

TASK 1 ESTIMATES OF BYCATCH IN ICCAT FISHERIES

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SUMMARY

Structural changes to ICCAT's Task 1 Nominal Catch (TINC) data reporting, implemented in 2024, allow for explicit classification of reported catches as target catch, bycatch, or unknown. Using the newly standardized 2023 data, we present the first comprehensive summary of bycatch across ICCAT fisheries. Approximately 13% of reported catch (98,596 t) was identified as bycatch, involving 97 species across 28 taxonomic families. We also propose an exploratory method for imputing historical levels of bycatch, target catch, and unclassified catch based on 2023 proportions. While this imputation provides insight into long-term trends, results must be interpreted with caution due to changes in regulations, targeting strategies, and data quality over time. This analysis offers a baseline for future bycatch monitoring and supports efforts to enhance transparency and comparability in ICCAT statistical reporting.

RÉSUMÉ

Les récentes modifications structurelles apportées au format de déclaration des captures nominales de la Tâche 1 de l'ICCAT (TINC), mises en œuvre en 2024, permettent une classification explicite des captures comme ciblées, accessoires ou inconnues. À partir des données normalisées de 2023, nous présentons un premier aperçu global des prises accessoires dans les pêcheries relevant de l'ICCAT. Environ 13 % des captures déclarées (98 596 t) ont été identifiées comme accessoires, représentant 97 espèces réparties dans 28 familles taxonomiques. Nous proposons également une méthode exploratoire d'imputation des niveaux historiques de captures accessoires, ciblées et non classées à partir des proportions de 2023. Bien que cette méthode éclaire les tendances passées, ses résultats doivent être interprétés avec prudence compte tenu des changements de réglementation, des pratiques de pêche et de la qualité des données. Cette analyse constitue une base pour améliorer le suivi des prises accessoires et renforcer la transparence des statistiques de l'ICCAT.

RESUMEN

Los cambios estructurales en el formato de declaración de capturas nominales de la Tarea 1 (TINC) de ICCAT, implementados en 2024, permiten clasificar explícitamente las capturas como objetivo, captura fortuita o desconocida. Utilizando los datos estandarizados de 2023, se presenta el primer resumen exhaustivo de las capturas fortuitas en las pesquerías de ICCAT. Alrededor del 13 % de las capturas declaradas (98.596 t) fueron identificadas como fortuitas, abarcando 97 especies de 28 familias taxonómicas. También se propone un método exploratorio para imputar niveles históricos de captura fortuita, objetivo y no clasificada, utilizando las proporciones observadas en 2023. Aunque esta imputación ofrece una perspectiva sobre las tendencias a largo plazo, sus resultados deben interpretarse con precaución debido a los cambios normativos, las estrategias de pesca y la calidad de los datos a lo largo del tiempo. Este análisis proporciona una base para el seguimiento futuro de la captura fortuita y apoya los esfuerzos para mejorar la transparencia en la información estadística de ICCAT.

KEYWORDS

Bycatch Catch/Effort, Spatial Analysis, Dataset join

Introduction

Even without considering governance and mitigation challenges (Hall et al. 2017), defining what constitutes bycatch and estimating its magnitude are nuanced tasks (Hall *et al.* 2000; Komoroske and Lewison 2015). Obtaining total estimates of species-specific bycatch in ICCAT fisheries is particularly difficult, especially for billfish and shark species that are primarily caught as bycatch across multiple gear types.

Historically, catches of billfishes and sharks were reported in aggregated codes: BIL (billfishes) until the mid-1990s, and SHK (sharks) until the end of the 1990s. Some CPCs also used PXX for pelagic sharks and CXX for coastal sharks. The disaggregation of BIL into blue marlin, white marlin, and sailfish began around 1992 and is now considered complete for the period 1950–2023. The disaggregation of grouped shark categories (SHK, PXX, CXX) began in the early 2000s and has since improved substantially, although species-specific time series remain incomplete before 2000. Shark catch data were first included in ICCAT’s Task 1 nominal catch database in 2005.

Various techniques exist to estimate bycatch, but most rely on operational data such as logbooks or observer programs (Yin et al. 2024). Consequently, the simplest and most direct approach is for CPCs that hold such data to estimate bycatch themselves. As of 2024, this is a formal requirement. Thus, 2023 marks the first year for which all CPCs are required to report complete estimates of bycatch, target catch, and unclassified catch under the revised T1NC format.

Methods

In 2024, ICCAT nominal catch form (ST02-T1NC) started to include fields for CPC to document fishing activity by catch intention for the species captured i.e. if the species was the intended target or if it was bycatch (see **Table 1**). This means that for every catch record the Secretariat can now assign this catch to be target, bycatch, or unknown. Accordingly, it is possible to parse out ICCAT Task 1 data into these three categories in order to produce a total estimate of bycatch in ICCAT fisheries, for 2023.

We explore these estimates of bycatch in two ways. The first of these is summarizing the sum of the reported bycatch (Byc), target catch (TC), and unknown targeted catch (totUN). Secondly we explore reconstructing historical bycatch by calculating the ratio of bycatch and unknown catch to total catch and then back calculating what historical bycatch would have been if these ratios held constant backwards in time. This document presents the mathematical equivalents for a sequence of R operations related to data filtering, aggregation, and transformation.

1. Summarizing Catch Data by Group

Let D be the Task 1 dataset for 2025

Define the filtered dataset:

$$D' = \{ x \in D \mid x.Qty_t > 0 \wedge x.YearC \geq 2000 \}$$

Group D' by Year y , FlagName f , Species s , and TargetByCatchCode $c \in \{TC, UN, BC\}$

Compute sum of Qty_t for each group:

$$S(y, f, s, c) = \sum_{x \in D', x.YearC = y, x.FlagName = f, x.Species = s, x.TargetByCatchCode = c} x.Qty_t$$

Pivot the results to create variables:

$$S_TC, S_UN, S_BC \leftarrow \text{values of } S(y, f, s, c) \text{ where } c = TC, UN, BC \text{ respectively}$$

Define TotalCatch as the row sum:

$$TotalCatch = S_TC + S_UN + S_BC$$

Replace missing values:

$$S_c := \{ 0 \text{ if } S_c = NA, S_c \text{ otherwise} \} \text{ for } c \in \{TC, UN, BC\}$$

2. Preparing Data for Species-Based Plotting

Let T be the dataset `sumByGrp.2023.sp`

Group by species s

For each species s , transform the percentage columns into long format:

$$L = \{ (s, c, p) \mid s \in \text{Species}, c \in \{P_{BC}, P_{TC}, P_{UN}\}, p = T[s][c] \}$$

Where:

- s is a species
- c is a catch class (e.g., BCpc, TCpc, UNpc)
- p is the percentage value of the corresponding catch class

Catch classified into BC, TC, and UN categories by species is presented in **Figure 1**. Catch classified into species by fishing activity catch intention (BC, TC, and UN) is presented in **Figure 2**.

3. Total Catch and Proportions

To calculate total TC, BC, and UN catch proportions we first grouped the Task 1 data by `YearC_i`, `FlagName_j`, `Species_k`, `TargetByCatchCode_l` where catches were greater than zero ($Qty_t > 0$) and only for those years after 2000 ($YearC \geq 2000$)

To reconstruct bycatch historically, we defined the total catch as the sum of TC, UN, and BC.

$$\text{TotalCatch} = TC + UN + BC$$

With the percentage of BC to the total catch given as

$$P_{BC} = BC / \text{TotalCatch}.$$

The proportion of the target catch to the total catch as:

$$P_{TC} = TC / \text{TotalCatch}$$

and the proportion of unclassified catch

$$P_{UC} = UN / \text{TotalCatch}$$

4. Imputed Catch Estimates

We calculate the total imputed bycatch (`imp_BYC`) from the declared BC and the unclassified catch as:

$$\text{imp_BYC} = UN \times P_{BC} + BC.$$

The total imputed target catch (`imp_TC`) imputed from unclassified using proportion as:

$$\text{imp_TC} = UN \times P_{TC} + TC.$$

If both imputed values for bycatch and target catch are NA, we kept the original UN designation; otherwise, the unclassified catch was given as the imputed total catch minus the imputed bycatch and minus the imputed target catch.

5. Group-wise Summarization

For presentation purposes we grouped Year, FlagName, and Species and summarized summing across all records so that the total bycatch was given as the sum of all imputed bycatch:

$$\text{sumBC} = \sum \text{imp_BYC}$$

and similarly target catch and unclassified were given as $\text{sumTC} = \sum \text{imp_TC}$ and $\text{sumUN} = \sum \text{imp_UN}$, respectively.

6. Final Aggregated Totals

To visualize the historical imputed series we grouped by YearC and Species so that the total BC, TC and UNC are given as

$$\text{totByc} = \sum \text{sumBC}, \text{ totTC} = \sum \text{sumTC}, \text{ and } \text{totUN} = \sum \text{sumUN}$$

7. Joins and Filtering

The final dataset for imputing the historical series consisted of joining the full dataset with the 2023 dataset which was used to generate the proportion as

$$\text{ljoin.t1} = \text{sumByGrp.all} \bowtie \text{sumByGrp.2023} \text{ joined on (FlagName, Species)}$$

using a many-to-many relationship. In this way, each proportion of BC, TC, and UN in the 2023 data an estimate of BY and TC could be imputed for preceding years. For (the many) species-flag combinations that had no estimates of proportions in the 2023 data, the estimates were assigned to the unclassified category.

We present totals of BC, TC and UN in **Figure 3**. Imputed total estimates of bycatch (totByc), target catch (totTC), and unclassified catch (totUN) aggregated by year are presented in **Figure 4**.

Results

The totals BC, TC, and UC as well as PBC, PTC and PUN in ICCAT fisheries, in 2023 by species group and species is presented Table 1. When aggregated by year and the species report in Task 1, the ratios of the bycatch, target catch, and unclassified catch were 13%, 83%, and 5% respectively amount to 98596, 642495, 35760 tonnes, respectively. This indicated that i) most parties reported their data as either bycatch or as target catch because the ratio of unclassified catch was only 5% and ii) in terms of tonnage most i.e., 83% of species reported in Task 1 occur in target fisheries.

The ratio of bycatch to target species differed considerably by species. The largest fisheries (in tonnage) by species, i.e. albacore tuna, bigeye tuna, bluefin tuna, skipjack tuna, swordfish, and yellowfin tuna tended to have a relatively small proportion of bycatch (**Figure 1, Figure 2**). However, other species such as blue marlin (BUM), sailfish (SAI), white marlin (WHM), most “other tunas”, porbeagle shark (POR), and shortfin mako (SMA) are reported are predominantly bycatch (**Table 1, Figure 1, Figure 2**).

The increase in P_{UC} (**Figure 3**) in the imputed historical series is an artifact. The 2023 data used to calculate P_{BC} , P_{TC} , and P_{UC} used for imputing the historical series contained many combinations of FlagName, Species, and GearCode in the historical data that were not 2023 data, and the script used for processing these data simply converted this into UC. Indeed, earlier attempts to calculate the P_{BC} , P_{TC} , and P_{UC} ratios with data grouped at higher resolution (i.e. quarter) failed because there were too many missing fields to impute historical targeting behaviour successfully.

Discussion

The Task 1 TargetBycatchCode field introduces a new method for defining which species are considered bycatch within ICCAT fisheries. It also provides a preliminary indicator of the bycatch ratio associated with each ICCAT target species. By filtering rows where the TargetBycatchCode equals "BC" and counting the distinct bycatch species, we obtain a list of species identified by the parties as bycatch (see **Table 3**). These species span 28 taxonomic families (excluding entries marked as "NA"; see **Figure 4**) and encompass 97 species in total. This list is valuable as it reflects the diversity of species regarded as bycatch in ICCAT fisheries. However, it should not be applied indiscriminately to classify a given species as bycatch. Notably, all major tuna species appear on this list, indicating that species listed by ICCAT may be targets in some fisheries and bycatch in others.

Analyzing data at the fleet level (Figure 5) might initially seem helpful in resolving this ambiguity. However, in practice, bycatch events occur at the set level, meaning that even within the same trip, a species might be targeted in one set and considered bycatch in another. Consequently, generating lists of bycatch species remains primarily a descriptive exercise. Quantifying the magnitude of bycatch necessitates a detailed, set-by-set examination of operational data.

The 2023 restructuring of TINC data is significant because it allows catch records to be explicitly categorized as target catch, bycatch, or unknown. This advancement enables, for the first time, a detailed summary of bycatch across all ICCAT fisheries. This differentiation represents a major improvement in data granularity and supports more accurate and transparent bycatch estimation. By standardizing the classification of catch types across CPCs, the new framework facilitates the development of consistent and statistically sound methods to estimate bycatch on a broader scale, including the potential reconstruction of historical trends using proportional assumptions. This approach aids in identifying species most affected by bycatch.

The historical imputation of the BC, TC, and UN time series should be viewed as exploratory and unofficial. Beyond our current inability to calculate the necessary ratios at high resolutions, the primary assumption underlying this reconstruction is that the 2023 ratios of bycatch, target catch, and unclassified catch to total catches remain consistent over time. This assumption is problematic. Firstly, consider regulatory changes affecting shark species. In the early 2000s, these species were targeted to varying degrees, but subsequent ICCAT recommendations—such as Rec. 21-09, 23-12, 11-08, and 15-06—prohibited their landing. Secondly, the population dynamics of many ICCAT species, particularly their relative abundance and spatial distribution, have likely changed over time, rendering the constant ratio assumption unreliable. While a ratio-based method might be appropriate for certain species groups, it may not be suitable for others. Therefore, this approach requires review on a species-specific basis.

Challenges associated with estimating bycatch are not limited to imputing historical catches. Statistical Correspondents to ICCAT, responsible for submitting Task 1 data, may also encounter difficulties in categorizing captured fish into BC, TC, and UN categories. Even with access to finer-scale data than the ICCAT Secretariat, CPCs might find it challenging to classify their catches accurately. The distinction between target and non-target species can be ambiguous. For instance, a species might be considered bycatch during one part of a trip but targeted in another, depending on factors like availability. Additionally, in multi-species fisheries, there may effectively be no bycatch. Furthermore, not all fishing events are covered by comprehensive observer programs or electronic monitoring systems that could assist in assigning fishing events to these categories. Consequently, the categorization of catch into these classifications remains uncertain.

References

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Table 1. Classification of fishing activity catch intention (planned/incidental) on species caught (target or bycatch).

TCorBC	TCorBC_Description
TC	Targeted catches (landed and/or discarded): obtained from fishing activities targeting one or more species (target species)
BC	By-catch/incidental catches: unintentional catches obtained from fishing activities (not a targeted species)
UN	Unknown OR not possible to discriminate between TC and BC (default)

Table 2. Sum of total tonnage (Values Total (tons)) of bycatch (BC), total catch (TC), and unclassified catch (UN) and the ratios of total bycatch to total catch (BC_r), total target catch to total catch (TC_r), and unclassified catch total catch (UN_r) for the 2023 fishing year.

SpeciesGrp	Species	Values		Target Bycatch Code		Ratio			Total Total (tons)		Total Ratio
		BC_r	TC_r	UN_R	BC_r	TC_r	UN_R	Total	Ratio		
1-Tuna (major sp.)	ALB	2714	46554	2918	5%	89%	6%	52186	100%		
	BET	2461	56446	309	4%	95%	1%	59215	100%		
	BFT	1282	40492	34	3%	97%	0%	41808	100%		
	BUM	1689	71	196	86%	4%	10%	1956	100%		
	SAI	1947	350	8	84%	15%	0%	2305	100%		
	SKJ	14287	234470	274	6%	94%	0%	249031	100%		
	SPF	661		0	100%	0%	0%	661	100%		
	SWO	2859	25005	243	10%	89%	1%	28107	100%		
	WHM	167	3	4	96%	2%	2%	174	100%		
	YFT	6662	130772	2883	5%	93%	2%	140318	100%		
2-Tuna (small)	FRI	2810	8648	3859	18%	56%	25%	15317	100%		
	BLF	5211	2274	112	69%	30%	1%	7597	100%		
	BLT	134	4272	62	3%	96%	1%	4469	100%		
	BON	7075	25397	6933	18%	64%	18%	39405	100%		
	BOP	1	133	111	1%	54%	45%	246	100%		
	BRS	315		695	31%	0%	69%	1010	100%		
	CER		0	0	0%	11%	89%	0	100%		
	KGM	5186	10162	2301	29%	58%	13%	17649	100%		
	LTA	5264	14967	4566	21%	60%	18%	24797	100%		
	MAW	10	1262	3252	0%	28%	72%	4523	100%		
	SSM	7350	2	2220	77%	0%	23%	9573	100%		
	WAH	1486	282	2305	36%	7%	57%	4073	100%		
	3-Tuna (other)	BLM	0		0	4%	0%	96%	1	100%	
BUK		81			100%	0%	0%	81	100%		
LEC		237			100%	0%	0%	237	100%		
MLS		7		5	58%	0%	42%	13	100%		
MSP		14			100%	0%	0%	14	100%		
NPH		0			100%	0%	0%	0	100%		
OIL		168			100%	0%	0%	168	100%		
RSP		11		0	97%	0%	3%	11	100%		
SBF		1983	72		97%	3%	0%	2054	100%		
SSP		25		1	96%	0%	4%	25	100%		
TUN		2862		363	89%	0%	11%	3224	100%		
TUS		54			100%	0%	0%	54	100%		
4-Sharks (major)		BSH	18370	35749	371	34%	66%	1%	54490	100%	
	POR	14		9	60%	0%	40%	23	100%		
	SMA	1525	536	24	73%	26%	1%	2085	100%		
5-Sharks (other)		1633	834	54%	28%	19%	3034	100%			
6-Other Species		2041	3742	1132	30%	54%	16%	6915	100%		
Grand Total		98596	642495	35760	13%	83%	5%	776851	100%		

Table 3. Species designated by ICCAT parties at bycatch.

Species Code	Scientific Name	Common Name	SpeciesGrp	FamilyTx
BUM	<i>Makaira nigricans</i>	Atlantic blue marlin	1-Tuna (major sp.)	Istiophoridae
RSP	<i>Tetrapturus georgii</i>	Roundscale spearfish	3-Tuna (other)	Istiophoridae
SAI	<i>Istiophorus albicans</i>	Atlantic sailfish	1-Tuna (major sp.)	Istiophoridae
SPF	<i>Tetrapturus pfluegeri</i>	Longbill spearfish	1-Tuna (major sp.)	Istiophoridae
WHM	<i>Kajikia albida</i>	Atlantic white marlin	1-Tuna (major sp.)	Istiophoridae
SKI	<i>Katsuwonus pelamis</i>	Skipjack tuna	1-Tuna (major sp.)	Scombridae
SWO	<i>Xiphias gladius</i>	Swordfish	1-Tuna (major sp.)	Xiphiidae
SSP	<i>Tetrapturus angustirostris</i>	Shortbill spearfish	3-Tuna (other)	Istiophoridae
BSH	<i>Prionace glauca</i>	Blue shark	4-Sharks (major)	Carcharhinidae
SMA	<i>Isurus oxyrinchus</i>	Shortfin mako	4-Sharks (major)	Lamnidae
POR	<i>Lamna nasus</i>	Porbeagle	4-Sharks (major)	Lamnidae
BON	<i>Sarda sarda</i>	Atlantic bonito	2-Tuna (small)	Scombridae
BRS	<i>Scomberomorus brasiliensis</i>	Serra Spanish mackerel	2-Tuna (small)	Scombridae
SSM	<i>Scomberomorus maculatus</i>	Atlantic Spanish mackerel	2-Tuna (small)	Scombridae
LTA	<i>Euthynnus alletteratus</i>	Little tunny(=Atl.black skipj)	2-Tuna (small)	Scombridae
KGM	<i>Scomberomorus cavalla</i>	King mackerel	2-Tuna (small)	Scombridae
FRI	<i>Auxis thazard</i>	Frigate tuna	2-Tuna (small)	Scombridae
BLT	<i>Auxis rochei</i>	Bullet tuna	2-Tuna (small)	Scombridae
ALV	<i>Alopias vulpinus</i>	Thresher	5-Sharks (other)	Alopiidae
BTH	<i>Alopias superciliosus</i>	Bigeye thresher	5-Sharks (other)	Alopiidae
FAL	<i>Carcharhinus falciformis</i>	Silky shark	5-Sharks (other)	Carcharhinidae
OCS	<i>Carcharhinus longimanus</i>	Oceanic whitetip shark	5-Sharks (other)	Carcharhinidae
PTH	<i>Alopias pelagicus</i>	Pelagic thresher	5-Sharks (other)	Alopiidae
SPK	<i>Sphyrna mokarran</i>	Great hammerhead	5-Sharks (other)	Sphyrnidae
SPL	<i>Sphyrna lewini</i>	Scalloped hammerhead	5-Sharks (other)	Sphyrnidae
SPZ	<i>Sphyrna zygaena</i>	Smooth hammerhead	5-Sharks (other)	Sphyrnidae
BFT	<i>Thunnus thynnus</i>	Northern bluefin tuna	1-Tuna (major sp.)	Scombridae
LMA	<i>Isurus paucus</i>	Longfin mako	5-Sharks (other)	Lamnidae
BET	<i>Thunnus obesus</i>	Bigeye tuna	1-Tuna (major sp.)	Scombridae
YFT	<i>Thunnus albacares</i>	Yellowfin tuna	1-Tuna (major sp.)	Scombridae
POA	<i>Brama brama</i>	Atlantic pomfret	6-Other Species	NULL
GAR	<i>Belone belone</i>	Garfish	6-Other Species	Belontiidae
QUL	<i>Squaliolus laticaudus</i>	Spined pygmy shark	5-Sharks (other)	Dalatidae
MOX	<i>Mola mola</i>	Ocean sunfish	6-Other Species	Molidae
SAU	<i>Scomberesox saurus</i>	Atlantic saury	6-Other Species	Scomberesocidae
SKH	<i>Selachimorpha (Pleurotremata)</i>	Various sharks nei	5-Sharks (other)	NULL
ALB	<i>Thunnus alatalunga</i>	Albacore	1-Tuna (major sp.)	Scombridae
MSP	<i>Tetrapturus belone</i>	Mediterranean spearfish	3-Tuna (other)	Istiophoridae
OIL	<i>Ruvettus pretiosus</i>	Oilfish	6-Other Species	Gempylidae
DOL	<i>Coryphaena hippurus</i>	Common dolphinfish	6-Other Species	Coryphaenidae
ALM	<i>Aluterus monoceros</i>	Unicorn leatherjacket filefish	6-Other Species	Monacanthidae
CFW	<i>Coryphaena equiselis</i>	Pompano dolphinfish	6-Other Species	Coryphaenidae
CNT	<i>Canthidermis maculata</i>	Rough triggerfish	6-Other Species	Balistidae
GBA	<i>Sphyaena barracuda</i>	Great barracuda	6-Other Species	NULL
LGH	<i>Lagocephalus lagocephalus</i>	Oceanic puffer	6-Other Species	Tetraodontidae
MRW	<i>Masturus lanceolatus</i>	Sharptail mola	6-Other Species	Molidae
NAU	<i>Naucrates ductor</i>	Pilotfish	6-Other Species	Carangidae
PLS	<i>Pteroplatytrigon violacea</i>	Pelagic stingray	5-Sharks (other)	NULL
RHN	<i>Rhincodon typus</i>	Whale shark	5-Sharks (other)	Rhincodontidae
RMB	<i>Manta birostris</i>	Giant manta	5-Sharks (other)	RAJIFORMES
RMM	<i>Mobula mobular</i>	Devil fish	5-Sharks (other)	Mobulidae
RMO	<i>Mobula thurstoni</i>	Smoothtail mobula	5-Sharks (other)	Mobulidae
RMT	<i>Mobula tarapacana</i>	Chilean devil ray	5-Sharks (other)	Mobulidae
RRU	<i>Elagatis bipinnulata</i>	Rainbow runner	6-Other Species	Carangidae
RUB	<i>Caranx crysos</i>	Blue runner	6-Other Species	Carangidae
SPN	<i>Sphyrna spp</i>	Hammerhead sharks nei	5-Sharks (other)	Sphyrnidae
TRG	<i>Balistes carolinensis</i>	Grey triggerfish	6-Other Species	Balistidae
USE	<i>Uraspis secunda</i>	Cottonmouth jack	6-Other Species	Carangidae
WAH	<i>Acanthocybium solandri</i>	Wahoo	2-Tuna (small)	Scombridae
YTL	<i>Seriola rivoliana</i>	Longfin yellowtail	6-Other Species	Carangidae
BSK	<i>Cetorhinus maximus</i>	Basking shark	5-Sharks (other)	Cetorhinidae
SBF	<i>Thunnus maccoyii</i>	Southern bluefin tuna	3-Tuna (other)	Scombridae
BLF	<i>Thunnus atlanticus</i>	Blackfin tuna	2-Tuna (small)	Scombridae
LEC	<i>Lepidocybium flavobrunneum</i>	Escotar	6-Other Species	NULL
TAL	<i>Taractichthys longipinnis</i>	Big-scale pomfret	6-Other Species	Bramidae
THR	<i>Alopias spp</i>	Thresher sharks nei	5-Sharks (other)	Alopiidae
BOP	<i>Orcynopsis unicolor</i>	Plain bonito	2-Tuna (small)	Scombridae
TIG	<i>Galeocerdo cuvier</i>	Tiger shark	5-Sharks (other)	Carcharhinidae
CCS	<i>Carcharhinus signatus</i>	Night shark	5-Sharks (other)	Carcharhinidae
STT	<i>Dasyatidae</i>	Stingrays, butterfly rays nei	5-Sharks (other)	Dasyatidae
SBL	<i>Hexanchus griseus</i>	Bluntnose sixgill shark	5-Sharks (other)	Hexanchidae
LEE	<i>Lichia amia</i>	Leerfish	6-Other Species	Carangidae
TUN	<i>Thunnini</i>	Tunas nei	3-Tuna (other)	Scombridae
MAW	<i>Scomberomorus tritor</i>	West African Spanish mackerel	2-Tuna (small)	Scombridae
TUS	<i>Thunnus spp</i>	True tunas nei	3-Tuna (other)	Scombridae
RSK	<i>Carcharhinidae</i>	Requiem sharks nei	5-Sharks (other)	Carcharhinidae
CCL	<i>Carcharhinus limbatus</i>	Blacktip shark	5-Sharks (other)	Carcharhinidae
GNC	<i>Ginglymostoma cirratum</i>	Nurse shark	5-Sharks (other)	Ginglymostomatidae
BRO	<i>Carcharhinus brachyurus</i>	Copper shark	5-Sharks (other)	Carcharhinidae
CCA	<i>Carcharhinus altimus</i>	Bignose shark	5-Sharks (other)	Carcharhinidae
CCG	<i>Carcharhinus galapagensis</i>	Galapagos shark	5-Sharks (other)	NULL
CCP	<i>Carcharhinus plumbeus</i>	Sandbar shark	5-Sharks (other)	Carcharhinidae
DUS	<i>Carcharhinus obscurus</i>	Dusky shark	5-Sharks (other)	Carcharhinidae
LMD	<i>Lamna ditropis</i>	Salmon shark	5-Sharks (other)	Lamnidae
BUK	<i>Gasterochisma melampus</i>	Butterfly kingfish	3-Tuna (other)	Scombridae
MLS	<i>Tetrapturus audax</i>	Striped marlin	3-Tuna (other)	Istiophoridae
MSK	<i>Lamnidae</i>	Mackerel sharks,porbeagles nei	5-Sharks (other)	Lamnidae
NPH	<i>Scomberomorus nipponius</i>	Japanese Spanish mackerel	3-Tuna (other)	Scombridae
PSK	<i>Pseudocarcharias kamoharai</i>	Crocodile shark	5-Sharks (other)	NULL
LAG	<i>Lampris guttatus</i>	Opah	6-Other Species	NULL
WSH	<i>Carcharodon carcharias</i>	Great white shark	5-Sharks (other)	Lamnidae
CCE	<i>Carcharhinus leucas</i>	Bull shark	5-Sharks (other)	Carcharhinidae
GAG	<i>Galeorhinus galeus</i>	Tope shark	5-Sharks (other)	Triakidae
BSF	<i>Aphanopus carbo</i>	black scabbardfish	3-Tuna (other)	Trichiuridae
TRI	<i>Balistidae</i>	Triggerfishes, durgons nei	6-Other Species	Balistidae
BLM	<i>Makaira indica</i>	Black marlin	3-Tuna (other)	Istiophoridae
BAZ	<i>Sphyaenidae</i>	Barracudas, etc. nei	6-Other Species	Sphyaenidae

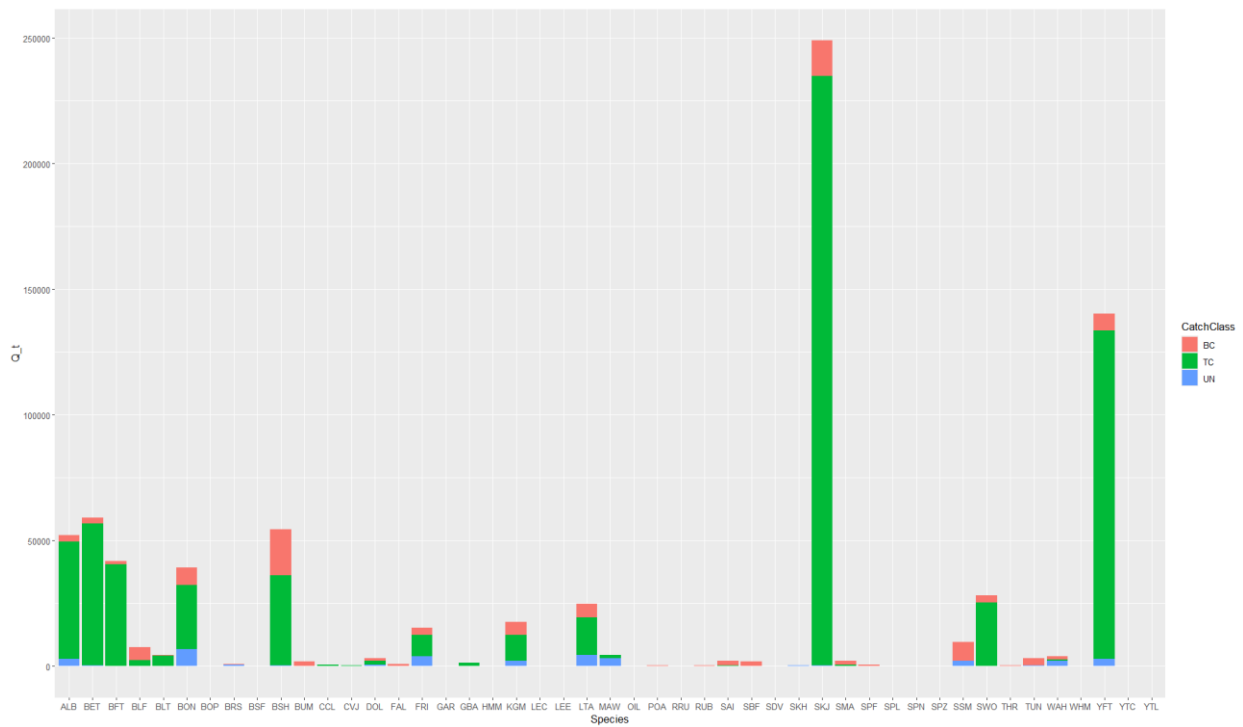


Figure 1. Summary of Task 1 data by species (x axis) categorized into bycatch (red), target catch (green), and unclassified (blue) for the year 2023.

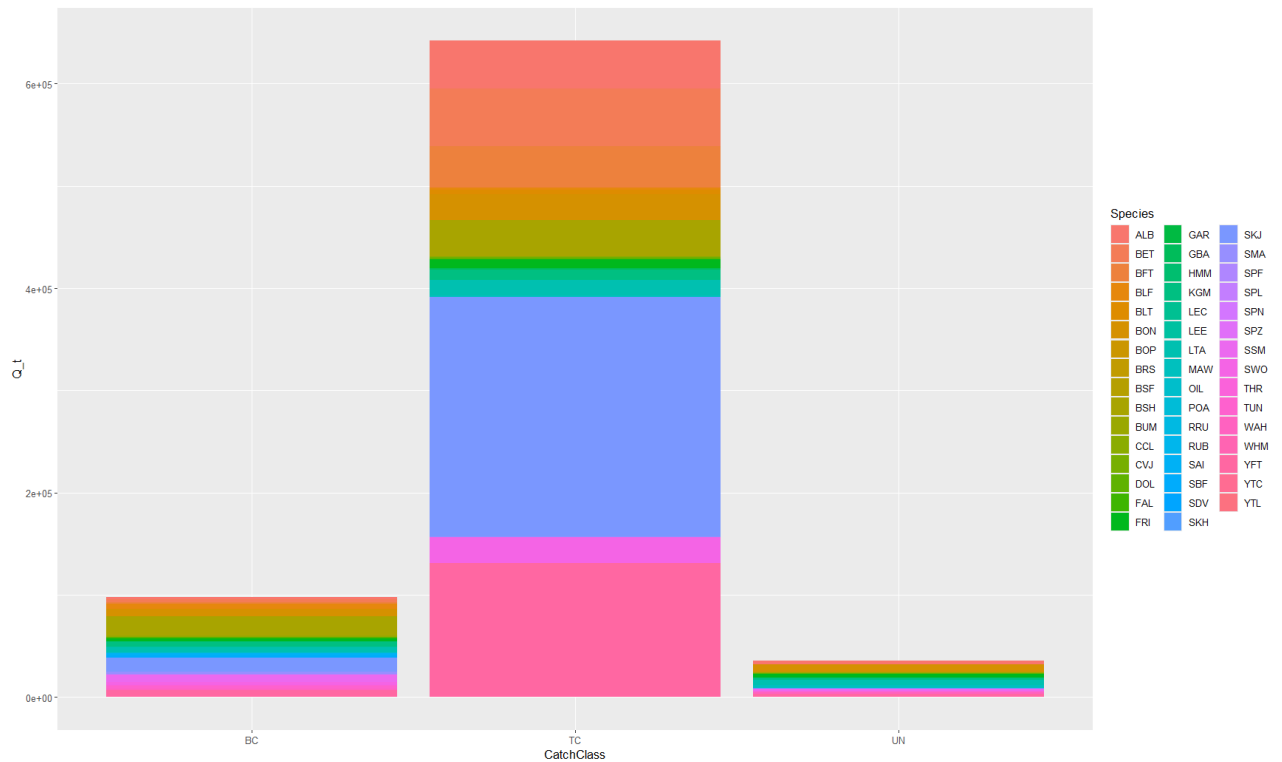


Figure 2. Sum of bycatch (BC), target catch (TC), and unclassified (UN) by species (see legend) for the 2023 fishing year.



Figure 3. Imputed total estimates of bycatch (totByc), target catch (totTC), and unclassified catch (totUN) aggregated by year (all species combined).

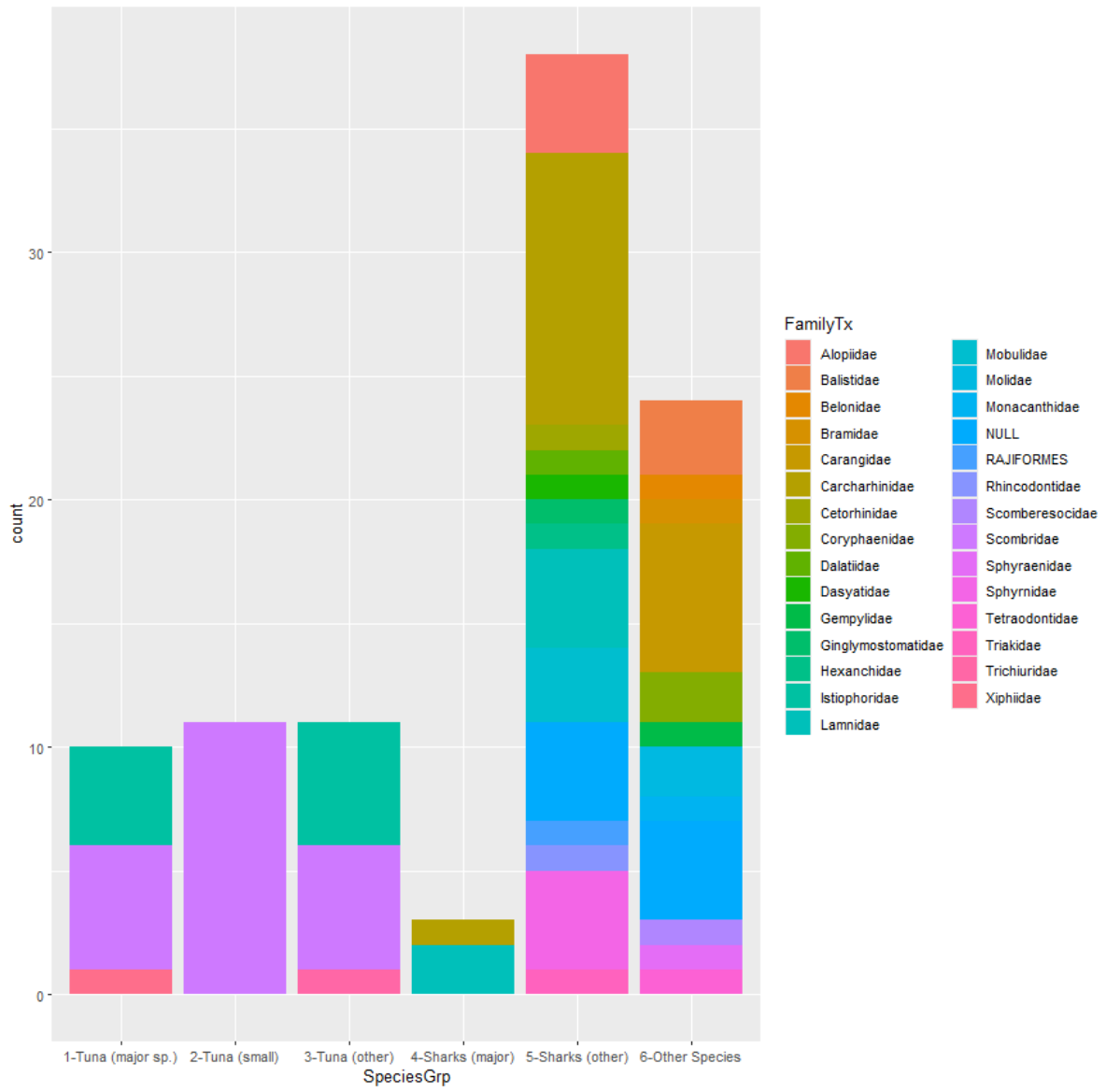


Figure 4. Count of fish bycatch at ICCAT by species group (SpeciesGrp) and family.

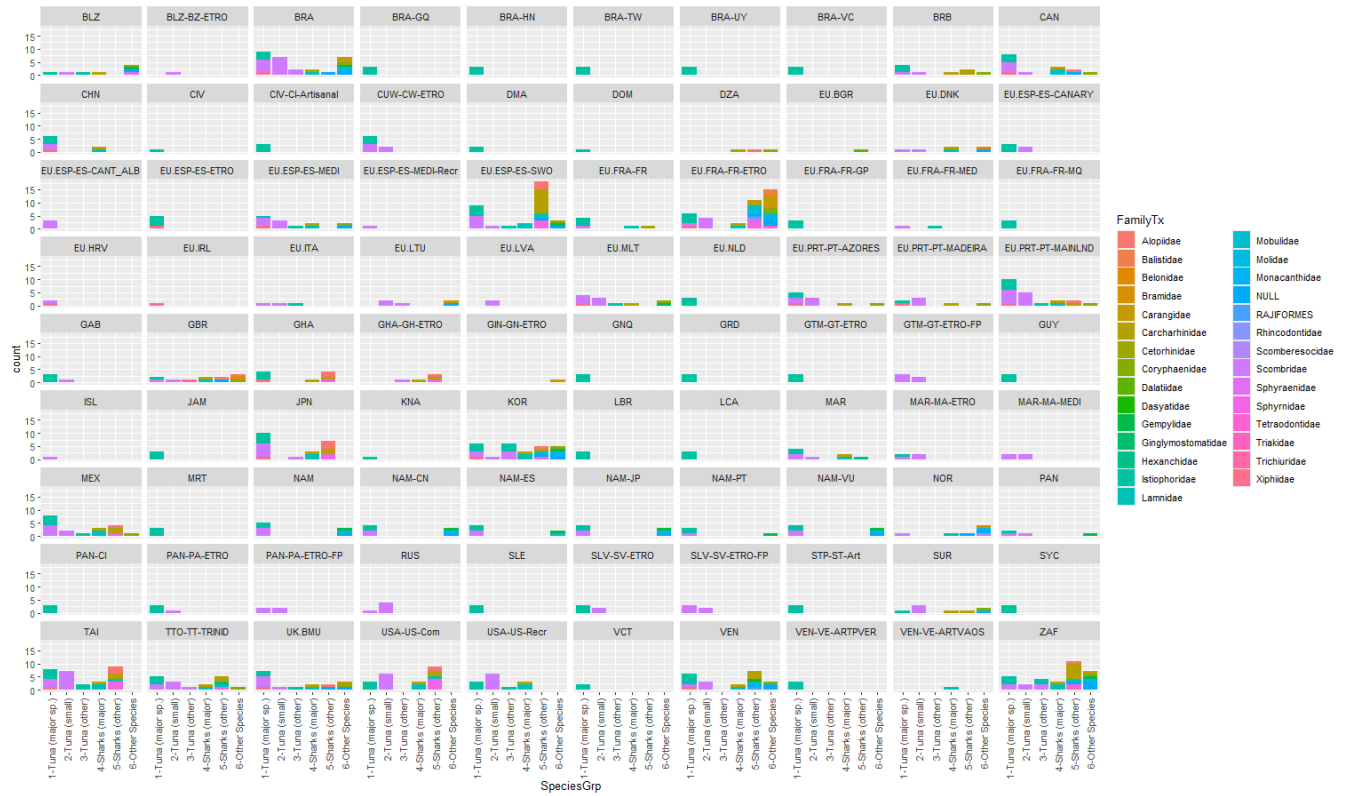


Figure 5. Count of fish species classified as bycatch by ICCAT species group (SpeciesGrp), and family.