SUMMARY OF THE 2021-2023 CATCH AND RELEASE TAGGING (CHART) PROGRAMME FOR ATLANTIC BLUEFIN TUNA (*THUNNUS THYNNUS*) IN SOUTHWEST ENGLAND

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SUMMARY

A CatcH And Release Tag (CHART) programme for Atlantic bluefin tuna (BFT) was undertaken in the western English Channel (la Manche) in 2021-2023. The programme was co-designed with representation from industry and recreational stakeholders and was overseen by Cefas. Each year, between 15 and 25 vessels were given dispensation to target BFT for a fishing season that ran between mid-August and mid-December. Fixed camera monitoring was mandatory for all new vessels in 2021 and 2022, changing to self-reporting video footage in 2023. Observer coverage was mandatory with coverage set at 10% in 2021, 7% in 2022 and up to 5% in 2023. Over three years, 1,647 fishing trips were undertaken involving nearly 4,500 anglers. In total 3,805 BFT were hooked up, of these, 3,177 (83%) tuna were tagged with large ICCAT floy tags, 72 (1.9%) were measured but not tagged, 521 (13.7%) escaped off the hook, and 23 fish died (0.6% at vessel mortality rate). The nominal catch per unit effort (CPUE) averaged 2 BFT per day with a size range of 97 to 288 cm straight fork length (SFL).

RÉSUMÉ

Un programme de marquage des captures et remise à l'eau (CHART) pour le thon rouge de l'Atlantique (BFT) a été entrepris dans la Manche occidentale en 2021-2023. Le programme a été conçu en collaboration avec des représentants de l'industrie et des parties prenantes du secteur de la pêche récréative et a été supervisé par le Cefas. Chaque année, entre 15 et 25 navires ont été autorisés à cibler le thon rouge pour une saison de pêche allant de la mi-août à la mi-décembre. La surveillance par caméra fixe était obligatoire pour tous les nouveaux navires en 2021 et 2022, avant de passer en 2023 aux enregistrements vidéo pour l'autodéclaration. La couverture des observateurs était obligatoire et fixée à 10% en 2021, 7% en 2022 et jusqu'à 5% en 2023. En trois ans, plus de 1.647 sorties de pêche ont été réalisées mobilisant près de 4.500 pêcheurs à la ligne. Au total, 3.805 thons obèses ont été pris à l'hameçon, parmi lesquels 3.177 (83%) ont été marqués avec de grandes marques floy de l'ICCAT, 72 (1,9%) ont été mesurés mais pas marqués, 521 (13,7%) se sont échappés de l'hameçon et 23 poissons sont morts (taux de mortalité à bord du navire de 0,6%). La capture par unité d'effort (CPUE) nominale était en moyenne de 2 thons obèses par jour avec une gamme de tailles de 97 à 288 cm de longueur droite à la fourche (SFL).

RESUMEN

En 2021- 2023 se llevó a cabo un programa de captura y liberación (CHART) para el atún rojo del Atlántico (BFT) en el oeste del Canal de la Mancha. El programa se diseñó junto con representantes de la industria y las partes interesadas del sector recreativo, y lo supervisó el Cefas. Cada año se autorizaba a entre 15 y 25 buques a pescar atún rojo durante una temporada de pesca comprendida entre mediados de agosto y mediados de diciembre. El seguimiento con cámaras fijas fue obligatorio para todos los buques nuevos en 2021 y 2022, cambiando a la

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grabación de vídeo con autodeclaración en 2023. La cobertura de los observadores era obligatoria y se fijó en el 10 % en 2021, el 7 % en 2022 y hasta el 5 % en 2023. En tres años se realizaron 1.647 mareas de pesca en las que participaron casi 4.500 pescadores. Se engancharon un total de 3.805 atunes rojos, de los cuales 3.177 (un 83 %) se marcaron con marcas grandes Floy de ICCAT, otros 72 (un 1,9 %) se midieron, pero no se marcaron, 521 (un 13,7 %) se escaparon del anzuelo y 23 peces murieron (0, 6% de tasa de mortalidad en el buque). La captura nominal por unidad de esfuerzo (CPUE) se situó en una media de 2 atunes rojos por día, mientras que el rango de tallas de los atunes rojos capturados se situó entre 97 y 288 cm de longitud recta a la horquilla (SFL).

KEYWORDS

Bluefin tuna; size distribution; sport fishing; tagging; temporal distribution; trolling; tuna fisheries

1. Introduction

Between 2021 and 2023 a CatcH And Release Tagging (CHART) programme was undertaken for Atlantic Bluefin Tuna *Thunnus thynnus* (BFT) in the waters of the western English Channel (as detailed in Phillips *et al*., 2021 and Ford *et al.,* 2022). The programme was designed to collect data on the geographical spread and spatial dynamics of BFT, the potential socio-economic gains of such a project and the welfare outcomes of targeting BFTin a sport fishing environment. During the three years of the programme, 29 skippers and 97 crew were trained to catch, tag and release BFT, and took to sea 4491 paying anglers for a total of 1655 days of fishing effort. The design of the project changed slightly after the first year with an increase in scope from 15 to 25 vessels and a longer season from 13 to 17 weeks but the scientific parameters remained constant with an emphasis on fish welfare and high quality data collection.

BFT welfare was at the forefront of the programme, with strict code of conducts for skippers, crews and anglers and an escalation process in place to ensure that the fishing and handling protocols were followed. To monitor the welfare adherence all trips were observed by scientific staff at the rate of a minimum of 10% of trips in 2021, a minimum of 5% of trips in 2022 and up to 5% in 2023.

2. Methods

CHART was co-designed and delivered under the auspices of a steering group (SG) and the programme was continuously evaluated and modified as necessary during the three seasons, thus ensuring the programme evolved with the advent of new information and feedback from all interested parties. The detailed methods for 2021 and 2022 are outlined in previous papers (Phillips *et al*., 2021 and Ford *et al.,* 2022) but there were refinements made in 2023 due to resource constraints. First, only fully qualified skippers from the previous fishing seasons in 2022 and 2023 were invited to take part in 2023, and there was therefore no need for an application process or full in-person training programme. Instead, a mandatory refresher training workshop was held online for all skippers and crews. As it was not possible to demonstrate or review tagging techniques in an online setting, only those who had been trained to tag BFT in person were certified to tag fish, so as to avoid any potential unfavourable welfare outcomes of those new to the procedure. The result of this change to the application process and training was that 24 vessels were licensed to take part in CHART 2023. Second, while data collection and data checking remained the same as in the previous year, with the Qualtrics (https://www.qualtrics.com/en-gb/) platform used for data collection and R-code used for data checking and quality assurance, some minor adjustments were made in Qualtrics to add greater depth to some of the welfare questions. Finally, the requirement for mandatory fixed camera monitoring was removed from the programme to reduce both the physical cost of the systems and the running costs of scrutinising footage but was replaced by a self-monitoring programme whereby skippers were required to record short videos of captured and tagged fish. The requirement was for each skipper to provide video evidence of their first five tagged fish of the season alongside the vessel immediately after tagging. After this, video footage was requested each week from eight vessels at random for a further two BFT each. This video footage was reviewed to ensure fish welfare standards were maintained to the highest level throughout the season.

As in previous years, Catch per Unit Effort (CPUE) was calculated as the number of fish brought boat-side and restrained per fishing day. BFT length (Standard Fork Length, SFL) distributions were compared to previous years. Individual round weights were calculated using length-weight relationship (calculated from Rodriguez-Marin *et al*. 2016).

3. Results

3.1 2023 Results

See **Table 1**. The 2023 fishing season ran from the 14th August to the 10th December inclusive and all 24 vessels made at least one fishing trip. By the end of the season, a total of 595 fishing trips had taken place, comprising over 3500 hours of fishing effort, with nearly 1700 paying anglers taking part (**Figure 1**). The potential for tagging in 2023 was 1631 fish (the number of BFT hooked for more than 30 seconds) of which 1483 (88%) were brought to the boat. In total, 1383 BFT were tagged and 53 were measured but not tagged. The CPUE ranged between 0.5 to 4.2, with rates highest at the start of the season and peaking in October, before falling away in November and December due to poor weather (**Figure 3a**). The average CPUE for 2023 was 2.44 BFT, with an average SFL of 165cm (ranging from 95cm to 262cm; **Figure 4**).

Of the 1436 fish brought boatside, the average time from hooking to restraint was 20 minutes with more than 75% of fish being alongside within 30 minutes. 92% of these BFT were hooked in the scissors, 6.8% were hooked in the jaw but not the scissors, 1% were hooked in the cheek, 0.7% were foul hooked outside of the jaw and 0.6% were deep-hooked.

3.2 CHART 2023 in context: programme results (2021-2023)

Between 2021 and 2023, 29 skippers and 97 crew were trained and signed off to catch and tag BFT, taking nearly 4500 paying anglers out over 1655 days of fishing effort (**Figure 2)**. Different vessels and skippers experienced variable catch rates: the total catch of vessels varied between 0 to 392 in a season. The length of BFT ranged from 95cm to 288cm with an overall average of 177cm (**Figure 4**). This corresponded to an estimated age range of 2-18 years old across the years (Rodriguez-Marin *et al.*2016) with a mean age of 7 – 9 years old. The greatest average length of BFT was observed in 2022 (189cm) and the smallest in 2023 (165cm). Each year the average size of caught BFT fell from the start of the season to the end (**Figure 3b**) with a pronounced dip between early to late September. This may be due to a change in the size of BFT present in the fished area or changes in the catchability of larger size classes.

The proportion of BFT that were tagged once they were brought to a vessel was between 94% and 96%, demonstrating that skippers and crews were competent in these aspects of the capture and release process. The welfare outcomes for BFT were very good with over 97% of all caught BFT reported as released in alert condition with no injuries or bleeding which was validated by video analysis. Further analysis of this aspect will be presented in the future.

The mean fight time (defined as the time from hookup until the point of restraint at the side of the vessel) ranged between 2 and 130 mins, with the average being similar across the seasons: ~20 mins in 2021 and 2023 and 23 mins in 2022. Overall, 70% of fish were restrained within 25 mins, while only 49 fish (0.1%) had a fight time in excess of that recommended (a maximum of 1 hour). Six fish had a fight time over 90-min, and these were all large fish, ranging between 203 and 288 cm.

There were 23 mortalities across the three years with just under half the skippers reporting a mortality. This represents an overall rate of 0.7% of all the BFT caught. The mortalities were due to either exhaustion, gill hooking, or tail wrapping. The mortalities from 2021 and 2022 were brought ashore and later dissected for further analysis while the mortalities from 2023 were discarded back to the sea.

3.3 BFT Sightings Data

Participants were requested to record the number of BFT sightings, both from visual observations of tuna at the surface and also any observations that were made of likely tuna marks on echosounders. In total, surface sightings were reported from of 1199 of 1625 trips (74%), and from sounders on 875 trips (54%). Of the 502 trips where no BFT were caught, BFT were sighted on 325 of them. More sightings were reported in 2022 (88% of trips, average 36 BFT) and 2023 (84%, 157 BFT) compared to 2021 (56%, 159 BFT). There were greater numbers of sightings (whether on the surface or on the echosounder) in late morning and early afternoon (**Figure 5**).

3.4 Monitoring and observing

The observer coverage followed the UK fishing plan submitted to ICCAT, i.e. 10% coverage in 2021, minimum of 5% in 2022 and up to 5% in 2023. During the three CHART seasons, the observer coverage decreased from 10% of the trips with observer in 2021 (49 out of 429 trips), to 7% in 2022 (44 out of 631 trips) to 3% in 2023 (19 out of 595 trips with an observer).

3.5 Recaptures

ICCAT provided details to Cefas on CHART tags returned to January 2023: 52 tags (1.6%) had been returned with an average time to recovery of 467 days (and up to 853 days), showing good evidence of long-term tag retention using the 'over the side' tagging method utilised in CHART. All of the captures were in the eastern Atlantic, with the majority recovered from the Mediterranean Sea, suggesting that the BFT were part of the spawning stock. None of the tagged BFT have been recaptured west of the 45°W meridian.

4. Discussion

Following the reappearance of BFT in the territorial waters of the UK and Ireland over the last 10 years (Horton), The English CHART programme has established the UK waters off the south-west coast as an important feeding area for BFT. Based on CPUE and sightings data, the abundance of BFT appears to have increased since 2021. Although catch rates could be variable week by week during the fishing season, a consistent pattern of increasing CPUE into late September/ early October, followed by a steady reduction through to December was apparent. The results show that BFT are present in the region over an extended period.

The standard fork length of the caught fish in all three years showed the largest fish being caught as the season started with a marked decline until between weeks 5 to 10 where there was an increase in SFL for a period (more pronounced in 2023) and then a further decline with the smallest fish being caught at the end of the season (**Figure 4.)**. This could be driven by one or a number of different circumstances: for example, an influx of smaller fish into the region at certain times, a movement of larger fish away from the region as the fishing season progresses, size dependent changes in the behaviour of BFT that lead to changes in catchability, or modifications to methods deployed by the vessels to target the smaller fish in the population.

The protocols established in CHART led to the majority of captures having excellent welfare outcomes, with an overall mortality rate of <1%, and the vast majority of captured individuals assessed as being in excellent condition at release. The survivorship of the tagged BFT can therefore be assumed with high confidence, and the tagged population of >3000 BFT is a significant addition to the population of ICCAT tagged BFT in the NE Atlantic. Recaptures of tagged BFT are, so far, consistent with the hypothesis that the BFT found off the UK coast belongs to the eastern stock of BFT.

Protocols and lessons learned during CHART have been adopted into the Code of Conduct of the Catch and Release Recreational Fishery (CRRF) for BFT that opened in the UK in 2024 with ~100 participating vessels. Data collected during the CRRF will extend the time-series of the spatial distribution and CPUE of BFT in UK waters begun in CHART in 2021.

5. Acknowledgements

This work was funded by Defra with specific leadership from Ruth Allin, Grant Horsburgh, Jamie Muddimer and Alex Maydew. The contents of this paper do not necessarily reflect the points of view of the funders, nor anticipate future policy. We would like to thank all the skippers, crew and anglers who participated in this programme and facilitated the collection of these data. Thanks too for the input of all project Steering Group members who assisted in the decision making and direction of this programme. This programme involved a lot of other staff to which we owe our thanks, including observers (Ruth Hicks, Mark Ives, Matthew Eade, Sam Roslyn and Serena Wright) and video specialists and analysts (Lauren Popham and Rebecca Skirrow).

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Table 1. CHART statistics by year showing number of vessels, number of trips, number of hook up's and number of tags deployed. Catch per unit effort, minimum, maximum and mean standard fork length of BFT and observer coverage.

Year	*Number of Vessels*	*Number of Trips*	*Hook Ups*	*Tags Deployed*	*CPUE (BFT d^{-1})*	*Min SFL (cm)*	*Max SFL (cm)*	*Mean SFL (cm)*	*Observer Coverage*
2021	15	429	901	704	1.71	100	288	182	10%
2022	25	631	1271	1082	1.77	119	284	189	7%
2023	24	595	1631	1383	2.44	95	262	165	3%
Overall	N/A	1655	3803	3169	1.99	95	288	177	N/A

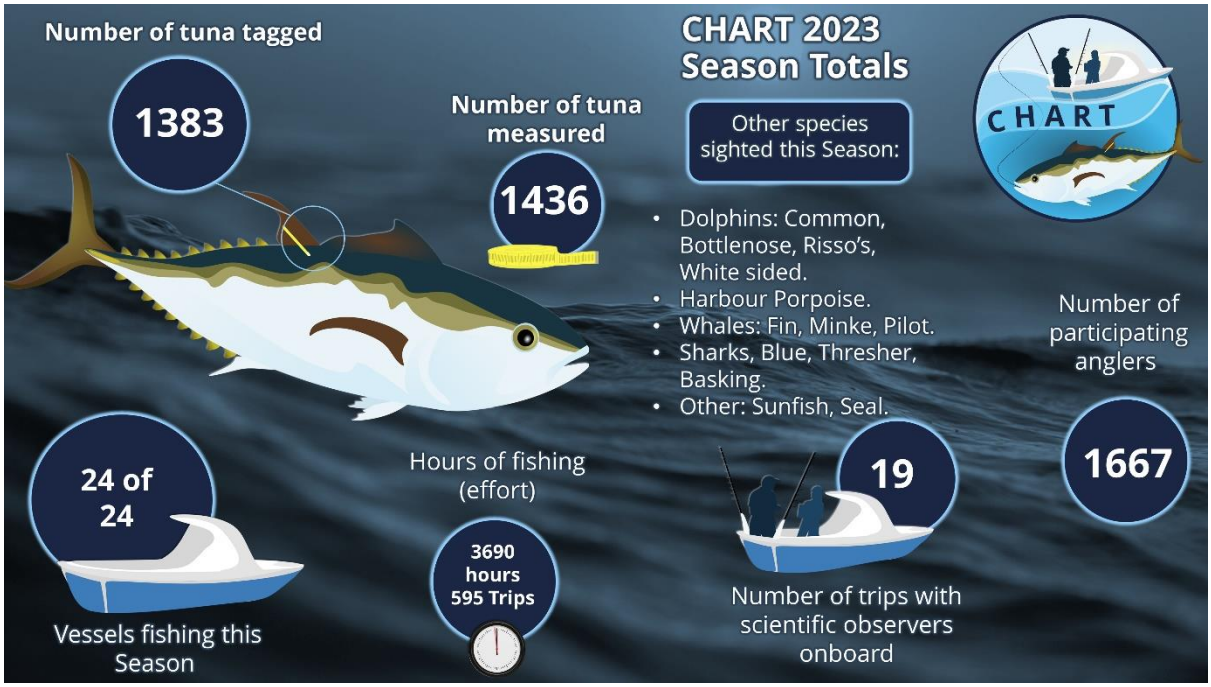

Figure 1. Final tally for CHART 2023.

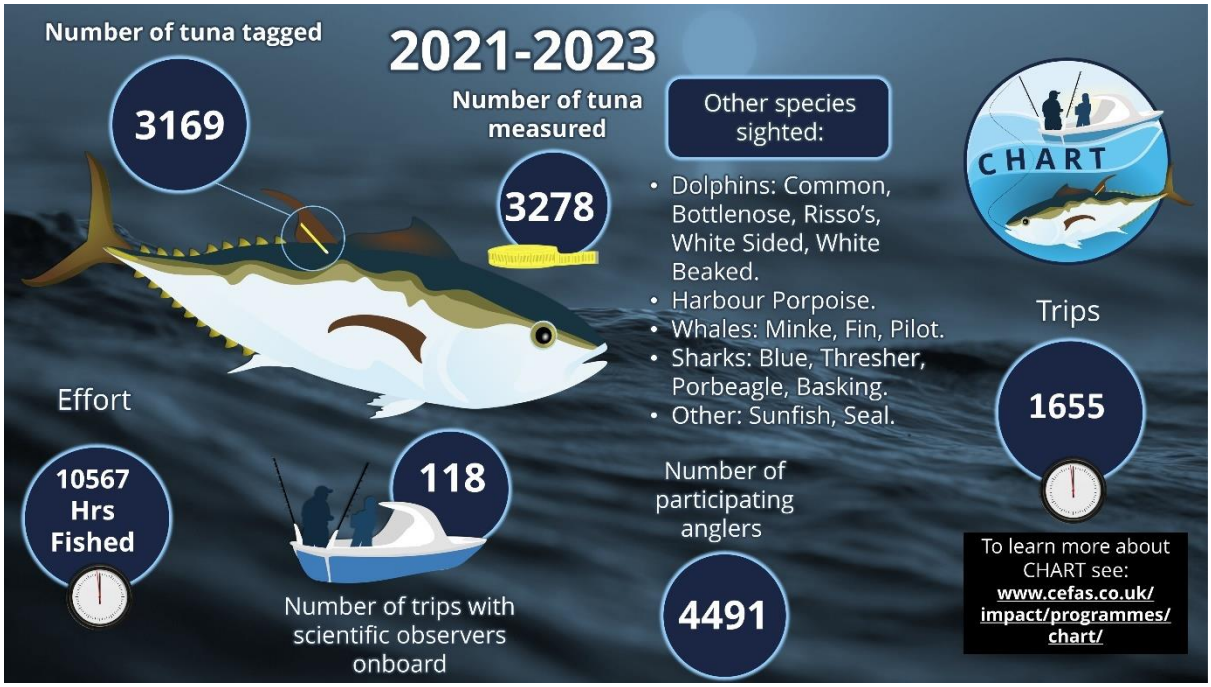

Figure 2. Final tally for CHART 2021-2023.

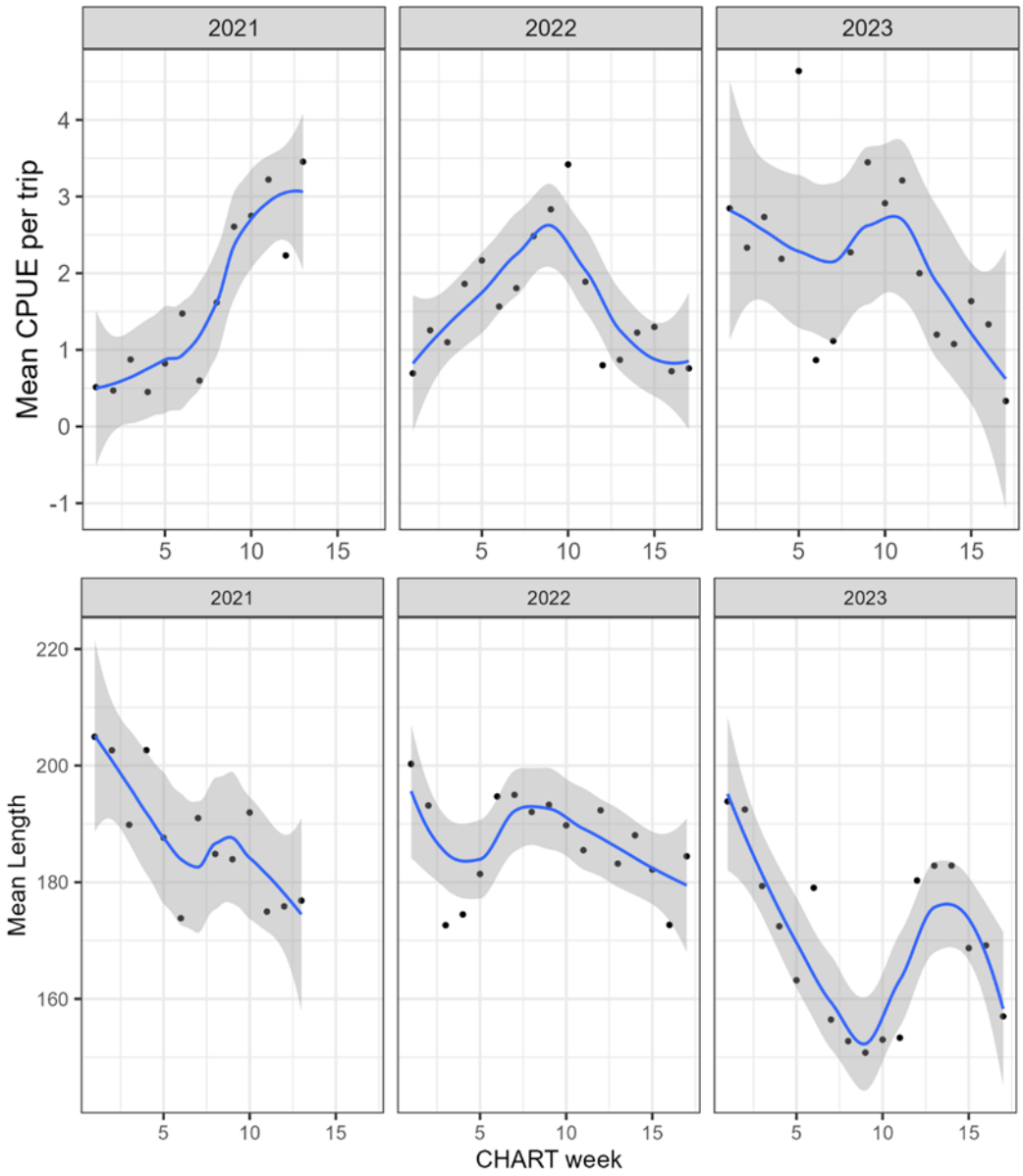

Figure 3. Variation of BFT mean length (cm) by week, in each CHART year (2021-2023). Blue lines show the fitted relationship, with grey shading indicating the 95% confidence interval.

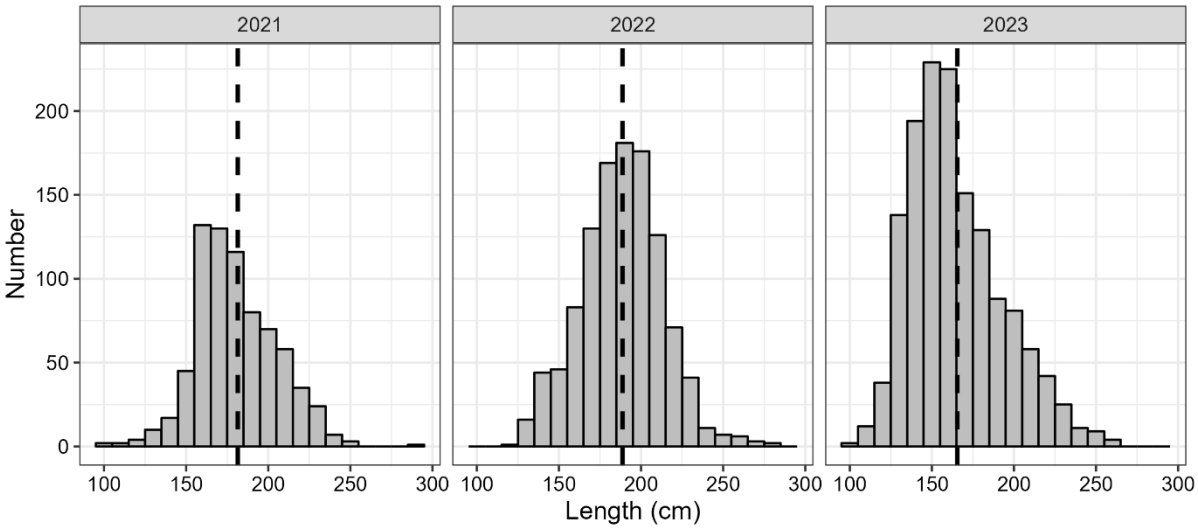

Figure 4. BFT mean length (cm) in each CHART year (2021-2023). Blue lines show the fitted relationship, with grey shading indicating the 95% confidence interval.

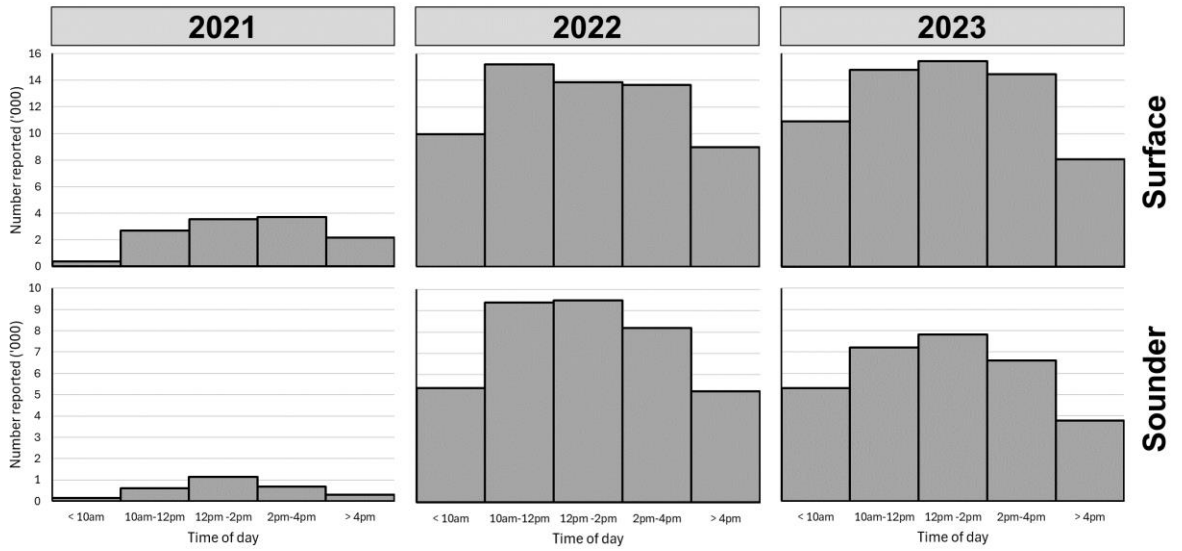

Figure 5. Total number of BFT sightings records from the surface (upper panels) and from echosounders (lower panels) throughout the CHART programme.