A large, long-billed fish, likely a Caribbean billfish, is shown swimming in the water. The fish is the central focus of the image, with its long, pointed snout extending to the left. The water around it is slightly rippled, and the overall scene is in grayscale.

Data and statistics from Recreational and Artisanal fisheries

Roy Bealey

Western Central Atlantic Fisheries Commission (WECAFC)

Caribbean Billfish Project

RECREATIONAL FISHING

- ▶ An estimated 220 million recreational anglers globally, and growing
- ▶ Total global expenditure conservatively estimated at over \$190 billion per year
- ▶ USA = \$60 - 82 billion
- ▶ Recreational fishers continue to promote catch and release while minimizing post release mortality, especially for billfish
- ▶ Eco-tourism through recreational fisheries can be a hugely valuable and more sustainable fishery option, but only when in a suitable context

Do recreational fishers care about data?

- ▶ They tend to have a great appreciation of nature and want to protect resources. Genuinely concerned about any unsustainable trends
- ▶ Many are competitive whether they fish tournaments or compete against each-other. They are looking for the edge against competitors and data can help
- ▶ Many already maintain their own records and logbooks (especially charter captains). We need to standardize formats and digitize these efforts to feed management decisions.
- ▶ Private records can be very detailed and have a long history

Interests include: water temperature, water clarity, weather conditions, tide phase, lunar phase, sea condition, Chlorophyll A, thermocline depth, bait species abundances, barometric pressure

A very diverse sector



Target pelagic charter captains

- ▶ They target tunas and billfish with relatively standardized gears and techniques
- ▶ Typically trolling lures and not changing gears to target other species
- ▶ Fish more consistently and professionally than other recreational fishers
- ▶ Typically consolidated in marinas, rather than broadly dispersed
- ▶ Their fishing around moored FADs may assist in the development of catchability coefficient correction factors
- ▶ Most aware of tRFMOS and are keen to contribute to sustainable management, their industry depends upon it

How do we collect the data then?

- ▶ If forced it won't work as commercial penalties are more tangible
- ▶ Focus on a section of the fishery that you can realistically work with and build interest in data & statistics
- ▶ Decide how to target the audience (sport fishing hubs, digital self input OR both?)
- ▶ Make data secure from others to build trust over time
- ▶ Clear and simple data use policies are vital
- ▶ Incentivize data provision with feedback rather than using data to impose controls or taxes
- ▶ Advertise the use of data to inform research and the sustainable management

Convenience is key!

What causes bias in recreational fisheries data?

1. Inconsistent fisher numbers, techniques, locations, target species, skill levels, fishing frequencies
2. Seasonal influences on accessibility to species according to weather, migrations etc.
3. Size estimates can be biased... typically upwards (tunas generally weighed though)
4. Inconvenient data capture and poor feedback will cause underreporting
5. FADs influence on pelagic species catchability

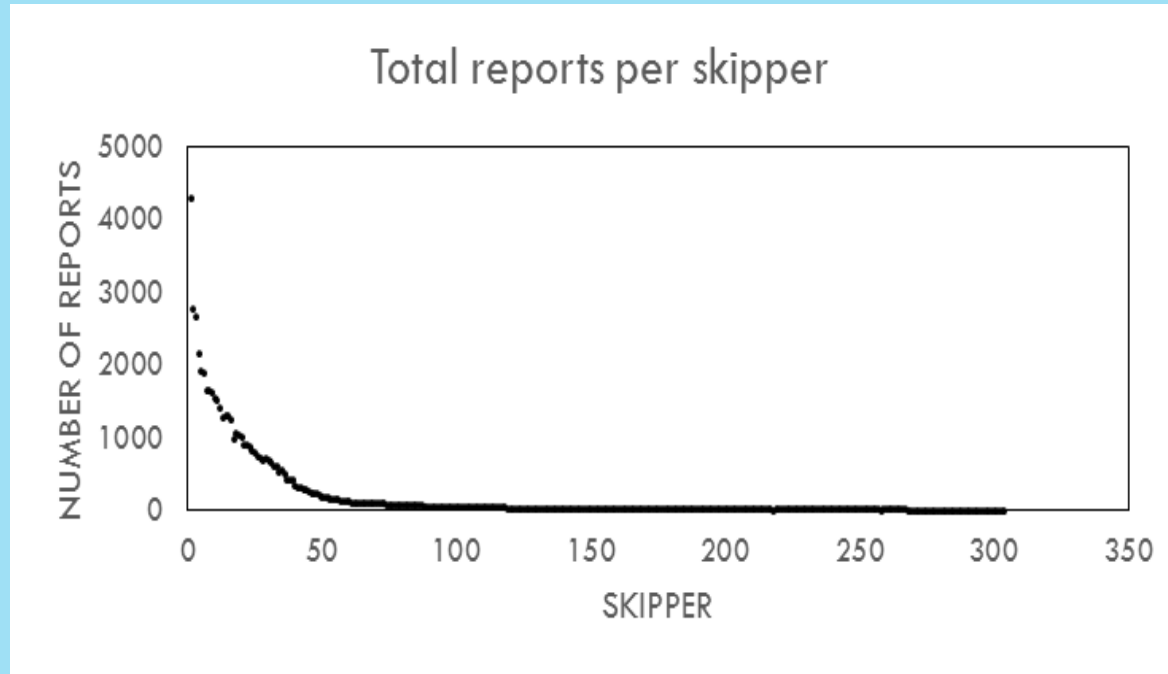


1. Inconsistent fisher numbers, techniques, locations, target species, skill levels, fishing frequencies

- ▶ Focus on pelagic charter captains



Not all skippers are equal



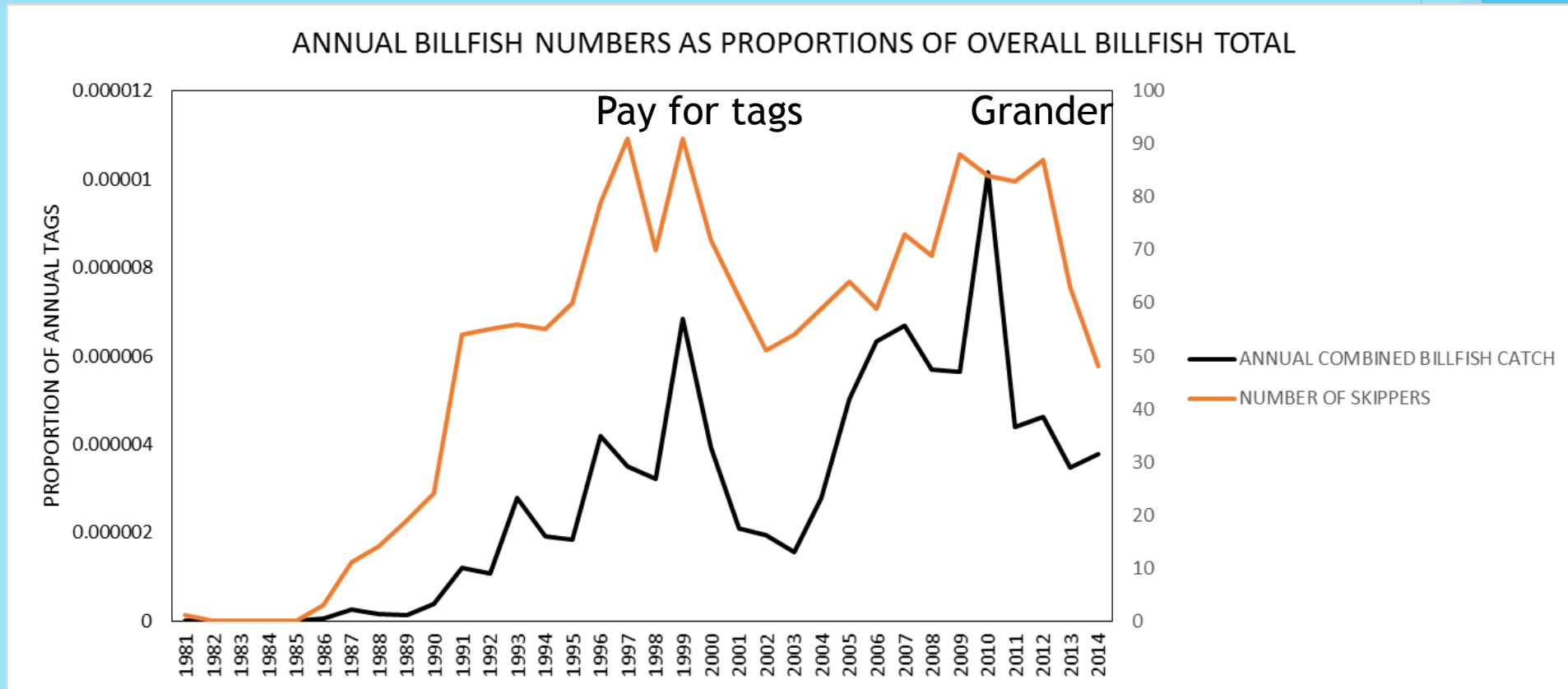
- ▶ Work with the ones that want to work with you, the trend will spread later
- ▶ Benefit from consolidation in marinas and utilize sport fishing associations (they would proudly advertise data assistance to tRFMOs management decisions)
- ▶ Leverage peer pressure while working with these groups (a very powerful tool)
- ▶ Maximize convenience everywhere you can!

2. Seasonal influences on accessibility to species according to weather, migrations etc.

- ▶ Don't stretch the data by being too specific - look for robust general trends (CPUE, while tracking moored FAD influence on catches)
- ▶ Statisticians must be aware of seasonal influences before making inferences from data. The fishers will gladly tell you the details
- ▶ Knowledge of fishing zones relative species abundances can also help inform what species are primary targets. Targeting black VS blue marlin in Kenya fleet. Potential weighting factors later)
- ▶ Compare alongside commercial fishery data and query or justify inferences

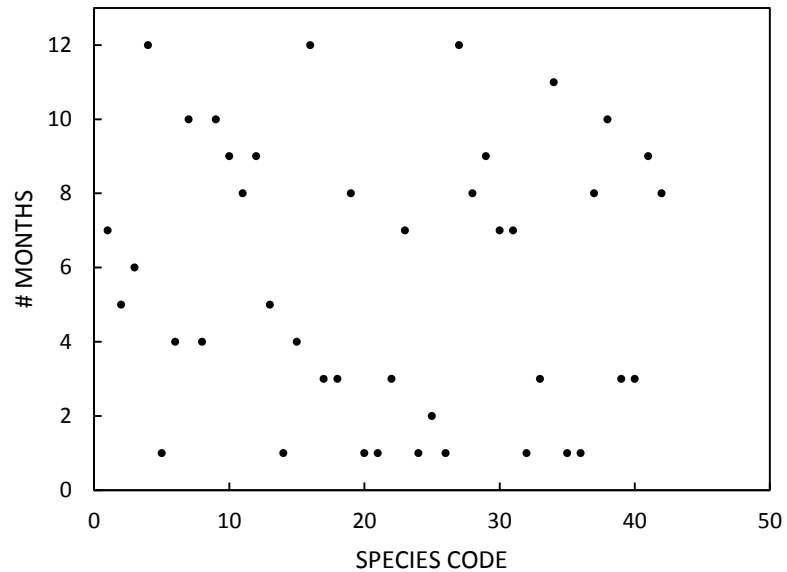


Monitor how many fishers are reporting, who's reporting and how many days fished are reported

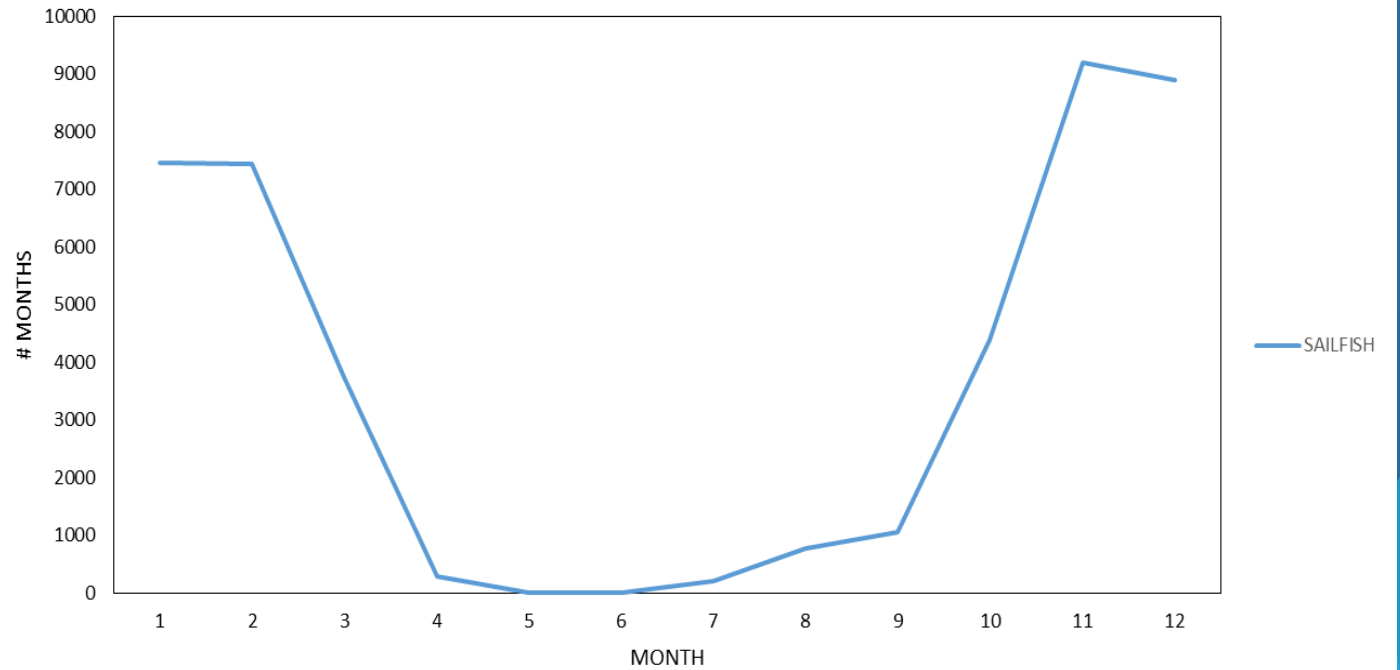


Seasonal influences - recreational

MONTHS EACH SPECIES HAS BEEN CAUGHT IN

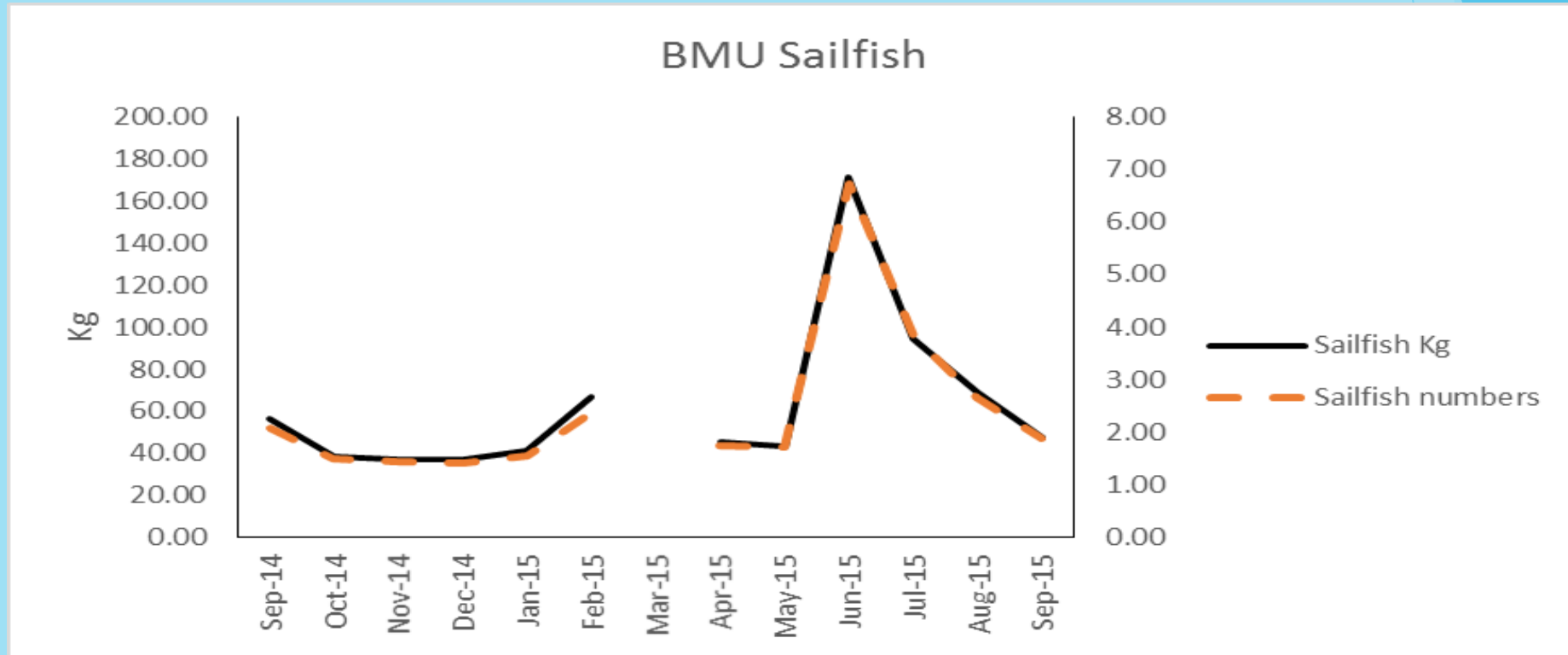


SAILFISH TAG REPORTS PER MONTH



No sailfish in June?

Compare to commercial



Recreational season closed April - August

3. Size estimates can often be biased..... typically upwards

- ▶ Charter skippers more likely to be honest if not reporting with client
- ▶ Should ideally have an estimation done before weighing and then the actual weight provided too (calculate estimation bias)
- ▶ Comparisons to commercial catch average weights from the same nation/area could also be useful, but best to primarily seek CPUE/abundance trends anyway



Final two points

4. Inconvenient data capture will cause underreporting

- ▶ Maximize convenience and provide feedback to promote ongoing and honest reporting
- ▶ The skippers don't want to assess data that is not truthful (self regulation of data quality)

5. FADs influence on pelagic catchability

- ▶ Seek recording of percent time spent fishing FADs to try determine catchability influences per species that could potentially draw future stock model values towards the truth

Feedback is vital - Why?

- ▶ Recreational fishers will supply data because they want to see and analyse their own results.
- ▶ Mutual benefits are essential and will promote accurate reporting.
- ▶ Without completing the loop, the system will probably fail
- ▶ Results show that the fishers aren't wasting their time, and it builds trust
- ▶ Results can also encourage fishers to adjust their methods through peer pressure
- ▶ Stakeholder driven initiatives can save time, costs and political capital



Some feedback considerations

- ▶ How often should feedback be provided (don't want to miss deadlines) ?
- ▶ Electronic feedback is best in modern times, continuous updates with fishers logging into their own data profiles?
- ▶ Privacy must be maintained, but individual anglers should be able to commit their data to national or marina scale lists (advertising/comparing catches to attract tourists)
- ▶ Formally recognizing and awarding the best data providers will build interest (awards for individuals, marinas and associations)
- ▶ Can the data be used to develop competition between anglers/clubs/countries without compromising data quality?
- ▶ Should species of primary interest and commercial value be targeted only?

Recreational fishers data wish list

Where are the fish and when?

- ▶ What month provides the best species diversity and catch per species?
- ▶ What month produces the biggest fish per species?
- ▶ What species bite best in what water temperatures?
- ▶ What species should I target according to weather and sea condition?
- ▶ What lunar phase is best per species, how much influence? (tournament dates for HIBT set according to 30 years of monitoring lunar phase influence on catch)
- ▶ What stage of the tide is best per species, how much influence?
- ▶ What barometric pressure is best per species, how much influence?

How does my catch compare to others here and elsewhere?

What can be done

- ▶ Convert dates to lunar dates (28 day cycle) to provide overlays for catch comparisons (numbers and size of fish)
- ▶ Digital tide table overlays to check effect of tide size (tide phase unavailable unless skippers want to record capture times)
- ▶ Peaks seasons per species by number, weight, average size etc can be easily and automatically calculated with a template, and potentially cut according to skipper to allow comparisons (CPUE and size competitions?)
- ▶ Photoperiod overlays can also provide seasonal indications
- ▶ Monthly average numbers and sizes per species, as well as species diversities, can be easily calculated automatically, and over different time periods as required

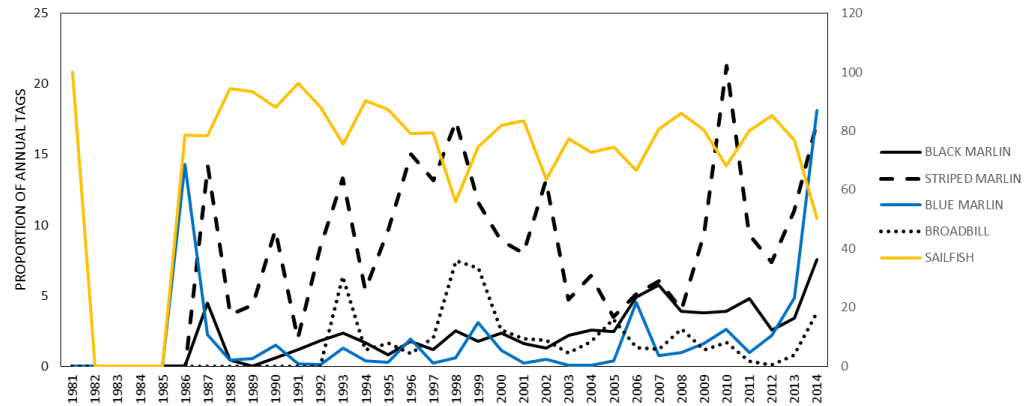
Suggestion

- ▶ Develop understanding and interest in CPUE among recreational fishers (efficiency)
- ▶ Seek to automatically provide digital data updates as frequently as practical and use as many environmental/seasonal overlays as possible so skipper interest is retained in the long term.
- ▶ Employ Australian methods where a catch & release recreational quota provides a precautionary buffer within management decisions

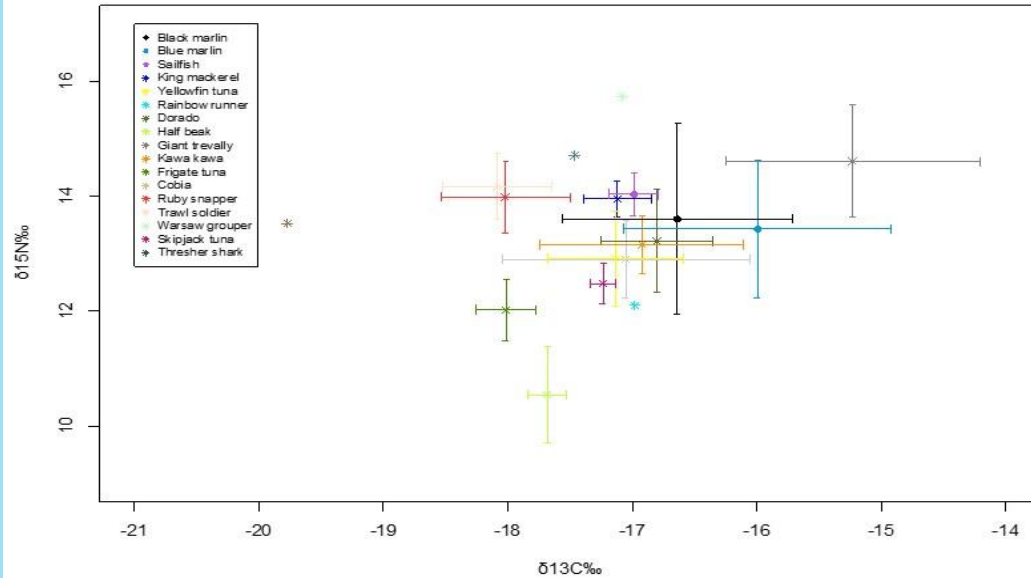
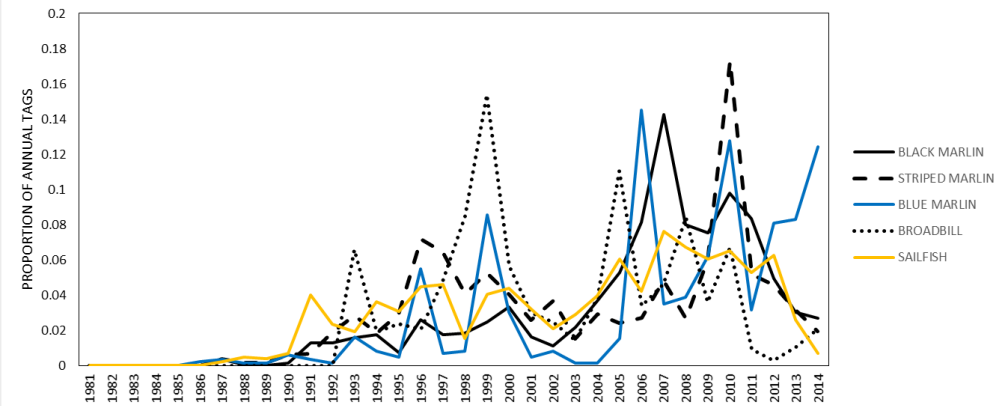


Some results

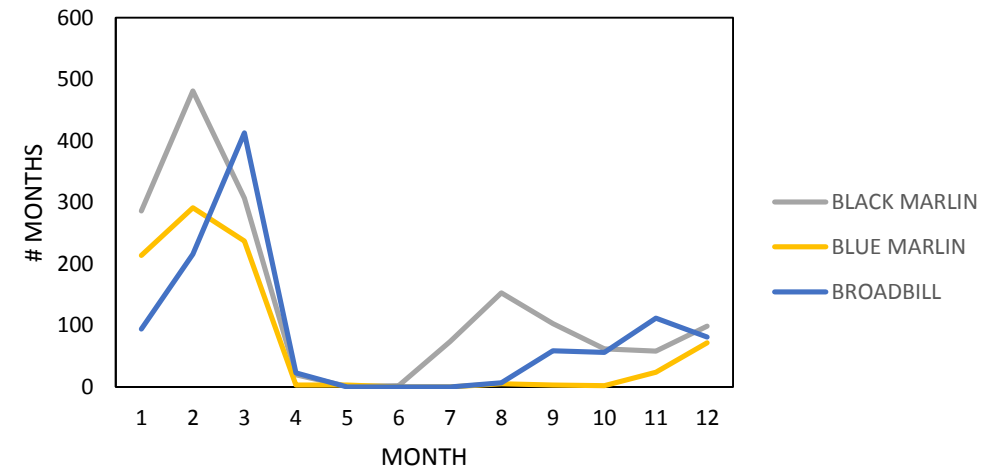
PROPORTION ANNUAL TAGS (ALL SPECIES)



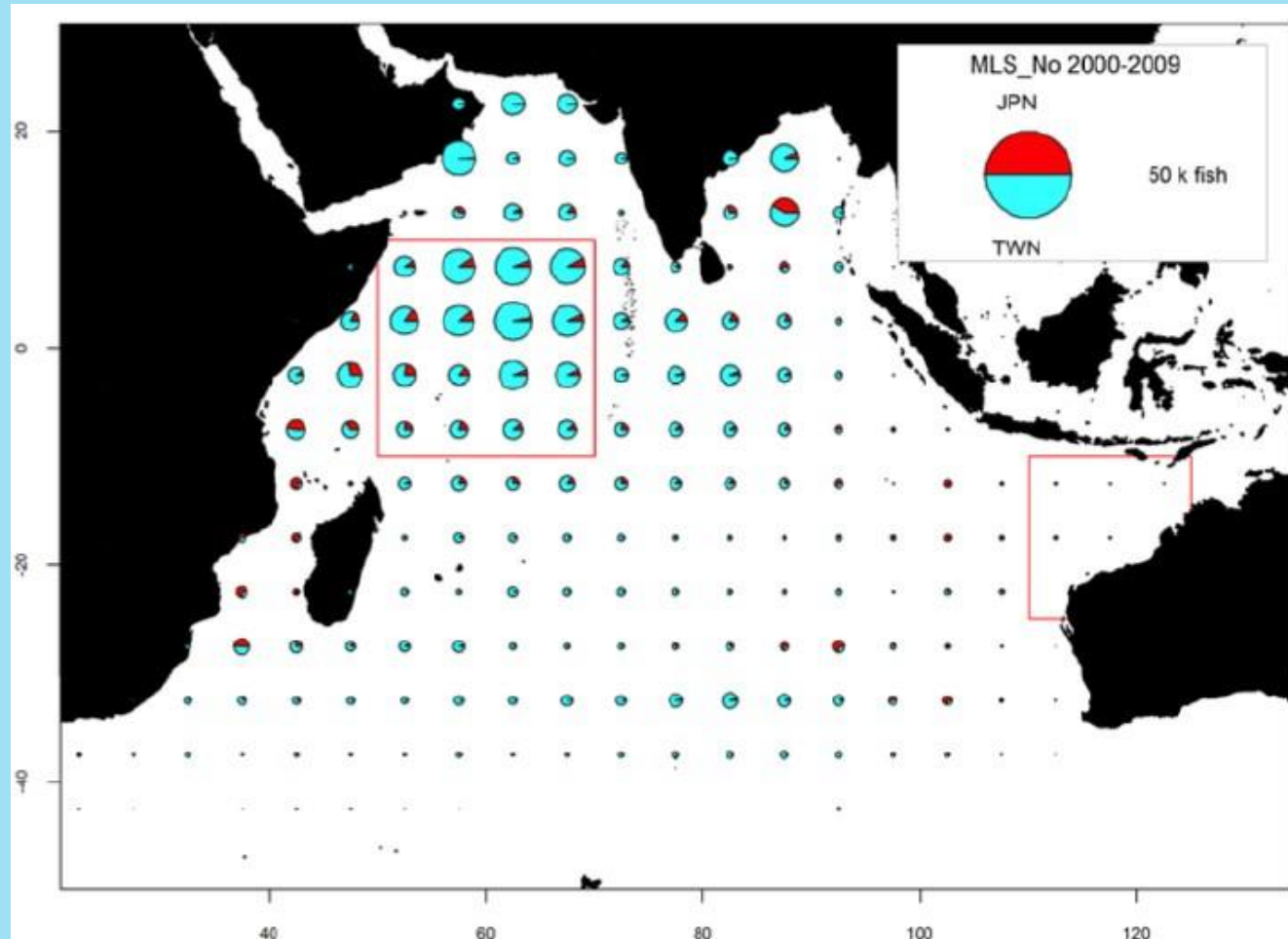
PROPORTION ANNUAL CONTRIBUTION TO EACH SPECIES OVERALL TOTAL



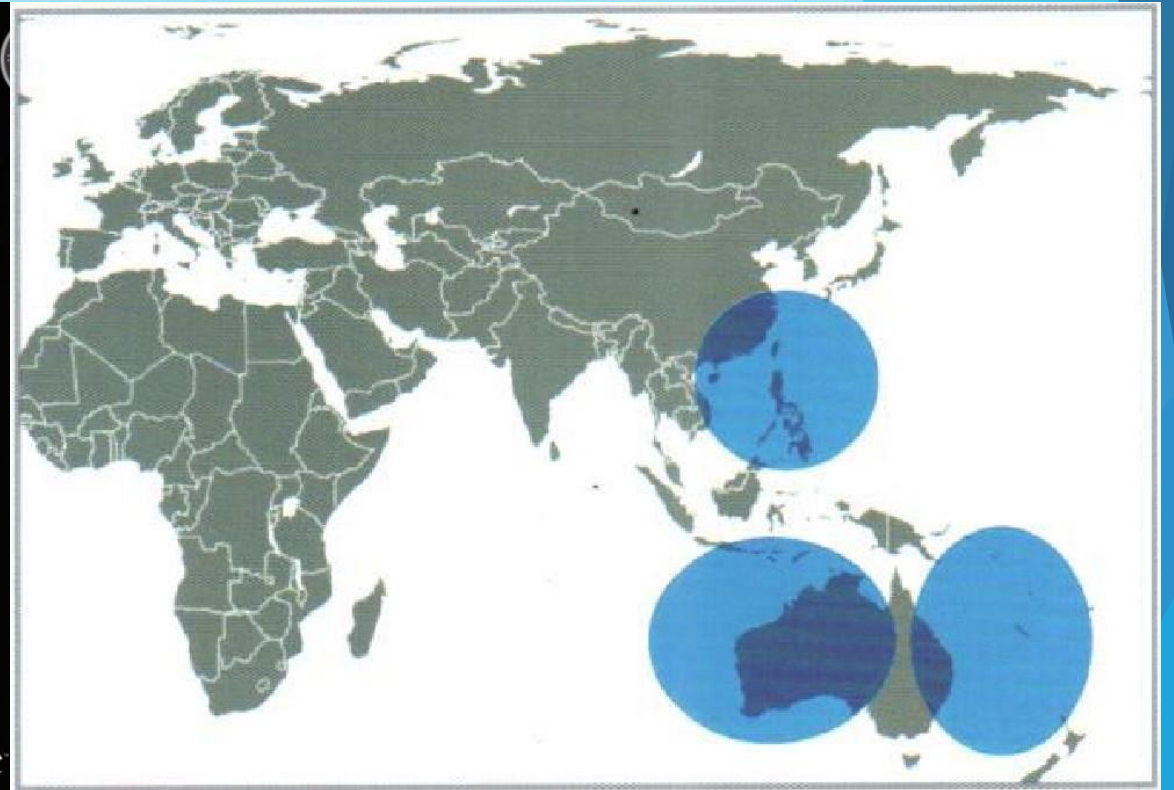
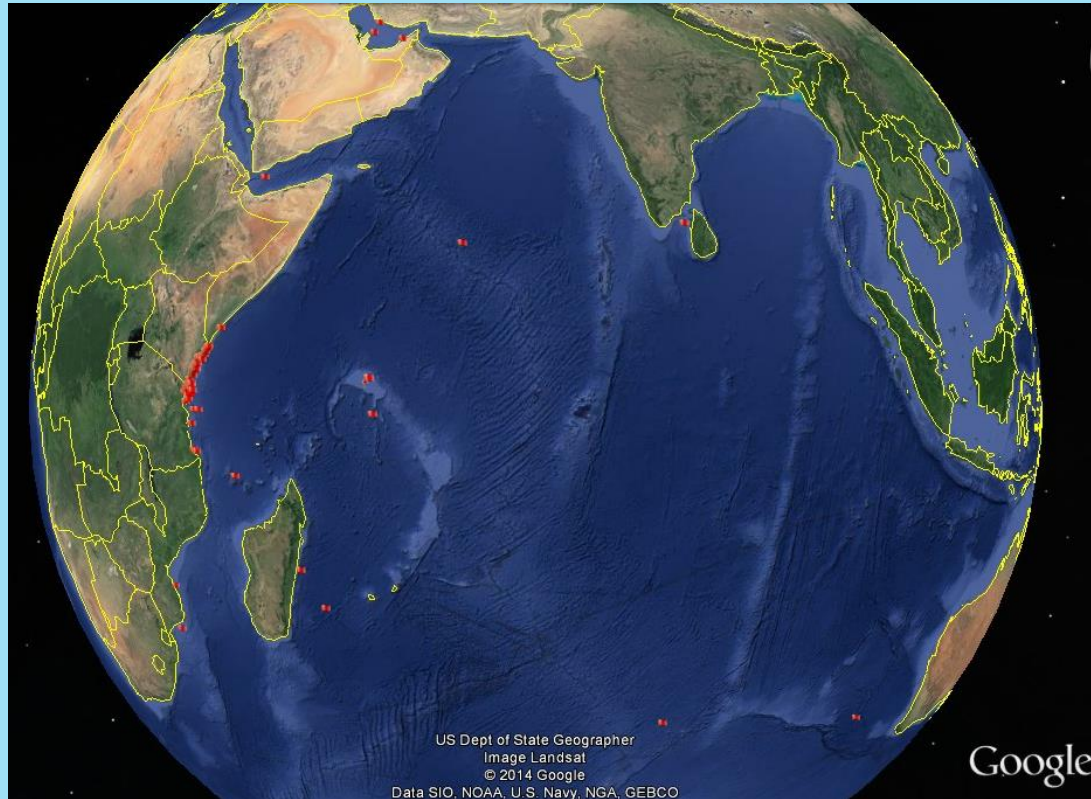
SPECIES TAG REPORTS PER MONTH



Commercial fishing pressure billfish hotspots



Merging tags and genetics



Satellite tags

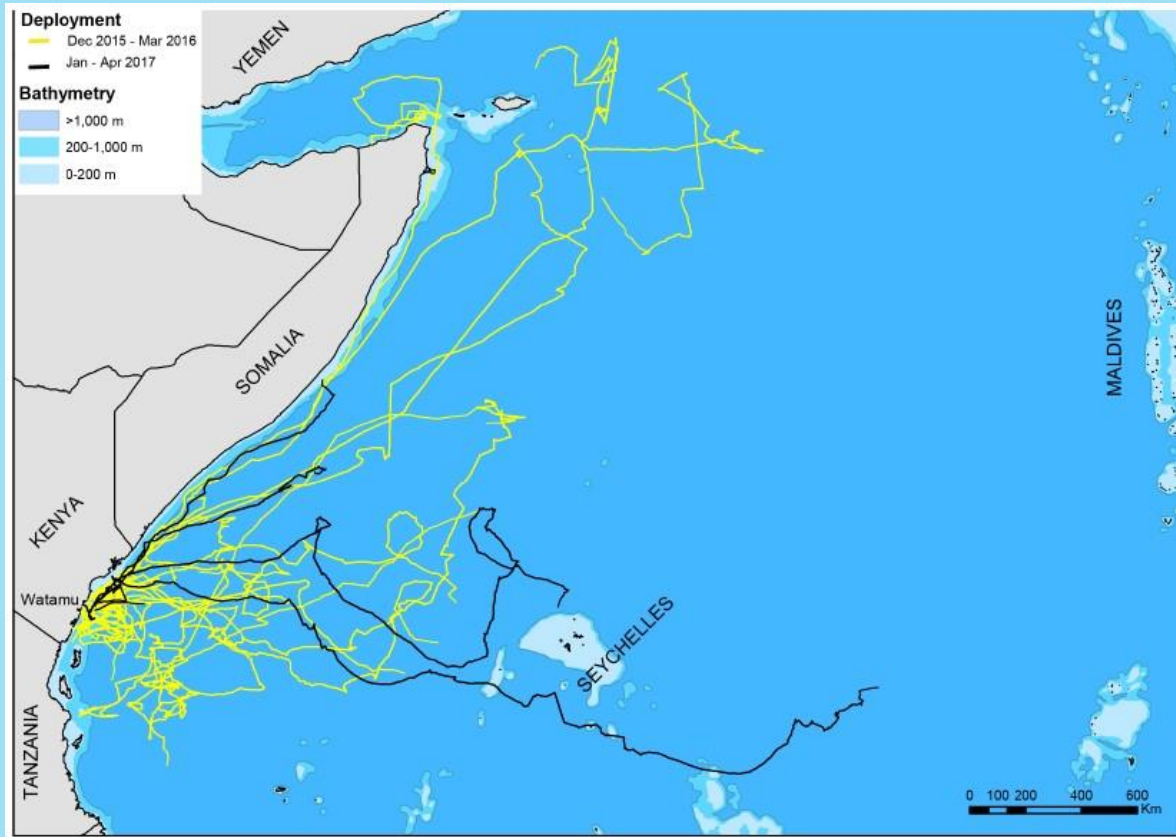


Fig. 7. Estimated tracks for striped marlin using miniPAT tags (2015-17).

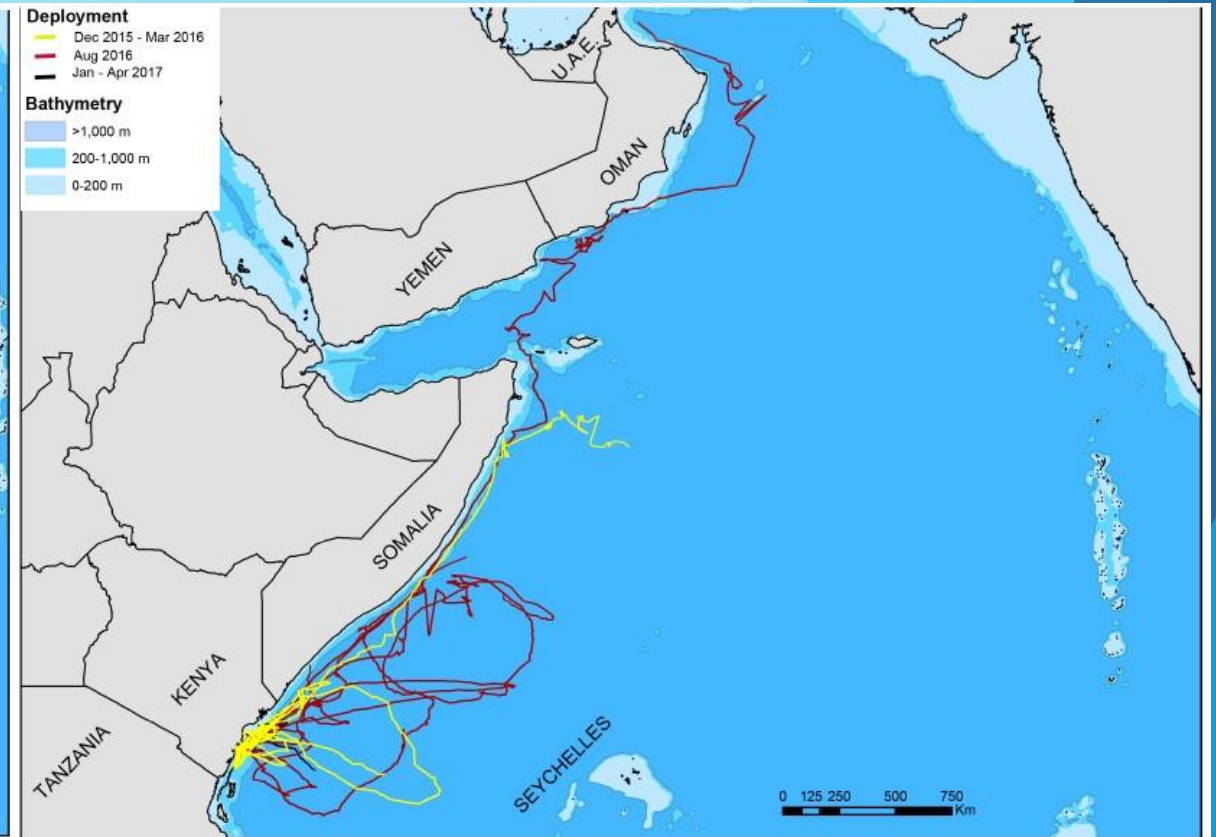
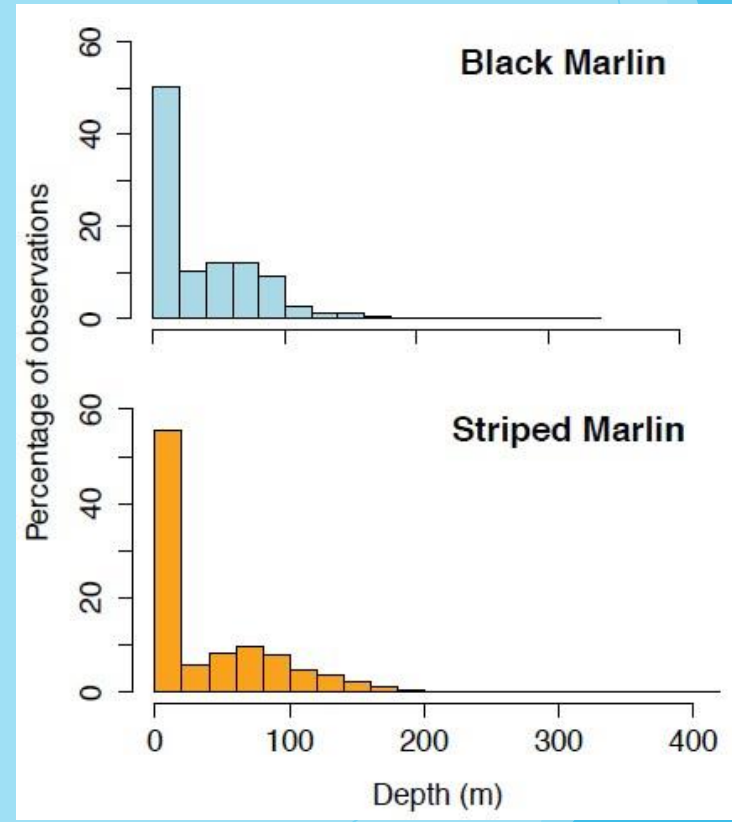
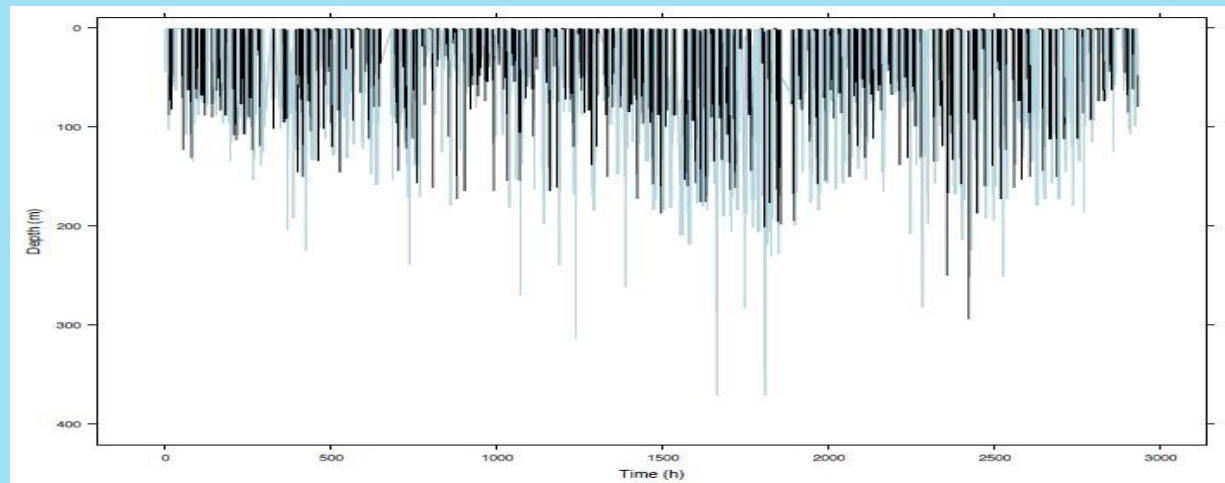
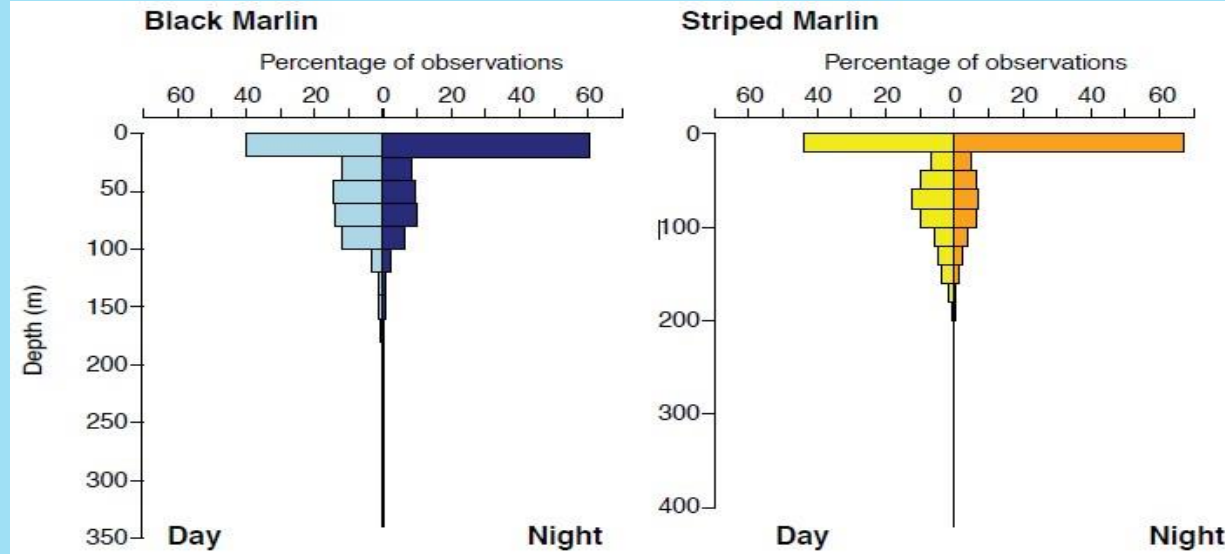


Fig. 6. Estimated tracks for black marlin using miniPAT tags (2015-17).

Depth profiles



ARTISANAL FISHERIES

- ▶ Another diverse and broadly distributed group which is rapidly increasing its' collective harvest capacity
- ▶ Collective impacts must not be underestimated and remember that this sector is politically very difficult, of not impossible, to control
- ▶ A precautionary quota should be allocated to this sector, recognizing food security needs and developing nation fishery development ambitions
- ▶ Fishing stocks to higher biomass levels could support need until better understanding
- ▶ Data should be collected by officials and feedback is again very important



How to collect data from this sector?

- ▶ Community groups must be formalized (BMU system in Kenya) and involve community leaders
- ▶ Link with NGOs locally, to prioritize workable sites from the beginning
- ▶ Someone from your organization **should** visit on site. In many communities public verbal commitments are much more powerful than email etc, which also may not be possible.
- ▶ Some will work better than others, but employ a data collector from within the community, and provide ongoing support to reliable ones (Ibrahim in Kenya was a disabled ex fisher)
- ▶ Prioritize CPUE data collection through simple **digital** tools, and seek to collect financial data if possible too. Money is the ultimate concern to these groups and this data will help them to make communal decisions



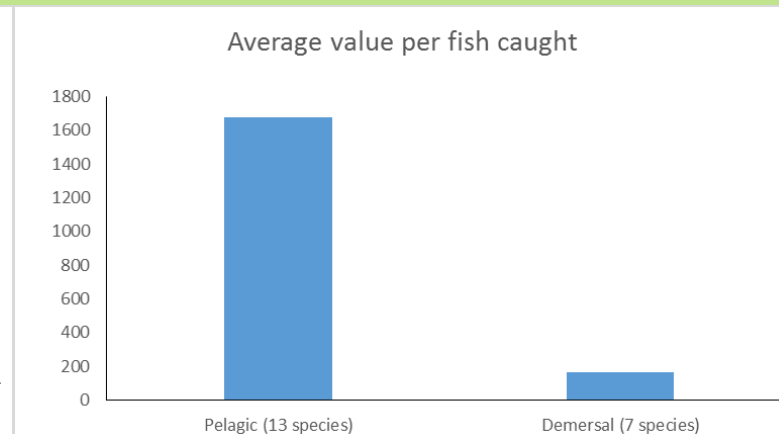
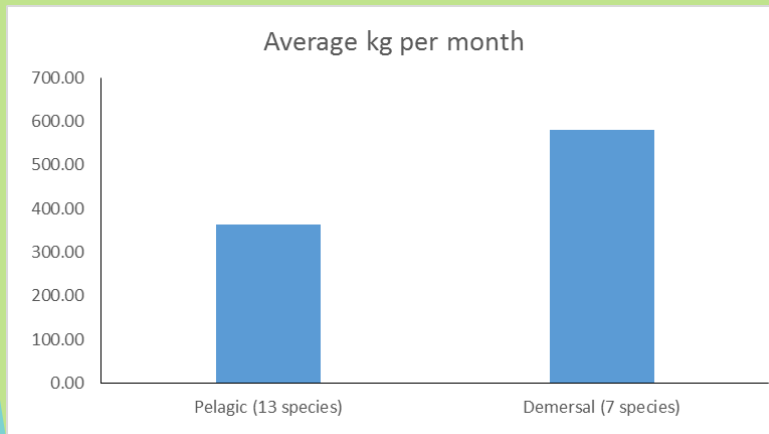
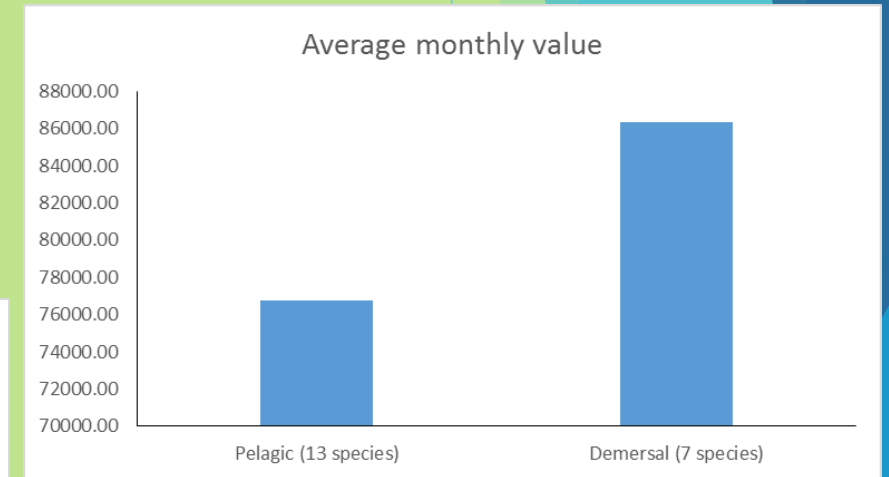
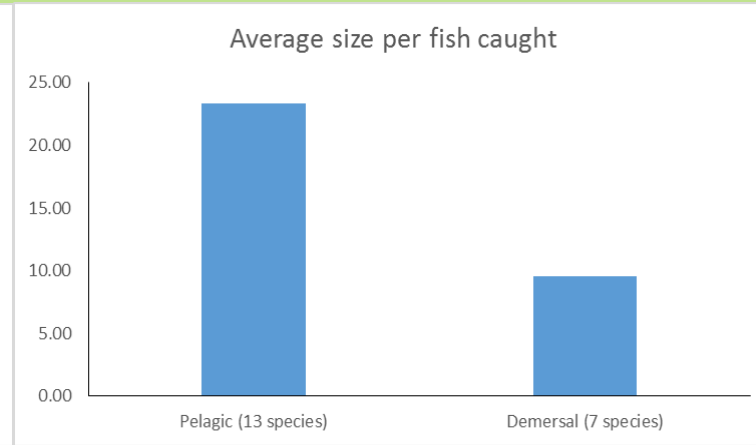
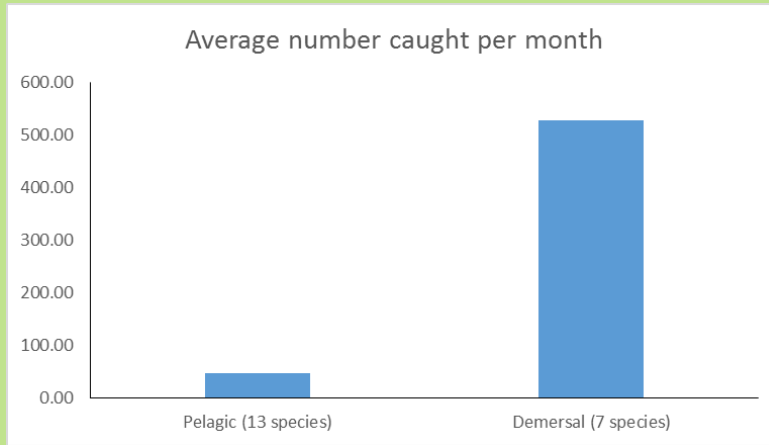
Benefits

- ▶ Improved information from this sector to monitor stock status'
- ▶ Capacity to set harvest intensities with precautionary buffers according to these fishers food security needs
- ▶ Artisanal fleets capture many species (EAF supporting data) and RFMOs can track the relative importance of pelagics' as inshore stocks are depleted
- ▶ Data collection can improve communities social cohesion and recognition of sustainability needs (future leverages)
- ▶ tRFMO approach can produce standardized input data structures, formats and methods to maximize use and comparability between national databases
- ▶ Digital capture cuts out the government middle man and ensures data is effectively captured (can also have quality checks in software during input)
- ▶ If the community can track their own data, this can also plant the seed for self regulation

Some results

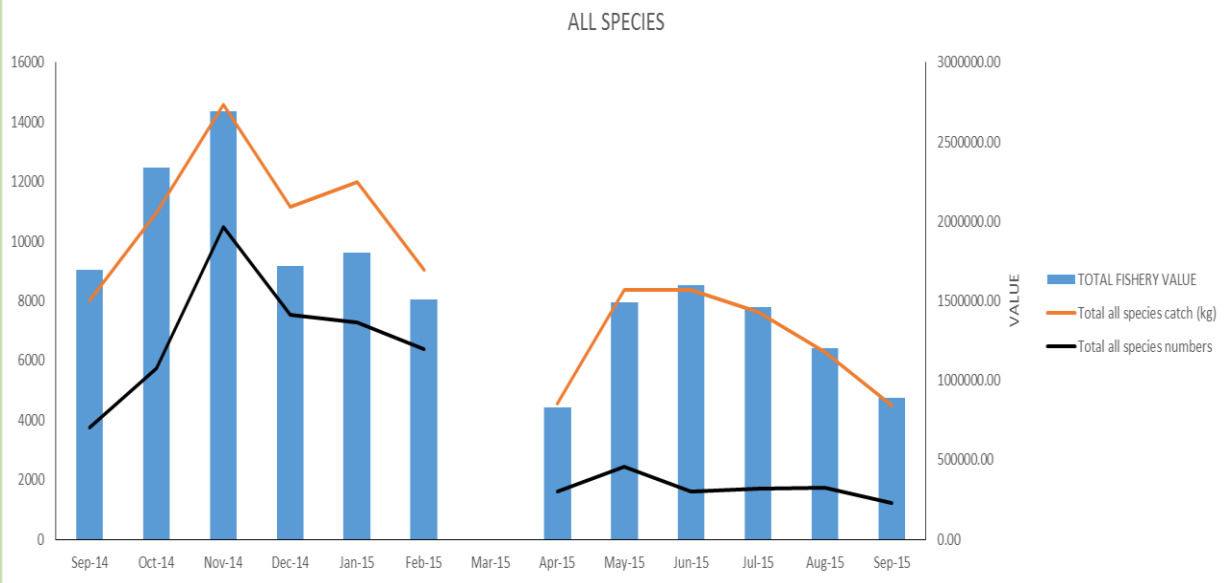
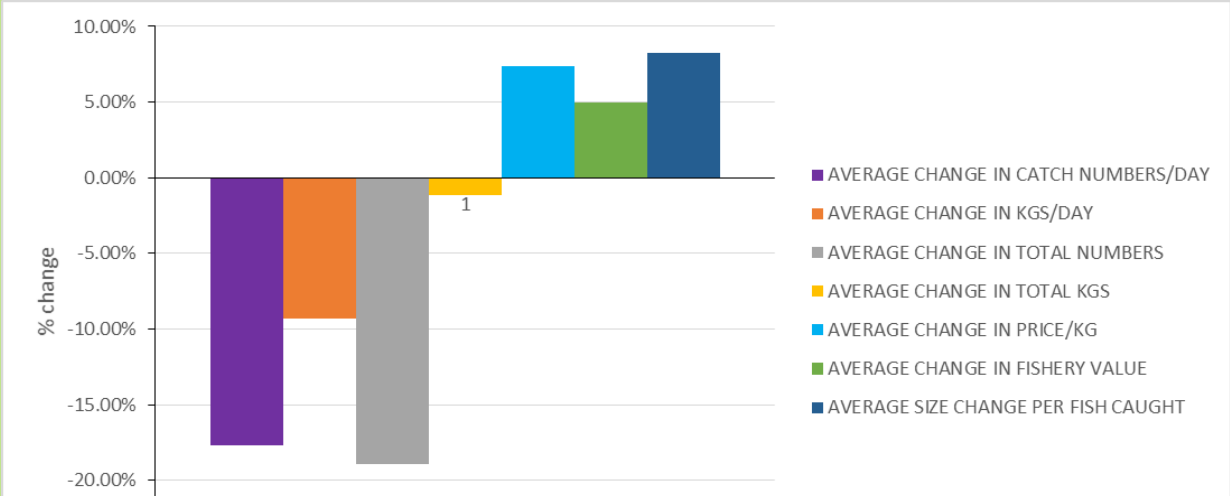
| Species | Month of peak catch (numbers) | Month of peak catch (kg) | Months of capture | Average size (kg) | Average catch (kg) per month | Average number caught / month | Average monthly value |
|------------------|-------------------------------|--------------------------|-------------------|-------------------|------------------------------|-------------------------------|-----------------------|
| Kole Kole | Dec-14 | Dec-14 | 12 | 12.88 | 330.25 | 22.33 | 49245.09 |
| Mixed fish | Nov-14 | Nov-14 | 12 | 0.59 | 1710.18 | 2854.50 | 280753.73 |
| Kingfish | Oct-14 | Jun-15 | 12 | 7.15 | 844.60 | 109.75 | 218188.33 |
| YF Tuna | Nov-14 | Oct-14 | 12 | 6.87 | 764.88 | 111.75 | 197592.71 |
| Black Marlin | Oct-14 | Feb-15 | 12 | 76.01 | 420.75 | 5.58 | 77347.88 |
| Red Snapper | Jan-15 | Jan-15 | 3 | 1.44 | 973.21 | 648.25 | 113540.97 |
| Groupers | Sep-15 | Jan-15 | 9 | 8.58 | 266.33 | 31.17 | 38766.30 |
| Striped Marlin | June 2015 + August 2015 | Aug-15 | 2 | 35.75 | 5.96 | 0.17 | 1191.67 |
| Dorado | Jun-15 | Jun-15 | 12 | 7.16 | 431.29 | 60.33 | 65942.23 |
| Wahoo | Oct-15 | Oct-15 | 12 | 11.29 | 756.67 | 67.83 | 194904.72 |
| Sailfish | Jun-15 | Jun-15 | 12 | 25.72 | 830.55 | 32.42 | 153219.94 |
| Baracuda | May-15 | Jan-15 | 12 | 7.21 | 149.92 | 21.08 | 22967.50 |
| Holy Fish | Nov-14 | Nov-14 | 9 | 3.39 | 414.36 | 123.50 | 73733.55 |
| Rainbow Runner | May-15 | Aug-15 | 9 | 2.90 | 82.08 | 28.17 | 14022.57 |
| Shark/Other | Jun-15 | Jul-15 | 12 | 35.70 | 342.83 | 9.67 | 42911.31 |
| Rock Cod | Nov-14 | Oct-14 | 3 | 4.33 | 30.12 | 6.83 | 5389.30 |
| Hammerhead shark | September 2014 + October 2014 | Sep-14 | 2 | 32.67 | 2.25 | 0.08 | 270.00 |
| Bonito | Sep-14 | Sep-14 | 12 | 2.72 | 395.02 | 148.58 | 46979.26 |
| Blue Marlin | September 2014 + August 2015 | Sep-14 | 2 | 85.00 | 2.25 | 0.08 | 450.00 |
| Skipjack Tuna | May-14 | May-14 | 3 | 3.38 | 29.25 | 8.92 | 4387.50 |

Simply illustrating financial results Pelagic VS Demersal example



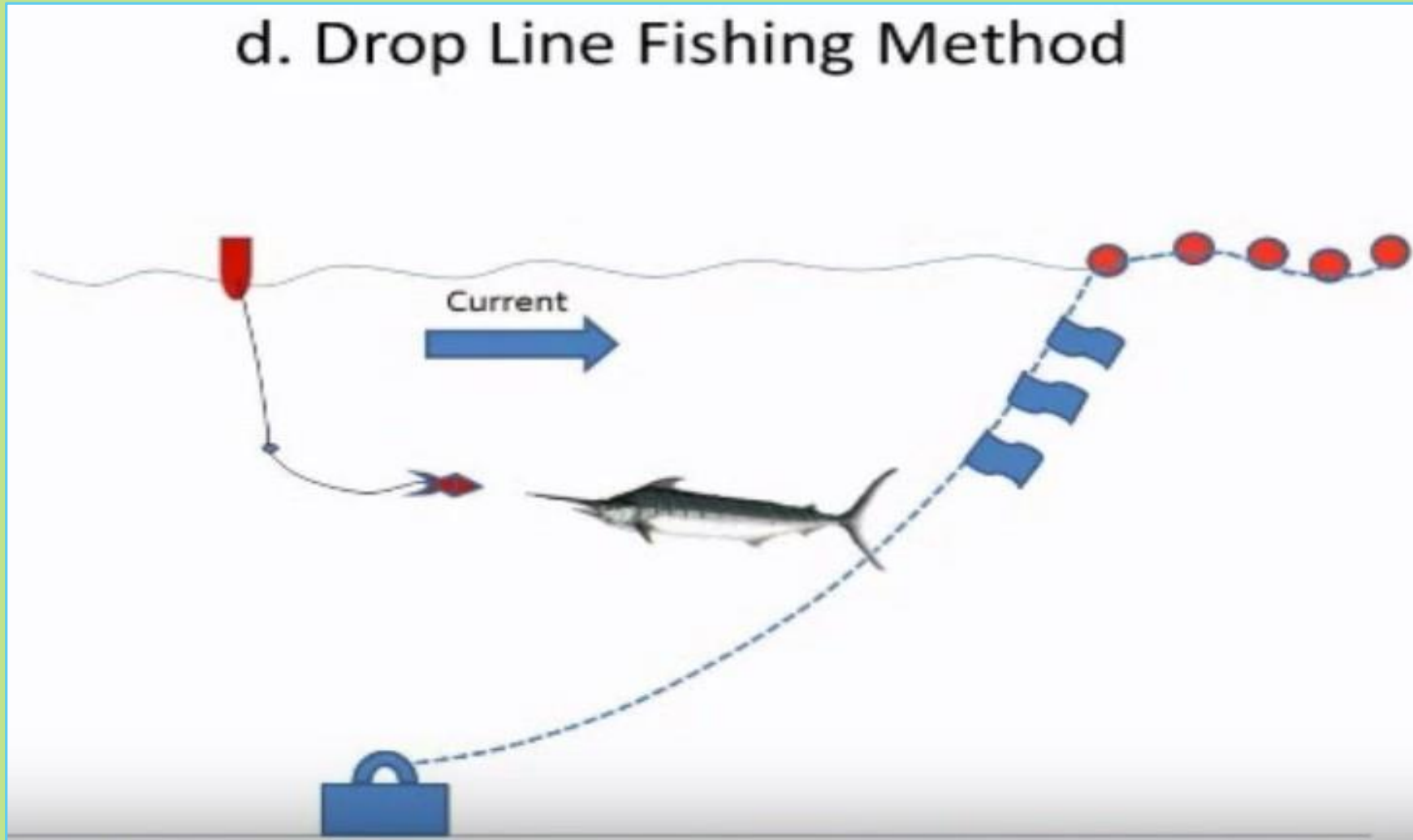
Fishery trends

- ▶ Increased targeting of pelagics' (FADs not common in Kenya yet)
- ▶ Catching less individual fish, less consistently, but they're typically bigger and more valuable
- ▶ Increasing reliance upon tunas and billfish to maintain profits (direct competition and worrying trend if these species are already overfished)
- ▶ Fishing stocks at higher biomass would leave a food security buffer until we better understand the impacts
- ▶ This data helped communities resolve foreign ring net issues in Kenya



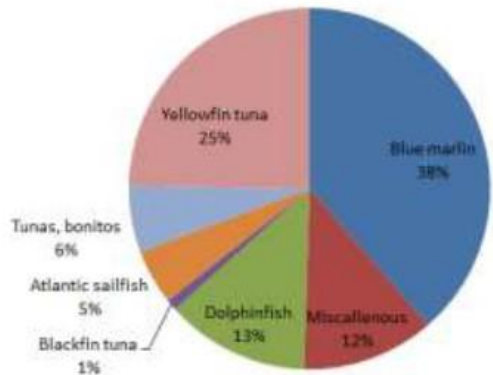
Drop lines in the Caribbean FAD fisheries

d. Drop Line Fishing Method

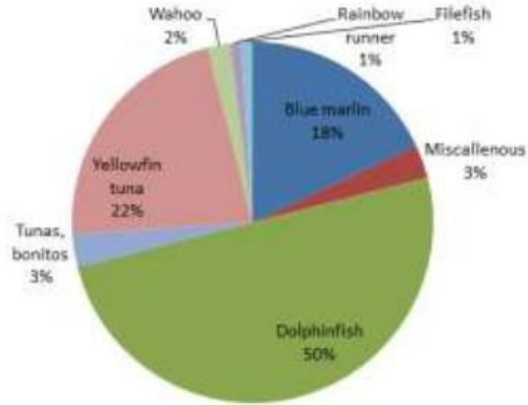


FAD catch compositions

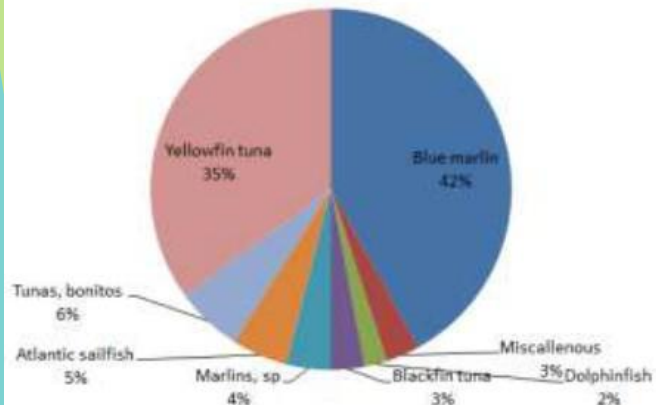
Martinique December-May 2008



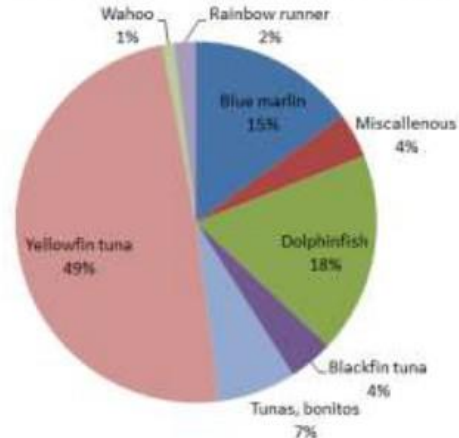
Guadeloupe December-May 2008



Martinique June-November 2008



Guadeloupe June-November 2008

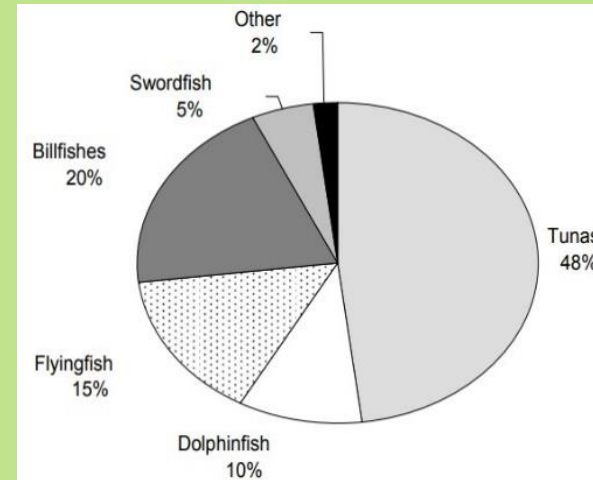
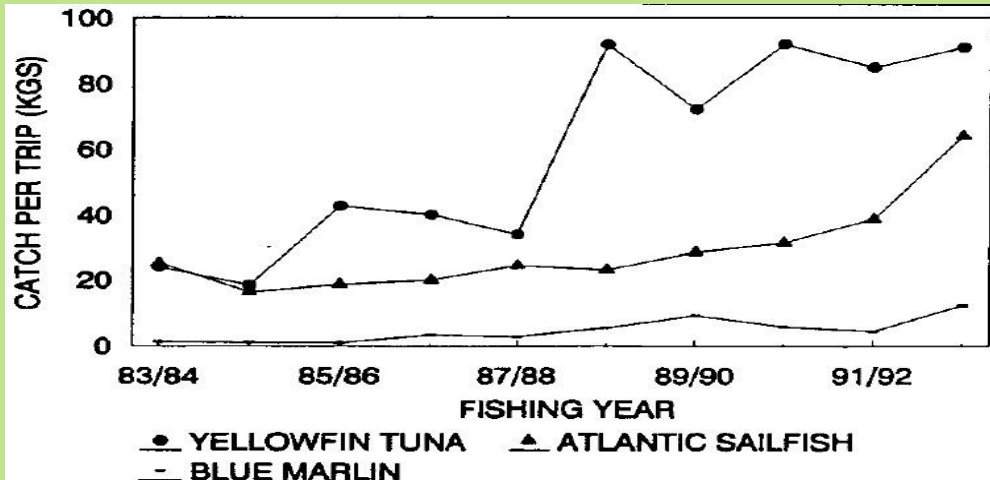


| Top species | Grenada | Saint Vincent and the Grenadines | Martinique | Dominica | Guadeloupe |
|-------------|----------------|----------------------------------|--------------|--------------|----------------|
| 1 | Blackfin | Blue marlin | Blue marlin | Yellowfin* | Yellowfin* |
| 2 | Yellowfin* | Yellowfin* | Yellowfin* | Dolphinfish* | Dolphinfish* |
| 3 | Cavalli | Blackfin | Little tunny | Skipjack | Little tunny |
| 4 | Dolphinfish* | Dolphinfish* | Blackfin | Blackfin | Blue marlin |
| 5 | Rainbow runner | Skipjack | Dolphinfish* | Sharks | Rainbow runner |

Figure 12: The top five species caught around FADs at 5 locations of the Lesser Antilles over at least one year, * indicates species which were present in the top five at all locations (top). Proportion of main target species caught on moored FADs in Guadeloupe and Martinique during December-May and June-November (bottom/pie charts)

Caribbean longline trends

- ▶ USA fleet - Billfish catch of 1.26%
- ▶ Caribbean fleet - Sailfish = 23% , blue marlin = 5%



- ▶ Shared stocks but trends towards live baits, drop lines and shallow longline sets in the Caribbean
- ▶ GOM reduction of 17% by USA PLL through ban on live-bait with time/area closure

Thank you



Kelly
DALLING FALLON
#black-marlinblog

