Snowy Grouper Exempted Fishing Permit (EFP) Proposal

Letter Addressed to:

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Objective:

The objective of this letter is to request the permission for the collection of snowy grouper juveniles. The fish collected will be brought to the laboratory at the Rosenstiel School of Marine and Atmospheric Science for the purpose of estimating and validating age and growth rates from daily rings observable in fish otoliths.

Background on Snowy Grouper:

Snowy Grouper, *Epinephelus niveatus*, is a commercially important deep-water fish that can be located in the western Atlantic from North Carolina to Brazil, including the Gulf of Mexico and the Bahamas (Wyanski et al., 2000). The adults reside on the upper continental slope at depths of approximately 116-258 meters (Wyanski et al., 2000), while juvenile snowy groupers are more likely to inhabit in shallower waters. Snowy grouper is a sought after species and is normally caught in areas that are characterized by rocky ledges, cliffs, and swift currents (Wyanski et al., 2000). This species is a commercially valued fish that can be caught using long-lines as well as hand-lines. Juvenile snowy groupers have been found in the waters of New York, New Jersey, Lower Florida Keys, and Massachusetts (Moore et al., 1984). The snowy grouper is considered to be protogynous hermaphrodite, which means that individuals undergo sexual transition from a fully functional female to a fully functional male at some stage of their lives (Moore et al., 1984).

Snowy grouper stocks have been heavily exploited in North and South Carolina for both recreational and commercial fisheries since the mid 1960s (Huntsman, 1976). Due to the exploitation of this species, the snowy grouper is listed as a priority species for management in the South Atlantic Fishery Management Plan (Moore et al., 1984). The South Atlantic Fishery Management Council regulates the snowy grouper under the snapper/grouper species. For commercial boats, a limited access permit is required for the fishing of snowy groupers, and a trip limit of 100-pounds per trip is enforced (SAFMC, 2014). The Snowy Grouper Fishery opened on January 1, 2015. This species is managed under an Annual Catch Limit (ACL) of 82,900 pounds (NOAA, 2014). For recreational fishing, there is a maximum bag limit of 1 grouper per vessel per day and it is also regulated under an ACL. In the recreational fishing season for 2014, a total of 523 snowy groupers were caught and recorded (NOAA, 2014). Circle hook are required when using hook-and-line gear, and all fish must be landed with head and fins intact (SAFMC, 2014). Not much is known about age and growth rates of juvenile snowy groupers of age less than a year old, since they are hardly seen in shallower waters and further studies must be performed. This species is listed as a vulnerable species under the International Union of

Conservation of Nature and Natural Resources red list (IUCN, 2014). Achieving an understanding of their growth rates is crucial in order to properly assess, manage, and sustain the fishery as a whole.

Summary of Previous Data:

A study performed by Moore et al. in the Lower Florida Keys reported juvenile snowy groupers in lobster traps in 1984. They caught a total of 71 snowy groupers in the lobster traps that ranged in size from approximately 10-27 cm in length (Moore et al., 1984). This study provided the first report that juvenile snowy groupers were settling in lobster traps possibly prior to leaving to find more sedentary locations in deeper waters. The analysis performed by Moore et al. was focused on the annual growth of snowy groupers by studying annual rings. In this study, Moore et al. found that approximately 2.5% of the 71 snowy groupers ranged in size from 10-12.5 cm long, 14.5% ranged from 12.5-15 cm, 30% ranged from 15-17.5 cm, 24% ranged from 17.5-20 cm, 10% ranged from 20-23.5 cm, 14% ranged from 23.5-25 cm, and 6% ranged from 25-27 cm (Moore et al., 1984). Along with sampling juvenile snowy groupers from lobster traps, Moore et al., also collected 238 snowy groupers using long-lines. Comparison of sizes of snowy groupers collected on lobster traps and long-lines from the different habitats in the Lower Florida Keys may (Moore et al., 1984) suggest that the species inhabits benthic, shallow-water inshore reefs early in life.

In a recent study conducted at the University of Miami juvenile snowy groupers were again found in lobster traps along the coast of the Florida Keys, predominantly in Conch Key (**Figure 1**). The study led by Dominique Lazarre, a graduate student, was monitoring catches of lionfish on these traps with the collaboration of a local fisherman. Juvenile snowy groupers were found settling in lobster traps at depths ranging from 13-61 meters. In the study each trap was lifted to the surface, and all contents of the trap were placed in a basket where the measurements, trap number, depth and location of the fish were recorded. All fish were then returned to the sea alive. Each grouper documented ranged in length from 2.5 to 20 cm long (Figure 2, **Table 1 and 2)**. This data was collected over the course of two years, with a total of approximately 30 trips made. In the first year, 63 snowy groupers were documented to have been located in the traps and in the second year 78 groupers of this species were found. There were 20 traps per line and every third trap was lifted to collect the data. Photos of the snowy groupers were also taken. This data suggests that it would be possible to collect enough specimens from these traps, to perform an age and daily growth rate study of this species.

This study would differ from the one by Moore et al., which focused on the growth of snowy groupers of approximately one year and older; whereas we would focus on examining the growth rates of juvenile snowy groupers within the first year. Even though methods for studying yearly rings for snowy groupers were validated by Matheson (Matheson, 1981) daily rings have yet to be validated.

Collection Method:

In order to perform this study on the growth rates of snowy groupers, several steps must be taken. First, each grouper will be collected from lobster traps aboard a 50-

foot Dorado boat called "G Force," captained by Gary Nichols in Conch Key. Conch Key is located in the Middle Florida Keys (**Figure 1**). Each year, approximately 15 trips will be made, and a maximum of 200 snowy groupers are expected to be collected through a year. All traps fished in a given day of fishing will be checked for the presence of snowy groupers. If there are groupers present, the trap number, location, depth, length measurement, and date will be documented as was done in the previous study by Dominique Lazarre. The collection of the juvenile snowy grouper would occur from August 6, 2015 through March 31, 2016 (lobster season) for the first year. Captain Gary Nichols will be deploying and extracting each trap. Each trip, Dr. Die and Chiara Pacini will be present during the deployment and extraction of the lobster traps. Snowy Groupers will only be collected when we are present, and they will be kept alive in an aerator tank. Overall approximately 200 lobster traps will be deployed or extracted during each trip. These traps are wire traps, which are weighted down with concrete slabs to prevent them from moving during storm winds and heavy currents. Each trap will have a tending period of two weeks and will be placed at a depth of around 62-187 feet. These traps are commercially available lobster traps and are 35 in. long, 23.6 in. wide, and 23.6 in. high (**Figure 6**), and will have a vertical line attached.

In addition to collect fish for otolith extractions, we also propose to collect as many as twenty live snowy groupers in order to validate the daily growth rings by keeping these fish in the laboratory alive. They will be marked with a solution of tetracycline for twelve hours and kept in a tank for approximately 30 days according the *UM Policy on Human care and Use of Laboratory Animals*. These fish will be kept in a flow through tank, therefore ammonia build up can be avoided and good water quality can be assured. The tanks temperature, salinity, and oxygen levels will be monitored daily. The fish will be fed every-other day and the tank will be cleaned daily to remove any uneaten food particles and solid waste. Before the addition of tetracycline, the fish will be acclimated to their new environment for one week.

Given that the boat we propose to collect fish is a commercial lobster boat we are seeking advice and approval to make the collections.

Along with the collection of snowy groupers from the lobster traps, we also seek to place our own commercially available blue crab and pinfish traps in state and federal waters. These traps will be placed at a depth range similar to where the snowy grouper juveniles were located in the Florida Keys, between 75-180 feet deep. The location of the traps is shown in (**Table 3**). The exact location of these traps may very, but they will remain within a half-mile diameter of these locations. Each trap will be labeled with a University of Miami RSMAS tag and will have a recreational buoy attached. The use of Galvanic Time Releases (GTR) will be used with our trap buoys in order to avoid detection and tampering and to minimize interactions with traveling vessels. A total of twenty (10 in state and 10 in federal waters) blue crab and twenty (10 in state and 10 in federal waters) pinfish traps will be set out. The traps will be checked approximately every seven days in order to assure enough time for the juvenile snowy groupers to enter and settle in them. This time frame may be altered as needed if the snowy groupers seem to be settling faster than the seven-day tending period.

Once the juveniles have been retrieved from the traps, they will be brought back to the University of Miami, RSMAS for further studies. The state water traps will be placed off the coast of Miami Beach (Figure 3), and the traps from federal waters will be placed around the same area in the Florida Keys were snowy groupers were found in Dominique Lazarre's study (Figure 1). Currently, we are waiting for approval from the Florida Fish and Wildlife Conservation Commission (FWC) for a Special Activities License (SAL) in order to place these traps.

Both the Blue crab and pinfish traps are made up of wire material and will be weighed down with concrete slabs to minimize movement during strong storms and currents. The blue crab traps have dimensions of 24 in. (L), 23.5 in. (W), and 11 in. (H) (the throat entrance in 8 in. (W), and 5.5 in. (H)). The pinfish traps are 24 in. (L), 11 in. (W), and 11.5 in. (H) (the throat entrance is ¾ in. (W) by 3 in. (H)) (**Figures 7 and 8**). Each trap will be attached to a commercially standard rope of 5/16 inches thick, which again, will be held with a Galvanic Time Release (GTR). Before each trap is placed, GPS and sonar 3-D imaging software will be used to assure the avoidance of high coral areas. Along with the imaging from the GPS and sonar, a GoPro camera attached to a rope will be deployed prior to trap deployment to provide additional assurance. These traps will be deployed and extracted by either Dr. Die or Chiara Pacini, and will be lowered and raised by hand.

Any bycatch captured by these traps will be released alive back into the ocean. Precautions will be taken to assure that the bycatch suffers the least amount of distress as possible. Each trap will be lifted slowly to allow the fish to adjust to the changes in pressure. After every 30 feet, the hauling of the trap will be paused for a few minutes to try to minimize the fish's chances of suffering barotrauma. If fish have suffered barotrauma from being pulled up, venting will be used to release any air captured in their swim bladder. In order to reduce the risk of infection, a hypodermic needle and betadine spray will be used. Also, release cages (or descending devices) will be utilized to aid any bycatch captured within the traps to adjust to the pressure changes the fish might experience on their way back down. These descending, or recompression, devices are tools used in order to reverse the effects of barotrauma (FWC 2015). A bottomless crate will be used, which will be attached to a rope and weighted down with four weights at each corner. There have been indications that the use of these release cages can increase the survival of the fish, which may have suffered the effects of barotrauma (FWC 2015). For all traps, lobster, blue crab and pinfish, exact depth and location can be provided once each trap has been placed. We understand that fish traps are not generally approved; therefore, if issues arise with the pinfish traps, we would still like to seek approval for the use of the blue crab and lobster traps.

Methods of Analysis:

In order to analyze each otolith, both otoliths (Sagittae) will be carefully removed from the skull of each fish. The otoliths will then be emerged in a water solution on a petri dish and any remaining tissue will be removed using tweezers. This procedure will be done under a microscope. Once the otoliths have been cleaned, they will be placed

under a microscope and the core will be located. Using a pencil, a perpendicular line will be drawn downward to mark the location of the core and used as a reference point when cutting the otoliths. If otoliths prove to be large, the will be embedded on a plastic mold in epoxy and left to dry overnight. Once the otoliths have been embedded and the epoxy has dried, the otoliths will be cut using a Buehler Isomet saw and diamond-edge wafering blade. This will allow for a precise and clean cut.

Each otolith will then be mounted onto a glass slide with crystal-bond thermo-plastic glue (D'Alessandro et al., 2013). Once the otoliths have been mounted properly, they need to be sectioned down. This is achieved by sanding the otolith in a circular motion to a thin transverse section where the rings and core are visible under a microscope (usually around 10x). Once the otolith has been sanded down to the specifications needed, it must then be polished using a polishing pad and some micropolish powder in order to remove any scratches or damage that may have occurred to the otolith while sanding down. After polishing, the otolith is ready to be read and analyzed under an imaging microscope. A 1000x digital image of each otolith will be taken using a Lecia DMLB microscope (D'Alessandro et al., 2013). The otolith increments (daily rings) will be measured and counted along the longest axis from the core to the outer edge.

Finally, twenty fish will be marked with tetracycline in order to validate the otolith analysis. These fish will be marked with 600mg/L solution of tetracycline for twelve hours by means of an immersion bath. This will allow for the comparison of growth rates of the fish kept in the laboratory versus those of the snowy groupers in the field.

Expected Results:

The expected results will be that the snowy groupers growth rates will be increasing on a linear scale during their first six months of life. Also, it is expected that the snowy groupers located within the lobster traps will be juveniles, and as they increase in length, they will move out of the traps and into deeper waters. Growth rates from simple length measurements of fish collected by Lazarre depict these expectations as well, because fish size tends to increase as the fishing season progresses **(Figures 3 and 4)**.

Our estimates of growth will allow us to better understand of the ecology of snowy grouper and thus help improve management for this fishery. A detailed report of the collection of the data and the analysis conducted will be provided to National Marine Fisheries Service (NMFS) as well as to the South Atlantic Fisheries Management Council (SAFMC) through the SEDAR process.

In conclusion, a study performed on the growth of juvenile snowy groupers by means of analyzing the daily rings of the otoliths, would provide a plethora of data that would be useful for understanding the life cycle of this species. Also, it will provide better means of assessing, managing, and sustaining the snowy grouper fishery. With a better understanding of this species, prevention of overfishing may be possible.

Table 1: Data Collected from Season 1 for Snowy Groupers in Traps:

Date	Number of Snowy Grouper Observed	Average Depth (m)	Average Length (cm)
9/22/11	1	35	15.50
10/12/11	15	32	4.07
10/29/11	8	43	12.06
11/9/11	3	45	13.83
11/16/11	6	42	13.00
11/27/11	11	45	13.68
12/9/11	4	46	15.13
1/7/12	4	50	15.00
2/6/12	3	53	15.17
3/9/12	8	47	13.06

Table 1: *This table depicts the dates, number of snowy groupers caught on that date, average length measurements (in cm), and depth (in meters) were the snowy groupers were collected form each trap for the first season.*

Table 2: Data Collected from Season 2 for Snowy Groupers in Traps:

Date	Number of Snowy Grouper Observed	Average Depth (m)	Average Length (cm)
8/31/12	1	39	4.50
9/24/12	3	34	3.67
9/27/12	1	37	8.00
10/10/12	1	27	2.50
10/17/12	1	42	5.00
11/21/12	3	52	5.33
12/23/12	15	49	9.50
1/12/13	9	46	12.17
1/16/13	9	56	10.67
1/25/13	9	54	11.00
2/7/13	12	54	11.13
2/21/13	9	52	13.94
2/22/13	5	51	11.00

Table 2: *This table depicts the dates, number of snowy groupers caught on that date, average length measurements (in cm), and depth (in meters) were the snowy groupers were collected form each trap for the second season.*

Figure 1: GIS map of the Study Area and Trap Position:

Figure 1: *The figure above demonstrates a GIS map of the study area where the juvenile snowy groupers were found, and the area position of where the traps were sampled.*

Figure 2: Size distribution of snowy grouper collected in season 1 and 2

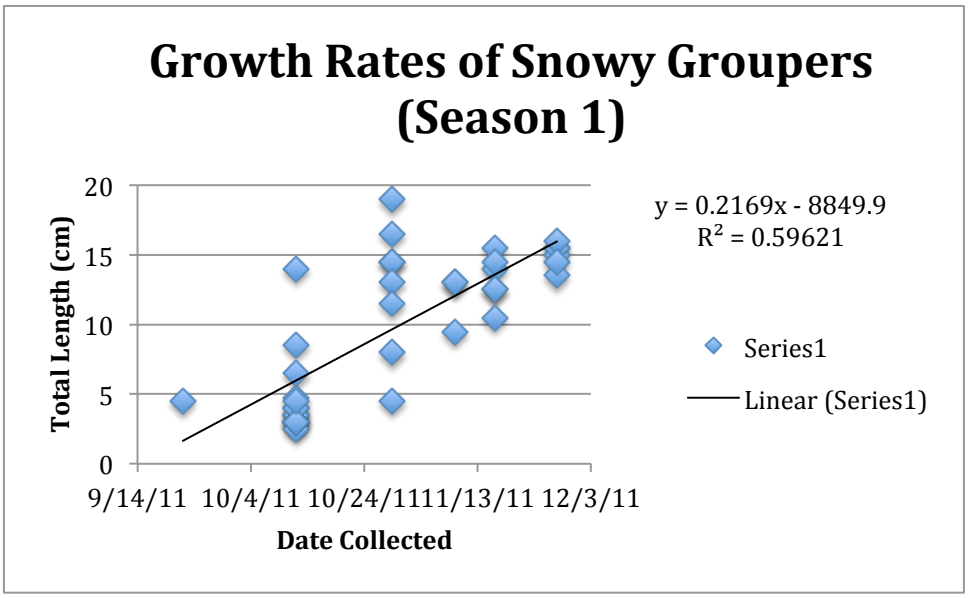

Figure 3: *Apparent growth of juvenile groupers through fishing season 1. It illustrates an increase in the Total Length (TL), in cm, of juvenile snowy groupers (table 1) over the different trips made.*

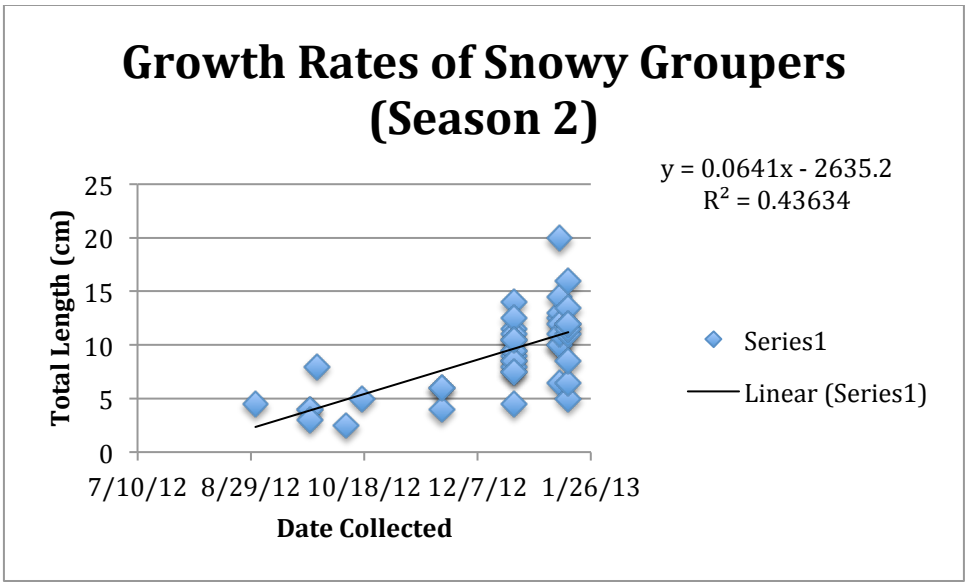

Figure 4: *Apparent growth of juvenile groupers through fishing season 2. This graph illustrates an increase in the Total Length (TL), in cm, of juvenile snowy groupers (table 2) over the different trips made for season 2.*

Table 3: Location of Blue Crab and Pinfish Traps (Coordinates):

Latitude (North)	Longitude (West)
25.84467	80.0829
25.83741	80.08791
25.81741	80.08817
25.8276	80.08674
25.80819	80.08144
25.81112	80.08349
25.85159	80.08235
25.85666	80.08215
25.80469	80.08282
25.80616	80.07997

Table 3: *This table demonstrates the coordinates where the blue crab and pinfish traps will be placed. The exact location of these traps may very, but they will remain within a half-mile diameter of these locations.*

Figure 5: Map of Study Area for Blue Crab and Pinfish Traps:

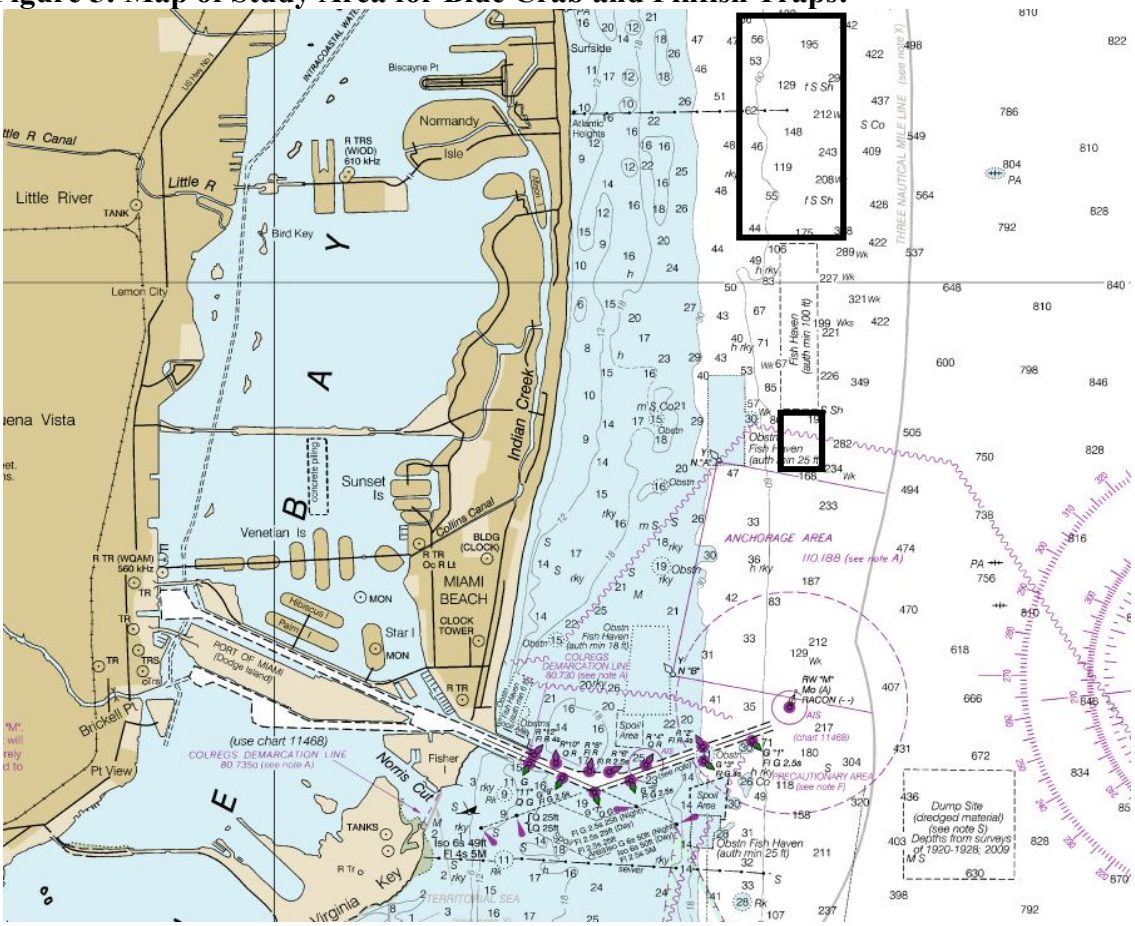

Figure 5: *The figure above demonstrates a map of the study area where the blue crab and pinfish traps will be placed in order to collect the juvenile snowy groupers from state waters (Image taken from NOAA).*

Figure 6: Lobster Trap Diagram:

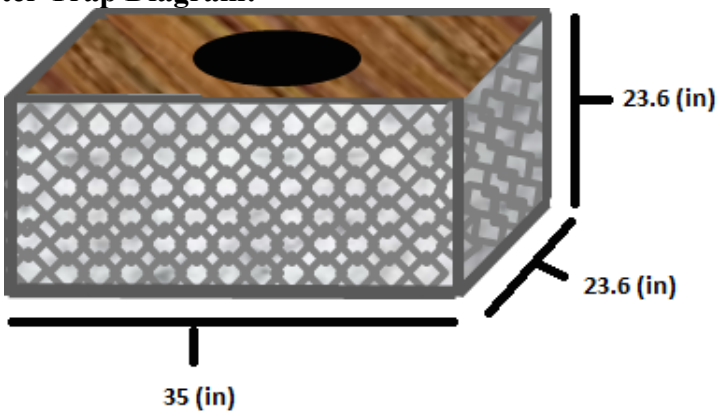

Figure 6: *The figure above shows a diagram of the lobster traps that will be used with commercial fisherman Gary Nichols.*

Figure 7: Blue Crab Trap Diagram:

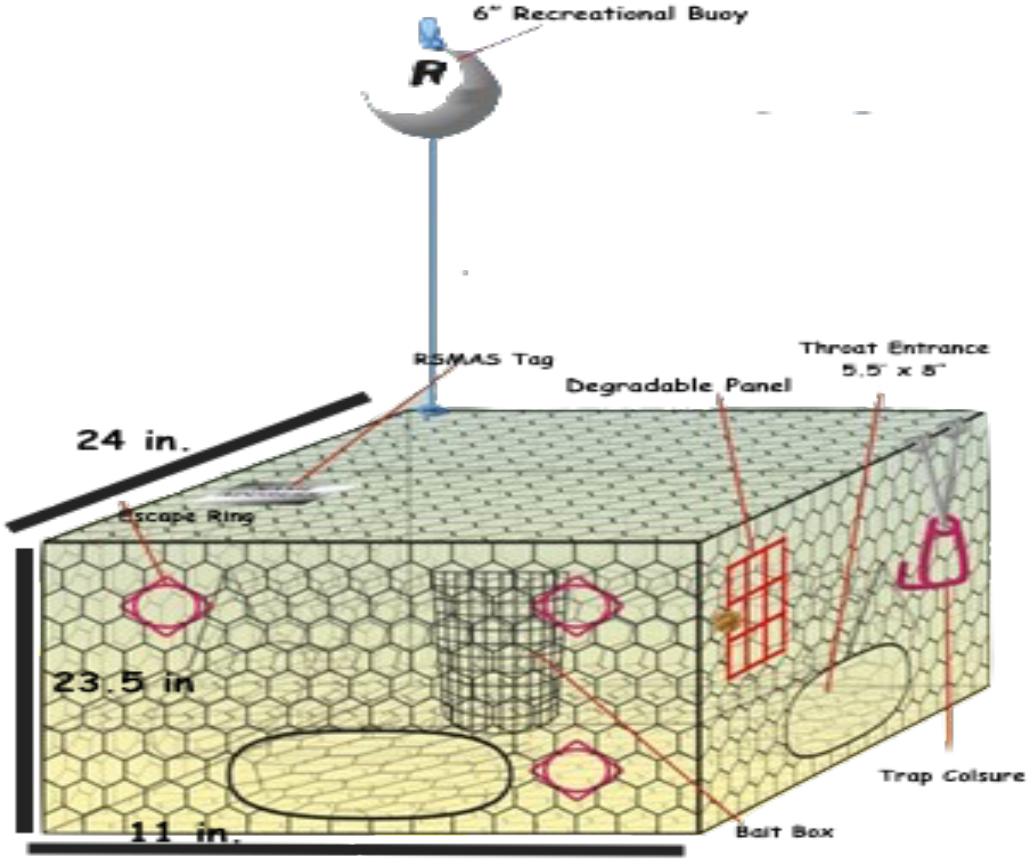

Figure 7: *The figure above depicts a diagram of the blue crab traps that will be used for this experiment, along with its exact dimensions. This image was taken from the FWC. (FWC 2015)*

Figure 8: Pinfish Trap Diagram:

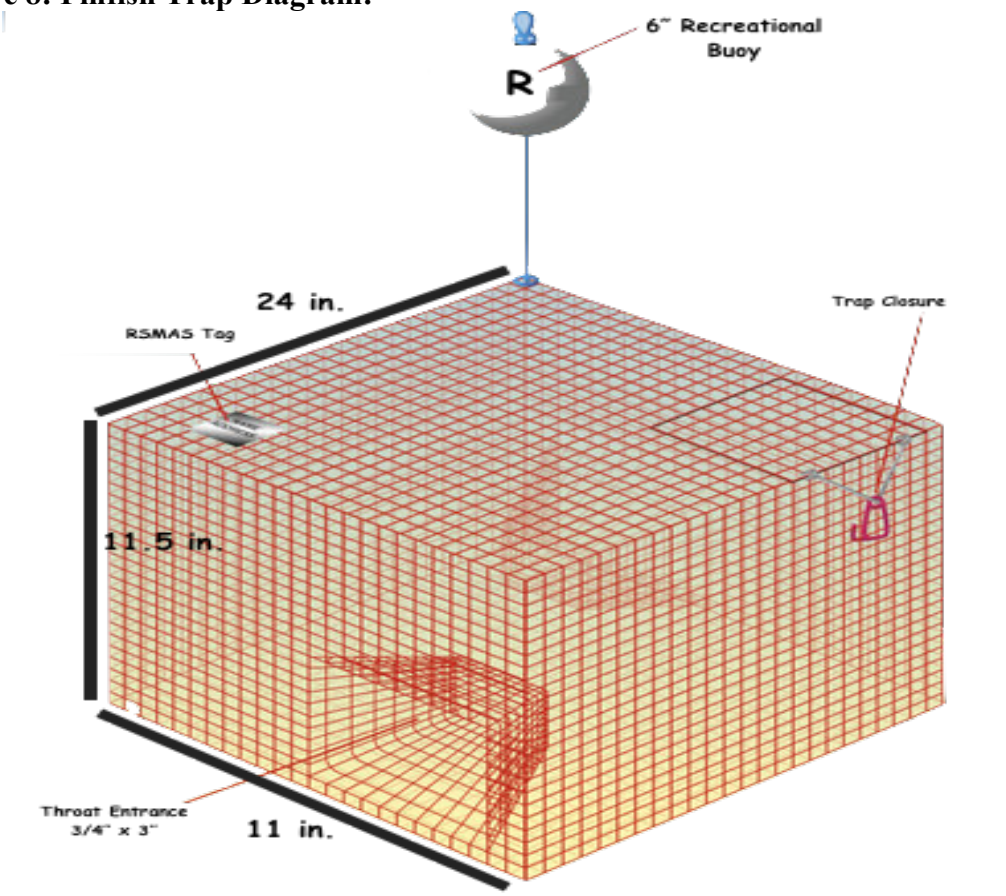

Figure 8: *The figure above is a diagram of the pinfish trap that will be used for this experiment, including exact dimensions. This image was taken from the FWC (FWC 2015).*

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