COMMONWEALTH OF
PUERTO RICO
Department of Natural and
Environmental Resources

March 8, 2016

Dr. Roy Crabtree
Director
Regional Administrator NOAA Fisheries Service,
Southeast Regional Office,
263 13th Ave South, St. Petersburg, FL 33701

RE: Exempted Fishing Permit (EFP) Dear Dr. Crabtree:

The Puerto Rico Department of Natural and Environmental Resources (DNER) is the agency in which the responsibility of protecting all the natural resources of Puerto Rico is delegated by the PR constitution. This also includes marine fisheries resources. Within DNER the Fisheries Research Laboratory (FRL) is the division in charge of collecting all commercial landings, fisheries independent data collection and determines the reproductive and sexual maturity of species of commercial and recreational importance. All the data collected by the FRL is used to provide guidance and management recommendations to DNER as well as to the Caribbean Fishery Management Council (CFMC).

For the last twenty years the FRL through the SEAMAP Program has been collecting fisheries independent data on the shallow water reef fishes, queen conch and spiny lobster. The sampling cycle for the reef fish survey started in March 2011 and will be carried out for the next two years intending to finish approximately in May 2018. As part of the reef fish survey, our vessels conduct sampling in state (shore to 9 nautical miles (nm)) and federal waters (>9 nm). The FRL obtained in 2013 an EFP from your office authorizing us to sample in federal waters from July 23, 2013 through December 31, 2015. In January 13, 2015 and January 27, 2016, reports pertaining to the catch of authorized species under such permit were submitted to your office in compliance with the permit requirements.

Below is included all the information requested in the EFP guidance, shall you need further information please do not hesitate in contacting Ms. Veronica Seda at 787-230-4950 (vseda@dma.pr.gov) or Ms. Noemi Peña (nopena@drna.pr.gov).

Cordially,

Miguel A. García
Director
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DNER

Application for EFP for Project 1

Points of contact:

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Ms. Noemí Peña, Fisheries Research Laboratory Marina Station P.O. Box 3665, Mayagüez, PR 00681. nopena@drna.pr.gov, P - 787-230-4950; F – 787-833-2410.

1. Statement of the purposes and goals of the experimental fishery for which an EFP is needed.

Two projects will be conducted to collect species of fish that are under management in federal waters. The former Fisheries Research Laboratory, now known as the Division of Investigation of Commercial Fisheries of the PR Department of Natural and Environmental Resources (PRDNER) obtained an EFP on July 23, 2013 authorizing to harvest in federal waters: vermillion, gray, lane, mutton, dog, schoolmaster, and yellowtail snappers; coney, red hind, graysby, yellowfin, red, tiger, and black groupers. This permit was in place until December 31, 2015. Authorized personnel under such permit were under contract or in charge of the projects described below. This EFP is requested to continue these projects. A description of the projects including any changes in the methodologies is described below:

I. PROJECT 1: Puerto Rico SEAMAP Program Reef Fish Monitoring

Conduct fishing at 60 stations off the west and 60 off the east coast of Puerto Rico to determine the spatial and temporal variations in stock abundance of the reef fish resources within the territorial sea of Puerto Rico and the U.S. Caribbean exclusive economic zone (EEZ). Of these sampling stations, 20 stations will be sampled in federal waters off the west coast of Puerto Rico and 10 stations will be sampled in federal waters of the east coast of Puerto Rico. Stations and sampling dates are randomly selected; therefore, sampling might occur during close seasons in federal waters.

Sampling methodology in both state and federal waters will be using hook and line, bottom longline and underwater cameras. Table 1 provides information of the species caught in past survey conducted in 2015 that could be captured and landed during the survey for which we are requesting the EFP. Among those

species expected to be caught and landed include federally managed specimens of lane, vermillion, yellowtail, mutton, silk, and blackfin snappers; schoolmasters; red hinds, coneys, graysby, yellowfin, yellowedge, red, tiger, and black groupers.

Monitoring goals and objectives:

Use of camera surveys to develop the method and technology to providing species ID, counts, and lengths of reef fish. Initial work will focus on species ID and counts in addition to lengths, via either stereo camera setup (multiplexed GoPros) or laser. Due to variance in distances, only one fish can reliably be measured in each frame unless deployment of some form of moving/rotating laser platform is utilized. Specific objectives are:

1. Acquire baseline data of species at selected sampling sites, species composition, and size of individuals using a modular optical underwater survey system (MOUSS, Young and Richards, 2014).

2. Assessment of the condition of species for better management decisions: A list of the specific regulations from which an exemption is being requested and why each exemption is required for the experiment to succeed.

    a. Collection of grouper unit 3, grouper unit 4, and grouper unit 5 during their closed season.
    b. Collection of snapper's unit 1 during their closed season.
    c. Collection of yellowtail snapper under the minimum size.
    d. Collection of snapper unit 3 during their closed season
    e. Incidental collection of the prohibited species Nassau grouper (Grouper Unit 1) and goliath grouper (Grouper Unit 2) and Midnight, Blue, and Rainbow Parrotfish These species will be discarded or returned to the water with minimum harm.
    f. Anchoring in Federal waters at Bajo de Sico for a maximum of 20 times in areas that do not affect any corals.
    g. Use of bottom longline in federal waters, which may include Bajo de Sico, Abrir La Sierra, and at Tourmaline reef. The longline will soak for 45 minutes, after which it will be lifted and the fish collected. The line will be set in a way to minimize impact to bottom habitat. It will not be deployed over coral reefs. Small buoys will be placed at several feet of distance between hooks to ensure that the line does not lay flat at the bottom to avoid entanglement.
    h. Fishing at random dates and sites may result in fishing during the

seasonal area closures of December 1 to February 28 in Abrir La Sierra, and at Tourmaline reef, and the closure in Bajo de Sico that runs from October 1 through March 31, each year.

Estimates of pounds that might be caught and retained were extracted from historic data collected during surveys conducted in 2009, 2010, 2011, 2012, and 2013. Table 1 included in this permit request displays information of species caught during 2014-15. This project may include the following:

a. Collection of 240 pounds of Grouper unit 3 (red hinds during their closed season).
b. Collection of 100 pounds of Grouper Unit 4 (grouper yellowfin, red, tiger, and black) and Grouper Unit 5 (yellowedge) during the closed season.
c. Collection of 100 pounds of Snappers Unit 1 (silk, black, blackfin, and vermillion snappers) during their closed season.
d. Collection of 500 pounds of yellowtail snapper (Snapper Unit 4), which may include individuals under the legal minimum size.
e. Collection of 600 pounds of Snapper Unit 3 (lane and mutton snappers, gray and schoolmaster). Some catches might occur during the lane and mutton snapper seasonal closure.

3. The geographical area(s) in which the project will be conducted. East coast of Puerto Rico from the Fajardo coast to north of Culebra Island and east of Vieques Island (Figure 1). West coast platform from parallel 67 (Figure 2). The areas in federal waters are: stations in federal waters may include 20 in the west and 10 at the east coast. Stations in the west coast include sampling in Abrir La Sierra, Bajo de Sico, and Tourmaline.

4. Vessels to be used (including name and documentation number): 42' Bruno-Stillman vessels: The R/V Miguel Abreu (Property Number 19198; Serial Number DRN-GE046) and the R/V Donald S. Erdman May Craft 23'2004 (Property Number: 52963; Serial Number: DRN103GE) are used to conduct the reef fish survey. Both vessels are part of the FRL-DNER fleet.

Vessels to be used (including name and documentation number): Other vessels belonging to commercial fishers will be used which are: Lighttackle Paradise (PR4250BB), Lighttackle Paradise 3 (PR5250BB).

Names, addresses, and phone numbers of captains of each vessel:

The R/V Miguel Abreu and R/V Donald S. Erdman captains will be either of the following; Verónica Seda Matos (Project Biologist, HC-03 Box 15519 Cabo Rojo PR 00623, 787-833-2025); Benígno Rodriguez Hernández (Fisherman, Calle Casimar #885 Puerto Real Cabo Rojo 00623, 939-865-0156) and Carlos Vélez Pabón (Boat Operator, Box 195 Boquerón PR 00622, 787-458-5188).

- Lighttackle Paradise and Lighttackle Paradise 3 captains will be; Marcos Hanke Herrera (Charter, Urb. Miradero 52 Camino de Las Lomas Humacao PR 00971-9661, 787-646-2585) and Juan Morales Delgado (Fisherman, Urb. Monte Mar Calle #8 B Fajardo PR 00738, 939-397-5031).

5. Detailed description of research/collection methods (number and species ID, and size and weight of each specimen to be harvested, GPS position of sample locations, number of trips/days/sets, gear type, soak times, hook type, type and test of line). Appendix 1 describes in detail the statement of work for the SEAMAP survey which is standardized for the Caribbean in state and federal waters. It is expected that at the west coast, 20 stations will be in federal waters and 10 in the east coast.

6. Research start and end dates – sampling will start in March 2016 to March 2018 in state waters, in federal waters sampling will start in June 2016 until May 2018.

7. The following catch information:
   - SEAMAP surveys will not target specific species, since the objective is to develop estimates of relative abundance. Therefore, we did not have incidental catches and all the catch is retained, unless are species prohibited by Law and not allowed to be kept with our permits. Examples of species that likely will be caught are shown in Table 1 with approximate number of pounds. See Table 1 for a list of collected species during 2014- 15 reef fish surveys off the west and east coast, respectively.

   - The only species potentially captured as incidental catch that will be discarded or returned to water with minimum harm are Nassau and Goliath groupers, parrotfish (midnight, blue, and rainbow); all other species of finfish would be landed. The weight, by species, of such harvest and/or discard anticipated to occur during the experimental fishing, regardless of whether or not it is retained for sale: All the fish that are caught will be landed and retained with the exception of Nassau and Goliath groupers as well as any midnight, blue and rainbow

parrotfish; we did not sell any of the catch resulting from the previous cycles of the project (over 664 kg of fish were either distributed among the FRL personnel or donated to the PR Zoo).

- The expected disposition of all regulated species harvested under the EFP: Expected disposition of all harvested species will follow the protocol created and put in place by the Fisheries Research Laboratory (FRL) personnel. Most of the catch is distributed for consumption either by zoo animals and other will be distributed for personal consumption among all the employees of the FRL.
- Any anticipated impacts on marine mammals or endangered species: Not likely, however impacts may be entanglement with fishing lines (80-pound test) or hooks. Since fishing is done actively, any species can be disentangled immediately by fishers. However, we are implementing and following the New Procedure and Actions for Incidental Takes of Marine Mammals in Research and Monitoring Activities approved in 201 (Appendix A).
- Any anticipated impacts on essential fish habitat: Possible entanglement of hooks with soft coral and/or sponges.

8. The following anticipated effort information for each vessel:
   - Type and size of gear to be used –
     - Bottom line fishing using manual snapper reels.
     - Bottom longline: a 300 feet #130 line will be deployed. This line will be anchored at both ends, with buoys to identify them. The line will have 18 inches of a 50-pound fishing line hanging with a #9 hook at the end, every 36" inches Squid will be used as bait.
     - Deploy camera array for 90 minutes at a nearby site to longline area.
   - Anticipated amount of gear to be used per day:
     - Bottom line fishing will be three reels per boat, each reel using three hooks for a total of nine hooks (#9).
     - One longline will be deployed twice during each fishing trip.
     - One underwater camera array.
   - Number of gear hauls - N/A- will depend on weather and other factors
   - The longline will soak for 45 minutes, after which it will be lifted and the fish collected. The longline will be set three times.
   - Anchor fishing will be done for 30 minutes at 4 different sampling stations including those in federal waters (Bajo de Sico, Abrir la Sierra and Tourmaline areas). Avoiding anchoring over coral is essential to protect habitat and preserve gear. This also includes during

closed seasons at federal water above mentioned.

- Drift fishing will be performed for 15 minutes (move to starting point or near area after 15-minute drift) at near anchor sampling stations up to a total of 2 hours.
- Number of days during which the experiment will be conducted –20 days consisting of one trip per day fishing for 4 hours.

II. PROJECT 2: Aspects of the reproductive biology of several recreationally important fish species in Puerto Rico.

Study Title: Maturation and reproductive seasonality of the mutton snapper (*Lutjanus analis*), red hind (*Epinephelus guttatus*), coney (*Cephalopholis fulva*), white grunt (*Haemulon plumieri*), tomtate (*Haemulon aurolineatum*), pluma (*Calamus pennatula*), king mackerel (*Scomberomorus cavalla*), and cero (*Scomberomorus regalis*) in Puerto Rico.

Objective: To describe through the use of histology, over the next four years, the annual reproductive cycle and minimum size of sexual maturation of mutton snapper, red hind, coney, white grunt, tomtate, pluma porgy, king mackerel, and cero.

- Samples for Project II will be collected by a DNER contracted fisherman and an Assistant Biologist. They will be performing 35 fishing trips in total from which 10 sampling trips will be within U.S. Caribbean EEZ. Also, samples or fishes collected under SEAMAP surveys will be used.

1. A list of the specific regulations from which an exemption is being requested and why each exemption is required for the experiment to succeed. Total amount of pounds might vary according to a number of reasons among those habitat type, season, depth, etc. This project may include the following:

   a. Collection of 150 pounds of red hinds during their closed season.
   b. Collection of 150 pounds of Snapper Unit 3 (lane and mutton snappers, gray and schoolmaster) some catches may occur during the lane and mutton snapper seasonal closure, only the mutton snapper will be retained; incidental catch of Snapper Unit 4 will be discarded.

c. Incidental collection of the prohibited species Nassau grouper (Grouper Unit 1) and goliath grouper (Grouper Unit 2) and Midnight, Blue, and Rainbow Parrotfish These species will be discarded or returned to the water with minimum harm.
d. Anchoring in Federal waters for a maximum of 10 times in areas that do not affect any corals.
e. Gears that will be used are: hand line and spear gun. These will be used within federal waters but not in the closed areas at the west coast.
f. Fishing during the seasonal area closure of December 1 to February 28 (for red hind) and from April 1 to June 30 every year within federal waters but not in the closed areas of Bajo de Sico, Abrir La Sierra, and at Tourmaline reef.

2. The geographical area(s) in which the project will be conducted are located on the west coast includes samplings within the 9-200 nm US Caribbean EEZ, not in closed areas of Abrir La Sierra, Bajo de Sico and Tourmaline.

3. Vessels to be used (including name and documentation number): A R/V Donald S. Erdman May Craft 23'2004 (Property Number: 52963; Serial Number: DRN103GE) are used to conduct the reef fish survey. Vessels to be used (including name and documentation number): Other vessel belonging to commercial fisher will be used is: "Jehova es mi Pastor" (PR7208HH).

4. Names, addresses, and phone numbers of captains of each vessel:
   - R/V Donald S. Erdman captains will be either of the following; Verónica Seda Matos (Project Biologist, HC-03 Box 15519 Cabo Rojo PR 00623, 787-833-2025); Benígno Rodriguez Hernández (Fisherman, Calle Casimar #885 Puerto Real Cabo Rojo 00623, 939-865-0156) Carlos Vélez Pabón (Boat Operator, Box 195 Boquerón PR 00622, 787-458-5188) and Pedro E. Silva Acosta (Fisherman, Parcelas Maní 723 Calle Caracol Mayagüez PR 00680-6157, 787-400-7937)

   - "Jehova es mi pastor" captain will be Pedro E. Silva Acosta (Fisherman, Parcelas Maní 723 Calle Caracol Mayagüez PR 00680-6157, 787-400-7937).

5. Detailed description of research/collection methods (number and type of each specimen to be harvested, approximate sample locations, number of trips/days/sets, gear type, soak times).

- Sample for each of the species under study II that are managed in federal waters, red hinds and mutton snappers. Hook and line, and spearguns according to the size of individuals will be used. Sampling trips undertaken by contracted fishers will be 2 trips per month to collect a minimum of 25 samples for each species. Incidental catch of any other species will be released.

6. Research start and end dates – Research start and end dates – sampling will start in March 2016 to March 2018 in state waters, in federal waters sampling will start in June 2016 until May 2018.

7. The following catch information:
   - The species (target and incidental species must be clearly differentiated) expected to be harvested and/or discarded under the EFP. For this survey the target species are specifically for the maturation study. Targeted species for the reproduction study managed in federal waters are the following: mutton snapper, red hind, and coney.
   - All other species incidentally captured will be discarded or returned to water; measurements will be recorded when possible.
   - The expected disposition of all regulated species harvested under the EFP. Expected disposition of all harvested species will follow the protocol created and put in place by the Fisheries Research Laboratory (FRL) personnel. Most of the catch is distributed for consumption either by zoo animals and other will be distributed for personal consumption among all the employees of the FRL.
   - Any anticipated impacts on marine mammals or endangered species. Not likely, however impacts may be entanglement with fishing lines (80-pound test) or hooks. Since fishing is done actively, any species can be disentangled immediately by fishers. However, we are implementing and following the New Procedure and Actions for Incidental Takes of Marine Mammals in Research and Monitoring Activities approved in 2015 (Appendix A).
   - Any anticipated impacts on essential fish habitat. Possible entanglement of hooks with soft coral and/or sponges.

8. The following anticipated effort information for each vessel:
   - Type and size of gear to be used
     - Hook and line- Line 60-100, 1-3 hooks
     - Spearfish
     - Squid and ballyhoo will be used as bait.
   - Amount of gear to be used per day: 2 hand lines

- Number of gear hauls **N/A**
- Anchor fishing will be done, within federal waters, not in closed areas of Bajo de Sico, Abrir la Sierra and Tourmaline. Avoiding anchoring over coral is essential to protect habitat and preserve gear. This also includes during close season at federal water above mentioned.
- Number of days during which the experiment will be conducted; 10 days (from June to October) consisting of one trip per day fishing for 6-10 hours to collect samples for maturity survey.

Table 1. List of species caught at the east and west coasts of Puerto Rico during 2014-15. All species herein listed are considered target by SEAMAP. Asterisks identify species with federal seasonal closures. All groups of fish are federally managed through the ACL's amendment to the FMP's.

	Species	Closed season	# of indiv.	% #	Wt. (Kg)	% Wt.
1	*Cephalopholis fulva*		477	20.32%	84.756	12.75%
2	*Lutjanus synagris*	*	320	13.63%	41.411	6.23%
3	*Caranx crysos*		296	12.61%	108.535	16.33%
4	*Epinephelus guttatus*	*	241	10.27%	116.772	17.57%
5	*Calamus pennatula*		229	9.76%	54.489	8.20%
6	*Ocyurus chrysurus*		131	5.58%	46.492	6.99%
7	*Holocentrus rufus*		115	4.90%	12.185	1.83%
8	*Rhomboplites aurorubens*	*	108	4.60%	17.366	2.61%
9	*Malacanthus plumieri*		102	4.35%	26.235	3.95%
10	*Cephalopholis cruentata*		85	3.62%	12.111	1.82%
11	*Haemulon plumieri*		56	2.39%	16.342	2.46%
12	*Holocentrus adscensionis*		51	2.17%	8.839	1.33%
13	*Haemulon aurolineatum*		28	1.19%	2.074	0.31%
14	*Lutjanus apodus*		14	0.60%	12.373	1.86%
15	*Balistes vetula*		9	0.38%	9.49	1.43%
16	*Chaetodipterus faber*		7	0.30%	8.18	1.23%
17	*Lutjanus analis*	*	7	0.30%	9.135	1.37%
18	*Lactophrys trigonus*		6	0.26%	5.702	0.86%
19	*Sphyraena barracuda*		6	0.26%	24.6693	3.71%
20	*Canthidermis sufflamen*		5	0.21%	6.247	0.94%
21	*Lutjanus vivanus*		5	0.21%	0.918	0.14%
22	*Synodus intermedius*		5	0.21%	0.568	0.09%
23	*Caranx ruber*		4	0.17%	3.927	0.59%

	Species	Closed season	# of indiv.	% #	Wt. (Kg)	% Wt.
24	*Melichthys niger*		4	0.17%	1.814	0.27%
25	*Caranx lugubris*		3	0.13%	5.126	0.77%
26	*Diodon hystrix*		3	0.13%	4.544	0.68%
27	*Lutjanus buccanella*	*	3	0.13%	0.649	0.10%
28	*Albula vulpes*		2	0.09%	0.992	0.15%
29	*Caranx latus*		2	0.09%	6.569	0.99%
30	*Echeneis naucrates*		2	0.09%	1.185	0.18%
31	*Echeneis neucratoides*		2	0.09%	0.215	0.03%
32	*Elagatis bipinnulata*		2	0.09%	1.171	0.18%
33	*Serranus tabacarius*		2	0.09%	0.093	0.01%
34	*Bothus ocellatus*		1	0.04%	0.094	0.01%
35	*Caranx bartholomaei*		1	0.04%	0.518	0.08%
36	*Carcharhinus acronotus*		1	0.04%	2.946	0.44%
37	*Carcharhinus perezii*		1	0.04%	5.783	0.87%
38	*Eucinostomus argenteus*		1	0.04%	0.054	0.01%
39	*Gerres cinereus*		1	0.04%	0.034	0.01%
40	*Haemulon flavolineatum*		1	0.04%	0.106	0.02%
41	*Haemulon macrostomum*		1	0.04%	0.494	0.07%
42	*Hypoplectrus unicolor*		1	0.04%	0.046	0.01%
43	*Lutjanus jocu*		1	0.04%	1.743	0.26%
44	*Seriola rivoliana*		1	0.04%	0.722	0.11%
45	*Sphoeroides nephelus*		1	0.04%	0.341	0.05%
46	*Sphoeroides spengleri*		1	0.04%	0.257	0.04%
47	*Synodus foetens*		1	0.04%	0.079	0.01%
48	*Trachinocephalus myops*		1	0.04%	0.33	0.05%
	Grand Total		**2347**		**664.7213**	

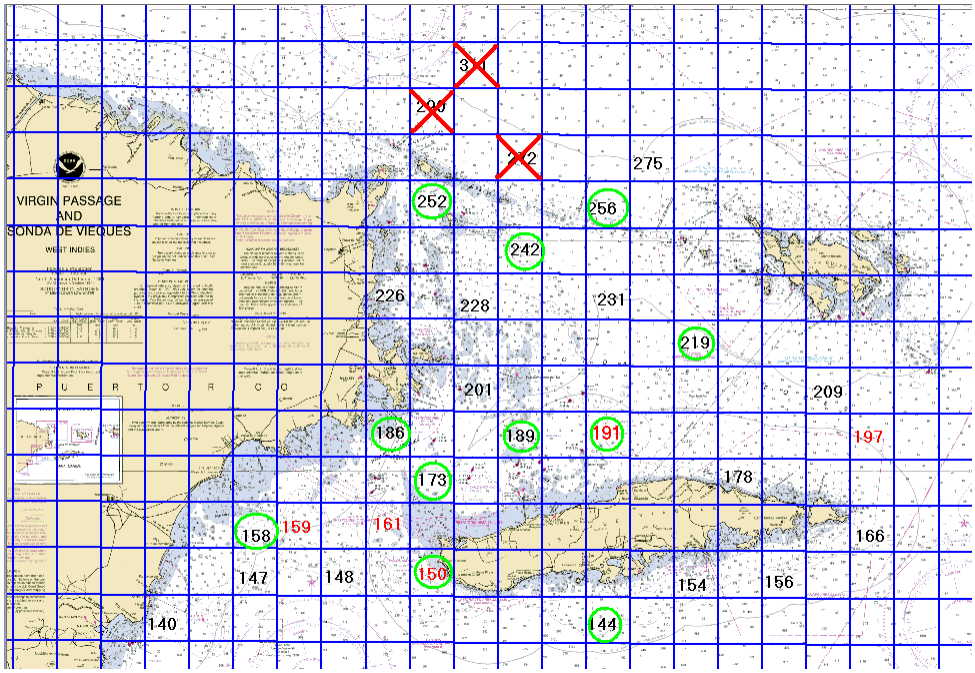

Figure 1. Sampling stations off the east coast of Puerto Rico during 2015. Those with a red cross are excluded from sampling in 2015.

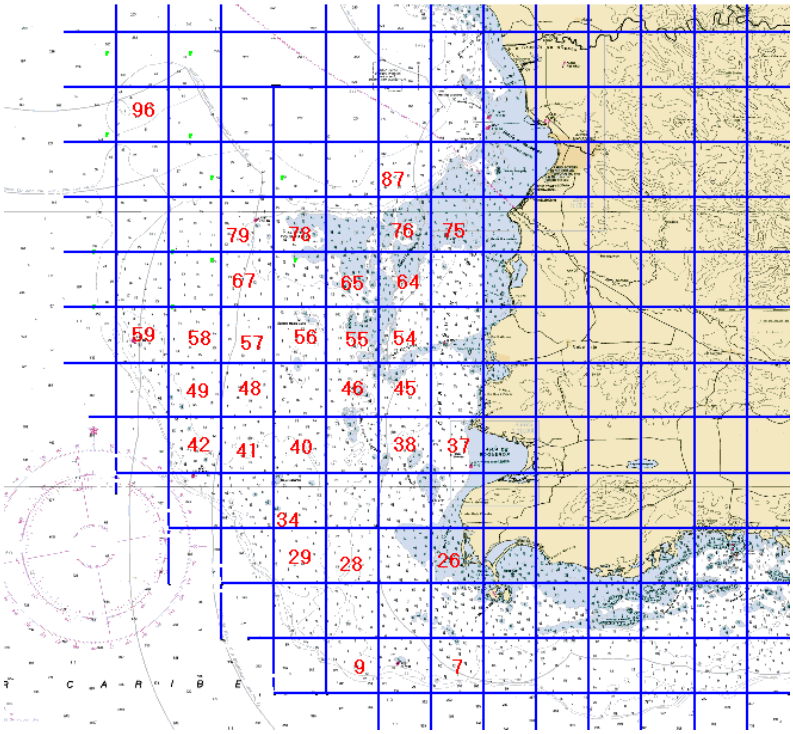

Figure 2. Sampling stations off the west coast of Puerto Rico during 2015.

Appendix 1 – PR SEAMAP Survey

[1]REVISED PROJECT NUMBER: **4**

REVISED PROJECT TITLE: Puerto Rico SEAMAP Program Reef Fish Monitoring

I. **Objective**:

To collect, manage, and disseminate fishery-independent data on the marine resources and their environment; encompassed in marine waters, along with their living marine resources, within the territorial sea and Exclusive Economic Zone (EEZ) contiguous to Puerto Rico and the U.S. Virgin Islands.

II. **Need**:

Fisheries-independent data are critically needed to obtain essential information for fisheries management. Data collected by fisheries-independent surveys is not derived with direct reliance on statistical and biological information collected from commercial fishers. Fisheries dependent data are significantly influenced by a combination of various factors such as economic conditions, changes in gear designs, discard patterns, changes in fishing strategies and practices that are difficult to measure or account for, and most important of all the inaccuracy of the data provided by the fisher.

Changes in management measures of marine resources required stock assessment directed to evaluate the proposed measures or those already in place. Several concerns have been pointed out in the stock assessment regarding the use of fisheries-dependent data and the uncertainty related to those. In 2014 the Southeast Data Assessment and Review (SEDAR) group recognized the need to develop statistically rigorous fisheries-independent survey to provide the information required in the assessment of manage resources (Cass-Calay et al 2015). A workshop was developed to have a comprehensive understanding of all fisheries-independent surveys of the existing surveys in the US Caribbean. A suite of recommendations was developed to adapt existing surveys or develop new ones. Among the recommendations made pertaining to proposed changes to the SEAMAP-C sampling scheme are the following:

[1] This Reef Fish Monitoring project replaces the Original Project 4, Puerto Rico Yellowtail Snapper monitoring SEAMAP Program Survey.

1. Identify species of interest in the U.S. Caribbean to allow optimization of survey design.
2. Consult experts in survey design, statistics and stock assessment prior to modifications/expansion/development of surveys.
3. Use similar methods across platforms to ensure adequate spatial coverage
4. When using different gears, overlap spatially and temporally to allow calibration of methods.
5. Drop Camera/Video surveys
6. AUVs and ROVs – provide other ecosystem information and ground-truthing on habitat mapping.

In order to improve the utility for stock assessment of the data collected by SEAMAP-C shallow water reef fish, it was recommended that the program be thoroughly evaluated in consultation with survey design and population dynamics experts with the intent of refining the sampling programs to augment the spatial- temporal coverage for priority species (Cass-Calay et al 2015). Ingram 2015 (Unpub.) conducted a power analysis of the historic SEAMAP-C in which a series of recommendations were done to improve the utility of data collected for stock assessments. Based on his analysis it was recommended to move to conduct an annual reef fish surveys using standardized sampling methodology between PR and the USVI. Depth and habitat stratification should be implemented for the next sampling cycle with approximately 50 to 100 sampling stations to effectively sample each area. A combination of sampling gears should include vertical line and a short bottom longline, as well to deploy drop camera/video surveys.

Kendall et al (2001) acquired aerial photos of shallow areas close to shore of Puerto Rico and the US Virgin Islands and created benthic habitat maps of the areas. Those maps serves as the backbone for other studies improving and validating the characterization of several areas, for instance for the east coast Vieques Island (Bauer et al 2008) and for the southwest Belverede and Guánica (Bauer et al 2012). Puerto Rico SEAMAP data from 2009-11 was incorporated into the southwest coast habitat maps created by Kendall et al. (2001) which were further validated by Bauer et al. (2012). Those were stations sampled for reef fish, yellowtail and lane snapper surveys at the west coast during those years. In 2013, bathymetry information was collected for what is known as the Northeast Grand Reserve at Puerto Rico's east coast. During 2011, the north east area from Culebra Island and the north coast of St. Thomas of the USVI were mapped. Kågesten et al. (2015) integrated the SEAMAP data collected for the east coast during 2009-12 into benthic maps. All this information will be used to create the habitat stratification that will be used in our projects.

Information on fish reproductive strategy is essential for stock assessments for species under management. No single program can logistically provide the samples for all the species currently under management. Different methodologies are need to catch certain species, for instance SEAMAP Reef Fish sampling was recommended to incorporate a different methodology to improve the yellowtail snapper's samples needed for their assessment (SEDAR 8, 2005). Similarly, it was determined the desirability to leverage funding, personnel and samples from the PR SEAMAP Program with the Reproduction Project F-48 (Peña et al 2012 and 2013; Rosario et al 2013). At the same time, we improved the data gathered for reproduction since all samples are now histologically examined and processed. This agreement and coordination allowed for increased number of stations and samples available. For the new funding cycle nonetheless, we will provide samples for species under study by the Reproduction Project, but we will maintain separate fishing efforts in order to maintain the standardize methodology.

The proposed projects will collect information on reef fish abundance and distribution for the waters surrounding Puerto Rico at the east and west coast implementing the changes in our surveys as recommended by Ingram (2015). The south coast remains to be included in the sampling since 1989 and it is necessary to gather information from this area. The proposed studies will implement some of the changes required by SEDAR and the SEAMAP program managers. Those will include a survey to calibrate drifting versus anchor fishing that will go on as necessary to gather enough samples to compare both methodologies. A secondary effort will be devoted to reef fishes with a bottom longline, deploy underwater cameras and active fishing while anchor. Those surveys will be refined and substituted as the final stratification and the data available ensures a strong statistical comparison of historical data. Effort by survey will vary according to the need of getting enough samples with the different methodologies and increased number of sampling sites. Final methodology will be developed to be implemented during the next funding cycle starting in April 1, 2016.

Results and Benefits Expected:

It is anticipated that the information collected from this cooperative program will provide the following benefits:

- Enable Puerto Rico to identify, implement and measure the effectiveness of fishery management measures for their Territorial Waters.
- Enable Puerto Rico to take full advantage of an integrated, coordinated, and cost effective approach to fishery-independent data collection to fulfil priority data needs.

- Provide information to support the Puerto Rico Department of Natural and Environmental Resources and the Caribbean Fishery Management Council's effort to implement and monitor the effectiveness of fishery management plans for fisheries in the U.S. EEZ.
- Enhance the usefulness of the data, minimize the costs, and increase the accessibility of information to fishery managers through the Caribbean region.
- Serve as an information and coordination effort to support plans to conserve and manage the fisheries that are Caribbean scope.
- Establish reef fish abundance, according to depth, along the south, west and east platform of Puerto Rico.
- Improve the gonads maturity stage identification chart for different fish species.
- Provide data on species of interest for management to improve their stock assessment.

III. Approach (Longline Fishing)

1. Stratify the west and east area by habitat categories and depth. Select randomly sampling areas within each of the identified habitats and depths categories.
2. Stations will be randomly selected according to the depths stratification 0-10, 11-20 and 21-50 fms.
3. A total of sixty sampling trips for each coast, the east and west coast, will be randomly chosen. Stations will be located by Global Positioning Systems (GPS). Sampling station and date will be random and may vary according to weather and sampling logistics.
4. Sampling will be conducted between 5:30 AM and 5:30 PM during the daylight.
5. For sampling, a 300 feet #130 lbs. longline will be deployed. The main braided line of 3/16" of diameter will be anchored at both ends, with buoys to identify them. The line will have 18" of a 50-pound fishing line hanging with a #9 circular hook (YOUVELLA Circular hook #9, HKS7152590) at the end, every 36".
6. Squid will be use as bait, pieces of 1" for each hook.
7. The longline will soak for 45 minutes, after which it will be lift and the fish collected.
8. Each captured fish will be identified by position assigned to the hook on the longline.
9. For each trip the following data will be recorded:

A. date, time (i.e. time 1st hook out hr, last hook out hr, 1st hook hr and last hook in hour)
B. station code and latitude and longitude
C. fishing time for line to the nearest in minutes
D. weather conditions
E. depth
F. total number of hooked fished per vessel
G. number, weight, length, reproductive condition and identification of fish per hook and line as well as by individual longline set.
H. substrate and or habitat type.

10. Visual inspection of gonads is carried out when all samples are processed (conducted by experts from the Reproduction Program at the Fisheries Lab). Sexual maturation stages according to the SEAMAP Pascagoula Sheet Detailed Meristic Form are the following: M3 or Ripe Testes with loose or running milt; F3 or Ripe Ovaries usually transparent and colorless (enlarged gonad with large, well developed eggs); spent gonads, enlarged and flaccid gonads (M4 and F4 for males and females, respectively). Unripe individuals are designated as F1 and M2, meanwhile F2 and M2 corresponds to subripe individuals.
11. Samples of the fish gonads are collected and preserved for histological analysis. One lobe, or a portion of it, is placed in Davidson's fixative (Yevich and Barszcz, 1981) for histological processing. Gonads are preserved for 48 hours, washed for 24 hrs and then stored in 70% ethanol until further processing. Photographs the gonads will be taken and identified with the gonad information. The slides are examined to determine sex and reproductive stage. The same categories used for the visual identification are used for female fishes. The purpose of this is to create a visual aid for the reproductive stage identification of gonads for the different fish species, and use it as a quality control for the visual identification of the fish gonads. This information all is used to determine the reproductive season for species caught.
12. NOAA: software is available for processing longline hauls. Number/tag each hook. Enter catch as hook is pulled in and tag fish with ID number. Several options are considered among them:
    a) Put tags on line with the hook using snap swivel. Pull it off and put it on the fish--probably won't work with this setup because gangions are close together and short.
    b) Use stringer to hang fish--if left together in a basket/well, they tend to thrash around and lose the tags

Procedure Hook and Line Fishing – drifting & anchor

1. Sampling stations will be stratified by depth and habitat within previous 2 x 2 nautical miles' quadrants used at the west and east coast platform. Fishing will be for 2 hours drifting and 2 anchored.
2. Stations will be randomly selected according to the depths stratification 0-10, 11-20 and 21-50 fms.
3. Sixty sampling trips to cover the randomly chosen stations for the east and west will be carried out. All sampled stations will be located by Global Positioning Systems (GPS). Sampling station and date will be random and may vary according to weather and sampling logistics.
4. Fishing order, anchor vs drifting will be selected randomly.
5. Anchor fishing will be done for 30 minutes at 4 different sampling stations.
6. Drifting fishing will be perform for 15 minutes (move to starting point or near area after 15 minute drift) at near anchor sampling stations up to a total of 2 hours.
7. At each quadrant fishing will be done using hook and line with fish hooks #06, sinker units (weights) and squid as bait. Three lines will be used for sampling, each line with four hooks, 2 size #6 and #9. Mustad Hook Kirby sea hook, ringed and tinned size #6 (HKS23306) and Mustad Hook Kirby sea hook, ringed and tinned size #9 (HKS23309). For every fishing day fishers will allocate randomly their hooks in the line.
8. Pieces of 1" of squid will be used as bait.
9. For each trip the following data will be recorded:
   A. Date, time (i.e. time out and time returned to dock).
   B. Station (latitude and longitude).
   C. Fishing time for line to the nearest 15 minutes.
   D. Weather conditions.
   E. Depth.
   F. Total number of hooked fished per vessel.
   G. Number, weight, length, reproductive condition and identification of fish per hook and line as well as by individual fishermen.
   H. Stratified habitat type, if at selected site substrate type was unknown it will be characterized whenever possible using drop cameras.
10. Each captured fish will be identified by hook size and assigned position in the line and fisher. Each individual will be recorded at a SEAMAP software with individuals GPS coordinate of capture.

Histology Procedure:

1. All fish captured will be visually sexed as follows:
    I. Unripe individuals are designated as F1 and M1.
    II. Sub-ripe individuals are classified as F2 and M2.
    III. Ripe individuals are designated F3. (Females with ovaries usually transparent and colorless; enlarged gonad with large, well developed eggs); and M3 (males with testes with loose or running milt).
    IV. Spent gonads F4 and M4; individuals with enlarged and flaccid gonads.
2. Two principal gonad stages will be used for each sex to establish the spawning period of selected species: ripe and spent gonads.
3. Gonads will be collected and preserved for histological analysis of species under study by the Reproduction Program of the FRL. Photos of the fish and the gonads will be taken and identified with the gonad tag information. The slides will be examined to determine sex and reproductive stage by the personnel of the FRL Reproduction Program.
4. Spawning season and size of maturity will be calculated for all species with enough data.

CAMERA SURVEY

Goals and Objectives:

Use of camera surveys is to develop the method and the technology. The end goal is to develop procedures to provide species ID, counts, and lengths. Initially, work will focus on species ID and counts. To include lengths, either stereo camera setup (multiplexed GoPros) or laser. Due to variance in distances, only one fish can reliably be measured in each frame unless we are deploying some form of moving/rotating laser platform.

1. Acquired baseline data of species at selected sampling sites, diversity and size of individuals using a modular optical underwater survey system (MOUSS, Young and Richards, 2014).
2. Assessment of the health of species for better management decisions.

Procedure Cameras deployment

1. Sampling stations will be stratified by depth and habitat within previous 2 x

2 nautical miles' quadrants used at the west and east coast platform.

2. Sixty sampling trips to cover the randomly chosen stations for the east and west will be carried out. All sampled stations will be located by Global Positioning Systems (GPS). Sampling station and date will be random and may vary according to weather and sampling logistics.
3. Deploy camera array for 60 minutes at a near site to longline area. Something similar but not limited to the MOUSS system used by NOAA's Pacific Islands Fisheries Science Center (PIFSC).
4. We will develop a three dimensional adaptation of the MOUSS designing the frame, assembling and testing the camera and recording system.
5. A light (92 lbs') 500 m rated system with highly light sensitive cameras able to be attached to different deployment platforms, and captures high-resolution digital footage. The use of high-resolution digital video allows for more accurate and precise fish identifications and measurements.
6. Video data will be downloaded into computers and processed and read the video footage from MOUSS and other platforms.

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