Feeding of Atlantic bluefin tuna *Thunnus thynnus* around the Canary Islands assessed from stomach content and stable isotope analyses

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ABSTRACT: The Canary archipelago, which is part of the Atlantic biogeographical region of Macaronesia, provides suitable habitat for tropical and temperate-water large pelagic species. Atlantic bluefin tuna (ABFT) *Thunnus thynnus* occur year round in the Canary Islands. Life history traits of ABFT, specifically foraging patterns, have not been studied thus far in this region. We investigated ABFT trophic biology, combining stomach content and stable isotope analyses. A high proportion (~77%) of the stomachs contained prey, indicating active foraging. The diet primarily consisted of fishes, among which the snipefish *Macroramphosus* sp. was the major prey. Cephalopods and crustaceans were less important diet components. Moreover, a well-preserved specimen of Cory's shearwater *Calonectris borealis* was found in a stomach sampled in 2018. Besides natural prey, 16.7% of the stomachs contained plastic debris. Inter-annual isotopic differences were detected in liver tissue samples, reflecting a dietary shift in 2018, where δ^{15}N values were lower than in 2016 and 2017. Isotopic niche width estimations from stable isotope Bayesian ellipse in R and kernel utilization density analyses suggested a more diverse diet in 2017. Corrected and Bayesian standard ellipse area values from muscle and liver data indicated that the diet of ABFT in the Canary Islands is more euryphagous than in the Strait of Gibraltar (East Atlantic) but more stenophagous than it is in the Gulf of Saint Lawrence (West Atlantic). The present results show that the Canary archipelago represents a foraging ground for ABFT in spring.

KEY WORDS: Scombridae · Trophic biology · Gut contents · Stable isotopes · Stable isotope Bayesian ellipse in R · SIBER · Kernel utilization density · KUD · Plastic debris

1. INTRODUCTION

The Canary Islands are located in the Atlantic biogeographical region of Macaronesia, which also includes the archipelagos of the Azores, Madeira, Savage Islands and Cape Verde (Masseti 2010). The Canary archipelago lies in a transition zone between cool, nutrient-rich waters of the coastal upwelling regime and warmer, oligotrophic waters from the open ocean (Barton et al. 1998). These oceanographic features make the area a suitable habitat for the coexistence of both tropical and temperate-water tunas, which are traditionally exploited by local fisheries (Delgado de Molina 2020).

The Atlantic bluefin tuna (ABFT) *Thunnus thynnus* is one of the most profitable commercial fish species worldwide, and has been subjected to strong fishing pressure in the East Atlantic Ocean and the Medi-

terranean Sea (Fromentin & Powers 2005). Historical catch records show that ABFT occur year round in the Canary Islands, with the exception of the spawning season (June–July), when catches are anecdotal (Delgado de Molina et al. 2014). By contrast, ABFT seem to be most abundant in this Atlantic region during the months preceding the spawning migration (February–April). These observations are supported by electronic tag data, which have documented the occurrence of ABFT around the Canary archipelago over winter and spring months (Block et al. 2005, Horton et al. 2020).

Traditional studies on the trophic biology of ABFT are based on stomach content analysis (SCA), which provides information on prey consumed hours before capture (Estrada et al. 2005, Logan et al. 2011). Stable isotope analysis (SIA) proves useful to complement gut analyses, as it gives an integrated measure of the assimilated prey at different time scales, depending on the tissue analyzed. Thus, tissues with fast turnover rates (e.g. liver) provide information about the trophic ecology of organisms over days to weeks, whereas tissues with slow turnover rate (e.g. muscle) integrate information from several months to a year (Graham et al. 2010, Madigan et al. 2012). Overall, stable carbon ratios ($\delta^{13}C$) are useful to trace sources of organic matter into food webs (DeNiro & Epstein 1978, Peterson & Fry 1987, Fry 2006), whereas nitrogen stable isotope ratios ($\delta^{15}N$) are often used to estimate the trophic position of consumers (DeNiro & Epstein 1981, Minagawa & Wada 1984, Post 2002).

ABFT feeding habits have been widely studied in the North Atlantic Ocean and Mediterranean Sea (Crane 1936, Karakulak et al. 2009, Butler et al. 2010, Logan et al. 2011, Battaglia et al. 2013, Medina et al. 2015, Olafsdottir et al. 2016, Sorell et al. 2017, Varela et al. 2014, 2019). Previous studies concluded that ABFT feed on a wide variety of pelagic and mesopelagic prey including fish, cephalopods and crustaceans. However, little is known about ABFT feeding habits in the Canary Islands (Mourente et al. 2015, Druon et al. 2016). Based on fatty acid analysis, Mourente et al. (2015) suggested that ABFT feed actively during their stay in the Canary Islands. Druon et al. (2016) predicted this area to be an unfavorable feeding habitat in summer (July–September). The present study was conducted to assess the potential use of Canarian waters as a foraging habitat for ABFT in spring. Furthermore, we aimed to identify feeding patterns of ABFT around the Canary Islands by combining SCA and SIA.

2. MATERIALS AND METHODS

2.1. Sampling and SCA

ABFT (n = 114) were caught by baitboat in Canarian waters (Fig. 1) in March 2016–2018. The fish were measured to the nearest cm (straight fork length, SFL) (Table 1). Stomachs and small pieces of liver and muscle taken from the head were collected from each individual. The samples were preserved at −20°C.

After thawing, stomachs were dissected and prey items were identified to the lowest possible taxon. They were then grouped into taxonomic categories and their wet weight was recorded to the nearest 0.01 g. Partially digested prey were identified to the level of species from hard part morphology, either fish otoliths (Härkönen 1986, Campana 2004) or cephalopod beaks (Clarke 1986).

2.2. SIA

A total of 104 muscle and liver samples were thawed and rinsed with distilled water. All samples were then freeze-dried and ground with mortar and pestle. Each sample was then divided into 2 subsamples. One subsample was analyzed for $\delta^{15}N$, whereas the other was lipid-extracted prior to $\delta^{13}C$ analysis (Varela et al. 2012, 2013). Bulk and lipid-extracted samples (0.9–1.1 mg) were placed in tin capsules and analyzed through a gas flow system using a Thermo Finnigan Flash EA1112 elemental analyzer coupled to a Thermo Finnigan Delta Plus isotope ratio mass spectrometer (Varela et al. 2015). All carbon and nitrogen isotope data are reported in δ notation according to the following equation: $\delta X = [(R_{sample}/R_{standard}) − 1] \times 1000$, where X is ^{13}C or ^{15}N and R is the ratio $^{13}C/^{12}C$ or $^{15}N/^{14}N$ (Peterson & Fry 1987). Standard materials are Vienna Pee Dee belemnite for carbon and atmospheric N_2 for nitrogen and expressed as parts per thousand (‰) relative to standards (Peterson & Fry 1987). Precision of either C or N isotopic determinations was ±0.15‰.

2.3. Data analysis

The dietary contribution of each prey category was evaluated using 3 indices (Varela et al. 2017a): frequency of occurrence (%O_i = 100 × number of stomachs with prey i / number of stomachs with food), percent by weight (%W_i = weight of prey i / total
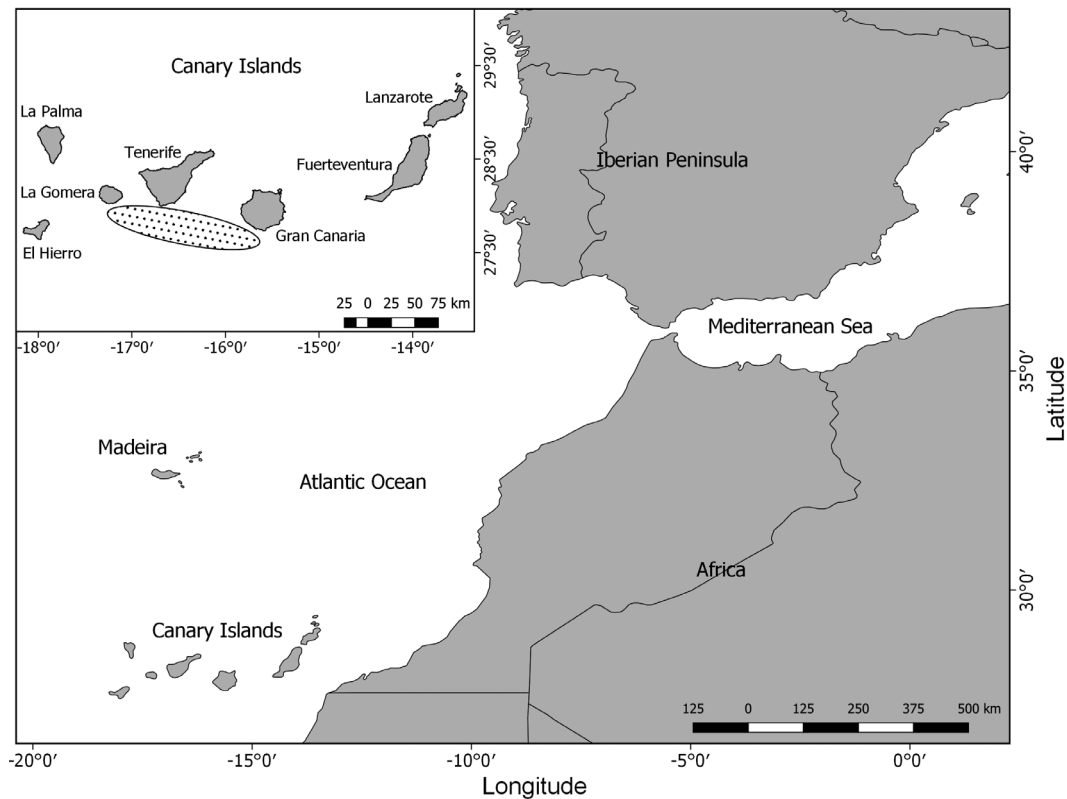
Fig. 1. Sampling area (dotted ellipse) in the Canary Islands where Atlantic bluefin tuna stomach samples were collected

weight of all prey) and alimentary index expressed as a percentage ($\%AI_i = [(\%W_i \times \%O_i) / (\Sigma\%W_i \times \%O_i)] \times 100$) (Kawakami & Vazzoler 1980).

Cumulative prey curves (CPCs) were used to determine if the number of stomachs was enough for ABFT diet description (Ferry & Cailliet 1996). CPCs were generated using the package 'vegan' (Oksanen et al. 2010) in R (R Core Team 2020). To determine whether the curve reached an asymptote, the slope of the straight line drawn from the 4 endpoints was compared to a line of 0 slope (horizontal asymptote) by a *t*-test (Preti et al. 2012).

The consumption rate was estimated from the equation:

$$r = \sum_{i=0}^{I} \frac{\bar{W}_i}{A_i} \qquad (1)$$

where *r* is the estimated feeding rate measured in grams per hour, $\bar{W}_i$ is the mean weight of prey item *i* in the stomach, and A_i is the average time (in hours) required to evacuate the average proportion of prey *i* in the stomach (Olson & Mullen 1986). Here, we used A_i values estimated by Olson & Boggs (1986) for yellowfin tuna *Thunnus albacares*. Considering that *r* represents the consumption rate per hour, and ABFT

feed at day and nighttime (Battaglia et al. 2013, Medina et al. 2015), the daily meal (DM) was estimated as *r* × 24 h. Daily ration (DR), expressed as a percentage, was calculated by dividing DM by the body mass (BM). BM was estimated using the equation: $BM = 0.00003508 \times SFL^{2.87549667}$ (Rodríguez-Marín et al. 2015).

To test for differences in diet composition and stable isotope data among years, we used permutational multivariate analysis of variance (PERMANOVA). 'Year' was considered as a fixed factor with 3 levels (2016, 2017 and 2018). For SCA data, the PERMANOVA was based on a Euclidean distance similarity

Table 1. Data summary of the Atlantic bluefin tuna sampled in this study; n: number of samples

Year	Straight fork length (cm)		n	Stomachs containing prey (%)	Empty stomachs (%)
	Range	Mean ± SD			
2016	202–252	229 ± 12	27	66.7	33.3
2017	197–260	234 ± 11	41	82.9	17.1
2018	211–270	244 ± 13	46	78.3	21.7
Overall	197–270	237 ± 14	114	77.2	22.8

matrix calculated from total prey weight after performing a fourth-root transformation. To test for differences in the isotopic variables, the PERMANOVA was also based on a Euclidean distance similarity matrix after performing log (δ^{15}N) and log (δ^{13}C + 50) transformations (Varela et al. 2020a). Pairwise PERMANOVA was used to test for differences between years. The homogeneity of multivariate dispersion was tested by PERMDISP (Anderson 2006). The multivariate analyses were conducted with the software PRIMER v6.1.13 & PERMANOVA + v1.0.3 statistical package (PRIMER-E).

Isotopic niche widths were estimated by stable isotope Bayesian ellipses in R (SIBER; Jackson et al. 2011), which produces corrected standard ellipse areas (SEA$_C$, containing 40% of the data) in a δ^{13}C–δ^{15}N bi-plot space. Bayesian SEA (SEA$_B$) was also calculated using 10 000 posterior draws. Additionally, the isotopic niche for each year was estimated using an R package for estimating isotopic niche size and overlap (package 'rKIN', Eckrich et al. 2020) via kernel utilization density (KUD, 40% contour), which is less sensitive to extreme values. Both SEA$_C$ overlap and KUD overlap between years were calculated as the proportion of the non-overlapping area, i.e. overlap area divided by the sum of the areas of 2 ellipses minus the overlap area.

3. RESULTS

3.1. SCA

The mean (±SD) SFL of the sampled fish was 237 ± 14 cm (Table 1). CPCs suggested that the stomach sample size was not large enough to describe the diet completely in any of the years and in the overall sample including the 3 years (t-test, p < 0.05) (Fig. 2). These data may be biased because several prey appeared only in 1 stomach. In fact, when prey taxa were ranked by importance, we found that the diet was mainly composed of snipefish (*Macroramphosus* sp.) (%W = 72.6, %O = 73.9 and %AI = 96.3) (Table 2). Of the 114 stomachs analyzed, the percentage of empty stomachs was 22.8% (n = 26), while the remaining 77.2% (n = 88) had at least 1 prey item (Table 1). A total of 17 prey categories were found, belonging to Teleostei (10), Cephalopoda (3), Crustacea (2), Thaliacea (1) and Aves (1). In addition to natural prey, plastic items were also observed in 16.7% (n = 19) of the stomachs. Overall, fishes were the most important prey group in terms of W, O and AI (91.1, 94.3 and 99.8%, respectively), with the other groups being poorly represented. Among the prey species, snipefish was the major dietary component in all years (%AI = 85.16, 98.82 and 89.93 in 2016, 2017 and 2018, respectively) (Table 2). PERMANOVA did not reveal shifts in diet composition among years (p > 0.05). The highest values of DM and DR were found in 2017 (Table 2).

3.2. SIA

Muscle and liver isotopic data (mean ± SD) are shown in Table 3. δ^{15}N values ranged from 10.8 to 14.8‰ for muscle and from 7.9 to 14.4‰ for liver. δ^{13}C varied between −19.9 and −17.6‰ for muscle and between −19.7 and −17.1‰ for liver. PERMANOVA detected inter-annual isotopic differences only in liver tissues (p = 0.001). Pair-wise PERMANOVA comparisons revealed significant differ-
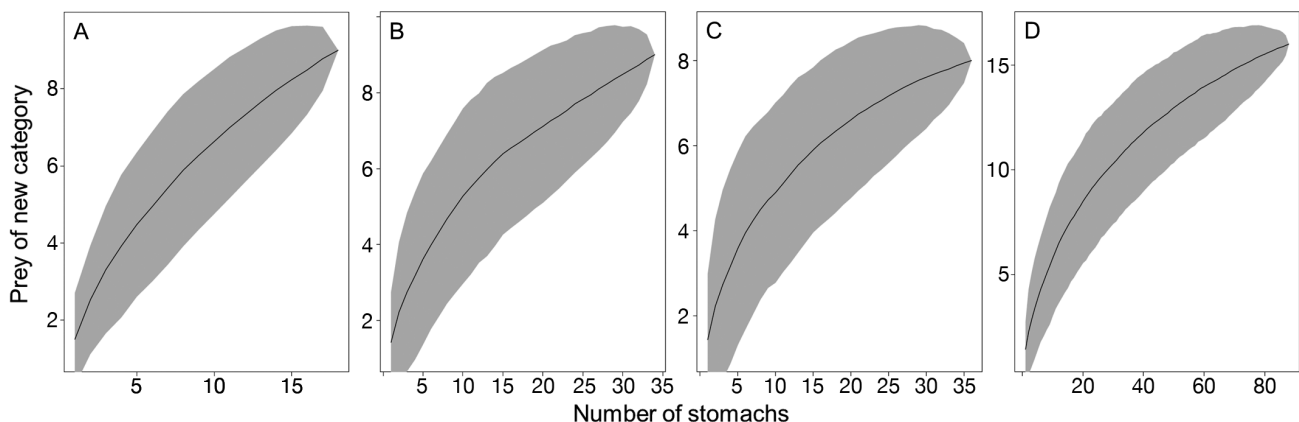

Fig. 2. Cumulative prey curves for Atlantic bluefin tuna stomach samples in (A) 2016, (B) 2017, (C) 2018 and (D) overall stomach sample (all 3 years combined). Grey shading: 95% CI

Table 2. Results of stomach content analysis and consumption rate of Atlantic bluefin tuna sampled in 2016, 2017 and 2018. %W: percent weight; %O: percent occurrence; %AI: alimentary index; DM: daily meal; DR: daily ration; BM: body mass

	2016 %W	2016 %O	2016 %AI	2017 %W	2017 %O	2017 %AI	2018 %W	2018 %O	2018 %AI	Overall %W	Overall %O	Overall %AI
Fishes	**95.49**	**83.33**	**99.37**	**99.68**	**97.06**	**99.95**	**78.77**	**97.22**	**99.23**	**91.1**	**94.3**	**99.83**
Trachurus picturatus	2.28	11.11	0.63	2.27	14.71	0.46	0.79	2.78	0.05	1.7	9.09	0.28
Scomber colias	11.71	33.33	9.74	3.09	14.71	0.63	8.07	25.00	4.50	6.14	22.7	2.50
Macroramphosus sp.	55.82	61.11	85.16	93.78	76.47	98.82	51.82	77.78	89.93	72.6	73.9	96.34
Scomberesox saurus	16.95	5.56	2.35							2.22	1.14	0.05
Sardinella sp.	7.23	5.56	1.00	0.10	2.94	0.00				1	2.27	0.04
Lepidopus caudatus				0.44	2.94	0.02				0.21	1.14	0.00
Lagocephalus sp.							10.61	5.56	1.31	4.09	2.27	0.17
Boops boops							6.34	19.44	2.75	2.44	7.95	0.35
Diretmidae	1.49	11.11	0.41				1.13	5.56	0.14	0.63	4.55	0.05
Unidentified fishes							0.02	2.78	0.00	0.01	1.14	0.00
Cephalopods	**4.01**	**11.11**	**0.56**	**0.00**	**2.94**	**0.00**	**0.04**	**5.56**	**0.00**	**0.54**	**5.68**	**0.04**
Histioteuthis sp.	0.05	5.56	0.01							0.01	1.14	0.00
Unidentified cephalopods	3.95	5.56	0.55	0.00	2.94	0.00				0.52	2.27	0.02
Octopoda							0.04	5.56	0.01	0.02	2.27	0.00
Crustaceans				**0.04**	**8.82**	**0.00**				**0.02**	**5.68**	**0.00**
Decapoda larvae (megalopae)				0.00	2.94	0.00				0	1.14	0.00
Caridea				0.04	5.88	0.00				0.02	2.27	0.00
Thaliaceans	**0.51**	**11.11**	**0.07**	**0.28**	**17.65**	**0.05**				**0.2**	**9.09**	**0.02**
Salpidae	0.51	11.11	0.14	0.28	17.65	0.07				0.2	9.09	0.03
Aves							**21.19**	**2.78**	**0.76**	**8.17**	**1.14**	**0.11**
Calonectris borealis							21.19	2.78	1.31	8.17	1.14	0.17
DM (g d^{-1})		487.21			1284.63			685.54			854.03	
DR (BM d^{-1})		0.23 ± 0.04			0.57 ± 0.10			0.26 ± 0.04			0.37 ± 0.07	

ences between 2016 and 2018 (p = 0.001), and between 2017 and 2018 (p = 0.001). PERMDISP analysis showed no significant differences (p = 0.076), indicating that the differences obtained with PERMANOVA were not due to multivariate dispersion.

The isotopic niche width and overlap estimated from liver and muscle isotopic data by SIBER and KUD methods are shown in Table 4 and in Figs. 3 & 4. The largest niche width was observed in 2017. SIBER and KUD overlap estimated from liver data was evident only between 2016 and 2017. Considerable overlaps were also estimated from muscle data between 2016 and 2018, and between 2017 and 2018.

Table 3. Muscle and liver δ^{15}N and δ^{13}C values (mean ± SD) of Atlantic bluefin tuna sampled in 2016, 2017 and 2018; n: number of samples analyzed per year

		2016 (n = 27)	2017 (n = 41)	2018 (n = 46)
δ^{15}N	Muscle	12.0 ± 0.6	12.4 ± 0.9	12.4 ± 0.8
	Liver	10.3 ± 0.5	10.3 ± 1.1	9.2 ± 0.6
δ^{13}C	Muscle	−18.7 ± 0.4	−18.9 ± 0.4	−18.7 ± 0.4
	Liver	−18.7 ± 0.4	−18.7 ± 0.4	−18.4 ± 0.3

4. DISCUSSION

The proportion of non-empty stomachs found in ABFT from the Canary Islands (77.2%) was similar to that previously reported in North Carolina (78.6%), Gulf of Maine (82.5%), Strait of Gibraltar (SoG) (72.0%), Iceland (85.9%) and Gulf of Saint Lawrence (GSL) (75.4%), which are oceanic regions serving as

Table 4. Isotopic niche widths and overlaps estimated using the corrected standard ellipse area (SEA$_C$, an ellipse that contains 40% of the data regardless of sample size) and kernel utilization density (KUD, 40% contour)

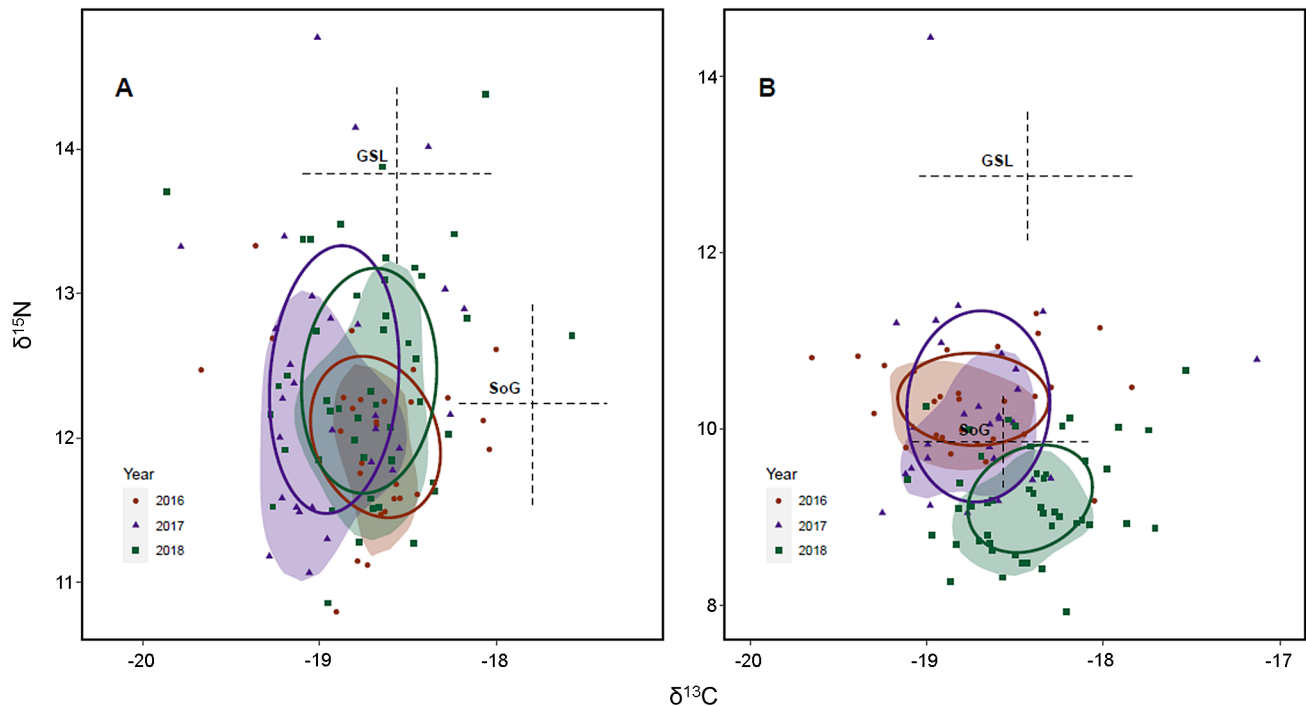| Group	SEA$_C$	KUD	SEA$_C$ overlap	KUD overlap
Muscle				
2016 (1)	0.66	0.45	1 vs 2 (0.26)	1 vs 2 (0.23)
2017 (2)	1.10	1.12	1 vs 3 (0.46)	1 vs 3 (0.41)
2018 (3)	0.95	0.99	2 vs 3 (0.49)	2 vs 3 (0.33)
Liver				
2016 (1)	0.73	0.80	1 vs 2 (0.49)	1 vs 2 (0.49)
2017 (2)	1.43	0.94	1 vs 3 (0.00)	1 vs 3 (0.00)
2018 (3)	0.67	0.77	2 vs 3 (0.07)	2 vs 3 (0.05)

Fig. 3. $\delta^{13}C$ and $\delta^{15}N$ bi-plots of (A) muscle and (B) liver samples of Atlantic bluefin tuna (ABFT) collected in 2016, 2017 and 2018. Isotopic niche widths were estimated using the corrected standard ellipse area (SEA$_C$, an ellipse that contains 40% of the data regardless of sample size; unfilled ellipses) and kernel utilization density (KUD, 40% contour; shaded areas). Also depicted are the $\delta^{13}C$ and $\delta^{15}N$ values (mean ± SD) previously reported by Varela et al. (2020a,b) for ABFT caught in the Strait of Gibraltar (SoG) and Gulf of Saint Lawrence (GSL)
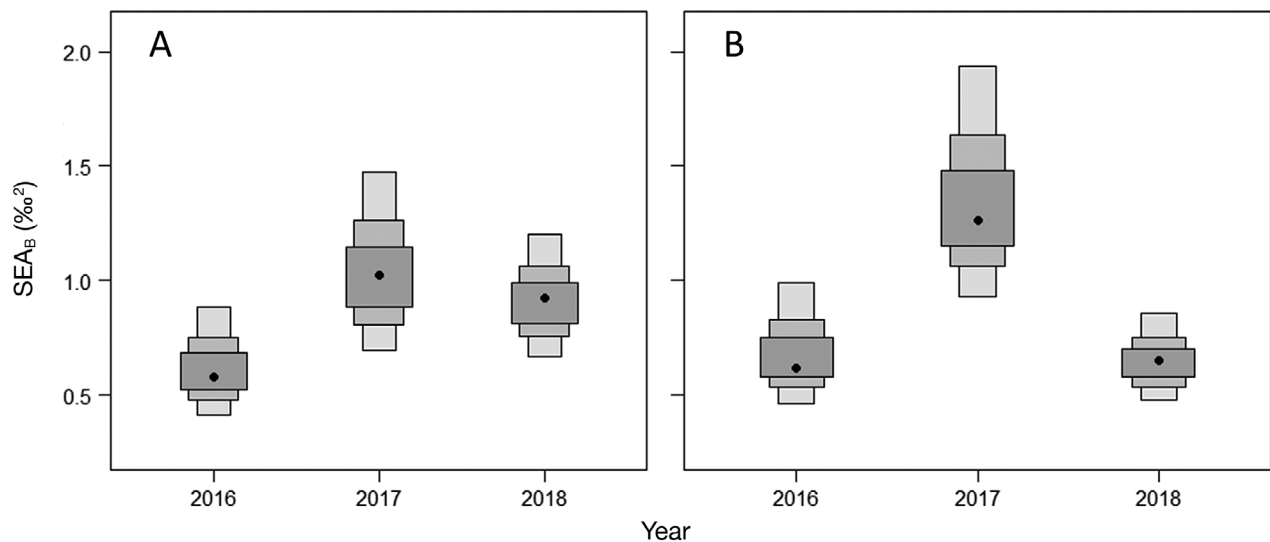
Fig. 4. Bayesian standard ellipse area (SEA$_B$, in ‰^{2}) estimated from Atlantic bluefin tuna (A) muscle and (B) liver isotopic data in the 3 sampling years (2016, 2017 and 2018). Black circles are mode for the total area and grey boxes represent 50 (dark grey), 75 (medium gray) and 95% credible intervals (light grey) produced from 10^5 Bayesian iterations of SEA

ABFT feeding grounds (Butler et al. 2010, Logan et al. 2015, Olafsdottir et al. 2016, Varela et al. 2020a,b). While the Canary Islands area was predicted to be unfavorable to large ABFT feeding in summer (July–September) (Druon et al. 2016), our observa-

tions show that adult ABFT use this habitat as a feeding ground in spring.

SCA showed that the diet of ABFT caught around the Canary Islands consisted almost exclusively of fishes. Within the fish prey group, all feeding indices

indicated that the snipefish was the predominant prey species. These results were to be expected, since an ichthyoplankton survey carried out around the Canary Islands during early spring in 2021 revealed a high abundance of snipefish early life stages (R. Laiz-Carrión pers. comm.). Snipefish are zooplankton feeders that may largely prey on fish eggs and larvae, causing an important impact on the recruitment of other fish species (Lopes et al. 2006). Therefore, the high predation of ABFT on snipefish may regulate the abundance of this small bentho-pelagic fish.

Romero et al. (2021a) also reported that snipefish was the most important prey by number (%N = 35.8) of skipjack tuna *Katsuwonus pelamis* caught in a nearby area (Madeira Islands) during 2016−2018. In the Macaronesia region, the snipefish represents an important dietary component not only for tunas but also for sharks, gadids, congrids and rays (Clarke et al. 1996, Morato et al. 1999, 2003). For instance, Clarke et al. (1996) reported snipefish to be the second most important prey by number (%N = 34.4%) for blue shark *Prionace glauca*, and Morato et al. (1999) found that this prey was a key dietary component for forkbeard *Phycis phycis* and conger eel *Conger conger* (index of relative importance, IRI = 881.8 and 555.8, respectively). Moreover, Morato et al. (2003) reported the family Macroramphosidae to be the main taxon in the diet of thornback ray *Raja clavata* and tope shark *Galeorhinus galeus* (% IRI = 34.0 and 93.25, respectively). *Macroramphosus* spp. have a higher caloric content than common ABFT prey such as Atlantic saury *Scomberesox saurus* or blue jack mackerel *Trachurus picturatus* (Martins et al. 2004), and occur at high densities in shallow waters during daytime (Miyazaki et al. 2004), representing an important energetic resource for predators.

It is worth noting the finding of a bird (Cory's shearwater *Calonectris borealis*) in 1 of the ABFT stomachs analyzed in this study (previously reported by García-Barcelona et al. 2019). The snipefish is an important dietary component of Cory's shearwater in the Macaronesia region (Granadeiro et al. 1998, Xavier et al. 2011, Romero et al. 2021b). Therefore, this bird may have been swallowed by an ABFT during an accidental encounter as they were feeding on the same snipefish school.

Plastic items were present in more than 16% of the stomachs analyzed. Overall, this plastic debris consisted of food and candy wrappers, probably from nearby beaches. Plastic items could be ingested during predation on snipefish in shallow waters. These data are consistent with those reported by Karakulak et al. (2009) and Romeo et al. (2015), who also found a high presence of plastics (%O = 17.0 and 18.2, respectively) in stomachs of top predators, including ABFT, caught in the Mediterranean Sea.

Our estimates of DR (0.23−0.57% BM d^{-1}) are lower than those reported for smaller-sized ABFT (SFL = 135 ± 15 cm) sampled in the SoG (2.52−20.88% BM d^{-1}) (Sorell et al. 2017, Varela et al. 2020b). These differences may be due to younger fish requiring more energy relative to body mass (NRC 1978). A similar observation was made for longtail tuna *Thunnus tonggol* (Griffiths et al. 2007), common dolphinfish *Coryphaena hippurus* (Varela et al. 2017b) and broadbill swordfish *Xiphias gladius* (Zambrano-Zambrano et al. 2019). DR values were also lower than those reported by Varela et al. (2020a) in the GSL (1.02−1.73% BM d^{-1}). Such differences may be related to the consumed prey types, which show different evacuation rates. Thus, while Varela et al. (2020a) reported that Atlantic herring *Clupea harengus* and Atlantic mackerel *Scomber scombrus* were the main prey species in the GSL, the present study shows that the diet of ABFT from the Canary Islands was primarily composed of snipefish, which are probably more easily digested and evacuated faster.

Consistently with SCA, PERMANOVA analysis of muscle isotopic data, as well as SIBER and KUD overlaps, showed that ABFT may exploit similar prey species in each of the 3 sampling years. In contrast, the analyses of liver isotopic data suggested a dietary shift in 2018. Considering that the lowest δ^{15}N values were found in the liver samples collected in 2018, this dietary shift may be attributed to recent ingestion of organisms with low δ^{15}N values, which probably occupied low trophic levels (Jennings et al. 2002). The lowest δ^{15}N values found in 2018 may be linked to the marine heat waves recorded in 2017, which caused blooms of the cyanobacterium *Trichodesmium* (Tassin 2018). This organism, which is located at the food-web baseline, is known to fix atmospheric nitrogen, leading to decreased δ^{15}N values in marine ecosystems (McClelland et al. 2003). The differences in stable isotope values found between tissues may be related to different turnover rates (MacNeil et al. 2005). Thus, muscle, which has a slower turnover rate, might reflect isotopic values of prey ingested in distant feeding grounds (Medina et al. 2015). Other top predators inhabiting the area, like the Atlantic spotted dolphin *Stenella frontalis*, show lower skin δ^{15}N values than those observed in our muscle samples (Méndez-Fernandez et al. 2020). Given that prey–muscle and prey–skin nitrogen stable-isotope discrimination factors show similar values in ABFT and dol-

phin (1.64 ± 0.20 and 1.57 ± 0.52, respectively; Varela et al. 2011, Giménez et al. 2016), one can infer that ABFT occupy higher trophic levels in the Canary Islands. A similar observation was made by Varela et al. (2018), who estimated that the ABFT occupies higher trophic levels than the striped dolphin *S. coeruleoalba* in the SoG.

$\delta^{15}N$ measured in muscle and liver tissues showed similar values to those observed in smaller-sized ABFT (SFL = 135 ± 15 cm) caught in the SoG (Varela et al. 2020b). Based on a meta-analysis of published zooplankton $\delta^{15}N$ data for the Atlantic Ocean, Mc-Mahon et al. (2013), showed that the Canary Islands and the SoG present similar $\delta^{15}N$ baseline values. This suggests that, although there exist large size differences between the specimens from both areas, they may occupy similar trophic levels in their respective food webs. Otherwise, the low $\delta^{15}N$ values of ABFT from the Canary Islands compared to individuals from the GSL (Varela et al. 2020a) suggest that ABFT occupy a lower trophic level in the Canary Islands. However, McMahon et al. (2013) reported higher $\delta^{15}N$ baseline values in the GSL, which suggests that ABFT would also occupy similar trophic levels in the Canary Islands and GSL.

Isotopic niche width estimations from SIBER and KUD indicate that the ABFT diet was more diverse in 2017. Overall, SEA_C and SEA_B values obtained in this study are higher than those reported for ABFT from the SoG (Sorell et al. 2017, Varela et al. 2020b) and lower than those reported for specimens from the GSL (Varela et al. 2020a). These results suggest a more euryphagous diet in the Canary Islands than in the SoG, but a more stenophagous diet than in the GSL.

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