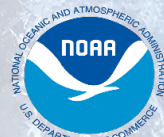


The final
Southwest Fisheries Science Center

2020 BILLFISH NEWSLETTER

research • news • tagging • photos

- ▶ **The Cooperative Billfish Tagging Program comes to an end**
- ▶ **2018, 2019, and 2020 Tagging and Angler Survey Results**
- ▶ ***The Last Tally: Top-Taggers since 1963***
- ▶ **Photo Gallery: Celebrating 57 years of Tagging**



NOAA
FISHERIES
Southwest Fisheries
Science Center



SWFSC Cooperative Billfish Tagging Program

<https://www.fisheries.noaa.gov/west-coast/science-data/billfish-newsletter>
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Congratulations to **Andrew Chalmers** for winning the 2020 *BFNL* Cover Photo Contest! Andrew photographed this marlin in 2018 off Kona, Hawai'i while fishing with Captain McGrew Rice and first mate Carlton on the *Ihu Nui*. Andrew would like to say *mahalo* to Mason Farish and the crew. Beautiful fish!

As of May 2021, the SWFSC will discontinue the Cooperative Billfish Tagging Program (CBTP).

As of this newsletter announcement, the SWFSC will discontinue distribution of new billfish tags, the International Billfish Angler Survey, and the *Billfish Newsletter*. **However, we will continue to log tag recoveries, so please continue to report recaptured billfish tags or the release of any existing tags in your possession.**

▶ What this means for captains and anglers:

- If you have unused tags—continue fishing, tagging, and reporting! We will continue to archive tagging information for tags that have not yet been deployed or for completed tagging report cards.
- Please report any recaptures, as these data will also be archived.
- You will no longer receive annual tag bundles, update emails, the International Billfish Angler Survey, or the *Billfish Newsletter*.
- If you deliver tags to international partners, please let them know of these changes.

▶ Looking ahead:

- All the *Billfish Newsletters* released since 1964 will be archived on the [SWFSC website](#).
- Updated data on tag releases and recoveries from 1963-2020 will be posted for public download at [ERDDAP](#) and [NMFS InPort](#) around June 2021. These sites allow you to query tag releases and returns by location, date, and species. The public dataset will NOT include Personal Identifying Information (PII) such as names, email, or physical addresses. It will, however, include anonymous angler sequence numbers and biological and fishing information. More information about accessing the data will be posted on the SWFSC Billfish Research page around June 2021.
- A historical review of the CBTP will be released around September 1 that describes the history of the program and the overall results from the 50 years of the International Billfish Angler Survey and 57 years of tagging.
- If other options for continuation of tagging efforts through another organization become available, we will send out an email notification.

Since 1963, the CBTP has operated with and for ethical anglers dedicated to the catch-tag-and-release of these amazing species. We hope this global catch-and-release practice continues to inspire the next generation of anglers well past the end of the CBTP.

▶ **Interested in purchasing your own tags?** Our latest publication details how the CBTP purchased and distributed tags, managed our data, and conducted outreach. We also provide suggestions for future tagging programs: <https://repository.library.noaa.gov/view/noaa/28449>.

FINAL ACKNOWLEDGMENTS

The SWFSC Cooperative Billfish Tagging Program thanks the thousands of anglers and captains who have supported and collaborated with the program over the last 57 years. Your enthusiasm to contribute to billfish research will have a lasting mark on generations to come.



Special recognition goes to the many charter desk managers and tournament organizers who distributed and mailed back thousands of CBTP tags each season.

We also understand many U.S. anglers traveled to Mexico, the South Pacific, and other locales to distribute CBTP tags to international partners. We are extremely grateful for your efforts!



A warm thank you to **The Billfish Foundation (TBF)** for the research collaboration over the years. We recognize the TBF as a pillar of tagging effort and wish all anglers the best of luck on their continued tagging and catch-and-release with TBF.



Major thanks to the former SWFSC staff who managed the CBTP and contributed considerably throughout the program's history:

James Wraith
Suzanne Kohin
Randall (Rand) Rasmussen
David B. Holts
Douglas W. Prescott
James (Jim) L. Squire, Jr.
Horace Witherspoon

Please keep in touch and continue to practice ethical angling. Tight lines!

Thank you | Mahalo | Fa'afetai | ありがとうございます | Gracias | Merci beaucoup



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swordfish in the California Current

Welcome to the *2020 Billfish Newsletter*, the final edition of the longstanding newsletter series initiated in 1964. We would be remiss in not acknowledging the profound impacts the global pandemic of the novel SARS-CoV-2 coronavirus (severe acute respiratory syndrome coronavirus 2), also known as COVID-19, has had on our nation and global community the past two years. The NOAA Southwest Fisheries Science Center (SWFSC) hopes you and your families are staying healthy and safe. Since March 2020, the SWFSC federal building in La Jolla, California has undergone various stages of restricted access and closures due to COVID-19 safety protocols. As a result, we were unable to send billfish tags to tournaments or individual anglers in 2020. We appreciate your patience and understanding during this unprecedented time. We wish you and yours health and prosperity in 2021.

Prologue

The annual *Billfish Newsletter* has been communicating the results of the Cooperative Billfish Tagging Program for 57 years. Southwest Fisheries Science Center researchers have been working alongside the billfish angling community for nearly six decades to promote ethical angling and further our understanding of various aspects of billfish biology and ecology. Billfish research conducted over the years as a result of this collaboration has included recreational fishery monitoring, biological research into the life history and ecology of specific billfish species, and determining the economic importance of billfish resources.

While our sponsorship of the CBTP is ending, we trust anglers will continue to practice catch-and-release practices and have opportunities to contribute to billfish conservation by promoting ethical angling and passing on best practices to future generations. We also invite you to browse the historical archives of tagging and survey data the SWFSC will make available in 2021. Thank you for your commitment and participation!

Kristen Koch

Director
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Annie Yau

Fisheries Resources Division Director
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Image credit Captain Steve Magassy of Blue Devil Fishing.

Introduction

The *2020 Billfish Newsletter* issue is a comprehensive review of the 2018, 2019, and 2020 fishing years. While the 2018 data were collected during the 2019 calendar year and the 2019 data were collected during the 2020 calendar year, the 2020 data were tallied from tags received by mail at the SWFSC as of February 10, 2021. We understand there will likely be 2020 tag report cards arriving following the release of this newsletter, so the 2020 data presented here may not be comprehensive. Tags arriving to the SWFSC after February 10 will be added to the database for public release and download by June 2021, with once-yearly updates thereafter.

In the next 25 pages, we present tag releases and recoveries for the 2018-2020 seasons and the results of the 2018 and 2019 International Billfish Angler Surveys. Our avid anglers have created one of the world's longest time series of regional estimates of relative abundance, migrations, growth, and distribution for billfish species from Baja to New Zealand. The 2018 and 2019 survey results show record high nCPUEs for various species in regions throughout the Pacific. It is also our pleasure to present the top-tagging standouts for 2018, 2019, and 2020, as our nod to their amazing efforts over the years.

We also continue our consistent series—*Science in Action*—featured here for the final time. Our final *Science in Action* series features one of our own from the SWFSC, Dr. Antonella Preti, detailing the diets of broadbill swordfish in the California Current. Antonella completed her Ph.D. in Marine Ecology in May 2020 from the School of Biological Sciences at the University of Aberdeen in Scotland. Congratulations, Dr. Preti!

In light of the news of the CBTP ending, we also include some additional acknowledgments and gratitude to the many participants over the history of the program. We hope you enjoy looking at the hundreds of photos submitted over the decades and the overall Top-Tagging Captains and Top-Tagging Anglers since 1963. While all good things come to an end, including this program, we are pleased to provide one last Billfish Newsletter to recognize the amazing community that has supported the CBTP since 1963. Tight lines and fine fishing for decades to come!

The International Billfish Angler Survey

The International Billfish Angler Survey is a digital form sent out to anglers annually at the start of each calendar year to be completed with the prior year's catch and effort information. The 2019 Angler Survey was the final survey sent out to the community, concluding a full 50 years since the first survey was distributed in 1969.

Anglers report the number of whole fishing days per fishing location as yearly effort, and report billfish catch (kept and released) by species at each location. From these two metrics—catch and effort—we calculate a nominal catch-per-unit-effort (nCPUE), defined here as the number of billfish caught per fishing day (total billfish caught/total fishing effort). The nCPUE alone should not be taken as a representation of population size or trends. Instead, as used here, the nCPUE infers a relative index of nominal recreational effort collected by this survey in the absence of comprehensive and systematic fishery-independent data collection. Thank you to the participants in 2018 and 2019 who quickly submitted their Angler Surveys. The survey results from the 2018 (Table 1) and 2019 (Table 2) calendar years are illustrated in Figure 2.

2018 Results

A total of 73 anglers reported 499 days of fishing effort and 895 billfish caught from destinations in the Pacific, Indian, and Atlantic Oceans in 2018. Per usual, anglers reported the majority of fishing days off Baja California, Mexico and Southern California. However, for the first time in years, Hawai'i did not rank as the top location reporting effort and billfish catch. Overall, striped marlin (*Kajikia audax*) was the most caught species caught in 2018, accounting for 67% of the total billfish caught, followed by Indo-Pacific sailfish (*Istiophorus platypterus*) accounting for 21% of the total catch, and Pacific blue marlin (*Makaira mazara*) accounting for just 8% of the total catch (Table 1). The overall nCPUE for all regions in 2018 was 1.79.



Image credit Larry Peabody, showing the *Dottie B II* in Baja.

Locations in Baja California, Mexico, accounted for about 25% of the total reported fishing days for the year and about 65% of the total reported billfish caught. With 575 billfish caught in 122 fishing days, **the 2018 regional nCPUE for Baja reached a record high of 4.71** (Table 1). This value outperforms even the 2016 (1.43) and the 2017 (1.55) nCPUE values which were considered the two highest for the region for more than 5 years. The most common species caught in all Baja locations was striped marlin, with a total of 562 reported caught off Baja in 2018 alone. This record nCPUE in Baja marks a change from years past, as the most fishing days and billfish caught are typically reported out of Hawai'i.

Southern California ranked below Baja's fishing effort, with anglers reporting 69 fishing days and 15 total billfish caught in 2018. The overall nCPUE for Southern California, 0.22, marks a return to the fairly typical results for the region (0.24 in 2015 and 0.18 in 2016)

following an anomalous zero billfish reported caught in 48 fishing days in 2017. Striped marlin remained the most-caught species in Southern California in 2018.

Anglers reported a total of 61 fishing days for Hawai'i and Costa Rica in 2018, with drastically different catch totals (Table 1). Anglers in Costa Rica caught 89 total billfish, mostly sailfish, amounting to an overall nCPUE of 1.46. Anglers only reported catching 32 billfish in Hawai'i during the same fishing effort, for an overall nCPUE of 0.52. Considering anglers from Hawai'i have consistently reported the greatest number of fishing days for the past seven years, this drop in nCPUE from 0.73 in 2017 to 0.52 in 2018 likely reflects lower reporting. Sailfish were the most-caught species in Costa Rica, accounting for 66% of the region's total billfish catch. The Pacific blue marlin remained the most-caught species for Hawai'i, accounting for nearly 80% of the region's total billfish catch.

2019 Results

A total of 75 anglers submitted surveys in 2019 to report 362 days of fishing effort and 500 total billfish caught from destinations in the Pacific, Atlantic, and Indian Oceans. Unlike the 2018 survey, anglers reported catching broadbill swordfish (*Xiphias gladius*) in 2019 from locations in Hawai'i and Southern California. The overall nCPUE for all regions was 1.38 billfish caught per fishing day. Sailfish was the most caught species in 2019, accounting for 34% of total billfish caught, followed closely by striped marlin at 33%, and Pacific blue marlin at 23% of the total catch (Table 2).

In contrast to the anomalous 2018 results, anglers from Hawai'i reported the most fishing days in 2019 (Table 2). The combined 103 days reported in Hawai'i accounted for just under 30% of the year's total reported

effort. The 117 billfish caught during this effort resulted in a regional nCPUE of 1.13, a major improvement from the 0.52 nCPUE reported for 2018. The main species caught in Hawai'i in 2019 was Pacific blue marlin and shortbill spearfish (*Tetrapturus angustirostris*), one of which was caught twice—check out our tag recovery report to learn more.

Locations in Baja accounted for 21% of the total reported fishing days in 2019. The 145 billfish reported caught in 55 fishing days in Baja locations resulted in a regional nCPUE of 2.63, which pales in comparison with the record high of 4.71 reported in 2018. Striped marlin was the most caught species in Baja, not only comprising 92% of the region's total catch, but accounting for 80% of the total striped marlin caught in all locations in 2018 (Table 2). Anglers in Acapulco/Ixtapa/ Zihuatanejo/Guerrero reported 48 fishing days, 13% of the total fishing days in 2018, with a total of 62 billfish caught for a regional nCPUE of 1.29. As expected, the majority of the catch in this region was sailfish.



Image credit Andrew Chalmers.

Table 1. Results of the 2018 International Billfish Angler Survey including fishing days, number of billfish by location, nominal catch-per-unit-effort (nCPUE), and major species caught by area: black marlin (BK), blue marlin (BM), sailfish (SF), and striped marlin (SM), and spearfish (SP).

Location	2018 International Billfish Angler Survey Results												
	Fishing Days	BM catch	BM nCPUE	BK catch	BK nCPUE	SM catch	SM nCPUE	SF catch	SF nCPUE	SP catch	SP nCPUE	Total catch	Overall nCPUE
Baja California, Mexico	122	6	0.04	0	0	562	4.60	5	0.04	2	0.01	575	4.71
Southern California, USA	69	0	0	0	0	14	0.20	0	0	1	0.01	15	0.22
Costa Rica	61	27	0.44	0	0	3	0.04	59	0.96	0	0	89	1.46
Hawai'i	61	25	0.41	0	0	1	0.01	0	0	6	0.09	32	0.52
Acapulco/Ixtapa/Zihuatanejo/Guerrero	43	1	0.03	0	0	8	0.18	52	1.20	0	0	61	1.42
Manzanillo/Colima, Mexico	41	2	0.04	0	0	4	0.09	16	0.39	0	0	22	0.54
Japan	32	12	0.37	0	0	3	0.09	0	0	0	0	15	0.47
Panama	22	3	0.13	4	0.18	0	0	3	0.13	0	0	10	0.45
Kenya	20	1	0.05	0	0	9	0.45	6	0.3	0	0	16	0.8
Australia	14	0	0	15	1.07	0	0	0	0	0	0	15	1.07
Malaysia	12	0	0	0	0	0	0	39	3.25	0	0	39	3.25
Colombia	2	0	0	0	0	0	0	6	3	0	0	6	3.0
Totals	499	77	0.15	19	0.03	604	1.21	186	0.37	9	0.01	895	1.79

Table 2. Results of the 2019 International Billfish Angler Survey including fishing days, number of billfish by location, nominal catch-per-unit-effort (nCPUE), and major species caught by area: black marlin (BK), blue marlin (BM), sailfish (SF), and striped marlin (SM), spearfish (SP), and swordfish (SWO).

Location	2019 International Billfish Angler Survey Results														
	Fishing Days	BM catch	BM nCPUE	BK catch	BK nCPUE	SM catch	SM nCPUE	SF catch	SF nCPUE	SP catch	SP nCPUE	SWO catch	SWO nCPUE	Total catch	Overall nCPUE
Hawai'i	103	80	0.77	0	0	7	0.06	0	0	28	0.27	2	0.02	97	1.13
Baja California, Mexico	55	8	0.14	0	0	134	2.42	3	0.05	0	0	0	0	142	2.63
Southern California, USA	52	0	0	0	0	4	0.07	0	0	0	0	1	0.02	5	0.09
Aca/Ixtapa/Zih./Guerrero	48	1	0.02	0	0	12	0.25	48	1.0	1	0.02	0	0	62	1.29
Japan	21	12	0.57	0	0	3	0.14	0	0	0	0	0	0	15	0.71
Manzanillo/Colima	21	4	0.19	0	0	6	0.28	6	0.28	0	0	0	0	16	0.76
Australia	17	0	0	17	1.0	0	0	0	0	0	0	0	0	17	1.00
Malaysia	12	0	0	0	0	0	0	39	3.25	0	0	0	0	39	3.25
Costa Rica	11	4	0.36	0	0	0	0	22	2	0	0	0	0	26	2.36
Panama	9	1	0.11	0	0	0	0	0	0	0	0	0	0	1	0.11
Bermuda	7	4	0.57	0	0	0	0	0	0	0	0	0	0	4	0.57
Guatemala	6	1	0.16	0	0	0	0	52	8.66	0	0	0	0	53	8.83
Totals	362	115	0.31	17	0.05	166	0.45	170	0.46	29	0.08	3	0.008	500	1.38

Since 1969, the CBTP has produced one of the longest time-series of nominal catch per unit effort as reported by volunteer anglers in the Pacific. The nCPUE were examined for Pacific blue marlin, striped marlin, sailfish, and black marlin (*Istiompax indica*) in the areas of Hawai'i, Baja California, Mexico, Southern California, Costa Rica, Panama, and Australia (Figure 1).

Pacific Blue Marlin

The nCPUE for Pacific blue marlin in Baja locations and Hawai'i have shown an increasing trend since 2017. Anglers reported catching 25 blue marlin in 61 fishing days in Hawai'i in 2018, resulting in an nCPUE of 0.44 (Table 1). Anglers reported catching 80 blue marlin during 103 total fishing days in Hawai'i in 2019 (Table 2), for a *record high nCPUE of 0.77 for Hawai'i in the history of the CBTP!*

In Baja California, Mexico locations, anglers reported catching six blue marlin during 122 total fishing days in 2018 (Table 1) and eight Pacific blue marlin in 55 total fishing days in 2019 (Table 2). These survey results show a similar increase in nCPUE for Pacific marlin in Baja from 0.04 in 2018 to 0.14 in 2019 (Table 2). This 2019 value also produced *the highest blue marlin nCPUE for the Baja region since 1994*, beating the previous and most recent record of 0.11 in 2016. While not shown in Figure 1, relatively high nCPUE values for blue marlin were reported in other locations in 2018 and 2019. Anglers caught 27 blue marlin in 61 total fishing days in Costa Rica in 2018 for an nCPUE of 0.44, and 12 blue marlin in 21 total fishing days in Japan in 2019 for an nCPUE of 0.57.

Striped Marlin

The aggregate catch totals for both years were dominated by striped marlin, accounting for 68% of the total billfish catch reported in 2018 and 33% of the total catch reported in 2019. Since 1969, the species has typically been caught in abundance in Southern California, Hawai'i, and Baja locations, and the 2018 and 2019 calendar years were no exception. In 2018, anglers caught 562 striped marlin in 122 fishing days for a *historical record nCPUE of 4.60!* This Baja figure dwarfed Southern California, where only 14 striped marlin were caught in 69 fishing days for an nCPUE of 0.20 (Table 1). Hawai'i had one of the lowest nCPUE values for striped marlin in 2018 in the last decade, 0.01, prompting the addition of a secondary axis in Figure 1 to account for the stark difference between the Baja and the Hawai'i nCPUE results in 2018.

In 2019, anglers reported catching 134 striped marlin in 55 fishing days in Baja for a regional nCPUE of 2.42 (Table 2). Anglers reported catching seven striped marlin in the 103 fishing days in Hawai'i (0.06 nCPUE) and four striped marlin in 40 fishing days in Southern California (0.07). The 2019 catch and effort represented an increase from the 2018 results in Hawai'i (0.01) and a decrease from the 2018 results in Southern California (0.20).

Indo-Pacific Sailfish

Sailfish have been caught in abundance in the tropical locales of Costa Rica, Mexico and Panama for decades, with Costa Rica as the typical hotspot for the species. The Mexico sailfish nCPUE value is based on fishing effort reported from locations across the entire country's west coast, including the mainland (Acapulco/Ixtapa/Zihuatanejo/Guerrero, and Manzanillo/Colima) and the Baja Peninsula (Baja California, Mexico). Unlike those for Costa Rica and Panama, the sailfish nCPUEs of Mexico have not exceeded 1.0 in the history of the program. This may be in part due to the expansive and diverse coastline of the country that includes temperate waters as opposed to the strictly tropical waters off Costa Rica and Panama that sailfish tend to prefer.

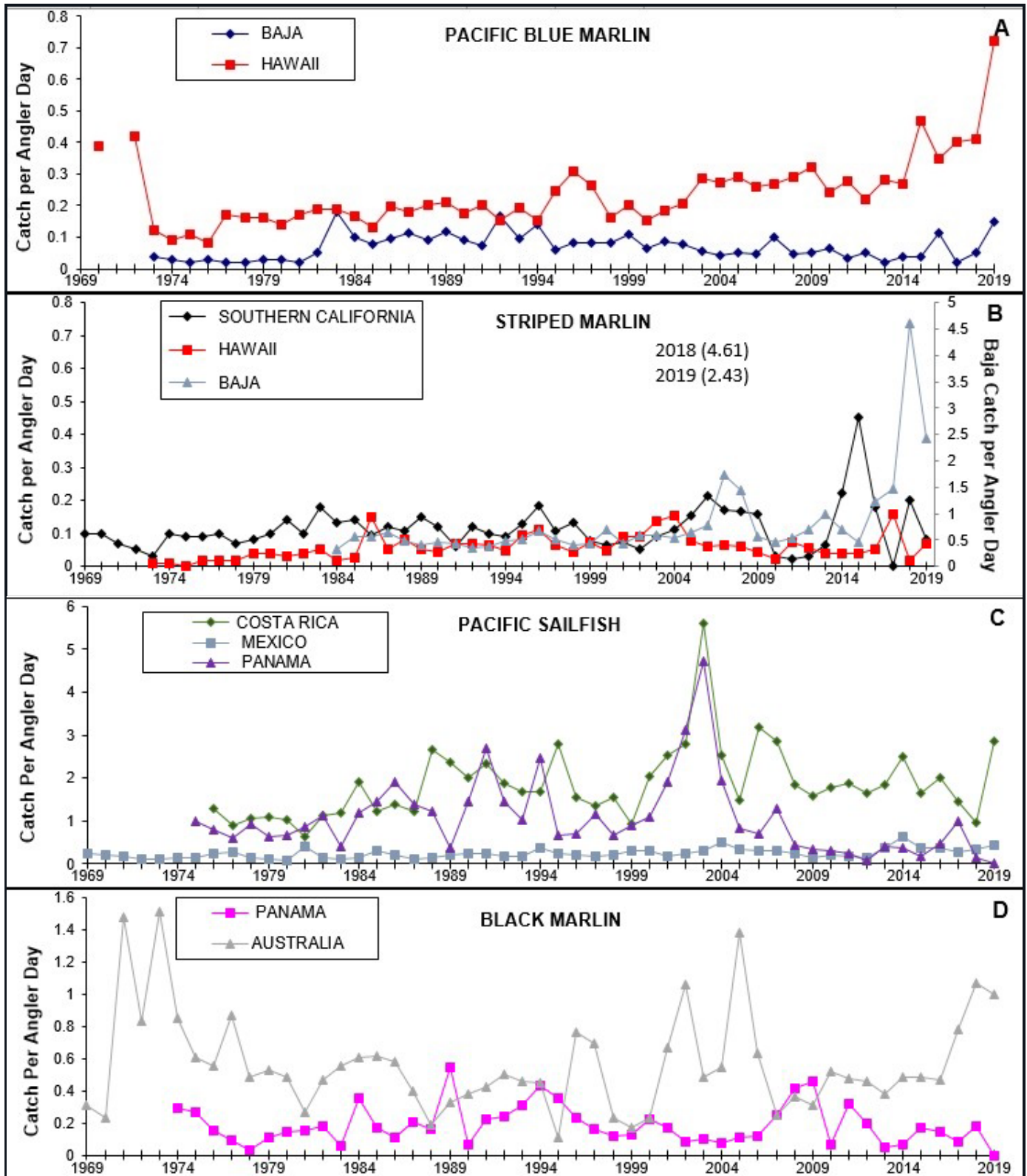


Figure 1. Nominal catch-per-unit-effort (nCPUE) as billfish catch per angler fishing day from 1969 through 2019 for Pacific blue marlin, striped marlin, Pacific sailfish, and black marlin.

In 2018, anglers reported catching 59 sailfish in 61 fishing days in Costa Rica for a regional nCPUE of 0.96 (Table 1). This presented a notable decrease from the nCPUE values of 2.0 in 2016 and 1.44 in 2017 (Figure 1). Panama showed a similar decrease, dropping from the 2017 nCPUE value of 1.0 down to 0.13 in 2018 based on just three sailfish caught in 22 fishing days. As for the combined Mexico locations, the 2018 nCPUE of 0.35 continued the region's steadfast consistency, where the time series has rarely exceeded 0.5.

Sailfish were a hot commodity in Costa Rica in 2019. Anglers reported catching 39 sailfish in seven total fishing days in 2019, resulting in an nCPUE of 2.0 (Table 2). Despite this value dwarfing the 0.45 value reported in combined Mexico locations and the 0.0 value reported in Panama for 2019, this result is fairly typical for Costa Rica, which generally reports nCPUE values above 2.0 (and setting a record high exceeding 5 sailfish per day in 2002). No sailfish were reported caught in Panama, as no fishing days were reported for the region in 2019. Again, the nCPUE for the combined Mexico locations deviated minutely, for a regional nCPUE of 0.45 in 2019 (Figure 1).

While not graphed, Guatemala and Malaysia were notable standouts for sailfish catch in the 2019 year. Anglers in Guatemala reported catching 52 sailfish in just 6 days, for an nCPUE of 8.6! Anglers reported catching 39 sailfish in Malaysia for another impressive nCPUE of 3.25.

Black Marlin

Throughout the history of the program, black marlin catch has been reported from Papua New Guinea, Malaysia, Guatemala, and Thailand. However, Australia and Panama were the only locations where black marlin were reported caught in 2018 and 2019. In fact, black marlin was the only species reported caught in Australia for both years.

Anglers reported catching 15 black marlin in 14 fishing days in Australia in 2018, resulting in a regional nCPUE of 1.07 (Table 1). This 2018 value is a notable increase from the 0.78 value reported in 2017 and just shy of the record 1.38 value in 2005. A total of 17 black marlin were reported caught in Australia in 17 fishing days in 2019, for a similar nCPUE of 1.0 (Table 2). The four black marlin reported caught in 22 fishing days in Panama resulted in an nCPUE of 0.18 for the region in 2018. Similar to the trend in Australia, this 2018 value in Panama is an improvement from the reported 0.08 value in 2017 (Figure 2). No fishing effort or catch was reported for Panama in 2019.

Thank you for 50 years of participation in the International Billfish Angler Survey!

The results presented here are the final update of the 50-year series of the International Billfish Angler Survey; however, the survey data will be available for public query and download in 2021 on ERDDAP and NMFS InPort. A comprehensive review of the survey results, angler participation, distribution and effort, and other metrics will also be reported in a NOAA Technical Memorandum in 2021.

The Billfish Tagging Program

With the conclusion of CBTP tagging operations, we recognize the many efforts by the recreational and commercial community in reporting tag releases and recaptures since 1963. While the results presented here encompass the last three years, we anticipate likely 2020 additions to the dataset as tags are continuously mailed throughout 2021.

The SWFSC’s Billfish Tagging Program has provided tagging supplies to billfish anglers around the world, with over 60,000 billfish tagged in the last 57 years. This tag release and recapture data are used to examine movement and migration patterns, species distribution, and age and growth and has created an irreplaceable constituent-based mark-recapture research venture that will inform fisheries management now and in the future.

Tag Releases

Based on tag report cards submitted to the SWFSC as of February 10, 2021, a total of 953 tags were released in 2018, 981 tags were released in 2019, and 336 tags were released in 2020 on billfish and other pelagic species (Table 3).

Table 3. Billfish tagging and return rates for 2018, 2019, 2020, and the history of the program (1963-2020).

Species	Tag releases				Tag returns	
	2018	2019	2020	1963-2020	1963-2020	Rate (%)
Pacific blue marlin (<i>Makaira mazara</i>)	555	640	163	15,957	117	0.73
Indo-Pacific Sailfish (<i>Istiophorus platypterus</i>)	201	181	143	10,834	53	0.49
Striped marlin (<i>Kajikia audax</i>)	136	97	22	24,111	353	1.46
Shortbill spearfish (<i>Tetrapturus angustirostris</i>)	55	57	5	2,880	10	0.34
Atlantic blue marlin (<i>Makaira nigricans</i>)	1	--	--	43	0	0.00
Black marlin (<i>Istiompax indica</i>)	--	1	1	3,400	70	2.05
Broadbill swordfish (<i>Xiphias gladius</i>)	--	--	--	525	18	3.23
Unidentified species	3	2	2	97	14	14.0
Shortfin mako shark (<i>Isurus oxyrinchus</i>)	--	2	--	3,677	93	2.52
Yellowfin Tuna (<i>Thunnus albacares</i>)	2	--	--	357	25	7.00
Northern kingfish (<i>Menticirrhus saxatilis</i>)	--	1	--	1	0	0.00
Total	953	981	336	61,882	753	1.20

Per usual, the majority of the tags released in 2018 were from locations in Hawai’i, which accounted for 66% of the 953 tags released in all locations. Nearly 90% of the billfish tagged in Hawai’i in 2018 were Pacific blue marlin (Table 4). Billfish tagged in the Acapulco/Ixtapa/Zihuatanejo/Guerrero region of Mexico accounted for 23% of the release totals in 2018, with about 92% of tags on sailfish. Notably, one tag was released on an Atlantic blue marlin (*Makaira nigricans*) in the Gulf of Mexico, bringing the total number of tags released on Atlantic blue marlin in the history of the CBTP to 43 (Table 3).

Table 4. Billfish tagging by location in 2018, 2019, and 2020, as indicated by tag report cards returned to the SWFSC as of February 10, 2021.

Location	Species	2018	2019	2020
Acapulco/Ixtapa/Zihuatanejo/ Guerrero, Mexico	Pacific blue marlin	2	3	--
	Striped marlin	14	39	1
	Sailfish	199	168	142
	Shortbill spearfish	1	1	--
	Unknown	--	--	1
	Totals	216	211	144
Baja California, Mexico	Striped marlin	80	4	2
	Sailfish	2	2	--
	Pacific blue marlin	--	1	--
	Totals	82	7	2
Gulf of Mexico	Atlantic blue marlin	1	--	--
Ecuador	Pacific blue marlin	--	--	1
Florida, USA (Miami or Keys)	Sailfish	--	6	--
Fiji	Pacific blue marlin	--	2	--
Hawai'i	Pacific blue marlin	551	624	159
	Striped marlin	22	40	12
	Sailfish	--	2	--
	Shortbill spearfish	54	55	5
	Yellowfin Tuna	2	--	--
	Black marlin	--	1	1
	Unknown species	1	1	1
	Kingfish	--	1	--
	Totals	630	724	178
Unknown location	Pacific blue marlin	2	3	--
	Striped marlin	4	--	--
	Sailfish	--	2	--
	Unknown	2	1	--
	Totals	8	6	--
Southern California	Striped marlin	16	14	7
	Shortfin mako shark	--	2	--
	Totals	16	16	7
Samoa	Pacific blue marlin	--	7	3
	Sailfish	--	1	1
	Shortbill spearfish	--	1	--
	Totals	--	9	4
All Location Totals		953	981	336

Tag releases in 2019 followed a similar pattern to 2018. Around 73% of the total tags released on billfish in 2019 were in Hawai'i, followed by 21% in the Acapulco/Ixtapa/Zihuatanejo/Guerrero region of Mexico. Within these locations, 87% of the billfish tagged in Hawai'i were Pacific blue marlin and 80% of the billfish tagged in the Acapulco region were again sailfish (Table 4). Tags

were released on six sailfish in Florida, two Pacific blue marlin in Fiji, and eight billfish—mostly blue marlin—in Samoa in 2019.

Tag Recoveries

Seven tags were recovered in 2018 from two sailfish, four shortbill spearfish, and one Pacific blue marlin at liberty from a range of 0 to 416 days (Table 5). For the one sailfish where both tag release and recovery coordinates were provided, the fish traveled a net displacement of 13.25 nautical miles off the coast of Zihuatanejo, Mexico.



Image credit Kenton Greer

A significant recovery was made in March 2018, when angler Yuan Marsan recaptured a shortbill spearfish 1,500 fathoms off Kaiwi Point, Hawai'i, while fishing with Captain Brian Wargo, Kenton Greer, and Eric Rusnak (*left*). While the release information was unknown at the time of recovery, we can now report that **this fish was tagged the very same day!** The spearfish was first caught and tagged off Kona by Harrison Lewis and Captain David Crawford on the *Kona Blue*. More information can be found in the [West Hawai'i Today](#) article with photos of the fish. What luck!

Captain Brian Wargo also helped tag a spearfish off Kona, Hawai'i with

angler Mari Arakawa in August 2018, which was recaptured 50 days later in the North Pacific Ocean. The recoverer, Edmar Aquino, had previously reported a recovered tag in 2016. Thank you for the diligent participation and reporting from all parties!

Nine tags were recovered in 2019 on two striped marlin and seven Pacific blue marlin (Table 5). Both the recovery and release locations were reported for just one tag in 2019, which was a significant recapture—a Pacific blue marlin tagged and released by Carol and Bruce Herren off Hawai'i in 2015 was recaptured **nearly four years (1,414 days) later and some 1,511 nautical miles away** near Howland Island in the Pacific Ocean by a Korean longliner. The marlin weighed 30 pounds at the time of tagging and 138 pounds at recovery. Thank you to both parties for their thorough reporting of both release and recovery information.



Image credit Nick Watson.

All other billfish recaptures in 2019 were released in Hawai'i and recovered off the Main Hawai'ian Islands despite some fish being at liberty for more than a year. Angler Nick Watson (*left*) recaptured a tagged 100-pound striped marlin off Kailua-Kona, Hawai'i in March of 2019.

The sole tag recaptured in 2020 was on a blue marlin caught by troll gear aboard a longline vessel off Hawai'i. The marlin had been at liberty for 656 days after tagging by Rolf Czabayski and Captain Chuck Wigzell off Hawai'i.

As demonstrated by the missing precise location information for both tagging and release events in Table 5, *it is vital to submit tagging release coordinates and report tag recapture coordinates in order to calculate net displacement.* Thank you to all the anglers and captains that reported released and recaptured tags in 2018 and 2019.

Thank you for 57 years of catch-tag-release and reporting!

While tagging is inherently useful research in itself, tag recoveries are the ultimate goal of the CBTP mark-recapture program. When reported, tag recoveries provide data to assess growth and migration patterns. **Although the CBTP will no longer distribute new tags, we want to emphasize the importance of continuing to report tag recoveries to the SWFSC.**

Recapturing tagged billfish and reporting as much information—fish condition, sex, and size, and fishing location and gear—is extremely valuable to the goals of the program now and in the future. Please continue to report billfish tag recoveries by emailing liana.heberer@noaa.gov or nicole.nasby-lucas@noaa.gov, or calling the SWFSC at 858-546-7000.

Be sure to check out two forthcoming publications—one describing the overall mark-recapture events and tagging by the CBTP since 1963, and another quantifying the movements of billfish throughout the Pacific based on recapture events.

Table 5. Billfish tag recoveries for 2018, 2019, and 2020.

Species	Tag Number	Tagger/Captain	Release Date (mm/dd/yyyy)	Release Location	Recoverer	Recovery Date	Recovery Location	Days at Liberty	Net Distance (nm)
2018									
Sailfish	A091842	Jan Halberg Madsen/ Adan Valdovinos Olea	12/28/2017	Zihuatanejo	Captain Dan	01/20/2018	Zihuatanejo	24	--
Sailfish	A093064	Jennifer Dudei/ Santiago Valdovinos	01/28/2018	Zihuatanejo	Manuel Nogeda/ David Perozak	02/12/2018	Zihuatanejo	15	13.25
Shortbill spearfish	A092480	Harrison Lewis/David Crawford	03/13/2018	Kona, HI	Yuan Marsan/Brian Wargo	03/13/2018	Hawai'i	0	--
Pacific blue marlin	A090159	--	--	--	Lynn	09/02/2018	N. Pacific	--	--
Shortbill spearfish	A080313	Ron Fulenchek/Seth Kizel	04/22/2017	Lanai, HI	Nelson Rubio	06/12/2018	--	416	--
Shortbill spearfish	A090979	Mari Arakawa/Brian Wargo	08/02/2018	Kona, HI	Edmar Aquino	09/21/2018	N. Pacific	50	--
Shortbill spearfish	A092786	John Cacace/Kenny Fogarty	2019	Hawai'i	Sean Palmer	2018	Hawai'i	--	--
2019									
Pacific blue marlin	A092465	Marie Byrnes/Kent Mongreig	01/15/2019	Hawai'i	Carson Orins	03/19/2019	N. Pacific	64	--
Striped marlin	A090057	Annette Oltman/Jeff Morris	11/15/2017	Hawai'i	Nick Watson	03/30/2019	Hawai'i	500	--
Striped marlin	A085801	--	--	--	Felipe Martinez	05/--/2019	Mazatlán	--	--
Pacific blue marlin	A094627	Pete Krug/Marlin Parker	04/22/2019	Hawai'i	Commercial	05/12/2019	Hawai'i	21	--
Pacific blue marlin	A092447	John Patterson/Marlin Parker	06/04/2018	Hawai'i	Observer	06/05/2019	Hawai'i	366	--
Pacific blue marlin	A093211	Rick Shedore/Rob Ellyn	09/18/2018	Hilo, HI	Commercial	06/20/2019	Hawai'i	276	--
Pacific blue marlin	A093560	David Mentan/Teddy Hoogs	06/15/2018	Hawai'i	Observer	07/21/2019	Hawai'i	401	--
Pacific blue marlin	A080833	Shawn Bessex/Don Stutheit	05/24/2016	Hawai'i	Observer	11/25/2019	Pacific	1,277	--
Pacific blue marlin	A090083	Carol Herren/Bruce Herren	11/20/2015	Hawai'i	Mi Kyung Lee	10/3/2019	Howland Island	1,414	1,511
2020									
Blue marlin	A094232	Rolf Czabayski/Chuck Wigzell	01/08/2019	Hawai'i	Wayne	10/24/2020	Hawai'i	656	--



1963-2020

- ▶ 62,151 billfish tagged
- ▶ 628 billfish tags recovered
- ▶ 54,807 participating anglers from 103 countries
- ▶ 262,789 fishing days reported

650
BLUE MARLIN
CASPAS
2/25/15
SILKY
John



THANK YOU FOR 57 YEARS!

COOPERATIVE BILLFISH TAGGING



RECREATIONAL ANGLERS • COMMERCIAL FISHERS • NOAA SWFSC

Top-Tagging Captains and Anglers

It is our pleasure with each edition of the *Billfish Newsletter* to report the top-tagging anglers and top-tagging captains of each year. These voluntary constituents are out on the water year-round to catch, tag, and release a wide array of billfish species around the world. The CBTP receives nearly 1,000 tags annually from a range of domestic and international participants, tagging their first billfish or their 300th billfish. We thank all the anglers who participated in tagging billfish in 2018, 2019, and 2020, and give special thanks to the many dedicated captains and charter desk personnel for supporting our program's mission.

Anglers Xavier Autrey and Craig Lindner shared the first and second spot for top-tagging angler over the last three years, alternating from 2018 through 2020. In 2018, Xavier tagged 44 billfish and Craig followed with 25 billfish; the pattern distinctly reversed in 2019 as Craig tagged 52 billfish and Xavier followed with 28 billfish; with Xavier tallying a whopping 68 tag releases in 2020, followed by Craig's 15 (Table 6). Both anglers have been prominent taggers in the CBTP and also made top-three appearances in 2016 and 2017. Great job, Xavier and Craig!



Image credit Derek from the vessel *Start Me Up*.

Notably, Tim Hawkins tagged 24 billfish in 2018, just one tag shy of Craig's winning effort. Jan Halberg Madsen also ranked a close third in 2019 by releasing 17 tags, and Rey Bubalcava released 6 tags to secure third in 2020. Thank you to all anglers who released tags, and congrats to Tim, Jan, and Rey.

Santiago Valdovinos, captain of *Gitana* out of Zihuatanejo, ranked as the top-tagging captain for both 2018 and 2019 and second in 2020 (Table 7). He assisted in releasing 93 billfish tags in 2018, 113 tags in 2019, and 49 in 2020. Adan Valdovinos Olea, captain of *Gitana II*, released 68 tags in 2018, followed closely by Dan Muslin, captain of *To The Limit* out of Southern California with 64 tags (Table 7). Teddy Hoogs, captain of *Bwana* out of Kailua-Kona, also released 94 tags in 2019, followed by Adan Valdovinos Olea with 61 tags. Congratulations to Odin Martinez, captain of *Mobius*, for releasing 68 tags as the top-tagging captain in 2020, followed by Santiago Valdovinos with 49 and Stretch Fogarty, captain of *Hula Girl*, with 27 tags. Tough competition! Congratulations to the top-tagging anglers and captains for the 2018, 2019, and 2020 seasons!

Be sure to check out *The Last Tally: Top-taggers since 1963* on page 24, for the aggregate totals of the CBTP since 1963.

Table 6. Anglers tagging more than three billfish in 2018, 2019, and 2020. *Based on tags received to the SWFSC by mail as of February 10, 2021.

2018	2019	2020*
Xavier Autrey (44)	Craig Lindner (52)	Xavier Autrey (68)
Craig Lindner (25)	Xavier Autrey (28)	Craig Lindner (15)
Tim Hawkins (24)	Jan Halberg Madsen (17)	Rey Rubalcava (6)
Tim Marrs (21)	Chad Beaudry (12)	Sally Asafo (4)
John Wilkinson (20)	Tim Shurtliff (9)	Steve Schutte (4)
Ann Thompson (19)	Gary Carruthers (7)	Tad Detwiler (4)
Sue Bentz (11)	Greg Marsolais (7)	Wesley Carvalho (4)
Dan Muslin (11)	Larry Shurtliff (7)	Ed Boyd (4)
Thomas Preston (8)	Doug Smith (6)	James Townsend (4)
Rick Shedore (8)	Rex Butler (6)	Kerry Bruno (4)
Mark Johnston (8)	Randy Weih (6)	Marty Patrick (4)
Matt Hoff (8)	Brett Fay (5)	
Jan Halberg Madsen (7)	Wilson Hall (5)	
Flemming Andersen (6)	Tim Mcbride (5)	
Clay Lawrence (6)	Ken Ristau (5)	
Marlin Kahl (5)	David Tubbs (5)	
Wilson Hall (5)	Barry Smith (5)	
Jose Manuel Vargas Campos (4)	Rex Pyne (5)	
Hugh Himmelreich (4)	Mike B. Jacobsen (5)	
Greg Pishkur (4)	Rolf Czabayski (4)	
Grady Mulbery (4)	Chris Futter (4)	
Ed Boyd (4)	Brian Whitley (4)	
David Finkelstein (4)	Pat Beall (4)	
Paul Douglas (4)	Scott Boggio (4)	
Carl Shepard (4)	Matt Hoff (4)	
Bill Ingram (4)	Robert Kurz (4)	
John Patterson (4)		



Captain Vincente Cosio and Tommy Trenkelbach. Image credit Larry Peabody.

Angler Larry Peabody wants to recognize Captain Vincente Cosio for nearly 30 years of tagging together.

“My wife, Barbara, and I first fished in the early 90’s when Vincente was captain of the Piñata. My friend, Dennis Noble, caught a 525-lb. blue marlin with him that is the biggest marlin Vicente has caught (and the mate on the Piñata that day is the uncle of the current mate on the Dottie B II, Marco Antonio Garcia Vargas). Both Vicente and Marco have treated our family like family, and our son, Wayne Trenkelbach, and 11-year-old grandson, Tommy Trenkelbach, think the world of them both. All the Valdez family at Hotel Buena Vista Beach Resort treat us like family, and are always very accommodating.”

Table 7. Captains tagging more than three billfish in 2018, 2019, and 2020. *Based on tags received to the SWFSC by mail as of February 10, 2021.

2018	2019	2020*
Santiago Valdovinos (93)	Santiago Valdovinos (114)	Odin Martinez (68)
Adan Valdovinos Olea (68)	Teddy Hoogs (94)	Santiago Valdovinos (49)
Dan Muslin (64)	Adan Valdovinos Olea (63)	Greg "Stretch" Fogarty (27)
Greg "Stretch" Fogarty (52)	Greg "Stretch" Fogarty (59)	Adan Valdovinos Olea (24)
Marlin Parker (47)	James Dean (41)	Teddy Hoogs (24)
Sergio Marin V. (43)	Neal Isaacs (38)	Neal Isaacs (16)
Brett Fay (40)	Kenny Fogarty (37)	John Bagwell (12)
Teddy Hoogs (40)	Marlin Parker (32)	Kenny Fogarty (9)
Bob Sylva Jr. (37)	Mcgreg Rice (31)	Shawn Rotella (9)
Mcgreg Rice (33)	Brett Fay (27)	Marlin Parker (8)
James Dean (26)	Sergio Marin V (22)	James Bach (7)
Jeff Kahl (25)	Bob Sylva Jr. (21)	James Dean (7)
Kenny Fogarty (22)	Jeffrey Fay (20)	Jason Holtz (4)
Shawn Palmer (19)	Tracey Epstein (19)	Andy Wearing (4)
Robert McGuckin (19)	Greg Hopkins (16)	Bill Casey (4)
Scott M. Fuller (16)	Jason Sweetwood (15)	
Greg Hopkins (15)	Shawn Palmer (12)	
David Crawford (14)	Jim Wigzell (11)	
Steve Bridges (13)	John Bagwell (10)	
John Bagwell (12)	Lance Gelman (10)	
Shawn Rotella (12)	Chuck Wigzell (9)	
Richard Hamilton (12)	Boyd De Coito (8)	
Rob Ellyn (11)	Bill Casey (8)	
Ann Thompson (11)	Kevin Hibbard (8)	
Jeffrey Fay (11)	David Crawford (8)	
Seth Kizel (10)	Joe O'neill (7)	
Tim Putnam (11)	Kai Hoover (7)	
Steven Fassbender (10)	Shawn Rotella (7)	
Kent Mongreig (9)	Robert McGuckin (7)	
Chuck Wilson (8)	Ryan Lutes (7)	
Lance Gelman (7)	Kelly Halpin (6)	
Robert Cosgrove (6)	Gary Lachman (6)	
Jason Holtz (6)	Odin Martinez (6)	
Anvar Salas V (6)	Andy Wearing (6)	
Mike Derego (5)	Chris Donato (6)	
Kelly Halpin (4)	Jean Nogues (6)	
Mike Tappero (4)	Cyrus Widhalm (5)	
Trevor Childs (4)	Bryan Tnoey (5)	
Al Bento (4)	Chuck E. Hauptert (5)	
Cyrus Widhalm (4)	Matthew Bowman (5)	
Tracey Epstein (4)	Kerwin Masunaga (5)	
Steve Carroll (4)	Kamal Pfeifle (5)	
Jim Kingsmill (4)	Tim Putnam (5)	
	Tony Clark (4)	
	Stymie (4)	
	Shane O'brien (4)	
	Keven Nakamura (4)	
	Bomboy Llanes (4)	
	Anthony Riccio (4)	
	Anvar Salas V (4)	
	Jeff Kahl (4)	

◀ *The Last Tally: Top-taggers since 1963* ▶

More than 38,000 anglers and nearly 700 captains have tagged billfish since 1963, with many dedicated anglers and captains tagging season after season. We congratulate and sincerely thank all captains and anglers that have made this program successful, whether you tagged 1 or 300 billfish. Congratulations to the Gold, Silver, and Bronze taggers—you were the backbone of the CBTP! *If you are listed here and would like a certificate of recognition, please email liana.heberer@noaa.gov.*

Top-Tagging Anglers

Carol Herren (389)
Don Anderson (199)
Xavier Autrey (183)
Howard Bond (172)
Craig Lindner (143)



David W. Denholm* (143)
Jo Jo Del Guercio (138)
John Hoolihan (126)
Herbert Kameon (122)
Denholm* (113)

*Multiple entries for Denholm since 1963

Stan Ecklund Sr. (78)
Steve Spina (75)
Lynn Jasper (68)
Kenneth R. Corday (67)
Mike Jacobsen (65)
Clarke Smith (64)



Karl Kogler (61)
Kathy Ecklund (60)
Ann Thompson (59)
Robert E. Rowan (58)
Douglas A. Daniels (57)
David John Ghigliotti (56)

Dan Muslin (49)
Gary Jasper (46)
Rich Johnson (45)
Pete Johnson Sr (43)
Larry Peabody (43)
Bill Hoey (42)
Sigrid M. Turner (41)
Dr. Hans H. Pfenninger (40)
Sue Vermillion (39)
Janet B. Martic (39)
Charles Helscel (38)
Jan Halberg Madsen (38)
Garrick Agnew (38)
Jerry Dunaway (38)
James Karamouzis (38)
Carl Taylor (38)
Michael S. Callan (37)
Jean-Pierre Malgorn (36)
Rick Chaponot (36)
John Patterson (36)

Tim Hawkins (36)
John Wilkinson (35)
Jerry R. Austin (34)
Henry Potts (33)
Richard Hamilton (32)
Jeff Wood (32)
Norman Cook (32)
Jim Robinson (32)
Randy Wood (31)
Donald Brandt (31)
Geza Csige (31)
Marty L. Sands (31)



Mark M. Wisch (31)
Barry H. Reese (30)
Steve Schumacher (30)
Richard Pietila (30)
Craig Oliver (30)
Richard E. Barrett (30)
Oswald F. Gregor (29)
Bob Creedon (29)
Craig Lindner, Jr (29)
Bill Lescher (29)
Paul A. Brower, M.D. (29)
Jim H. Edmiston (28)
Michael Thomas (28)

Charles Stirling (28)
Clay Lawrence (28)
Randy Weih (28)
Keishi Shiohata (27)
Robert Anthony (27)
Eric Fonteyne (27)
Rex Crosland (26)
Danny Lee Jones (26)
Steve Brackmann (26)
Clay Lawrence (28)
Randy Weih (28)
Jim H. Edmiston (28)
Russell V. Bear (28)
Ron Hubbard (27)
Matt Hoff (27)
Keishi Shiohata (27)
Steve Brackmann (27)
Eric Fonteyne (27)
Rex Crosland (26)
Danny Lee Jones (26)
Jason Blower (26)

These results represent tags received to the SWFSC in the mail as of February 10, 2021. We understand this may not reflect the existing tags in transit to the SWFSC. Please note some tag cards arrived to the SWFSC torn, illegible, or damaged, so some tally numbers may be incorrect by one or two tags.

If you are listed here and feel there may be a mistake in your tag tally or name spelling, please email Liana Heberer at liana.heberer@noaa.gov.

Top-tagging Captains

Santiago Valdovinos (790)
 John Bagwell (654)
 Marlin Parker (651)
 Mcgrew Rice (608)
 Peter Hoogs (515)
 Jeffrey Fay (512)
 Jesus Araiza Ruiz (469)
 Richard Hamilton (452)



Teddy Hoogs (441)
 Kenny Fogarty (438)
 Bruce Herren (434)
 Adan Valdovinos Olea (424)
 Guy Terwilliger (423)
 Mark Shultz (377)
 Victor Garciglia (377)
 Dennis Cintas (360)
 Scott M. Fuller (343)
 Jesus Araiza Jr. (323)

James Dean (289)
 Jose Luis 'Pepino' Servin Hernandez (287)
 Tim Hicks (279)
 Chuck Wigzell (262)
 Bill Crawford (260)
 Charles (Chuck) E. Hauptert (254)
 John Jordan (254)
 Gilberto Castro (251)
 Robert McGuckin (245)
 Robert C. (Bob) Sylva Jr. (240)
 Armando Arciniega (240)



Tom Casey (229)
 Neal Isaacs (222)
 Martin V. Fiol (220)
 Kevin Hibbard (218)
 William Dorr (216)
 Randy Wood (209)
 Kelley Everette (206)
 David Crawford (205)
 Mike Derego (203)
 Bobby Brown (200)



Vincente Cosio (199)
 Steve Epstein (198)
 Bill Casey (192)
 Jose Ortiz (188)
 Martin G. Cortez (186)
 Steven D. Kaiser (183)
 Jerry Allen (181)
 Jim Donnelly (171)
 Dan Muslin (171)
 Antonio Vargas Meza (169)
 Kent Mongreig (168)
 Howard Bond (164)
 Jeff Kahl (163)
 Greg "Stretch" Fogarty (161)
 Chuck Wilson (160)
 Manuel Castro (160)
 Mike Shrosbree (160)
 Randy Parker (156)
 Cami Garnier (151)
 Kevin M. Hogan (147)

Tomas Yepiz Cota (142)
 Martin Verdugo Collins (134)
 Kerwin Masunaga (130)
 Steve Bridges (123)
 Tim Putnam (122)
 Ned Falschlehner (122)
 Marty L. Sands (117)
 Gilberto Castro Collins (117)
 Brian (Chip) Van Mols (115)
 Daniel Espinozala Jimenez (114)
 Doug Barna (114)
 Peter E. Wishney (114)
 Randy O. Orkisch (114)
 Rob Ellyn (112)

Tony Clark (112)
 Alan Abdill (112)
 James R. Bass Jr. (112)
 Odin Martinez (108)
 Ed Martin (105)
 Ari Kreiss (104)
 Javier Romero Fiol (104)
 Tom Siebler (99)
 Kevin Hiney (98)
 Robert Hudson (97)
 Stan Ecklund Sr. (96)
 Mike Holtz (96)
 Brett Fay (95)
 Dave McIntyre (95)
 Mark Henwood (94)

Paulino Martinez (Castro) (93)
 Freddy Rice (93)
 Gene Vanderhoek (92)
 Eduardo Cosio (91)
 Joe Mike Lopez (90)
 William Lazenby (89)
 Rich Johnson (88)
 Michael (Mouse) Libby (88)
 Thomas A. Shanahan (87)
 Brian Wargo (86)
 Frank 'Skip' Smith (85)
 Steve Cravens (85)
 Wayne Knight (84)
 Peter Groesbeck (84)
 Adrian Paul (84)
 Steve Carroll (83)
 Sergio Marin V. (83)
 Lance Gelman (82)
 Angus Paul (82)
 Eric A. Wahrenbrock, M.D. (81)
 Peter J. Ready (81)



Science in Action

Feeding ecology of broadbill swordfish (*Xiphias gladius*) in the California Current

Dr. Antonella Preti

Institute of Marine Sciences, University of California Santa Cruz

NOAA Southwest Fisheries Science Center, Fisheries Resources Division, Life History Program,

Broadbill swordfish are the most widely distributed billfish and occur worldwide in tropical, subtropical and temperate waters from around 50°N to 50°S. Throughout this range they are found primarily in areas where prey are aggregated including in convergence zones, on sea mounts and in productive boundary currents. Swordfish command a high economic value in both commercial and recreational fisheries and in the California Current Large Marine Ecosystem (CCLME) swordfish is commonly taken in both the U.S.A. and Mexican fisheries by longlines, deep-set buoy gear, harpoons and drift gillnets (DGN). While the CCLME is known to be an important foraging ground for swordfish during certain times of year, the feeding habits of swordfish in this region are not well documented. To date, there have been two extensive studies of swordfish feedings habits in the CCLME and a few other reports, none recent. The objectives of this study were to analyze the relative importance of different prey types and examine variability across years, regions and body size.

Methods

Swordfish stomachs were collected by federal fishery observers aboard DGN vessels during years 2007-2014. In recent years, the majority of the fishery operated in the Southern California Bight (SCB) between Point Conception, California and the U.S.-Mexico border. Prey were weighed, counted and identified to the lowest taxonomic group possible. Data analyses included prey accumulation curves and relative indices of importance including the Index of Relative Importance (IRI) and geometric index of importance (GII) which are both measures of diet composition. To examine patterns in prey importance, including the impacts of size, regions, season and sea surface temperature, a number of additional analyses were conducted including redundancy analysis (RDA) and generalized additive modelling (GAM).

Results

A total of 299 broadbill swordfish stomachs were collected of which 292 contained prey, including 60 different prey taxa. Squid dominated with diets and constituted the top six most important prey with the Jumbo squid (*Dosidicus gigas*) and boreopacific gonate squid (*Gonatopsis borealis*) ranking first and second, respectively. For fish prey, Pacific hake (*Merluccius productus*) ranked sixth with other fish observed including barracudinas (Paralepididae), coastal pelagic fishes (jack mackerel (*Trachurus symmetricus*), Pacific sardine (*Sardinops sagax*), Pacific saury (*Cololabis saira*), northern anchovy (*Engraulis mordax*)), and the Myctophidae family. Some variation in prey composition with swordfish body size was apparent. Northern anchovy was found only in the small size group while louvar was eaten only by large swordfish. Jumbo squid, *Gonatus* spp., and Pacific hake were significantly more important in larger swordfish. Differences in prey composition were also apparent across region and years. RDA explained only 6% of the variability. GAMs revealed a range of patterns depending on prey species with differing impact of the explanatory variables, size, year, sub-season, region, SST, and area.

Discussion

Results from this research are consistent with the biology and ecology of swordfish and are in broad agreement with other studies that found they consume cephalopods and epipelagic and mesopelagic teleosts although the relative importance of fish and teleosts varies across studies. Differences across explanatory variables provide some insight into foraging ecology. While Jumbo squid were the most important prey across size classes, they were significantly more important for larger swordfish indicating that larger fish may be more adept at capturing larger cephalopods. Regional differences in diet, for example Jumbo squid, *Gonatus* spp. and market squid were significantly more important within the SCB while *Gonatopsis borealis* and Pacific hake were more important beyond the SCB, likely reflect the distributions of these species. The fluctuations across years can, in part, be linked to oceanographically-driven variation in prey availability. The most obvious shift was the transition from 2010 to 2011 from Jumbo squid to Pacific hake being the most important prey item. This reflects the range expansion of Jumbo squid from 2002-2010 during a period when water temperatures were cooler.

Overall, there is considerable overlap with other predators in the CCLME. For example, jumbo squid are also important in the diets of mako sharks and squid overall, are important in the diets of blue sharks. A key difference is that the mesopelagic teleosts observed in swordfish have not been observed in any shark species examined in the SCB. This suggests that that swordfish may be foraging in mesopelagic waters more frequently than any of the shark species studied. Future studies would benefit for a larger and more extensive sampling regime and a more detailed examination of the impacts of environment on the distribution of prey. Overall results indicate that swordfish are generalists that can forage across the water column. Consequently, diet studies could provide a valuable tool for examining shifts in the availability of prey.

To read the full research: Preti, A. 2020. Trophic ecology of nine top predators in the California Current. Ph.D. Dissertation. The School of Biological Sciences, University of Aberdeen, Scotland, UK.

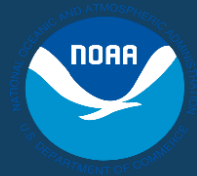
For more information, contact: antonella.preti@noaa.gov.

PAPERWORK REDUCTION ACT NOTIFICATION

NOAA Fisheries uses the information reported on Billfish Tagging Cards and the International Billfish Angler Survey to characterize effort, movements and growth rates of billfish for research. Public reporting time and effort for the Billfish Angler Survey card is estimated to average five minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. You can send comments regarding this burden estimate to the SWFSC, 8901 La Jolla Shores Drive, La Jolla, CA 92037. The information submitted will become public record. Notwithstanding any other provision of the law, no person is required to, nor shall any person be subject to a penalty for failure to comply with collection of information subject to the requirements of the Paperwork Reduction Act.



Image credit Matt and Steve Magassy.



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