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### Artificial Reefs: Why they are Important to the Marine Ecosystem

The coral reefs are considered the 'underwater rainforest' where thousands of marine species come together to live and grow in harmony. The coral reef is an ecosystem within itself, with tiny corals and polyps that attach to each other on top of a hard ground in order create the large and magnificent shapes and colors with which we are so familiar. Today, coral reefs are degrading and are becoming smaller in size around the world. This is where artificial reefs come into the picture in that they help to improve the underwater rainforest and the largest underwater ecosystem. Some critics complain that artificial reefs will hurt the environment, that they cost too much and are not effective enough to invest in. While there maybe some downfalls, but there are more benefits than costs for the use of artificial coral reefs around the world's coastlines. The ways artificial reefs are beneficial to the ecosystem are that they create a structure for coral polyps to cling onto and grow into coral reefs, increase fish reproduction and fishing production, and increase economic values through diving and tourism by investors.

Coral polyps are small invertebrates which come together and grow into a large coral reef. Unfortunately, because of environmental conditions, diseases and certain types of fishing, they are being threatened ("WOW! Florida | Artificial Reefs - Pros and Cons"). Not only are the coral reefs are under threat, but also all of the marine life is threatened because their home is slowly degrading worldwide. If there are more artificial reefs placed in the ocean, not only will

it increase coral reefs, but also the population of small juvenile fish species. “By providing shelter from predation...the man-made structure creates a habitat. Lower level food chain organisms attract predators increasing the biodiversity” (“Artificial Reefs: What are Artificial Reefs?”). All organisms, from the coral invertebrates and small juvenile fish to the large predators, are essential to having a successful artificial reef. Every organism in the marine ecosystem benefits from having artificial reefs in the environment.

Unfortunately, some are against the artificial reefs projects. Not because they do not want to help save the coral reefs and the fish populations, but because they argue that it is not a natural solution. People who oppose the artificial reef programs argue that “dumping junked items in the ocean is just an easy way to dispose of scrap material – a waste disposal activity under the umbrella of artificial reef construction” (“Artificial Reefs: New Methods for Helping Create and Restore Coral Reefs”). The opposing side fights with the fact that the materials that are being dumped into the ocean are unsafe and therefore should not be a solution for saving marine life. Tom Bowerman and the articles, “Artificial Reefs: New Methods for Helping Create and Restore Coral Reefs” and “Artificial Reefs: What are Artificial Reefs?”, assert(s) that the materials used to make the reefs could be potentially dangerous – mainly for the fact that they could leak out toxic pollutants into the ocean water, as well as the material could degrade decades later, destroying any reefs already grown on the structures. Also, the materials – either man-made or recycled – could sink into the sand, rust, and even come loose and wreak havoc throughout the ocean floors. An example would be the dumping of over 700,000 tires off the coast of Fort Lauderdale in 1972 and again in 1986 off of the New Jersey coast...though the tires were strapped together, the straps were often no match for tropical storms that tore them apart (Fismer; “Sunk On Purpose”). After the incident of the tires, they now roam the ocean floors

and even wash up the beaches as trash. On the other hand, there is a way to make the materials used for artificial reefs environmentally safe for the ocean. Carol Cox, spokesperson for Mexico Beach Artificial Reef Association (MBARA), said that one way to help determine which materials are and are not safe is to have research divers investigate the materials' toxic levels, corrosion, and stability in the environment; to learn from and improve the mistakes made in the past through this research. The research that is conducted by research divers will be used to increase the effectiveness of the artificial reefs. Another important part of the usage of man-made and recycled materials are the laws and regulations for these materials so that they do not put out toxins or debris. "FDEP (Florida Department of Environmental Protection) will only allow clean concrete or rock, clean steel boat hulls, other clean, heavy gauge steel products with a thickness of a quarter of an inch or greater and prefabricated structures that are a mixture of clean concrete and heavy gauge steel" (Fluech). There are many other regulations, including the placement of the reefs and making sure that it will not disrupt the naturally-occurring coral reef ecosystems. Because of all of the regulations, laws and research done for artificial reefs, people have found more successful materials for them. Cleaned rocks and steel ships are great resources for artificial reefs, but the most productive material of all is pH level concrete that has limestone inbedded in it, which helps the coral to attach to the structure, which in turn brings the juvenile and larger fish to the reefs (Cox). With the correct regulations and laws for materials, artificial reefs can be beneficial.

Fishing is one of the most popular activities to do in Florida and one that everyone seems to try at least once in their lifetime. In the state of Florida, though, the fish population is decreasing because the fishing rate of fished species is higher than the reproduction of fish around Florida. "...We already unbalance nature by fishing the seas, and while we might restrict

and manage fishing, we will never stop” (Copperthwaite). Artificial reefs can help with the fishing by balancing out fish population versus the amount of fishing occurring along the coastlines. In “Artificial Reefs: What are Artificial Reefs?”, it says, “...the reef increases the environmental carrying capacity by establishing an additional habitat. This therefore increases biomass.” The artificial reefs have, and will continue, to increase the species population which will increase fishing recreationally and for fisheries as well.

Environmentalists agree that artificial reefs will increase the fish population. But at what cost? Chuck Adams, Lindberg and Stevely quotes Milon, Holland, and Whitmarsh that ““a reef that is not useful to people is not a successful reef.”” For this reason, some environmentalists consider artificial reefs as not helping the marine ecosystem, but only being beneficial for people who make a profit from fishing. In the article “WOW! Florida | Artificial Reefs - Pros and Cons”, they said that “if the problem is overfishing, then it is exacerbated by creating more fishing areas.” In other words, the assertion is that artificial reefs will not help even out the reproduction and fishing ratio, but only increases fishing production to the point where fish species will eventually become extinct. Overturn another negative effect is the fishing gear and equipment creating a hazard to the reefs by fishing lines being caught in the reefs and anchors landing on and destroying the artificial reefs. Trawling from large fisheries is especially a problem with this—but it is not their fault. The spots of artificial reefs are not usually marked on the maps, making navigation difficult and creating dangerous situations for fishing gear as well as larger boats and vessels (Bowerman). Fishing-wise, artificial reefs could cause problems for both land and sea dwellers. However, there are solutions to the problems for fishing. First, for overfishing, FWC (Florida Fish and Wildlife Conservation Commission) has a list that the number of type of fish that can be caught per person, per day as well as the size and weight of the

fish that is allowed to be caught. Also, artificial reefs are here to help take the fishing pressure off of naturally occurring coral reefs by establishing an artificial reef away from the natural reefs, making a new fishing spot for tourists and businesses (Thole). As for fishing gear, those are the fisher's responsibility to make sure that they are not harming the environment. For the fishing gear, there is a certain amount of gear and certain kinds that are allowed to be used around the artificial reefs ("Artificial Reefs"). Unfortunately, many people will still use unauthorized fishing gear around artificial reefs. One of the solutions would be to make a reef to prevent the use of fishing gear, like trawling nets, to make a specific reef that is a slab of concrete with stakes sticking out of it ("Artificial Reefs"). But even with regulations on fishing gear and creating reefs to stop usage of illegal gear, people will continue to do so for profit. Another solution is for research divers to look for any fishing equipment that may have caught on the reefs, and if so, then improve on the structure so that the gear will not get caught on artificial reefs in the future (Cox). Navigation of the reefs is a difficult problem to solve. There are local dive shops and fishing stores that usually have most updated information on the locations of the new reefs. Although the problems with the fishing on artificial reefs can be severe without knowing the laws, regulations, and locations of the reefs, the positives of fishing the artificial reefs outweighs the negatives, because those problems can be fixed.

Diving is another popular water activity in Florida. It is a great way to see coral reefs and the ecosystem at work right in front of the divers. Because the coral reefs are degrading, there are limited places where divers can go and have the adventure of a lifetime. This is where artificial reefs step in for the tourist industry. Because of the material used for artificial reefs, it grows into unusual, but beautiful reefs that attract many divers, which increases tourism in certain areas ("Artificial reefs: What are Artificial Reefs?"; "Sunk on Purpose"; Thole). Where

there are more tourists, there are more demands and needs in the towns near the reefs location.

“Artificial reefs: What are Artificial Reefs?” article says that because more tourists are interested in the reefs, the needs for more hotels, restaurants, and other markets for tourism will rise. With the artificial reefs, everyone can benefit—from the townspeople receiving money from tourists to divers finding new places to explore.

Some will argue that artificial reefs are dangerous to divers because of the unnatural materials used for them. “There have been fatal accidents on some of these artificial reefs...The safety people weld up hatches, trying to make sure they are as safe as can be, but there have been incidents where I wonder if they welded up enough of them” (Fismer). Some incidents have seen tourists dive shipwrecks and sometimes do not come out alive or are injured from the artificial reefs. Also, the artificial reefs do cost money. All materials have to be prepped, cleaned, tested for stability, and then be put onto the bottom of the ocean, which has to be approved. Cox stated that for the MBARA, the minimum order for artificial reefs is \$45,000; that the number of reefs purchased will vary depending on size and type of reef purchase. That is a lot of money for a group of artificial reefs that may not even be successful. “It has been suggested that only 50% of artificial reefs meet the established goals” (“Artificial reefs: What are Artificial Reefs?”). It seems like a risk for investors and buyers to pay \$45,000 to ‘maybe’ have a successful reef. Fismer asks the question, “In the end, do the tourist dollars make up for it?” It is not worth risking the marine life in order to possibly increase tourism and economy in a small town. On the other side, there have been great benefits for the economy. “A study conducted in 2001 by researchers at the University of Florida IFAS Extension estimated that non-residents and tourists spent \$1.7 billion annually on fishing and diving activities associated with artificial reefs in southwest Florida” (“Sunk on Purpose”). If this is the results from an already thriving

economy, imagine how a small town or third world countries could benefit from putting artificial reefs on their coastlines. For investors, a 1.7 billion dollar annual return from artificial reefs sounds like great results given the fact that artificial reefs are thriving along the coastlines of Florida. As for the diving accidents, especially around shipwrecks, they can be preventable by having knowledge about the shipwreck reefs and having the correct training for diving shipwrecks. The “Oriskany Reef Dive Safety Considerations” article and Cox state that to dive in shipwrecks, divers must have the correct equipment, training, fitness and experience. Some of the divers that do end up being in an accident may not have had the knowledge for diving at those depths and types of reefs, which makes the tourist, and not the reefs, responsible. Cox says that another solution for making shipwreck reefs safer is to create larger opening in the wreck so that divers have more natural light as well as an easier way of getting out of the wreck. For investors, they do have benefits with a successful reefs. There have been many reefs that have success in making endangered species grow and prosper with the right habitat as well as management (Cox). Because of the investor’s money, time and patience, the Goliath Grouper are now a protected species and are not seriously endangered. Economically, artificial reefs are beneficial for the tourist industry, where divers can be safe with the correct knowledge and equipment and investors can be successful with the construction of the correct habitat as well as management of the reefs.

Comparing the pros and cons of artificial reefs, there are certain points where the cons seem to overshadow the pros. However, artificial reefs have an overall positive effect on not only the marine ecosystem, but also on the fishing and tourism industries. Although some of the negative aspects can do harm, there are solutions to every problem. The only thing that needs to be done is to find those solutions to the problems associated with artificial reefs instead of

fighting them. If there is already a solution for a problem, then action should be taken to improve and enhance those solutions. Now is the time to take action by applying what we already know about artificial reefs and using it to improve the marine life as well as the fishing and the economy.



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