

East Africa billfish Conservation and Research: Marlin, Sailfish and Swordfish Mark-Recapture field studies

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Abstract

Over the last fifteen years, the African Billfish Foundation in collaboration with the sport fishing fraternity has run a billfish tagging and recoveries programme in the East African waters. To date, over 45,000 fish have been tagged and up to 1,700 tags have been recovered. This paper explores the trends and changes in the number of different billfish species tagged over the years and the number of billfish recaptured, together with the overall recapture rates for each species. The trends over years show that the sailfish have been tagged in the largest numbers whilst the swordfish are the least of all the species tagged. In regards to the recaptured billfish, the patterns depicted by tagged billfish that have been caught as far as the Arabian Gulf, the West Coast of Australia, South Africa, Reunion, Chagos and many more are also included. This paper also gives an overview of the factors determining the percentage of recapture rates and the tagging efforts. Highlights to the challenges faced in the conservation and management of billfish species in the East African waters have also been discussed in-depth. As a conclusion, the paper also presents the different ways to address the threats facing the billfish species in the Indian Ocean.

Introduction

Much of the interest in billfishes along the East Africa coastline stems from their popularity among marine recreational fishermen. Compared to other countries in the region, Kenya has a long history of excellent marlin and sailfish angling, dating back to the 1950's (Stroud, 1990). Billfishes play a critical role as apex predators in the ocean's complex and far-reaching food webs (Prince, 1998). Throughout the developed world, the importance of billfish resources to local and national economies is well established. Recreational billfishing activities provide economic support for a wide range of activities--- for example; the International Game Fish Association (IGFA) estimated that expenditures by U.S. recreational billfish anglers exceed \$2.13 billion annually (ASA, 2001). However, little information is known regarding the resource status of billfish within the Indian Ocean and this has continued to trigger interests from a wide range of fishery constituents to become increasingly concerned over the billfish populations in this region. It is this paucity of information and the dire need to understand the mystery behind the ecology and biology of these incredible species that resulted to the formation of the African Billfish Foundation which was initiated in 1990 with an aim of gathering information on growth rates, movement patterns and distribution of these large predatory fish throughout the East African waters. Present tagging efforts target the following species: Blue marlin (*Makaira mazara*); striped marlin (*Tetrapturus audax*); sailfish (*Istiophorus Platypterus*); black marlin (*Makaira indica*) and swordfish (*Xiphias gladius*). Sailfish are the most abundant in this region which concurs with earlier analysis on billfishes in the Western Indian Ocean Region by Williams (1959, 1970) and Merrett (1971) who recorded that most billfishes off the Kenya waters are predominated by the sailfish which account for the largest percentage of the total catch by number. This also agrees with other reports by Nakamura, 1932, 1940, and Ueyanagi, 1959.

The purpose of this paper is to primarily summarize the available data on billfish relating to marking of billfish using conventional tags both locally and in regional areas. Data on recapture of the marked billfishes is also included and has been used to make inferences on the movements of billfishes although it should be noted that the points of recaptures are entirely dependent the place and time of the fishing activities and the numbers of recaptured fish only represents a small proportion of the entire stock. We also present notes on the major issue affecting the conservation and management of these incredible species. Information on the foundation's activities geared towards addressing these issues have been summarized with examples drawn from different regions within the West Indian Ocean region. Finally, we have also briefly discussed four solutions than can be employed in addressing the challenges in the management of the billfish fishery.

The overall aim of this presentation is to provide the Working Party on Billfish with background information on the available billfish data obtained in the mark and recapture studies, the challenges encountered including the identification of the major gaps in knowledge and data in order to consider areas for research, develop management strategies and promote the sustainable use of billfish resources

Materials and methods

Tagging involves use of conventional plastic dart tags with specific numbers. These are inserted anteriorly beside the dorsal fin using an applicator stick when the fish is brought alongside the boat. After tagging a fish, the angler then fills out a tag card with the following requested details: Species, date, location, estimated length and weight, condition, bait type, and the angler's and captain's names and addresses. The completed cards are then returned to the African Billfish Foundation for storage of the information. Subsequently, the same basic information is requested of any fisherman returning a recovered tag.

Results and Discussion

Table 1 presents the breakdown in the numbers of all billfish species tagged since the programme began. The numbers tend to reflect the abundance of the species although there are considerable fluctuations over the duration of the programme. The fluctuations are dependent on the nature of the fishing and also the tagging effort prevailing in a given season.

Table 1: Number of species marked per season

Tag Season	Black Marlin	Blue Marlin	Broadbill	Sailfish	Striped Marlin
90/91	0	0	0	16	0
91/92	18	0	0	1357	73
92/93	28	9	33	863	128
93/94	25	8	30	660	76
94/95	10	3	15	1781	103
95/96	29	44	17	1273	285
96/97	23	5	33	2189	416
97/98	25	9	110	1028	63
98/99	41	69	82	1024	409
99/00	36	27	120	2009	228
00/01	53	3	36	1680	131
01/02	26	9	40	912	199
02/03	32	2	16	974	63
03/04	63	0	44	1287	166
04/05	44	8	111	2047	126
05/06	118	123	40	2440	130
06/07	265	34	42	2104	235
07/08	125	29	92	3618	148
08/09	103	51	33	2590	273
09/10	174	107	81	3450	829

Sailfish represent 82.93% of the total marked billfish (Fig 1), followed by striped marlin (10.23%). Of the other species, broadbill swordfish constitutes 2.63%, followed by black marlin (2.6%) and blue marlin (1.53%).

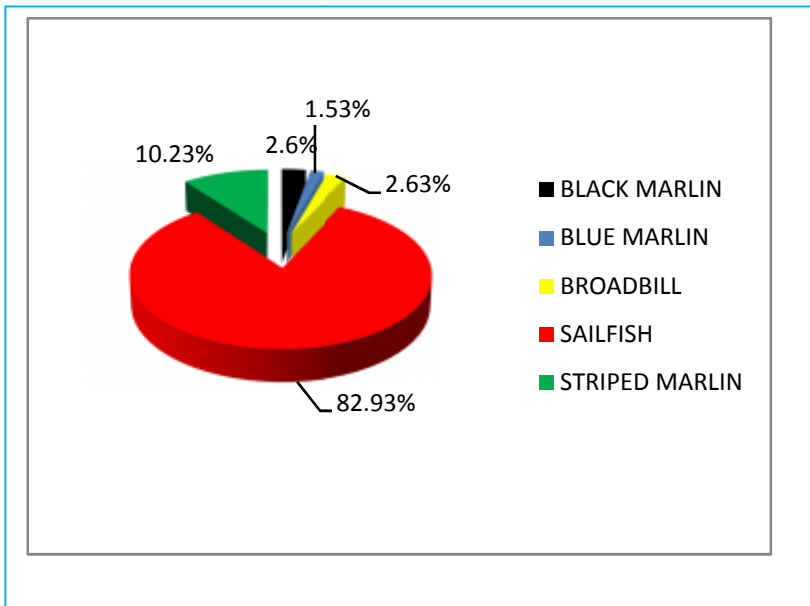


Fig 1: Proportion of species marked/tagged between the year 1990 and 2010

Numbers of billfish species tagged/marked each season have fluctuated considerably through time indicating the availability of billfish during these years.

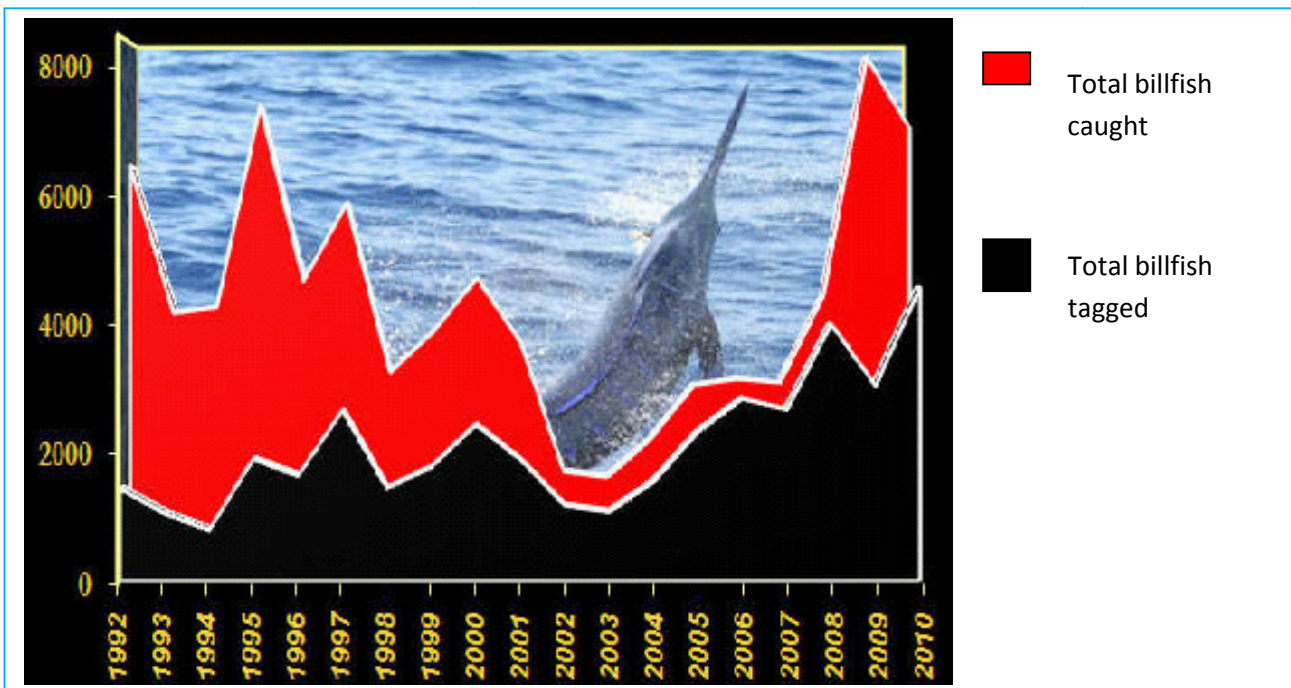


Figure 2: Graph showing relationship between the numbers of billfish caught and those tagged

Figure 2 represents the relationship between the total of all billfish reported caught in Kenya (tagged, released or killed) versus the total of billfish tagged. The graph summarizes how successful the A.B.F. has been in educating the fishing concerns the importance of conserving this incredible fishery. Back in the early nineties around 20% of all billfish caught were being tagged compared to 2008 when nearly ninety percent of all billfish were tagged. Unfortunately with funds for free tags to charter boats running out in the 2008 to 2009 season the percentage fell back to less than 60% tagged setting tagging back by years, while the numbers of billfish being killed by sport fishing boats increased dramatically to an all time high of over 1500 billfish reported in the 2009-10 season.

Recaptures

The vast majority of over 1500 reported re-captures are within Kenyan waters; times out range from eight years to the same day. Nearly all recoveries are confined to the Somali basin and its surrounding

Long range recoveries had been restricted to broadbill and marlin until 2006 when a sailfish that had travelled 3923 miles was recaptured by a commercial trawler on the Atlantic Indian Ridge; another sailfish was caught in the same year off Cape Town by a Japanese long liner. Some of the most exciting international recoveries are presented in the figures below. These include among others a striped marlin tagged off Kenya coast and re-caught off Perth, Australia having travelled 5250 miles in just 195 days. Similarly, a broadbill tagged in the Kenyan waters was re-caught on the Mid Indian Ridge after traveling about 3600 miles.



Figure 3: Recoveries in the North West Indian Ocean

Note: The numbers indicate the regions where the fish was re-caught.

1. Blue Marlin that was tagged in Pemba – Tanzania and Re-captured in Oman on a commercial Trawler having traveled a Distance of approx. 2620 miles. Time Out: 249 days, Estimated Weight: 64Kgs, Recapture Weight: 68Kgs.
2. Black Marlin that was tagged in Kenya and Re-capture in Yemen on a commercial trawler having traveled a distance of approx. 1880 miles. Time Out: 159 days, Estimated Weight and Recapture Weight: Unknown
3. Striped Marlin that was tagged in Kenya and Re-captured in Carlsberg Ridge on a commercial trawler having traveled a distance of approx. 960 miles. Time Out: 39 days. Estimated Weight: 45 Kgs, Recapture Weight: 60 Kgs.
4. Broadbill Swordfish that was tagged in Kenya and Re-capture in Somalia Recapture in nets having traveled a distance of approx: 250 miles. Time Out: 165 days Estimated Weight: 35 Kgs. Recapture Weight: Unknown
5. Sailfish that was tagged in Kenya and Re-captured in the Chagos Archipelago on purse seiner having traveled a distance Traveled of approx. 2000 miles. Time Out: 66 days. Estimated Weight: 23 Kgs. Recapture Weight: Unknown



Figure 4:
Recoveries in the
South West Indian
Ocean

Note: The numbers indicate the regions where the fish was re-caught.

8. Broadbill Swordfish that was tagged in Kenya and Re-capture in Madagascar on a commercial trawler having traveled a distance of approx: 1200 miles. Time Out: 2years, 31 days. Estimated Weight: 20 Kgs. Recapture Weight: Unknown
9. Broadbill Swordfish that was tagged in Kenya and Re-capture in Reunion on a commercial trawler having traveled a distance of approx: 1500 miles. Time Out: 1 years, 250 days. Estimated Weight: 22 Kgs. Recapture Weight: 30 Kgs

The recapture of a sailfish (**Figure 5**) midway between the tip of South Africa and Antarctica (indicated by number 12) suggest that billfish migration from the Indian Ocean to the Atlantic may be a possibility. This idea was further strengthened with another reported recapture of a

second sailfish over that same time on a Japanese long liner off Cape Town, South Africa (indicated by number 11). However these record setting recaptures are only a small proportion and more data are needed to verify this trend.



Figure 5: Recoveries in the South West Indian Ocean

Note: The numbers indicate the regions where the fish was re-caught.

10. Broadbill Swordfish that was tagged in Kenya and Re-captured at Port Elizabeth – South Africa on commercial trawler having traveled a distance of approx: 2400 miles. Time Out: 1years, 6 days. Estimated Weight: 50 Kgs. Recapture Weight: Unknown

11. Sailfish that was tagged in Kenya and Re-captured in Cape Town – South Africa on a Japanese long liner. Time Out: 2 years. Estimated Weight: 30 Kgs. Recapture Weight: unknown

12. Sailfish that was tagged in Kenya and Re-capture in the Atlantic Indian Ridge on a commercial trawler having traveled a distance of approx: 3300 miles. Time Out: 1.5 years. Estimated Weight: 24 Kgs. Recapture Weight: Unknown

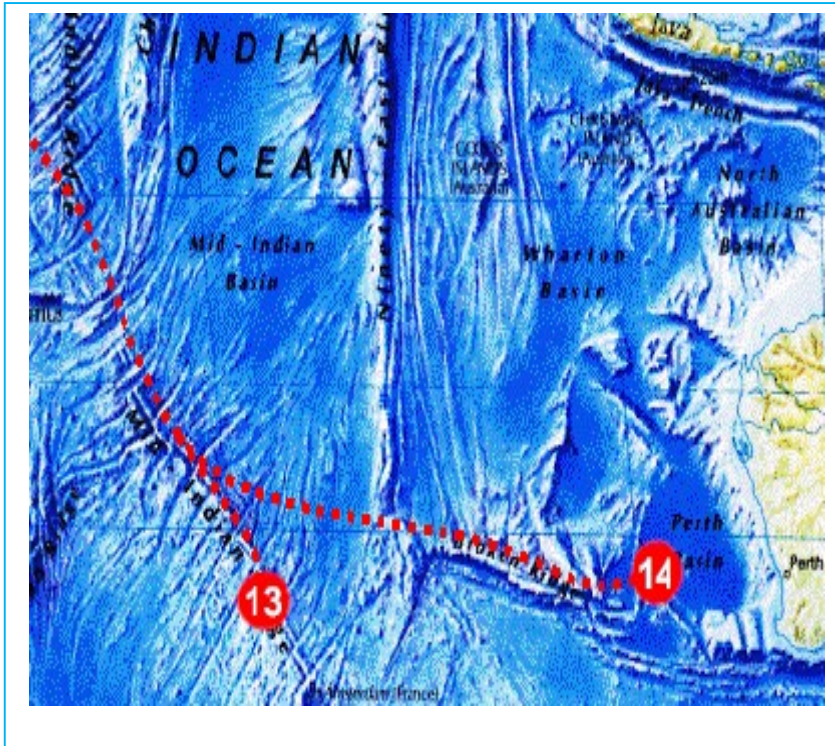


Figure 6: Recoveries in the South East Indian Ocean

Note: The numbers indicate the regions where the fish was re-caught.

13. Broadbill swordfish that was tagged in Kenya and Re-captured in the South Indian Ridge on a commercial trawler having traveled a distance of approx: 3600 miles Time Out: 360 days Estimated Weight: 30 Kgs. Recapture Weight: unknown

14. Striped marlin that was tagged in Kenya and Re-captured in Perth, Australia on a commercial trawler having traveled a distance of approx: 5250 miles. Time Out: 195 days. Estimated Weight: 48 Kgs. Recapture Weight: 40 Kgs.

Recapture rates

The recapture rates for the programme represent the proportion of the fish tagged which are subsequently recaptured or reported as a recapture. The total number of fish recaptured represents an overall reported recapture rate of 2.0% of all for all the billfish tagged. Recapture rates per species include 1.9% for sailfish, 0.03% for both swordfish and black marlin, 0.06% for striped marlin and 0.02% for blue marlin. At present, the recapture rates are hindered by the under-reporting, discarding and non-reporting of billfish catches by species.

Threats

With rising concerns for the depleted stocks of Broadbill swordfish, there is a possibility that the remaining species could also fall on the list of endangered species if precautionary measures are not undertaken. Generally, all the world fishery resources are at a risk of overfishing and one would argue that billfish are not an exception in this case as they are caught as by-catch in various fishing gears which include longline and gillnet fishing among others.



Plate 1: A pick-up full of dead billfish at a fish market

At this stage, it is challenging to point out specific threats affecting billfish species as more studies need to be done to understand the nature of these species as well as their current status in the Indian Ocean.

Current challenges

There is no doubt that the challenges facing billfish conservation and management are extensive. This section outlines the main challenges to the conservation and management of billfish species in the East African waters.

- ❖ Billfish roam large expanses of the ocean and their nature makes them difficult to study, making it difficult to collect adequate data that can be used draw inferences about their status, ecology and biology.
- ❖ Scant recognition for the need to preserve billfish as a top level predators
- ❖ Inadequate support from the local communities and back-up from industries that are directly or indirectly related to the billfish fishery.
- ❖ Inadequate support from governments and partner agencies- This is required to implementing fishery management measures needed to protect billfishes.
- ❖ Lack of funding and other important resources

Promising solutions

The African Billfish Foundation recognizes the much needed efforts to seriously address the challenges and threats affecting the billfish resources in the Western Indian Ocean. Training, Enhanced research, Education and Awareness and Regional cooperation are presented as ways of tackling these issues.

More training is required on tagging in order to obtain data and results that can guide management decisions for reducing billfish by-catch and also enhance the development of fishing technologies, practices and gears that will minimize by-catch and mitigate post-release mortality in both the recreational and commercial fisheries. A multi-stakeholders' approach on collaborative research is required to obtain adequate data that will be vital in understanding the status of the fisheries as well as their biology and ecology. This would be greatly improved by the collection of more information on movements of billfishes. The collection of data should not only be through conventional tagging studies but also via archival tags to allow the collection of information of vertical movements. Further, extensive tagging of billfishes would also allow the estimation of mortality rates.

In the case of obtaining information for a recaptured fish, education and awareness is required at both local and regional level for both artisanal and large scale fisheries. This calls for regional cooperation as billfish species swim beyond the limits of a national jurisdiction.

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