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Ghost Gear: The Abandoned Fishing Nets Haunting World Ocean

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Streszczenie pracy dyplomowej w języku polskim (min. 500 – max. 1000 znaków ze spacjami)/ Summary in Polish (min. 500 – max. 1000 signes)	
<p>Zagubione i porzucone narzędzia połowowe przyczyniają się do poważnej katastrofy ekologicznej i społeczno-gospodarczej. To właśnie z powodu połowów rośnie liczba stworzeń morskich o niskiej płodności. Wymieranie i zmniejszanie się stad gatunków docelowych w wyniku utraty sieci rybackich ogranicza zrównoważoną produkcję zasobów rybnych, co oznacza upadek gospodarki. Najbardziej poprawną odpowiedzią na pytanie, jak uporać się z tym pozornie nierozwiązywalnym problemem, jest stworzenie ogólnego porozumienia międzynarodowego z jasnymi zobowiązaniami, normami i przepisami, które mają zapobiegać przedostawaniu się sieci rybackich do oceanu. Problem plastikowych sieci rybackich to nie tylko problem zanieczyszczenia przez nie oceanów, to kwestia naszej przyszłości, ponieważ takie aspekty jak problemy z bezpieczeństwem żywnościowym ze względu na zmniejszenie zasobów ryb i wpływ na ludzi nie mogą nas ominąć.</p>	
Streszczenie pracy dyplomowej w języku angielskim (min. 500 – max. 1000 znaków ze spacjami)/ Summary in English (min. 500 – max. 1000 signes)	
<p>Lost and abandoned fishing gear is contributing to a major environmental and socio-economic disaster. It is because of ghost fishing that the number of sea creatures with low fertility is increasing. The extinction and reduction of stocks of target species due to lost fishing nets reduce the sustainable production of fish resources, which means a decline in the economy. The most correct answer to the question of how to deal with this seemingly unsolvable problem is the creation of a general international agreement with clear obligations, norms, and regulations to prevent fishing nets from entering the ocean. The problem of plastic fishing nets is not just a problem of ocean pollution by them, it is a question of our future, because such aspects as food security problems due to a decrease in fish resources and the impact on humans cannot bypass us.</p>	
Słowa kluczowe w języku polskim (min. 5 – max. 8) / Key words in Polish (min. 5 – max. 8)	
Katastrofa, rybacki, plastik, ocean, sieci, ekologia, rezerwy, gospodarka	
Słowa kluczowe w języku angielskim (min. 5 – max. 8) / Key words in English (min. 5 – max. 8)	
Disaster, fishing, plastic, ocean, nets, ecology, reserves, economy	

Podpis promotora/ Supervisor's signature

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INTRODUCTION

My work provides an insight into the difficult topic of how the ghost gear harms the marine environment and threatening marine biodiversity. Lost, abandoned, or discarded fishing gear is commonly called ghost gear is having an inevitable environmental, social and economic impact.

My work includes analysis, collected from many sources, about the environmental and socio-economic problems the world is facing due to abandoned, lost and discarded fishing gear. Much of the data was taken from the official websites of such global organizations as the World Wide Fund for Nature, from the articles of the famous “The Guardian” and “Wikipedia” from reports such as “Breaking the plastic wave” and many other research sites from around the world, more details can be seen at the end of each page. Every year, millions of tons of fishing gear are lost in the ocean. Humanity is not yet fully aware of the seriousness of the problem, how pernicious the consequences can be. But this does not remove responsibility from fishermen and companies that have been destroying the marine world for several decades. Thanks to advances in technology, we have recently drawn attention to the magnitude of the impact of discarded and lost plastic fishing nets. The first chapter reveals the problem, tells in detail what ghost fishing is, how nets get into the oceans and seas, and what kind of ecological disaster it entails. Lost fishing gear is a deadly form of weapon that leaves no one alive who gets caught in it, dooming seabirds, sea mammals and all kinds of marine life to a long and painful death. Obviously, all fishing lines, snares, snares and all fishing nets in use around the world continue to kill sea creatures when lost in the aquatic environment.

The second chapter shows methods for detecting stray fishing nets, because this topic is only gaining popularity and attention. It will also be fashionable to learn more about the risks for each area of life, such as economic, social, etc. This work is about fighting plastic lost fishing gear pollution. And yet we must recognize that although the scale up of recycling and waste management is critically needed in many parts of the world and is the cornerstone of a circular economy, these efforts alone will not be enough to avoid plastic pollution within budgetary and political constraints at the current levels of plastic production let alone the expected growth. Reduction through elimination in an appropriate substitution are essential to achieving a system change and stopping plastic leakage into the ocean. I want to show the importance of lost and abandoned fishing nets because it threatens both our health and our oceans, on which so many lives and livelihoods depend.

Also, the third chapter will outline what kind of response is needed to combat this global threat, what effective prevention of plastic items leaking into the ocean requires extensive coordination, what increased resources and close cooperation between governments and industry are needed, as well as constant vigilance and participation of citizens and communities. I have used the

latest data available to highlight the relevance, including military action around the world, especially in Ukraine. It would also need to enact ambitious policy measures across the plastics value chain to foster innovation. Public-private collaborations would be required to set standards on materials, formats, reuse, and recyclability. Managing the many issues around plastic marine nets has a very important role to play. There is now an incredible opportunity for governments, businesses and innovators to become ready to lead the move towards sustainable fishing practices and biodegradable nets. Breaking the wave of ocean plastic pollution is a challenge that respects no boundary: it affects communities, businesses, and ecosystems in both the high-income and middle-low income geographies. Businesses, governments, investors, and civil society should aspire to a shared near zero leakage vision and commit to ambitious, concrete steps towards achieving this critical objective.

I believe that everyone is responsible for our future, and discarded plastic nets directly affect people, as they carry a great force in the destruction of marine diversity. We are already seeing how fish species disappear forever, how marine life populations are declining, and how *micro plastics* get into our food. In the next couple of decades, we must decide how to change the cost of plastic fishing nets in order to reduce their use. We don't have much time, but there's still time before the risks to marine species and ecosystems, our climate, our economies and our communities become irreversible.

CHAPTER I : POLLUTING THE WORLD OCEAN WITH GHOST FISHING

1.1 Impact of ghost fishing nets on fisheries and aquaculture

Intentionally or not intentionally, one way or another, fishing tackle, namely fishing nets, ends up in the seas and open oceans. For decades and centuries, they continue to perform their main function: to kill sea inhabitants and the underwater world. The harm from fishing nets cannot but affect even people, it would seem, but we are also involved in this sinister chain. Fishing nets are the deadliest form of marine plastic debris, although fishing feeds billions of people and is vital to the economies of countless coastal communities. But the fact that people use fishing nets even though it causes colossal harm remains a fact. The irrational use of fishing gear leads to the fact that many species of animals, fish, and even birds die in vain and disappear from the face of the earth. Abandoned, lost, or discarded fishing gear, commonly referred to as ghost gear, contributes significantly to the problem of plastic pollution in our oceans.¹ Absolutely all types of fishing gear that remained in the ocean are extremely dangerous because their harm is much higher when they, uncontrollably and without selectively, doom the inhabitants of the seas and oceans to a painful death, since they can die a slow and painful death from suffocation or exhaustion as well as these networks decompose into harmful and toxic micro particles that enter the human body along with the use of fish and other sea products. Because of this, the ghost gear has been dubbed the most deadly form of marine plastic debris, damaging the vital ocean habitat, and aquatic life. Several studies were held on the impact of abandoned or lost fishing gear, most of which gill and multi-walled networks are recognized as the most problematic in terms of quantitative losses and scale of ghost fishing. Multi-walled networks are made of two or three layers of a network in which more of the small network is located between the layers of the larger network. They are often secured with floats and lead and are very effective for catching fish, and therefore contribute to higher by-catch rates. For these reasons, they cause the greatest harm to abandoned or lost fishing gear. Gill and multi-walled nets are used throughout the world in coastal, traditional, and small-scale fisheries and they account for more than 1/5 of the total world catch. This problem has become known for a long time, but relatively recently, it gained worldwide publicity: people began to look at thousands of evidence in the form of photos and videos, looking at how animals suffer and suffer. Ghost gear is at least 10% marine debris. This means that roughly 500,000 to 1 million tones of fishing gear are thrown into the ocean each year. It is not for nothing that lost fishing gear is the deadliest kind of marine debris,

¹ Ghost fishing gear, <https://www.worldwildlife.org/stories/ghost-fishing-gear>, {viewed on 29 November 2021}.

because it has been killing the underwater world every day for years. Some species of marine life are either extinct or in danger of extinction, for example, in the Gulf of Mexico, the *vaquita* porpoise is threatened with extinction because of fishing gear. WWF cleared more than 70 tons of lost fishing gear from the bay to try and save this rare and smallest of all the porpoises. There are very few of them left and it was the fishing nets that stampeded out the *vaquita* almost completely, and unfortunately not only the *vaquita*.

In general, fishing nets catch species that are strategically important financially, but unfortunately, other sea creatures are also caught in the nets. But worst of all, if the net breaks off, or is purposely discarded, it continues to kill for decades. Ghost gear can undermine the stability and economic returns of the fishery by reducing catches. Also, lost fishing nets are a threat to coastal areas, shipping and seafarers. Like any other trash, no matter where in the world, fishing gear is incredibly harmful to tourism, polluting coastal areas. But we should not forget about coral reefs, because everything is interconnected, and they too suffer from such human activities, which reduce fish stocks, because coral reefs are the habitat of marine creatures. It's safe to say that the overall sustainability of fisheries and people who depend on fish for food is being undermined. Unfortunately, quite often fishing nets are torn and lost due to rough seabed or coral, but this is nothing compared to the number of discarded fishing nets due to human error. For example, in the Asia-Pacific region, reasons such as underfunding force fishermen to throw their nets overboard in order to reduce fuel consumption.² Further, such nets become responsible for 60 percent of the extinctions caused by them. There are an incredible number of gruesome stories and photos on the Internet of the consequences of wandering and lost fishing nets. For example, a dead pregnant striper was found on a Scottish beach, entangled in the nets, and those nets got caught in its feeding system.³ Another equally sad case was recorded off the coast of Mexico, where about 300 dead turtles were dumped on the beach. An entire generation of turtles was accidentally killed by fishing nets. About 640,000 tons of fishing nets and traps are dumped or lost at sea every year. Such fishing gear wanders the oceans and spreads very quickly due to the tides, leaving not a single clean spot. Traces of ghost fishing can be found everywhere, from the shores of the Arctic to remote islands in

² *Asian Development Blog Straight Talk from Development Experts*, published: 16 October 2020 by Rocky Guzman, <https://blogs.adb.org/blog/the-ghost-gear-that-haunts-the-world-s-oceans>, {viewed on 29 November 2021}.

³ *Pregnant whale found tangled in 'ghost fishing net' dies in Scotland*, published: 09 October 2019 by Harry Cockburn 09 October 2019, <https://www.independent.co.uk/climate-change/news/whale-death-pregnant-minke-scotland-ghost-nets-fishing-pollution-oceans-a9149006.html> , {viewed on 30 November 2021}.

the Pacific Ocean. Studies show that up to 70 percent of the macro plastic that floats on the surface of the ocean is due to fishing nets. And a recent study of the Great Pacific Garbage Patch found that it contains about 42,000 tons of mega-plastic, 86 percent of which is fishing gear. Plastic debris pollutes every inch of the ocean and threatens every marine life, including people who get plastic in their food. During their long lifespan, fishing nets and other plastic debris slowly break down into very small particles called micro plastics. These tiny particles have a great toxic effect on the food chain in which you and I participate. Some documentation claims that over 800 species of sea creatures are affected by fishing nets, but in reality the figure is much higher. Pollution from decaying fishing nets can now be found everywhere, even in remote areas of Antarctic habitat. And despite the fact that this topic is gaining more and more popularity, the problem continues to worsen at a critical pace. This problem requires incredible resources in order for humanity to overcome the use of fishing nets and forget about them forever. Switching to biodegradable or reusable fishing nets is a very difficult, long and costly journey. And unfortunately at the moment it is only at the initial, but promising stage.⁴ The nets that fishermen use now have been recycled for centuries, and over time they still have a detrimental effect on the underwater world and on the person himself. Despite the fact that almost all fishing tackle is designed to catch a certain species, they still catch sea creatures indiscriminately. For example, proof of this is the situation that happened in the Salish Sea, where more than 250 species of rare animals, birds, fish got into nets that should only catch salmon fish. One lost fishing net is estimated to easily destroy \$20,000 worth of seafood.⁵ The fish that gets caught in the net becomes its hostage. She cannot breed and she is unlikely to become food for other fish. Ghost fishing causes damage to the UK alone by 420,000 Euros a year. About 32,000 tons of lost or discarded crab pots have been found in the Chesapeake Bay. These traps contained moderately about 1.25 million rare blue crab. This leads to significant financial losses. For example, in Louisiana, about 250 crab pots are lost each year, at a cost of US\$4 million. And in the Gulf of Oman, more than 15,000 traps are being lost, causing US\$2.6 million in damage. There are also plenty of examples of how people who live in coastal areas suffer. Slightly less than half the population lives within 100 kilometers of the coast, and of course they depend on fishing.⁶ Catch numbers are declining, for reasons we know, driving up the price of seafood, and sadly, the poor who

⁴ *Dumped fishing gear is biggest plastic polluter in ocean*, published by Sandra Laville on 6 November 2019, <https://www.theguardian.com/environment/2019/nov/06/dumped-fishing-gear-is-biggest-plastic-polluter-in-ocean-finds-report> , {viewed on 02 December 2021}.

⁵ *Ghost gear, a grave threat to ocean life*, published by Elizabeth Hogan on October 29, 2018, <https://chinadialogueocean.net/5085-ghost-gear-a-grave-threat-to-ocean-life/> , {viewed on 02 December 2021}.

⁶ *Blue Crabs*, https://www.chesapeakebay.net/issues/blue_crabs , {viewed on 02 December 2021}.

can't afford to buy it suffer the most. Economic losses for fishermen, a catastrophic threat to the ocean and nature in general - all this is provoked by just one fishing net. You can endlessly continue to point out examples of how detrimentally they affect the environment. Approximately 136,000 whales, dolphins, and sea lions die each year as a result of being entangled in marine fishing nets. The wounds received are terrible. All these creatures die a long and painful death. Wounds cause severe pain, interfere with nutrition, reproduction, and normal existence. If something gets into a fishing net, it is unlikely to get out of it already. Coastal fishermen who fish illegally use illegal gillnets to catch the rare *totoaba* fish that lives in US, Mexican and Gulf of California waters, then sell it to China, where its bladder is used in medicine. *Totoaba* is currently endangered. Unfortunately, such fishing also harms the quality of seafood and the marine industry. For every 125 tons of total fishing, there are about a ton of fishing equipment.⁷ Scientists continue to assess the damage that ghost fishing is causing to marine ecosystems, and at the moment it is a 10% reduction in fish stocks. American researchers believe that in just 10 years, one network roaming the expanses of the oceans can kill the Dungeness crab, which costs \$ 20,000. In fact, countries spend millions of dollars to avoid or eliminate the problems that ghost fishing causes. This is a real global problem, and it requires large-scale solutions.

Summary, such global fishing supplies the whole world with seafood, but this entails very tragic consequences, due to unscrupulous companies who want to make as much money as possible from this business, but do not think that their nets are destroying the underwater world.

1.2 The World Wildlife Fund (WWF)

The World Wildlife Fund is one of the largest and most independent organizations dedicated to the protection of nature and operates in more than 100 countries. One of the main goals of this organization is to preserve nature and everything that is included in it, stop the degradation of the environment and the disappearance of endangered species of creatures, as well as achieve mutual understanding, respect, balance and harmony between man and the planet. The World Wildlife Fund is an ardent advocate of the underwater world, and one of the main fighters against ghost fishing. The organization tries to preserve biodiversity in the form in which it exists now.⁸

⁷Chinese appetite for totoaba fish bladder kills off rare porpoise, published by Damian Carrington on 16 May 2017, <https://www.theguardian.com/environment/2017/may/16/chinese-appetite-totoaba-fish-bladder-threatens-rare-vaquita> ,{viewed on 04 December 2021}.

⁸ World Wide Fund for Nature, https://en.wikipedia.org/wiki/World_Wide_Fund_for_Nature, {viewed on 04 December 2021}.

The World Wildlife Fund was formed from The Conservation Foundation, which was founded in New York in 1947. The British businessman Victor Stolan was the generator of the idea of founding such an organization, and later Julian Huxley and Max Nicholson gave a helping hand. It was Max Nicholson who coined the name. The prototype was invented after a huge panda was brought to the London Zoo from China in 1961, and one of the founders of the organization saw it and copied it. But this is not just a drawing, it is a symbol that depicts an endangered animal species. In the end, the organization officially began work on April 29, 1961. At the moment, the main offices of this organization are opened in many cities around the world. The World Wildlife Fund has many achievements, among which is the so-called debt swap. The essence of this action is that the World Wildlife Fund buys the external debt of a country, then converts this money into local currency, and uses it in favor of environmental needs, for example, financing of any events. The World Wildlife Fund is actively fighting against manufacturers of fishing tackle, and even conduct events to train fishermen in the proper disposal of fishing nets.⁹ WWF in India is working on regulatory issues, they are also interacting with fishermen, educating them, giving lectures on the damage that fishermen can do to the environment by throwing fishing nets into the ocean. All these actions help to awaken the awareness of one's actions, and to understand how much one act can harm the underwater world, and many living beings. The foundation creates policies and regulations that govern the release of fishing nets into the ocean. This helps create quite different ways to dispose or recycle fishing nets. The Fund has chosen to fight this problem as its main goal, because for every big catch, there is a whole ton of fishing tackle. Unfortunately, at the moment, the world is just beginning to actively take root in this topic, and the World Wildlife Fund is still trying to reach out to governments with a request to create international agreements to combat lost fishing nets. A large number of leaders from around the world actively support the fund and call on the society for global solutions to this problem. Now we can already see progress, for example in Peru, fishing companies are recycling worn out and damaged nets, turning plastic into toys and clothes, and they are making a good income from this. But when viewed globally, there are no clear rules regulated by law, so unscrupulous fishermen and big fishing companies take advantage of this. The World Wildlife Fund is calling on world leaders to take action to combat ghost fishing so as not to miss the situation while there is still a chance to repair the damage done and even out the balance of the underwater world.¹⁰

⁹ *Reaching an important milestone in reducing dangerous "ghost gear"*, <https://www.worldwildlife.org/about/>, {viewed on 04 December 2021}.

¹⁰ *Fishing's phantom menace*, https://www.worldanimalprotection.org/sites/default/files/media/int_files/sea-change-tackling-ghost-fishing-gear-summary.pdf, {viewed on 07 December 2021}.

In my opinion, The World Wildlife Fund has great potential and great support. This organization is slowly but successfully making progress on ghost fishing. Of course at this stage the organization is still gaining momentum, but now they are working to increase their strength in order to create international treaties. The WWF is already collaborating with some countries, and together they are trying to introduce innovative methods in global fishing.

1.3 How much fishing gear becomes ghost gear?

During the early days of mass fishing, nets were made from natural materials such as linen and hemp, which decomposed rather easily and quickly. But for half a century, plastic nets have become popular, causing incredible harm to the environment. Unlike the first networks, plastic ones take more than a century to partially decompose, but at the same time, macro plastic will be released, which carries no less harm. More and more environmentalists and scientists are beginning to find macro plastic in many marine creatures, including those we eat. More than half of the Pacific garbage consists of lost fishing nets. fishing nets enter the ocean in quite a few ways, including illegal fishing, because often such vessels are pursued, and when they discover this, they have to dump their cargo in order not to be caught. Also, the high price of fuel makes fishermen throw used nets overboard to reduce fuel consumption on the way back. Unfortunately, the disposal of fishing nets is not cheap, because of this, dumping the net into the ocean is the cheapest method of disposal. Also, fishing nets fall into the ocean not only due to the human factor, but due to natural phenomena as a storm. Even nets that are strongly attached to the seabed often break off and are carried away by the current. It is almost impossible to measure the exact number of roaming fishing nets, because they are constantly moving due to the current. But still, there are some studies that show a rough estimate of the extent of the problem.¹¹ Studies in South Korean waters have documented that over 11,000 tons of fishing traps and 38,000 tons of gillnets are dumped by fishermen into the waters every year. It is also a fact that the black halibut fishery in Canada has dropped about 70 km of gillnets in just 5 years. And between 5,000 and 10,000 gillnets enter the Baltic Sea every year. Research also shows that about 5.7 percent of all fishing nets in the Northern Hemisphere, 8.6 percent of traps and about 30 percent of all fishing tackle are discarded or lost. In 2018, Lively and

¹¹ *The Most Dangerous Single Source of Ocean Plastic No One Wants to Talk About Sea*, published by Shepherd Global Volunteer Lauren Wills on 22 August 2019, <https://www.seashepherd.org.uk/news-and-commentary/commentary/most-dangerous-single-source-of-ocean-plastic.html>, {viewed on 07 December 2021}.

Goode began to collect information from various sources, and found that for every fishing set, half was lost. Also, every boat that fishes with nets loses 3 to 7 nets every year. And in the coastal areas of South Korea, where gillnets are most popular, the figure is much higher, hence they estimate that about 40,000 tons of gillnets are lost there. All this is the main reason for the increase in the amount of plastic in the ocean, and the reason for this is far from the plastic straws that everyone is so vehemently shouting about, namely, fishing nets. And this is true, because 50,000 - 130,000 tons of plastic in the Pacific garbage patch are traces of fishing.¹²

Summary, factors such as illegal fishing and economic reasons leave fishing companies no choice but to throw their nets overboard. Measures must be taken at the state level to prevent plastic nets from entering the ocean, otherwise the underwater world is doomed, as the nets decompose for more than 100 years, and during these years they cause excessive harm to marine life.

1.4 Ghost gear dangerous for to the inhabitants of the underwater world

The saddest thing is that when a fishing net is lost in the waters of the ocean, it becomes a cruel murder weapon, because it continues to do what it was intended to do. Compounding the problem is the fact that almost all fishing gear used is made of plastic, which eventually decomposes into no less harmful particles – micro plastic, and it takes more than 600 years for it to do this. Fishing nets are very strong, and the scary thing is that after a thrown net kills an animal entangled in it, it will kill quite a few more, just with its fragments. The size of the fishing nets is shocking, they reach the size of a football field. Ribbon-shaped rigs are just as big, and mostly harbor seals and sea lions fall into their trap. Each year, over 100,000 whales, dolphins, sea lions and other incredibly beautiful and unique sea creatures get caught in these ghostly gear. Smaller sea creatures that are caught in these nets often stick their heads through a small hole in the net, which slowly and very painfully wraps around and cuts into the neck, for example, a baby seal, continues to kill the poor animal as they mature into a long painful death.¹³ Such creepy shots are very popular on the Internet.

¹² *Ghost gear are the most lethal threat of plastic waste in the world*, published on 29 October 2020, <https://www.wwf.org.ec/?365018/Ghost-gear-are-the-most-lethal-threat-of-plastic-waste-in-the-world> , {viewed on 07 December 2021}.

¹³ *Ghosts in our ocean: lost and abandoned fishing gear is killing thousands of marine animals every year*, published by Ingrid Giskes on October 10, 2017, <https://impakter.com/the-ghosts-in-our-ocean-lost-and-abandoned-fishing-gear-is-killing-thousands-of-marine-animals-every-year/> , {viewed on 07 December 2021}.

Larger sea creatures that also get caught in the nets suffer great suffering, lose the ability to eat and reproduce normally, and accordingly such a population will decline. Whales are too big to be freed from the net, so this animal is more likely to die faster by drowning or from exhaustion. The suffering of poor sea creatures can last for months, years. Weaves of rope or fishing line from fishing nets leave wounds on the body of an escaped animal that lead to amputation and infection, which reduces the chance of survival to almost zero. At the moment, about 240 species of marine life are under great threat, and until global action is taken, this figure will continue to grow. The most vulnerable are sea lions and seals. For example, in Australia, where sharks are caught with gillnets, about 1,500 sea lions are caught in these nets every year, because the net technique not only helps to catch sharks, but also attracts sea lions who simply cannot avoid it. Teenage sea lions are very receptive, having an interest in everything, they become entangled in these networks. Data from various studies were collected from 1997 to 2012, which showed that half of the objects that fur seals got entangled with off the coast of South Australia were plastic ropes, fishing lines, fishing nets. The problem is that a net designed for catching one species has a negative impact on the catch of non-target species. This puts a big cross on the habitat of marine creatures and on the biodiversity of the underwater world. There are nets that are well fixed to the seabed and are very selective, they have little impact on the underwater world, but such nets are more demanding in their care and use. Therefore, fishermen give priority to conventional nets that catch everything indiscriminately, everything that gets in their way. In a panic attack, the entangled sea creatures try to get out, but by doing so, they provoke more entanglement and cause even more harm to themselves. They can die from asphyxiation, but almost all get "chronic effects" that ultimately affect the well-being of the species, reducing their resilience, their ability to reproduce, and generally increasing infections.¹⁴ But also the injuries and consequences rendered to the creature after entanglement in the network may be different depending on the material of the network in which they fell. For example, multifilament fishing tackle tends to be more bacterial than others. Unfortunately, the exact number and calculations are impossible, so you have to rely on approximate data, of which species, in which networks and under what conditions most often fall.

Finally, the lost net continues to kill the underwater world in many ways. People who buy seafood also suffer a share, as marine life can feed on micro plastics. The world has already lost quite a few species of marine life precisely because of the ghost gear, and now several hundred species are

¹⁴ *A Review of the Welfare Impact on Pinnipeds of Plastic Marine Debris*, published by Andy Butterworth on 18 August 2018, <https://www.frontiersin.org/articles/10.3389/fmars.2016.00149/full> , {viewed on 07 December 2021}.

under threat of extinction. But the marine inhabitants who are entangled in the nets are doomed to a painful and long death. Such a business does not deserve development and money, because if you do not try to change their behavior, then in the near future the ocean will lose a huge number of marine life species important to people and the ocean.

CHAPTER II : CHALLENGES ON THE WAY TO COMBAT GLOBAL OCEAN POLLUTION AND RETRACTING THE EYES FROM THE TRUE PROBLEM

2.1 Methods and estimates of rates of abandonment, loss and discarding and use in estimating ghost gear density

In order to understand what kind of threat to the environment the ghost gear carries, we need to know at least approximate data on the number of losses and the number of deaths of certain species. As mentioned above, the problem is that no one can provide accurate data, because it is practically unrealistic. But there are several methods that help to study the problem. The most common method of study is questioning and observation. Researchers are interviewing fishermen, crew and residents of coastal areas. The survey can be conducted both in person and via e-mail, mobile phone. This method does not inspire confidence, but it only seems so at first glance, because in fact it helps to collect information that was not available before. With this method, the density and frequency of loss of fishing nets can be estimated. After collecting data in this way, you can move on based on the information received. Researchers are starting experiments to test and get more specific data. Very long rows of records and documentation are needed. The obvious fact is that the true amount of discarded and lost fishing gear is hidden from human eyes, because a very small percentage of losses are legally recorded, because most companies operate illegally. From this it is clear that such fishermen will never document their loss. All this makes it difficult to accurately assess the rate and loss of fishing nets. Some ships have the ability to track their lost network and find it accordingly, but this feature is rarely used because it consumes fuel and time, so it is cheaper to purchase another network. Tackle can be lost as a result of a gear conflict. This means that only part of the flotilla with the gear installed was lost, and part of the flotilla can be restored with the help of a ship. Often fishing gear is lost due to weather conditions, as a storm, a strong current, this is also not critical.¹⁵ At the moment, technology allows you to track the lost network even under such conditions. Thus, due to the variety of networks, the results vary greatly. The studies primarily assessed gillnet or trawl net abandonment rates based on interviews with fishermen. Such data are difficult to confirm experimentally and remain based on observational programs or logbooks, which sometimes have more reliable results and could be used to verify first order estimates from surveys of fishermen. Some study findings did not specify whether estimates of loss rates accounted for the

¹⁵ Highest risk abandoned, lost and discarded fishing gear, published by Eric Gilman, Michael Musyl, Petri Suuronen, Milani Chaloupka, Saeid Gorgin, Jono Wilson & Brandon Kuczenski on 30 March 2021, https://www.pewtrusts.org/-/media/-assets/2020/07/breakingtheplasticwave_report.-pdf , {viewed on Januar 2022}.

proportion of initially lost gear that was recovered by the vessels. There has been inconsistent use of units for reporting ghost gear rates using length or area per ship per year and percentage. This shows that the data obtained from different types of ghost gear cannot be summarized and compared, but on the contrary, proper records should be grouped according to the type of fishing gear. A small proportion of all studies carried out were in Europe, using coastal *demersal gillnets* and *tram* networks.¹⁶ The most popular methods of obtaining a result when studying the density and frequency of loss of nets are to survey the seabed of the area of common fishing grounds and interview the experts present in the designated area. For part of the study, the documentary area was selected by interviewing fishermen who identified areas where they had lost gear or observed lost fishing gear. Also, some studies were randomly documented to try to characterize the density of lost fishing gear in the fishing grounds. For example, scuttled ships attract a lot of attention and study, as there is a possibility of a large accumulation of fishing nets in them. Therefore, such objects are studied within a radius of 100 km, since various data can be obtained from the wreckage. Observations by divers, sonar, video and photographic footage from ships, towed structures, manned submersibles and underwater have been used to search for abandoned equipment in areas of intense fishing. For example, the number of abandoned gear in the study area was obtained from surveys of fishermen and seabed surveys using side-scan sonar. A test using gillnets to simulate abandoned equipment found that towed side-scan sonar equipment did not reliably detect equipment when the sea was too rough to keep the towed unit at a constant depth, the unit was too far from the seabed, or when the ship was moving too big. Another method of assessing the loss density of fishing gear in the studied area of the fishing area is towing grabs "crawlers". The results reveal fundamental gaps in the information needed to support reliable estimates of regional and global numbers and mortality rates from phantom fishing for individual species and higher taxonomic groups. For each term, there is a large lack of information. A brief overview of key information gaps: small sample sizes for abandoned gear production, abandoned gear density, mortality rates, and levels from ghost fishing by region and gear type. This reduces confidence in fund valuations. In addition, this is part of a small number of studies that have used methods that reduced the validity of the results, such as the introduction of sampling bias in the selection of study sites and the omission of organisms caught in a ghost net but removed entirely between two monitoring events. This increases the error in the calculated means. Estimates of abandoned gear production rates abandoned gear densities, mortality rates, and levels from ghost fishing were understated by region and gear type. This lack of balance in

¹⁶ The Gillnet: A controversial fishing gear requires responsible fishermen, published by Fisheries and Oceans Canada Fisheries Management Sector Program Planning & Coordination on November 2001, <https://waves-vagues.dfo-mpo.gc.ca/Library/351322.pdf> , (viewed on January 2022).

sample sizes between regions and gillnet and tramway species would reduce the accuracy of estimates if data were pooled by region and capture method and then collected to provide a global estimate. Variable units were used to report estimated abandonment, loss and discard rates, lost gear density, and mortality rates and levels from phantom fishing. This prevents some data sets from being combined, reducing the sample sizes available to estimate the averages. There were large differences in estimates of abandoned gear production, net density lost, and mortality from phantom fishing. Higher scores also have larger error estimates, so they may not reflect fishing nets and phantom fish in modern fisheries.¹⁷ There are no databases available to estimate the extent of global pollution from fisheries and damage from gillnets and tramway networks. The data now available to mankind could theoretically be used to improve estimates of fishing gear productivity and loss density and mortality rates from phantom fishing. Therefore, these information gaps will result in very high uncertainty in estimating the global average mortality rate from phantom fisheries, especially for taxa that are less likely to be by catch such as the marine mega fauna. The four priorities to address these identified information gaps are to harmonize gillnet and tramline loss data collection protocols in logbooks and monitoring programs, were in place, and to fill gaps in gear loss data collection records, were in place. Currently, they are not available. The priority is to establish large observer program logs and datasets that include records of the number and quantity of abandoned, lost, and discarded gear and the number of finds by fishing vessels with lost gear made by other vessels, using standardized data collection logs. A resource for researching fishing gear loss and ghost fish. More research is needed that uses advanced methods to reduce sources of uncertainty in estimating ghost fishing mortality rates and levels that are balanced in space and time and across gillnet and tramway types. The use of standardized units will help report estimates of abandoned, lost, and discarded gear, the density of lost gear, and ghost fishing mortality rates and levels. And conducting a meta-analysis of data from relevant pooled studies will provide more accurate estimates of phantom gear performance, gear loss densities, and phantom fishing mortality rates. Because of the larger sample size and number of studies, a well-designed meta-analysis can provide estimates with greater accuracy and validity than estimates derived from individual studies with greater

¹⁷ An experimental study of gillnet and trammel net 'ghost fishing' off the Algarve (southern Portugal). *Marine Ecology Progress Series*, 158: 257–265, published by Erzini K., Monteiro, C.C., Ribeiro, J., Santos, M.N., Gaspar, M., Monteiro, P. & Borges, T.C., Milieu Ltd in November 1997, <https://www.researchgate.net/publication/250216524>, (viewed on February 2022).

statistical power. In this way, reliable estimates of regional and global fishing efforts can be developed using gillnets and tram networks.¹⁸

Summary, this activity is prioritized both to identify regions where managing loss fishing gear by these gear types is most important, and to support estimates of ghost fishing mortality levels. It is very difficult to get information about how many nets fall into the ocean and continue to destroy the underwater world, not only because most companies and fishermen hide the truth, but also because each type of fishing net needs an individual research method.

2.2 The hidden cost of ghost gear lost by fishing and aquaculture

Buying a fishing net is not a cheap pleasure, sometimes sailors deliberately throw it away to reduce fuel costs, but as a rule they don't want to just throw it away, but getting a fishing net into the ocean still cannot be avoided. Fishing tackle is left in the ocean when the fisherman cannot pick it up, or when the tackle breaks and breaks away from the boat due to coral reefs, rocks, or the weather. Sets are lost and torn off due to net conflicts, if one gets caught on the other, they become tangled and eventually become unusable for the ship. Other causes of loss of fishing gear are long soak times, improper use of nets such as gillnets by non-food vessels, or fishing in very deep places, or many nets in one area. Illegal fishing entails lawlessness, so illegal fishermen can throw their net wherever they want so that their deeds cannot be discovered. The loss of fishing gear has hardly been assessed from an economic point of view on the impact of aquaculture. One study was conducted in the Nova Scotia Southwest Fishing Area, where 21,000 square kilometers are dedicated to lobster fishing. The lobster catch there is so big that in 2019 it was estimated at more than \$700 million, which is even more than half of the income in Canada from such fishing. In 2020, a project was carried out to survey 1,500 square kilometers of the seabed, where more than 7,000 kilograms of abandoned plastic fishing nets were found and removed. But lobster traps made up a significant portion of the rubbish that was brought to the surface, about 60%, and the rest was tow ropes. These studies showed that a lot of fishing gear that was recovered was in use for no more than 3 years. Such data is very sad, because the faster the fishing tackle deteriorates, the more they will pollute the ocean. It is also not economically viable, as further calculations based on this study showed that the loss or disposal of fishing traps and lobster tackle costs the industry more than \$140,000 per year. This was the first

¹⁸ Building evidence around ghost gear: Global trends and analysis for sustainable solutions at scale, published by K. Erzini, C. C. Monteiro, J. Ribeiro, M. N. Santos, M. Gaspar, P. Monteiro and T. C. Borges on January 2019, <https://www.jstor.org/stable/24858816>, (viewed on January 2022).

and preliminary assessment of the environmental and economic impacts of lobster fishing in that region. The loss of fishing gear is costly for fishermen, which has a significant impact on their overall income. There is evidence for this, as in British Columbia, Canada alone, in the crab fishery, it costs nearly \$500,000 a year to replace a lost fishing gear. Therefore, solving this problem will greatly reduce such expenses and losses for the state and fishing companies. A study by the Institute of Marine Sciences found that after the Chesapeake Bay was cleared, fishermen's income increased by as much as \$20 million over the past 6 years. Although the problem of loss of fishing gear is a new topic for discussion, it is still gaining momentum in attracting attention and responsibility of people.¹⁹ Fishing is the fastest growing food production industry in the world. And it continues to grow, with a 37 percent increase expected in 2030 compared to 2016, where more than half of the percent is in the marine food industry for human consumption. All of these numbers will continue to rise and affect the underwater world, especially vulnerable species will go extinct if we don't act now. In order to take the necessary action, a lot of research must be done on how the loss of fishing gear and the growth of aquaculture will affect the underwater world, our lives, and water. It is also necessary to understand the impact of plastic and determine the overall losses on aquaculture. For example, on a small oyster farm in Iceland, where one farmer uses more than 30,000 plastic bags that are easily lost, not to mention large productions where the number of plastic uses is much higher. As such industries expand, the harm will also increase. The government should enact tough laws to regulate fishing, install devices to track lost fishing nets ensure the disposal and recycling of old nets.²⁰

Finally, while studies like these provide us with critical insights, there are still many unknowns when it comes to the causes, prevalence, and costs of ghost gear.

2.3 The multiple risks and costs of inaction

Environmental risks

¹⁹ The hidden cost of ghost gear lost by shing and aquaculture, published by Lisa Jackson on 27 October 2021, <file:///C:/Users/Lena/Downloads/the-hidden-cost-of-ghost-gear-lost-by-fishing-and-aquaculture.pdf> , (viewed on March 2022).

²⁰ The Best Practice Framework, published by Arthur Vining Davis Foundations, Darden Restaurants, Government of Norway, and Hollomon Price Foundation in 2021, <https://static1.squarespace.com/static/5b987b8689c172e29293593f/t/61842bfa0288483db7328a12/1636051979399/GGGI+Best+Practice+Framework+for+the+Management+of+Aquaculture+Gear+%28A-BPF%29.pdf> , (viewed on March 2022).

The amount of plastic floating in the oceans will certainly not be without harm to the biodiversity of the ecosystem. We already know about 800 species of sea creatures that have been affected by ocean plastic pollution. Among these creatures there are turtles, birds, cetaceans, fish, in short, it affected everyone. Sea creatures become entangled in nets, after which a long painful death awaits them. Some feed on the decomposition products of plastic – *micro plastics*, after which they will eventually die. If left unchecked, these unfortunate impacts will affect more and more species as the levels of pollution of the oceans from discarded plastic nets rise. The uptake and *trophic* transfer of *micro plastics* has been observed in the food chains of marine life, and laboratory studies have shown that there are direct effects on the health, growth, fertility, survival and nutrition of a vast range of invertebrate fish. Potential impacts on ocean carbon sequestration have also been postulated. Of course, this new science is still evolving and there isn't much evidence right now about how *micro plastics* are harming the marine environment, but the fact remains that they are emitted from discarded and lost fishing gear, and unless the amount of them entering the ocean is reduced, then *micro plastic* emissions will increase, and the consequences will be wide-ranging. Disruptions to the aquatic food chain due to pollution of the oceans from discarded and lost fishing nets can also adversely affect the scientific and cultural value of marine ecosystems and can reduce the functioning and productivity of the marine environment. Also, studies show that some species of marine inhabitants, using plastic residues, can carry diseases to new places, where they harm people from coastal areas. New research shows that the impact of plastic nets in the ocean meets two of the three main conditions for compounds to be considered a threat in the planetary frontier of chemical pollution. The system defines boundaries for certain anthropogenic disturbances, set at levels to avoid thresholds or shifts in Earth function that could pose increasing risks to populations. One review found that ocean plastic pollution is irreversible and globally widespread, but there is inconclusive evidence to determine if it has disrupted Earth system processes or regulatory capacities. Filling these gaps in knowledge may allow for a better understanding of the critical points and thresholds for environmental pollution by plastic nets. Business risks

Plastic pollutes the oceans, coastal areas, while a large number of companies and enterprises depend on the cleanliness of the ocean. Therefore, business costs for fisheries, tourism and infrastructure operators, among others, are increasing, estimated at US\$13 billion per year. As far as risks are concerned, there is a decline in overall fish catches, demand for marine products, a decline in fishing assets, as well as reduced demand and higher operating costs (i.e. clean-up costs) in the tourism industry. In addition, there are indirect risks for businesses related to the response of regulators, investors, consumers, employees and the general public to plastic pollution. Consequences of the backlash and public opinion, businesses and commerce will face supply issues, lower product prices

and demand, and heavy use of plastic and reputational risk due to brand association with plastic pollution.

Socioeconomic risks

Using virgin plastic fishing nets is expensive. In fact, the misuse of nets is much more costly, as their useful life is reduced and they are increasingly in need of repair. But this fact is hushed up in the market, and these large costs are not disclosed. One of the socio-economic consequences is a decrease in the price and demand for the coastal area, because it is polluted with plastic, which constantly throws the ocean ashore, respectively, the standard of living in such an area is reduced to a minimum. By one estimate, the ocean is losing \$1.5 trillion a year due to declining seafood, genetic resources, oxygen, clean water, cultural value, and reduced ability to regulate the climate. Another study models the social and environmental impacts of marine plastic even higher at \$2.2 trillion per year. These data are often disputed, and it is impossible to be 100% sure of them, but it is also impossible to determine the exact figure, but nevertheless, the fact remains that the level of ocean pollution is significant. The total global cost for governments to manage plastic waste in this low-bleed system between 2021 and 2040 is estimated at US\$600 billion in present value compared to with a cost of US\$670 billion to manage a high leakage system. In other words, governments could save US\$70 billion globally and also reduce plastic mesh pollution, although costs in low-middle income countries would be US\$36 billion higher under a 20-year system change scenario.

Health risks

It's no secret that at every stage of the plastics production and supply chain, there are numerous consequences for human health and life. Virgin plastic is composed of volatile organic compounds and persistent *bio accumulative* and toxic pollutants. It has been proven that during the production of primary plastic with prolonged contact, people begin to suffer from diseases associated with human reproductive functions, and also get cancer. Prefabricated plastic fishing nets also damage the coastal environment, as they block channels, rivers, drainage systems, which ultimately leads to floods and stagnant water. This spreads diseases throughout the communities. According to research, *micro plastics* are increasingly found in marine products, including shellfish, bottled water, as well as in the tissues of terrestrial and marine invertebrates, fish and humans. But the study of *micro plastics* is a new science for humanity, which is only gaining momentum. Therefore, the levels of exposure to *micro plastics* and their potential long-term effects are not yet fully understood, but one thing is clear - it cannot positively affect human health, just like on the creatures of the underwater world.²¹

²¹ Reporting & retrieval of lost fishing gear:

Finally, many solutions have already appeared, but this is not the end, and this topic is open to new suggestions and ideas. The implementation of solutions is technically feasible and in the process of being implemented, makes economic sense and is socially acceptable. The potential for solving the problem of fishing nets roaming the oceans is great, but unfortunately, unscrupulous companies are standing in the way of non-compliance with the regulatory framework, not just by fishing companies but by entire states. There is a lack of clear business models on the part of the fishing companies, as well as incentive and financing mechanisms. Therefore, the main task at this stage is to overcome these difficulties and adapt the laws. Economic incentives to prevent device loss and encourage proper disposal of unwanted devices. For example, damaged fishing gear is accepted free of charge in dedicated port reception facilities, therefore the responsibility of the fishing gear manufacturer is strengthened and measures are put in place to prevent fishermen from throwing nets overboard. It is also necessary to produce eco-friendly nets, the design and technology of which reduce the risk of detachment and loss of the net, which quickly deteriorates or gets stuck and breaks on the seabed. An important fact is the regulation of the equipment used, namely the sites for catching marine life, the methods of catching and the placement of the nets.

CHAPTER III : METHODS TO AVOID AND MINIMIZE GHOST FISHING GEAR

3.1 Preventive methods to avoid and minimize fishing gear from becoming abandoned, lost and discarded

One option to involve fishermen in the recycling of their old and worn-out fishing nets may be to hand over the nets at special port reception facilities. It will also help to create some reports and documentation. The local authorities of such portside points created all the conditions for the old, lost ones to come to them. broken networks, or those that are confused. There are several programs that carry out the removal of nets from port points and their further processing. For example, in such establishments in Korea, fishermen are paid to bring nets to a collection point for reuse or recycling. If the network is not reusable, then it is processed and converted into energy. For example, within the framework of the Fishing for Energy program, it is meant to process and receive not only broken fishing gear, but also metal. The progress in the installation of such ports is quite progressive, because in the United States of America alone there are as many as 41 port reception points in 10 states.²² The relevant authorities accept the lost fishing gear and then convert it into electricity by burning it. Also, some authorities introduce requirements such as the presence on board of special equipment that helps track the lost net, both one's own and another vessel, so that in the event of a collision, it is possible to find the fishing net of another vessel and report information about its location, or that it could not be traced. Reporting lost gear can help you quickly find it, and partially remove legal liability from the fisherman, in the form of an exception to the assessment of fines.²³ Also, several government agencies and organizations are implementing programs for the periodic survey of areas where fish are caught in commercial quantities. Surveys are also underway at vulnerable marine life, shoreline and benthic habitats and pelagic areas to locate and remove lost fishing nets and other plastic debris. Methods for searching for discarded nets are quite diverse, as they are searched for with the help of aerial surveillance, side-scan sonar, remotely controlled search facilities, as well as divers and towing. If they want to retrieve a fishing net from shallow water, they use inflatable lifting bags, winches located on ships, and even by hand, if the net or part of the debris is not large. If you partially change the design of fishing tackle itself, this can really help in the fight

²² Reporting & retrieval of lost fishing gear: recommendations for developing effective programmes, 27–29, published by Joan Drinkwin in 2022, <https://www.fao.org/3/cb8067en/cb8067en.pdf> , (viewed on April 2022).

²³ Highest risk abandoned, lost and discarded fishing gear, published by Eric Gilman, Michael Musyl, Petri Suuronen, Milani Chaloupka, Saeid Gorgin, Jono Wilson & Brandon Kuczynski on March 30, 2021, <https://www.nature.com/articles/s41598-021-86123-3> , (viewed on April 2022).

against ghost fishing, since the material from which they are made decomposes for centuries, and not only the species for which it was intended get into the net itself.²⁴ For example, if you reduce the cell of the net, shorten the length of the net itself and abandon the bindings and straps, much fewer turtles will fall into it. Ghost fishing mortality can be reduced by increasing the diameter of the fishing net, changing the weave (e.g. using multi-monofilament instead of single), using larger floats on the top line and heavier weights on the bottom line, and adding splices to make the net stiffer. These changes described above will reduce the number of hits in the nets of large sea creatures.²⁵ Another effective method is the installation of drift nets, which are clearly visible at a depth of at least 2 meters, and not on the surface of the water, reduces the number of entanglements in the birds' nets. You can also make the network noticeable and visible simply by painting it in some bright color. Illegal and improper fishing removes not only the by-catch rate of marine mammals, but also the by-catch of target species. Such small changes, but they solve so much. If we change the structure a little, for example by attaching materials such as thick polyester rope and chains, or incorporating metals such as barium sulfate and iron oxide into nylon nets, eventually these precautions will reduce the capture rate of cetaceans. All this is due to the fact that such materials increase acoustics, respectively, cetaceans more easily recognize the network and can avoid it. Acoustic sensors and alarms, increasingly seen on gillnets in recent times, reduce by-catch of marine mammals. Lighting with battery-powered flashlights or special chemicals that can be added to the net reduces the by-catch of sea turtles and other vulnerable marine creatures. Another way to avoid ghost fishing for non-strategic species is to use nets made of fragile ecological material so that large species of marine life can get out of the net. This technology was developed to reduce the duration of the fishing power of abandoned nets through designs that use rapidly degradable materials. For example, cotton fiber fishing nets already exist and are gaining popularity. Degradable rescue panels and cords, and even the nets themselves, can be made from synthetic materials that will be destroyed by microbes and ultraviolet light. Also, it is worth noting that there is some difference between multifilament and monofilament, as the former have a shorter fishing life. Therefore, weaker and weaker nets will

²⁴ Global Causes, Drivers, and Prevention Measures for Lost Fishing Gear published by Kelsey Richardson, Britta Denise Hardesty, Joanna Zofia Vince, Chris Wilcox in July, 2021, https://www.researchgate.net/publication/353133716_Global_Causes_Drivers_and_Prevention_Measures_for_Lost_Fishing_Gear, (viewed on April 2022).

²⁵ Acoustic pingers eliminate beaked whale bycatch in a gill net fishery published by Kelsey James V. Carretta, Jay Barlow, Lyle Enriquez on 22 October 2008, <https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1748-7692.2008.00218.x>, (viewed on April 2022).

require frequent replacement, which is not very environmentally friendly, and they will more often come off and be lost.²⁶

Summary, as we can see, many programs are being created to support the recycling of plastic fishing nets. They can also be renewed, repaired and put into further use, which is a very profitable option as well.

3.2 How do biodegradable networks work?

Of course, the production of fishing nets is a complex process, because it is necessary to make a net suitable for each fisherman and his vessel. But biodegradable fishing nets are not easy to make either. The mesh of such a fishing net must be impregnated with a material that will contribute to rapid decomposition. Such a process should include rapid decomposition into micro particles, which in turn are not toxic and will not harm marine life. This manufacturing practice is already being used, not only in the production of fishing nets, but also in sports, construction and other areas.²⁷ IRC biodegradable fishing nets are already gaining popularity in Europe and the US. This product has exceeded society's expectations because it has passed all tests of durability, as every detail has been tested. They are strong enough, withstand heavy loads, strong and not subject to rapid wear. These biodegradable fishing nets are planned to replace plastic gill fishing gear because they are the most widely used in the world's fisheries, due to the fact that they have a high catch rate, but at the same time they are most often lost in the ocean. These nets catch both target and non-target species in huge numbers every year. They also want to replace gill nets with biodegradable ones, for the reason that the synthetic material from which they are made decomposes into toxic particles for a very long time. But every year, more and more fishermen are starting to switch to replacing the material of gill fishing tackle. The only thing about new nets is that they are more expensive than usual ones, which is not beneficial for fishermen, especially illegal ones. But the problem of ocean pollution and the extinction of entire species of marine creatures requires an urgent solution to this problem. Therefore, the questions of how to use biodegradable materials and how to get commercial

²⁶ Commentary. Biodegradable fishing gear: part of the solution to ghost fishing and marine pollution published by Eric L Gilman in July 2016, https://www.researchgate.net/publication/305323124_Commentary_Biodegradable_fishing_gear_part_of_the_solution_to_ghost_fishing_and_marine_pollution , (viewed on April 2022).

²⁷ Biodegradation of Wasted Bioplastics in Natural and Industrial Environments: A Review published by Adele Folino, Aimilia Karageorgiou, Paolo S. Calabro, Dimitrios Komilis on 27 July 2020 <file:///C:/Users/Lena/Downloads/sustainability-12-06030-v3.pdf> , (viewed on April 2022).

companies to replace synthetic fishing tackle remain open. Despite the fact that the trend of switching from plastic to biodegradable gillnets has been growing in the last decade, this is still not enough, because a large-scale intervention of everyone who is somehow connected with this topic is needed. It is necessary to draw the attention of fishermen that biodegradable gillnets will begin to decompose if they are lost at sea and that the fisherman will not be held responsible for the loss of his net, because in the future it is expected that states will tighten their laws against irresponsible fishermen. Of course, biodegradable fishing nets still need to be improved, but it's only a matter of time since they were invented not so long ago. Because studies show that in some ways they are less effective than conventional plastic nets, especially when catching cod. We still need to work out the price of new networks so that they become more affordable. However, in the long term, the disposal of abandoned, lost or discarded fishing gear can bring collective benefits in terms of better fisheries management, increased fish stocks, and so on. The use of gillnets, once considered a natural adaptation to the local environment, now faces new sustainability issues that were not previously part of traditional inshore fishing nets. When new stakeholders join the discourse, it is important to understand how different actors or social groups try to impose and defend different interests, values and norms in the sustainable development discourse. Under these circumstances, stakeholders with a more ecological approach see gill fishing as a source of abandoned, lost or discarded fishing gear and therefore see phantom fishing as a threat to fisheries management with negative impacts on marine ecosystems.²⁸

Finally, in this context, sustainability labels and the best market access may impact the transition towards the use of biodegradable gillnets. However, a quota compensation for the use of less efficient biodegradable gillnets, will ease the transition. Here, the options may include a full compensation, a public decree to ban nylon gillnets and a control system to enforce the use of biodegradable gillnets, a partial quota-compensation, or a voluntarily approach. The future status of the gillnet fisheries depends on negotiations and interpretations of values and norms based on the principles of sustainability and on the ability of stakeholders to address the problem and find a future solution.

3.3 Wars on land and in the oceans and seas

²⁸ Governance implications for the implementation of biodegradable gillnets in Norway published by Standal, Dag; Grimaldo, Eduardo; Larsen, Roger B. on 15 October 2020 <https://munin.uit.no/handle/10037/20147>, (viewed on April 2022).

One way or another, but the world is very small, and here everything is interconnected. This work reveals the problem of gradual, but rather progressive extinction of the underwater world. We are seeing the disappearance of some species of marine life precisely because of the pollution of the oceans with marine plastic nets for catching fish, turtles, lobsters, crabs, and so on. But this is far from the only pernicious reason. The recent attack on Ukraine, the sinking of a Russian cruiser in the Black Sea is also destroying this world, including the underwater one. Not much time has passed, but we are already seeing some of the consequences, which, unfortunately, are only the beginning of a natural disaster. Recently, dead dolphins have begun to appear on the Black Sea coast. They fall into the radiation zone of the navigational instruments of Russian ships, which disables the dolphin's hearing organ. Having lost their orientation, "blinded" dolphins lose their acoustic control over the environment. In a panic, they can throw themselves ashore and die. The cruiser "Moskva" now remains at the bottom of the Black Sea, continuing to see radioactive and chemical substances, thereby poisoning everything in its path, since the Black Sea is the inland sea of the Atlantic Ocean basin, connected by the Bosphorus and Dardanelles straits.

War always brings only destruction. The Second World War changed the world beyond recognition, but unfortunately, not all countries were able to learn this cruel lesson for themselves. Three-quarters of all diesel ships ever sunk in the world's oceans are ships sunk during World War II. Today, many of them are so rusted that they pose a danger to the environment. During the Second World War alone, thousands of ships were sent to the bottom. On board these sunken ships today is - according to various estimates - from 2 to 15 million tons of oil and oil products. But, in addition to oil, many of these ships also have a lot of ammunition on board. A lot has passed since the end of the war, and all this time the ships on the seabed are rusting and falling apart. Unfortunately, history is now repeating itself, and everything that has been rebuilt for so long, everything that people have been trying to change for so long, does not matter now.

Only one thing matters - stop the war, and stop destroying the terrestrial and underwater world. Destroying is always much faster than building all over again. This work is dedicated to the struggle for the life of the underwater world, and therefore our life, the life of future generations. Abandoned and lost fishing nets are wreaking havoc on the oceans, but we have the power to change that, as well as many other things.²⁹

²⁹ Sunken ships threaten the ecology of the seas and oceans published by Vladimir Fradkin on 16 November, 2010, <https://www.dw.com/ru/%D0%B7%D0%B0%D1%82%D0%BE%D0%BD%D1%83%D0%B2%D1%88%D0%B8%D0%B5-%D1%81%D1%83%D0%B4%D0%B0-%D1%83%D0%B3%D1%80%D0%BE%D0%B6%D0%B0%D1%8E%D1%82-%D1%8D%D0%BA%D0%BE%D0%BB%D0%BE%D0%B3%D0%B8%D0%B8-%D0%BC%D0%BE%D1%80%D0%B5%D0%B9-%D0%B8-%D0%BE%D0%BA%D0%B5%D0%B0%D0%BD%D0%BE%D0%B2/a-6236276> , (viewed on April 2022).

SUMMARY AND RECOMMENDATIONS

Lost and abandoned fishing gear is contributing to a major environmental and socio-economic disaster. But this issue has been increasingly attracting public attention in the past few years. Unfortunately, we do not have clear and precise numbers of deaths that ghost fishing entails, since none of the fishermen will document the catch of non-strategic fish species, and no one knows how many marine life are killed by nets wandering the expanses of the ocean. Therefore, it is difficult to estimate populations and stock. Particularly at risk are species of sea creatures that have low fecundity, making them the most vulnerable to ghost fishing. Such vulnerable species include both seabirds and turtles and fish. It is because of ghost fishing that the number of sea creatures with low fertility is increasing. The extinction and reduction of stocks of target species due to lost fishing nets reduces the sustainable production of fish resources, which means a decline in the economy. Problems also arise with the mortality of the fauna's flagships, due to the fact that marine life caught in lost nets die much longer and more painfully than catches in used gear. One fifth of the world's marine fisheries are gillnets and tram nets, which have a very high phantom catch rate. Based on this, the United Nations Fisheries Program commissioned a study to provide at least a rough estimate of ghost fishing rates and levels, and to understand what would be required for further research. But despite the fact that the solution of the problem is moving forward, and more and more public attention is being attracted, there are still huge problems in regulating the rules at the legislative level. There are no clearly defined global goals. There are a lot of gaps, for example, action plans not developed and implemented, including preventive, mitigating and corrective actions that will help in the fight against ghost fishing. There are also no universal standards and reports for monitoring the use of plastic fishing nets, because in addition to ghost fishing, plastic also pollutes the ocean and the environment in which we live. Added to this is the lack of good funding to support the fight against ghost fishing. So far, the United Nations Environmental Assembly has adopted a total of four resolutions that aim to address marine litter issues, including abandoned and lost fishing nets, to prevent the extinction of many species of marine creatures and reduce plastic pollution in the oceans and coastal areas. It is the most destructive form of marine debris. The most correct answer to the question of how to deal with this seemingly unsolvable problem is the creation of a general international agreement with clear obligations, norms, and regulations to prevent fishing nets from entering the ocean. But this must be supported by the community, including the creation of ambitious goals and support mechanisms. Such innovations should unite all the countries of the world that are responsible for the entry of fishing nets into the ocean. All this should also help to establish the level of responsibility towards states and private companies, as well as individuals. We must raise the

level of awareness of humanity so that they understand the full threat of this problem. Preventive measures such as not catching fish during certain periods, such as migration or breeding seasons or in certain areas, and marking gear are a good start. Still, the loss of fishing gear cannot be 100% avoided, but it is possible to replace them with biodegradable ones so that the decomposition process becomes much faster. In recent years, many research companies have been trying to find some alternative way of fishing to reduce the level of ghost fishing. For example, Flip Farm was the first to come up with a semi-automatic oyster farming system that permanently attaches oyster baskets, which in turn reduces the percentage of basket wastage to near zero. Also, the Californian company Blue Ocean Gear has developed "*smart buoys*" that can be tracked through the phone. Such technological breakthroughs will help solve this complex problem. If we continue to invent such technologies in the fight against ghost fishing, then the world has a great chance to reduce the detrimental impact on the environment and the economy. But this problem cannot be solved individually, such a global issue requires the same global solution. After all, the problem of plastic fishing nets is not just a problem of ocean pollution by them, it is a question of our future, because such aspects as food security problems due to a decrease in fish resources and the impact on humans cannot bypass us. There is not a moment to lose, because every day a trail of plastic fishing gear is left in the ocean.

Conclusion

Ghost gear harms the marine environment and threatening marine biodiversity. We need to find the root causes of gear loss. Need to adopt preventive and mitigation measures, including binding measures, use of biodegradable materials, creating awareness at local, regional, and international levels. Apart from that, we need to create an International treaty with clear responsibilities and ambitions to prevent and reduce ghost gear. However, perhaps the most crucial measure to prevent ghost gear's impact would be implementing a strict code of conduct to reduce gear loss from gear interaction and theft.

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