Analysis of The Gulf and Florida Coast Lionfish Population

SCUBAnauts International

MASTERNAUT PROJECT

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Abstract:

In order to gain a deeper understanding of the Gulf and Florida Coast lionfish population, this project analyzes the preferred habitat and conditions of various dive sites across the Gulf of Mexico, Texas Flower Gardens, and Florida Panhandle Coast. Research for this project was performed in the form of benthic surveys and roaming fish counts, both performed by the American Academy of Underwater Sciences divers using SCUBA. After analysis of data gathered, the conclusion can be made that Lionfish in the area thrive on man-made structures as opposed to naturally occurring reefs.

Introduction:

For more than a decade now, the Lionfish population in Florida has been growing and ravaging Florida's reefs and marine ecosystem. Lionfish are a predatory species native to the South Pacific and Indian Ocean, that primarily prey upon smaller fish species (Morris and Akins). Identifying features of Lionfish (Fig. 5) are their dark orange and red coloration, striped pattern, and tassels surrounding their mouths. Their most notable feature however, is the array of venomous spines protruding from their all fins, except the caudal and pectoral fins. It is believed they were brought to Florida as part of the exotic pet trade. Being a relatively new invasive species in the region, Lionfish have little-to-no natural predators to keep their population in check. This is allowing them to easily prey on native species, with little to no resistance. In order to gain a deeper understanding of the local Lionfish population, divers conducted surveys in the Florida Panhandle Coast and the Gulf of Mexico. In the panhandle, data was gathered offshore of Destin. Whereas data gathered in the Gulf of Mexico is from the Texas Flower Garden Banks.

The surveys conducted allow for the identification of the behavior patterns and habitat associated with areas where the Lionfish population thrives. By identifying these areas, it is possible to assist organizations such as the Reef Environmental Education Foundation (REEF) in organizing lionfish roundups (also known as derbies) that target specific areas that will likely have a high lionfish population due to similarities with the preferred habitat determined in this study (REEF, Lionfish Derbies). By performing these targeted roundups, divers are able to more effectively aid in the restoration of Florida's marine ecosystem and control the population of this destructive species.

Methodology:

In order to accurately gather data, divers made use of two different types of marine surveys.

The first survey was the roaming fish count. In this, divers traveled in buddy pairs, each diver freely observing and taking note of the fish species that surrounded them as they patrolled the reef. There was no limit on the specificity of which species were taken note of, rather divers were encouraged to record every mobile organism they observed (excluding all invertebrates except mollusks). The second method made use of a 30 meter long transect. Divers laid this transect along the seabed and then swam back along the transect to observe any species found within 10 feet of either side of the transect.

While swimming the divers also took note of the habitat features any lionfish was located on. These habitat features included whether the lionfish was sheltered (e.g., inside crevice), exposed, and the benthos (e.g., sand, reef, or rubble) the fish was located on. The behavior of the Lionfish

was also recorded as either swimming, resting, or hovering. In addition to these surveys, all divers were required to fill out data including the type of habitat the dive site was (natural or artificial), name of the dive site, the depth of each survey, visibility, water temperature, and a qualitative estimate of the current present at each site. After data was recorded, all information was manually transferred into excel (Fig. 1). Using this software, data was organized and sorted by habitat type (natural or artificial). Under each of these, it is specified what type of artificial reef (structure, debris, artificial reef, or wreck) and all site-specific metadata mentioned above. Each of these habitat types are as follows. Structure includes actively used man-made structures that serve a purpose besides acting as an artificial reef, for example oil rigs or bridges. Debris are classified as trash or building material that was discarded in the ocean, regardless of whether it's placement was intentional or not. The artificial reef category pertains to any purposefully constructed and designed formation that was placed on the sea floor, specifically to become an artificial reef, for example reef balls. Finally, wrecks include any vessel that now lies on the seabed.

Figure 1. Format used to organize and analyze data

Project Data
Lion Fish Survey - Miramar Beach
All Transects spaned 30 meters/ 100 feet

															Predators										Predators				
Date	Site	Site Depth (ft)	Water Temp	Visibility	Site Type	Current	LionFish #	Transect Distance (feet)	Total fish length (nose to tail)	Habitat	Depth of lionfish (feet)	Behavior	Habitat Feature	Diver(s)	Goliath	Shark	Baracuda	Jack	Snapper	grouper	Flounder	Batfish	Spanish Makeral	Trigger	Tomtate	Toad Fish	Eel	Grunt	Angelfish
7/10/2021	Liberty Ship	80	77	60	Wreck	mild	None							Brayden		xx			>50								x		
7/10/2021	Liberty Ship	81	74	60	Wreck	mild	None							Diana					>25						x				
7/10/2021	Pyramids FH-14-08	60	77	50	Artificial	mild	1	20	12	Reef	62	Hover	not listed	Brayden					xx										
7/10/2021	Pyramids FH-14-08	60	77	50	Artificial	mild	2	90	12	Reef	62	Hover		Brayden															
7/10/2021	Pyramids FH-14-08	60	77	50	Artificial	mild	3	100	10	Reef	62	Rest		Brayden															
7/10/2021	Pyramids FH-14-08	60	77	50	Artificial	mild	4	100	14	Reef	62	Swim		Brayden															
7/10/2021	Pyramids FH-14-08	65	78	50	Artificial	mild	None							Lauren									x						
7/10/2021	Pyramids FH-14-08	68	80	50	Artificial	mild	None							Diana					x										
7/10/2021	Pyramids FH-14-09	70	78	60	Artificial	mild	1	5	10	Reef	62	REST		Diana					xx				x						
7/10/2021	Pyramids FH-14-09	70	78	60	Artificial	mild	2	5	5	Reef	62	REST		Diana															
7/10/2021	Pyramids FH-14-09	70	78	40	Artificial	mild	1	0	14	Reef	67	REST		John			x												
7/10/2021	Pyramids FH-14-09	70	78	40	Artificial	mild	2	0	10	Reef	67	REST		John									x						
7/10/2021	Barrel Barge	69	78	40	Wreck	Moderate	none							Diana	x			x	xx					x	x	x			
7/10/2021	Barrel Barge	70	78	40	Wreck	Heavy	none							Lauren	x				x										

Results:

Throughout this study, divers gathered data on a series of twenty-one dives. Among these dives, twenty-nine surveys were conducted on artificial reefs, whereas twenty-eight surveys were conducted on natural reefs. The maximum depth reached across all dives was 101 feet of salt water, this dive was in the Texas Flower Gardens. While the shallowest dive occurred in Destin Florida at a depth of 60 feet of salt water. The average depth of all dives was 73.543feet of salt water.

After careful analysis, it is clear that Lionfish in the study area prefer shallow water manmade structures. Lionfish are known to be a tropical Shallow water, reef dwelling species; this remains evident in the results. However, their preference of manmade structures was unknown. Throughout this study, artificial reefs consistently displayed a higher Lionfish abundance than any natural reef observed by divers, meaning divers observed a higher population of Lionfish on reefs that grew on man-made structures. Figure two provides a visual representation of the drastic gap between the 72 Lionfish observed on man-made reefs, in comparison to the total of 5 observed on natural reefs. Moving to the next discovery and regarding the presence of predators, the project's hypothesis was supported in that as the population of predatory species increases the Lionfish population decreases. This remains true in areas where there is a high Lionfish population, thus causing a decline in the population of competing predatory species.

The second trend identified is as follows; lionfish do not have a direct competition with any specific species of the local predators. Rather, Lionfish abundance has negative correlation with all species schooling predators, the prime example of this being snapper (Fig.3). This goes

against expectations that a specific predatory species poses the most competition with lionfish and brings forth a new concept that deserves further study.

The final trend that arose during data analysis is the preference of environments with low to absent current. Lionfish often exhibited a higher and more active population on reefs with mild currents (Fig. 4).

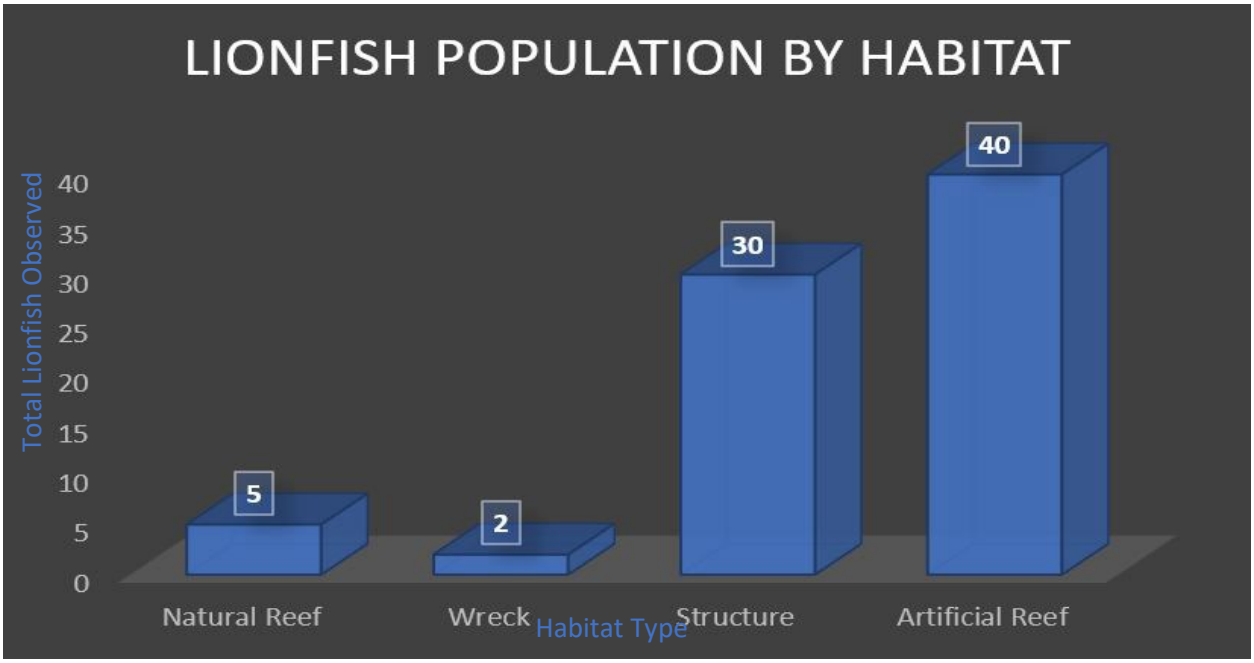
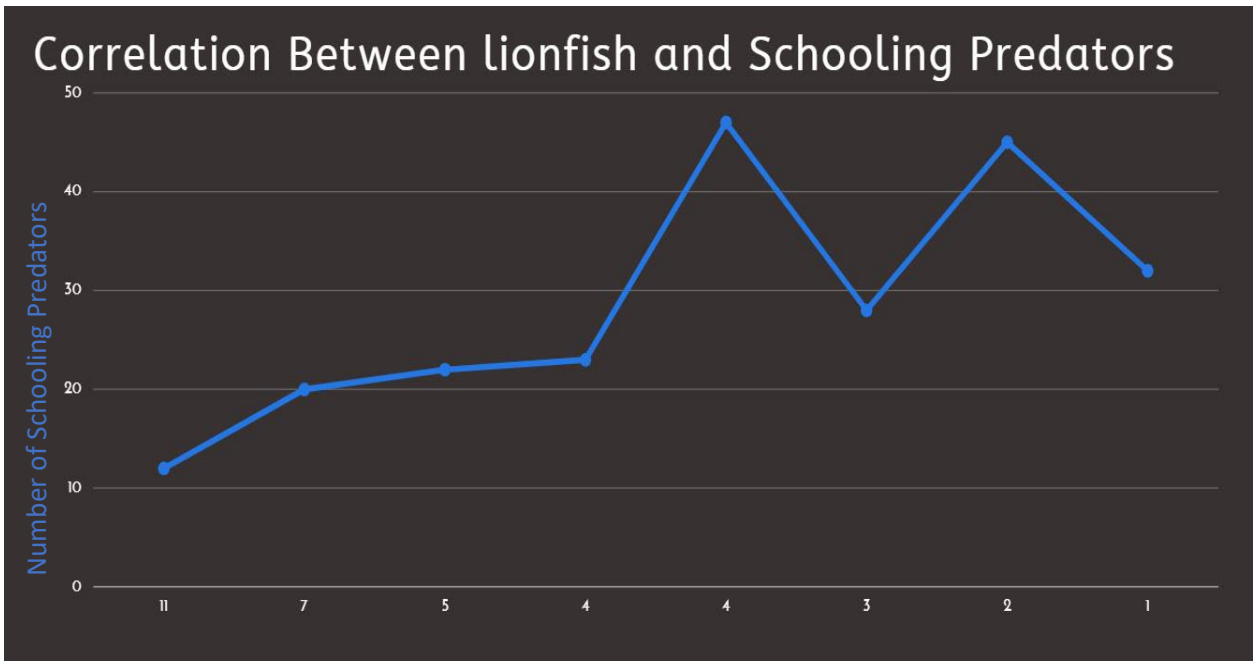


Figure 2.



Number of Lionfish Observed

Figure 3.

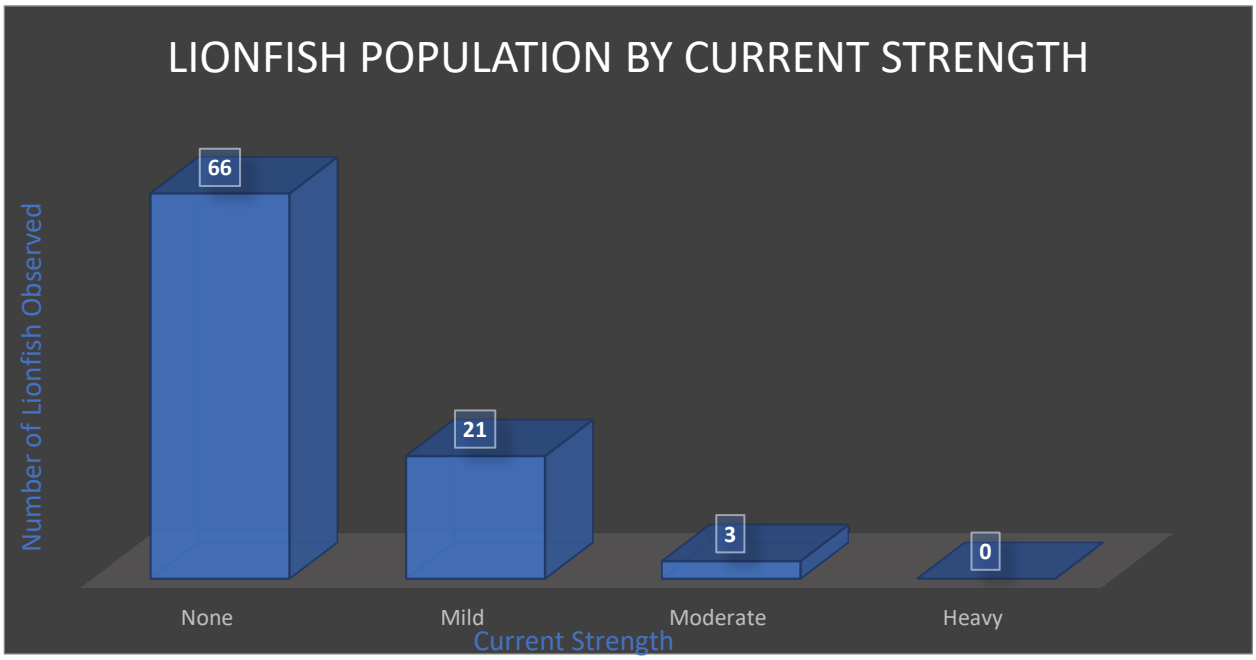


Figure 4.

Discussion:

With the current data, the conclusion can be drawn that lionfish prefer man-made habitats. This being the presence of far more favorable dwellings. Lionfish appear to prefer to inhabit crevices and any habitat features that provides cover. For example, in a structure such as a rubble pile or a wreck has an abundance of crevices and cracks for the lionfish to take shelter within. The same is applicable for manmade artificial reef habitats such as the reef ball (Fig. 6). Reef balls and many other artificial reefs have an exceptionally porous design where fish can seek refuge. A porous design is not often seen among reefs in northern Florida, rather these reefs are often low-relief, sparse, limestone habitats with many sandy patches. This preference of habitats that offer a concealed dwelling space is likely the same reason behind the negative correlation between

abundances of lionfish and schooling predatory species. Schooling predators require a large open space to hunt effectively and therefore flourish. On the other hand, lionfish are an ambush predator and hunt with their peak efficiency when they can hide themselves amongst a structure to conceal their presence from any unsuspecting prey. Their position in the food web as an ambush predator is also why they may also prefer habitats with little-to-no current, as hovering requires less energy.

These findings will aid in organizing lionfish derbies on sites that meet the criteria that lionfish are shown to prefer. The importance of Lionfish derbies cannot be overstated. Not only do Lionfish derbies provide anglers with a sport-like environment that encourages them to hunt as many Lionfish as possible, derbies provide researchers with an abundance of data and a valuable insight into the diet of Lionfish. This insight is gained by measuring and on occasion dissecting Lionfish that anglers have brought to the weigh-in station, that each angler must present their catch to once the tournament concludes. By encouraging and making use of Lionfish derbies, it is possible to control Florida's invasive lionfish population and give our local reefs relief from the harmful population. Before this can be done though, it would be best to repeat this study across several more dive sites throughout the Gulf of Mexico and Florida's coasts. More data only further increase the accuracy of any findings.

Acknowledgments:

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Citations:

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Appendices:

Figure 5. This image depicts a lionfish seeking refuge in a confined space. Image by NOAA

Figure 6. An example of a man-made artificial reef, a reef ball, that has become home to several gorgonians.