Commonwealth of Puerto Rico
Department of Natural and Environmental Resources
Fish and Wildlife Bureau
Marine Resources Division

PUERTO RICO MARINE RECREATIONAL FISHERIES STATISTICS PROGRAM

FINAL REPORT
2009-2013

Hon. Carmen R. Guerrero Pérez
Secretary

Miguel A. García, Ph.D.
Director
Fish and Wildlife Bureau

Craig Lilyestrom, Ph.D.
Director
Marine Resources Division

Grisel Rodríguez
Project Leader F-42
Marine Resources Division

Yamitza Rodríguez
Project F-42
Marine Resources Division

Project Title: Puerto Rico Recreational Statistics Program

Study Title: Activity and Harvest Patterns in Puerto Rico Marine Recreational Fisheries

Grant objective
To collect, store, analyze, manage and disseminate fishery-dependent, biological and socioeconomic data on the marine recreational fisheries, their users, and their environment, within the territorial sea of the Commonwealth of Puerto Rico, in support of Management policies, strategies and tactics.

Introduction

The Puerto Rico Marine Recreational Fisheries Statistics Program was instituted in 1999 with funds from the Sports Fisheries Restoration Program to monitor for the first time the marine recreational fishery in Puerto Rico. The project was run from 1999-2013 under the Marine Resources Division, Department of Natural and Environmental Resources.

This project has filled a major gap in fisheries management. Data from this project was used in the formulation of the first modern Fisheries Regulation for Puerto Rico in 2004, in subsequent amendments to this, and in the most recent Fisheries Regulation 7949 (2010). It is also used by the Caribbean Fisheries Management Council for fisheries management plans and amendments. The data has been instrumental for the development of fishing facilities such as boat ramps and fishing piers. With the data collected, suitable areas with high recreational fishing pressure were chosen and now are some of the most important fishing spots; some examples are the municipalities of Arecibo, Guayanilla, and Cabo Rojo. Data has been also used by other researchers within and outside the agency to develop projects of importance for recreational fisheries. The data has been useful in showing data gaps or necessity of information on recreationally important species, for example for fisheries such as the dolphinfish, tarpon, and wahoo (Peña-Alvarado and Torres-Ruiz 2013, Merten, W. 2014). Most recently, data from this project was used to perform the first ever analysis of the economic value of marine recreational fisheries in Puerto Rico, by the Gulf States Marine Fisheries Commission.

To cover all aspects of the marine recreational fisheries, the Program is divided in two components: the data gathering on marine fishing tournaments and the assessment of recreational fisheries through intercept surveys. The methodology for collecting data on fishing tournaments consists of project staff attending marine fishing tournaments and collecting biometrical, catch and release data as well as total participation and effort information from records (logbooks). For the assessment of recreational fisheries, an interview form adapted for Puerto Rico from the Marine Recreational Fisheries Statistics Survey (NMFS) is used for the three main fishing modalities: shoreline, charter boat and private/rental. Data gathered includes catch, species identification, fish weight and length, effort, location, bait, fishing gear and basic socioeconomic data (party size, place of residence, species targeted etc.). Components of catch and fishing effort (CPUE) are estimated. These estimates are an important component of the fisheries analysis. Dramatic fluctuations in CPUE may be indicative of changes in regional fish abundance caused

by corresponding changes in prey availability, fish population size or the environment (Skomal G. 2002).

Job 1: Multimedia Monitoring and Review

Job Objective: To monitor appropriate literature and news on the activity and harvest patterns of marine recreational fishermen.

This has been a constant process, involving review of technical and popular publications such as nautical periodicals which supply monthly fishing tournament calendars and updates, and especially internet searches which provide valuable information regarding publicized Puerto Rico deep-sea and light tackle charter recreational fishery activities. In addition, monitoring requires on-site verification of pending or last minute fishing tournaments, especially at commercial fishing associations and small-scale marinas, not published in local papers. Such literature may be in the form of pamphlets and brochures.

Procedures/Results

Literature information has been collected periodically, and is currently in progress through multi-resources such as the Internet as well as produced reports generated from recreational fishery projects. Also, digital fish photographs were downloaded and filed along with pictures that had been scanned from original prints. This file is continually updated and was used in fish tests and training for interviewers.

Job 2: Assessment of Marine Recreational Tournament Fishery Procedures/Results

Job Objective: To estimate tournament landings and/or releases by kilogram and catch per unit effort of marine recreational anglers. To collect, store and analyze biostatistical and socioeconomic information, on-site effort, landings and/or release data. Tournament surveys included dolphinfish (*Coryphaena hippurus*), tarpon (*Megalops atlanticus*), snook (*Centropomus undecimalis*), billfish (Istiophoridae) and any other finfishes such as snappers (Lutjanidae), groupers (Serranidae), etc.

Procedures

Marinas and angler associations throughout the Island were called to develop a fishing tournament calendar for each year from 2009-2013. DNER personnel contacted tournament organizers to determine the arrival time of fishermen and the weighing period for each tournament. During the first fishing day, the number of participants and boats in the activity as well as a copy of the rules of the tournament were requested.

Fishermen were contacted upon their arrival at the weigh station, where they were interviewed regarding fishing for the day. The following information was obtained: A) Boat name B) Number of people fishing C) Time spent fishing D) Fishing location E) Fish species F) Number

of tags/releases G) Fish Condition at release (e.g. Mutilated, healthy, dead etc) H) Sex I) Length (mm) J) Weight (lbs/kg) of boarded fish.

For the purpose of this study, the term "by-catch" refers to any fish species that was not targeted for points or prizes in the tournament. The information on by-catch was mostly collected at the piers, not at the official weigh station. Whenever possible, all boarded fish were measured and weighed for each boat.

The data were entered for further analysis using Microsoft Access 2007®. The information was annotated to determine size and weight frequencies by species. These data were used to determine Catch per Unit Effort (CPUE) for the fishing activity. All boarded fish were measured to the nearest millimeter (mm) and weighed in pounds during the tournament and then further converted to kilograms for data analysis. All measurements were taken in a straight line from the fish lower jaw (LJ) to the tail fork (TL).

For Billfish, measurements were taken drawing a straight line on the floor from the lower jaw (LJ) to the tail fork (TF). To standardize the data, ORC Macro Intercept Interviewing Manual for the Atlantic and Gulf Coasts ten (10) digit species code was applied.

From the data collected, the catch per unit effort was determined using the following formula:

Catch per unit effort=CPUE=C/f

Catch=C=No. of fish

Fishing Effort=f=No. Boats x hours-spent fishing

Results

The Puerto Rico Department of Natural and Environmental Resources (DNER) has continuously monitored marine recreational fishing tournaments in Puerto Rico over the past 14 years. This has helped the agency to have a better understanding of the activities related to recreational fishing and create management measures to promote the sustainability of the fishery resources around the Island and its territories. Determining life history, biological trends, fishermen preferences and even the economic impact this fishery has on the local economy are important factors to consider in the management and development of fisheries.

Since the 1950's, recreational or sport fishing tournaments have been monitored on the Island. At first, only Blue Marlin tournaments were monitored since they were a great source of tourism activity and of particular interest to the scientific community in the description of the Puerto Rican fishery (Rodriguez-Ferrer et al. 2005). The DNER Marine Recreational Fishing Tournament monitoring began in 1999 and covered about 12 events that year. Since then, a more standardized and comprehensive monitoring began and about 25-39 events are covered each year.

There are least 25 major tournaments, run by 12 clubs and marinas throughout Puerto Rico. This report summarizes activities related to marine recreational fishing tournaments for the period of 2009-2013.

Over this period, a total of 164 tournaments were monitored comprising a total of 271 fishing days (Table 1). Marine recreational fishing tournaments in Puerto Rico mostly targeted migratory species like dolphinfish, wahoo *(Acanthocybium solandri*), and blue marlin (*Makaira nigricans*). Of these, only dolphinfish is both a recreational and commercially important species (Rodriguez-Ferrer et al 2006). Other types of tournaments that target inshore species are less common.

Table 1. Summary of events per tournament type (2009-2013).

Target Species	2009	2010	2011	2012	2013	Totals
Blue Marlin	14	12	10	10	10	56
Dolphinfish	6	6	7	10	8	37
Trolling/Several Species	1	3	4	0	3	11
Shore	1	1	2	3	4	11
Kayak	0	0	0	5	5	10
Sailfish	2	1	3	2	1	9
Wahoo	2	1	1	1	1	6
Tarpon	1	1	1	2	1	6
Wahoo/Sailfish	1	1	1	1	1	5
Dolphinfish/Wahoo	2	1	1	0	0	4
Mackerel	1	0	0	2	0	3
Bottom	1	0	1	1	0	3
Great barracudas	0	0	2	0	0	2
Lionfish	0	0	0	2	0	2
Totals	**31**	**27**	**33**	**39**	**34**	**164**

Pelagic fishing tournaments have always been the most common type of tournament in Puerto Rico. The main reason is that this type of event brings more people; advertising is greater and it is easier for staff to find out about them. Shore or inshore fishing tournaments are less popular, less formal and harder to monitor because they are not as widely advertised as pelagic tournaments.

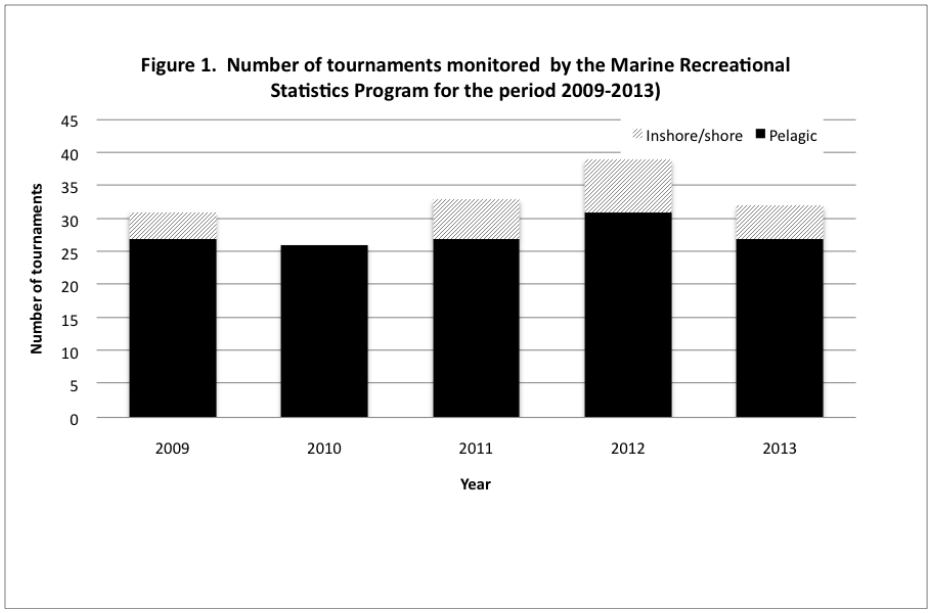


Figure 1. Summary of the number of fishing tournaments by type for the periods 2009-2013. Note that pelagic tournaments are more prevalent.

Participation in these events has remained somewhat consistent throughout the period (Figure 1). It is worth mentioning that since 2012, events such as lionfish tournaments and kayak fishing tournaments have added variety to the events around the island. Although small, compared to other events, these have been successful in attracting anglers to their activities and appeal to a new sector of the fishing community. Lionfish fishing tournaments were unique in the fact that spear fishing was the primary fishing mode in the events. Spear fishing with scuba is only allowed for lionfish fishing. Under current regulations, recreational fishermen are not allowed to spearfish with scuba for other species.

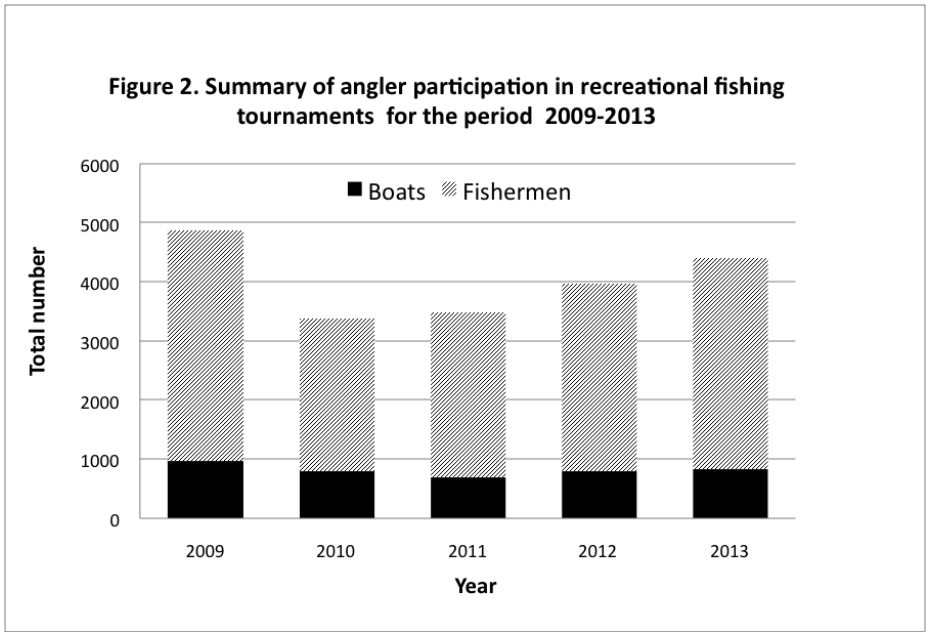


Figure 2. Summary of angler participation in recreational fishing tournaments for the period 2009-2013.

Some angler associations organize small events that they don't consider tournaments just because of their smaller angler participation and they do not comply with the proper permits. For the purpose of this project, any event in which fishermen come together and compete with other fishermen is considered a tournament and for the most part were covered by the personnel or the data was collected after the activity. In 2012 and 2013, some tournaments targeting billfish and dolphinfish were held without proper monitoring. Project staff contacted event organizers but some information was not available. In previous years, information regarding events not monitored by our staff was made available by some clubs or was found in local press.

Summary of Dolphinfish (Coryphaena hippurus) tournaments

Since 2005, after the new fishing regulations for Puerto Rico were implemented, tournaments have been complying with the bag limit established for the species. Although an exemption to this bag limit can be applied to marine tournaments no event has ever been granted the exemption (DNER permit division pers. comm.). Dolphinfish fishing tournaments have become the most sought after fish for recreational fishermen (Rodriguez-Ferrer and Rodriguez Ferrer 2009). In the 2009 period, a bag limit of 20 fish per boat was established for all recreational activities by PRDNER. In 2010, the bag limit was again amended to 30 fish per boat (PRDNER Fisheries Regulation 7949) and that bag limit still prevails for landings. Since its establishment in 2006, the quota has had an effect on tournament rules and consequently on the number of landings. Most clubs eliminated the smallest fish and the most-fish-caught categories from their prize categories. That was enhanced by a minimum weight established by some clubs. Until

2010, this minimum weight was 10 pounds, but in 2011 it was changed to 5 pounds, and thus smaller fish were landed (Rodriguez Ferrer and Rodriguez Ferrer 2011). For the period of 2012-2013 tournament organizers set the minimum weight at 10 pounds for qualifying fish, and even so fishermen harvested non-qualifying fish just to catch the allowed bag limit.

We are aware of fishermen that land more than the established bag limit. Most dolphinfish is sold at these events, although fishermen are aware that to buy/or sell fish caught recreationally is illegal.

In the case of dolphinfish, a total of 37 tournaments targeted dolphinfish from 2009-2013 (Table 1). In 2010, a total of 12 tournaments were for dolphinfish making this the year with the most events in the period (Table 1). Total participation in these events for the period 2009-2013 was 4,081 anglers in 1,406 boats (average 816 fishermen per year, and 209.2 boats per year). Income to the Clubs from tournament fees for the period of 2009 to 2013 was approximately $311,619.00; the average income was $62,324.00 per year (Table 2).

Table 2. Income and participation per year for Dolphinfish (*Coryphaena hippurus*) tournaments (2009-2013).

Year	Events	Fishermen	Boats	Income from tournament fees
2009	6	928	225	$69,655
2010	6	664	166	$45,299
2011	7	734	194	$65,880
2012	10	861	230	$59,915
2013	8	894	231	$70,870
Average	**7.4**	**816.2**	**209.2**	**$62,324**
Totals	**37**	**4,081**	**1,046**	**$311,619**

A total of 43,270.42 kg of dolphinfish was reported as harvested during these events in the 5-year period with an average of 8,654.08 kg per year (Table 3). Total weight for 2010 is different from other years and the main reason is that due to the lack of personnel several tournaments were not covered and data is missing.

Table 3. Total weight of target species (kg) by tournament type for fishing tournaments 2009-2013.

Tournament type	2009	2010	2011	2012	2013	Total	Average
Dolphinfish (*C.hippurus*)	9,656.76	4,871.11	7,986.50	9,734.25	11,021.80	43,270.42	8,654.08
Blue marlin (*M. nigricans*)	660	1,030.21	479.8	241.13	806.88	3,218.02	643.6
Wahoo (*A. solandari*)	N/D*	248.9	307.72	1,112.22	908.5	2,577.34	644.33
Wahoo/dolphifish	218	265.9	273.16	NT	NT	757.06	252.35
Wahoo/Sailfish	N/D*	145	60	205	182	592	148
Several species	0	18.08	158.3	0	0	176.38	88.19
Shore	72	146.86	11.31	55.06	38.37	323.6	64.72
Kayak	NT	NT	NT	71.32	77.59	57.81	67.7
Tarpon/Snook**	0	0	0	0	0	0	0
Total	10,606.76	6,726.06	9,276.79	11,418.98	13,035.14	50,972.63	10,562.97

*ND=No weight data, **=all released, NT=No tournament

The fish landed ranged from 406 mm to 1,422 mm. Size frequency distribution for the species differs between and among years.

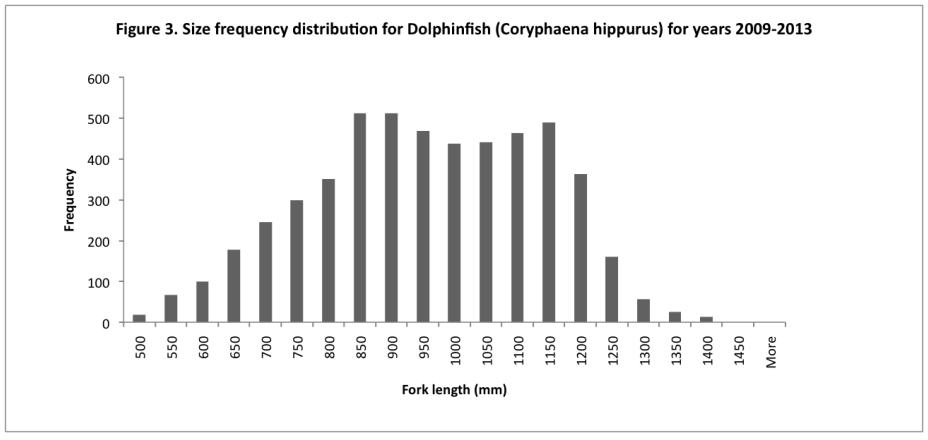


Figure 3. Size frequency distribution of dolphinfish (*Coryphaena hippurus*) all years combined (2009-2013).

Several trends are noted when the size frequency distribution of the species is divided by year (Figure 4). There is a marked tendency between 2009 and when the new bag limit regulation was established. The distribution goes from normal to bimodal distribution mainly is due to the fact that with the imposed bag limit the tendency is to target the large individuals.

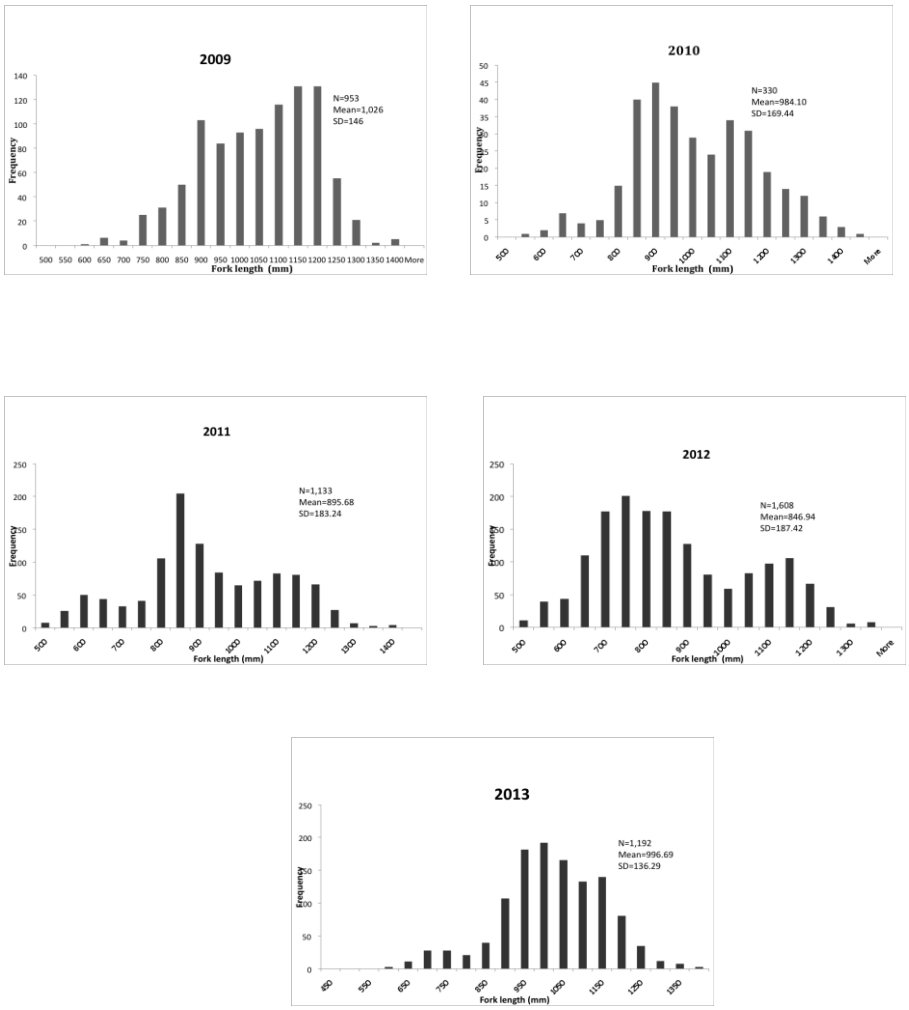
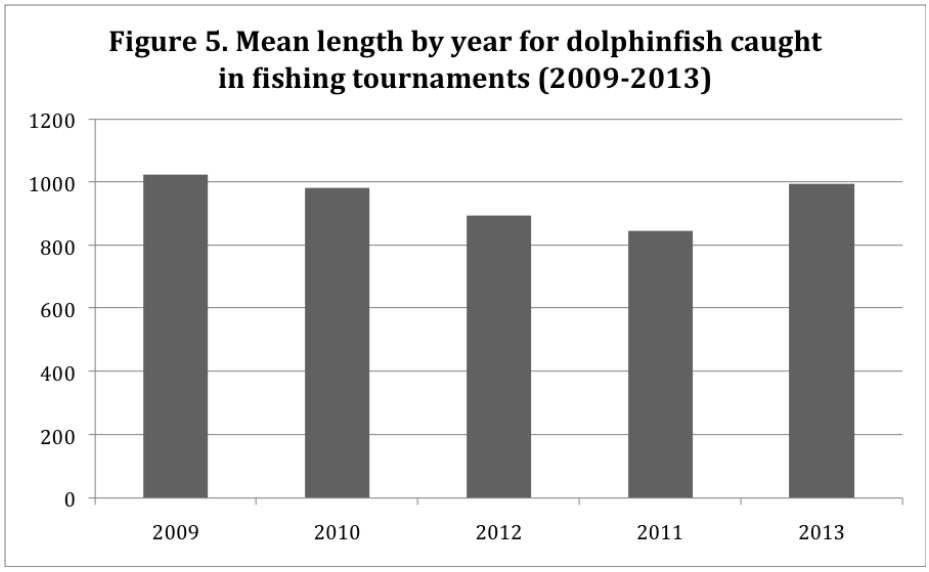


Figure 4. Size frequency distribution by year for dolphinfish (*Coryphaena hippurus*)

When mean length by year is compared there is no marked tendency and the mean size ranges from 800-1000 mm – all adult individuals. Currently, some research on dolphinfish biology and genetics are being conducted in Puerto Rico, which could help guide better management of the species in Puerto Rican waters (Merten W. 2014, unpublished).



Summary of Blue Marlin (Makaira nigricans) tournaments

The second most important target species is the blue marlin. These events are the ones that continuously have the most participation around the island. The importance of Puerto Rico as a blue marlin fishing spot has been well documented and it continues to provide scientists with information regarding the species. In 2011, as part of collaboration of Project F-42 with the Sea Grant HMS Pilot Project, a tag was attached to landed fish. All blue marlin tagged under the Sea Grant project were those tagged by the DNER personnel attending tournaments. Since most of these fish encountered in Puerto Rico are part of tournaments, they provide the most accurate information of the status of the blue marlin fishery around the Island. A total of 56 blue marlin tournaments were monitored during the period 2009-2013 (Table 1). The year 2009 had the most tournaments with 14 events targeting the species. Since 2010, averages of 10 tournaments per year have been reported. Blue Marlin tournaments continue to be the ones with the most angler participation in the Island. During the period 2009-2013 an average of 1,464.8 anglers/year and 363.3 boats/year were registered to participate in these events (Table 4). These tournaments generated close to $1.1 million from inscription fees for the five-year project period (Table 4).

Table 4. Income and participation per year for Blue Marlin (*Makaira nigricans*) tournaments (2009-2013).

Year	Events	Fishermen	Boats	Income from tournament fees
2009	14	1,861	448	$221,617
2010	12	1,587	401	$169,999
2011	10	1,359	347	$174,700
2012	10	1,085	287	$227,312
2013	10	1,432	332	$248,365
Totals	**56**	**7,324**	**1,818**	**$1,041,993**
Averages	**11.2**	**1,464.8**	**363.6**	**$208,398**

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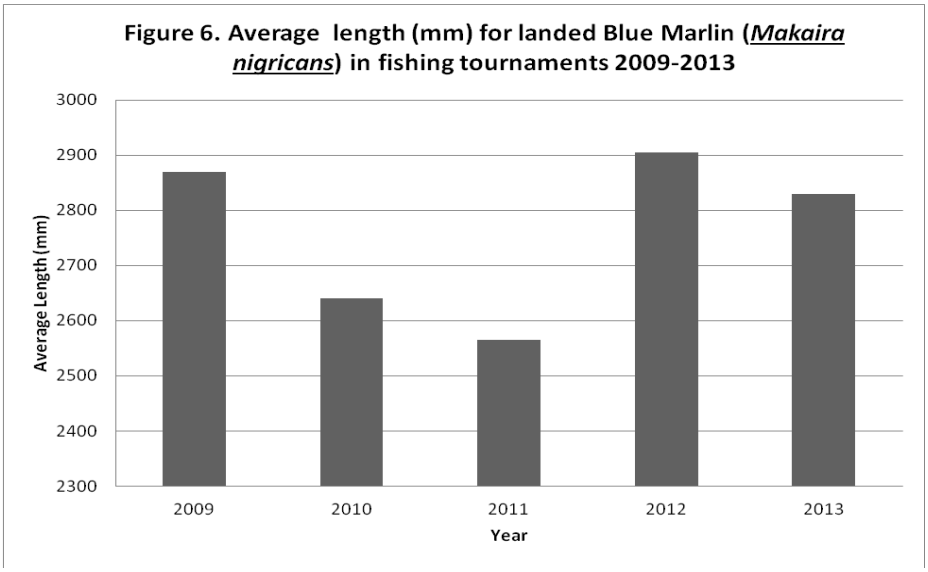
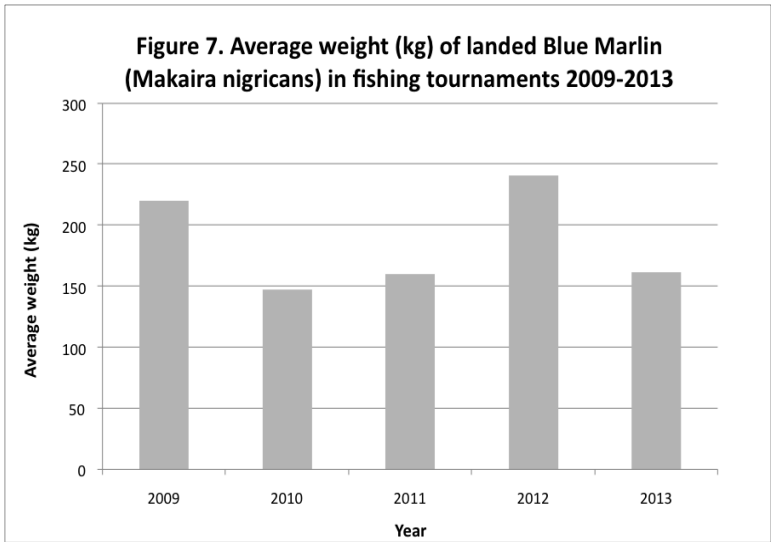
Since 2009, a total of 19 blue marlin were harvested as part of these events for a total weight of 3,218.01 kg with an average weight of 646.60 kg (Table 2). Landed fish ranged from 2,476 mm to 3,124 mm and 154.2 kg to 319.32 kg (Figure 6 and 7).



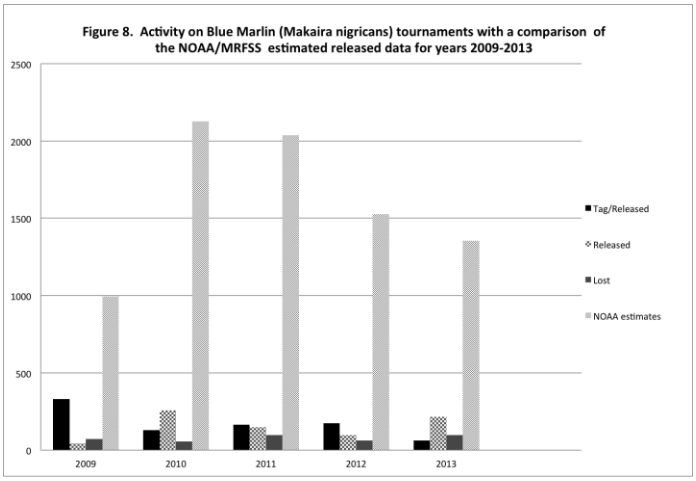


In these five-years, 2,005 blue marlin were reported as tagged/released or lost. Years 2009 and 2010 had the highest number of reported fish tagged and released (Figure 8). No recaptures of tagged individuals were ever reported to the agency.

From data available through MRFSS a total of 8,039 blue marlin were reported as released in this period for Puerto Rico. In contrast to our data, no individuals were reported to MRFSS as landed (Figure 8).

Figure 8. Number of reported blue marlin tagged/released in fishing tournaments

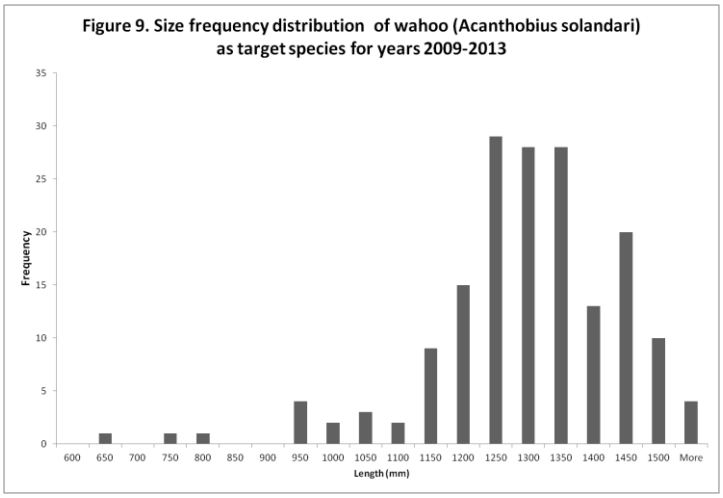
2009-2013.



Summary of Wahoo (Acanthobius solandari) tournaments

All wahoo specific tournaments were held at one club on the south coast of Puerto Rico. Since the seasonal distribution of wahoo coincides with sailfish and dolphinfish seasons other clubs have opted to have wahoo/sailfish and/or wahoo/dolphin tournaments. This data will be discussed separately. In this period, a total of 6 tournaments targeted wahoo only (Table 1). Participation in these events can be summarized as 1,185 fishermen and 298 boats (Table 5). In the case of wahoo fishermen landed a total of 2,577.34 kg.

Regarding size of landed fish, when all years are grouped together it ranges from 650-1500 mm for fishing tournaments. This would indicate mature individuals. Figuerola et. al. 2008 reported size of maturity for females at 896 mm and for males 918 mm.



When the data is divided by year the same trend is noted, with only mature individuals being brought to the weight station. Length data for 2009 was not collected and therefore not included on this analysis.

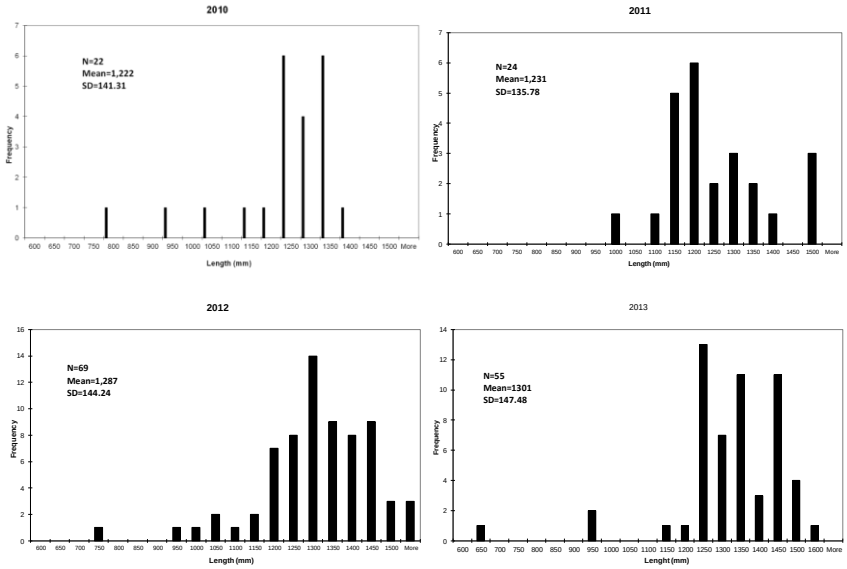


Figure 9. Size frequency distribution for landed wahoo (*Acanthobius solandari*) by year in tournaments specifically targeting the species.

About $84,950 was collected by the clubs through inscription fees in wahoo tournaments (Table 5). Through Regulation 7949, the species is also currently regulated, establishing a bag limit for recreational landings of wahoo of 10 fish per boat/trip (5 per fishermen) though rarely is the quota ever reached.

Table 5. Income and participation per year for Wahoo (*Acanthobius solandari*) tournaments (2009-2013).

Year	Events	Fishermen	Boats	Income from tournament fees
2009	2	327	83	NA
2010	1	276	69	$27,600.00
2011	1	196	49	$19,600.00
2012	1	166	42	$15,750.00
2013	1	220	55	$22,000.00
Average	**1**	**395**	**59.6**	**$21,238.00**
Totals	**6**	**1,185**	**298**	**$84,950.00**

Summary of Sailfish/wahoo tournaments

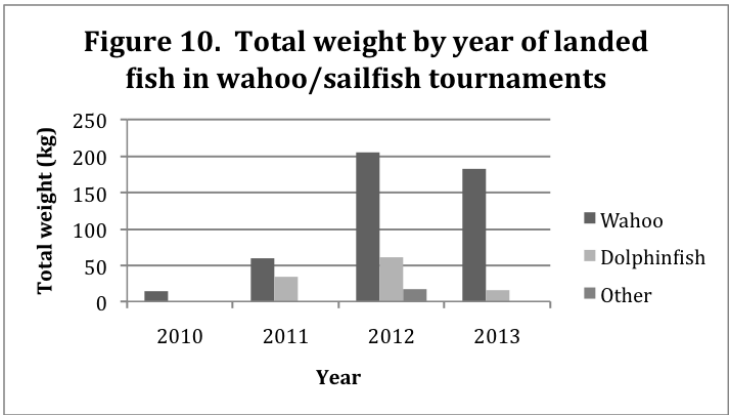
The modality of targeting two species in a single tournament is common during the peak of the season of the species. One example is wahoo/sailfish tournaments. Although fairly uncommon, 1 tournament per year (Table 1) this type of tournament is important especially to record data on the by-catch species. This type of tournament is increasing in popularity among fishermen as we noted an increase in participation (Table 7). With just one tournament island wide targeting both species, the total income averages $1,350 per tournament.

Table 7. Income and participation per year for Sailfish/wahoo tournaments (2009-2013).

	Events	Fishermen	Boats	Income from tournament fees
2009	1	64	16	NA*
2010	1	36	9	NA**
2011	1	48	12	$1,500.00
2012	1	88	22	$2,750.00
2013	1	100	25	$2,500.00
Average	**1**	**67.2**	**16.8**	**$1,350.00**
Totals	**5**	**336**	**84**	**$6,750.00**

*NA=data not available. Information on the tournament was provided by the Puerto Rico Sportfishing Association income data was not available, **NA=data was provided by the tournament organizer Los Locos Adams and income data was not available.

The composition of the catch for this type of tournament is mainly wahoo, dolphinfish and other species such as king mackerel and barracudas (Figure 10). No sailfish were landed, tagged/released or reported lost during these tournaments. This information is extremely important to determine species that are impacted in the different types of tournaments.



Summary of Wahoo/dolphinfish tournaments

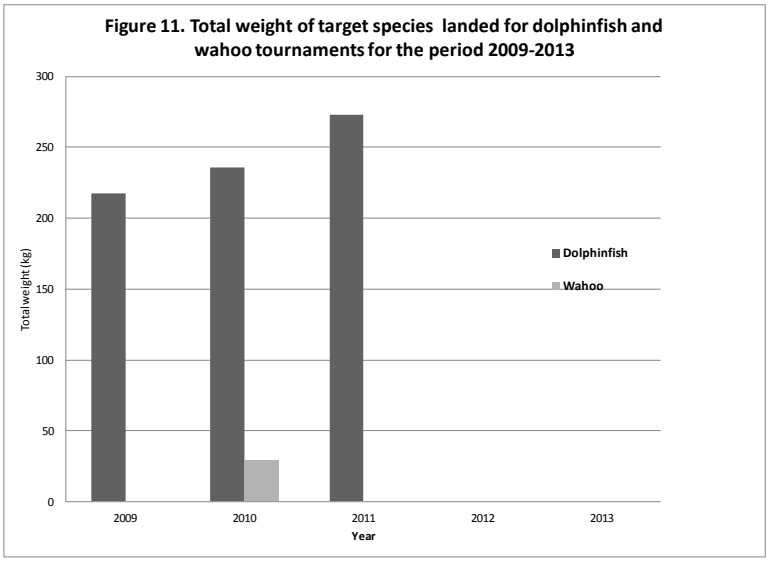
The second type of two species tournament is the one targeting wahoo and dolphinfish. This type of tournament is quite rare. As organizers have noticed that most of the catch is dolphinfish they prefer to use this species as the only target species.

Table 10. Income and participation per year for Dolphinfish/wahoo tournaments (2009-2013).

Year	Events	Fishermen	Boats	Income from tournament fees
2009	1	55	11	$1,925.00
2010	1	60	15	$ 2,250.00
2011	1	52	13	$1,950.00
2012	NT	NT	NT	NT
2013	NT	NT	NT	NT
Average	**1**	**56**	**14**	**$2,800.00**
Totals	**2**	**167**	**39**	**$4,200.00**

NT=no tournament

It is interesting that in these two-species tournaments dolphinfish again is the species most landed by recreational fishermen. This means that the species is targeted not only during the peak of the season but also at other times of the year.



Summary of Sailfish tournaments

Sailfish is the only other billfish pursued in tournaments around the Island, and these events are very small compared to others. Data from a total of 10 tournaments targeting sailfish was collected (Table 1). Participation in these events can be summarized as 865 anglers in 228 boats, collecting approximately $41,229 from inscription fees (Table 11). In the past five years, 4 Sailfish were landed in recreational fishing tournaments. A total of 212 Sailfish were reported as either tagged/released or lost. Most of these were reported in 2012 when the Puerto Rico Light Tackle Association had a 4-day tournament in November in which 98 Sailfish were reported as released. One sailfish was reported as landed but the size and weight information was not available. Species such as dolphinfish, mackerels, tunas and wahoo are landed in this type of tournaments as bycatch. This will be discussed in the bycatch section. Also billfishes such as blue and white marlin are also impacted in this type of tournament, though these species are mainly reported as tagged and released (Table 13).

Table 11. Income and participation per year for Sailfish tournaments (2009-2013).

	Events	Fishermen	Boats	Income from tournament fees
2009	2	236	59	$8,295.00
2010	1	68	20	N/A
2011	3	272	71	$7,052.00
2012	3	295	77	$21,49800
2013	1	82	23	$7,134.00
Average	**1.8**	**173**	**45.6**	**$8,245.80**
Totals	**9**	**865**	**228**	**$41,229**

Table 12. Total number of sailfish tag, released and or lost per year for sailfish tournaments.

	2009	2010	2011	2012	2013
Tag/Released	28	11	6	5	6
Released	11	0	15	98	0
Lost	3	6	6	2	0

Table 13. Total number of other species tagged, released and or lost per year for sailfish tournaments.

Species	2009			2010			2011			2012			2013		
	T/R	R	L	T/R	R	L	T/R	R	L	T/R	R	L	T/R	R	L
Blue marlin	1	0	0	0	0	0	2	4	4	0	0	5	5	1	2
White marlin	0	0	1	2	0	1	2	10	2	0	7	0	3	0	0
Great barracuda	0	0	0	0	0	0	0	0	0	0	4	0	0	4	0

Summary of Atlantic tarpon (Megalops atlanticus)

Tarpon fishing is also a very important activity for charter fishing around the Island. Tarpon fishing supports many independent fishing guides and even a fishing lodge in the San Juan area. Most tarpon are reported in this mode of fishing. Only one club has an annual tarpon tournament. A total of 6 tarpon tournaments have been reported for the study period (Table 1). In 2012, one new facility had a Tarpon tournament but it did not have a tournament the following year. Releasing the fish is the only activity permitted for tarpon. Since in these tournaments, fishing is primarily done at night and all fish are released, data is acquired through tournament

organizers. From inscription fees, approximately $19,097.00 was earned for the clubs. Tarpon fishing tournaments can be summarized as follows 375 fishermen, 144 fishermen (Table 14) and a total of 240 Tarpon were reported to the agency as released (Table 15).

Table 14. Income and participation per year for tarpon (*Megalops atlanticus*) tournaments for 2009-2013.

Year	Events	Fishermen	Boats	Income from tournament fees
2009	1	85	35	$9,605.00
2010	1	52	26	N/A
2011	1	40	16	N/A
2012	2	124	40	$7,050.00
2013	1	74	27	$2,442.00
Average	**1.2**	**75**	**28.8**	**$6,365.67**
Total	**6**	**375**	**144**	**$19,097.00**

Table 15. Total number of tarpon (*Megalops atlanticus*) reported as tagged, released or lost during tarpon tournaments (2009-2013).

	2009	2010	2011	2012	2013	**Totals**
Tag/Released	0	0	0	0	0	**0**
Released	43	20	1	36*	46	**146**
Lost	39	NR	13	22	20	**94**
Totals	**79**	**20**	**14**	**58**	**66**	**240**

Summary of shore fishing tournaments

In the period of 2009-2013, 11 shorefishing events were monitored by our personnel. Most of these events aim to teach children to fish and most of the catch is returned after being weighed or are too small for weight to be recorded (Table 12). Participation was 1,047 fishermen. In some instances, tournaments were for shore fishing for kids and boats could be registered in the event; in this case, 36 boats were registered.

Table 16. Income and participation in shore fishing tournaments (2009-2013).

Year	Events	Fishermen	Boats	Income from tournament fees
2009	1	20	4	0
2010	1	72	32	0
2011	2	59	0	0
2012	3	371	0	$1,615*
2013	4	425	0	$2,275**
Average	**2.2**	**209.4**	**7**	**$778.00**
Totals	**11**	**1,047**	**36**	**$3,890.00**

*= Two tournaments charged $5 per fishermen, **=one tournament with 455 participants charged $5 per fishermen.

Total weight reported for these tournaments ranges between 15 kg to 142 kg (Figure 12). They are characterized by catching mainly juveniles or smaller species that inhabit the shore. Catch was composed of approximately 834 fish species include Puffers (**Tetraodontidae** spp), Jacks (***Caranx*** spp), Grunts (**Haemulidae**), Tunas (***Thunnus*** spp), Seabasses (**Serranidae**), Mackerels (**Scombridae**), Barracudas (***Spyraena* spp**) among others (Figure 13). The composition of the fish landed in these tournaments varies within years. Several pelagic species are present due to the fact that in 2009 and 2010 some shore fishing tournaments allowed boats also. The catch is composed mainly of reef fish, mostly juveniles.

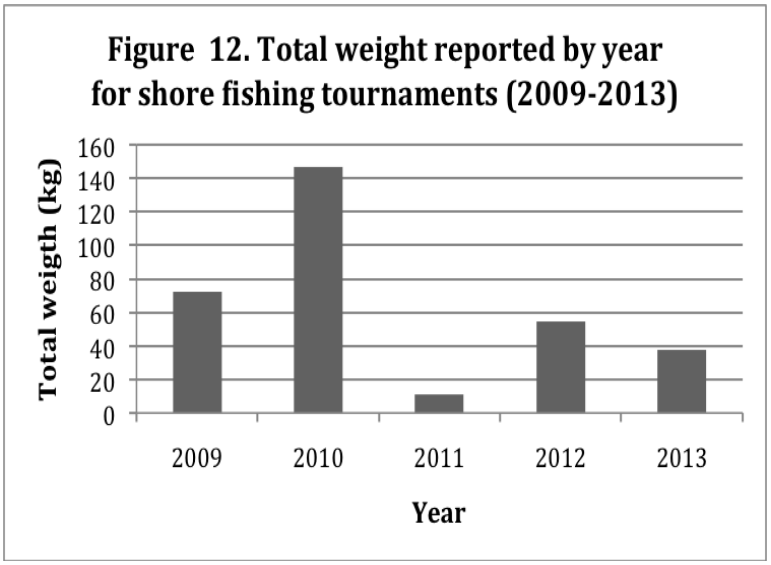
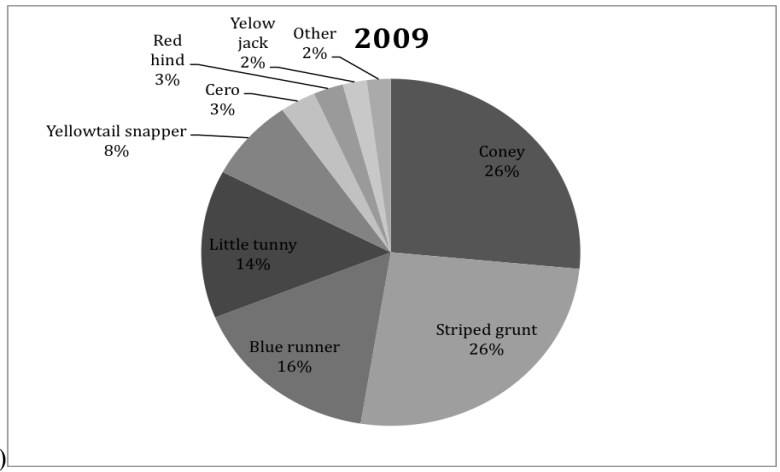
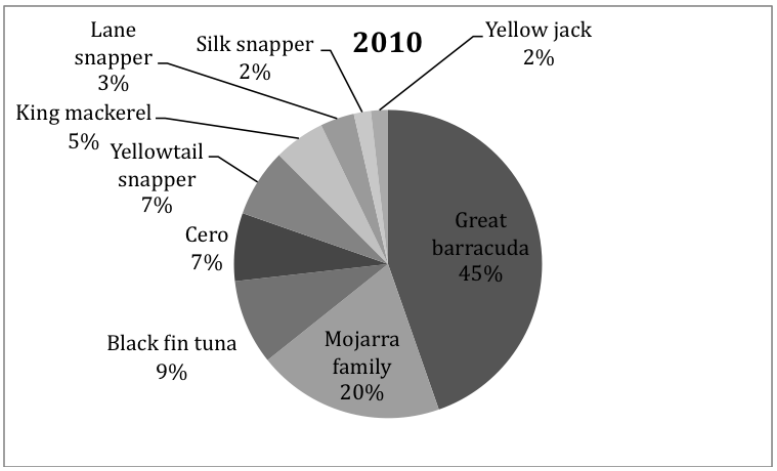


Figure 12. Total weight reported by year for shore fishing tournaments.

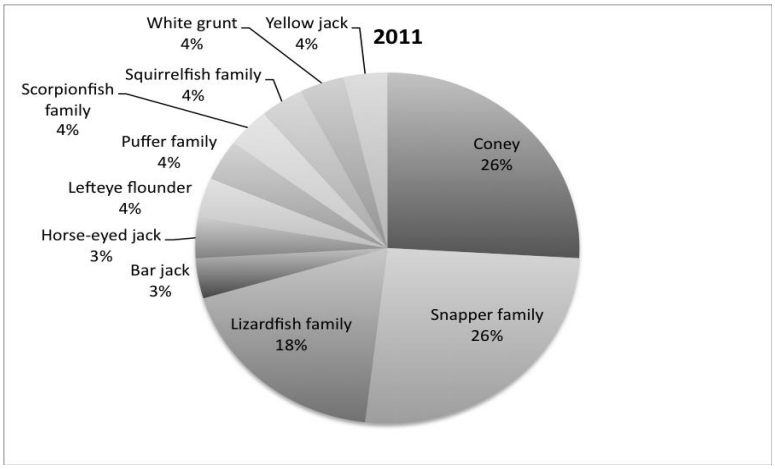
A)


2009
Yelow jack 2%
Other 2%
Red hind 3%
Cero 3%
Yellowtail snapper 8%
Coney 26%
Little tunny 14%
Striped grunt 26%
Blue runner 16%

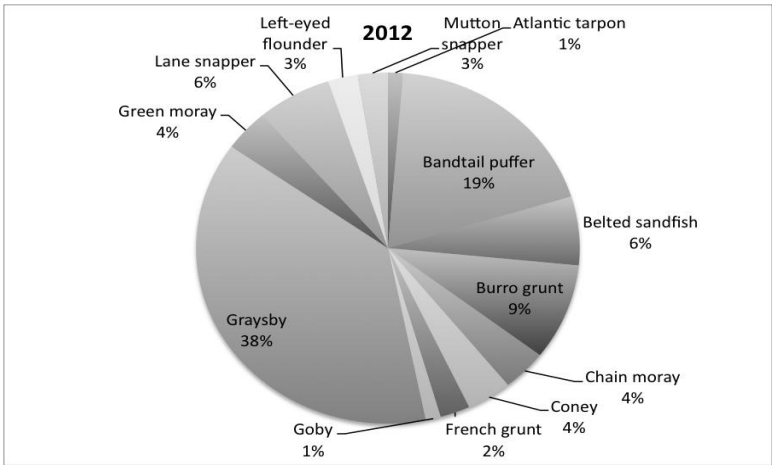
B)


2010
Lane snapper 3%
Silk snapper 2%
Yellow jack 2%
King mackerel 5%
Yellowtail snapper 7%
Cero 7%
Great barracuda 45%
Black fin tuna 9%
Mojarra family 20%

C)


2011
White grunt 4%
Yellow jack 4%
Squirrelfish family 4%
Scorpionfish family 4%
Puffer family 4%
Lefteye flounder 4%
Horse-eyed jack 3%
Bar jack 3%
Lizardfish family 18%
Snapper family 26%
Coney 26%

D)


2012
Left-eyed flounder 3%
Mutton snapper 3%
Atlantic tarpon 1%
Lane snapper 6%
Green moray 4%
Bandtail puffer 19%
Belted sandfish 6%
Burro grunt 9%
Chain moray 4%
Coney 4%
French grunt 2%
Goby 1%
Graysby 38%

E)

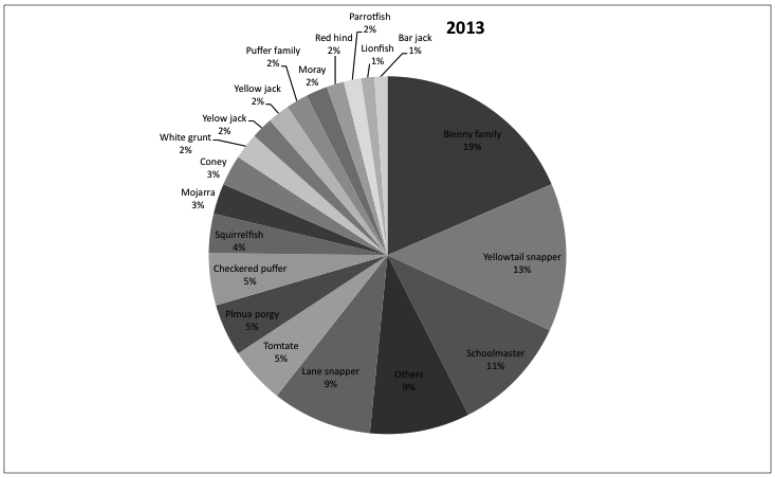


Figure 13. Catch composition in shore fishing tournaments 2009-2013 (A-E).

Summary of Kayak fishing tournaments

In 2012, Kayak fishing tournaments became popular around the Island, as part of an international tournament called "Kayak wars" in which teams fished in Puerto Rico, accumulating points. This event gave kayak users an opportunity to organize and have regular events. The first event was held on the West Coast of the Island with the participation of 23 kayakers; most of the catch is measured on site and released. Since then events became bigger and have their own set of regulations, regarding size of qualifying fish. Participation has increased from 105 kayak fishermen in 2012 to 135 kayak fishermen in 2013. Event fees generated $2,201 in 2013 (Table 16). These events have gained world-wide following, which ensures more participation in future events. These events also have categories for kayak/spear fishing; in this only free-diving spear fishing is allowed.

Table 16. Participation in kayak fishing tournaments 2012-2013.

Year	Events	Fishermen	Boats	Income from tournament fees
2012	5	105	104	0
2013	3	135	138	$2,201.00*
Average	**4**	**120**	**242**	**$2,201.00**
Totals	**8**	**240**	**121**	**$2,201.00**

* only 1 tournament had a $31.00 participation fee

The data collected for this new tournament type shows similar catch composition. It is interesting to note that reefs as well as pelagic fish are impacted in this tournament type.

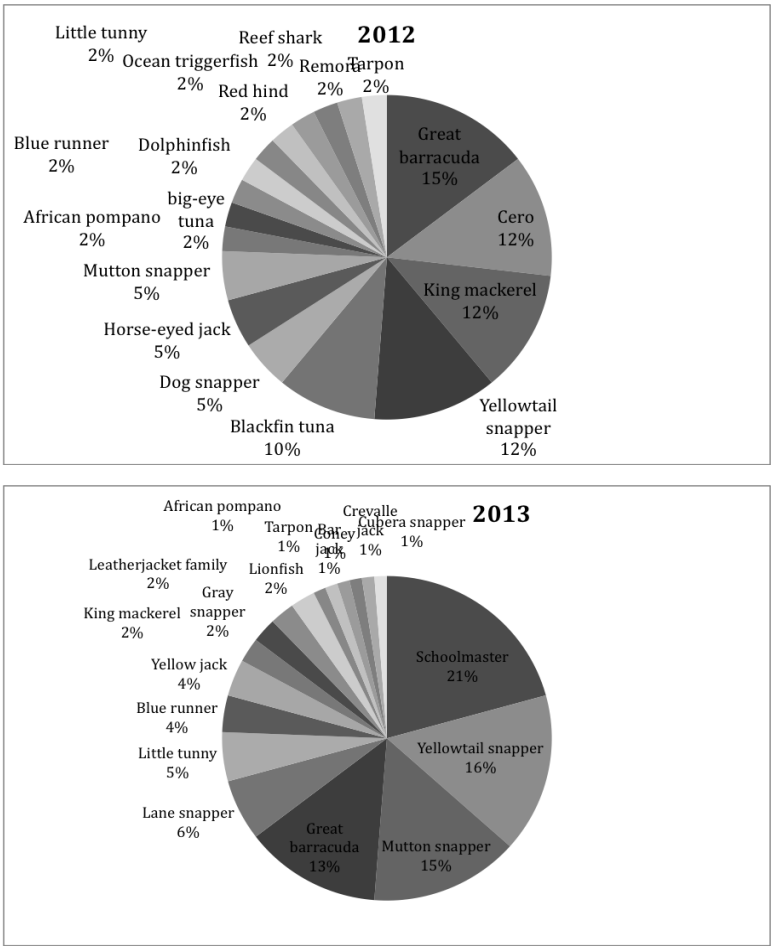


Figure 14. Catch composition in kayak fishing tournaments 2012-2013.

Summary of Mackerel tournaments

Two mackerel tournaments were reported during the study period. In 2009, a tournament was held at Cangrejos Yacht Club. The information on this tournament was found in a nautical periodical. A total of 56 fishermen landed 28 mackerel (species or weight was not specified). In 2012, two tournaments targeted mackerels. These events attracted 96 anglers (33 boats). Catch for the events was 23 kg (n=7). Inscription fees were about $1,700.00.

Summary of bottom fishing tournaments

Bottom fishing tournaments are mainly activities held at commercial fishermen associations and are open to any fishermen (Table 17). Due to the fact that in these events prizes are given towards highest total weight, it was difficult to properly measure and weigh each individual. Fish were brought in bunches and mixed. Catch composition was mostly reef fish (yellowtail snapper, grunts, red hind etc).

Table 17. Participation in bottom fishing tournaments (2009-2013).

Year	Events	Fishermen	Boats	Income from tournament fees	Total weight (kg)
2009	2	201	55	free	724
2011	1	30	NA	free	NA
2012	1	18	9	free	86.51
Average	**1**	**83**	**32**	**----**	**270**
Totals	**4**	**249**	**64**	**----**	**810 kg**

Summary of lionfish tournaments

Two events that targeted lionfish (*Pterois volitans*) were covered in 2012. These events were organized by spearfishing enthusiasts and by divers off Aguadilla, free of charge. The intention of the tournament was to control the invasive species in the reef area. A total of 90 fishermen took part in these events. Total landings for the events were 22.72 kg (n=146). Sizes ranged from 38-380 mm.

Summary of several species tournaments

Data for this type of tournament was collected in 2010 and 2011 (Table 1). Marinas that hosted these tournaments have stopped doing them in recent years. In 2010, a total of 173 fishermen (50 boats) participated in several-species tournaments. Target species included blue marlin (all tag and release), mackerel, wahoo, tunas and dolphinfish. Total weight reported was 18.08 kg for 2010. In 2011, one tournament was reported with 72 participants and 20 boats. This included tunas, dolphinfish, wahoo and sailfish (tag and released).

Bycatch per tournament type

As stated previously, "by-catch" refers to any fish species that was not targeted for points or prizes in the tournament. The information on by-catch was mostly collected at the piers, not at the official weigh station and therefore some catch is missed as fish are filleted before the weighing period is over. In tournaments such as shore, several species and bottom fishing, all fish count for points and therefore data on bycatch is not collected.

In dolphinfish tournaments, tunas, mackerel and barracudas have been the species most landed in the 2009-2013-study period. Billfishes such as blue and white marlin and sailfish have been reported as tag and released, but never landed in dolphinfish tournaments.

Blue marlin and sailfish tournaments coincide with the end of dolphinfish season, dolphinfish is landed in great quantities as bycatch and to a lesser extent tunas and wahoo.

Discussion

The fluctuations in participation and number of tournaments during the five-year period are not as signficant as it might be expected by the changes in the economy. Fishing tournaments still attract a good number of fishermen. Pelagic fishing tournaments are the most popular for Puerto Rico's fishers, but other types such as kayak-fishing tournaments have increased in numbers in recent years. A continuing difficulty is that the spear-fishing sector is quite difficult to monitor, since virtually no infrastructure is required beyond an access to the sea. This fishing type can impact several habitats as well as a diversity of species that go from reef fish to pelagic species.

Blue Marlin and dolphinfish are the preferred species. In the case of dolphinfish, this species is not only the number one targeted and number one in terms of weight harvested, but also the number one as bycatch species in other tournaments. Fluctuations in size preferences over the years in this species area quite noticeable. This information should be taken into consideration in the management of the species. Due to the low catch rate and small size of fish captured, shore-fishing tournaments are not that popular among organizers as they don't attract high numbers of fishermen. These tournaments have been adopted mainly by town's municipalities and are part of the sports and recreation programs focused on children and young adults.

Recreational fisheries can contribute significantly to the overall catch of a particular fishery, in some cases exceeding commercial catch of some species. A good example is the dolphin fish fishery in Puerto Rico. "There is need for more longitudinal (i.e. long term time series) data on recreational fishing effort catch, harvest and population structure to evaluate the possible role of recreational fisheries." (Cooke and Cowx , 2005). Fishery-dependent data, such as that provided through tournament-based monitoring, provides information relevant to the quality of the recreational fishery. With such information, fisheries scientists and managers are able to monitor the quality of select recreational fisheries (Williams & Scandol, 2008). The importance of proper management of recreational fishing tournaments comes as these events can represent a magnified exploitation of the fishery resource in a short period of time.

The fact that PR recreational fisheries are well monitored in all its modalities becomes an advantage over other places where recreational fisheries are not managed as well as commercial fisheries. It has been documented that commercial and recreational fisheries are not inherently different; both have the potential to harm fisheries negatively (Mac Phee et. al 2002, Coleman et. al. 2004). Although commercial fisheries harvest more fish than the recreational sector on a global basis, the converse can be observed - recreational catch can contribute significantly to the overall catch from a particular fishery (Cooke and Cowx 2005). Puerto Rico's initiative to survey all recreational fishing tournaments represents an advantage to managers in need of reliable data. Harvests by recreational fishermen need to be accounted for to have better understanding of the status of the fisheries resources and if necessary adjust regulations to reflect current trends.

Tournaments can provide information on some species that have to be monitored frequently. In Puerto Rico, tournaments have proven their value as a source of valuable information. Over the years, these events have allowed managers to compile good scientific data that helps in the creation and modification of fishing regulations. Fishermen that actively take part in these events are for the most part well educated in current fisheries regulations. The impact of recreational harvest from tournaments on the Island's fisheries and economics should be measured. Since the implementation of fisheries regulations, fishermen are more selective in the catch they bring to the weigh station; this also implies the harvest of small individuals just to reach the allowed quota. Even though some clubs establish that small fish will not count, and impose a minimum weight, reaching the bag limit is more important for some anglers. Most recreationally caught dolphinfish is sold regardless of the fact that this is not allowed for any recreational catch (Regulation 7949). As in previous years, we emphasize that an assessment of the measures taken to manage this and other species in our waters is needed to see if these have been successful or if changes are needed to ensure a sustainable harvest for this and other species.

Job 3: Assessment of Marine Recreational Fisheries

Job Objective: To generate statistically valid estimates of catch and fishing effort of marine anglers in Puerto Rico

Introduction

To fulfill the objective of generating valid catch estimates for the recreational fishing activity in Puerto Rico, DNER became part of the Marine Recreational Fisheries Statistics Surveys (MRFFS) of the National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS). MRFSS is a nationwide program developed in the late 1970s to provide a database of marine recreational fishing activity. The MRFSS consists of several independent, yet complementary, surveys that cover all coastal zones of the continental US and Puerto Rico. DNER is in charge of conducting the surveys for shore, for-hire, and private boat modes, an activity under the Fisheries Information Network (FIN).

Procedures

The MRFSS Survey is structured on the basis of fishing pressure and historical productivity data. This information in then used to determine interview quotas for each region. MRFSS uses a wave system wherein each wave consists of two-months starting in Wave 1 with January-February. The quotas are assigned by mode/wave combination. The total quota for each wave was 420 intercepts, distributed as follows: 130 shore, 90 charter, and 200 private/rental. MRFSS randomly generated the required number of interview assignments for monthly and bi-monthly (wave) point-access intercepts in the three modes, shoreline (SH), private boat (PR) and charter boat (CH). A hundred percent (100%) of quotas were expected to be completed at the end of each wave to minimize the statistical error in data. In terms of completed assignments, a minimum of 70% is accepted.

The job is divided into three activities by fishing modality: Activity 1: Assessment of shoreline marine recreational fisheries; Activity 2: Assessment of charter boat marine recreational fisheries; and Activity 3: Assessment of private/rental boat marine recreational fisheries. Field sampling is conducted during daylight hours at 147 sites that are accessible to the public and samplers. Anglers are intercepted at the end of their fishing day on piers, jetties, beaches, public and private ramps. Samplers conduct interviews regarding fishermen activities, interests, examine their catch, weigh and measure the catch. Catch and fishing effort estimates were generated from wave (bi-monthly) reports and MRFSS estimate tables. Fishing effort is estimated from the telephone survey made by MRFSS. A contractor randomly calls households to estimate fishing effort in the Island.

Results

The total bi-monthly quota was 12,600 intercepts for years 2009-2013. The project staff completed a total of 9,992 intercepts (79.3% completed interviews) (Table 16) .

Table 16. Total intercepts interviewed per mode per year.

Mode	2009	2010	2011	2012	2013	Total
Shore	617	773	835	888	392	3,505
Charter	425	475	674	554	552	2,680
Private Boat	603	1018	878	929	379	3,807
Total per year	1,645	2,266	2,387	2,371	1,323	9,992

The participation level (number of people) in Puerto Rico's recreational fishery resources, regardless of mode were Puerto Rico residents. There is a steady decrease in participation over the five year period presented (Table 17).

Table 17. Participation by location of residence. Participation of marine recreational anglers residing in Puerto Rico (Residents) versus Out-of State during the 2009-2012 period. Data from 2013 is not available. PSE = Proportional Standard Error.

Residency	2009	PSE	2010	PSE	2011	PSE	2012	PSE
Residents	110,236	12.9	92,191	13.3	98,662	14.8	83,837	14.6
Out-of-State	22,352	17.6	11,096	28.5	13,795	26.8	10,003	22.8
Total	132,589	11.2	103,287	12.2	112,457	13.4	93,839	13.3

Collected data show some fluctuations in fishing effort versus total fish harvest for all modes. The trend in the past years has been towards increased effort and a decrease in total fish harvested (Figure 15).

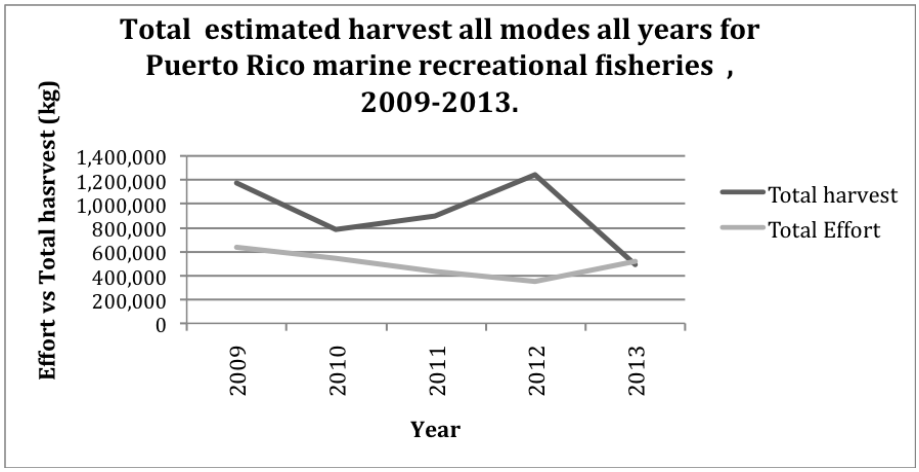


Figure 15. Total estimated harvest all modes all years for Puerto Rico marine recreational fisheries, 2009-2010.

In Puerto Rico fishing effort among years has fluctuated between 40- 50% of total trips either in shore or private mode. 2009, 2011, 2013 have most of the trips in shore mode, whereas 2010 and 2012 the percent was higher for the private boat mode (Figure 16). Although only 1% of trips are in charter mode there is a fully established industry on the north coast that comprises to an average of 4,000 trips per year.

It is worth noticing that the private boat mode has transformed from just motorboats as mode of transportation to now kayaks, paddleboards and jet skies. This new trend should be studied more carefully, as changes in prey, target species and or fishing facilities is a possibility because the needs of each are different.

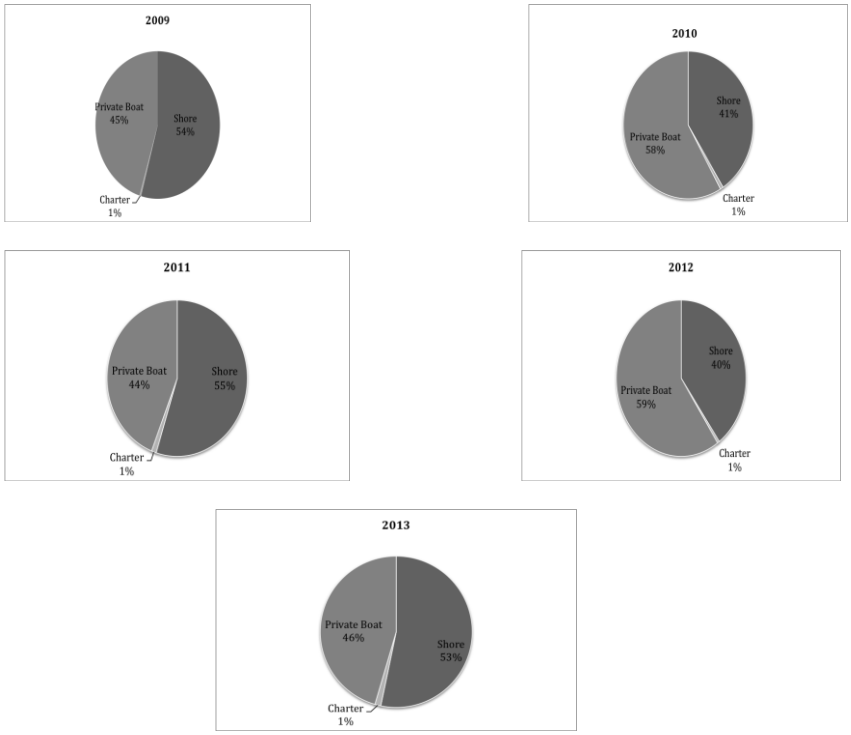


Figure 16. Percent of fishing trips per mode per year for the period 2009-2013.

Activity 2: Assessment of Shoreline Marine Recreational Fisheries

Objective: To generate statistically valid estimates of catch and fishing effort of marine shoreline anglers.

Procedure/Results: Shoreline marine anglers were surveyed using the point-access intercept method. 50% of intercepts in beach/bank mode were completed before the angler had finished his/her fishing trip. All other intercepts were completed after a complete fishing trip.

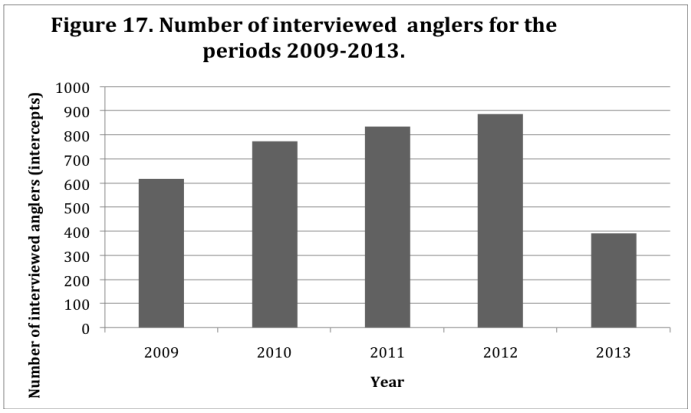


Figure 17. Number of interviewed anglers (intercepts) for the periods 2009-2013.

Number of intercepts ranged from 600-900 per year for shore mode. The number of interviewed anglers increased with increased effort by staff for the periods 2009-2012 (Figure 17). Fishing trips in the shore mode decreased in the 2009 - 2012 period (Figure 18). Then a noticeable increase in fishing trips was observed in 2013. One reason could be the world-wide economic crisis, as shore fishing is the cheapest way to obtain fish and or enjoy a hobby.

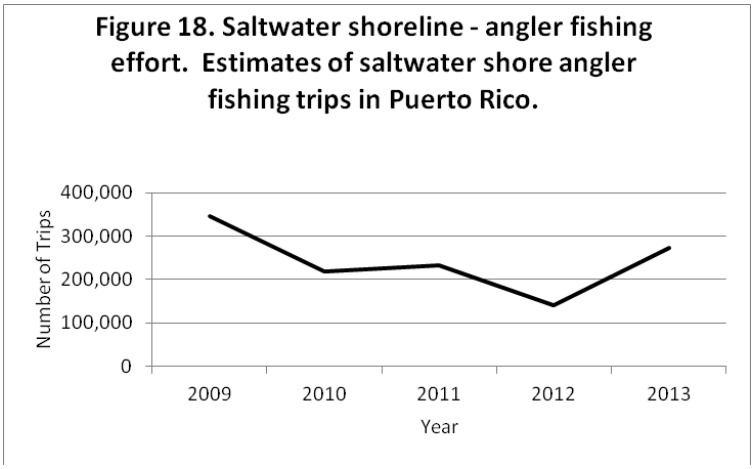


Figure 18. Saltwater shoreline - angler fishing effort. Estimates of saltwater shore angler fishing trips in Puerto Rico.

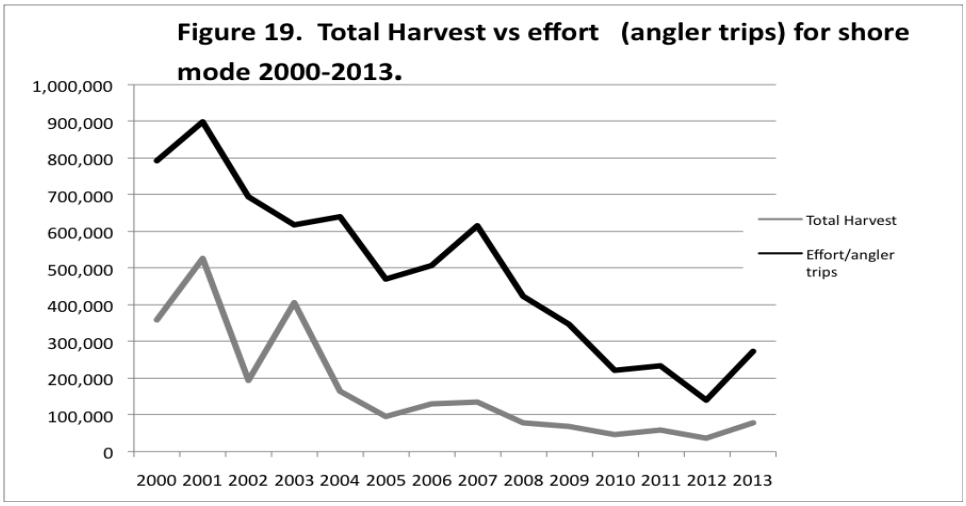


Figure 19. Total Harvest vs. effort (angler trips) for shore mode 2000-2013.

When total harvest is analyzed by mode the trend has been of an increase effort and a decrease in total harvest (Figure 19). A variety of species are reported as harvested by shore fishermen - mostly reef fish. It is interesting to notice the increase in herrings reported for 2013 (Table 19). This is an artifact of the interviewer measuring all the fish and not using the bag technique (where a sample is weighed). If herring (baitfish) are eliminated, snappers are the fish species most targeted by shore fishermen. Snappers are also targeted by commercial fishermen, therefore they are a group that should be looked at closely.

Table 19. Total kilograms of harvested fish by species by year; shore mode 2009-2013.

Species	2009	2010	2011	2012	2013
BARRACUDAS	6,960	1,494	1,544	28	0
GRUNTS	1,311	186	541	532	0
JACKS	7,513	6,450	6,769	2,159	818
OTHER FISHES	8,236	9,984	5,998	5,402	5,275
PUFFERS	1,635	124	127	9	
SEA BASSES	127	143	116	103	50
SNAPPERS	4,205	858	6,624	4,476	8,454
TRIGGERFISHES/FILEFISHES	508	0	0	0	0
MACKERELS	29	34	1,541		
WRASSES	219	0	507	33	157
Drums	0	63	165	31	87
EELS	0	368	0	0	0
HERRINGS	0	355	513	539	18,473
MULLETS	0	810	401	1,005	1,496

PORGIES	0	138	353	68	0
CARTILAGINOUS FISHES	0	0	1,393	2,249	0
FLOUNDERS	0	0	204	4	0
Total	**30,743**	**21,007**	**26,592**	**16,638**	**34,810**

In the past several years, the recreational fishing community has promoted releasing individuals as a conservation measure. To determine if this trend has increased in shore fishing we analyzed the number of fish released vs the number of fish harvested. At least for shore fishing, in the past five years the norm is to harvest the fish (Table 20 and Fig. 20). One recommendation is by outreach and education to encourage fishermen to release small individuals and/or non-edible species.

Table 20. Total number of fish released alive by year for shore mode

SPECIES	**2009**	**2010**	**2011**	**2012**	**2013**
BARRACUDAS	0	0	1,267	172	0
CARTILAGINOUS FISHES	0	345		602	0
EELS	305	187	1,142	319	0
FLOUNDERS	243	0	0	0	0
GRUNTS	12,803	114	1,089	1,065	1,667
HERRINGS	0	7,929		185	0
JACKS	9,182	2,526	3,057	3,658	0
MULLETS	0				0
OTHER FISHES	19,049	29,285	21,666	7,019	17,669
PORGIES	0	0	0	70	
PUFFERS	4,030	2,179	782	2,461	5,600
SEA BASSES	0		500		
SNAPPERS	10,812	7,764	5,247	5,003	19,993
TRIGGERFISHES/FILEFISHES	0	0	0	0	0
TUNAS AND MACKERELS	0	0	0	0	0
WRASSES	0	345	0	0	0
DRUMS	0	0	0	0	3,476
TOTALS	**56,424**	**50,674**	**34,750**	**20,554**	**48,405.**

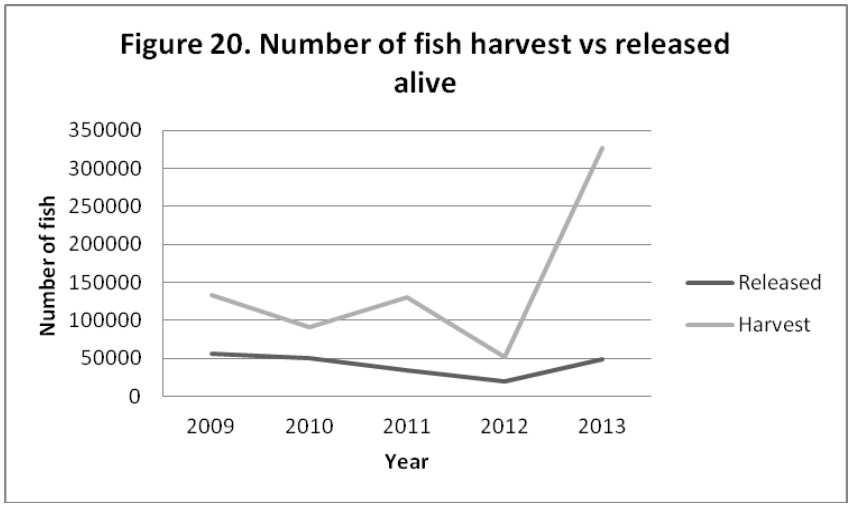


Figure 20. Number of fish harvested vs released alive.

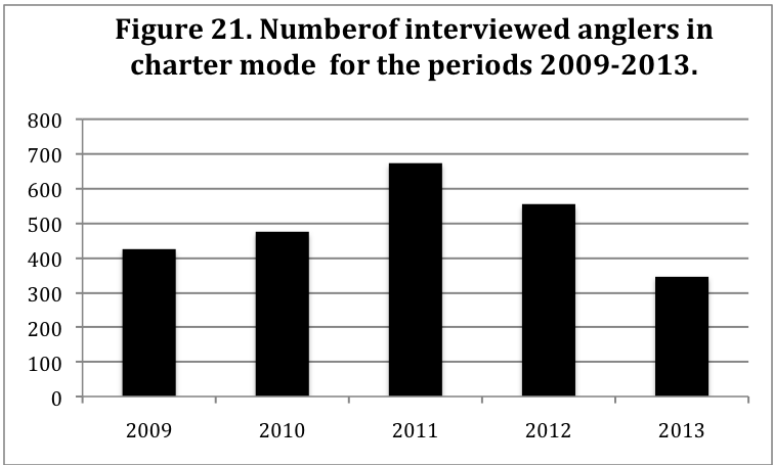
Activity 2: Assessment of Charter Marine Recreational Fisheries

***Objective*:** To generate statistically valid estimates of catch and fishing effort of marine charter boat anglers.

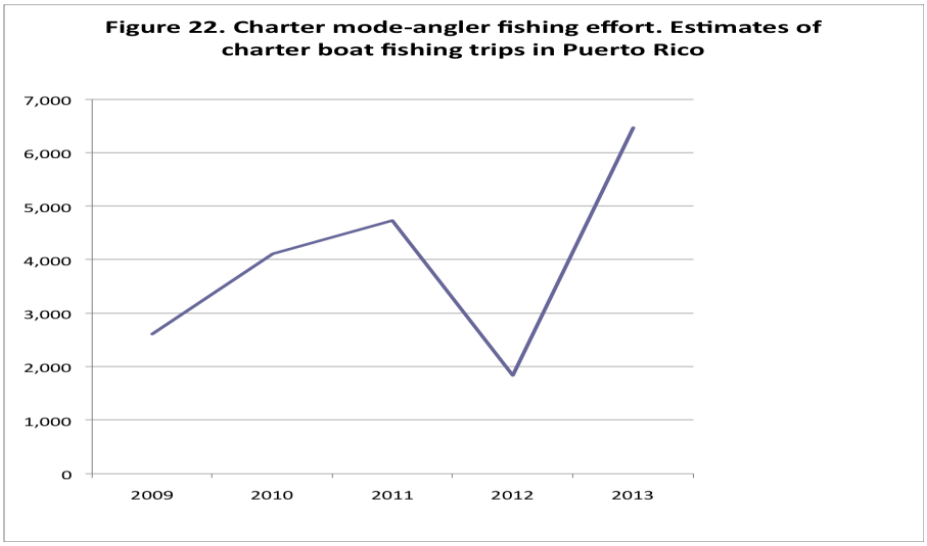
Procedure/Results: Marine charter boat anglers were surveyed using the point-access intercept method. All intercepts were performed after a complete fishing trip. A quota of 90 intercepts was established for all waves all years.

Results

The number of interviews per year ranged from 452-674 fishermen for charter mode. Similar to shore mode, the tendency is towards an increased number of interviews when staff effort is increased (Figure 21).



Data on charter mode fishing trips is a reflection of the fluctuations in the economy. Most of the charter services are provide to out of state residents (Figure 22). This mode is characterized mainly as a catch/release type of fishery. Still, there is a noticeable increase in effort to obtain the harvest (Figure 23). Total kilograms harvested per year is no more that 5,000 kg. Species mainly harvested are dolphinfish and tunas (Table 21).



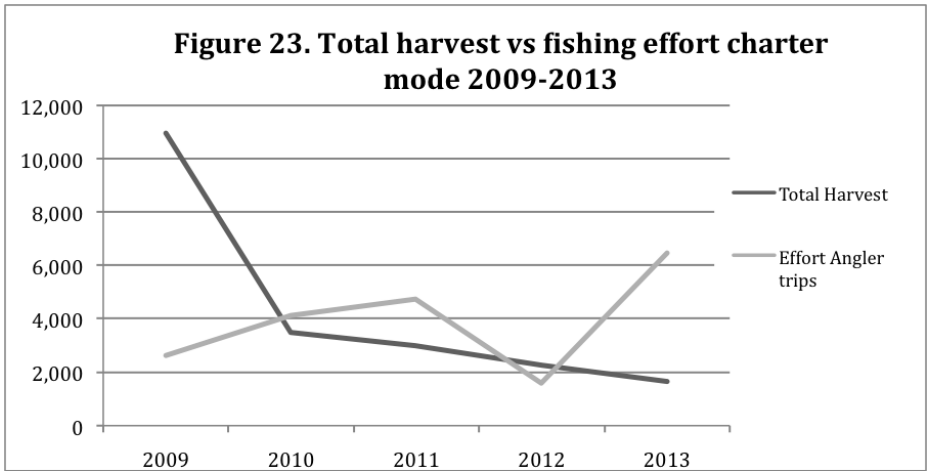


Table 21. Total kilograms of harvested fish by species by year charter mode 2009-2013.

SPECIES	2009	2010	2011	2012	2013
BARRACUDAS	7	40	47	196	0
CARTILAGINOUS FISHES	0	0	208	474	0
DOLPHINS	4,964	1,521	482	59	0
TUNAS AND MACKERELS	0	0	486	237	719
GRUNTS	0	0	0	3	0
JACKS	0	0	31	184	0
SEA BASSES	0	0	0	5	0
SNAPPERS	0	0	86	6	31
TOTALS	**4,971**	**1,561**	**1,340**	**1,164**	**2,763**

This mode is characterized as a catch/release mode, targeting mainly tarpon (Table 22). As the industry develops, we have noticed an increase in fish reported as released (Table 22).

Table 22. Total number of reported fish released by species by year charter mode 2009-2013.

SPECIES	2009	2010	2011	2012	2013
BARRACUDAS	0	273	96		502
CARTILAGINOUS FISHES	0	0	21	39	0
GRUNTS	0	0	42	0	0
DOLPHINS	0		0	0	0
JACKS	0	775	186	78	942
OTHER FISHES	861	1,819	2,525	1,683	4,837
SNAPPERS	0	210	236	157	377
TUNAS AND MACKERELS	0	118	59	39	126
DRUMS	0	0	0	20	
SEA BASSES	0	0	0	0	63
ATLANTIC TARPON	722	1,497	2,312	1,057	2,827
TOTALS	**1,583**	**4,692**	**5,477**	**3,073**	**6,847**

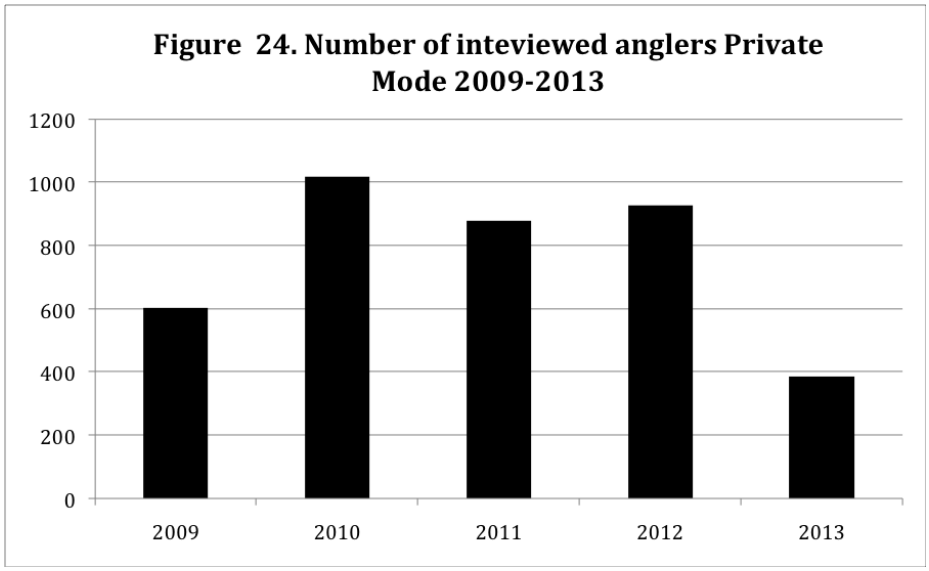
Activity 3: ***Assessment of Private Boat Marine Recreational Fisheries***

***Objective*:** To generate statistically valid estimates of catch and fishing effort of charter boat marine anglers.

Procedure/Results: Private boat marine anglers were surveyed using the point-access intercept method. All intercepts were made after a complete fishing trip. A quota of 200 intercepts was established for each wave.

Results

Puerto Rico is characterized by a high number of fishermen that prefer fishing in deeper water. The number of interviews ranged from 600-1000 per year for this mode. The 2013 decrease is a reflection of less staff and as well as fewer trips due to the increase in fuel prices (Figure 24).



This mode is the one that harvests the most fish per year and per mode. Kilograms landed ranged from 333,000 to 550,000 kg per year of mainly pelagic species such as the dolphinfish and barracudas. The interesting aspect of this mode is that it includes different types of gear and transportation. This mode inlcudes power boats with multiple lines in the water that troll for pelagic species as well as kayaks that fish in shallower waters. Also gear types range from rod and reel to spear fishing, which means that it impacts from reef fish to pelagic species (Table 23). For this reason, numbers of fish harvested are quite high.

Table 23. Total kilogram harvested by species private mode 2009-2013.

Species	**2009**	**2010**	**2011**	**2012**	**2013**
BARRACUDAS	10,462	24,117	10,232	15,399	21,211
CARTILAGINOUS FISHES	381	1,183	0	2,798	839
DOLPHINS	342,581	203,534	263,737	350,347	116,912
GRUNTS	295	210	468	1,239	86
JACKS	16,998	8,538	7,843	25,967	9,370
OTHER FISHES	14,193	20,986	20,780	37,448	5,983
PORGIES	0	0	39	682	0
SEA BASSES	4,436	7,737	2,021	8,392	1,916
SNAPPERS	27,845	34,744	11,478	42,406	40,080
TRIGGERFISHES/FILEFISHES	916	2,798	924	12,804	2,354
TUNAS AND MACKERELS	75,097	24,602	56,374	49,907	50,727
WRASSES	60	4,591	2,422	0	275
DRUMS	0	45	0	0	0
TOTALS	**493,264**	**333,085**	**376,318**	**547,389**	**249,753**

Releasing fish in this mode is quite rare, and most of the fish reported released are individuals lost during the fight to catch them (Table 24) .

Table 24. total number of fish reported released in Private Mode 2009-2013).

Species	2009	2010	2011	2012	2013
BARRACUDAS	5,306	9,424	3,047	1,899	8,342
CARTILAGINOUS FISHES	326	474	266	724	565
DOLPHINS	345	821	556	0	0
GRUNTS	0	0	0	0	0
JACKS	6,650	15,671	1,370	3,952	928
OTHER FISHES	24,014	32,388	13,518	15,285	26,318
SEA BASSES	15,307	6,401	0	2,021	215
SNAPPERS	6,947	18,203	816	1,152	9,643
TRIGGERFISHES/FILEFISHES	729	15,142	0	0	0
TUNAS AND MACKERELS	2,271	1,995	1,491	1,062	430
WRASSES	0	455	0	0	0
EELS	0	1,153	0	0	0
PUFFERS	0	119	0	0	0
TOTALS	**61,895**	**102,246**	**21,064**	**26,095**	**46,441**

Conclusions

Is important to recognize that in fisheries, the same resource is used by a variety of fishermen all with different interests. There are people with ecocomic interests (commercial fishermen and charter boats), those that fish recreationally (family trips, relaxation) and those that do it as a sport (tournament anglers) . All these aspects should be taken into consideration when species are managed and when facilities are built to impact these groups. Harvest from recreational fishing is increasingly as important as commercial harvest (Idhe at al 2011). In 2012 it was estimated for Puerto Rico a total of 93,840 recreational fishermen (83,837 residents and 10,003 non residents), this population should be taken into consideration in the management of the resource.

Data collected in this project has shown a decrease in harvest and participation but an increase in fishing effort. Therefore it shows a decrease in the stock and measures should be taken to #1. restore stock size and #2 promote better fishing practices to ensure a healthy stock into the future, as for example to promote and support catch/release practices.

Stock assessments tend to target the industrial and artisanal commercial fisheries and ignore the recreational fisheries. This project has shown that recreational fisheries contribute roughly half of the total annual catch of fish species in Puerto Rico. For the first time in Puerto Rico history, this project has characterized marine recreational fisheries for 13 years. It recorded trends previously not known to the management agencies, it has developed a good relationship between fishermen and the agency, collaboration with the scientific community and even with other Sport Fish Restoration projects that have benefited from the data collected in F-42 to determine important species, fishing pressures and facilities needs.

Outreach and Education

In addition to duties under project F-42 over the five-year period (2009-2013), our project coordinated three shore fishing tournaments in Mayaguez and Arecibo. These events were held with the purpose of informing fishermen of the objectives of our project and to teach participants about marine resources conservation. More than 300 fishermen took part in these events. Since 2002 and up to 2011, our personnel have given talks to the Puerto Rico Sport Fishing Association at their request, mostly to present the data collected during recreational fishing tournaments. Throughout the duration of the project, our personnel have participated in events coordinated by small fishermen associations, local schools (all levels), universities (public and private) and summer camps. Depending on the target audience, the talks were focused on data collected and its use, current local and federal fishing regulations and/or marine ecosystems and conservation. Since 2003, our personnel have presented talks and posters in the Gulf and Caribbean Fisheries Institute Symposiums (GCFI) and in the Caribbean Fisheries Management Council meetings. Data from Puerto Rico recreational fishing activities has been continuously presented to the scientific community and to the users, in addition to being available on the web. Another accomplishment for the project was the 2010 publication of the report entitled "**Non tournament Highly Migratory Species landings reporting for private boats in Puerto Rico**". It can be accessed at https://www.countmyfish.noaa.gov/projects/index.html. With the collaboration of project F-42 personnel, the local Sea Grant program developed a study of highly migratory species landings and reporting. It is worth mentioning that our personnel reported the only tagged fish.

In 2011, project F-42, with the assistance of NOAA and the GSMFC conducted a socioeconomic survey with the standard MRFSS survey, which attempted to determine for the first time ever the economic value of the entire marine recreational fishery in Puerto Rico. This report is about to be published. In June, 2014, the results were presented to the DNER, including the Secretary, at the San Juan Yacht Club, and copies of the presentation were sent to the Governor's office and others, by request.

The importance of tournament data collection was presented on the FAO Recreational Fisheries Workshop at the 66th Gulf and Caribbean Fisheries Institute Annual meeting, Santa Marta Colombia. Several Caribbean countries expressed interest in having similar projects, when they realized the type of information and data collected; important for

management and to understand recreational fisheries. This is the first step to develop healthy recreational fisheries.

Data from the project have been used by other DNER projects for justification for the location of ramps for recreational fishing boats. It has also been used to recommend modifications to coastal development projects that could affect habitat of importance to recreational fisheries. (Lilyestrom, Personal Communication)

List of Publications

Rodriguez-Ferrer G., Rodriguez-Ferrer Y. and C. Lilyestrom. 2003. "Blue Marlin (Makaira *Nigricans*) Fishing in Puerto Rico", 56th Gulf and Caribbean Fisheries Institute Symposium, Tortola British Virgin Islands, 2003, Poster presentation.

Rodriguez-Ferrer G., Rodriguez-Ferrer Y. and C. Lilyestrom. 2003. "An Overview of Recreational Fishing Tournaments in Puerto Rico", 56th Gulf and Caribbean Fisheries Institute Symposium, Tortola British Virgin Islands, 2003.

Rodriguez-Ferrer G., Rodriguez-Ferrer Y. and C. Lilyestrom. 2004. Dolphinfish fishing in Puerto Rico, 57th Gulf and Caribbean Fisheries Symposium. St. Petersburg, Florida, 2004.

Rodriguez-Ferrer Y., Rodriguez-Ferrer G. and C. Lilyestrom. 2005. Trends in Altlantic Billfish Fisheries in Puerto Rico 1954-2004,58th Gulf and Caribbean Fisheries Symposium. San Andres, Colombia.

Rodriguez-Ferrer G., Rodriguez-Ferrer Y. and C. Lilyestrom. 2005. Seasonal distribution of Wahoo (*A. solandri*), 58th Gulf and Caribbean Fisheries Symposium, San Andrés, Colombia, 2005. Poster presentation.

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MRIP Highly Migratory Species Work Group, C. Lilyestrom, Rodriguez-Ferrer G., Rodriguez-Ferrer "Non tournament Highly Migratory Species landings reporting for private boats in Puerto Rico", Report 2009.

Rodriguez-Ferrer G., Rodriguez-Ferrer Y. and C. Lilyestrom. 2012. Changes in Recreational Tournament Fishing as a Result of New Regulations for Recreational Fishing in Puerto Rico Proceedings of the Sixty Fifth Annual Gulf and Caribbean Fisheries Institute. Santa Marta Colombia, November, 2012, Poster presentation.

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Rodriguez-Ferrer Y, Rodriguez-Ferrer G. and Lilyestrom C. 2005. Trends in Atlantic Billfish Fishery in Puerto Rico 1954-2005. Proceedings of the 58th Gulf and Caribbean Fisheries Institute, Santa Marta, Colombia November 2005.

Rodriguez-Ferrer Y, Rodriguez-Ferrer G., Matos-Caraballo D. and Lilyestrom C. 2006. Comparison of Dolphinfish (*Coryphaena hippurus*) Commercial and Recreational Fisheries In Puerto Rico during 2000-2003. Proceedings of the F 57th Gulf and Caribbean Fisheries Institute, St.Petersburg Florida November 2004.

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W. D. L., Scandol J. P., Review of NSW recreational fishing tournament based monitoring methods and datasets, NSW Department of Primary Industries, Cronulla Fisheries Research Centre of Excellence, Australia, April, 2008.