SUPPORTING STATEMENT

**Limits of Acceptable Change Study surveys in the Northeast Reserves and Culebra Island, Puerto Rico**

**OMB CONTROL NO. 0648-xxxx**

**B.  COLLECTIONS OF INFORMATION EMPLOYING STATISTICAL METHODS**

**1.  Describe (including a numerical estimate) the potential respondent universe and any sampling or other respondent selection method used. Provide data on the number of entities (e.g., establishments, State and local governmental units, households, or persons) in the universe and the corresponding sample in tabular form. The tabulation must also include expected response rates for the collection as a whole. If the collection has been conducted before, provide the actual response rate achieved.**

There are a total of four sampling subunits in this study, which together represent the universe of primary stakeholders, or those stakeholders who utilize the resource directly and/or rely on the resource and resource area as the main source of income. The typology, adopted from Pomeroy and Douvere (2008), represents a well-established and accepted approach to assessing stakeholder involvement/participation and allows for a clear delineation between primary and other stakeholders. The subunits are commercial fishers; water-based operators; vessel operators; and visitors. Each subunit is described in more detail below.

Commercial fishers
There are six ports located in and around the NMC: Rio Grande; Luquillo; Fajardo (including Las Croabas, Martenillo, and Puerto Real); Ceiba (Playa de Los Machos); Vieques (Isabel Segunda; Esperanza); and Naguabo. The most recent estimate of active, commercial fishing operations that target the NMC in the six ports is 90 (Leon, personal communication; Medina, personal communication). This includes the fishers who are presently sampled by fisheries agents from the PR DNER Fisheries Laboratory, and thus represents the post-Hurricane Maria total.

The approach adopted for sampling commercial fishers is to obtain a census sample. The expected response rate is expected to exceed 90%, as was obtained by Matos Caraballo and Agar (2011) in the 2010 PR fishery census effort. Hernandez-Delgado et al. (2014) also employed a census approach to the commercial fishery in northeastern Puerto Rico and achieved an over 95% response rate.

| Area | Total population | Expected sample | Response rate |
|---|---|---|---|
| Rio Grande to Luquilo | 15 | 14 | 93.3% |
| Fajardo to Ceiba | 35 | 33 | 97.1% |
| Naguabo | 5 | 5 | 100% |
| Vieques and Culebra | 35 | 33 | 94.3 |

| TOTAL | 90 | 84 | 95.6% |
|---|---|---|---|

Water-based operators
There are a total of 103 water-based operations that target the NMC and its environs (Medina, personal communication). While a majority of the operations (46.6%) are located in Fajardo, there are several operations on the eastern islands of Vieques (33.0%) and Culebra (17.5%) that also target the (mainly eastern half) NMC. Fewer operations are located near the southern and western margins of the NMC, and only three (2.9%) of these target areas within the NMC.

The approach adopted for sampling water-based operations is to obtain a census sample. The expected response rate is expected to exceed 95%, as was obtained by Shivlani and Bruckner (2007) in similar work conducted in Vieques and by Hernandez-Deglado et at. (2014) with water-based operations in Fajardo.

| Area | Total population | Expected sample | Response rate |
|---|---|---|---|
| Fajardo to Ceiba | 48 | 46 | 95.8% |
| Naguabo to Humacao | 3 | 3 | 100% |
| Vieques and Culebra | 52 | 50 | 96.2% |
| TOTAL | 103 | 99 | 96.1% |

Registered vessel operators
Based on the Departamento de Naveagacion, there were over 74,000 registered vessels in Puerto Rico in 2016-17. That total included approximately 26,000 **active** registered vessels. However, it remains unclear as to how many vessels were permanently damaged or disabled by Hurricane Maria, which severely affected the region in September 2017. However, the approach to be taken will (a) focus mainly on vessel operators who utilize northeastern Puerto Rico and (b) utilize an intercept survey to obtain information on trip use and perceptions from vessel operators returning from a trip.

There is one main public boat ramp in the NMC, which is located in the Las Croabas region of Fajardo. Two other public boat ramps are occasionally used (off Medio Mundo in Ceiba and in Puerto Real in Fajardo), but these do not garner much traffic. Based on discussions with DNER and field observations, it is estimated that the Las Croabas boat ramp accommodates as many as 60 vessels per day. The maximum number of vessels using the ramp over a year is estimated at 21,840 vessels.

Based on a normal distribution of 21,840 vessel operators, the required sample size is 384 vessels.

The methodology will comprise of intercept survey sessions undertaken over two week days and two weekend days per month over a six hour period for each session. Each session will commence at 10 am and end at 4 pm, thereby capturing those operators who return from overnight trips and those who return from day trips. Also, given that it is the only consistently used public ramp in the region, intercept surveys conducted at Las Croabas boat ramp will effectively capture NMC boaters.

It is expected that an average of ten (10) surveys will be conducted over each eight hour session. This is estimated by separate observational sessions taken in February, March, and May 2018, when the project team counted trailers and conducted return counts over four days. The average for that period was 12 vessels/day (counts = 8, 14, 11, and 12), suggesting that the survey sessions will obtain a minimum average of 10 vessels/day.

Based on ten surveys per session, it is expected that the survey effort will yield a total of 480 surveys. Response rates in exit boater surveys have been demonstrated to be high (Shivlani, 2006; BRC, 1991), and the study will achieve a 90% response rate based on past, similar work. Moreover, the project team will work with DNER to help publicize the effort among registered vessel operators to maximize participation.

| Site | Total approached | Total sampled | Response rate |
|------|------------------|---------------|---------------|
| Las Croabas public boat ramp | 533 | 480 | 90.0% |

Visitors
The most recent study conducted with visitors in the NMC region determined that there were 1.16 million visitors who traveled to areas 4 (San Juan to Fajardo) and 5 (Culebra and Vieques). Most of these visitors (85% in area 4 and 14% in area 5), or 871,000 visitors, participated in one or more reef-based activity. This comprises the most accurate estimate of reef-based tourism for the region, which is closely linked to activities in the NMC (based on activities offered by water-based operations).

There are five major sites in the region where a range of visitors can be accessed, and these are: Culebra Ferry Dock; Vieques Ferry Dock; Medio Mundo Beach in Ceiba; Seven Seas Beach in Fajardo; and Monserrate Beach in Luquillo. The Fajardo to Vieques and Fajardo to Culebra ferry system is the most used transportation mode for visitors and residents, and past research (Shivlani and Bruckner, 2007; Loftin, 2003) has determined that both docks are excellent sites to approach and survey visitors returning from one of the smaller islands to Fajardo.

The methodology will comprise of intercept survey sessions undertaken over two week days and two weekend days per month over a two hour period for each session. Sessions for the ferry docks will take place two hours before the afternoon ferry is scheduled to depart from Culebra and Vieques to Fajardo. Visitors will be approached and requested to participate in the study. Sessions for the beaches will take place over the afternoon hours (2-4 pm) for a period for two hours. Beach visitors will be approached and requested to participate in the study.

It is expected that an average of nine (9) surveys will be conducted over each two-hour session at each of the five sites, such that each site will yield 36 surveys per month. The sample size per site will be 432 surveys, collected over the 12-month survey period. Response rates with visitors in past studies in the region (Shivlani and Bruckner 2007; Loftin, 2003) have yielded response rates of 90%, and it is expected that equal response rates will be achieved in the survey. Additionally, respondents will be informed that the surveys will provide important feedback information on management effectiveness and that their responses will be held in confidence to

improve response rates.

| Site | Total approached | Total sampled | Response rate |
|---|---|---|---|
| Culebra Ferry Dock | 462 | 432 | 93.5% |
| Vieques Ferry Dock | 462 | 432 | 93.5% |
| Seven Seas Beach | 480 | 432 | 90.0% |
| Medio Mundo Beach | 480 | 432 | 90.0% |
| Monserrate Beach | 480 | 432 | 90.0% |
| TOTAL | 2,364 | 2,160 | 91.4% |

**2.  Describe the procedures for the collection, including: the statistical methodology for stratification and sample selection; the estimation procedure; the degree of accuracy needed for the purpose described in the justification; any unusual problems requiring specialized sampling procedures; and any use of periodic (less frequent than annual) data collection cycles to reduce burden.**

The procedures for data collection vary across the sub-units being sampled, in that the commercial fishers and water-based operators are census samples, and registered vessel operators and visitors are intercept samples. The procedures for data collection for each sub-unit is described in more detail.

Commercial fishers

 a.  Statistical methodology for stratification and sample selection
The statistical methodology is straightforward for the commercial fisher population, in that the methodology adopted is to obtain a census sample. Fishers from each fishing port (villa pesquera) who target the NMC will be identified and requested to participate in the study, and these fishers will comprise the sample. While there are no intra-sample stratifications to be determined, the population will be selected from a larger population of fishers in the region, of which those who do not fish within the NMC will be excluded.

 b.  Estimation procedure
The population of NMC fishers has been estimated on two occasions, where the first estimate was achieved in June 2017 and the second estimate was achieved in May 2018. The former estimate was the pre-Hurricane Maria total, and it was estimated using three main sources: Information provided by DNER; information provided by the north and east coast DNER fisheries agent; and information provided by each fish house visited from Rio Grande to Humacao from March-May 2017. The post-Hurricane Maria total was estimated using the aforementioned DNER fisheries agent and by visiting each fish house from Rio Grande to Humacao from March-April 2018. It should be noted that almost all fishing activity in much of Puerto Rico ceased for the first few months following Hurricane Maria, due in part to flattened demand, lack of transportation to markets, and patchy electricity (and refrigeration) (Matos-Caraballo, personal communication). Thus, the May 2018 total represents the most accurate total of NMC fishers as the island has recovered from the storm.

c.  Degree of accuracy required

Since this is a census sample, and because of excellent, existing relationships between the study team personnel and DNER, fish houses, and fishers, a high degree of accuracy will be achieved. Past work in the region (Hernandez-Delgado et al., 2014; Shivlani, 2009) has yielded similarly high degrees of accuracy due to very high response rates (>95%).

d.  Unusual problems requiring specialized sampling procedures

Hurricane Maria has severely affected the region and interrupted all study-related work for well over six months. The island and its coastal economy has re-emerged since then but not in the shape that it was prior to the catastrophic storm. The study team has redone a lot of the initial fieldwork in support of population and sample estimation over the first half of 2018, and as part of that effort, the population (and hence census sample) of NMC commercial fishers has been accurately estimated.

e.  Any use of periodic (less frequent than annual) data collection cycles to reduce burden

No other work on characterizing use and views on capacity and limits of acceptable change with the region's commercial fishers has been conducted at this scale. Shivlani (2009) conducted a smaller capacity study aimed at La Cordillera Reserve and Natural Area stakeholders, including commercial fishers, but given that the study was smaller, is now over a decade old, and due to unprecedented changes since Hurricane Maria, neither that study nor others conducted in prior data collection cycles would suffice.

<u>Water-based operators</u>

The statistical methodology is straightforward for the water-based operator population, in that the methodology adopted is to obtain a census sample. Water-based operators who have been identified to target the NMC will be requested to participate in the study, and these operators will comprise the sample. While there are no intra-sample stratifications to be determined, the population will be selected from a larger population of operators in the region, of which those who do not take trips within the NMC will be excluded.

a.  Estimation procedure

The population of NMC water-based operators has been estimated on two occasions, where the first estimate was achieved in June 2017 and the second estimate was achieved in May 2018. The former estimate was the pre-Hurricane Maria total, and it was estimated by working with reserve and natural area officials from DNER (which provides concessionaire permits for those operators using La Cordillera and Culebra Reserve and Natural Areas), meeting with local area operator group representatives, and by directly consulting with operators from Rio Grande to Humacao. The post-Hurricane Maria total was estimated using the aforementioned DNER officials and by visiting each operator from Rio Grande to Humacao in May 2018. It should be noted that, as with fisheries, almost all water-based tourism in much of Puerto Rico ceased for the first few months following Hurricane Maria, due in part to airport closures, lack of supplies (including fuel), and flattened visitor totals (Sea Ventures, personal communication). Tourism totals averaged less than 25% of average winter totals in 2017, and visitor totals had approximated 50% of average totals in the eastern NMC region by March 2018 (Sea Ventures, personal

communication). Nevertheless, operator representatives consulted suggested that visitation will likely recover to near pre-storm totals by the fall of 2018. Thus, the May 2018 total represents the most accurate total of NMC operators as the island has recovered from the storm.

b. Degree of accuracy required

Since this is a census sample, and because of excellent, existing relationships between the study team personnel and DNER, and water-based operators a high degree of accuracy will be achieved. Past work in the region (Hernandez-Delgado et al., 2014; Shivlani, 2009) has yielded similarly high degrees of accuracy due to very high response rates (>95%).

c. Unusual problems requiring specialized sampling procedures

Hurricane Maria has severely affected the region and interrupted all study-related work for well over six months. The island and its coastal economy has re-emerged since then but not in the shape that it was prior to the catastrophic storm. The study team has redone a lot of the initial fieldwork in support of population and sample estimation over the first half of 2018, and as part of that effort, the population (and hence census sample) of NMC commercial fishers has been accurately estimated.

d. Any use of periodic (less frequent than annual) data collection cycles to reduce burden

No other work on characterizing use and views on capacity and limits of acceptable change with the region's commercial fishers has been conducted at this scale. Shivlani (2009) conducted a smaller capacity study aimed at La Cordillera Reserve and Natural Area stakeholders, including commercial fishers, but given that the study was smaller, is now over a decade old, and due to unprecedented changes since Hurricane Maria, neither that study nor others conducted in prior data collection cycles would suffice.

Vessel-based operators

The statistical methodology for vessel-based operators is based on obtaining a simple random sample from the population of vessel-based operators accessing the NMC from the region's main boat ramp in the Las Croabas section of Fajardo in northeastern Puerto Rico (which has been refurbished as of the spring of 2018 following damage sustained by Hurricane Maria in September 2017). As previously stated, it is re-emphasized that because of the devastating effects of Hurricane Maria, it is difficult to state how the vessel traffic will change or even to accurately estimate how many vessels may access the ramp, given the damage caused to the coastal infrastructure; thus, in many ways, this data collection effort of an industry that has previously been grossly understudied will represent a new baseline.

The methodology for sample selection is based on standard sample size determination, where the assumptions are that the population is unlimited and represents a normal distribution, where the desired error is within 0.05, and where the confidence level is 95%:

$$n = (z^2 \, p \, q)/d^2$$

Where:
n = sample size

z = standard normal deviate, set at 1.96 to correspond to the 95% confidence level
p = proportion in target population with the set characteristics; here, it is set at 0.50
q = 1-p
d = absolute precision, set at 0.05

The required sample, based on the population of Las Croabas registered vessel operators, is 384.16 for 95% confidence level with a +/- 5% error. Because the total sample surveyed will be 480, the confidence level and error will be 95% +/-4.47%.

a. Estimation procedures

The population of vessel-based operators who access the NMC via Las Croabas boat ramp has not been previously estimated. A previous vessel study conducted by Shivlani (2009) was based on using vessel license centers, but those results were focused more on island-level use, rather than NMC use. Field-based estimates conducted by the study team in 2017 estimated that up to 21,840 vessel operators may access the boat ramp on an annual. Given that this approach has not been utilized before and due to the impacts of Hurricane Maria, this effort will represent an unprecedented effort in estimating the level and types of vessel use.

b. Degree of accuracy required

The degree of accuracy that can be achieved is 90% or higher. This is based on work done with other stakeholders in the region (Hernandez-Delgado et al., 2014), which yielded high response rates, and because of the high response rates obtained from vessel-based operators in other intercept, boat ramp surveys (Shivlani, 2006; BRC, 1991). Given the brevity of the survey instrument, participation from DNER, and well-trained, bi-lingual data collectors, a response rate of 90% or higher can be readily achieved.

c. Unusual problems requiring specialized sampling procedures

Hurricane Maria has severely affected the region and interrupted all study-related work for well over six months. The island and its coastal economy has re-emerged since then but not in the shape that it was prior to the catastrophic storm. The study team has redone a lot of the initial fieldwork in support of population and sample estimation over the first half of 2018, and as part of that effort, the population (and hence census sample) of Las Croabas vessel-based operators has been estimated to the extent that the ramp may accommodate incoming and existing vessels on a daily basis.

d. Any use of periodic (less frequent than annual) data collection cycles to reduce burden

No other work on characterizing use and views on capacity and limits of acceptable change with the registered vessel operator population targeting the NMC has been conducted at this scale. Shivlani (2009) conducted a smaller capacity study aimed at La Cordillera Reserve and Natural Area stakeholders, including recreational boaters, but given that the study was smaller, is now over a decade old, and due to unprecedented changes since Hurricane Maria, neither that study nor others conducted in prior data collection cycles would suffice.

Visitors

The statistical methodology for visitors is based on obtaining a simple random sample from the

population of NMC visitors at five sites: Culebra Ferry Dock; Vieques Ferry Dock; Medio Mundo Beach; Seven Seas Beach; and Monserrate Beach. As previously stated, it is re-emphasized that because of the devastating effects of Hurricane Maria, it is difficult to state how visitation, which approximated over 1.1 million visitors in 2016-2017 (V. R. Leeworthy, personal communication), has changed since Hurricane Maria. Anecdotal information provided by several water-based operations in Fajardo suggest that visitation rates for recreational activities decreased by as much 75% in the winter season following Hurricane Maria; these totals did not increase to 50% of previous years until spring 2018. Also, it should be noted that, apart from the 2016-2017 recreation and expenditures study (V. R. Leeworthy, personal communication), no NMC-specific, visitor studies have been conducted in the region. Thus, in many ways, this data collection effort of visitors will represent a new baseline.

The methodology for sample selection is based on standard sample size determination, where the assumptions are that the population is unlimited and represents a normal distribution, where the desired error is within 0.05, and where the confidence level is 95%:

$$n = (z^2 \, p \, q)/d^2$$

Where:

n = sample size
z = standard normal deviate, set at 1.96 to correspond to the 95% confidence level
p = proportion in target population with the set characteristics; here, it is set at 0.50
q = 1-p
d = absolute precision, set at 0.05

The required sample, based on the larger visitor population estimated in the 2016-2017 recreation and expenditures study, is 384.16 for 95% confidence level with a +/- 5% error. Because the total sample surveyed will be 2,160, the confidence level and error will be 95% +/- 2.11%. If each site sample is considered separately, which will be 720, then the confidence level and error will be 95% +/-4.72%

   a.  Estimation procedures
The population of visitors who visited the area between San Juan and Fajardo and the islands of Culebra and Vieques has been estimated in the 2016-2017 recreation and expenditures study (V. R. Leeworthy, personal communication); however, no study directed on visitors who target the NMC has been previously completed. Studies by Loftin (2003) and Shivlani and Bruckner (2007) focused on visitor use and resource perceptions around Culebra and Vieques, respectively, but these are both been conducted over a decade or longer ago and concerned only a segment of the overall NMC. Given that this approach has not been utilized before and due to the impacts of Hurricane Maria, this effort will represent an unprecedented effort in estimating the level and types of visitor activities and perceptions on resource health and capacity conditions.

   b.  Degree of accuracy required
The degree of accuracy that can be achieved is 90% or higher. This is based on previous work

done on general visitors (V. R. Leeworthy, personal communication), which yielded high response rates and on visitors who participated in water-based activities (Shivlani and Bruckner, 2007), for whom response rates were even higher. Given the brevity of the survey instrument, participation from DNER, and well-trained, bi-lingual data collectors, a response rate of 90% or higher can be readily achieved.

 c. Unusual problems requiring specialized sampling procedures

Hurricane Maria has severely affected the region and interrupted all study-related work for well over six months. The island and its coastal economy has re-emerged since then but not in the shape that it was prior to the catastrophic storm. It remains unclear whether visitation rates will recover to the pre-hurricane levels, but these will not require any specialized sampling procedures.

 d. Any use of periodic (less frequent than annual) data collection cycles to reduce burden

No other work on characterizing use and views on capacity and limits of acceptable change with visitors targeting the NMC has been conducted at this scale. Loftin (2003) and Shivlani and Bruckner (2007) conducted a smaller visitor studies around the eastern islands, and the most recent visitor and expenditure study included large areas which included the NMC and segments of other coastal areas. Finally, due to unprecedented changes since Hurricane Maria, no previous studies conducted in prior data collection cycles would suffice.

**3. Describe the methods used to maximize response rates and to deal with nonresponse. The accuracy and reliability of the information collected must be shown to be adequate for the intended uses. For collections based on sampling, a special justification must be provided if they will not yield "reliable" data that can be generalized to the universe studied.**

Methods to be taken to maximize response rates will vary across the different sampling sub-units (stakeholders). Maximizing responses via in-person interviews with commercial fishers and water-based operators will be done by working with local area officials and representatives (DNER Fisheries Laboratory, DNER reserve and natural area officials, commercial fishery organization leaders, local area advisory boards, and water-based operator organization representatives) to broadcast the effort, its objectives, and importance to the region's resources. Also, each respondent who is approached will be provided information on the study, be asked with courtesy to participate, and be assured of total anonymity.

Maximizing responses via intercept surveys with registered vessel operators and visitors will be done by providing background information on the study, itemizing study objectives, and assuring anonymity to potential participants. The survey instruments to be used are also very short and can be completed in most cases within a few minutes, and the brevity of the effort will be explained to promote participation.

With both the in-person interviews and intercept surveys, data collectors will be trained fully on best management practices to obtain objective data and to promote participation. Training sessions will focus in part on how to approach and recruit participants, while maintaining a high

level of professionalism.

It should be noted that none of the stakeholder populations for the NMC have been estimated before, so this will be the first complete effort of its kind.

Nonresponse will likely not be an issue with the in-person interviews given the expected high response rate and because of the census survey effort. Nonresponse will also likely not be an issue with the intercept surveys given the expected high response rate.

**4.  Describe any tests of procedures or methods to be undertaken. Tests are encouraged as effective means to refine collections, but if ten or more test respondents are involved OMB must give prior approval.**

All four survey instruments have been tested with five or fewer trusted members of each stakeholder group. The time needed to complete each survey has been estimated and used in this document to estimate total burden hours. All survey questions have been scrutinized by the aforementioned stakeholder group members, both to determine whether the questions apply to their respective groups and if the questions are understandable in the form in which these are constructed.

Other DNER (navigation, fisheries, and protected area) officials and local area experts have been consulted on the construction, content, and implementation of each survey instrument. Their comments and recommendations have been considered in developing the final survey instruments.

**5.  Provide the name and telephone number of individuals consulted on the statistical aspects of the design, and the name of the agency unit, contractor(s), grantee(s), or other person(s) who will actually collect and/or analyze the information for the agency.**

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