

The Southwest Fisheries Science Center's

2016 Billfish Newsletter

2016 BILLFISH NEWSLETTER

- ▶ **Global Tagging Map**
- ▶ **El Niño fishing conditions**
- ▶ **Catch-Photo-Release mobile phone application**
- ▶ **IGFA Great Marlin Race and satellite tagging**
- ▶ **Top Anglers and Captains of 2015**



NOAA FISHERIES
Southwest Fisheries Science Center

Table of Contents

<u>Special Foreword</u>	<u>3</u>
<u>An Inside Look</u>	<u>4</u>
<u>Prologue</u>	<u>5</u>
<u>Introduction</u>	<u>5</u>
<u>The International Billfish Angler Survey</u>	<u>7</u>
<u>Pacific blue marlin</u>	<u>9</u>
<u>Striped marlin</u>	<u>10</u>
<u>Indo-Pacific sailfish</u>	<u>11</u>
<u>Black marlin</u>	<u>13</u>
<u>Shortbill spearfish</u>	<u>13</u>
<u>Broadbill swordfish</u>	<u>14</u>
<u>The Billfish Tagging Program</u>	<u>14</u>
<u>The Hawaiian Islands</u>	<u>16</u>
<u>2015 Tagging-at-a-Glance Map</u>	<u>17</u>
<u>Baja California and Guerrero, Mexico</u>	<u>18</u>
<u>Southern California</u>	<u>18</u>
<u>Western Pacific</u>	<u>18</u>
<u>Top Anglers and Captains Acknowledgements</u>	<u>19</u>
<u>Top Tagging Anglers</u>	<u>19</u>
<u>Top Tagging Captains</u>	<u>21</u>
<u>Tag Recoveries</u>	<u>21</u>
<u>Science in Action: “The IGFA Great Marlin Race and Marlin Tagging”</u>	<u>23</u>
<u>Acknowledgements</u>	<u>25</u>
<u>Angler Photos</u>	<u>26</u>



Congratulations to Captain Teddy Hoogs of the *Bwana* for winning this year’s cover photo contest! Teddy photographed this spectacular marlin off the coast of Hawaii. Fish on!

Special Forward

James Wraith, director of the SWFSC Cooperative Billfish Tagging Program since 2007, recently left the SWFSC to move back to Australia. James was an integral part of the Highly Migratory Species (HMS) program. In addition to day-to-day work, James planned and organized the research cruises for HMS at the SWFSC and was involved in tagging thresher, blue, and mako sharks in the Southern California Bight for many years. We are sad to see him go but are excited for his future opportunities and thankful for his many contributions to the program over the last 10 years. We wish him all the best in his new endeavors!

One of James' recent achievements for the Billfish Tagging Program was his proposal and execution of the new FishCPR mobile phone application coming out in 2017. The application streamlines the process of billfish tag reporting (see *Inside Look*). We hope that this newly developed app facilitates an easier transfer of data and helps all of you who help us!

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Find more information about our billfish science at <https://swfsc.noaa.gov/HMS/>.

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An Inside Look

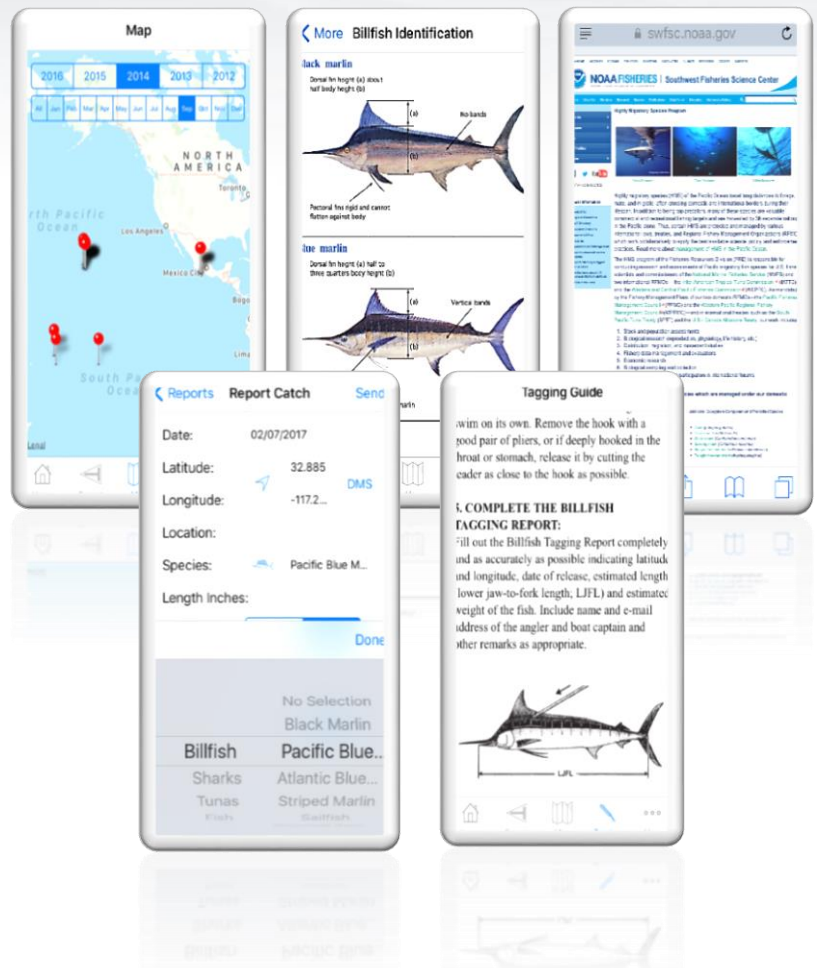
During the 2017 season, the SWFSC team will be rolling out a new mobile phone application called FishCPR (Fish Catch, Photo, and Release) to report billfish tagging and tag recaptures as well as billfish, tuna, and shark catch and release. It is designed for easy and convenient tag reporting while out on the water, including one-touch GPS location input, automated email tag reports, identification guides, and an interactive map of monthly tagging effort around the world. It will also be a platform for anglers to submit their fishing photos for publication on the SWFSC website. The app requires Apple iOS version 8.0 or higher and will be available for download in the Apple App Store in fall 2017. An android version is in the works. We hope you enjoy the app and find it easy to use!



FishCPR- Catch, Photo, Release, v.1.0

Available for download Fall 2017

- Easy, one-touch GPS location input
- Streamlined drop-down menus and buttons for tag reporting
- Automated email submission for tag reports—keep digital records of your sent tags
- Interactive map of monthly tagging effort around the world
- Platform for anglers to submit fishing photos for publication on SWFSC website
- Step-by-step billfish tagging instructions
- Detailed species identification and measurement guides for tuna, billfish, and sharks
- Direct access to SWFSC website information, including the Billfish Newsletter, International Billfish Angler Survey, and research information



Prologue

The annual Billfish Newsletter has been communicating the results cooperative efforts between fishery scientists and billfish anglers for over 50 years. The Newsletter presents the results of the Cooperative Billfish Tagging Program, which began in 1963 and has successfully promoted ethical angling while tracking the migration and movement of large gamefish. Additionally, the Newsletter disseminates the results of the International Billfish Angler Survey, in which cooperative anglers have participated since 1969. The combined efforts of recreational anglers and the scientific community have helped to expand our understanding of assessing changes in billfish distributions and changes in recreational fisheries. In the last three years, we have witnessed unusual ocean conditions with the “warm blob” and El Niño/La Niña cycles altering ocean temperatures from Washington to Baja California. Understanding the effects of such events on our fisheries resources is enhanced through our work with billfish anglers like you. The Southwest Fisheries Science Center looks forward to our sustained collaboration ensuring our goals are met and thanks you for your support.

Kristen Koch

Acting Director
Southwest Fisheries Science Center

Gerard DiNardo

Fisheries Resources Division Director
Southwest Fisheries Science Center

Introduction

We are pleased to provide the 2016 edition of the Southwest Fisheries Science Center’s Billfish Newsletter as a tribute to the collaboration between recreational billfish anglers, researchers, sportfishing clubs, and commercial anglers affiliated with the SWFSC. For over 50 years, our Billfish Program has been able to reach anglers from all corners of the world and promote catch-and-release of these spectacular sportfish. We thank those who participated in our tagging program and billfish survey this year, and we welcome new anglers who are interested in joining these efforts.

The 2016 Billfish Newsletter describes ongoing billfish research projects conducted at the National Oceanic and Atmospheric Administration’s (NOAA) SWFSC in La Jolla, California, including the results of the 2015 International Billfish Angler Survey and 2015 Cooperative Billfish Tagging Program.

The 2015 season was marked by anomalous ocean conditions influenced by the El Niño Southern Oscillation (ENSO), the warm phase of a recurring climate pattern across the Eastern Pacific Ocean (EPO) which induces changes in winds, precipitation and temperatures. Most notable for the fishing community was the abnormally warm sea surface temperatures (SST) in the eastern Pacific which appeared to affect the distribution, abundance, and diversity of regional fish populations. Additionally, we saw the effects of “the Blob” (Figure 1), characterized by SST as much as 3° C (5.4° F) higher than average, lasting for months, and appearing on largescale temperature maps as a mass of warm water hundreds of miles wide. NOAA recently announced that the weak and short-lived La Niña phenomenon is over and we may be moving into new and unexpected weather patterns that will affect local fishing conditions in 2017.

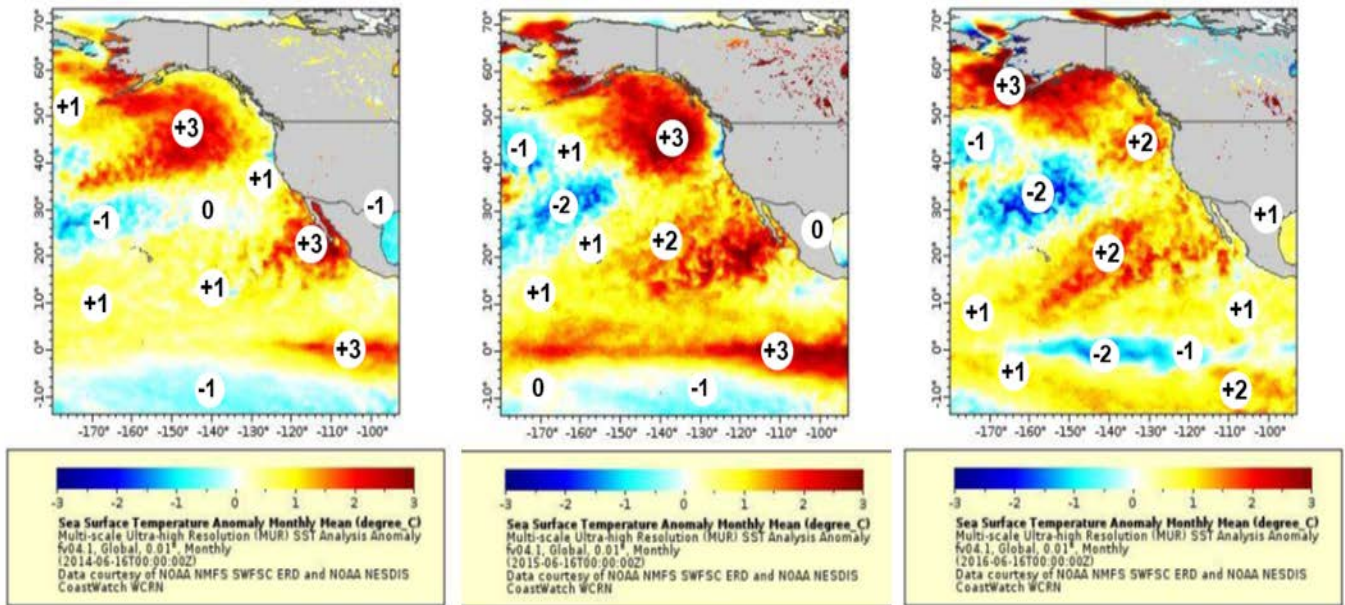


Figure 1. Sea surface temperature (SST) anomalies for the north East Pacific Ocean in June 2014, June 2015, and June 2016 (left to right). SSTs in the North Pacific were more than 3°C warmer than normal in concentrated areas in the Gulf of Alaska and the California Current. The warm water phenomenon was nicknamed “the Blob” and peaked in 2015 just as El Niño was bringing warm water north from the equatorial region. Notice the appearance of cooler-than-average SST in the equatorial region in 2016 map, an indication of La Niña.

This change in SST may have had an effect on the latitudinal distribution of billfish species distributed in the tropical and subtropical waters of the EPO as warmer waters pushed northward. Not surprisingly, the Billfish Angler Survey nominal catch-per-unit effort (nCPUE) for Southern California was almost doubled from 0.21 in 2014 to 0.41 in 2015. For more insight into billfish movement, check

out our [*Science in Action* section](#) where Dr. Aaron Carlisle describes his work with tagging and tracking marlin to observe their migrations and diving patterns.

The International Billfish Angler Survey

The International Billfish Angler Survey has been reporting angler effort and catch since 1969 and provides a valuable 47-year time series of self-reported fishing effort and location. Anglers report fishing location, species caught, and fishing days. This information serves as a basis for observing changes in billfish recreational fisheries. Your participation is important, so be sure to fill out the form completely and accurately!



BILLFISH ANGLER SURVEY cards for fishing during the 2016 calendar year were emailed or mailed in early 2017. If you have not already completed the Survey, please fill it out and return the post-paid form as soon as possible. Additional 2016 Angler Survey forms are available to all billfish anglers by contacting Liana Heberer (liana.heberer@noaa.gov), downloading it from our website (<http://swfsc.noaa.gov/FRD-Billfish/>), or by scanning the provided QR code (*left*) with a smartphone.

The survey results from the 2015 calendar year are summarized in Table 1 and include fishing area, angler days, and species caught. More than 270 anglers submitted surveys in 2016 to report over 2,000 fishing days and more than 1,500 billfish caught. The 2015 season proved to be a successful one compared to 2014, as the number of billfish caught per day increased for all locations. The overall nominal catch-per-unit-effort (nCPUE; fish per angler day) in 2015 was 0.73, which surpasses those from the previous four years (2014: 0.58, 2013: 0.64, and 2011-2012: 0.46). Similar to the 2013 and 2014 seasons, the majority of the 2015 fishing effort was reported off the Hawaiian Islands, Southern California, and Baja California, Mexico (states of Baja California and Baja California, Sur). The major species caught per area remained unchanged, as Pacific blue marlin (*Makaira nigricans*) was the dominant species in Hawaii and the striped marlin (*Kajikia audax*) was most prevalent in Southern California and Baja. Compared to 2014, anglers from Hawaii reported 137 more fishing days and 298 more billfish caught, resulting in an nCPUE of 0.65. Off the continental coast, anglers in Southern California and Baja reported fewer fishing days, although there was an improvement in Southern California's nCPUE while Baja's nCPUE effectively dropped.

Anglers from Hawaii have consistently reported the greatest number of fishing days for the past five years, and in 2015 they accounted for nearly 50% of the total reported fishing days (**Table 1**). In their 1,035 combined fishing days, Hawaiian anglers also caught the most billfish in 2015, with Pacific blue marlin remaining the most dominant species followed by shortbill spearfish (*Tetrapturus angustirostris*) and striped marlin.

Table 1. Results of the 2015 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).

LOCATION	ANGLER FISHING DAYS	NUMBER OF BILLFISH	BILLFISH PER FISHING DAY (nCPUE)	MAJOR SPECIES
Pacific Ocean				
Hawaii	1035	677	0.65	BM
Southern California	479	225	0.47	SM
Baja California	159	94	0.59	SM
Acapulco/Ixtapa/Zihua.,Guerrero	88	90	1.02	SF
Costa Rica	84	181	2.15	SF
Panama	48	30	0.63	BM
New Zealand	25	5	0.20	SM
Australia	25	13	0.52	BK
Puerto Vallarta, Jalisco	20	2	0.10	BM/SF
Tahiti	15	7	0.47	BM
Guatemala	14	77	5.50	SF
Manzanillo, Colima	14	8	0.57	SF
Malaysia	12	74	6.17	SF
Fiji	10	7	0.70	SF
Japan	10	4	0.40	BM/SM
Mazatlán, Sinaloa	8	7	0.88	SF
Guaymas, Sonora	4	0	0.00	-
Puerto Escondido, Oaxaca	1	2	2.00	SF
Indian Ocean				
Kenya	15	18	1.20	SF
Atlantic Ocean				
Bermuda	14	7	0.50	BM
Florida	4	1	0.25	SF
Canary Islands	3	0	0.00	-
Isla Mujeres, Quintana Roo	2	1	0.50	SF
Bahamas	1	0	0.00	-
Cayman Islands	1	0	0.00	-
Total	2,091	1,530	0.73	BM

The ocean conditions off Southern California were phenomenal for fishing in 2015, with warmer-than-average water temperatures during summer and extended distributions of subtropical species into temperate waters such as hammerhead sharks, large yellowfin tuna, and wahoo. While the number of angler days decreased by 191 from 2014 to 2015, the number of billfish increased by 84. As such, the

nCPUE for Southern California (0.41) shattered last year's nCPUE of 0.21, which was the third-highest on record for Southern California. The region's nCPUE was also exceptionally higher than 2013 (0.03) and 2014 (0.07). Per usual, the major species caught in Southern California was striped marlin.

Despite being one of the top three fishing areas season after season, both the nCPUE and number of reported fishing days has declined for the Baja region over the past four years. The nCPUE in 2015 (0.59) was relatively low compared to the nCPUE in 2014 (0.90) and 2013 (1.11). Regardless of this region-specific decline in 2015, the nCPUE for Baja has almost always exceeded that of Southern California and Hawaii. Historically, the region is extremely productive for billfish fishing. Although striped marlin was the major species caught, blue marlin and sailfish were also reported caught.



Pacific blue marlin (*Makaira nigricans*)

Blue marlin is the most tropical of the marlin species and is distributed in tropical and subtropical areas of the Pacific, Atlantic, and Indian Oceans. It generally inhabits blue water and tagging data suggests the species prefers the top 30-50 meters of the water column while remaining above the

thermocline most of the time.^{1, 2, 3} Blue marlin is typically found as scattered individuals rather than in schools. The species feeds primarily during the day on fish but are also known to consume cephalopods such as squid and octopus. The species can exceed 1,500 pounds in weight and are the largest of the various marlin species.

The blue marlin is the most common billfish encountered by anglers off Hawaii and other central and western Pacific island nations. Historically, Atlantic and Indo-Pacific blue marlin were believed to be different species but genetic evidence points to a single blue marlin species worldwide. Not surprisingly, Pacific blue marlin are the most common billfish caught in 2015 in the more tropical survey regions including Bermuda, Hawaii, and Tahiti. To observe long-term trends of blue marlin nCPUE in the Pacific Ocean, we highlighted nCPUEs from Hawaii and Baja California, Mexico (**Figure 2A**). The 2015 Hawaii blue marlin nCPUE was 0.47, which is higher than the 2014 nCPUE of 0.27 and the recent 10-year average of 0.27. The blue marlin nCPUE reported off Hawaii has been higher than Baja's since 1994, although has experienced more fluctuations.

Baja's 2015 nCPUE remained unchanged at 0.04 and ranked lower than both the recent 10- and 20-year averages of 0.05 and 0.07, respectively. In fact, the observed trend is a decline in the blue marlin

1. Holland, K., R. Brill, and R.K.C. Chang (1990). Horizontal and vertical movements of Pacific blue marlin captured and released using sportfishing gear. *Fish. Bull.* 88:397-402.
2. Block, B.A., D.T. Booth, and F.G. Carey (1992). Depth and temperature of the blue marlin, *Makaira nigricans*, observed by acoustic telemetry. *Mar. Biol.* 114:175- 183.
3. Block, B.A., Booth, D.T. and Carey, F.G. (1992b). Direct measurement of swimming speeds and depth of blue marlin. *J. Exp. Biol.* 166:267-284.

nCPUE off Baja California since 1992. The blue marlin nCPUE has been at or below 0.10 since 2000, and at or below 0.06 since 2008.



Striped marlin (*Kajikia audax*)

The striped marlin is an oceanic species found in tropical, subtropical, and temperate waters of the Pacific and Indian Oceans. It generally inhabits cooler water than black and blue marlin. Although it uses its spear for defense, the striped marlin also

uses it as a mechanism to forage on fishes, crustaceans, and squids. It is the most common billfish species encountered by anglers off Southern California, the Baja Peninsula, and New Zealand. The species can reach more than 13 feet in length and 350 pounds in weight.

To examine trends in striped marlin nCPUE, we compared the individual nCPUEs of striped marlin in Southern California, Hawaii, and Baja, as summarized in Figure 2B. Since 2011, the Southern California striped marlin nCPUE has been steadily increasing and the 2015 value of 0.45 is the *highest ever*. Needless to say, 2015 was a spectacular year for striped marlin fishing in the waters of Southern California, and was most likely attributed to the combined effects of “the Blob” and El Niño in regional waters, as mentioned in the introduction.

The striped marlin fishing in the Baja California region was similar to that of Southern California, with an nCPUE of 0.46 in 2015, which is lower than both the 5- and 10-year average (0.68 and 0.85, respectively). Compared to the double-digit nCPUE values for Baja and Southern California, the striped marlin nCPUE for Hawaii in 2015 was 0.04. Although the Hawaiian nCPUE is orders of magnitude below the nCPUE from Southern California and Baja, the Hawaii striped marlin nCPUE has been stable throughout the survey’s history, fluctuating at the most by only 0.035 over the past 47 years.



Indo-Pacific sailfish (*Istiophorus platypterus*)

The Indo-Pacific sailfish is found in oceanic tropical waters of the Pacific and Indian Oceans and are most dense near coasts and islands. Sailfish can grow up to 250 pounds in weight and can be found in schools, often with others of similar size, feeding on fishes, crustaceans, and cephalopods.

We cannot interpret sailfish trends without examining the regional nCPUEs from Mexico, Panama, and Costa Rica. In particular, the Costa Rican sailfish nCPUE has remained the highest for all three locations since 2003 and reported an nCPUE of 1.63 this 2015 season. Since 1976, Costa Rican sailfish nCPUEs have ranged from 0.60 to 5.60 and have dipped below 1.00 on only three occasions. Excluding the 2.50 nCPUE from 2014, the sailfish nCPUE for Costa Rica has remained fairly consistent since 2008, with an average of 1.74.

Although neighbors, the 2015 sailfish nCPUE in Panama (0.17) was largely below that of Costa Rica and has been since 2003. This 2015 season marked another drop in nCPUE for Panama for the second year in a row, which is also below the overall average nCPUE of 1.11.

The Mexico sailfish nCPUE value is based on fishing efforts reported from locations across the country, including the mainland and the Baja Peninsula. The 2015 sailfish nCPUE of 0.38 dropped from the 2014 value (0.63) but still remains higher than the 5- and 10-year averages (0.31 and 0.29, respectively) and the region's overall nCPUE (0.23). Unlike Costa Rica and Panama, the sailfish nCPUEs of Mexico have never once exceeded 1.0 in the history of the program. This may be due to the expansive and diverse coastline of the country which includes both tropical and temperate waters, as opposed to the strictly tropical waters off Costa Rica and Panama which sailfish tend to prefer.

It must also be noted that Guatemala has high sailfish nCPUEs, ranging from 0.61 in 1984 to 11.59 in 2009, and reported a value of 5.36 this year. The 10-year average sailfish nCPUE for Guatemala is 6.21, which is the highest 10-year average for any species in any location. Sailfish catch was also reported from Malaysia, Kenya, Fiji, and the Florida Keys.

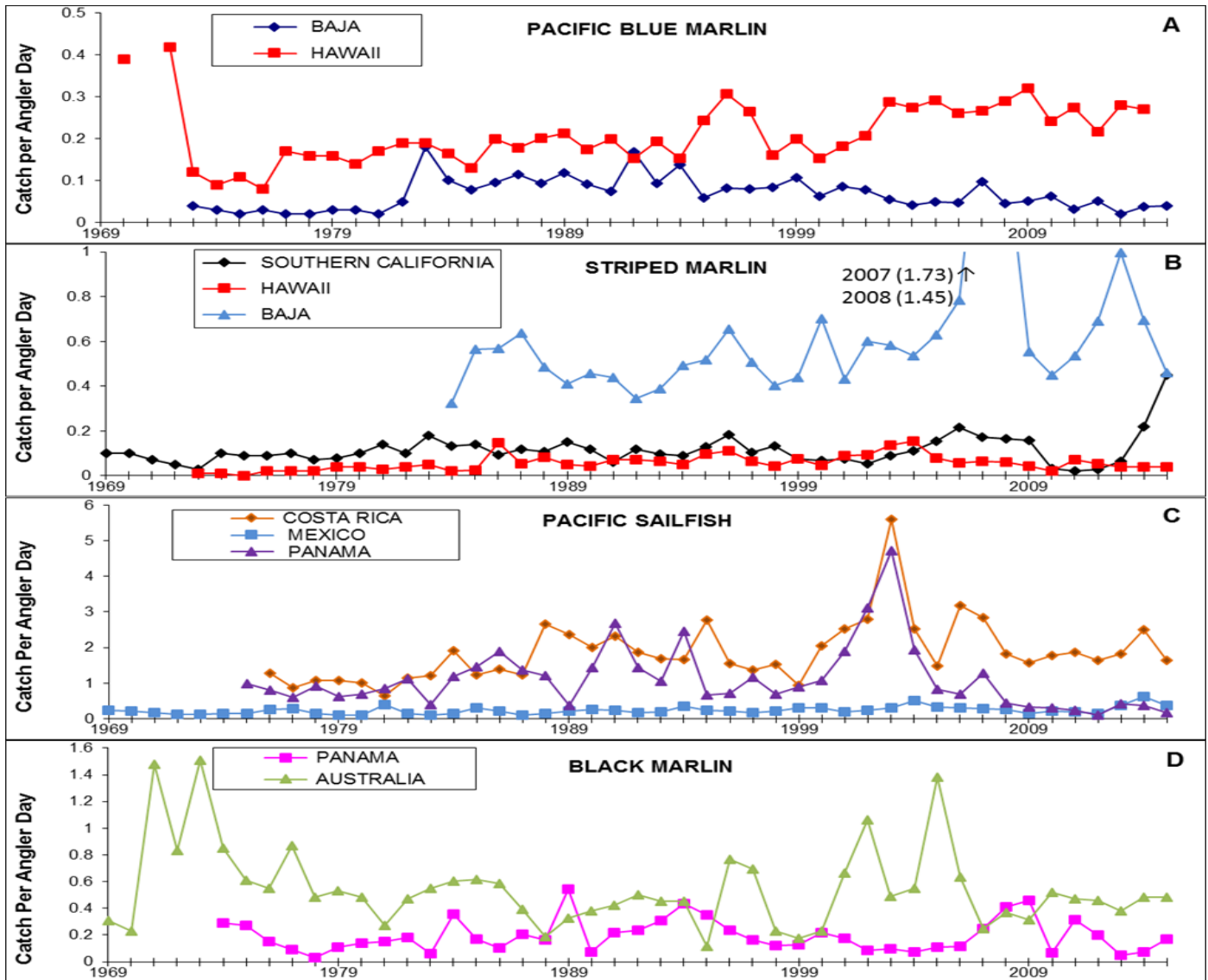


Figure 2. Nominal catch-per-unit-effort (nCPUE) in number of fish per angler fishing day reported by region from 1969-2015 for Pacific blue marlin (A), striped marlin (B), Pacific sailfish (C), and black marlin (D).



Black marlin (*Istiompax indica*)

Black marlin is typically found in the tropical and subtropical waters of the Pacific and Indian Oceans, with occasional distribution in temperate waters. The species is often caught near land masses and coral reefs and feeds on fishes, cephalopods, crustaceans, and small tunas when abundant. The black marlin is considered one of the largest fish in the world, able to grow to more than 2,000 pounds and 15 feet.

We examine the black marlin nCPUE by looking at the regional nCPUEs for the species in Panama and Australia. Australia has been the exemplar region for the species, as black marlin is the major billfish caught and the country retains the highest black marlin nCPUE of all locations for five years running. In fact, with the exception of 1989, 2008, and 2009, the black marlin nCPUE in

Australia has been consistently higher than Panama since 1969. The 2015 black marlin nCPUE for Australia was similar to last year's value, 0.48. This is higher than the 5-year average (0.46), but lower than the overall regional average nCPUE of 0.55. Black marlin fishing has stayed fairly consistent in the last 5 years and has remained between 0.38 and 0.48 since 2011.

The runner-up for black marlin nCPUE is Panama, which reported an nCPUE of 0.17 for 2015. This is an increase from the previous two years (0.05 and 0.07) and above the 5-year average for the region (0.14). Papua New Guinea, Malaysia, Guatemala, and Thailand have all reported black marlin catches in the past, however, the consistent standouts for the species have been Panama and Australia since 1974 and 1969, respectively.



Shortbill spearfish (*Tetrapturus angustirostris*)

The shortbill spearfish is an oceanic species with a distribution across tropical, subtropical, and temperate Pacific Ocean waters with limited abundance near Hawaii, Central America, Mexico, and the west coast of the United States. Shortbills have been occasionally reported in the Atlantic Ocean, but it is thought that the primary populations and spawning grounds are within

the Pacific and Indian Oceans. It feeds on fishes, cephalopods, and crustaceans. Historically, most spearfish catch for our program has been reported off the coast of Hawaii. For 2015, the only reported shortbill catch was off Hawaii with 117 spearfish caught.



Broadbill Swordfish (*Xiphias gladius*)

Broadbill swordfish is a commercially important fish and in the NPO, is comprised of two stocks. A diagonal boundary extending from Baja, California to the Equator separates the Western and Central North Pacific Ocean stock (WCNPO), distributed in the western and central Pacific, and the Eastern Pacific Ocean stock (EPO), distributed in the eastern Pacific.

Historically, swordfish have not been taken in high numbers by recreational anglers in the Pacific and reports of swordfish catch among the billfish angling community are usually minimal. However, one broadbill swordfish was tagged in 2015 in Hawaii! Despite the low tag rate, the return rate for swordfish is high in our program, no doubt due to the large commercial effort targeting the species resulting in higher chances of finding a tagged fish. The fishing method typically used for targeting swordfish differs from other billfish because recreational anglers typically target these fish at night.

The Billfish Tagging Program

The angler-based International Billfish Tagging Program began in 1963 at the SWFSC to provide tags to billfish anglers in order to promote catch-and-release. Since its inception, the program has sent more than 72,000 tags around the world and has received information from more than 58,000 tagged billfish. The billfish community is a huge proponent of promoting ethical angling, skillful tagging, and release while still experiencing the thrill of sportfishing. This voluntary tagging program depends on the participation of committed recreational and commercial anglers and captains, sportfishing organizations, and individuals. Over 601 tags have been recovered since the inception of the program—these valuable release and recapture data are used to determine movement and migration patterns, species distribution, and age and growth for species that are difficult to study in pelagic waters. Thank you for your participation!

Overall, the tagging effort in 2015 was phenomenal. Anglers released 1,416 tags on billfish alone and 242 tags on other sharks and other fish, amounting to a total of 1,665 total pelagic fish tagged (**Table**

2). For billfish, anglers released 362 more tags than in 2014 and 648 more than in 2013. This year’s efforts increased the program’s total releases to over 82,000 tags!

Table 2. Tag release and recapture totals for the span of the tagging program, 1963-current. The pelagic sharks and albacore were tagged during NOAA SWFSC and affiliated research operations.

SPECIES NAME	RELEASES 2015	RELEASE TOTALS (1963-2015)	RETURN TOTAL (1963-2015)	RETURN RATE (%)
Pacific Blue Marlin	953	13,545	104	0.77
Sailfish	195	10,050	51	0.51
Striped Marlin	147	23,661	350	1.48
Shortbill Spearfish	117	2,556	4	0.16
Black Marlin	3	3,395	69	2.03
Broadbill Swordfish	1	525	17	3.24
Billfish, Unidentified	0	4,386	6	0.14
Shortfin Mako Shark	93	6218	380	6.11
Blue Shark	12	9974	207	2.08
Leopard Shark	9	244	12	4.92
Common Thresher Shark	4	2,547	114	4.48
Albacore Tuna	123	1,172	38	3.24
All Others	8	3,851	180	4.67
Total	1,665	82,124	1,532	1.87

This year, the Hawaiian Islands contributed the majority of totals tags released in 2015, followed by Acapulco/Ixtapa-Zihuatanejo, and then Southern California, as visualized by tag density in [2015 Billfish Tagging At-a-Glance](#). This is the first time in four years that the tag releases in Southern California exceeded those of Baja. This switch in tagging effort in conjunction with the continuous drop of Baja’s nCPUE—1.11 in 2013, 0.90 in 2014, 0.59 in 2015—may indicate a link to changes in SST and the occurrence of “the Blob” in the Northeast Pacific. By far the most-tagged species in 2015 was the Pacific blue marlin, accounting for 67% of all billfish tagged. A total of 953 blue marlin were tagged and released, mostly in the Hawaiian Islands. Sailfish was the second most-tagged species, with 195 fish tagged mostly in the Acapulco/Ixtapa-Zihuatanejo area of Mexico, followed by 147 striped marlin mostly tagged in Southern California (**Table 3**). These results are consistent with the 2014 season in that Pacific

blue marlin, sailfish, and striped marlin are the top three billfish tagged and released. However, anglers in 2015 tagged almost double the amount of blue marlin and half the amount of sailfish than in 2014.

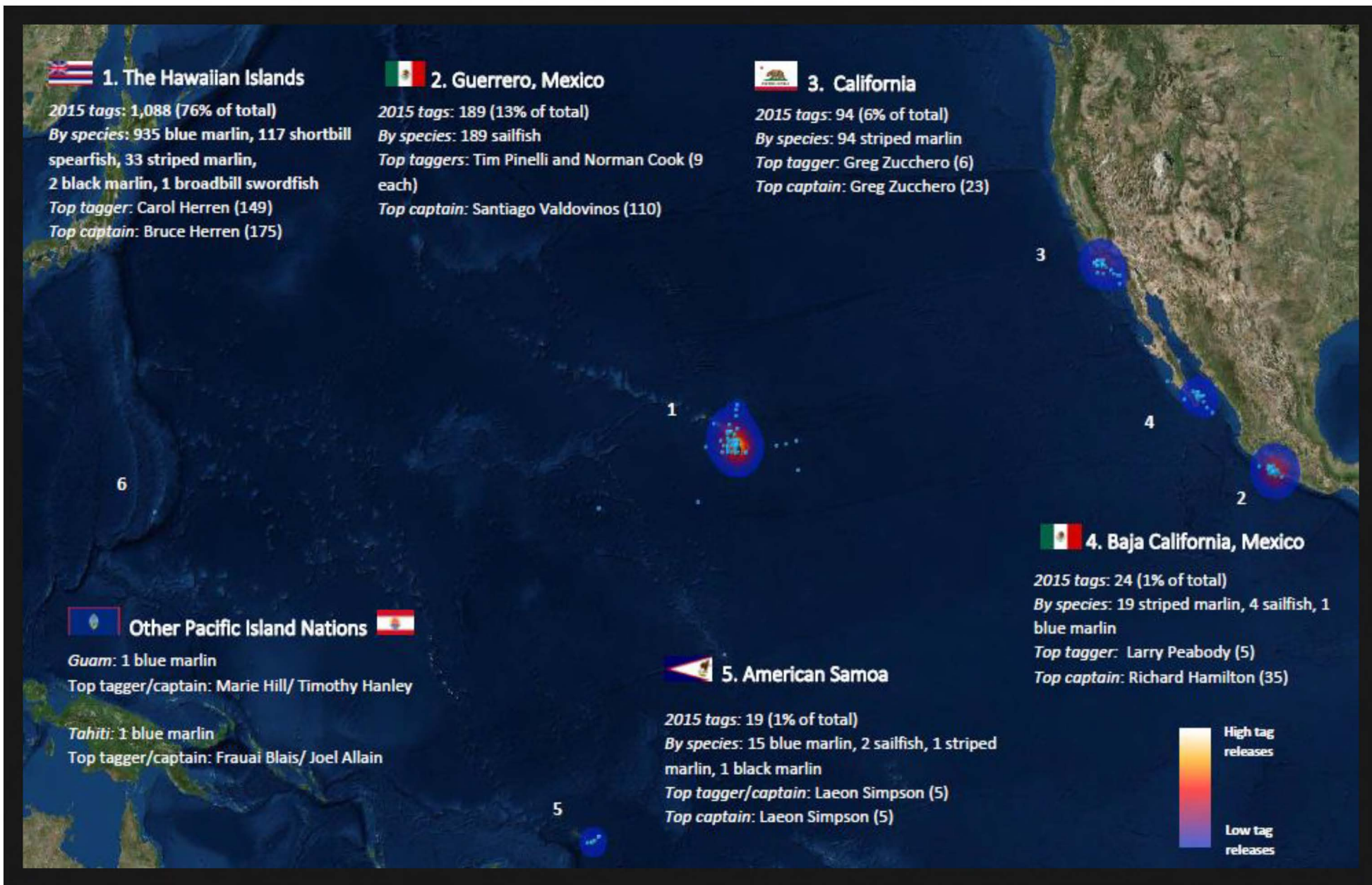
Table 3. Summary of billfish tagged during 2015, by region.

Southern California	
Striped Marlin	94
Baja California / Baja California Sur	
Striped Marlin	19
Sailfish	4
Pacific Blue Marlin	1
Acapulco - Ixtapa - Zihuatanejo, Guerrero	
Sailfish	189
Hawaii	
Pacific Blue Marlin	935
Shortbill Spearfish	117
Striped Marlin	33
Black Marlin	2
Broadbill Swordfish	1
Guam	
Pacific Blue Marlin	1
Samoa	
Pacific Blue Marlin	15
Sailfish	2
Tahiti	
Striped Marlin	1
Black Marlin	1
Pacific Blue Marlin	1
Total	1,416

The Hawaiian Islands

Like most seasons, anglers in Hawaii tagged the most billfish than any other location this year, amounting to 1,088 tags (76% of total effort). This year's tagging effort out of Hawaii towers over the past two years when anglers tagged 619 billfish in 2014 and 433 in 2013. Most tags this year were released on Pacific blue marlin (935 tags), in addition to 117 on shortbill spearfish, 33 on striped marlin,

◀ 2015 BILLFISH TAGGING AT-A-GLANCE ▶



2 on black marlin, and 1 on a broadbill swordfish. Hawaiian efforts are consistently a pillar of our tagging program, due in large part to the tournament operations out of Kona including the Kona Charter Desk and the Hawaii Marlin Tournament Series facilitated by Jody Bright. Hundreds of tags are sent to these operations each year and end up on billfish through charters and tournaments. The majority of the tags released in the Islands are centralized around the west coast of the Big Island, with many off the west coast of Maui in the Kealaikahiki Channel.

Baja California and Guerrero, Mexico

With such an expansive and diverse coastline, Mexican anglers are consistent contributors of billfish tags season after season. The area produces the second-highest tag release count of the program, a total of 213 for the 2015 season. The 189 tags released off Guerrero amount to more tags than Baja and Southern California combined and notably, only sailfish were tagged from the region whereas sailfish, striped marlin, and blue marlin have historically been tagged in Guerrero. Off the Baja Peninsula, we saw tags released on blue marlin, stripers, and sailfish, albeit half the amount of tags released in 2014. The captains from Mexico contribute greatly to our program and take out locals, tourists, and veteran anglers returning to the area to fish billfish every year. In particular, captains and anglers fishing from the port of Zihuatanejo made a huge contribution this year!

Southern California

The 2015 tagging total for Southern California—94 tags—was the region's best tag releases in the history of the program! To provide some perspective, this year's tag number exceeds the number of tags released in the past five years combined. All the tags released this year were solely on striped marlin, which is an indication of the rising nCPUE of the species in the area. No doubt the changing ocean conditions in Southern California have proven helpful for billfish anglers the past two seasons.

Western Pacific

The island nations of the Western Pacific continue to contribute valuable tag information to our program season after season, and anglers tagged a combined 21 billfish this year. After Hawaii, this region tags the most diverse suite of billfish species, including Pacific blue marlin, striped marlin, black marlin, and sailfish. Samoa tagged 19 billfish, the majority of which were blue marlin, while Tahiti and Guam each tagged one Pacific blue marlin in 2015. We'd like to acknowledge that much of the tagging effort and outreach is the result of cooperative anglers involved in the Pago Pago Fish Association and their annual Game Fish Tournament.

Top Anglers & Captains Acknowledgements

We appreciate the cooperation of the dedicated anglers and captains who tag and release billfish in cooperation with our program. Every released tag is a valuable contribution to our program’s research and we hope you enjoy your time out on the water while being stewards of ethical angling. Individual recognition of the 49 anglers who reported 3 or more billfish tag releases is presented in **Table 4**.

Table 4. Top tagging anglers by region for the 2015 fishing season.

ANGLER NAME	BILLFISH TAGGED
California	
JOSEPH (GREG) ZUCCHERO	6
ANN THOMPSON	5
JOHN A. DRAGOS	5
JOHN HARRINGTON	5
KATHY ECKLUND	5
SEAN MULROONEY	4
Baja California / Baja California Sur	
LARRY PEABODY	5
Acapulco - Ixtapa - Zihuatanejo, Guerrero	
TIM PINELLI	9
NORMAN COOK	9
RON HUBBARD	8
T. BROWNE	8
CORLEY PHILLIPS	6
MARTIN MALESHYN	6
CARL TAYLOR	6
RANDY KOLLODGE	5
RICK REINERTSEN	5
JIM SORENSON	4
SHERRY COOK	4
SONIA HUBBARD	4
Hawaii	
CAROL HERREN	149
NICHOLAS CORBAT	15
HEATHER MASUNAGA	12
MIKE JACOBSEN	10
CRAIG LINDNER	8
LARRY PEARDON	7
CRAIG LINDNER, JR	7
DAN DOHERR	6
STEPHANIE CHOATE	6
JASON LONG	5
BRIAN ISHERWOOD	5
LEE JIE	5
STEVE SPINA	5
PAT BRIAN	5
CHRIS HOWAT	4
CRAIG CHAMBERS	4
RICH WILSON	4
WES CONGAN (COGAN)	4
JADA HOLT (VAN MOLS)	4
SEAN CONNOLLY	4
DYLLON SMITH	4
NICHOLAS WADA	4
MITCHELL FIRESTEIN	4
MICHELLE AMADOR	4
MASAHARU MATSUSHITA	4
JUSTIN CURRY	4
JENNIFER RICE	4
HIDEYO HOSHINO	4
SEAN WEAVER	4
Samoa	
LAEON SIMPSON	5

For the sixth year in a row, Carol Herren topped the charts for most tags released for all locations! In fact, the 149 tags she released this year amount to more than those by the top anglers in California, Baja, and Acapulco-Ixtapa/Zihuatanejo combined! Nicholas Corbat also released 15 tags from Hawaii, followed by Heather Masunaga with 12 tags, and Mike Jacobsen with 10 tags. The competition in the Zihuatanejo region was close this year, with Tim Pinelli and Norman Cook topping the charts with nine tags each, but followed closely by all other anglers of the region. Greg Zucchero led the charts for California with six tags released but also faced stiff competition from Ann Thompson, John A. Dragos, John Harrington, and Kathy Ecklund with five tags each. Great job, anglers!

Charter and private boat captains who enable anglers to catch and release billfish play a huge role in the success of our Cooperative Billfish Tagging Program. Captains and crew also hold a huge privilege in setting the example of catch-and-release stewardship for locals and tourists alike. We thank you for your continued work and commitment to the skillful tagging and release of these beautiful fish! A collection of 50 dedicated captains skippered trips this year and oversaw 6 or more tag releases each (**Table 5**).

For the second year in a row, Captain Bruce Herren was the top-tagging skipper out of Hawaii and for the first time in five years, the overall top tagging skipper for all regions. This year, he more than doubled his 2014 record (68 tags), with 175 tag releases! Bruce operates the *Raptor* out of Hawaii, a region that is always marked by tough competition and great captains such as Ken Fogarty of *Hula Girl*, Marlin Parker of *Marlin Magic*, McGrew Rice of *Ihu Nui*, and Jeff Fay of *Humdinger* who oversaw the deployment of more than 50 tags each. Thank you for all your effort and we're looking forward to another fantastic season ahead. Great job, Team Hawaii!

Ranking second overall for all regions and first in Mexico, Captain Santiago Valdovinos of the *Gitana* skippered during 110 tag releases this year. Since 2014, Santiago has consistently reported more than 100 tags during his trips and this year he upheld his reputation as the top tagging captain of the region. Santiago is joined by fellow skipper Adan Valdovinos Olea of the *Gitana II*, who oversaw 48 tag releases this year and contributed greatly to the Zihuatanejo region's productive tagging effort. Richard Hamilton is the highest-tagging skipper in the Baja California Sur region, with an impressive 35 tags on his trips aboard *Escape Artist*. Combined, Mexico had a very successful tagging season thanks to all the dedicated skippers!

In Southern California waters, Captain Greg Zucchero of *Gadzukes* made his way to the top of the list with 23 tags, a position he can also claim next to top Southern California angler of the year! Also notable are the efforts of Captain Dan Muslin of *To the Limit* for skippering trips which saw the release of

12 billfish tags this year. We'd also like to recognize our captains operating in the far western Pacific, in particular Captain Vaughan Simpson in Samoa with five tags and Captain Joel Allain in Tahiti with one tag.

Table 5. Top tagging captains by region for the 2015 fishing season, with more than five tags.

CAPTAIN	BILLFISH TAGGED
California	
JOSEPH (GREG) ZUCCHERO	23
DAN MUSLIN	12
BILL MAC CORKELL	8
STAN ECKLUND SR.	7
Baja California / Baja California Sur	
RICHARD HAMILTON	35
Acapulco - Ixtapa - Zihuatanejo, Guerrero	
SANTIAGO VALDOVINOS	110
ADAN VALDOVINOS OLEA	41
ARMANDO ARCINIEGA	24
(CHIRO) ISIDRO BARRAGAN	7
Hawaii	
BRUCE HERREN	175
KEN FOGARTY	68
MARLIN PARKER	58
MCGREW RICE	52
JEFFREY FAY	50
DAVID CRAWFORD	41
JOE SCHUMAKER	40
STEVE EPSTEIN	38
TEDDY HOOGS	30
ROBERT C. (BOB) SYLVA JR.	29
JOHN BAGWELL	27
JAMES DEAN	27
KERWIN MASUNAGA	24
JEFF KAHL	23
ROB ELLYN	22
TIM HICKS	21
STEVE CARROLL	16
DON STUTHEIT	15
ANDREW PETERSON	14
TOM CASEY	11
SCOTT M. FULLER	11
MIKE DEREGO	11
BRIAN WARGO	10
NEAL ISAACS	9
BILL CASEY	9
KEVIN HIBBARD	9
MICHAEL O'TOOLE	9
KEVIN NAKAMARU	9
TIM PUTNAM	8
BRETT FAY	8
AL GUSTAVSON	8
KAI HOOVER	8
KEVIN MCLAUGHLIN	8
DENEEN WARGO	7
ROBERT MCGUCKIN	7
JASON HOLTZ	7
TREVOR CHILD	6
CHUCK WIGZELL	6
KENNY LLANES	6
RYAN C. FOSTER	6
CHUCK WILSON	6

Tag Recoveries

One of the main goals of our tagging program is to eventually recover tagged fish at a later date to assess growth and migration patterns. It is always exciting to see reported recaptures and this year, we had four

tag recoveries for Pacific blue marlin. We encourage anglers to report tag recoveries, including those that are re-released with or without new tags.

As shown in **Table 6**, all known recaptures in 2015 were for blue marlin tagged in Hawaii. The five fish were at liberty in the Pacific Ocean ranging from 11 to 1,270 days. Ivan Livas of Mexico caught a marlin that was originally tagged in 2011 by Teddy Hoogs in Hawaii. The fish had traveled a total of 3,122 nautical miles down to Manzanillo, Colima, Mexico! This case of tag recovery shows the importance of reporting your catches, tags, and recoveries to allow for observation of general migration patterns of different species.

Jason Nagahisha recovered in tag from a blue marlin in June, but unfortunately, no release information was found for the tag. Thank you for reporting it, Jason.

The three remaining tagged marlin appeared to have stayed locally in Hawaii, travelling between 2 and 79 nautical miles around the islands before recapture. Tim Putnam and Dyllon Smith tagged a marlin that was recovered by Chad Williams 34 days later and 16 nautical miles northwest. Tom Casey and Neil Ruditsky tagged a marlin that Chad Tontessa caught almost a year later and 79 miles south. Finally, Ken and Greg Fogarty tagged a marlin that barely made it two miles before being caught by Rob Ellyn 11 days later. Thanks to responsible tagging techniques and practices, it is obvious these billfish remain in good condition after release.

In years past, tag recoveries have been on striped marlin and shortbill spearfish in addition to blue marlin, and with this year’s significant amount of tag releases, we’re looking forward to a 2016 season with plenty of tag recoveries!

Table 6. Tag recovery information for 2015.

TAGGER / CAPTAIN	RELEASE DATE	RELEASE LOCATION	RECOVERY DATE	RECOVERER	RECOVERY LOCATION	DAYS AT LIBERTY	NAUTICAL MILES - DIRECTION TRAVELED
Pacific Blue Marlin							
Teddy Hoogs / Wally Campbell	9/1/2011	Hawaii	2/22/2015	Ivan Livas	Manzanillo, MX	1270	3122- SE
N/A	N/A	N/A	6/20/2015	Jason Nagahisa	N/A	N/A	N/A
Tim Putnam / Dyllon smith	7/13/2015	Hawaii	8/16/2015	Chad Williams	Hawaii	34	16 - NW
Tom Casey / Neil Ruditsky	9/5/2011	Hawaii	8/14/2015	Chad Tontessa	Hawaii	343	79 - S
Ken Fogarty / Greg Fogarty	8/26/2015	Hawaii	9/6/2015	Robert Ellyn	Hawaii	11	2

Science in Action

The IGFA Great Marlin Race and Marlin Tagging

By Dr. Aaron Carlisle

We first reported on the International Game Fish Association Great Marlin Race (IGMR) in the 2014 NMFS billfish newsletter, and since then, this citizen-science-based tagging program—a collaboration among the IGFA, Stanford University, and anglers—has continued to expand. As of 2015, there have been 38 IGMR events around the world, which have deployed a total of 260 pop-up satellite archival transmitting (PAT) tags on blue, black, white, and striped marlin as well as on sailfish and spearfish. Cumulatively, these tags have recorded nearly 22,000 days of temperature and depth data, and tagged fish have covered more than 181,000 nautical miles during their journeys.



Figure 3. A Pacific blue marlin (*Makaira nigricans*) with a conventional billfish tag (yellow) and pop-up satellite archival transmitting tag (in black).

We are excited to report that the first peer-reviewed scientific paper using IGMR data has been published in the journal *Fisheries Oceanography*. In this paper, entitled “Influence of temperature and oxygen on the distribution of blue marlin (*Makaira nigricans*) in the Central Pacific” we studied the movements and habitat use of blue marlin in the Central Pacific between 2009 and 2013. The marlin in this study were tagged in Hawaii as part of the Hawaiian International Billfish Tournament (HIBT), as well

as in Tahiti. By studying blue marlin over this five-year time frame, we were able to better understand how marlin use their oceanic environment, and how patterns of movement and habitat use change across years as oceanographic conditions change. This, in turn, gave us new insights into the role different oceanographic factors play in shaping their distribution and migratory behavior.

We found that blue marlin generally reside in the upper part of the water column, rarely diving below 150 meters. Their behavior varies between night and day, staying near the surface at night but diving to deeper depths during the day. Prior research suggests that this nighttime surface behavior may represent a resting behavior, while the deeper dives during the day may be related to active foraging. Interestingly, the depth distribution of blue marlin was remarkably consistent during the study period,

being nearly identical across all of the years in this study. Although their overall depth distribution was consistent across years, we found that their diving behavior subtly changed as they moved through different regions of the Central Pacific. In particular, as they moved into regions where cold, low-oxygen water came closer to the surface, which generally occurs in regions closer to the equator, their dives tended to be shallower. We found that the combination of cold temperature and low oxygen levels led to the greatest vertical habitat compression, as opposed to either of those factors alone. While the vertical habitat of marlin was compressed by low oxygen and temperature conditions, this really only impacted

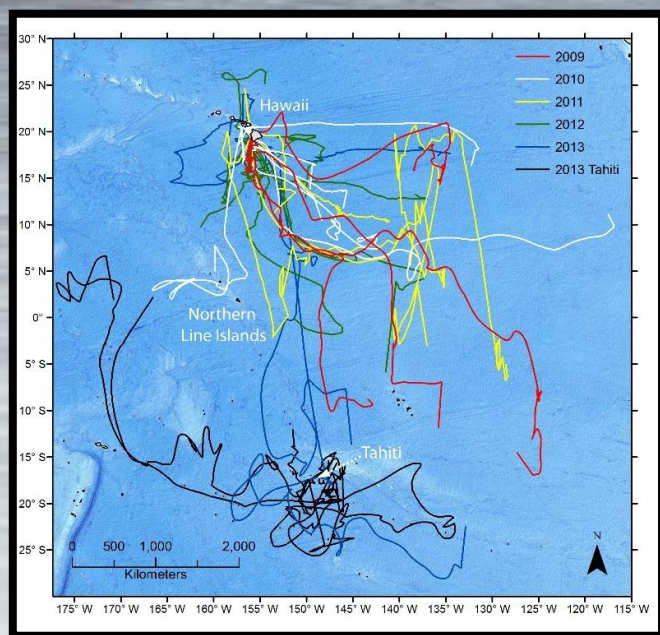


Figure 4. Marlin tag tracks in the South Pacific between 2009 and 2013. Distribution of this image is prohibited without permission from authors.

their deepest dives—as they spend the majority of their time at depths above which these conditions occur.

In addition to the effect that environmental conditions had on the vertical distribution of marlin, they also had an effect on their broad migratory patterns. The study period overlapped with both the warm (El Niño) and cold (La Niña) phase of El Niño Southern Oscillation (ENSO) cycle. These different oceanographic phases are characterized by very different oceanographic conditions, with the warm phase having very warm water temperatures and depressed equatorial upwelling (which reduces vertical habitat compression), and the cold phase having much cooler water temperatures and

increased equatorial upwelling (which increases vertical habitat compression). Over the course of the five-year study period, blue marlin consistently migrated across the equator. The only year that this did not occur was during the 2010 La Niña. In that year, blue marlin moved towards the equator, but encountered an oceanographic barrier around the equator in the form of cold, low oxygen waters resulting from the La Niña. These conditions created a barrier that blue marlin were unwilling or unable to cross.

While there is uncertainty about how climate change will impact the world’s oceans, recent research has suggested that there may be an increase in the frequency of extreme El Niño and La Niña events, in addition to expansion of these regions with low oxygen and temperature conditions. If this is the case, then these types of barriers may become a more common and persistent feature in the oceanic habitats of the blue marlin. Changes in the distribution, frequency of occurrence, and duration of these

oceanographic barriers could have direct effects on the habitat use and migratory behavior of blue marlin, with potentially important implications to the ecology and population dynamics of this important pelagic predator.

To read further, check out the research paper:

Carlisle, A.B., Kochevar, R.E., Arostegui, M.C., Ganong, J.E., Castleton, M., Schratwieser, J. and Block, B.A., 2016. Influence of temperature and oxygen on the distribution of blue marlin (*Makaira nigricans*) in the Central Pacific. Fisheries Oceanography 26 (1): 34-48.



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The information here would not be possible without the cooperation of thousands of international anglers and volunteers who support these investigations, which we greatly appreciate. We also thank Dr. Aaron Carlisle for contributing his research to our Newsletter. Our Billfish Newsletter archive, Angler Surveys, and tag request page can be found online at the SWFSC webpage, <https://swfsc.noaa.gov/FRD-Billfish/>.

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



PAPERWORK REDUCTION ACT NOTIFICATION

NOAA Fisheries needs the information reported on Billfish Tagging Cards and the International Billfish Angler Survey for the conservation and management of fishery resources. The information will be used for billfish 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.



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Thank you to the thousands of anglers, captains, and volunteers from around the world for tagging. We received many great photos and wanted to showcase as many of your submissions as possible. To be potentially featured in the next Billfish Newsletter, please send us your photographs (digital or hard copy) and the winning cover photo entry wins a shirt and full credit in the next issue. Happy fishing!



Photo credit Shannon Terrell.



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