"I wish, I wish I weren't a Fish"

A history and painting on the overfishing of the North Atlantic cod and how we are catching ourselves in our own net

By

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Abstract:

After continued fishing efforts since the discovery of vast stocks since the 1500s, Atlantic cod have become an overfished species, though its decline was only noticed by fisheries in the mid 1900s. Since the introduction of the Magnuson-Stevens Fishery and Conservation Management Act in 1976, several steps have been taken by both the Canadian and United States governments in combating the overfishing of this species. To address the problem at hand and change public perception in the hopes of creating further protective measures, I created a 10 ft. by 5 ft. 4 inch painting. The images within the work aim at placing the viewer into the Atlantic along with a school of cod about to be caught in a massive trawling net. By informing the public, specifically fishermen, lawmakers and consumers of this commodity, the painting may become an impetus for change. These can include choosing alternative gear or marine species, new and improved legislation, and decreased demand for cod due to public refusal to purchase an overfished, vulnerable species.



Figure 1: "I wish, I wish I weren't a Fish", a painting depicting the overfishing of cod.

Introduction

Currently, water systems around the world are plagued with a multitude of manmade problems that have wrought destruction and death upon ecosystems. The oceans in particular have a vast number of manmade that must be grappled with at an increasing rate. Water acidification, invasive species, rising temperatures, and the dumping of waste, including oil spills, are a few of the calamities troubling our oceans (Blumer 1971;Guinotte 2008; Knap 1983; Laist 1987; Lowe 2000; Moore 1974; Orr 2005; Roessig 2005; Sorte 2010; Yamashita 2011). Each of these problems is the consequence of human interactions with the environment, mismanagement and a complete disregard for the welfare of the effected ecosystems. The end result will almost always end in habitat destruction and alteration or an increase in the number of threatened and endangered species. One issue humans are actively involved in all across the world, which is restructuring trophic cascades towards complete collapse, is overfishing. The current situation surrounding North Atlantic cod population collapse is a prime example of the imminent dangers associated with overfishing and the lasting effects it can have.

The Atlantic cod, *Gadus morhua*, (See Figure 2) is common to both sides of the Atlantic Ocean but in North America can be found ranging from Greenland to Cape Hatteras (Rodger 2006, Rose 2007). These fish can reach a total length of 200 cm (78.7 in), a max weight of 96.0 kg (211.6 lbs) and live to be up to 25 years old (Rodger 2006, Rose 2007). Some of their defining features include three soft rayed dorsal fins and two anal fins with a slightly concave but mostly square caudal fin (Rodger 2006, Rose 2007). *G. morhua* is a large mouth fish with a projecting upper jaw and a chin protrusion called a bar bell (Rodger 2006, Rose 2007). The upper body of the Atlantic cod is usually a gray or green, although depending on the cod's surroundings the fish can be more a reddish brown (Rodger 2006). The dorsal and sides are covered in distinctive round spots that are

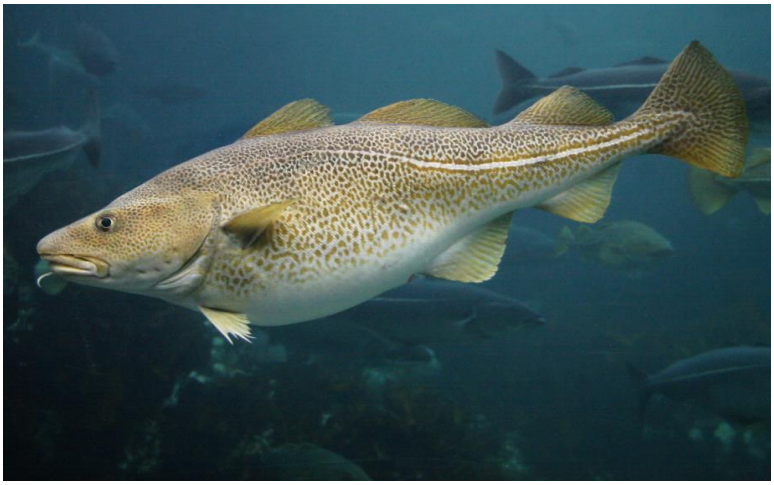


Figure 2: Atlantic cod in its natural habitat (Turner 2016).

red to brownish in color (Rodger 2006). The underbelly is a whitish color and a pale lateral line can be seen running from the gills to the tail (Rodger 2006). Cod have been known to be opportunistic feeder, especially as adults, but still consume mainly herring and capelin (Rose 2007). After approximately 2 years, juvenile cod will leave the nursery (Rose 2007). At 3 to 4 years, cod will join the established shoals, "size structure aggregations", and begin to follow the feeding and spawning migrations (Rose 2007).

Cod are migratory fish that spawn across various banks of the continental shelf (Rodger 2006). Stocks will spawn at different times of the year depending on the location (Rodger 2006). This can last anywhere from March to June and at a depth from 183 to 610 m (600 ft. to 2000 ft.) (Rodger 2006). When spawning, Atlantic cod prefer waters at 2.2°C to 4.4°C (36°F to 40° F) but have been known to travel to warmer shallower coastal waters as well (Rodger 2006). A sexually mature female can produce 2 million eggs at a time, but only a few will survive to adulthood (Rodger 2006). According to Rose, "a large female may hold 5-10 million eggs; smaller females have many fewer eggs, perhaps less than a million. Older females not only carry more eggs, but larger and better quality eggs, and are very important to overall reproductive output" (2007). Once the eggs are laid, they rise to the surface where the larvae will live off a yoke sac for 1 to 2 weeks (Rodger 2006). After they've grown to about 1.5 inches in length, the larvae will settle to the bottom (Rodger 2006). *G. morhua* reach maturity after 3 to 8 years, or at approximately 18 to 24 inches (Rodger 2006, Rose 2007). For males, they have been found to mature sooner and be slightly smaller than females (Rodger 2006). Atlantic cod are often caught between the ages of 4 and 8 years, which can be before the fish reaches maturity (Rodger 2006). This can be a problem by reducing the breeding population and prohibiting the stock from recovering or growing in the future as the result of a year's catch by the fishing industry. Additionally, if fewer females are surviving to adulthood, the quality and quantity of eggs produced if severely reduced. This can ultimately hinder the chances of a stock repopulating itself after a year's catch by the fishing industry.

Over time, a steady change in the North Atlantic cod stocks has occurred and not for the better. One of the leading contributors to the rapid decline in this population was the ever-increasing demand for these fish in food markets around the world and the ability of fishing fleets to supply the demand. On top of that, the stocks of cod have not been able to repopulate to

the levels they were once at. This problem didn't happen over night, but has been in the making for almost 500 years, when fishermen began exploiting the waters of Newfoundland.

Between 1450 and 1500 AD, Europeans from several countries were intrigued by tales of Norse success in the 1000s and arrived at Newfoundland after several exploratory voyages through the waters northwest of the England (Rose 2007). In 1497, John Cabot sailed on behalf of England with 16 merchant mariners and found Newfoundland(Rose 2007). Sebastien, Cabot's son who had gone on the voyage, later reported that the sea "abounds in fishes" and "above all, there is a great abundance of those fishes which we call bacualaos [cod]" (Rose 2007; p. 181). A letter from an English merchant to the Duke of Milan described the details of John and Sebastien Cabot's findings (Rose 2007). It told of how the fish were so plentiful that they could be caught with baskets from the sides of boats. From around 1510 and thereafter, vessels from Portugal, England, France and Spain traveled to the waters off of Newfoundland to fish, although records of how many boats and when are sparse (Rose 2007). By 1577, the waters off of Newfoundland were well known to each of these European countries (Rose 2007). According to Rose, "all of the cod stocks, with exception to those in northern Labrador, were being fished by the mid-1500s" (2007; p. 191). Documentation of catch sizes was sparse until the late 1500s. At the time, the catches were not large enough to impact the cod stocks, with the exception of much smaller coastal stocks (Rose 2007). The lower catch sizes were due primarily to the use of handlines, which required more effort (See Figure 3).

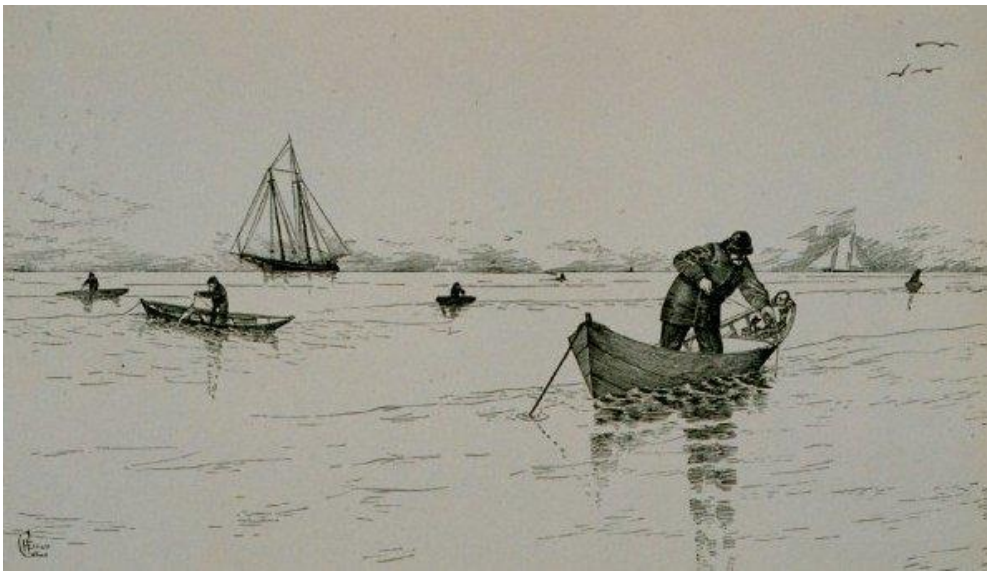


Figure 3: Handlining for cod from dories was a previous method of fishing used by fishermen at the start of the cod fishery (NOAA 2015).

The climate during the late 1500s began to cool and this was the primary influence on marine species decline in productivity and biomass (Rose 2007).

From approximately 1580-1600, the English began expanding their fishery in Newfoundland (Rose 2007). This was done in order to meet the demand for salt cod when trading with other countries, since the English local stocks had been depleted (Rose 2007). It was during this time that England also made attempts to claim Newfoundland as it own and continued to explore the area (Rose 2007). In 1586, Captain John Davis discovered immense stocks of cod off the shores of northern Newfoundland and Labrador (Rose 2007). He described that his crew "found great abundance of cod, so that the hooke was no sooner overboard, but presently a fish was taken. It was the largest and best fed fish [he] ever sawe" (Rose, 2007; p. 210). The English were turning enormous profits and the fishery became one of the major contributors to its economy.

With the exception of the Portuguese, who had removed themselves from the North Atlantic cod fishery, and in times of war, England, France and Spain continued to fish the area extensively (Rose 2007). In the 1600s, cod hauls averaged about 100,000 tonnes per year and were as large as 200,000 tonnes per year in others (Rose 2007). Despite these large landings, the originally untouched cod stocks were reduced only by about ten percent (Rose 2007). In the early 1700s, the English fishery began to decline as the number of boats went from approximately 800 to 300 (Rose 2007). From 1713 to 1724, the climate grew colder and the number of cod brought in was dramatically reduced (Rose 2007). A new type of vessel called a banker, which could be loaded up with fish and brought back to land for curing, was introduced in the early 1700s and by 1765-1775 there were more than 200 of them (Rose 2007).

Handlines operated from small boats that had been used during the 1700s continued into the 1800s (Rose 2007). Cod seine and gill nets were used sparingly (Rose 2007). In 1866, Captain W. H. Whiteley invented the cod trap (See Figure 4), which was a stationary modification of the seine net used to catch fish and salmon (Lear, 1998). The number of traps went from 2588 in 1891 to 4182 in 1901 (Lear 1998). Around the same time, longlines began to be used by bankers (Lear 1998). These were lines with hundreds of baited hooks were suspended on long lines off the back of ships.



Figure 4: Fishermen bringing collecting the catch from a cod trap (Gagnon 2016).

In the 1860s, steam power was incorporated and allowed for larger cargoes of fish to be brought into market. With the advancement of steam power, fishing pressure towards cod stocks along the coast of Newfoundland increased immensely (Lear 1998). This resulted in a decline of the seal fishery and subsequently the Atlantic cod fishery (Cudmore 2009). With the steady decrease in seal harvesting, fishermen switched to cod in the hopes of tuning a profit. However, just as seal numbers plummeted, the same befell cod. This resulted in fewer numbers of recorded landings and in turn lower profits. Unemployment rose and the standard of living in Newfoundland worsened (Cudmore 2009; Lear 1998). Draggers (See Figure 5), or otter-trawlers, were first used off the Atlantic coast in 1908 and trawlers were first used commercially in 1935 (Lear 1998). Draggers were severely restricted for many years because inshore fishermen felt that this new gear could be a threat to their own catches and, because of its expense, could only be used by private businesses (Rose 2007). Since these vessels no longer needed bait, steam powered trawlers soon outcompeted longliners and other primitive methods (Rose 2007). Another reason behind the restriction was the notion that overly efficient machines would lower employment rates in the fishing industry (Rose 2007). This was because significantly fewer people were required to operate the machinery. After a period of intense competition, the era of schooners came to an end and followed with an industrialization of the fleets (Cudmore 2009).

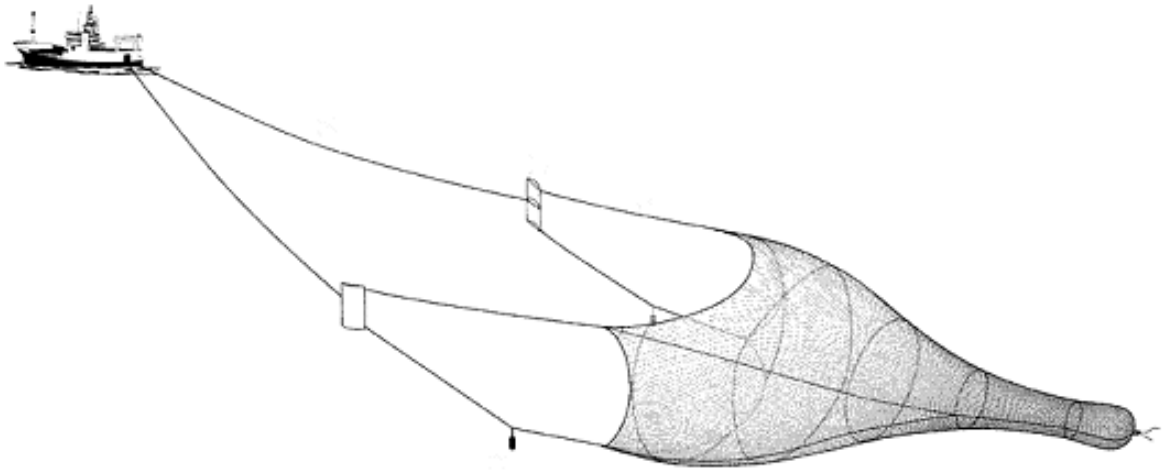


Figure 5: Dragger, or otter trawler, pulling a net through water (FIO 2013).

During the 1930s, the fisheries on Newfoundland were only taking in approximately 40% of the fish caught, meaning the remaining 60% was going to foreign fleets (Cudmore 2009). Research into the stocks suggested that the incorporation of trawling for cod had the potential to deplete stocks and to use them wisely (Cudmore 2009). Despite the warning, it was soon discovered by fishermen to be the most effective means of capturing fish and replaced earlier methods (Cudmore 2009). Consequently, bottom-trawling methods spurred a rapid increase in bycatch and destroyed seabed habitat. As early as 1914, a report by the U.S Commissioner of Fisheries stated:

> While the facts before us show no proof or presumption of any depletion of the fisheries on the banks frequented by American otter trawlers, it is possible that the seeds of damage already have been sown and their fruits may appear in the future or that the development of a wholly unregulated fishery eventually may result in injury where none exists (Cudmore 2009).

Management agencies were aware of the potential long-term risk to the fishery, though there showed no immediate threat.

One of the greatest technical advancements was deployed in 1954 when England sent its first "factory-freezer" trawler to the Grand Banks off of Newfoundland for cod (Cudmore 2009). The 400 ft. vessel had onboard processing plants and could accumulate 600 tons of fish per day (Cudmore 2009). The boat was also able to fish at all times of the day and year round, despite

weather conditions (Cudmore 2009). Most countries followed suit soon after and "distant water fleets" were born (Cudmore 2009). Yet again, the fishing pressure of Atlantic cod increased considerably.

New fishing grounds were discovered to the east of Newfoundland in the 1950s and 60s (Cudmore 2009). Once added to established fishing grounds, cod landings increased. Previously, landings had reached a maximum in 1910 with about 300,000 tons (Cudmore 2009). This changed significantly in 1968 when more than 800,000 tons of cod were reported, totaling for about 40% of the global landings (Cudmore 2009). The southeastern portion of Canada had become a hub for international fishing fleets. Unfortunately, any attempts to control the fishery by the United States and Canada were either ignored or nonexistent (Cudmore 2009). Foreign vessels specifically came during times when the largest spawning congregations were occurring as to maximize landings (Cudmore 2009). This inevitably caused massive problems down the line as reproducing cod became fewer in number over time and were unable to repopulate at a level that would compensate for the number taken. According to Cudmore, by 1971, a massive fleet of close to 900 "factory trawlers" were fishing within 200 miles off the U.S. and Canadian coastline, 400 of which were from the Soviet Union (2009). The annual hauls from these boats took approximately 60% of the adult cod, about three times the advised amount to sustain healthy stock levels (Cudmore 2009). In 1976, the Magnuson-Stevens Act was passed by the U.S. and established a 200 nautical mile boundary from the coast out (NOAA 2016). It was designed as an "exclusive economic zone" that would avoid overfishing as well as rebuild stocks, increase economic and social benefits and ensure a sustainable supply of seafood (Cudmore 2009, NOAA 2016). Due to proximity and sharing of fishing grounds, Canada was given permission to operate within these waters as well. Within the U.S, eight regional fishery management councils were created to represent coastal states and their stakeholders (NOAA 2016). These councils would then cultivate management plans for the fishery that were geared towards conservation.

Despite the best intentions towards ending overfishing by foreign vessels, domestic overfishing was still a problem. This was evident when the government offered subsidies to help build a new, modern fishing fleet (Cudmore 2009). By 1990, cod stocks had continued to decline (Cudmore 2009). 1992 marked the collapse of the fishery off of Canada's Grand Banks off the coast of Newfoundland. The number of cod at the time had reached 1% of its original population

size (Cudmore 2009). To combat this, an immediate moratorium was placed on the fishery in this area, leaving close to 35,000 fishermen jobless (Cudmore 2009). The Canadian government spent approximately $8 billion on the Atlantic fishery, half of which went to unemployment benefits of fishermen and fish factory workers (Cudmore 2009). The U.S. supported the declining fishing industry by buying out vessels, offering job-retraining programs and subsidizing health insurance (Cudmore 2009). The active attempts to reduce the size of the fishery was met with great opposition due to the deeply rooted history of communities and job assurance for of many for over 300 years (Cudmore 2009). In 2003, three fishing regions off Newfoundland and Labrador were ordered to end all fishing of the Atlantic cod (Cudmore 2009). Later that year, cod in that same area were listed as "endangered" and, as a result, the Canadian government established a $50 million plan to assist fishermen and their communities (Cudmore 2009). During that same time, environmental groups sued the U.S. government claiming that NOAA had failed to enforce its own rules on the prevention of overfishing (Cudmore 2009). Afterwards, new management plans were enacted to curb fishing effort and rebuild cod stocks. Despite efforts to rebuild the cod fishery, there has been limited progress, if any, in some cases (Cudmore 2009).

The evolution of equipment used in the fishing process as well as the decline on stock numbers has served as the impetus for the collapse of the fishery. A study conducted by G. Rose in 2004 created a model that would simulate the effect of both overfishing and climate change. When looking at overfishing alone, coupled with factors like the declining stock population due to fishing pressure and advancements in gear, the study found that this was the cause of cod stock collapse in the 1960s. Rose also discovered that the collapse in the 1980s was due to the compound threats of both overfishing and climate change. As a result of decrease in the North Atlantic cod fishery, the fish themselves have been unable to repopulate to replace the amounts of fish removed. Most of the cod caught are only a few years old, which in some cases means they are not sexually mature. Another study found that when populations of fish and the egg hatch rates of these fish are low, fewer eggs are produced and results in a decreased annual population growth (Hutchings 2005).

To address the problem at hand and change public perception in the hopes of creating further protective measures, I created a 10 ft. by 5 ft. 4 inch painting. The images within the work aim at placing the viewer into the Atlantic along with a school of cod about to be caught in

a massive trawling net. By informing the public, specifically fishermen, lawmakers and consumers of this commodity, the painting may become an impetus for change.

Methods

The first step towards my goal of creating a painting that visually represented overfishing was to narrow my topic to a specific fish. To best illustrate the primary target species of oceanic trawling, I sought out types of fish fishing vessels were pursuing. Generally, trawlers in the fishing industry aim to catch schooling and shoaling species, meaning ones that will stay in large groups while traveling or feeding. These species are chosen due to their ease of detection underwater by radar and, once the boats have lined up with the fish's potential trajectory shown on radar, trapping in large trawling nets pulled behind ships. Then I narrowed my view even further by picking the North Atlantic as the region fish species would be chosen from. Here, several types of tuna, mackerel, bluefish and bass can be found (Mid Atlantic Fishing 2015). This area was chosen based on my previous personal interactions with the fishing industry. Being from the Northeast, my family frequented Long Island, New York during the summer where I grew up learning to fish. While there, we also visited docks and markets where fresh fish had been caught only a few hours prior. I had been on charter boats and seen commercial fishing vessels throughout the inlet. Due to my visual knowledge of the fishery, it sparked my curiosity in covering a species from the area I was familiar with. I chose North Atlantic cod specifically because it has been heavily overfished by the fishing industry and labeled as vulnerable by the IUNC Red List (1996).

After choosing the fish I wanted to represent in my painting, I pondered scenarios that could potentially be used to inform content. The goal behind the painting was to craft an image that would put the viewer into the situation and cause them to consider our impact on the species. I wanted the viewer to feel over powered, just as cod are helpless in the face of large expanses of net invading their habitat and decimating their species. With this visual in mind, I decided to set the scene underwater somewhere in the North Atlantic. Initially I considered doing a bottom up view of the ocean with a large trawling net sweeping through and decimating an entire school of cod. As I pondered the angle and positioning the viewer was put in, the scene began to morph. This perspective seemed to separate the audience from the issue at hand and fails to address the faults of humanity in the overfishing of the Atlantic cod. This concept also had issues in being

able to properly identify the key subjects within the scope of the painting. The next concept was slightly different in that, instead of the scene being directly overhead, the observer was set slightly lower and further back in space. This gave the illusion that the audience is presently watching the net and school go by but not having the power to do anything to stop it from happening. This notion still did not sit well with me, largely because I want the audience to feel so impassioned as to take action, and again caused me to shift perspective. The last visual concept I created was of a net and school of fish coming not quite directly towards the audience. The purpose of this angle was to change the perspective of the audience. No longer were they observers but instead became part of the school about to be caught and face their untimely doom.

When I had finally settled on a concrete concept, I choose the dimensions I wanted to work with. After seeing several sheets of plywood, a few paintings by Leslie Flores, and measuring out the dimensions of each of the previous, I decided that I wanted to do a large canvas. Leslie Flores is a painter and student studying art at Allegheny College. She has created a multitude of large paintings that have been on public display at the college, which is where I was inspired. The plywood had been 8 ft. by 4 ft. and Flores' paintings were approximately 5 ft. by 6 ft. Once I had looked at the dimensions for some time, they began to feel minute compared to the vastly important topic I was attempting to cover. I opted for a canvas that was 10 ft. in length and 5 ft. 4 in. wide. Ten feet seemed to be large enough for a single painting and the 5 ft. 4 inches is a reference to my personal height. I wanted to incorporate a part of myself into the very fiber of the painting and could think of no better way of doing this than to make the width as tall as myself. The size of the width also enables the painting to overpower the viewer when standing next to it, being that it was the size of a person.

In terms of placement, the net is set in the top left corner stretching to almost half way across the length and approximately two thirds of the width. In the bottom right corner are a few large cod that seem to be somewhat coming towards the viewer. The larger school of cod is set behind the initial cod in the foreground and progressively get both smaller and twist over towards the opening of the net. Again, it is important to note that the school of cod are not swimming into the net but attempting to escape by seemingly pouring off the page. Additionally, since this is a scene set underwater and overfishing of the Atlantic cod is presently occurring, I wanted to keep a somewhat realistic color palate. This means various shades of blues and greens, depending on the amount of white and black added to the colors respectively.

Once I had formulated my concept and dimensions, I began to accumulate the supplies needed to create and paint my canvas. My first step was to get wood for the frame of my canvas but in order to determine exactly how many boards I would require, I needed to know two things: how long were the boards sold by Home Depot and how would the frame be built. After briefly perusing the Home Depot website, I found that they carried bars of wood that were longer than 10 ft. I then had a few conversations with the Technical Assistant, Ian Thomas, and decided to focus on the 12 ft. boards, as to have excess wood to use in case of a bad cut or for corner support pieces. We came up with a plan for how to construct a sturdy frame that could handle the stress of the canvas and length of the frame. Thomas informed me that the frame would need interior support as to prevent the wood from bowing and becoming misshapen.

In order to create a 10 ft. by 5 ft. 4 inch frame, I needed several pieces of wood of varying size. For the outside, base structure, I required 2 boards that were 10 ft. long and an additional 2 boards of 5 ft. 4 inches in length. It is important to note that these boards, both the 10 ft. and 5 ft. 4 in. beams, needed to be beveled. This means the wood is cut flat and at an angle along the edge so when canvas is stretched across the frame, it is not touching the wood. The two 10 ft. boards were then cut in half, to provide for ease of transportation and disassembly, then held together by an approximately 2 ft. long board that was screwed into each side of the 10 ft. board. Next we cut 3 boards that were approximately 5 ft. 4 inches. (~5 ft. 4 in.) The three boards would be running vertically within the inside of the frame to help create stability. The central board among the three would be slightly shorter as to fit between the 2 extra boards used to hold the bars that made up the 10 ft. board pieces together. Next two approximately 5 ft. (~5 ft.) boards went across the middle, horizontally. Lastly, four pieces about 2 ft. (~2 ft.) in length were then put into each of the corners of the larger structure of the frame. In total, I needed six 12 ft. boards of wood. We decided to use treated pine boards due to higher quality when treated and are quite sturdy.

Construction of the frame (See Figure 6), however, occurred in a different order than the supply list previously mentioned. First an "I" shape was created using the middle, slightly smaller ~5 ft. 4 in. bar (D) and the two ~2 ft. bars (C) used to hold the larger 10 ft. boards together. One of the ~2 ft. pieces was screwed into each end of the ~5 ft. 4 in. bar. Once the "I" shape was complete, the pieces that comprised the 10 ft. boards (A) were then screwed into the ~2 ft. boards on each end of the "I" formation, beginning to create the main structure of the

frame. Next, the 5 ft. 4 in. sides (B) that main frame were then screwed into the 10 ft. bars at each end. Afterwards, the other two ~5 ft. 4 in. vertical middle beams (E) were screwed into the 10 ft. board at approximately a quarter of the length of the frame. The horizontal ~5 ft. bars (F) were screwed into the 5 ft. 4 in. bars along the outer frame and the ~5 ft. 4 in. bar a part of the "I" formation. Both of the ~5 ft. beams must have a notch large enough to cross over the top of each of the middle vertical ~5 ft. 4 in. bars while still fitting closely. The ~5 ft. boards must also be screwed in at slightly different heights, since the boards cannot overlap in the center. That would prevent one of the boards from being screwed in, therefore varying the height of each is warranted. Lastly, the ~2 ft. pieces are screwed into the corners of the main frame.

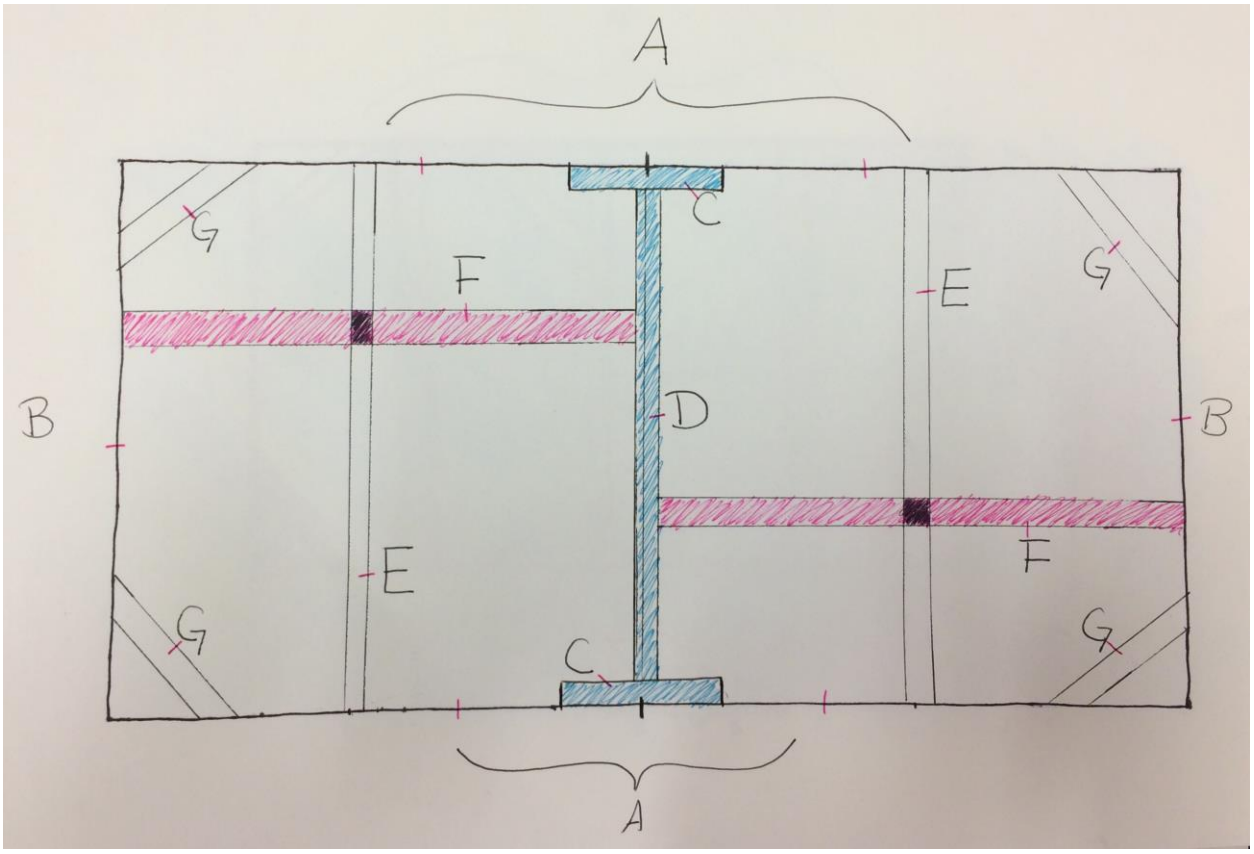


Figure 6: Layout of the frame and the pieces included in its construction. The "I" structure is outlined in blue and the notched ~5 ft. beams are outlined in pink. The black areas mark the approximate location where the horizontal ~5 ft. beams (F) cross over the top of the vertical ~5 ft. 4 in. bars (E) as well as where the notch should be placed.

Once the frame was constructed, it was taken from the woodshop and upstairs into the painting studio. There, Byron Rich, Art professor at Allegheny College, helped me put in D-

hooks into the inner side of the frame. We drilled 2 base holes, one on each side, into the 5 ft. 4 in. beam of the main frame. Then we hand screwed in the D-hooks. Afterwards, heavy-duty wire knots were made on the first D-hook and then looped across to the second. The wire was doubled back to and through the first hook, then the second again, as to support the weight of the frame, where it was knotted and tied off. The wire of the frame was then placed on the two screws that had been drilled into the wall in the painting studio, to test whether the wire was sturdy enough. Next, the 10 ft. by 12 ft. canvas I had bought was rolled out onto the ground and the frame placed on top of it. An excess of roughly 4 ft. of canvas was trimmed off one side. Then Rich and I each got on either side of the canvas and pulled it tight, followed by stapling it in place. We repeated this step multiple times till there was a staple around the outer edges of the frame about every half to a foot distance between each. While stretching, Rich and I remained parallel at all times across each side of the canvas. This ensured that the canvas was taught. The frame was then hung back on the wall within the painting studio. Following this, I combined a primer called gesso with water to create an almost fluid consistency. Then I applied this mixture to the surface of the canvas evenly, allowed it to dry and sandpapered the surface until no bumps were felt. This process was repeated three times to create a smooth surface on the canvas. The primary purpose of gesso is to fill in the gaps of the canvas. Once the spaces are filled, a smooth surface is created and paint can be easily spread. It also prevents a wasting of paint that would otherwise have filled in the gaps of the canvas. Once this was done, my canvas was ready to be painted.

Results and Discussion

The primary purpose of this project is to inform and persuade the audience to be conscious of the overfishing of the Atlantic cod as well as the associated repercussions. This project is geared towards influencing the minds of fishermen, lawmakers and consumers in particular. Fishermen may be more inclined to consider switching to alternative or more conservative gears. Additionally, they may also consider fishing for an other lucrative species, whether that be fish or shellfish. Upon reading the 500 year history of the fishery as well as learning the inability of cod stocks to repopulate without considerable action by humans to decrease fishing efforts, lawmakers may be more inclined to consider and pass bills that promote better management practices. Some consumers of Atlantic cod may be more wary of purchasing or ordering the fish for consumption. Others may completely remove cod from their diet to

support decreased fishing of the species. In reality, everyone can take away something from my research. The overfishing of the Atlantic cod can exemplify how fish species have great importance to people and removing too many from the environment can have drastic repercussions.

My initial sketch (See Figure 7) was of a large trawling net, which gave a good look at how nets of this caliber are typically designed. The purpose behind the sketch is to glean a better sense of both what trawling nets look like in reality versus what we are accustomed to seeing and the scale of the net. Additionally, the sketch accurately represents what these nets look like when pulled through water. This initial graphic was a potential option for how the net would be seen in the painting, back when the point of the view of the scene was still in flux. As for how I developed the image, I began by searching Google Images for "trawling nets". I focused on looking at images of a more technical nature compared to those of nets dragged off the back of a

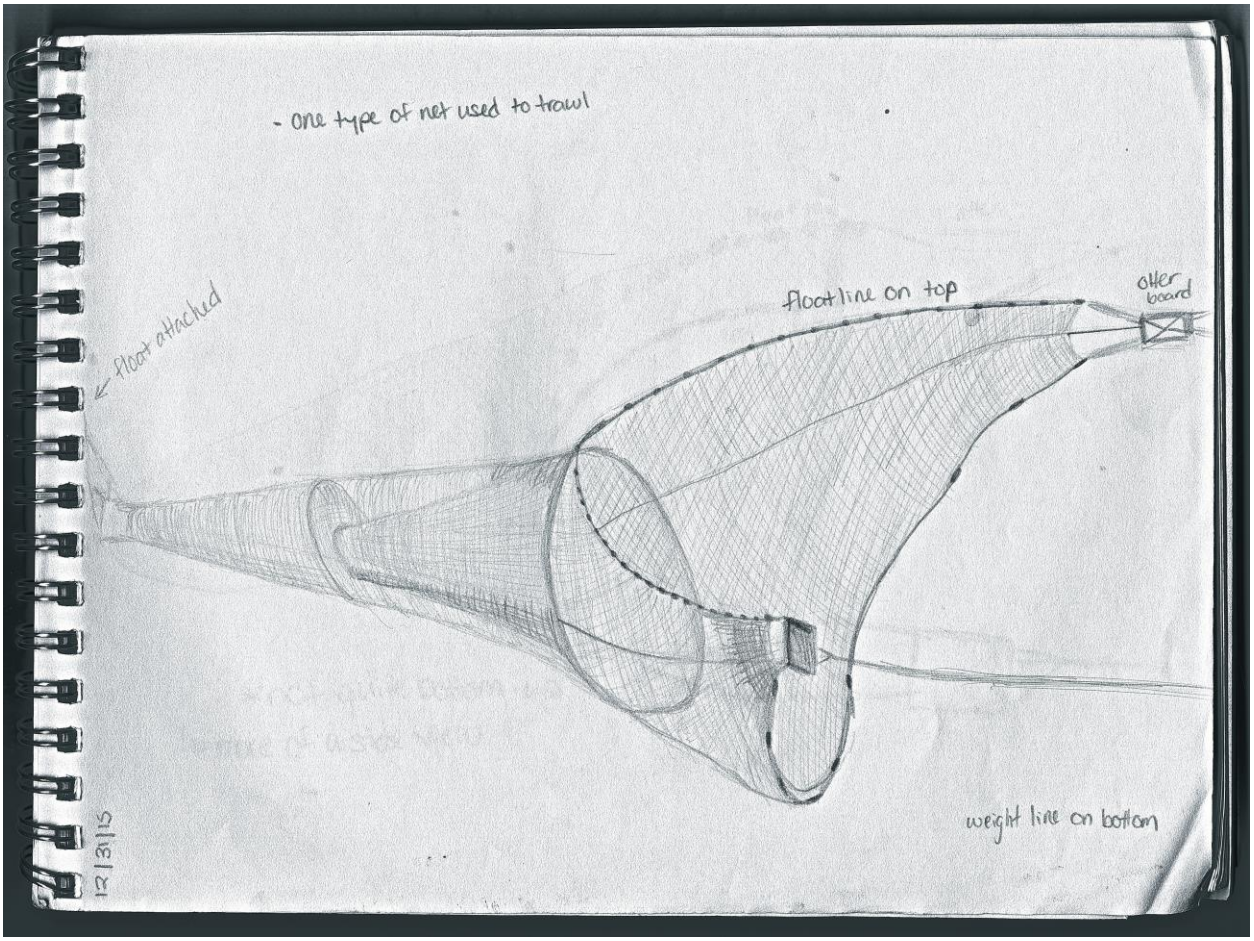


Figure 7: Initial sketch of a standard trawling net and its defining features. Each net typically has a float and lead line, though some have otter boards as well as a float line attached to the end.

boat. The reason behind this, again, goes back to the desire to accurately depict the size and shape of the net. It gives a more feasible depiction of how the net will seemingly balloon while being pulled through the ocean. Compared to technical drawings, it is rather difficult to gather an accurate estimate of what trawling nets look like. This is because the pictures that commonly come to mind are of piles of net or a section of net disappearing into the ocean as it is pulled through the water off the back of the boat. I also looked up the general features that are characteristic of trawling nets. Some of these features include a cone shape ending in a bag or cod end, a horizontal opening with an otter board on either side, and a vertical opening with a float line on the top portion and a weight line on the bottom. The cone shape allows for a streamlined shape when being pulled through the water. A cod end is the narrow end of a tapered trawl net. Otter boards (See Figure 8) are a pair of either boards or metal plates, one per side of the net, that are angled in a way that will keep the net open as it is pulled. Float lines are



Figure 8: An image of an otter board attached a trawling net. These boards are used to keep the net opening from closing (Ecomare 2015).

designed to keep the top horizontal line of the net open through buoyancy. Weight lines are just as the name implies, meaning they cause the bottom horizontal portion of the net to sink. When both the float and weight line are used in unison, they create a wide opening as to catch as many fish as possible. In addition to these features, trawling nets may also have a float at the end of the net to prevent it from sinking and becoming less streamlined while being pulled through the ocean.

The final sketch (See Figure 9) is used as the basis for my painting, in both the placement of figures and scale. This image was then shrunk down to a scale that would fit on the 4 inch by 6 inch window of an opaque projector. Afterwards, I projected the image onto the 10 ft. x 5 ft. 4 in. canvas. This would give me the best chance at accurately painting a scene with figures of appropriate size and placement. This way I can achieve the most representational version of the

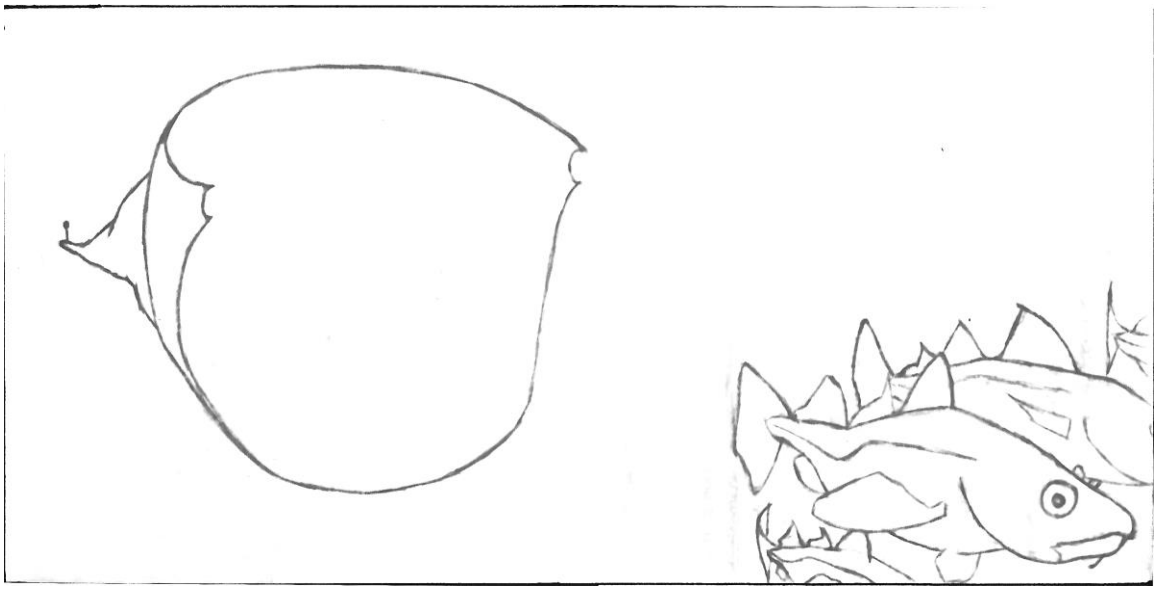


Figure 9: Final sketch showing the basic layout of where the net and Atlantic cod will be placed. The cod are large since they are in the foreground.

vision I want to display to my audience. The final sketch of the net was achieved through two ways: continued review of technical trawling net drawings from various angles and experimentation. I chose to make the painting flow from the bottom right corner to the top left. The net I had drawn in my initial sketch, however, was at a drastically different angle than the one I wished to portray in my painting. I crafted several more drawings based off a few technical pictures of nets from a Google Image search. After doing so, I was able to get a better understanding of how the net openings would curve while being pulled through water. Additionally, I bent cords and even the long strap of a purse at various angles to best gauge how the opening would look. A small, open, empty bag of chips with the end tapered off was also used to assess how the end of the net would appear from the desired direction and angle it would be pulled from. Several smaller quick sketches were also completed. Each of these was made with the intention of depicting the net being pulled from slightly different angles. I mainly

adjusted the positioning of particular parts of the net and how they were angled in space as well as the direction the otter boards were facing in the sketch. I sketched out the fish after looking at several images of schooling Atlantic cod. I made sure to focus on cod that were coming towards the viewer in my searches. This angle was my primary focus because my intent to bring the fish to the forefront of the bottom right corner and seemingly make them spill off the canvas.

Aside from the outward intention of the painting to change environmental perceptions towards the overfishing of the Atlantic cod, there are several other facets within the work that speak of the issue in itself. These can be broken down into three major areas: color and lighting, images, and the title. Each of these categories has its own deeper contextual meaning in relation to humanity's actions towards the environment and those that reside in it as well as work to bring about an emotional response from the viewer.

While the color scheme (See Figure 10) within the painting may seem natural, especially with extensive use of blues to simulate the various shades found in the ocean, the use of colors such as green serve to play on another concept. Green is typically associated with avarice and connected to the greed of humans. The link is further extended to the various countries that, in the past and even today, attempt to take as much fish from the sea as they can. Even though blue is characteristic of the ocean it can denote the morbidity of overfishing in connection to species collapse and inevitable loss. The sense of sadness connected to the color blue is similar to the



Figure 10: Background color scheme of painting.

meaning behind the use of darker shades throughout the painting. While they show depth of space in some areas, the darkness within the painting symbolizes the death and destruction wrought on Atlantic cod stocks by trawling nets as they sweep through the sea. This drastically contrasts the use of natural sunlight rays. The light coming through the net represents the changes and technological adaptations humans have made to nets that reduce the bycatch of marine species and mammals. The rays can be seen as a literal glimmer of hope ,shed on the dire situation at hand.

The cod within the painting have several hidden meanings to them as well. These fish are representative of the species, speaking of the dwindling stocks remaining across the Atlantic. Additionally, their positioning in the lower right corner as they broach the viewer has major significance. Their size in the foreground suggests that they are coming towards the audience. The reason for this is to place the viewer within the work or the ocean in itself. This was done with the intention of enhancing the perspective of the public by including them as part of the school about to be caught. Once part of the school, the viewer can gain insight into the responses of the school. "What would you do?" is the question we could be asked. Some may say they would swim around or away from the net but what most fail to realize is the certain tragedy the school is fated to encounter. Not only do trawling vessels have the technology to detect when schools will change direction, but the nets used by these boats are often so large that most fish cannot escape its grasp. The nets pulled through the water are often able to match the speed of the school. Regardless of our actions, we are trapped and ultimately doomed just as the Atlantic cod is without aid and the desistance of human fishing effort. The net symbolizes not only the greed and gluttonous nature of humans but also the resulting destruction caused by our actions. Again, this painting serves to speak for the Atlantic cod species as a whole and how human efforts have pushed these creatures to the point that can no longer match the rate at which we are catching and consuming them. In addition to the net and fish, another aspect of this painting with much to say on the topic is the angle at which everything is flowing. The net and school of cod are not coming directly at the viewer but are instead moving to the right side. The intention is to make the observer feel as though they could be caught up in the school and net at any time but have the option. This is a metaphor for the future of the cod fishery and species as a whole. We have the choice in catching ourselves within our own net, dooming the species and any who rely

on it as a source of income, namely fishermen and their families. Will we fate ourselves and this vulnerable species to a dire outcome due to our excessive greed?

It is not as though we haven't attempted to resolve this issue in the past but our actions have hardly gone far enough to cause any real change. Government entities had knowledge of the implications and consequences of the immense fishing pressure on stocks as of 1914, if not earlier. This was mentioned in the report given by the U.S. Fisheries Commissioner of the time (Cudmore 2009). The greatest attempt to right the lack of management was the introduction of the Magnuson-Stevens Fishery and Conservation and Management Act. Outwardly, the act was specifically designed to protect the stocks. In reality, this legislation was simply a means to safeguard American profits from the fishing industry by prohibiting foreign vessels from fishing within 200 nautical miles of the U.S. coast. The countries with land surrounding the Atlantic cod fishery have done far too little and acted retroactive to the crisis that had unfolded before them. Canada and the U.S. barely implemented moratoriums on the cod fishery after the populations had already failed. The crash in 1992 off the Grand Banks resulted in only 1% of the original population remaining. Only when extinction is imminent do fishermen and lawmakers begin to actively attempt to change. When the U.S. began down sizing its fleet after a stock collapse, protection methods were strongly opposed. Though the need to make a living is important to fishermen, it is impossible to do so when no fish are left in the sea. While fishermen were given job retraining opportunities and subsidies, the cod was left hanging by the skin of its teeth. The U.S. and Canada spent billions to support the fishery and fishermen but what fails to be mentioned is that they may have never needed to spend that had they implemented protection and preservative measures earlier. They had foreknowledge of the potential destruction their actions could bring but failed to address them all for the sake of greed.

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