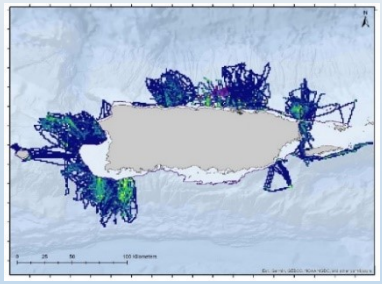
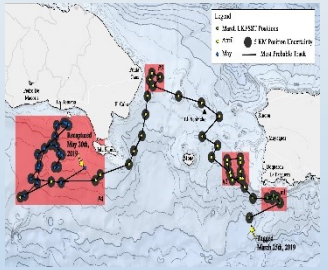
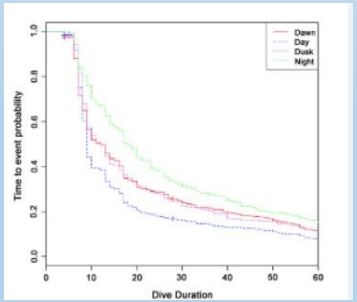
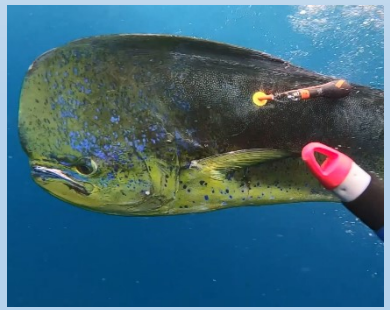
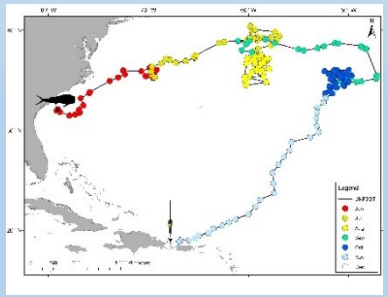
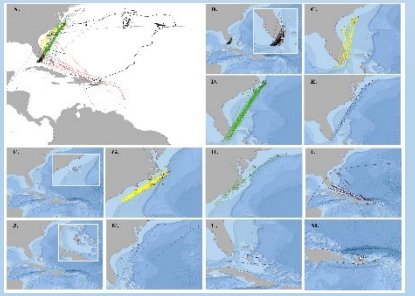
Dolphinfish Research Program







Dr. Wessley Merten

CFMC 8.16.2023

Beyond Our Shores Foundation

Dolphinfish Research Program

Newport, Rhode Island

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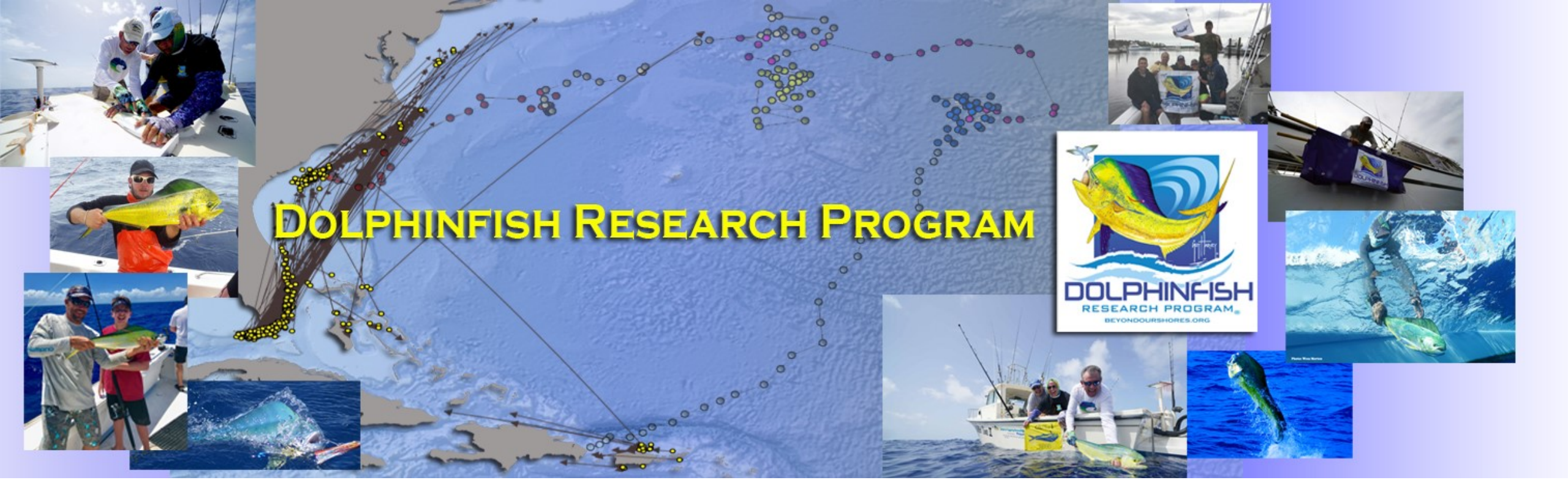

- **International citizen science mark and recapture program for dolphinfish**
- **Designed to collect data on movements, life history patterns, and population dynamics**
- **Started in 2002 – Now, in its 21st year**

34,589
Tagged

84 – 81 DOL, 3 WAH
Satellite tags deployed

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804
Recaptured

12
Publications

41
Total de FAD Desplegados

23
FADs Activo

2225
Informes

1106
Fish Tagged en FADs en el Carib

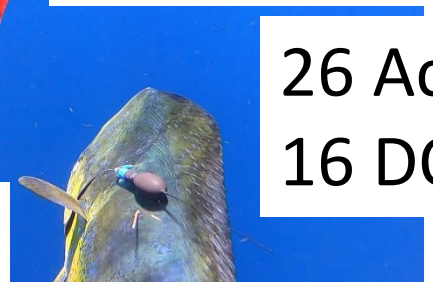
As of 8.16.2023

24 Surface / 17 Subsurface

2,779 trips up to July 31st, 2023

1 Published
1 in review *CJS*
1 in prep

31 Satellite Tag Deployments
27 DOL, 3 WAH, 1 FAL



26 Acoustic Tag Deployments
16 DOL, 5 YFT, 3 WAH, 1 BLK, 1 FAL

FAD Research Program

51 Vessels Involved

Scientia Marina 82(2)
June 2018, 000-000, Barcelona (Spain)
ISSN-L: 0214-8358
https://doi.org/10.3989/scimar.04730.09A

Use of video monitoring to quantify spatial and temporal patterns in fishing activity across sectors at moored fish aggregating devices off Puerto Rico

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(OC) E-mail: ancollazo@drna.gobierno.pr. ORCID ID: https://orcid.org/0000-0003-2478-7285
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Summary: A key challenge in small scale fisheries that use moored fish aggregating devices (mFADs) is the ability to accurately quantify multi-sector fishing activity through fishery-independent methods. Here, we present a novel fishery-dependent assessment of multi-sector fishing activity associated with a newly developed open access mFAD programme off San Juan, Puerto Rico. We identified three fishing sectors recreational, charter and commercial, and 158 individual fishing vessels that routinely operated in the vicinity of the mFADs. The results indicate that daytime fishing activity varied by time of day, day of week, location and sector. During fishing tournaments, the data revealed that fishing activity increased three-fold across monitoring periods, for hire charter vessels were the most consistent day to day user segment, and recreational activity peaked on weekends. Our study represents a new technique for rapidly identifying and detecting multi sector fishing activity near mFADs and highlights the potential to gather comparable data whenever mFADs are deployed. The results are used to discuss how this technique can be used to assess the performance of mFADs to identify sector overlap and guide management in determining deployment patterns and facilitate the design of cost-effective surveys to estimate mFAD vessel activity, and potentially catch, of mFAD-associated species.

Keywords: fish aggregating devices; fishery independent survey; video monitoring; small-scale fisheries; recreational fishing; Caribbean Sea.

Uso de video para cuantificar los patrones espacio-temporales de la actividad pesquera de los distintos sectores en los Sistemas de Agregadores de Peces de Puerto Rico

Resumen: Un reto crucial en las pesquerías artesanales que utilizan los sistemas de agregadores de peces fijos (mFAD, por sus siglas en inglés) es el poder cuantificar con certeza la actividad pesquera multisectorial a través de métodos independientes de la pesca. En este estudio presentamos un innovador análisis independiente de la pesca para la actividad de pesca multisectorial asociada a los nuevos mFAD establecidos en Puerto Rico. Se identificaron 3 sectores pesqueros (recreacional, de alquiler y comercial) y 158 embarcaciones que rutinariamente pescaban alrededor de los mFAD. Los resultados muestran que la actividad pesquera diurna variaba por hora del día, día de la semana, mes y sector. Durante torneos de pesca la actividad pesquera se triplicó, a lo largo de los períodos evaluados los botes de alquiler mostraron mayor consistencia a ser día a día actividad recreativa aumentó durante el fin de semana. Nuestro estudio muestra una nueva técnica para identificar rápidamente y detectar actividad multisectorial pesquera cerca de los mFAD y revela el potencial de tomar datos comparables en otros lugares donde se coloquen los mFAD. Los resultados se utilizan para discutir cómo esta técnica puede ser utilizada para evaluar la ejecutoria de los mFAD, identificar solapes de uso por varios sectores y guiar las decisiones en cuanto a los patrones para colocar los mFAD y facilitar el diseño de estudios costo eficaces para estimar la actividad de embarcaciones y el potencial de captura de peces alrededor de los mFAD.

Palabras clave: sistemas de agregadores de peces; estudios independientes de pesca; evaluaciones utilizando video; pesquería artesanal; pesquería recreativa; mar Caribe.

Citation/Como citar este artículo: Mertens W., Rivera R., Appeldoorn R., Serrano K., Collazo O., Jimenez N. 2018. Use of video monitoring to quantify spatial and temporal patterns in fishing activity across sectors at moored fish aggregating devices off Puerto Rico. Sci. Mar. 82(2): 000-000. https://doi.org/10.3989/scimar.04730.09A

Presentation Outline

Presentation Objective:

Provide a comprehensive update of specific data collected through the DRP in the U.S. Caribbean Sea and broader Caribbean Sea Basin.

Outline:

1. Case Study 1a: Catch and effort off San Juan, PR (June 2022 – July 2023) (10 min)
   1b: Commercial Catch DR and west

2. Case Study 2: Dolphinfish Movements in the Caribbean Sea (Emphasis on DR) (7 min)
3. Case Study 3: Dolphinfish Growth (5 min)
4. Conclusion: Issues Facing WCA Stock (2 min)

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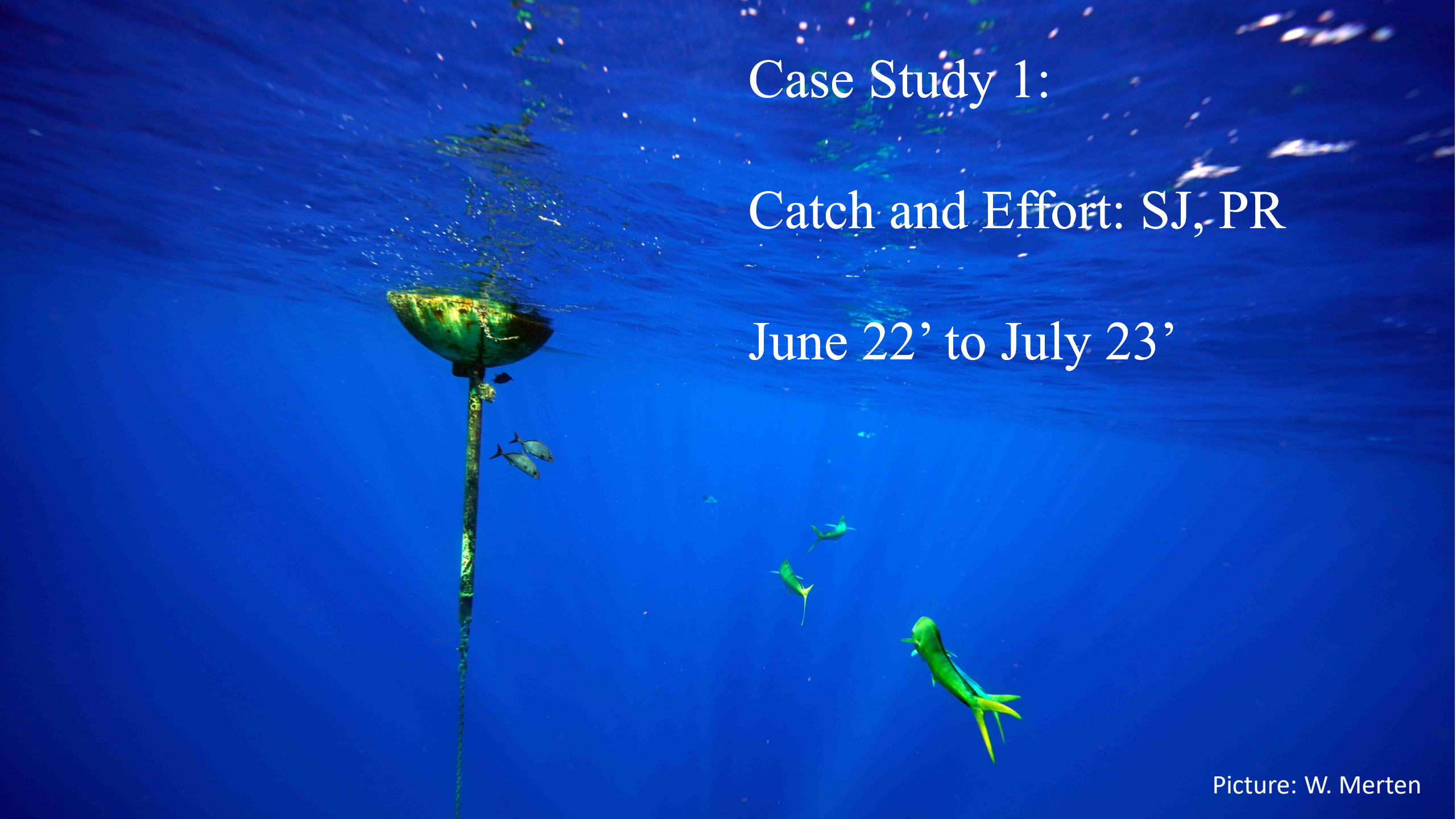
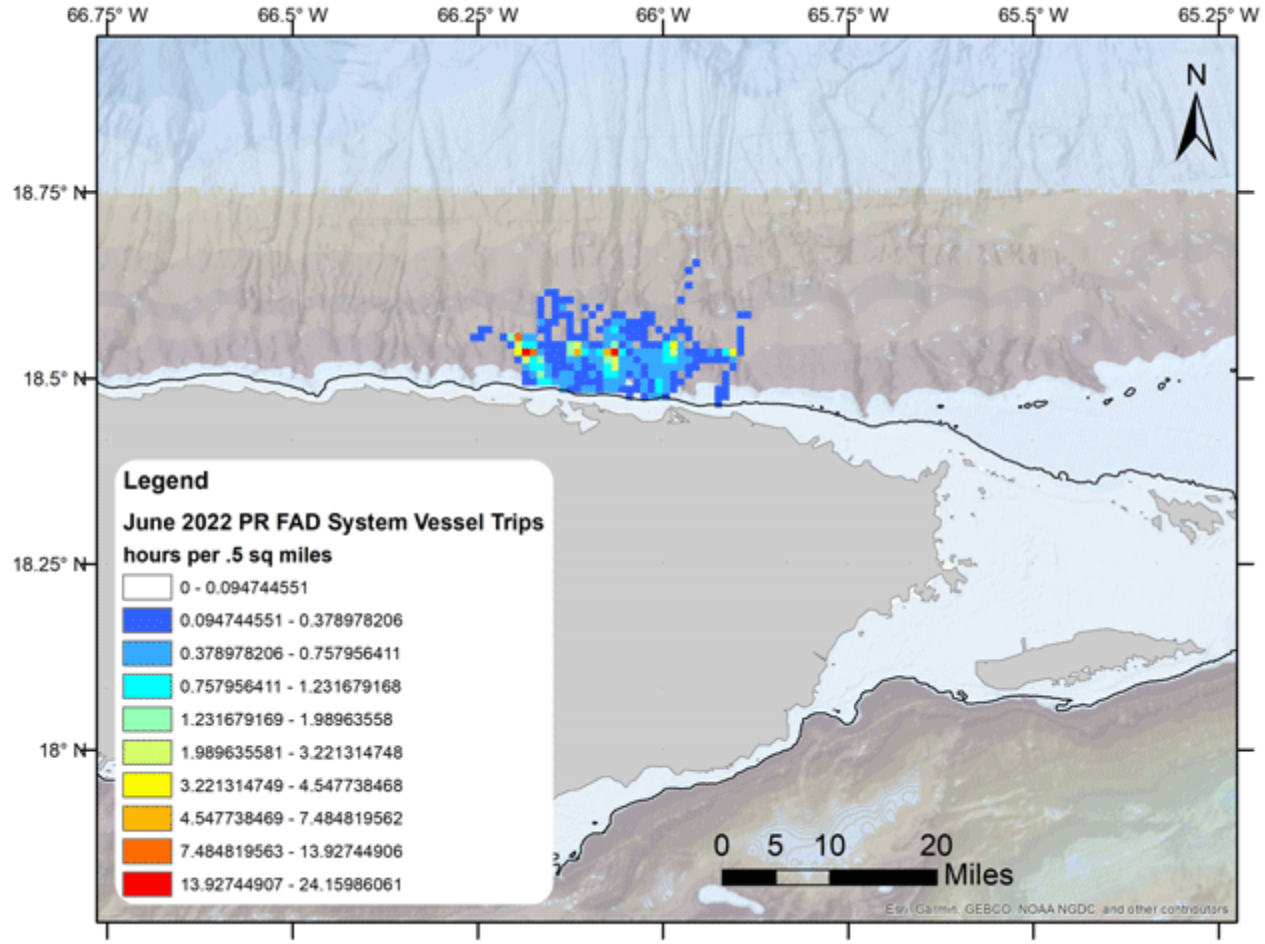


Case Study 1:

Catch and Effort: SJ, PR

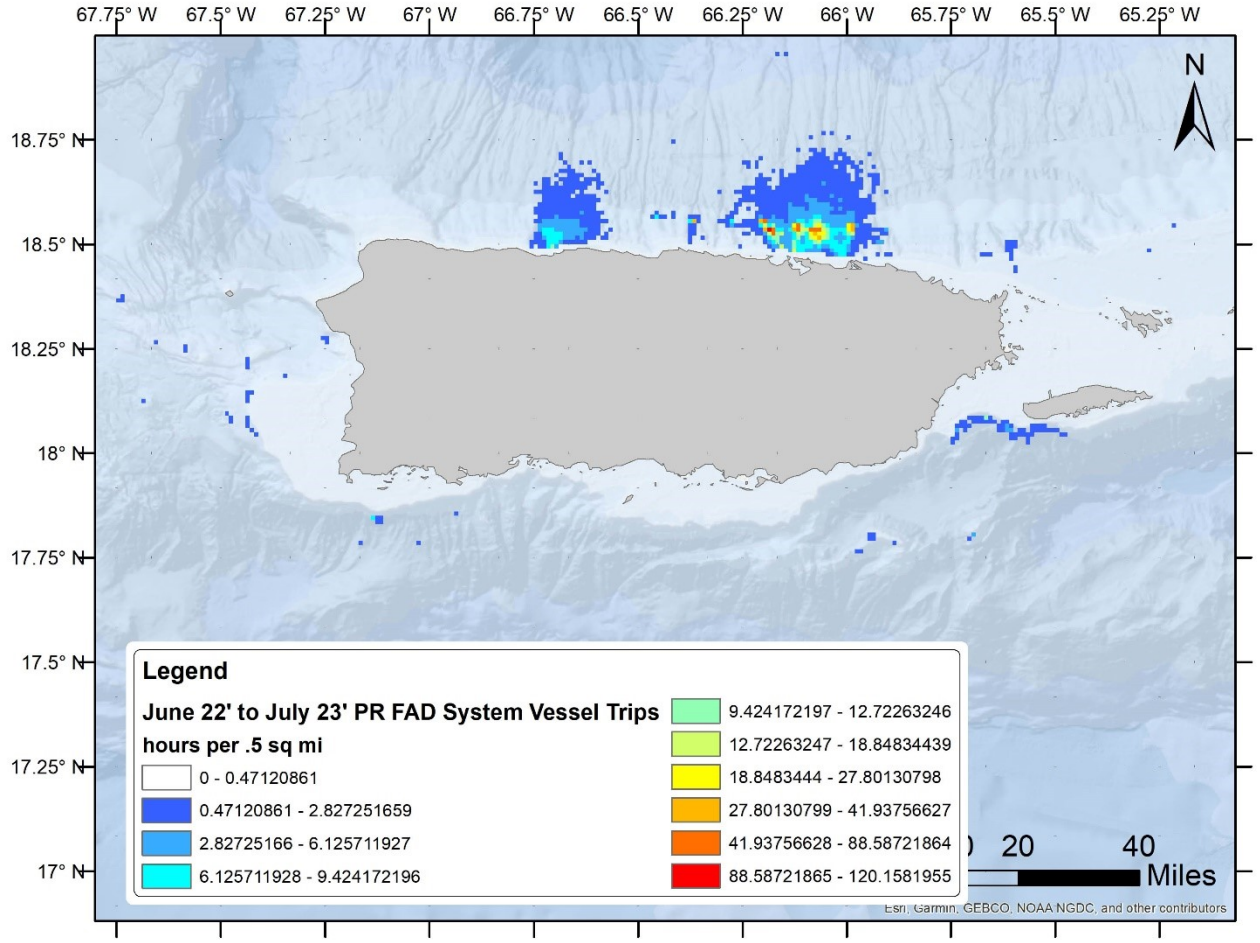
June 22’ to July 23’

Picture: W. Merten



Trips Logged Per Month	Cumulative Trips
56	56

Animation – not viewable in PDF



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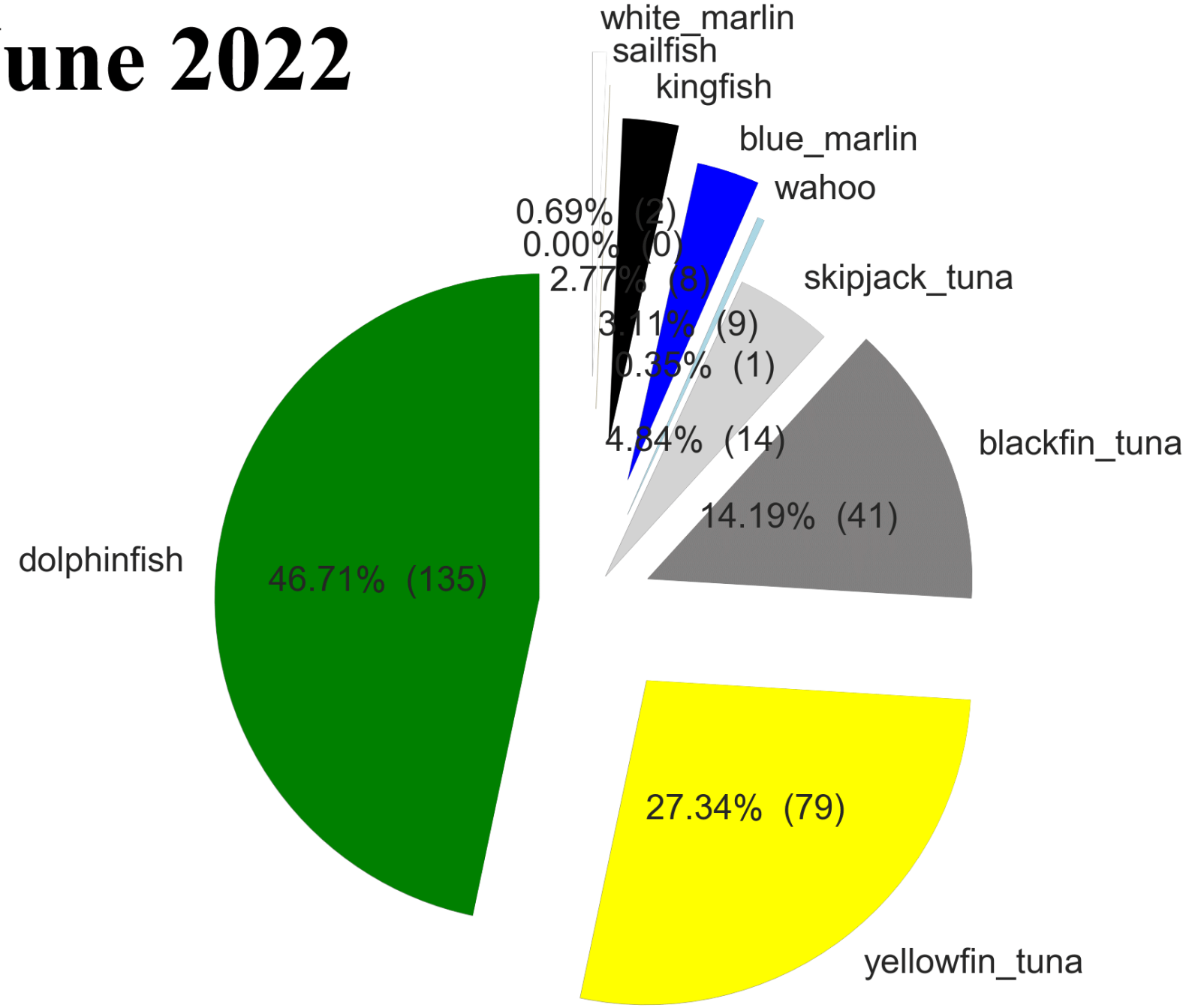
Average Trips Logged Per Month	Cumulative Trips
59	830

94% Landings Reporting Rate

89% Charter / 11% Private Recreational

June 2022



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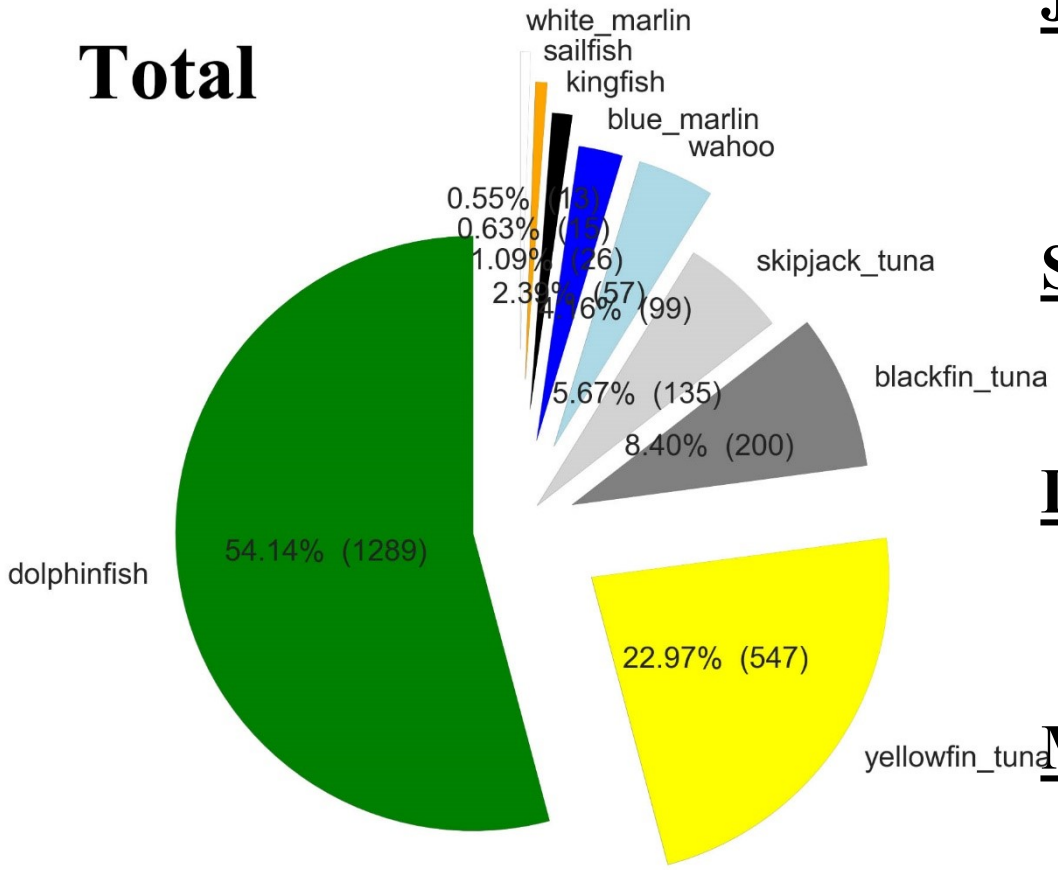
Animation – not viewable in PDF

Seasonal Trends

Total



Jun-Aug 22’

dolphinfish
298
43%

FAD Dominated
Size range 1-20 pounds

Sept-Nov 22’

dolphinfish
302
42%

NonFAD Dominated
30% of catch 1-10 lbs

Dec-Feb 23’

dolphinfish
400
78%

FAD Dominated
30% of catch 11-20 lbs
> % of fish 30+ lbs than other periods

Mar-May 23’

dolphinfish
228
78%

FAD Dominated
But, Equal % of 1-10, 11-20 FAD vs. NonFAD; > amount of 21+ at FADs

Jun-Present

dolphinfish
61
30%

FAD Dominated
Majority less than 10 lbs

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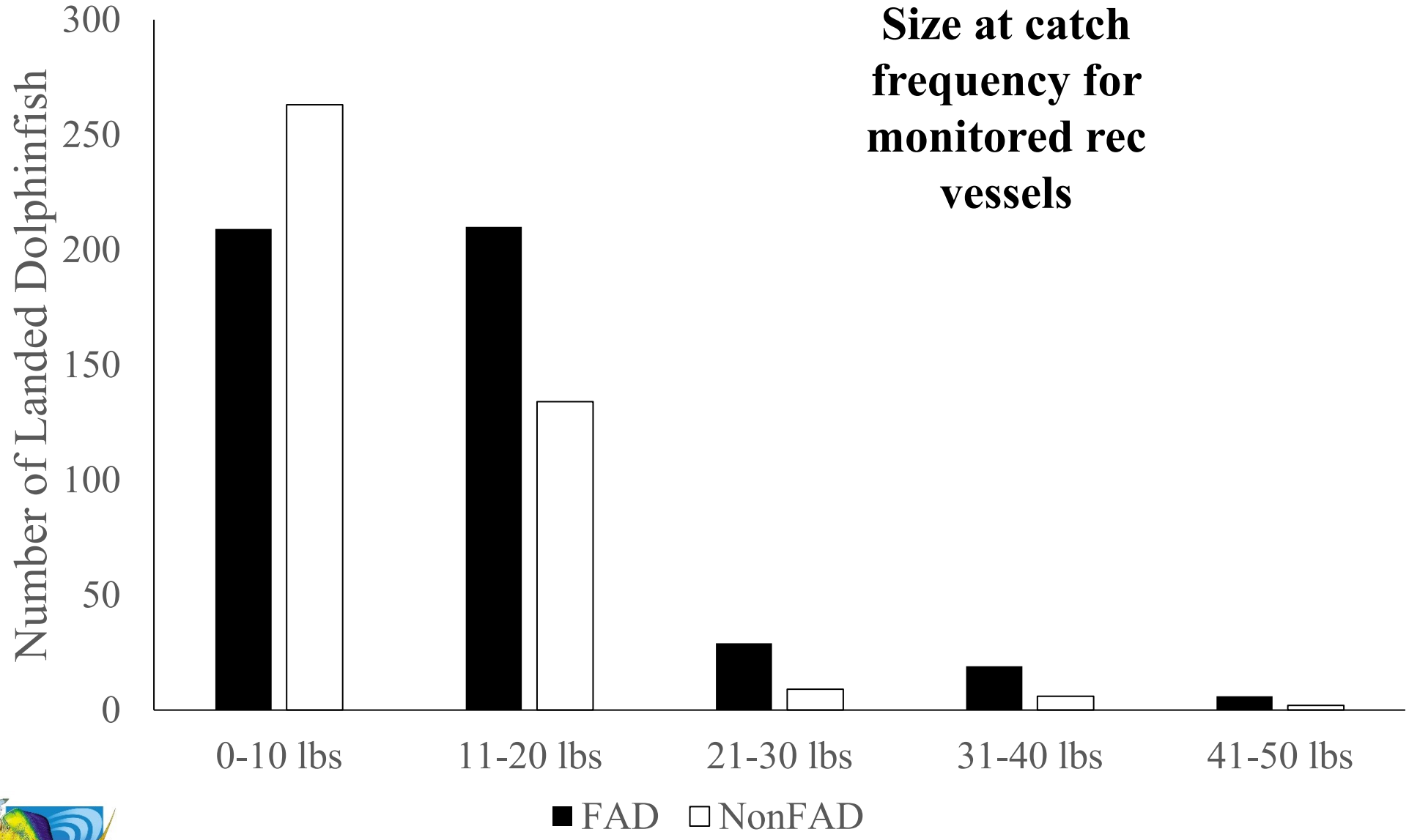

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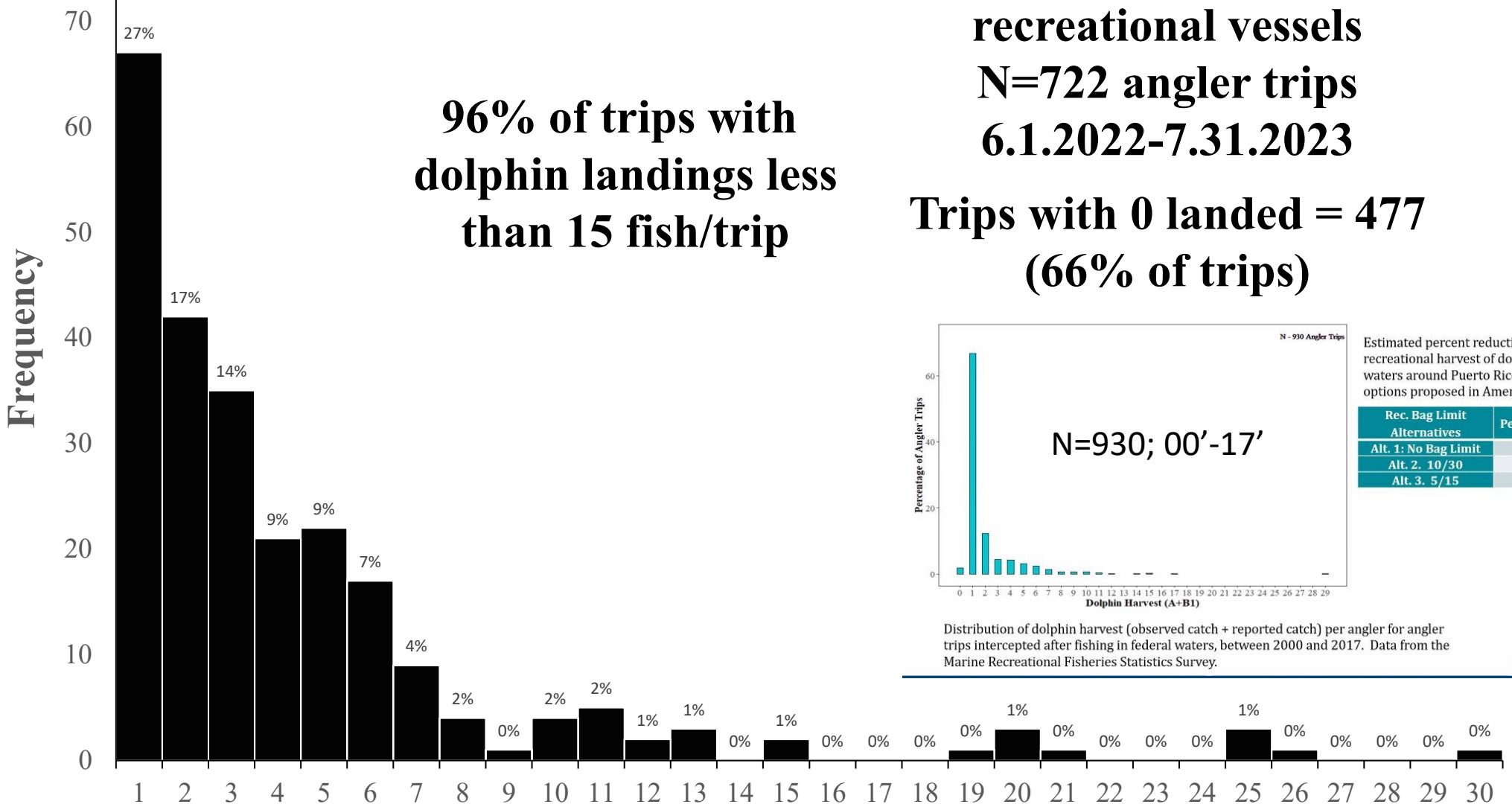
Catch per trip for recreational vessels N=722 angler trips 6.1.2022-7.31.2023

96% of trips with dolphin landings less than 15 fish/trip

Trips with 0 landed = 477 (66% of trips)



N=930; 00'-17'

Distribution of dolphin harvest (observed catch + reported catch) per angler for angler trips intercepted after fishing in federal waters, between 2000 and 2017. Data from the Marine Recreational Fisheries Statistics Survey.

Estimated percent reduction in recreational harvest of dolphin in federal waters around Puerto Rico under the options proposed in Amendment 3.

Rec. Bag Limit Alternatives	Percent Reduction
Alt. 1: No Bag Limit	0
Alt. 2. 10/30	3.11%
Alt. 3. 5/15	14.62%

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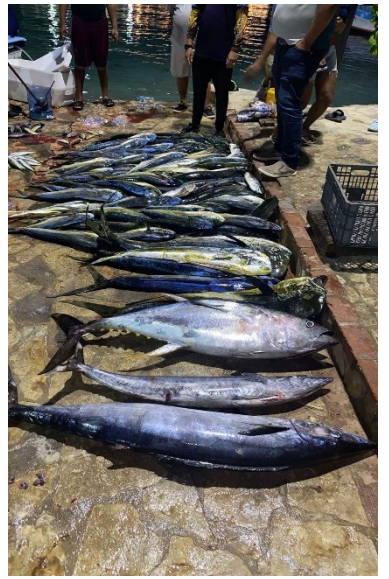
Case Study 1b: Commercial Catch DR & West

Picture: T. Dooley









Average of 416 pounds per outing for last 16 (Max: 670; Min: 40)

5,430 pounds in 16 outings – 1 boat – southern DR

*First image represents smallest catch recorded as of 8.16.2023 – 40 lbs of dolphin.

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Animation – not viewable in PDF

Food and Agriculture Organization of the United Nations

FISH4ACP

Unlocking the potential of sustainable fisheries and aquaculture in Africa, the Caribbean and the Pacific

Dominican Republic

FISH4ACP aims to make the mahi-mahi fishery in the Dominican Republic stronger to improve the livelihoods and working conditions for artisanal fisher folk, ensuring that growth goes hand in hand with environmental sustainability to preserve mahi-mahi for future generations of local fishers.

WHAT WE focus on

- Value chain analysis and upgrading strategy to make the mahi-mahi value chain more productive and sustainable.
- **Improving mahi-mahi production, handling and marketing** to increase benefits and reduce dependence on imports.
- Helping fisher associations to **improve business environment** and **social security benefits** for artisanal fishers.
- Strengthen governance and management to make mahi-mahi fishing **more efficient, safer and environmentally sustainable.**

VALUE CHAIN AT A GLANCE

Mahi-mahi

(Coryphaena hippurus)

PRODUCTION METHOD	VOLUMES *	VALUE *
Wild caught, artisanal	610 tonnes	USD 6.6 million

* estimated primary production

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Also known as dolphinfish, mahi-mahi is a highly appreciated food fish common to most of the world's warm and temperate seas. It is one of the principal catches of artisanal fishers in the Dominican Republic.

The fishery provides local fishermen with an income and is an important source of food that sells well on local markets and in the capital of Santo Domingo. Improvements to the cold chain and post-harvest handling could increase economic returns, but they require investments in human capital and the processing facilities.

FISH4ACP is supporting the Dominican Republic in making the mahi-mahi value chain, an important artisanal fishery, more productive and sustainable, making sure that benefits are shared equitably and growth does not increase th on the environment.

FISH4ACP is fostering social integration by working with local fisher ass and organized groups of women fish vendors. Activities seek to promot participation of artisanal fisherfolk in the value chain by improving acce social security and education, and through capacity building.

Facts & figures

Mahi-mahi is fished along the southern coast of the Dominican Republic. Captures **increased** from **255 tonnes** in **2000** to an estimated **612 tonners** in **2023.**

Mahi-mahi is a fish that grows and matures rapidly. It can be **harvested more frequently** than other species.

Fish consumption of around **8 kg** per person **per year** in the Dominican Republic is low compared to other Caribbean countries.

Mahi-mahi exports are low and go mainly to the United States, around

Pescadores de dorado N= 2369 (860 asociados y 1509 independientes)

Producción nacional de dorado fresco (V = 388 TM reportadas + 224 TM estimadas)

This document was produced with the financial assistance of the European Union (EU) and the Ge Ministry for Economic Cooperation and Development (BMZ). The views expressed herein can in n to reflect the official opinion of the EU, the Organisation of African, Caribbean and Pacific States

FISH4ACP@fao.org
Food and Agriculture Organization of the United Nations

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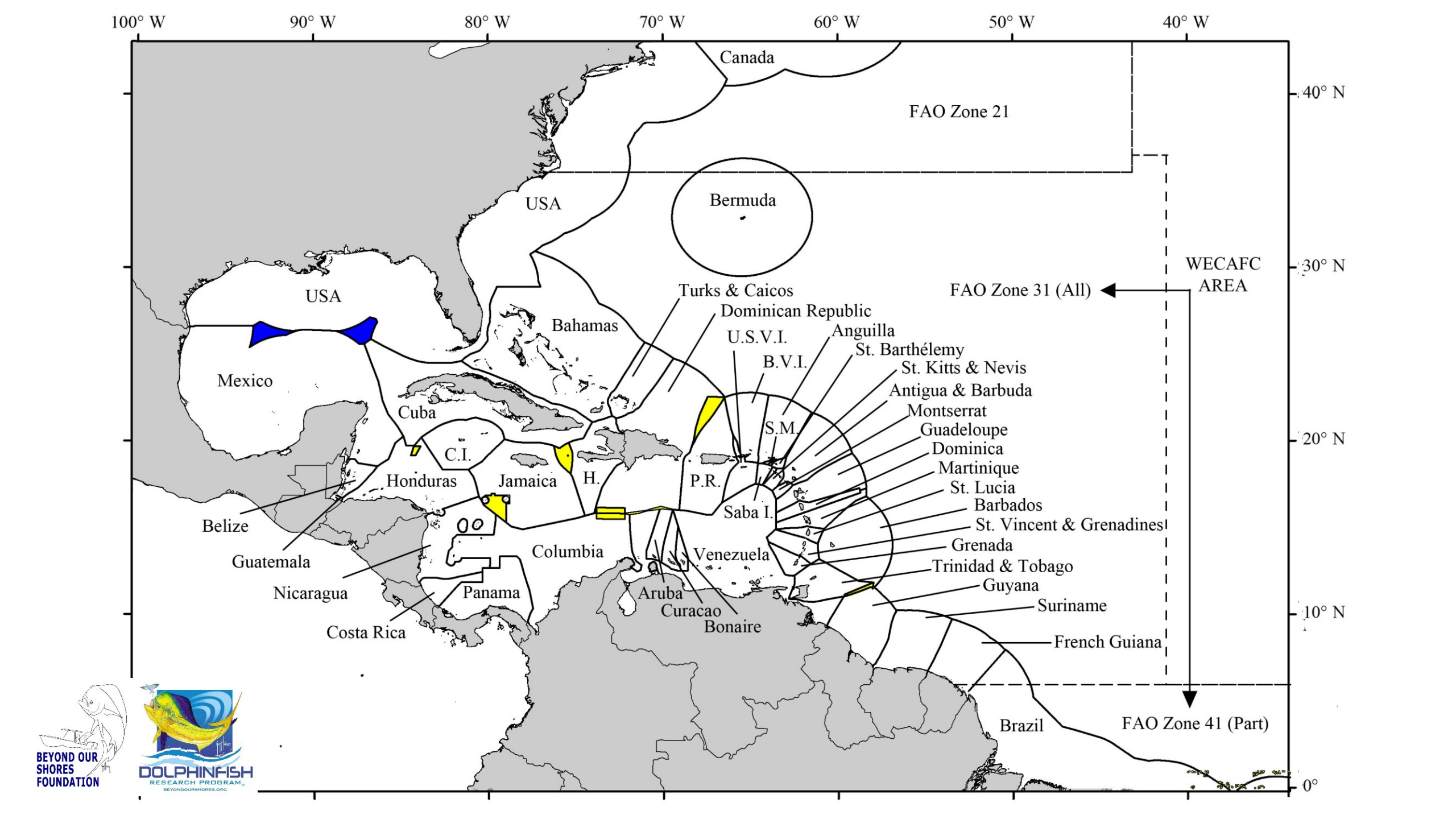
100° W
90° W
80° W
70° W
60° W
50° W
40° W
40° N
30° N
20° N
10° N
0°
Canada
FAO Zone 21
USA
Bermuda
USA
Mexico
Bahamas
Turks & Caicos
Dominican Republic
U.S.V.I.
Anguilla
B.V.I.
St. Barthélemy
St. Kitts & Nevis
Antigua & Barbuda
Montserrat
Guadeloupe
Dominica
Martinique
St. Lucia
Barbados
St. Vincent & Grenadines
Grenada
Trinidad & Tobago
Guyana
Suriname
French Guiana
WECAFC AREA
FAO Zone 31 (All)
Cuba
C.I.
Honduras
Jamaica
H.
P.R.
S.M.
Saba I.
Belize
Guatemala
Nicaragua
Costa Rica
Panama
Columbia
Venezuela
Aruba
Curacao
Bonaire
Brazil
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B) MECANISME DE COFINANCEMENT (Matching Grant)

➔ **Biens déjà livrés (Phase 1)**

- Bateaux : 39
- Moteurs : 172
- Congélateurs : 41
- Glacières : 194

Taux de contrepartie

- Bateaux 12%
- Moteurs 12%
- Glacières 25%
- Congélateurs 15%
- Gilets de sauvetage 0%

➔ **Pour une valeur 990,000 USD**

➔ **Bénéficiaires : 53** associations

➔ **Phase 2**

- 101 moteurs , 32 bateaux de 18 pieds, 168 glacières de 75 litres, 50 glacières de 120 litres et 200 gilets de sauvetage. 65 congélateurs
- **Bénéficiaires :** 70 associations

100° W 90° W 80° W 70° W 60° W 50° W 40° W

40° N 30° N 20° N 10° N 0°

Canada
FAO Zone 21
USA
Bermuda
WECAFC AREA
FAO Zone 31 (All)
Turks & Caicos
Dominican Republic
Bahamas
U.S.V.I.
Anguilla
B.V.I.
St. Barthélemy
St. Kitts & Nevis
Antigua & Barbuda
Montserrat
Guadeloupe
Dominica
Martinique
St. Lucia
Barbados
St. Vincent & Grenadines
Grenada
Trinidad & Tobago
Guyana
Suriname
French Guiana
Mexico
Cuba
C.I.
Honduras
Jamaica
H.
P.R.
S.M.
Saba I.
Belize
Guatemala
Nicaragua
Costa Rica
Panama
Columbia
Venezuela
Aruba
Curacao
Bonaire
Brazil
FAO Zone 41 (Part)

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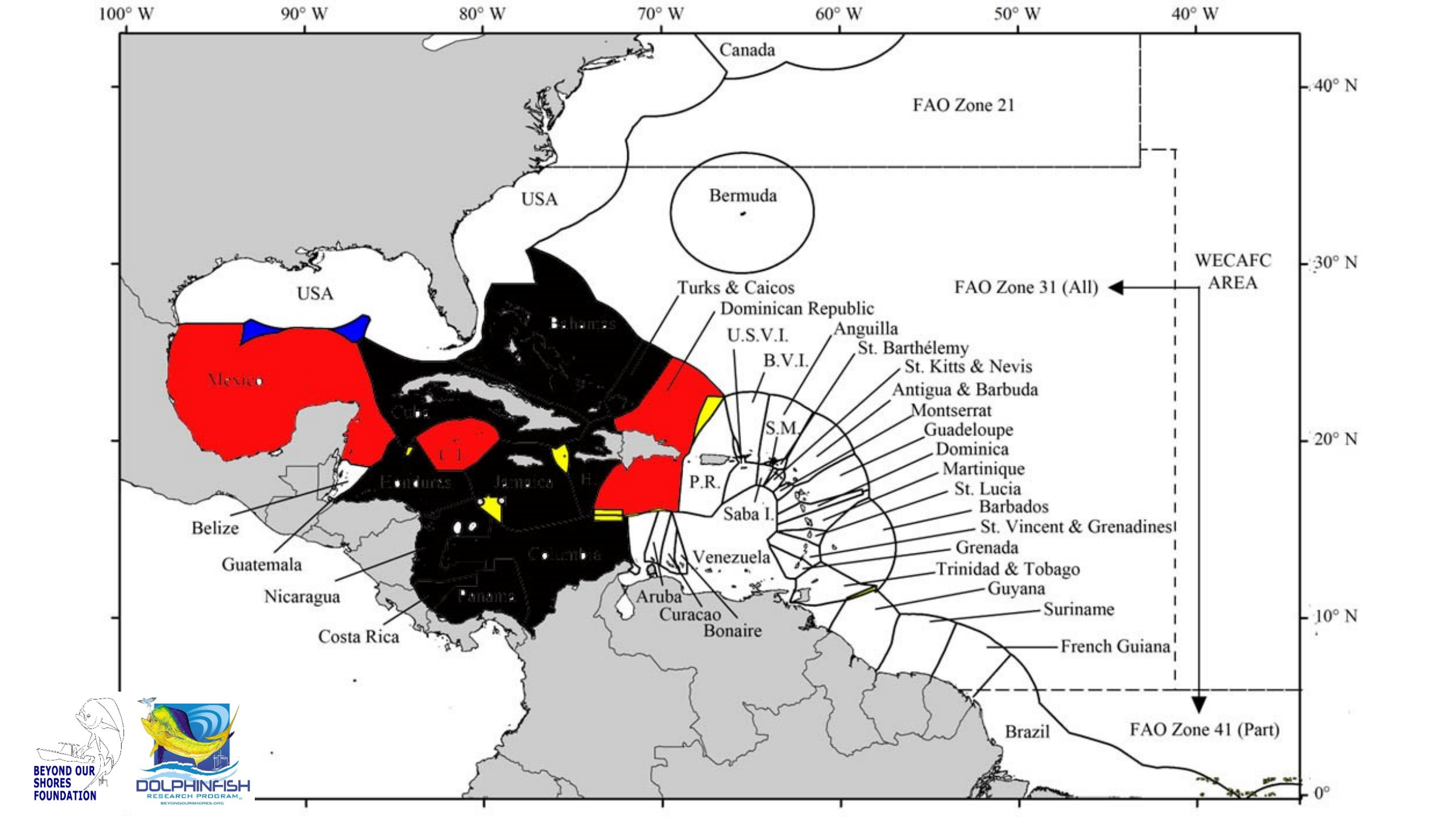

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Marine Policy 143 (2022) 105189

Contents lists available at ScienceDirect

Marine Policy

journal homepage: www.elsevier.com/locate/marpol

Full length article

Condition of the international fisheries, catch and effort trends, and fishery data gaps for dolphinfish (*Coryphaena hippurus*) from 1950 to 2018 in the Western Central Atlantic Ocean

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[d] Department of Mathematical Sciences, University of Puerto Rico, Mayagüez, Puerto Rico
[e] Unaffiliated

ARTICLE INFO

Keywords:
International fisheries
Dolphinfish
Catch and effort
Precautionary management

ABSTRACT

We conducted a scientific literature review, and a comprehensive analysis based on international fisheries databases, for dolphinfish (*Coryphaena hippurus*) from the Western Central Atlantic Ocean (WCA) from 1950 to 2018. This analysis updated the dolphinfish catch and efforts trends in comparison to those calculated in Mahon (1999), the first regional catch review for the species that was conducted with data from the 1950s through the mid-1990s. Results showed that the commercial pelagic longline effort doubled within, and quadrupled outside, of national jurisdictions. Commercial landings increased nearly three-fold, but 23 nations still do not report explicit dolphinfish landings to the FAO yet are known to catch dolphinfish. In the WCA, the US Atlantic recreational fishery represents the largest reporting sector by two-fold. When combined with reported commercial landings for 2016, total direct dolphinfish catch was 14,110 metric tons, of which 62 % was estimated to be recreational catch. Since the first regional fishery analysis of dolphinfish, the uncertainty of the status of the fishery has increased with several nations reporting higher landings of unidentified marine fish species. Also, new burgeoning social (e.g., FAD programs) and environmental processes (e.g., *Sargassum* blooms) lead to the presumption that higher amounts of juvenile dolphinfish are caught throughout the region. First reports of consequential amounts of dolphinfish bycatch have been documented in the pelagic longline fisheries, as well as the first modeled and anecdotal evidence of stock decline has been suggested. Results stress the immediate need for WCA nations to adopt a precautionary approach for proper fishery management of dolphinfish throughout the WCA, not only to increase spawning biomass but also for overall stock health and its conservation.

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Case Study 1 Summary:

PR Segment

* Dolphin dominated charter catch last 14 months; dominated catch for records back to 2016

* Summer; dolphin < dominate due to catch of tuna; > at FADs; majority small

*Fall; dolphin catch ⬆; > NonFAD catch; majority small

*Winter; dolphin overwhelmingly caught at FADs & away; 30% 11-20 lbs at FADs; up to 50 lbs

*Spring; Equal % of 1-10, 11-20 FAD vs. NonFAD; > amount of 21+ at FADs

*Overall, more small fish caught away from the FADs; FADs can hold large fish = > opportunities

*477 recreational trips off north coast of PR resulted in 0 catch over last 14 mo.

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Case Study 1 Summary:

Western Caribbean Segment

*16 outings southern DR 416 lbs/trip; slow spring 23' season

*Spring run along south coast is major focus of DR supply chain research

*Fish4ACP- DR volume ⬆ 3X since 2000; 36% catch estimated – lends the question of what is the actual amount of commercial landings?

*No dolphin specific landings reported in 8 EEZs west of DR & all upcurrent of Florida Straits

*23 EEZs not reporting dolphin landings; reported landings dominated by recreational sector

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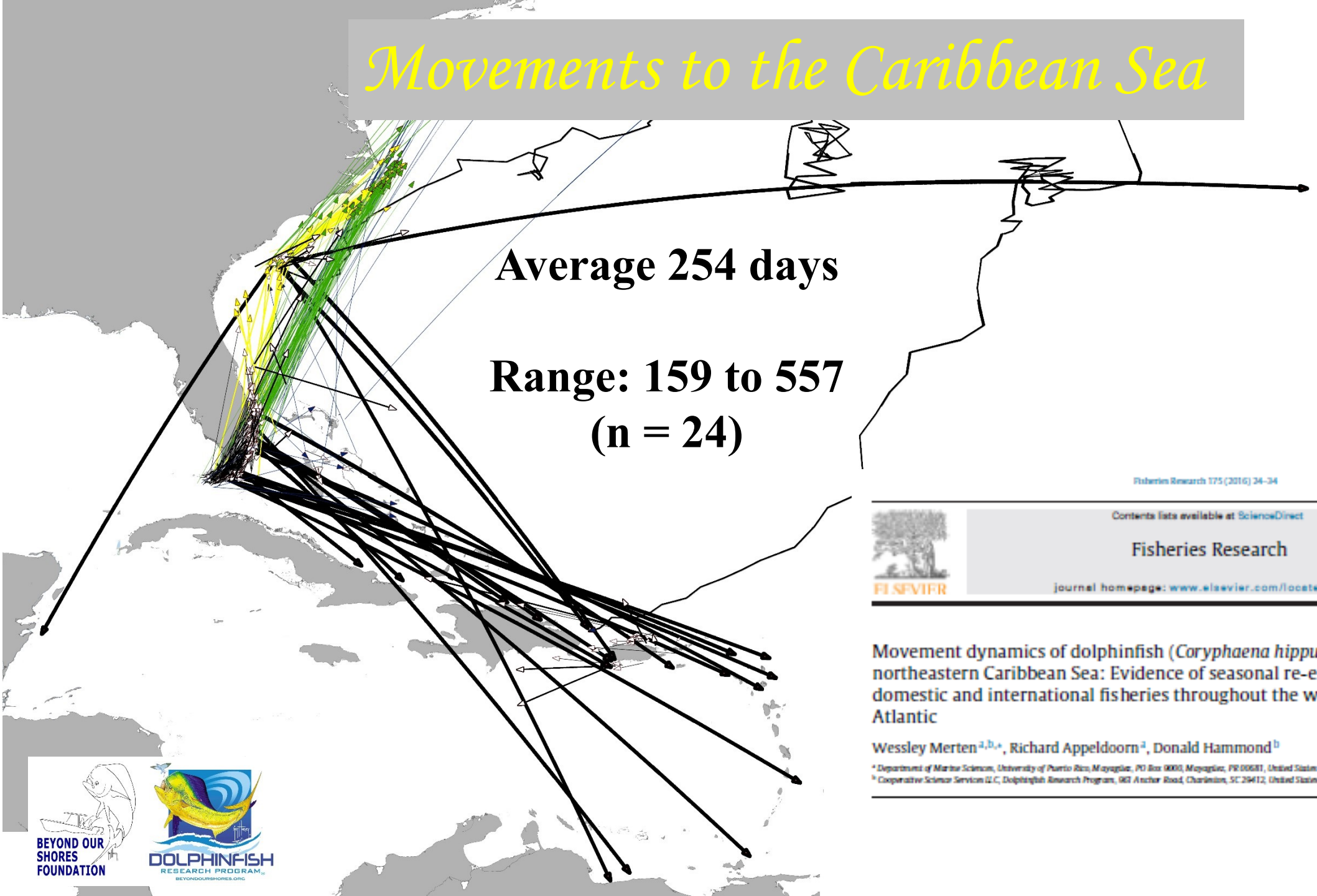
Case Study 2: Movements in the Caribbean Sea

Picture: W. Merten

Movements to the Caribbean Sea



Average 254 days

Range: 159 to 557
(n = 24)

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Fisheries Research 175 (2016) 24–34

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Fisheries Research

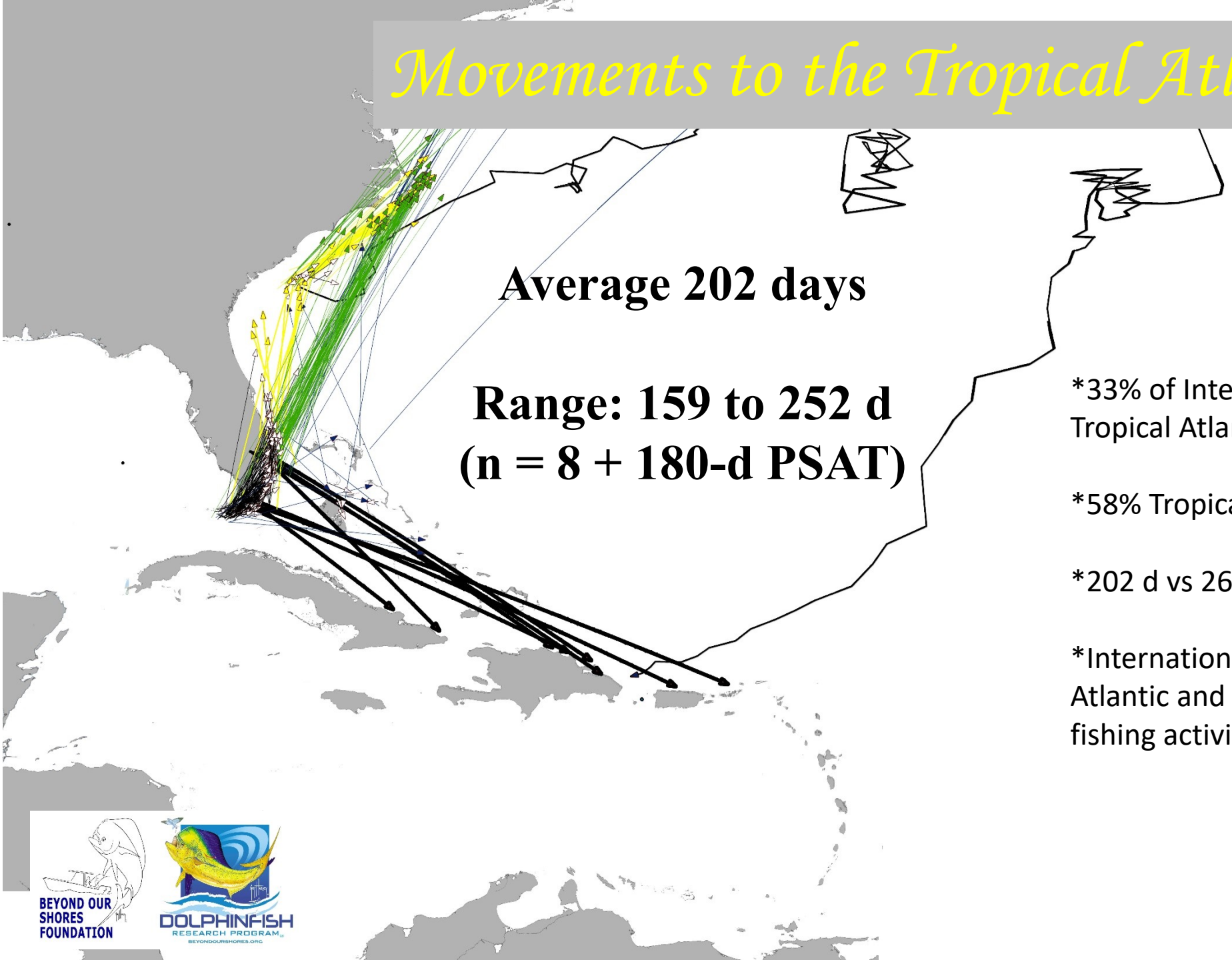
journal homepage: www.elsevier.com/locate/fishres

Movement dynamics of dolphinfish (*Coryphaena hippurus*) in the northeastern Caribbean Sea: Evidence of seasonal re-entry into domestic and international fisheries throughout the western central Atlantic

Wessley Merten[a,b,*], Richard Appeldoorn[a], Donald Hammond[b]

[a] Department of Marine Sciences, University of Puerto Rico, Mayagüez, PO Box 9000, Mayagüez, PR 00681, United States
[b] Cooperative Science Services LLC, Dolphinfish Research Program, 983 Anchor Road, Charleston, SC 29412, United States

Movements to the Tropical Atlantic



*33% of International Movements to Tropical Atlantic

*58% Tropical Atlantic/Northern Leewards

*202 d vs 268 d

*International dispersals highlight Tropical Atlantic and Northern Leeward Islands fishing activity.

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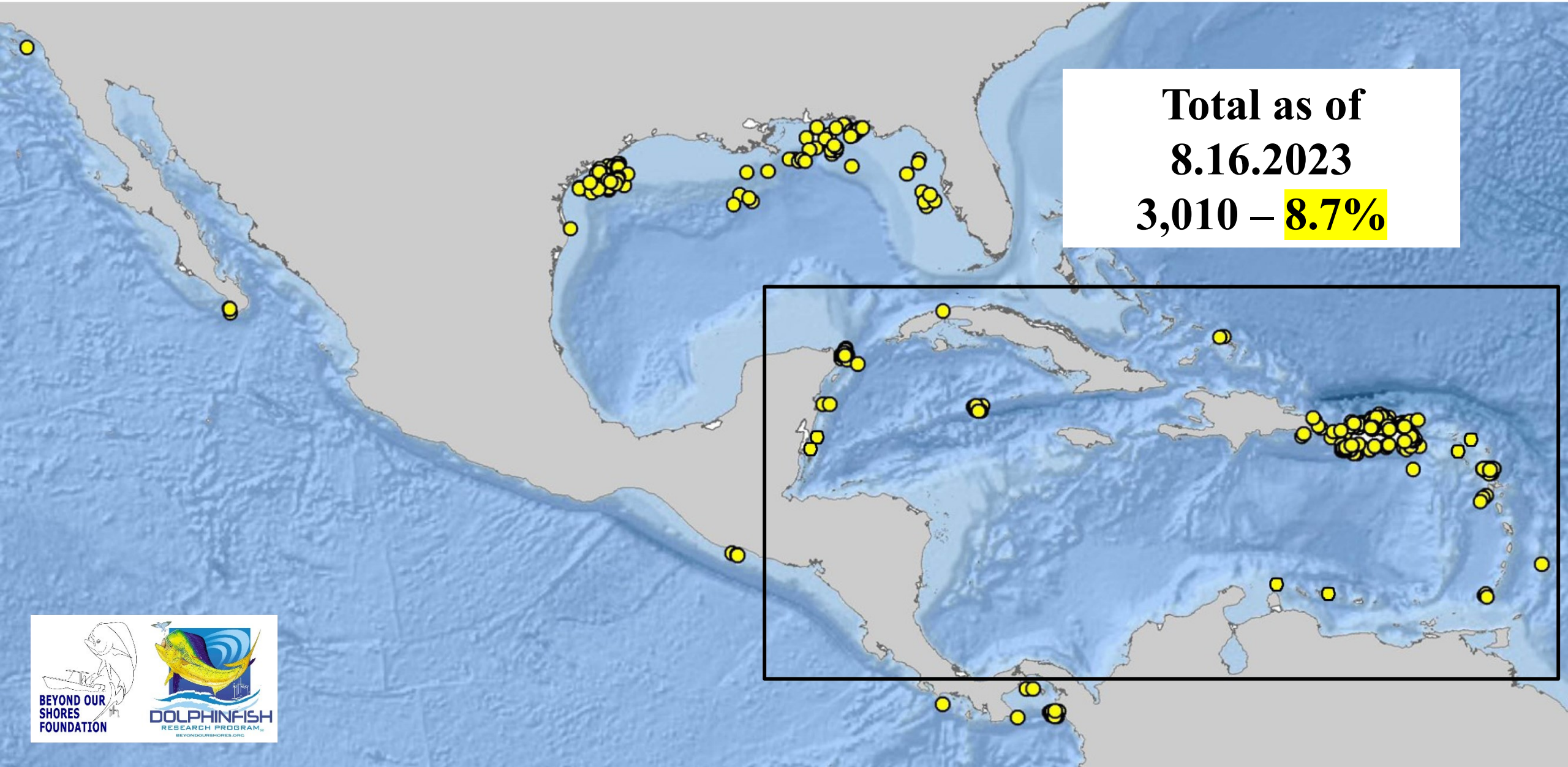
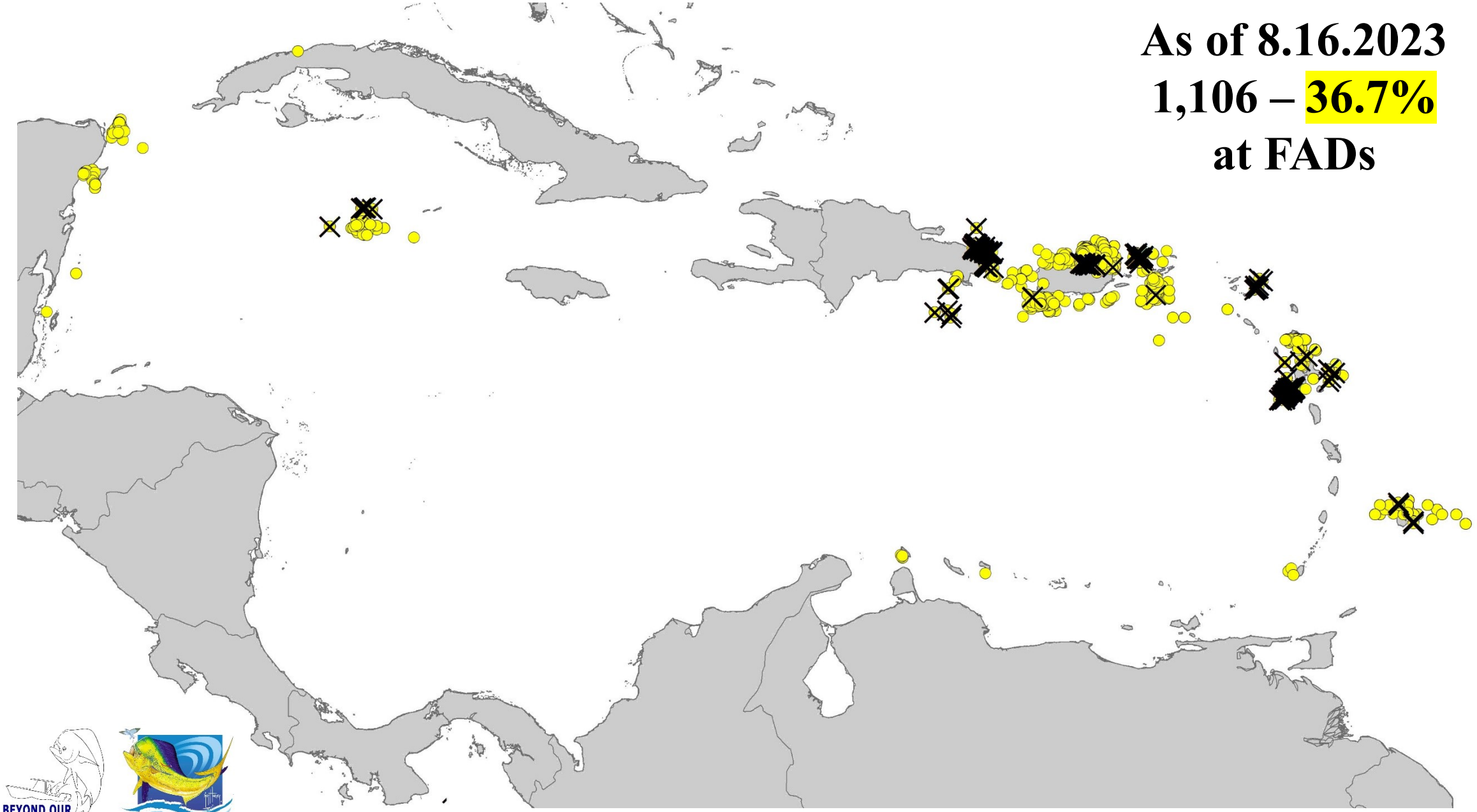
Caribbean Sea Tag Deployments





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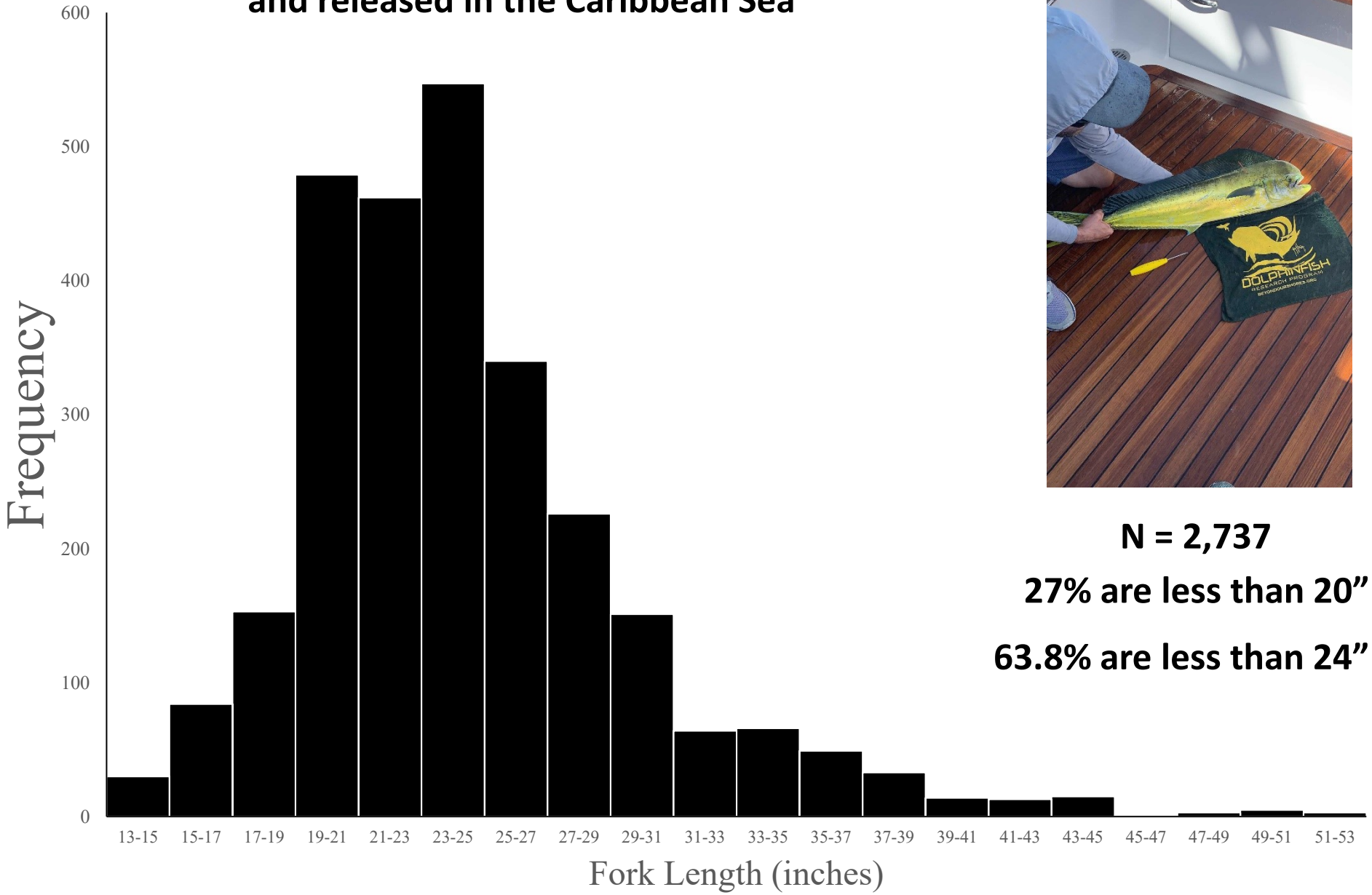
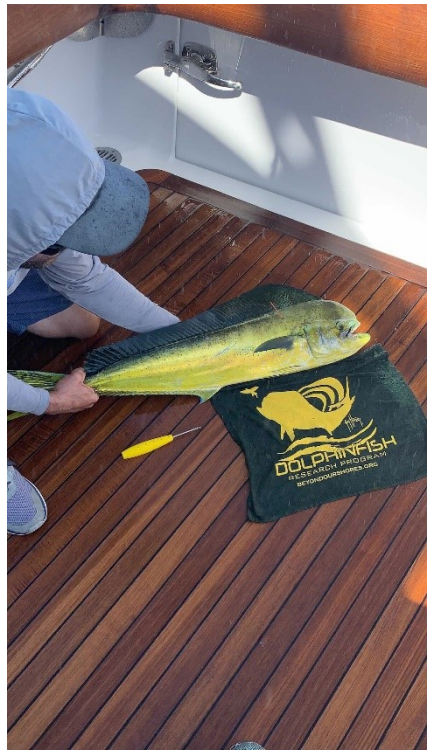
Frequency of fish tagged and released in the Caribbean Sea





N = 2,737

27% are less than 20” FL

63.8% are less than 24” FL

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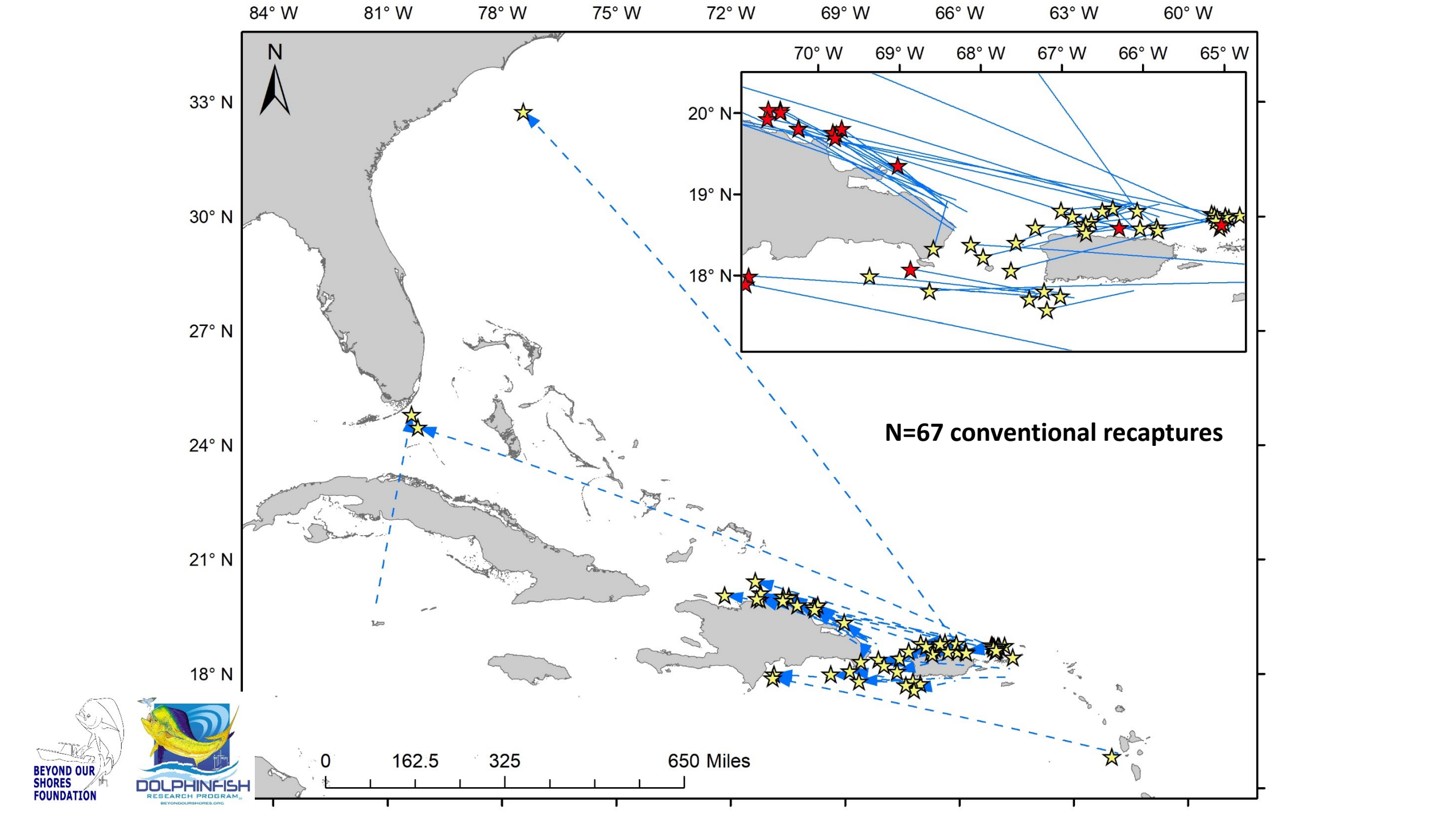
84° W
81° W
78° W
75° W
72° W
69° W
66° W
63° W
60° W
N
33° N
30° N
27° N
24° N
21° N
18° N
70° W
69° W
68° W
67° W
66° W
65° W
20° N
19° N
18° N
N=67 conventional recaptures
0
162.5
325
650 Miles
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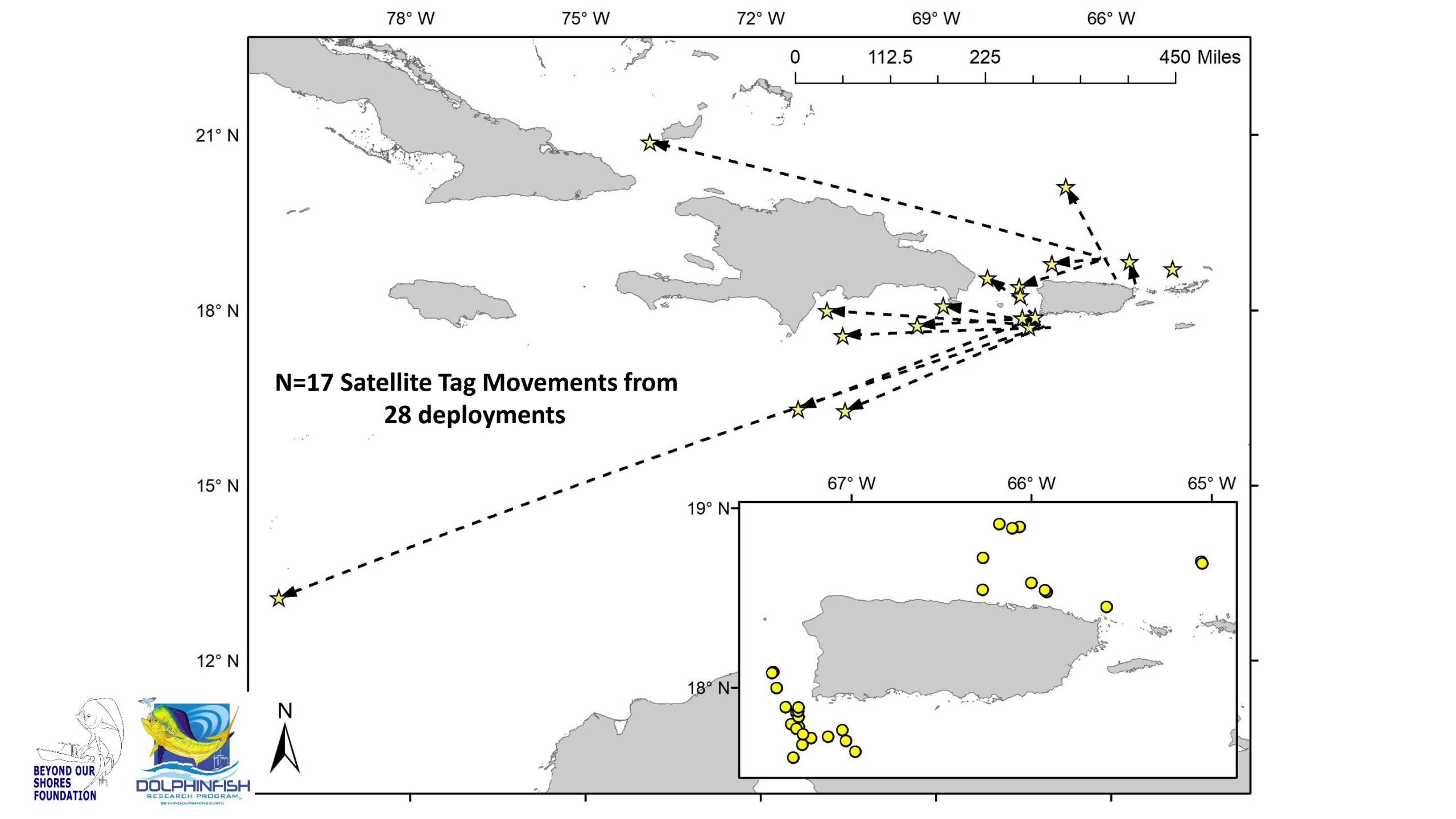
78° W
75° W
72° W
69° W
66° W
0
112.5
225
450 Miles
21° N
18° N
15° N
12° N
N=17 Satellite Tag Movements from
28 deployments
67° W
66° W
65° W
19° N
18° N
N
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44” Cow released 3.30.2022

Picture: W. Merten

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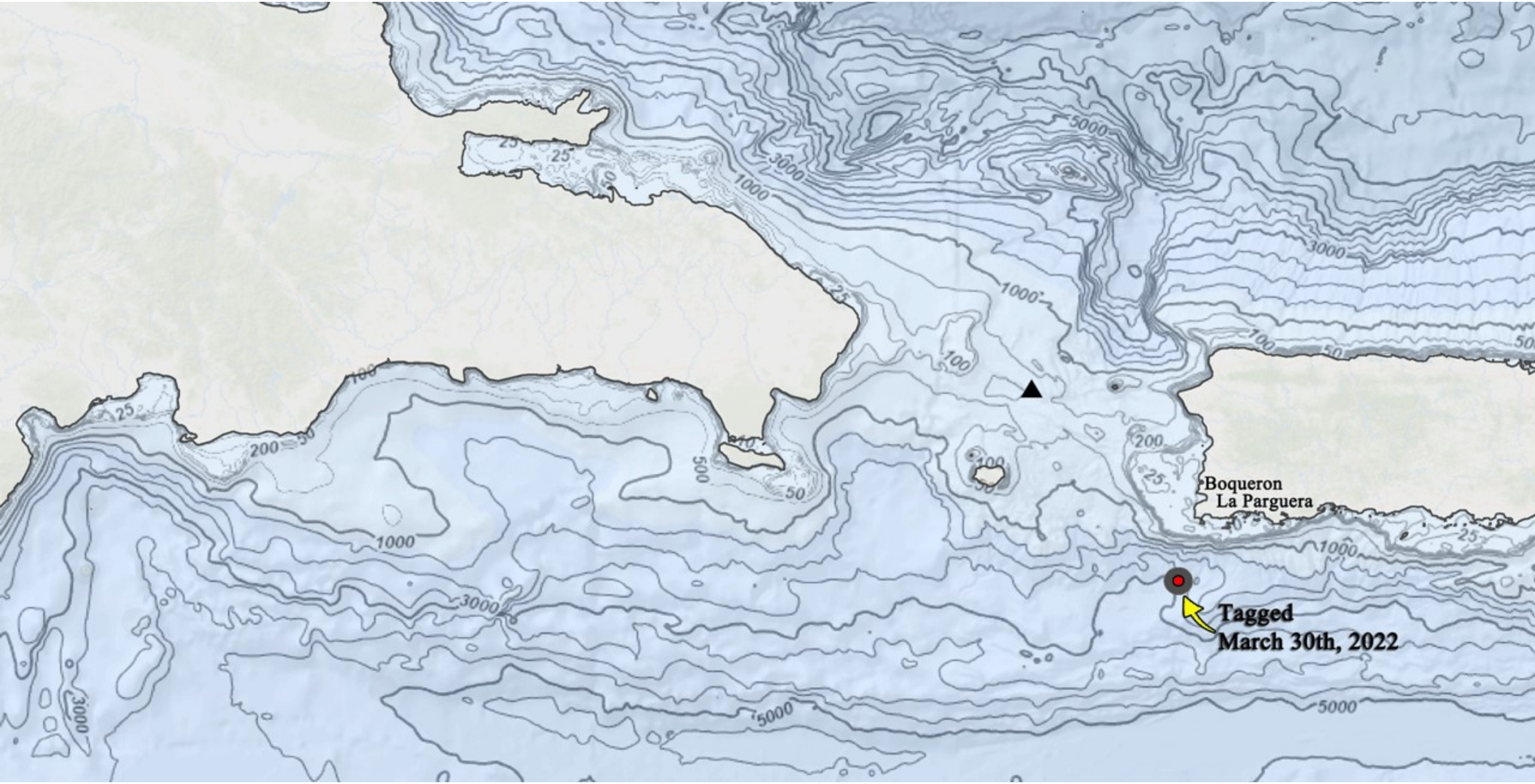
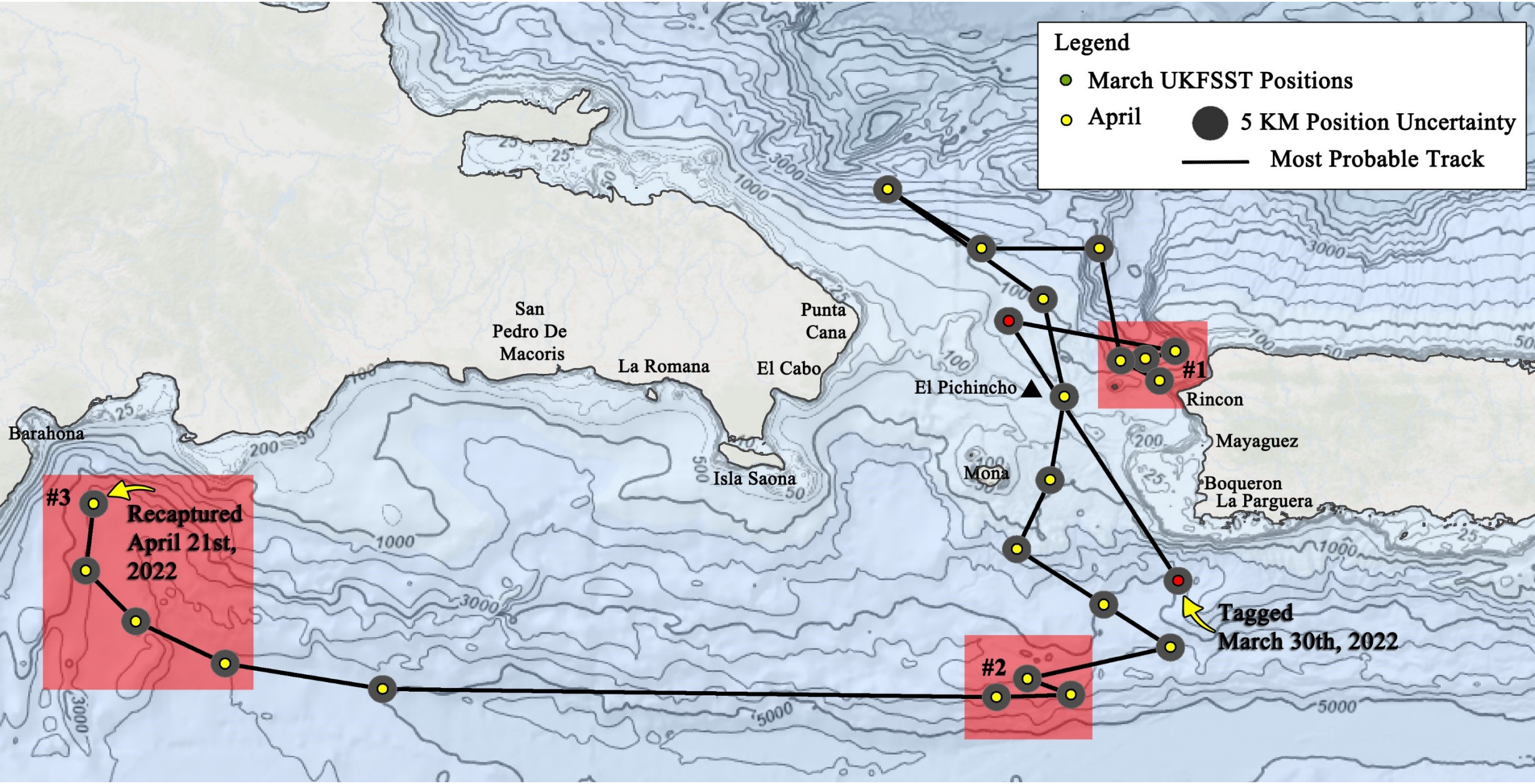
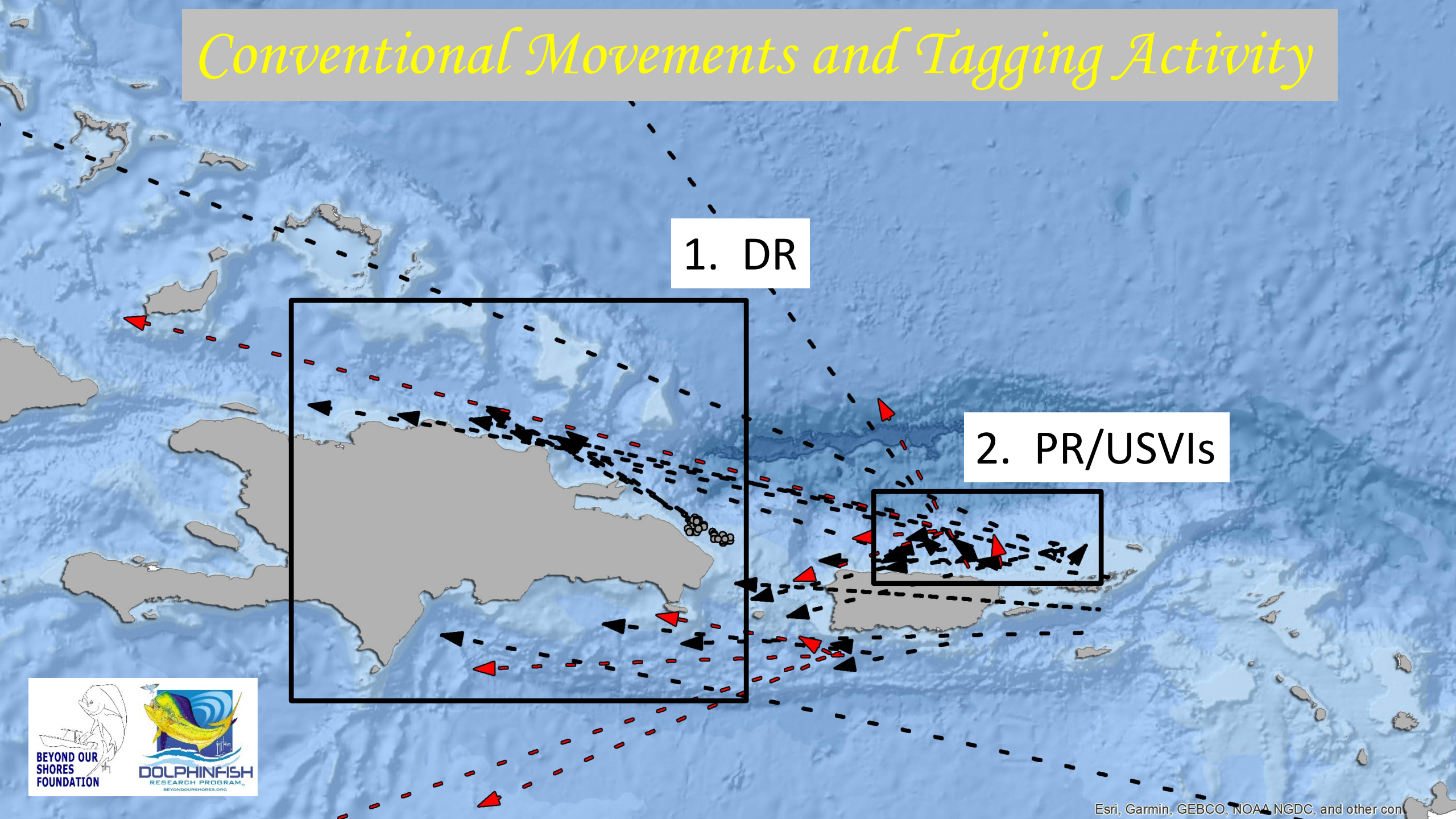
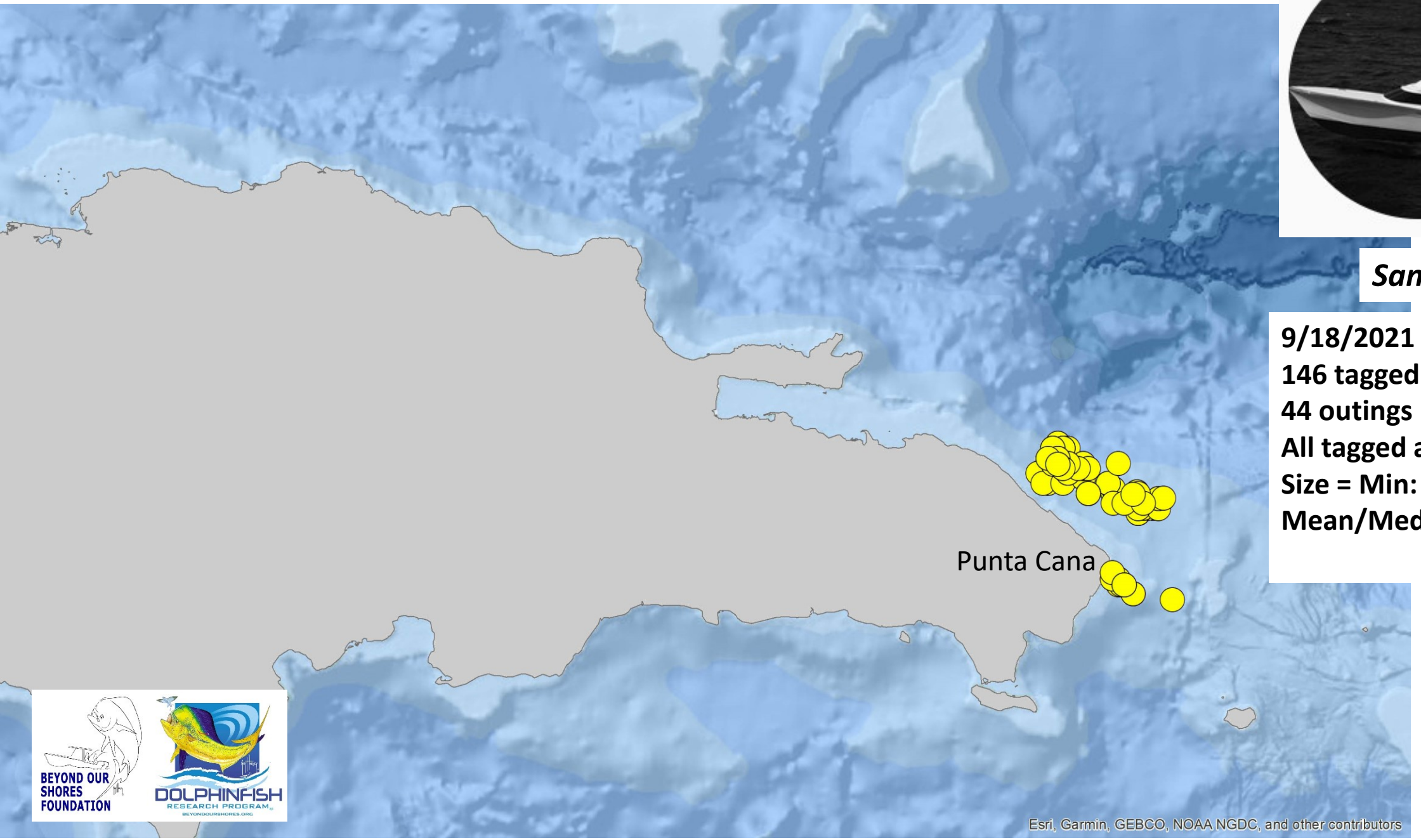


Animation – not viewable in PDF


Legend
March UKFSST Positions
April
5 KM Position Uncertainty
Most Probable Track
San
Pedro De
Macoris
La Romana
Punta
Cana
El Cabo
Isla Saona
El Pichincho
Barahona
Mona
Rincon
Mayaguez
Boqueron
La Parguera
#1
#2
#3
Recaptured
April 21st,
2022
Tagged
March 30th, 2022

Conventional Movements and Tagging Activity





Sandman

9/18/2021 to 12/1/2022
146 tagged
44 outings
All tagged at or near FADs
Size = Min: 16”; Max: 38”;
Mean/Median/Mode: 26”

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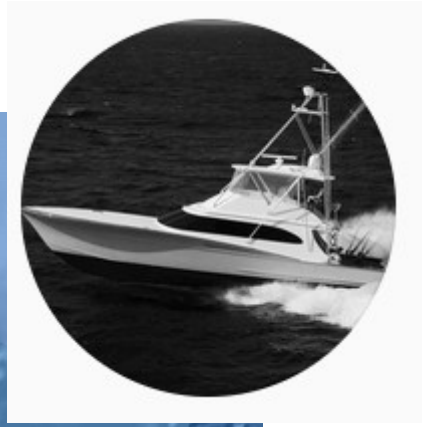
12 of 146 recaptured or 8.2%

All recaptures occurred at FADs
19 days at liberty on average



Sandman

9/18/2021 to 12/1/2022
146 tagged
44 outings
All tagged at or near FADs
Avg size: 26.2”

Puerto Plata

Cabrera

Punta Cana

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Sandman's 8.2% recapture rate remains higher than…

and Killin' Time II's highest 5.1% June-August rate in the Florida Keys - the location of the largest directed dolphin sector in the region.

Wam-Jam's highest 5.9%

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Case Study 2 Summary:

* Sandman Fishing Team's recapture rate remains the highest for a tagging team in the DRP over a seasonal window

* Tagging and recaptures (11 of 12) occurred at FADs in DR – Average size 26" FL (Fall)

* North Coast DR tag and recapture activity highlights north coast DR dolphin fishery

* Two of 12 satellite tags (16%) recovered at FADs off southern DR (Spring)

* Past reported data showed dolphin to be recaptured at FADs in the USVIs after 2 to 6 months at liberty; 4 days at PR FADs

* FADs are prevalent and increasingly referenced as reported tag and recovery sites in the Carib for the DRP over the last several years.

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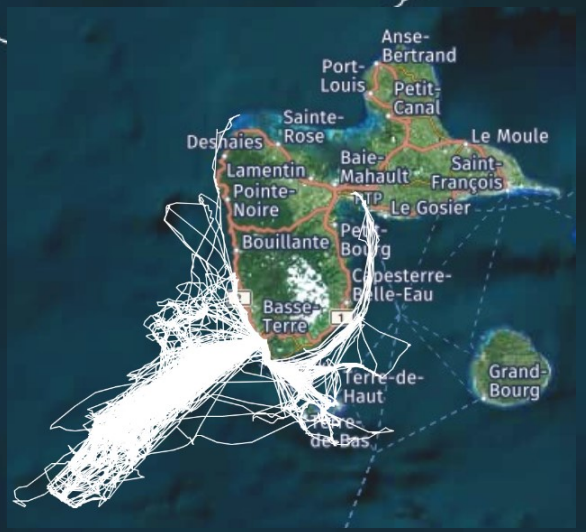
- Increase in FAD use and increase in large episodic sargassum events (Johns et al. 2020) raises the need for increased protection for juvenile and sub-adult fish

8.19.2017 to 10.15.2022
517 tagged
120 Outings
Most tagged near FADs
Size = Min: 13” Max: 35.5”
Mean (21”)/Median (21”)/Mode (18”):



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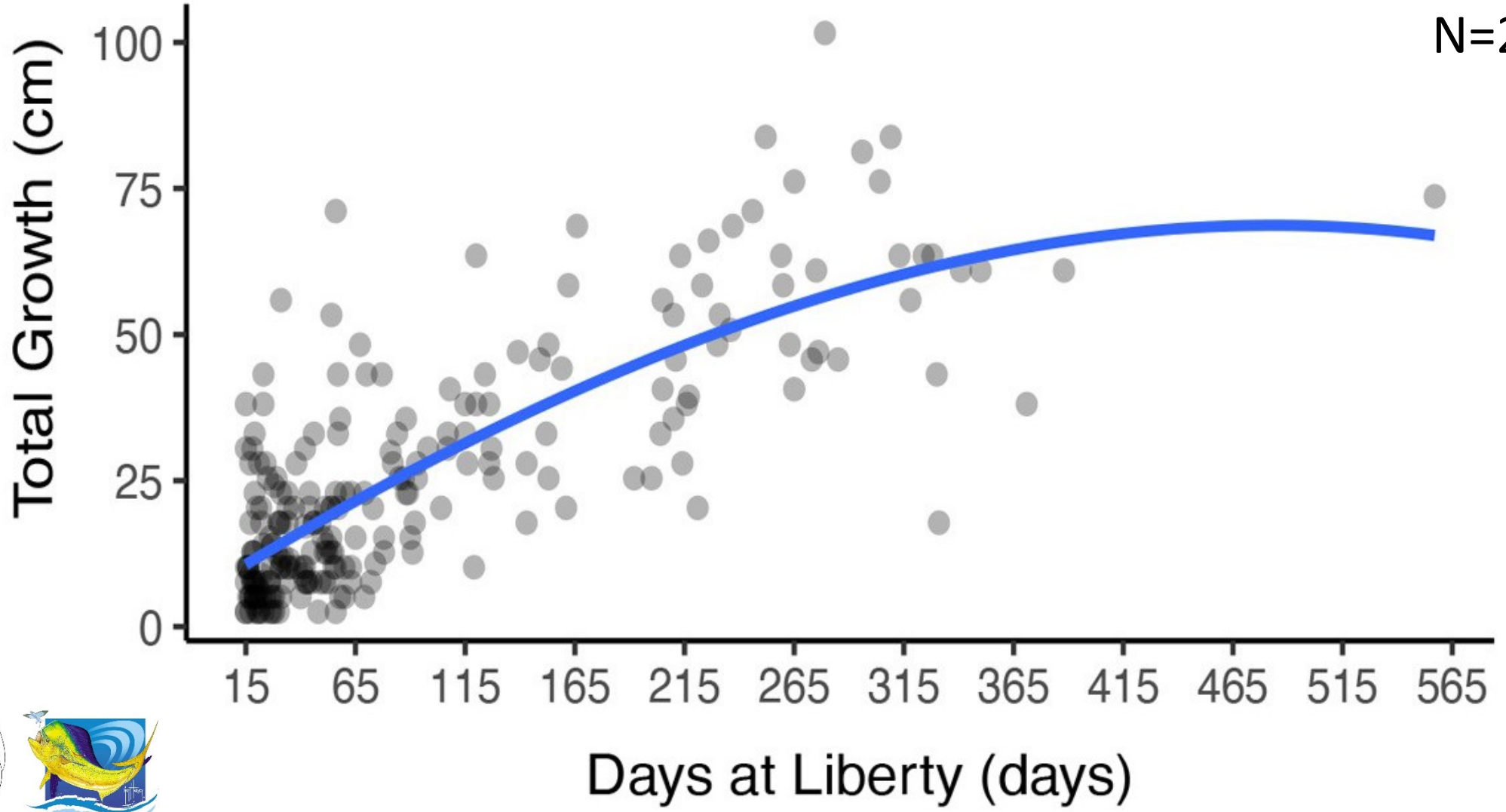
Growth

Picture: W. Merten

$$y = 25.8 + 238x - 43.8x^2 - 3.34x^3,\ R^2 = 0.61$$

N=245



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Using “All Types” after filter 0, filter dal < 14, filter 2 ITQs the model predicts growth in mm:

intercept + daily growth rate*days_at_liberty

= 10.14 mm + 1.63 mm * 365

#With days at liberty of 1 year, the model predicts:

594.95 mm

or

59.49 cm

Or

Total growth or 23.42“

Daily Growth Rate in inches = .064
Weekly Growth Rate in inches = .44”

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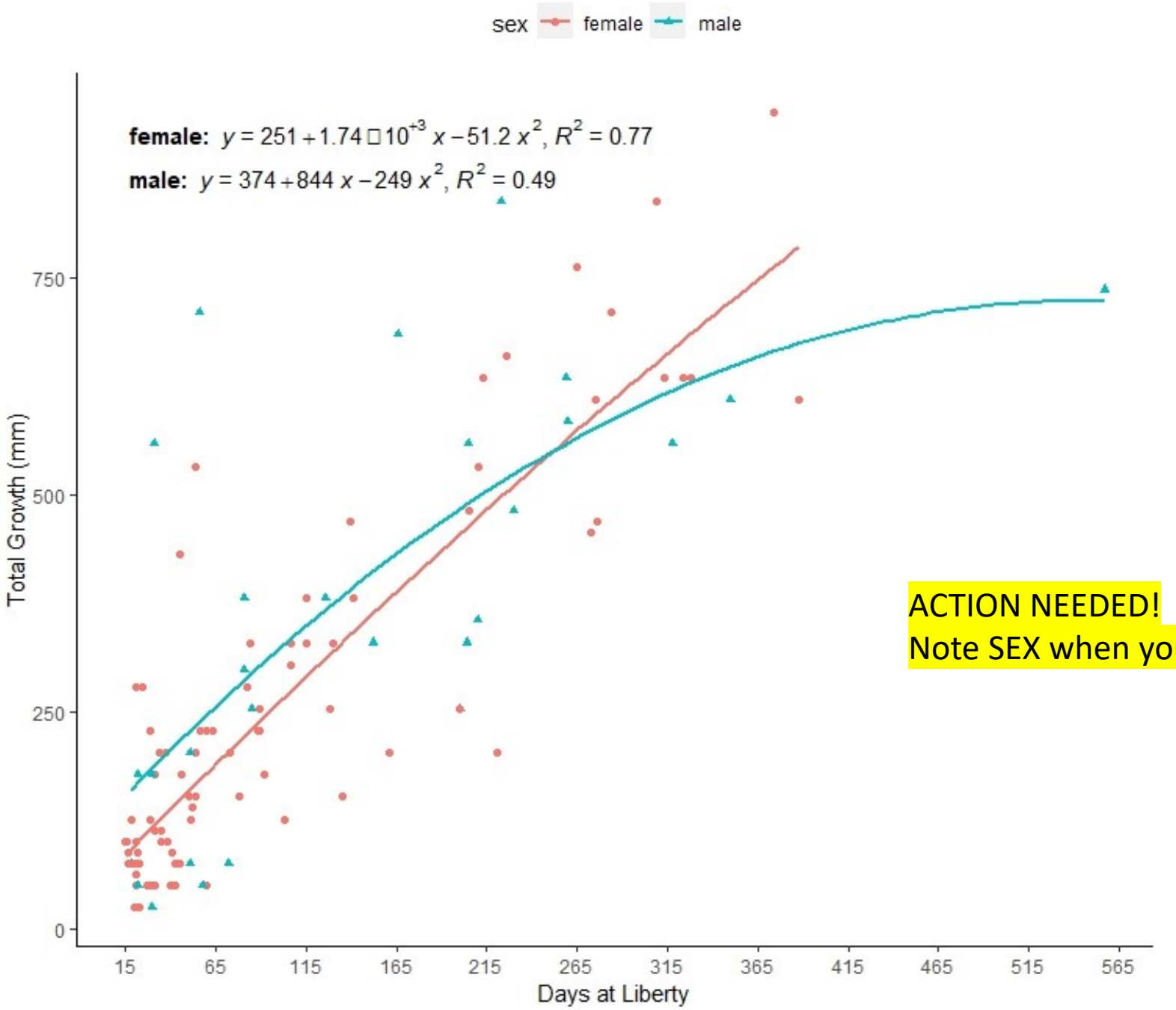

Female n = 86

Male n = 29

ACTION NEEDED!
Note SEX when you TAG FISH!!

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Conclusion: Issues Facing WCA Dolphin Stock

- Lack of data on/at FADs in Caribbean Sea and Sargassum events
- Inconsistent regulations on same stock despite transitory evidence
- Generally, small subadult fish (<24” FL) are being caught at FADs but frequency varies seasonally
- Lack of quality data on the recreational fishery yet increase in the fishery (Freire et al. 2020)
- Unknown Indirect harvest in longline fisheries (Lynch 2018)
- Lack of landings data from 23 nations in WCA
- Under reporting of landings is likely in some major FAO dolphin reporting nations in the WCA
- Increasing demand in major seafood markets (MSA 2016)
- High discard mortality (Rudershausen et al. 2019) – Need to promote use of circle hooks
- Perception of resistance to overfishing
- Underappreciate of multinational distribution which fragments data collection and management

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Questions?

Picture: W. Merten

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