AND DISCUSSION

Morphometric parameters

Whole rough scad specimens had an average length of 15.9 ± 0.5 cm and a total weight of 35.8 ± 3.7 g, while trunks (gutted and headless fish) showed values of 12.4 ± 0.8 cm and 25.1 ± 3.6 g, respectively. Hence, *T. lathami* captured in coastal waters of Buenos Aires Province can be described as a small-sized species. Dividing the fish into adults (13-15 cm) and juveniles (< 13 cm) after Cousseau and Perrota (2013), it was observed that specimens captured in this study corresponded to adults. Similar morphometrics were also observed in horse mackerel *T. trachurus* from the northeastern Mediterranean Sea (Celik 2008), with average total length and weight of 17.42 ± 1.68 cm and 47.63 ± 11.41 g, respectively. Studies on jack mackerel *T. symmetricus murphyi*, one of the most important pelagic resources in the southeastern Pacific Ocean, reported lengths of 20-25 cm and weights of 200-300 g (Aranda et al. 2006), as well as a wider size range going from 21.6 cm to 39 cm in the coasts of Peru (Andrianov 1985). However, for *T. trachurus* caught in the central Tyrrhenian Sea (Italy), Passi et al. (2002) reported a similar total length as in this study (22.5 ± 2.1 cm) but heavier weights (123.7 ± 19.5 g). This same pattern was observed in the southern Adriatic coast of Italy (23.9 ± 3.6 cm and 116.23 ± 48.19 g, respectively) (Orban et al. 2011). Interestingly, these authors investigated nutritional properties of *T. trachurus* along different seasons, and found non-significant differences in length and weight.

On the other hand, the residue had an average weight of 10.7 ± 1.9 g. It is usually discarded, even though it can represent up to 30% of the total weight of specimens, being a rich source of lipids, proteins and other compounds with potential commercial interest. Results regarding the yield of the portion intended for human consumption (trunk; 68.3 ± 2.6%) agreed with Orban et al. (2011) who showed similar results for *T. trachurus* and reported a yield of the edible portion of 62.42 ± 0.77% in spring. Since species with the highest meat yield (trunk) are the most attractive from a commercial point of view, knowing this value is crucial.

Nutritional quality

Proximal analyses of whole specimens, trunk and residue of rough scad showed that the most abundant macronutrient was protein, followed by lipids and ash ($p < 0.05$) (Table 1). In the residue, lipids and ash presented similar levels ($p > 0.05$). These results were expected based on the basic nutrient compositions commonly found in fish species, which generally include 72% of water, 19% of protein, and 8% of lipids, as well as smaller amounts of ash, carbohydrates, vitamins, and minerals (Tawfik 2009).

Regarding humidity, an average value of 75% was observed in whole specimens and trunk. This is similar with those reported in other fish species (Tawfik 2009), including other *Trachurus* species. For instance, moisture content ranging from 75-81% has been reported in the horse mackerel *T. trachurus* (Aubourg and Ugliano 2002; Aubourg et al. 2002; Losada et al. 2005; Celik 2008). In the edible portion, results agreed with those obtained by Orban et al. (2011) in spring, with reported values of 79% in fillet. On the contrary, in the residue, a reduction in the percentage of humidity was observed with respect to whole specimens and trunk, which could be due to a loss of liquid during evisceration and a higher content of bone tissue (Table 1).

Ash content varied between 2.9% (trunk) and 4.8% (head). The latter could be related to the high amount of bone tissue present in the head of specimens. However, Celik (2008) and Orban et al. (2011) reported values of 1.35% and 1.38% of ashes in *T. trachurus*, respectively. The high content of ashes reported in this work might be connected with the separation of the head and the trunk that was done manually.

With respect to protein content, the average percentage in whole individuals was 16.6% (Table 1), indicating that rough scad can be considered as a food of high nutritional value. In contrast, after evisceration, a decrease in protein content was observed ($p < 0.05$) with a value of 12.7%. This result is lower than previously observed in the muscle of *T. trachurus*. In this sense, Celik (2008) and Orban et al. (2011) reported protein contents of 20.1 and 18.9%, respectively. Bandarra et al. (2001) reached similar results and reported a protein content of 18.3-19.9% in *T. trachurus*. Moreover, the content of protein in muscle of jack mackerel *T. symmetricus murphyi* was 17-19% (Aranda et al. 2006). Although *T. lathami* exhibited lower protein values compared to *T. trachurus* and *T. symmetricus murphyi*, it can be considered a significant source of protein. We estimated, on average, that a 150 g edible portion of rough scad would provide approximately 35% of the recommended daily protein intake for a 70 kg adult (FAO 2012).

On the other hand, lipids presented a value of 5.4% in whole individuals (Table 1). This indicates that *T. lathami* is a moderately fat or semi-fat species (4-8 g 100 g^{-1}), according to the classification of Özden (2010). Similarly, a fat content of 4-5% was reported for *T. murphyi*, also considered moderately fatty species (Aranda et al. 2006). Moreover, these were similar to values published for *T. trachurus* (Bandarra et al. 2001) and *T. japonicus* (Osako et al. 2002; Kim et al. 2016). However, similar studies reported lower content of lipids.

Table 1. Proximate composition (humidity, ash, lipids and proteins; mean percentage ± standard deviation) of whole specimens, trunk (muscle + vertebral column and vertebrae) and residue (head + viscera) of rough scad *Trachurus lathami*. ANOVA: within a row, values not sharing the same superscript letter are significantly different ($p < 0.05$).

	Whole specimens	Trunk	Residue
Humidity	75.08 ± 0.33^{a}	75.41 ± 0.32^{a}	73.10 ± 0.33^{b}
Ash	3.15 ± 0.21^{b}	2.88 ± 0.12^{b}	4.83 ± 0.16^{a}
Lipids	5.41 ± 0.90^{b}	4.80 ± 0.22^{b}	6.80 ± 0.10^{a}
Proteins	16.60 ± 0.29^{a}	12.66 ± 0.23^{b}	15.40 ± 0.35^{ab}

Celik (2008) and Orban et al. (2011) reported percentages of 2.03 and 1.42% in spring, respectively. Moreover, Aubourg and Ugliano (2002) found 1.58%, Losada et al. (2005) reported 1.2-3.7%, and Aubourg et al. (2002) estimated 0.6-2% content of lipids for horse mackerel. Observed differences could be resulted from seasonal influences, geographic region and differences in the maturity level of fish (Celik 2008). At last, it should be mentioned that the rough scad residue exhibited high lipid percentages ($p < 0.05$), probably related to viscera content, highlighting its technological potentiality for the extraction of fatty compounds of commercial interest. This residue is a good example of a 'nutraceutical' food because it is an important source of nutraceutical products such as fish oil.

Finally, various studies propose that there are several fundamental factors to consider in the development of restructured products, including their quality, which will be a determinant of their gelling capacity and color, and their yield. In this sense, these factors are decisively influenced by the quality of the raw material (Moreno et al. 2014). From results, it can be suggested that the rough scad and related *Trachurus* species, currently being discarded by the fishing industries in Argentina and worldwide, can be used as a raw material for the manufacture of various restructured products. Fish species with a similar nutritional composition to that reported here for rough scad have been previously analyzed as raw material for the preparation of different ready-to-cook products from muscle. For instance, Moreno et al. (2009) studied two different cold restructuring processes in hake (*Merluccius capensis*) muscle, with addition of microbial transglutaminase, while Blanco et al. (2018) evaluated three types of products (burgers, nuggets and structured fingers), chosen as examples of different manufacturing procedures. In both cases, it is evident the valorization of fish muscle proteins from high quality discarded species that presented protein content considered suitable for the preparation of different seafood products, with enhanced added value in comparison to the traditional preparation of fish meal. This type of studies set the basis for the future development of *T. lathami* restructured products.

Fatty acids composition

In the qualitative profile of the trunk, saturated fatty acids (ΣSFA) predominated, followed by polyunsaturated (ΣPUFA) and monounsaturated (ΣMUFA) (Table 2). These proportions have been previously observed in many fish species (Zhang et al. 2020).

However, for *T. trachurus*, predominance of fatty acids fractions exhibited some variability. For instance, Passi et al. (2002) and Celik (2008) found that ΣSFA > ΣMUFA > ΣPUFA, while Bandarra et al. (2001) and Orban et al. (2011) observed that ΣPUFA > ΣSFA > ΣMUFA. These variations are commonly found in studies conducted on marine species in different parts of the world, and can be associated with seasonal changes, species, sex, size, food availability, geographical location, reproductive status, water temperature and salinity (Zhang et al. 2020).

Saturated fatty acids

Within SFAs, palmitic acid (16:0) was the most abundant, contributing approximately to 55% of the total saturated fraction. This result is in agreement with previous studies in *T. trachurus* (Passi et al. 2002; Celik 2008; Orban et al. 2011) and *T. symmetricus murphyi* (Aranda et al. 2006), as well as in other marine fish species from several regions (Zhang et al. 2020). Human consumption of SFAs is generally associated with a high risk of coronary heart disease and increasing LDL-cholesterol (Santos et al. 2013). In a comparative study, Zhang et al. (2020) pointed out that fish species with lower SFAs proportions (33%) would be healthier than those with higher amounts of SFAs (48%). These reference values indicate that consumption of *T. lathami* can be consider to be healthy, provided its relatively low SFA content (39%).

Table 2. Qualitative profile of fatty acids (means percentage of area (%) ± standard deviation) in the trunk (muscle + vertebral column and vertebrae) of rough scad *Trachurus lathami*. c: cis, t: trans. SFA: saturated fatty acids; MUFA: monounsaturated fatty acids; PUFA: polyunsaturated fatty acids.

Fatty acid	%area
14:0	5.12 ± 0.22
15:0	0.63 ± 0.02
16:0	21.5 ± 0.79
17:0	0.22 ± 0.04
18:0	5.40 ± 0.47
20:0	0.41 ± 0.02
22:0	5.41 ± 0.61
23:0	0.13 ± 0.02
24:0	0.09 ± 0.03
ΣSFA	38.9 ± 1.3
14:1	0.22 ± 0.01
15:1	0.06 ± 0.005
16:1	4.50 ± 0.18
17:1	0.16 ± 0.00
18:1n9c+t	9.92 ± 0.46
18:1n7	1.65 ± 0.10
20:1n9	2.62 ± 0.15
22:1n11	0.50 ± 0.12
22:1n9	0.13 ± 0.03
ΣMUFA	19.8 ± 0.7
18:2n6c+t	1.10 ± 0.03
18:3n6	0.08 ± 0.003
18:3n3	0.66 ± 0.05
18:4n3	1.20 ± 0.16
20:2n6	0.18 ± 0.01
20:3n6	0.09 ± 0.01
20:4n6	0.55 ± 0.06
20:3n3	0.55 ± 0.05
20:5n3	5.60 ± 0.92
22:2	0.22 ± 0.04
22:5n3	1.51 ± 0.16

Table 2. Continued.

Fatty acid	%area
22:6n3	16.79 ± 2.61
ΣPUFA	28.6 ± 3.8
Σn-3	26.4 ± 3.7
Σn-6	2.0 ± 0.1

Monounsaturated fatty acids

With respect to MUFAs, Zhang et al. (2020) showed that the percentages of total lipids in fish species vary over a wide range. Moreover, although seasonality was not evaluated in this study, it is known that it might affect MUFA levels (Osako et al. 2002), which is lower in winter and autumn (Celik 2008). However, the amount of MUFAs in *T. lathami* was low compared to that described in other fish (Zhang et al. 2020). The major MUFA was oleic acid (18:1n-9c+t) (Table 2). Predominance of oleic acid was also observed for *T. trachurus* (Passi et al. 2002; Celik 2008; Orban et al. 2011) and *T. symmetricus murphyi* (Aranda et al. 2006).

Polyunsaturated fatty acids

The proportion of PUFAs in rough scad (29%) was higher than other fish species. In this sense, Zhang et al. (2020) described that the proportion of PUFAs found in fish species ranged from 10.3% to 28.4%. This result is very interesting, given that a high PUFA content makes the species nutritionally and technologically attractive in the medium term future for the development of new foods. Moreover, it should also be highlighted that, within the polyunsaturated fraction, the percentage of n-3 PUFAs (Σn-3) was 26.4 with respect to total fatty acids, with average percentages of DHA (22:6n3) and EPA (20:5n3) of 16.8 and 5.6, respectively. This result is connected with the storage of these lipids in the muscle, as opposed to lean fish that store lipids in the liver and, therefore, contain less EPA and DHA (Wall et al. 2010). In addition, the predominance of DHA is proposed as a consequence of the type of food available (crustaceans, mollusks, and small fish) to *T. trachurus* (Bandarra et al. 2001). Accordingly, *T. lathami* showed predominance of n-3 (26.4%) over n-6 PUFAs (2%), with the n-3/n-6 PUFA ratio being 13.2. The high n-3/n-6 PUFA ratio that characterizes the lipid fraction of the species is an element of nutritional relevance as well as an index of the lipid quality (Zhang et al. 2020). Therefore, the present study indicates that *T. lathami* is appropriate in terms of n-3⁄n-6. An increase in the human dietary n-3⁄n-6 fatty acid ratio is essential to help prevent coronary heart disease by reducing plasma lipids (Chen et al. 2022). In the last decades, EPA and DHA have received a lot of attention from the scientific and medical community, since they provide numerous benefits in the prevention and modulation of cardiovascular and inflammatory processes, among other diseases (Chen et al. 2022; Sugasini et al. 2023).

Hygienic-sanitary quality

Total volatile basic nitrogen values were low in all the samples analyzed (Table 3), below the limit established by different legislations (30 mg of TVB-N in 100 g of fish; EU 1995). Similar results were obtained in whole jack mackerel *T. murphyi* (Bórquez et al. 1994; Aranda et al. 2006). Moreover, trunk showed the lowest TVB-N ($p < 0.05$) compared with the residue, because the head and viscera deteriorate faster owing to greater exposure and development of bacteria. This index is important because it reflects the loss of freshness of the fish in relatively advanced stages of deterioration. On the other hand, the lipid oxidation values in all the samples (whole specimens, trunk and residue) were less than 2 mg MDA kg^{-1}, value considered as a threshold of sensory acceptability regarding lipid oxidation (Chow 2000). The lower oxidation value was observed in the trunk ($p < 0.05$), which could be due to a decrease in the content of digestive enzymes when eviscerated. It should be noted that specimens of rough scad analyzed, despite exhibiting moderate percentages of lipids (Table 1), showed low oxidation levels. These results evidence a good management in the hygienic-sanitary quality of samples from the moment of fishing to the analysis. Particularly, control of the storage temperature is usually a critical factor, since it favors the development of spoilage bacteria and the occurrence of autoxidative processes of fatty acids in lipid raw materials (Wu et al. 2022).

CONCLUSIONS

Results on the nutritional characterization of *T. lathami* in the Argentine Continental Shelf, indicate that this is a moderately fat species with predominance of omega-3 polyunsaturated fatty acids (EPA

Table 3. Total volatile basic nitrogen (TVB-N mean percentage ± standard deviation) and content of malondialdehyde (MDA; mean mg kg^{-1} of sample ± standard deviation) in whole specimens, trunk (muscle + vertebral column and vertebrae) and residue (heads + viscera) of rough scad *Trachurus lathami*. ANOVA: within a row, values not sharing the same superscript letter are significantly different ($p < 0.05$).

	Whole specimens	Trunk	Residue
TVB-N	24.92 ± 0.33^{b}	27.77 ± 0.33^{a}	24.33 ± 0.27^{b}
MDA	1.00 ± 0.08^{ab}	0.71 ± 0.04^{b}	1.11 ± 0.06^{a}

and DHA). In recent years, both fatty acids have received a lot of attention from the medical community, provided their numerous benefits in the prevention and modulation of cardiovascular diseases and inflammatory processes, among others. In this sense, development of products based on *T. lathami* raw material might be beneficial for individuals with specific nutritional requirements. The use of this species will be relevant, not only from the nutritional and health point of view, but also economic, since the development of new fishery products with little commercial value can increase current commercial offers and promote new national and international markets. In this sense, and based on the information gathered here, our next step includes the development of restructured products from rough scad by adding antioxidant compounds that will enhance its value as a functional food.

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Conflict of interest

The authors declare that there is no conflict of interest and that the research meets the required ethical guidelines.

Author contributions

Francesca M. Mitton: conceptualization, data curation, formal analysis, funding acquisition, investigation, writing-original draft. Marina Vittone: methodology. Brenda Temperoni: methodology, writing-review and editing. Agueda E. Massa: conceptualization, supervision, conceived, funding acquisition, writing-review and editing.

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