

The Southwest Fisheries Science Center's

1995 Billfish Newsletter



Results of Cooperative Programs

- Trends in 1993 Billfish angler catch rates
- 1994 Billfish tagging and recoveries

Results of recent investigations



INTRODUCTION

The *Billfish Newsletter* is an annual publication produced by the Southwest Fisheries Science Center (SWFSC) as a service to the international angling community. Emphasis is on billfish angling in the Pacific, Indo-Pacific and Indian Oceans. The results of the 1993 *International Billfish Angler Survey* and the 1994 *Cooperative Marine Game Fish Tagging Program* are described in this issue. The data presented are the result of cooperation by billfish anglers, sport fishing clubs and affiliated agencies with the SWFSC. We express our sincere appreciation to all anglers completing the survey forms and to all those who tag and release billfish. We welcome comments concerning both the *Survey* and *Tagging* programs as well as the contents of this *Newsletter*.

INTERNATIONAL BILLFISH ANGLER SURVEY

OVERVIEW

The *Billfish Angler Survey* provides the only estimates of billfish angling activities in the Pacific and Indian Oceans. Collection of recreational billfish catch and effort data which began in 1969 provides an index of catch and effort trends for the recreational fishing community. The recreational fisheries are important economically to many areas of the Pacific. Tourism in places such as Hawaii and Baja California is enhanced by the presence of billfish sport fishing facilities. Total expenditures by anglers in pursuit of catching trophy billfish is large and can be a major source of revenue in some local areas.

RESULTS OF THE 1993 BILLFISH ANGLER SURVEY

Billfish anglers responding to the *Billfish Angler Survey* for 1993 reported catching 3,378 billfish throughout the Pacific, Indo-Pacific and Indian Oceans. This included 906 Pacific blue marlin, 166 black marlin, 1,021 striped marlin, 1,042 sailfish, 238 spearfish and 5 swordfish.

In Table 1 the results of the 1993 *Billfish Angler Survey* as reported by anglers, by landing location for the Pacific and Indian Oceans are presented. The fishing area, number of angler days fished, catch of billfish per angler-day (CPUE), and major species are indicated. The catch rates for 1992 are shown in parenthesis.

The majority of striped marlin were taken in southern California, along the southern coast of Mexico's Baja peninsula and in the waters surrounding Hawaii. Blue marlin were most often reported from Hawaii, Baja California, Guam and New Zealand. Black marlin

Table 1. Results of 1993 *Billfish Angler Survey*. Data in parentheses are values recorded in 1992. Species codes are striped marlin (SM), blue marlin (BLM), black marlin (BKM), and sailfish (SF).

LOCATION	ANGLER FISHING DAYS	BILLFISH PER FISHING DAY (CPUE)	MAJOR SPECIES
PACIFIC OCEAN			
Hawaii	3,259 (3,379)	0.33 (0.28)	BLM
So. California	1,456 (2,220)	0.10 (0.12)	SM
Baja California Mexico	1,278 (1,240)	0.60 (0.60)	SM
Guaymas, Mexico	24 (37)	0.29 (0.46)	SM
Mazatlan, Mexico	15 (23)	0.67 (0.96)	SF
Puerto Vallarta, Mexico	41 (42)	0.46 (0.55)	SM
Manzanillo, Mexico	86 (28)	0.55 (0.61)	SF
Acapulco, Mexico	72 (79)	1.54 (0.90)	SF
Guatemala	101 (334)	2.89 (1.37)	SF
Costa Rica	117 (234)	1.80 (2.03)	SF
Panama	120 (38)	1.78 (1.97)	SF
Peru	- (117)	- (0.41)	SF
Japan	826 (38)	0.05 (0.16)	BLM
Guam, U.S.A.	253 (102)	0.18 (0.29)	BLM
Micronesia	5 7	0.20 (0.43)	BLM
Fiji	13 (51)	0.23 (0.14)	SF
Tahiti, French Polynesia	34 (83)	0.38 (0.47)	BLM
Australia	156 (213)	0.53 (0.55)	BKM
New Zealand	135 (143)	0.27 (0.06)	BLM
INDO-PACIFIC			
Papua New Guinea	46 (30)	0.22 (0.63)	SF
Malaysia	- (35)	- (0.09)	BLM
Thailand	3 (2)	0.33 (0.50)	BKM
Hong Kong (Pratas)	16 (31)	0.12 (0.16)	BLM
INDIAN OCEAN			
Kenya	141 (142)	0.67 (1.07)	SF
Mauritius	225 (11)	0.22 (0.09)	BLM
Seychelles	- (43)	- (4.81)	SF

INFORMATION FOR RECEIVING THIS NEWSLETTER AND ANGLER SURVEY FORM

The *Billfish Newsletter* is sent to individuals who have within the past year tagged and released billfish, or have submitted the *Billfish Angler Survey* form to the Southwest Fishery Science Center during the past year. U.S. Government regulations require us to purge our mailing list each year. If you did not fish for billfish in 1994, but would like to continue to receive the *Billfish Newsletter* indicate your name and address on the bottom portion of the *Billfish Angler Survey* form and indicate "NO FISHING" and return the form. Your name will be retained on the mailing list. Your cooperation in the annual *Billfish Angler Survey* and the *Cooperative Marine Game Fish Tagging Program* is appreciated.

were most often reported from Australia, Panama and Baja California. Sailfish were reported caught in greatest numbers along the entire west coast of Mexico and Central America and short-billed spearfish from Hawaii and Panama.

The total number of angler-days reported for 1993 was 8,561 days, a decrease of 1.7% from the number of angler-days reported in 1992. The overall catch per unit of effort (CPUE) for 1993 was 0.40 billfish caught per angler-day (or 2.5 days fishing per billfish). This is similar to the 1990 and 1992 catch rates of 0.42 and 0.43 billfish/day but only about 75% of the 1991 catch rate of 0.57 billfish/day.

It is important to understand these catch rates represent annual means and are calculated over the entire 1993 reporting year. They are not indicative of seasonal highs or lows encountered in any particular region. For regions reporting fewer than 100 angler days (i.e. small sample size), the statistical error of the mean may be somewhat greater than for regions reporting more than 100 angler days. The principal value of these data are in the trends observed over a long period of time. These trends can then be com-

SURVEY RESPONSE

Your response to the *Billfish Angler Survey* is needed to better determine the trend of angler catch rates which provides an index on the health of the billfish stocks important to recreational fisheries.

Enclosed you will find three copies of the *Billfish Angler Survey* card for the 1994 calendar year; one for your individual use and extras for family members or others anglers not familiar with the *Survey*. Additional 1993 *Survey* cards are available to billfish anglers through this office.

The following billfish tags have been recovered but *Billfish Tagging Report* cards, with release information were never returned. Please check to see if you have any misplaced *Billfish Tagging Report* cards in your tackle box.

Species codes are: striped marlin, SM; blue marlin, BLM; swordfish, swordfish, SWO and unidentified billfish, BILLFISH.

TAG NUMBER	SPECIES	YEAR RECOVERED
A 175	SM	1986
A 1437	SM	1988
A 4581	SM	1988
A 6046	SM	1988
A 7336	SM	1989
A 8285	SM	1989
A 8925	BILLFISH	1989
A 9353	SM	1990
A 9387	SM	1989
A 9738	SM	1989
A 11409	SM	1989
A 15345	SM	1995
A 19327	SM	1991
A 20380	BLM	1993
A 20760	BLM	1994
A 21137	SM	1993
A 23671	BILLFISH	,
H 16797	SM	1986
H 37204	SM	1987
H 43017	SM	1990
H 46699	SM	1988
H 51032	SM	1987
H 51697	SM	1987
HM49687	SWO	1987
W 1057	SM	1995

pared with other events affecting catch rates including meteorological patterns such as El Niño events, regional commercial fisheries or local economies.

Highest catch rate for striped marlin was at the southern tip of Baja California (0.39). High catch rates for blue marlin were recorded in Hawaii (0.18), Mauritius (0.18), Tahiti (0.35), Guam (0.18) and New Zealand (0.20). High catch rates were reported for black marlin in Australia (0.46) and Panama (0.31). Excellent catch rates for sailfish were reported from central and southern Mexico, Costa Rica and Panama.

The trends in CPUE recorded during the *Billfish Angler Survey* are shown graphically by location for striped marlin (Figure 1A), blue marlin (Figure 1B), black marlin (Figure 1C), and sailfish (Figure 1D).

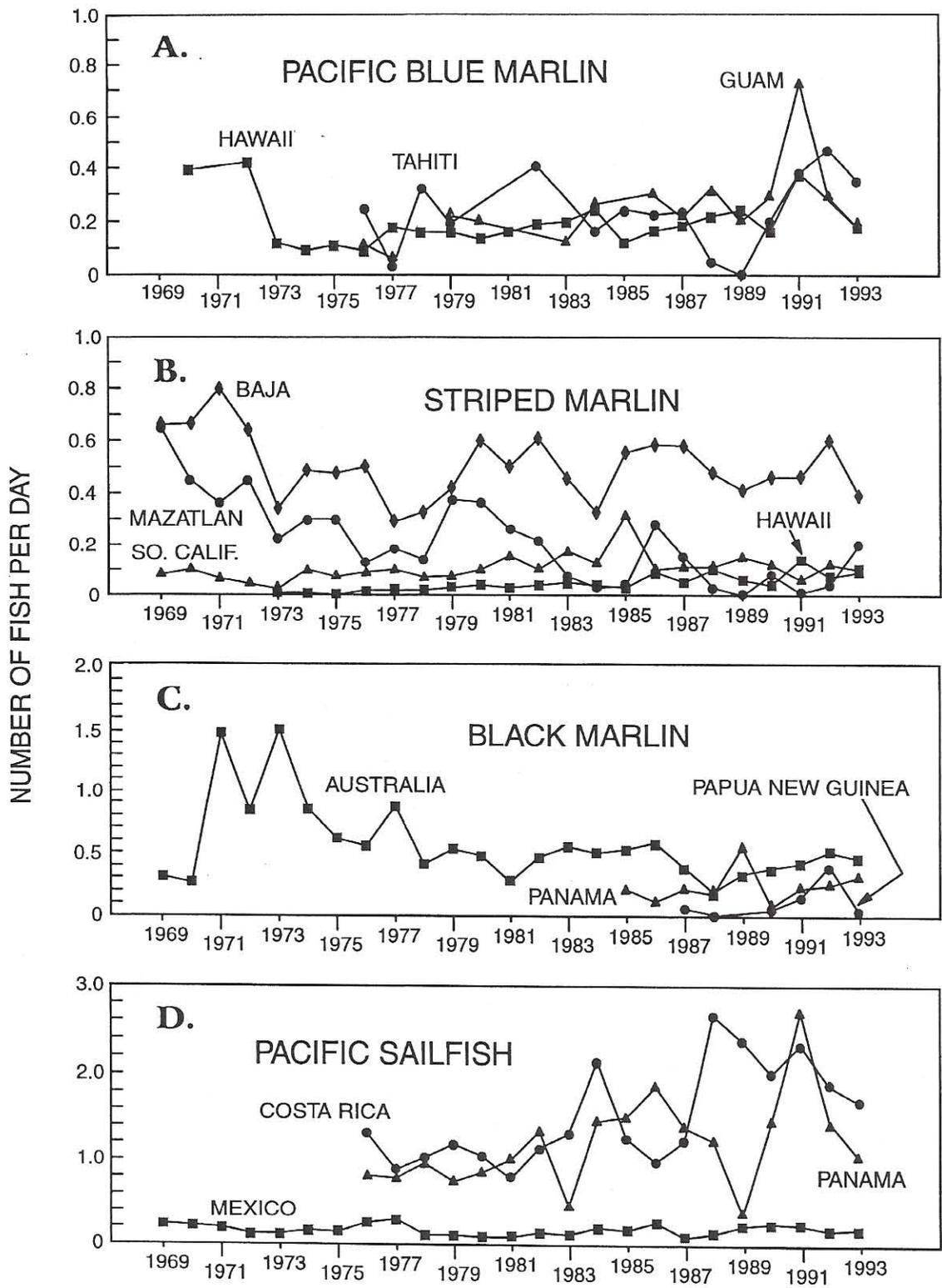
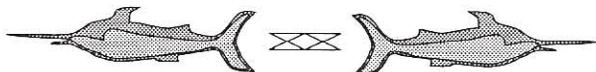


Figure 1. CPUE (number of fish/angler day) for A) striped marlin, B) blue marlin, C) black marlin, and D) sailfish reported by region, 1969-1993.

Table 2. Summary of billfish tagged in 1994.

AREA	SPECIES	TOTAL
PACIFIC OCEAN		
Southern California, U.S.A.	Blue Marlin	2
	Striped Marlin	82
Hawaii, U.S.A.	Blue Marlin	184
	Black Marlin	10
	Striped Marlin	120
	Sailfish	1
	Short-Billed Spearfish	55
	Broadbill Swordfish	46
Baja California, Mexico	Blue Marlin	20
	Black Marlin	2
	Striped Marlin	51
	Sailfish	23
Manzanillo/Acapulco, Mexico	Blue Marlin	2
	Striped Marlin	1
	Sailfish	9
Panama	Black Marlin	6
	Striped Marlin	1
	Sailfish	37
Colombia	Sailfish	11
Hong Kong	Black Marlin	1
Guam, U.S.A.	Blue Marlin	35
	Black Marlin	1
	Sailfish	5
	Short-Billed Spearfish	2
Fiji	Blue Marlin	13
	Black Marlin	2
	Striped Marlin	1
	Sailfish	11
Tahiti	Blue Marlin	3
	Striped Marlin	1
	Sailfish	1
Australia	Black Marlin	1
INDIAN OCEAN		
Kenya	Sailfish	3
Mauritius	Blue Marlin	1
Seychelles	Sailfish	1
ATLANTIC		
Grand Banks	Broadbill Swordfish	5
TOTAL		750



COOPERATIVE MARINE GAME FISH TAGGING PROGRAM

TAGGING RESULTS FOR 1994

The *Billfish Tagging Report* cards received in 1994 indicate a total of 750 billfish were tagged and released; 34% fewer than in 1993 (1,135). This is the fewest number of releases recorded since 1985 (Table 2). Decreased tagging of blue marlin and striped marlin were noted from Hawaii while increases in tagging were seen for blue marlin and sailfish in Fiji and Guam. The cause of this observed decrease is not known although swings of 30% to 40% in numbers of tag releases is not uncommon between years. We anticipate an increased number of tag releases in 1995. Tagging supplies are available for tagging billfish from the SWFSC office at no cost. Billfish anglers tagged an additional 35 "other fish" (Table 3). The tagging of other fish, however exciting, is not encouraged even though it may provide a reason to release a fish. The results of this ancillary data do not support or further the goals of the *Billfish Tagging Program*.

Table 3. Summary of all fish tagged in 1994.

Blue Marlin	260
Striped Marlin	257
Sailfish	102
Short-billed Spearfish	57
Broadbill Swordfish	51
Black Marlin	23
Albacore Tuna	12
Bigeye Tuna	9
Yellowfin Tuna	4
Skipjack Tuna	1
Bronze Whaler Shark	2
Opah	2
Shortfin Mako Shark	1
Blue Shark	1
Hammerhead Shark	1
Ulua	1
Unidentified	1
TOTAL RELEASES	785

This year we have endeavored to recognize all anglers who reported tagging billfish in 1994 (Table 4). We have also listed the names of charter and private boat captains who have tagged significant numbers of billfish in their region (Table 5). The captains of cooperating commercial fishing vessels are recognized in Table 6. We appreciate the efforts of everyone involved in the *Billfish Tagging Program* and emphasize that although your name may not be included in the lists we nonetheless appreciate your efforts in contributing to the research program.

Table 4. Names of anglers tagging billfish in Southern California, Baja California and Hawaii. Information taken from *Billfish Tagging Report* cards received for the 1994 calendar year releases.

ANGLER NAME	BILLFISH TAGGED						
SOUTHERN CALIFORNIA							
JOHN H. AURE	1	BRAD KARR	2	RON FREITAS	7	D. BRENT NELSON	2
GERONIMO AUSTIN	4	JAMES KEY	1	SEAN FREITAS	7	DAVID NOTTAGE	2
BRYAN BINGHAM	2	SHIPMAN KIM	1	BEN GAGE	1	DOC OBERMEYER	1
VIC BIRNBERG	1	GREG KOVACEVICH	1	CAROL GARNER	1	JOHN M. ODA	1
HENRY BODKIN	1	JOHN J. KOVACEVICH, JR.	1	LARA L. GARNER	1	EDNA T. OISSON	1
DAVID BRANT	1	ANNA KUNZE	1	MICHAEL J. GARRIS	1	THOMAS G. PARKER	1
MICHAEL S. CALLAN	4	BILL LEAKE	2	FREDDY GARTLEY	1	ROBERT PASCAL	1
JAMES CECCONI	1	JASON MARIWETHER	1	MARK T. GEORGANTAS	1	HUGH PATTINSON	3
MIKE COOING	1	ALAN MIZUTANI	1	DANA GIAMMARIA	1	PAT PAULSON	1
LARRY COOTS	1	TOM MOBLEY	1	JERRY GLEASON	1	GENE PERKINS, JR.	2
DOUGLAS A. DANIELS	6	SUE MOBLEY	1	R. D. GODFREY	1	RICHARD PICKLES	1
DAVID M. DENHOLM	1	SHAWN MOORE	1	MILTON GOLDBERG	1	JOHN PICKLES	1
RICK ECKLUND	1	J.S. NASSIMBENE	2	GREG GOODHEART	1	GEORGE POROI	1
STAN ECKLUND	2	KENT NICHOLS	1	TOM GOWIN	1	RAY PRATT	1
BILL FREDERICK	1	BARBARA PEABODY	2	ALVAR GREEN	1	BARBARA PRITCHARD	1
CAMI GARNIER	1	LARRY PEABODY	1	CHARLES A. GRIEGER	1	BARBARA PURMORT	1
GEORGE A. GARRETT	1	JAY RIEBER	2	DORA GROVES	1	NASARIO QUEMADO	1
STANLEY GRAHAM	1	STEVE SEIDNER	1	STEVE GUNDER	1	LARRY QUIGLEY	1
BOB HANDLOSER	1	PAT SNYDER	1	GRAHAM HART	2	JIM RAMSEY	1
TOM HARGRAVES	1	ANDREW STANEVICIUS	1	RAY HAWKES	2	ALAN D. RAPP	1
LINDA HEIL	1	SUNNY STEINER	1	CHARLES W. HELSCEL	2	GEORGE RENNER	2
KATHY HENDERSON	1	JOHN THOMPSON	2	TIM HERZOG	1	FREDDY RICE	1
THOMAS S. HOMRIGHAUSEN	1	MIKE THOMPSON	1	BILL HOEY	6	KAULIKE RICE	1
CHRIS HULL	1	RAY L. UNDERWOOD	1	RICK HOFFMAN	1	OSKIE RICE	1
KIRSTEN JOHNSON	1	EDDY VAN WORMER	1	KEITH J. HOLLINGWORTH	1	D'NESE RICHARDSON	1
PAT JOHNSON	1	FABIAN VON POSERN	1	LANCE HUFFMAN	1	THOMAS RICKETT	2
DANNY LEE JONES	1	DAN VIRNICH	1	DAN HUNSAKER	1	IRV RIDD	1
KARL KOGLER	8	AL WATLET	4	NORM ISAACS	3	KEITH ROBERTSON	2
RICH KOHLER	1	JIM WILFONG	1	DAN ISAACSON	1	BRUCE ROE	2
PUNKY LANGSTON	1	JAMES YOUNG	1	HIROSHI ISOE	1	JIM ROSS	1
BILL LESCHER	1	HAWAII					
RON LOO	1	CHRISTOPHER ABEL	1	MASATAKA IZUMI	1	STERLING ROSS	1
BOB MEFFAN	1	RICK ACEVEDO, JR.	1	GERALD JACK	1	ROGUE ROYDS	1
REED MILLER	2	BEN ADAMS	1	DOUG JOHNSTON	1	KEN RUSSELL	1
MARK MITCHELL	2	DENNIS L. ALBERT	2	JOYCE JORDAN	1	BONNIE RYAN	3
LAN TRAN OKUDA	1	MARY F. ANESON	1	EMMET KANE	1	WANDA L. SAFE	1
JOE OLIVER	1	ROBERT ANTHONY	1	JOHN KENDRICK	1	SANBO S. SAKAGUCHI	1
JIM PERSONS	1	ADAM ATKIN	1	MARLA KENDRICK	1	CHUCK SANFORD	2
SUZANNE PLANT	1	KEITH BARBRIE	1	BOB KENNY	1	BRENT SARRIA	1
BLAIR PROULX	1	ROBERT BARRON	1	STEVE SCHUMACHER	3	STEVE SCHUMACHER	3
MIKE ROSS	1	MARK BARTELL	1	ERIK P. SEBUSCH	1	ERIK P. SEBUSCH	1
DON SCHUMACHER	1	TOD A. BARTELL	1	JOE SEWELL	1	MICKEL SHERRICK	1
BEN SECREST	1	ROBERT W. BEAMAN	1	WEN-LONG SHI	1	WEN-LONG SHI	1
DICK SIEMINSKI	1	TED BIRKLAND	1	DONNA SIEBLER	1	DONNA SIEBLER	1
JIM SIEMINSKI	1	WAYNE BISBEE	1	KEVIN M. SKALING	1	KEVIN M. SKALING	1
GREG STOTESBURY	1	DAVID O. BLAIR	1	DAVID SMALL	1	DAVID SMALL	1
MIKE THOMAS	2	BILL BORKEN	1	TEENA KRAUSE	1	SHARON SMITH	1
BRAD THOMPSON	2	RICK BOURNE	1	RICK KRUPA	2	TERRY SNOW	1
GUY WHITNEY	1	ADDISON BOWMAN	1	RICHARD KUHLMAN	1	PAT SNYDER	1
MARK M. WISCH	1	GAIL BRADFORD	1	MASAHIRO KUNIMI	1	MARK STANLEY	1
BAJA CALIFORNIA							
ARI HIETA AHO	1	DOUG BUEHLER	1	DAVID KURI	1	BOB STERLING	1
GARY ALBERY	1	LARRY BURNS	2	BOB KURZ	3	SUE STOLZMAN	3
BARRY ANDERSON	5	ROBERT T. BURSTALL	1	SALLY L. KURZ	3	CAL STORER	1
DON ANDERSON	9	JOHN CASTNER	1	BOB LARRABEE	1	PAT STRAEDER	1
JOHN ARCHIBALD	1	CRAIG P. CAUGHLAN	4	GORDON LEWANDOWSKI	1	JEFF STRONG	1
D.V.T. BEAR	1	JASON CAUGHLAN	2	DENNY LIUW	1	JAREN STURDY	1
DON BEAR	1	RICK CHAPENOT	1	TISH LOCKER	1	AIKO SUSUKI	1
DOUG BEAR	2	KUANG MING CHEN	1	RICKY LOO	1	JAMES M. SVETICH	5
JAY DE BEAUBIEN	1	ROGER CHRISTMAN	1	BOB LOWE	1	RALPH SVETICH	1
MIKE BENENSON	1	CODY CLAYTON	1	C. MAAS	1	RAY SWIFT	1
DAVID BISHOP	2	WARD COFFMAN	1	WADE MABRY	3	DIANE SWOBODA	1
BRIAN BRAY	2	MIKE COIDIRON	1	HOWARD MACNAIR	1	ARTHUR SYMES	2
PAUL A. BROWER	1	KENNETH R. CORDAY	5	ROBERT MAHR	1	ICHIRO TAKAHASHI	1
BILL BUCKLEY	1	GLEN W. CORNWALL	2	THOMAS D. MARQUEZ	1	KIICHI TAKAHASHI	2
JIM CAVIN	1	REX CROSLAND	1	BARRY MARSH	1	YOSHINORI TAKANO	1
PAT COLUCCI	1	GEZA CSIGE	6	JOHN R. MARSH	1	SHIGESHI TANAKA	1
BILL CROZIER	1	CHRISTOPHE CULINE	1	ROLAND MARTINES	1	JOHN TATUM	1
JOHN DAVIS	1	RENO DANO	1	PETER MAXWELL	1	CHIWAKI TOMOKATA	2
SETH DEWEY	3	JASON DEAN	1	PHIL MAXWELL	1	DEBI TYNER	3
SALLY DOLL	1	JEAN-PHILIPPE DE RAVEL	1	ALTON MCCrackEN	1	RALPH UMANA	1
RAY FERNANDEZ	1	RICHARD M. DEVINE	2	RYAN MCCrackEN	2	ROBERT VAN GAAL	1
JUDY FRANICH	1	BODO DIERKS	1	CHARLES MCGREEVY, JR.	1	MIRSAD VILICH	1
ROCKY FRANICH	1	NEIL DOUGLAS	1	JACKY MCINTOSH	1	CHARLES L. WALIGURA	1
BERNARD A. GUENTNER	1	DOVENBERG	1	KARLA MCKAMEY	1	DAN WARNE	1
BILL M. GUENTNER	2	BOB DUDLEY	1	GORDON MCLEVIN	1	MARK WENIGER	1
BROCK GUENTNER	1	CECIL DUPREE	1	CHRIS MCMILLAN	1	RALEIGH WERKING	1
FRED W. HARMON	1	C. P. EICHORN	1	T. NEAL MCNAMARA	2	TERRY WHERLOCK	2
GORDON HART, JR.	1	VONGUE EMILE, JR.	1	JEFF MEYER	4	TIMOTHY J. WHIP	1
JEFF HASSEN	1	PHIL FESSENDEN	1	ROBERT J. MILTON	1	JOHN F. B. WILKINSON, JR.	2
		CHRISTINE FIENE	1	SMOKEY MOLLE	1	DEBBIE WILLIAMS	3
		CHRIS FISCHER	1	HIDEFUMI MORIBE	1	REED WILLIAMS	1
		KEVIN FISHER	1	BROOKS MORRIS	1	DONALD E. WILLIS	1
		DONALD FREITAS	2	WILLIAM F. MORRIS	2	DENNIS ROY WONG	1
				KEN MORTIMER	1	TAKASHI YAMASHITA	1
				KEVIN NAKAMARU	2	PETER B. YUNICH	1

Table 5. Names of captains tagging substantial numbers of billfish, and the number of billfish tagged and released. From *Billfish Tagging Report* cards received for 1994 calendar year releases.

CAPTAIN NAME	TOTAL
HAWAII, U.S.A.	
Capt. Mark Shultz	22
Capt. Freddy Rice	22
Capt. Ron Freitas	20
Capt. Jim Anderson	16
Capt. Robert McGuckin	16
Capt. Bobby LaRue	15
Capt. Randy Orkisch	14
Capt. Chuck Hauptert	12
Capt. Marlin Parker	12
Capt. Gene Vanderhoek	12
Capt. Tom Siebler	10
Capt. Jerry Allen	8
Capt. John Jordan	8
Capt. Darryl Chow	7
Capt. Steven Kaiser	7
Capt. William Dorr	6
Capt. Richard Keith	6
Capt. John Llanes	6
Capt. Bob Sterling	6
Capt. Mike Holtz	5
Capt. Dick Krupa	5
BAJA CALIFORNIA, MEXICO	
Capt. Martin Collins	9
Capt. Jesus Agundez	4
Capt. Jesus Araiza	4
Capt. Paulino Martinez	4
Capt. Felix Olachea	3
SOUTHERN CALIFORNIA, U.S.A.	
Capt. Jerry Austin	9
Capt. Michelle Kogler	6
Capt. Ken Brookins	4
Capt. LaRay Daniels	4
Capt. Stan Ecklund	3

TAGGING SUPPLIES are available to billfish anglers through this office and the following locations:

Southern California

- San Diego Marlin Club, San Diego, California
- Balboa Angling Club, Newport beach, California
- Catalina Seafood, end of Avalon Pier, Catalina Island

Hawaii

- Pacific Ocean Research Foundation (PORF), Kailua-Kona
- SWFSC, Honolulu Laboratory

Baja California, Mexico

- Rancho Buena Vista, East Cape
- Rancho Leonero, East Cape

Table 6. We wish to thank the captains of commercial fishing vessels tagging billfish in 1994.

Jim Anderson	Swordfish	5
	Striped Marlin	11
Murray Cudworth	Swordfish	1
	Striped Marlin	6
	Blue Marlin	2
Tony Geisman	Swordfish	1
John Gibbs	Swordfish	8
	Mako Shark	1
Gerald Guidry	Blue Marlin	2
Joe Hamil	Swordfish	5
David Haworth	Swordfish	3
Randy Hisler	Swordfish	2
Bobby LaRue	Swordfish	15
Robert Vacchetta	Swordfish	4
TOTALS	Swordfish	44
	Striped Marlin	17
	Blue Marlin	4
	Mako Shark	1

TAG RECOVERIES - 1994

Thirteen billfish tags were returned in 1994. Four were from blue marlin, seven from striped marlin, one swordfish and one shortfin mako shark (Table 7). Of the four blue marlin, only two had been reported tagged and released. Both of those were tagged near Kailua-Kona and moved west over a period of 292 and 317 days (Figure 2). Of the blue marlin not reported released, one was recovered northwest of Kauai and the other in the south Pacific near Tahiti. It is important to mail in the *Billfish Tagging Report* card as soon after a fish is tagged as possible. Tagging serves little purpose without full release and recapture information.

Seven striped marlin were recovered during the year. Three of these were tagged and recovered in the waters off Hawaii. These varied in time of release from 18 to 327 days. Three other striped marlin were released along the coast of Baja California, Sur and had been recovered nearby in 8, 29 and 75 days. The striped marlin at liberty for eight days (Table 7) had been in our recovery data base since November 1988. We received the *Billfish Tagging Report* with the release information in March 1994 (a little late but greatly appreciated none-the-less). One striped marlin tagged at Santa Catalina Island, CA moved 580 miles (933 km) south to Thetis Bank, Mexico in 149 days (Figure 3).

Table 7. Billfish and tuna release and recapture information.

SPECIES	TAGGER CAPTAIN	RELEASE DATE	RELEASE LOCATION	RECOVERY DATE	RECOVERY LOCATION	DAYS FREE	MILES/ DIRECTION TRAVELED
Blue Marlin	Brian Banovich Rick Rose	08/03/92	19°30' N 156°00' W Kailua Bay, HI	05/22/93	19°35' N 158°02' W W. of Kailua-Kona, HI	292	130 - W
Blue Marlin	No release card for tag # A20380	-	-	09/11/93	31°41' N 164°35' W NW of Kauai, HI	-	-
Blue Marlin	No release card for tag # A20760	-	-	07/07/94	16°52' S 149°00' W Tahiti	-	-
Blue Marlin	Louise Sterling Bob Sterling	09/24/93	19°30' N 156°00' W Kailua-Kona, HI	08/07/94	19°34' N 160°17' W W. of HI	317	257 - W
Striped Marlin	- Jim Anderwon	12/04/92	21°10' N 157°15' W Molokai, HI	10/27/93	24°46' N 153°45' W N. of HI	327	301 - NNE
Striped Marlin	- Mark Shultz	01/09/94	20°42' N 156°58' W Lanai, HI	01/27/94	19°38' N 156°08' W Kailua-Kona, HI	18	81 - SSE
Striped Marlin	Joe Atterberry Rob Purdy	02/01/93	19°30' N 156°00' W Kailua-Kona, HI	02/27/93	15°31' N 158°44' W S. of HI	27	294 - SSW
Striped Marlin	Mark M. Wisch Jeff Jones	09/12/93	33°19' N 118°22' W Santa Catalina Is., CA	02/08/94	25°14' N 113°04' W Thetis Bank, MX	149	580 - SSE
Striped Marlin	Dennis Gagnon Jerry Lewis	11/07/93	24°55' N 112°36' W Thetis Bank, MX	01/21/94	22°58' N 109°41' W East Cape, Baja	75	219 - ESE
Striped Marlin	Bill Holmes John Nulton	11 07/88	24°27' N 112°15' W Santa Margarita Is., MX	11/15/88	23°11' N 111°19' W SE. of Lucitania Bank, MX	8	94 - SSE
Striped Marlin	James Key John Grabowski	10/18/94	24°55' N 112°36' W Thetis Bank, MX	11/16/94	25°35' N 113°27' W Uncle Sam Bank, MX	29	65 - NW
Swordfish	- Dave Ghiglotty	05/01/93	28°20' N 149°08' W NW of HI	01/01/95	32°03' N 118°29' W San Clemente Is., CA	610	1,852 - ENE
Shortfin Mako Shark	- Jason Blower	07/30/88	33°37' N 117°56' W San Pedro, CA	09/01/93	32°26' W 117°35' W SW of San Diego, CA	1,859	74 - SSE

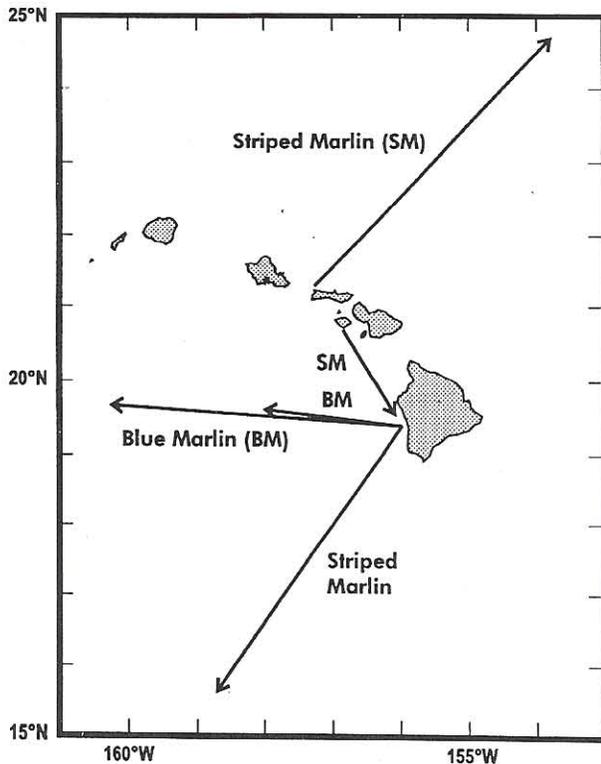


Figure 2. Movements of blue and striped marlin tagged and recaptured in the waters surrounding Hawaii.

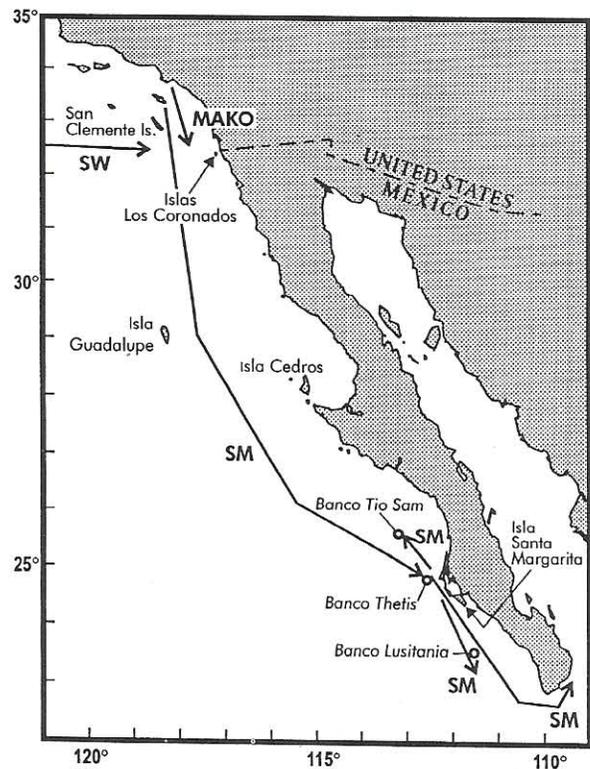


Figure 3. Movements of fish tagged and recovered along the west coast of California and Baja, California.

The longest movement reported this year was from a swordfish tagged northwest of Hawaii which moved east-north-east 1,859 miles (2,990 km) to just south of San Clemente Island, California in 610 days (1.67 years). The fish reported at liberty for the longest period was a shortfin mako shark tagged at the "Rigs" near San Pedro, California in 1988 and recovered south-west of San Diego, CA 1,859 days (5.1 years) later. This shark had gained nearly 100 pounds.

RESULTS OF RECENT INVESTIGATIONS

STRIPED MARLIN MOVEMENTS

Striped marlin (*Tetrapturus audax*) are widely distributed in the Pacific and Indian Oceans. Like many large pelagic predators, they make extensive movements although they are not considered as highly migratory as some tunas which make regular and rapid trans-oceanic migrations. Studies recently completed by SWFSC biologists indicate some interesting facts influencing the movements of striped marlin in the Pacific.

Horizontal and vertical movements of striped marlin were monitored with ultrasonic depth-sensitive transmitters in southern California, along the Kona coast of Hawaii and off the tip of Baja California, Sur, Mexico. Horizontal positioning and water temperature depth profiles were routinely taken in all three areas. In Hawaii, additional data on speed and direction of oceanic currents were obtained directly using an acoustic Doppler current profiling system. Comparison of striped marlin movements and their depth distributions in vastly different areas revealed some valuable information concerning specific habitat preference.

In the spring and summer when striped marlin are present in southern California, surface water temperatures average about 18°C to 20°C. The depth of this mixed surface layer tends to average between about 15m to 20m, below which temperatures drop considerably. Here striped marlin spend about 85% of their time in the surface mixed layer (ML). Occasionally they will penetrate into cooler waters of 14°C at depths of 40m to 50m. Striped marlin tracked off La Paz and Cabo San Lucas, Mexico exhibited similar patterns. They spent nearly 100% of the time in the mixed layer (30°C) and only occasionally descended below the bottom of the mixed layer into the thermocline near a depth of 50m. In contrast the surface waters off the Kona coast averaged 25°C to 27°C and the mixed layer extended to 90 m. Here striped marlin tracked spent 80% of their time in the mixed layer above 90m and

never ventured in water colder than 18°C. The maximum recorded depth for these striped marlin was 170m.

Analysis of this data reveals that, within a wide range, striped marlin do not have an absolute temperature preference. In all three areas they spent the vast majority of their time either in the mixed layer or in water no colder than 2°C below that of the mixed layer. The fish did not descend to a depth where the temperature was 8°C lower than that of the mixed layer. When temperature is expressed relative to the mixed layer the depth distributions of striped marlin are similar (Figure 4). The maximum depth for striped marlin appears to be limited by temperatures of 8°C colder than the surface layer. The change in water temperature, not the absolute temperature or its depth in the water column, is what limits the vertical movements of striped marlin.

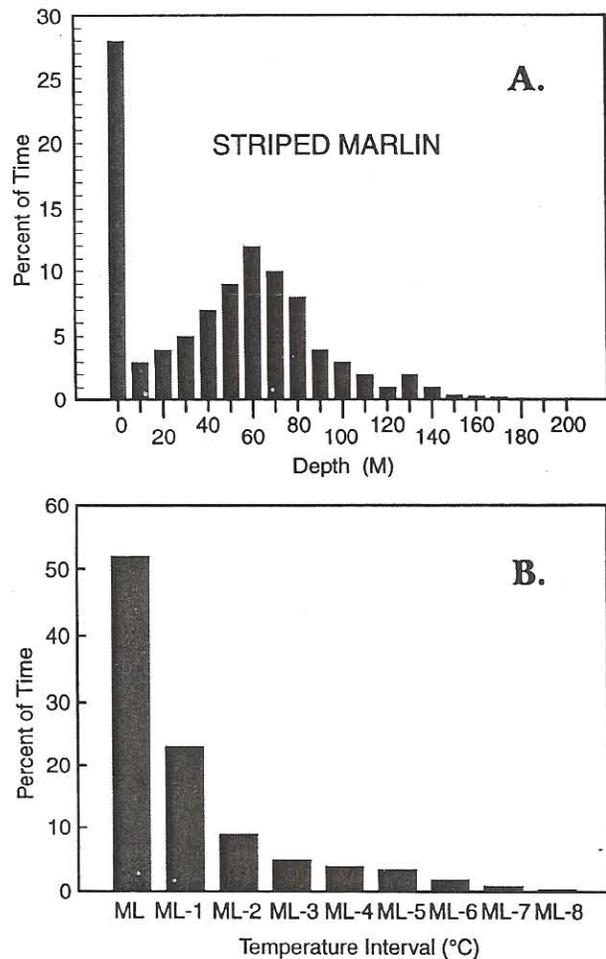


Figure 4. Percent of time striped marlin tracked near Kona spent at each 10 meter depth interval (A), and percent of time spent in the mixed layer (ML) and at each 1°C interval below the mixed layer temperature (B).

The horizontal displacements of striped marlin off southern California, Baja and near Hawaii are also similar. Most fish moved in relatively straight lines or slowly curving arcs. Several striped marlin tracked for up to 48 hours moved predominately in one direction at an average ground speed of 1.18 knots. Movements were not unanimous however. Some fish remained in the vicinity where they had been initially captured and released. The movements of one striped marlin tracked off Kailua-Kona was apparently strongly influenced by the current during much the time (Figure 5). Its speed over ground was strongly influenced by current velocity. When moving nearly par-

allel with the current, its ground speed was about 2.1 knots. During the last 5 hours of the track it was moving against the current and its ground speed was considerably slower (0.7 knots). It is possible that striped marlin can use (or avoid) water currents in their horizontal movements.

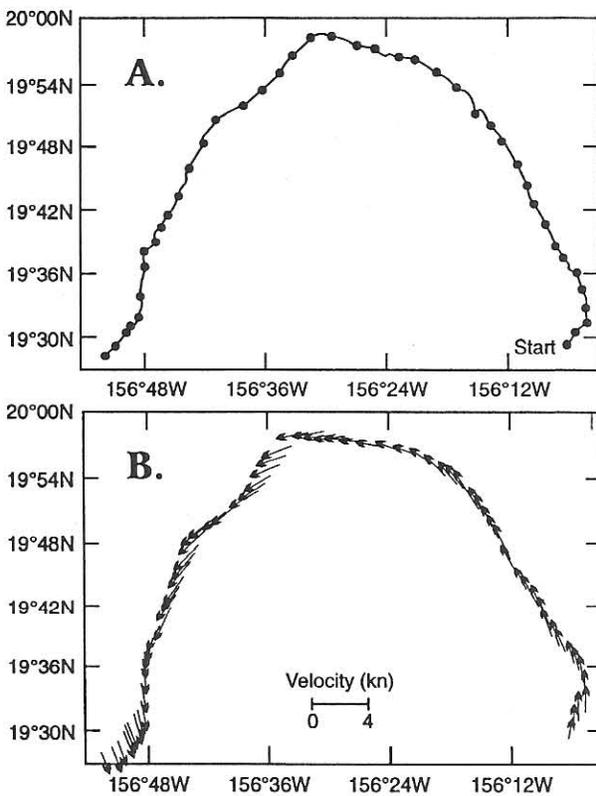


Figure 5. Horizontal movements of one striped marlin (A) and simultaneously collected water current velocity data (B).

Recapture and Tag Return Rewards

The *Tagging Program's* reward hats have been redesigned and improved. The new tag reward hats are grey corduroy with an emblem of a marlin leaping from the water embroidered on the front. The emblem was fashioned from the cover photo on the 1994 *Billfish Newsletter* (Figure 6). These baseball hats are given to anglers who recapture a tagged billfish and to the angler that tagged the billfish.

TAGGING PRIORITIES

Our current tagging emphasis, by location is:

Southern California	Striped Marlin
	Broadbill Swordfish
Hawaii	Blue Marlin
	Striped Marlin
	Black Marlin
	Broadbill Swordfish
Mexico	Blue Marlin
	Black Marlin
Central America	All billfish
Indo-Pacific	All billfish
Indian Ocean	All billfish

TAG PERFORMANCE STUDIES

Scientists at the Southeast Fisheries Science Center (SEFSC) in Miami, along with several other private agencies, are currently conducting research into the performance of the tags developed jointly by The Billfish Foundation and the NMFS in 1990. Dr. Eric Prince and Mr. Chris Jones, of the SEFSC report that the RF-tag design is a miniaturization of the tag primarily used on highly migratory species. The RF-tag, which is designed as a intermuscular form of attachment using medical grade



Figure 6. New design of billfish reward cap.

nylon, was developed in response to the need for a more biologically compatible tag for inshore and reef species. Biological compatibility implies that the tag has a higher retention rate, causing lower release mortality, is more compatible for tissue healing around the tag anchor, and minimizes adverse effects on growth and behavior.

In one project underway scientists are examining the performance of the RF-tags on two important recreational and commercial species, red drum and red snapper. Several hundred fish are being held under controlled conditions at the University of Miami experimental fish hatchery and the New Orleans Aquarium of the Americas. Two tag types, the NMFS RF and a single barbed dart (the most popular tag now used on inshore species) are being evaluated for tag performance by examining mortality, shedding rates, tag anchor holding power, growth, condition, and tissue response. One objective is to determine

which tag design provides the best overall quality of data used in estimating vital parameters. This is determined by examining and comparing the quantitative performance indicators affected by the presence of different tag designs. Several designs are being examined. Another objective is to systematically track the development of tissue attachment to the tag heads, and determine the required time for a tag to be set firmly and permanently into the muscle tissue. This project was initiated in April 1994 and is scheduled to be completed in mid 1995.

The results of this tag performance project will greatly improve our knowledge of tag retention, tissue adherence, and biological compatibility of dart-type streamer tags. This in turn will lead to better use of tag-recapture data in fishery management models, more intelligent stock assessments, and better management of our natural resources.

HOW TO TAG YOUR BILLFISH

First, have your tag loosely affixed to the applicator tip with a rubber band before you catch your fish.

When the fish is brought alongside your boat, allow the fish time to calm down so you can better control it for accurate tag insertion.

The tag is inserted in the dorsal back muscle just below and behind the tallest part of the dorsal fin (pictured below). The tag should be inserted a full two inches into the muscle and at an angle matching the flow of water over the fish's back. Take care to avoid the head and gill areas.

The fish should be tagged without excessive handling or removing it from the water. If the hook cannot be easily removed, the fish can be released by cutting the leader as close to the hook as possible.

A fish that is over-exerted can often be revived by slowly pulling it through the water until it begins to swim on its own. A fish that has thrown its stomach can still be released. Several returns have been received when the *Billfish Tagging Report* card indicated "stomach thrown".

It is equally important to complete and promptly return the *Billfish Tagging Report* cards.

